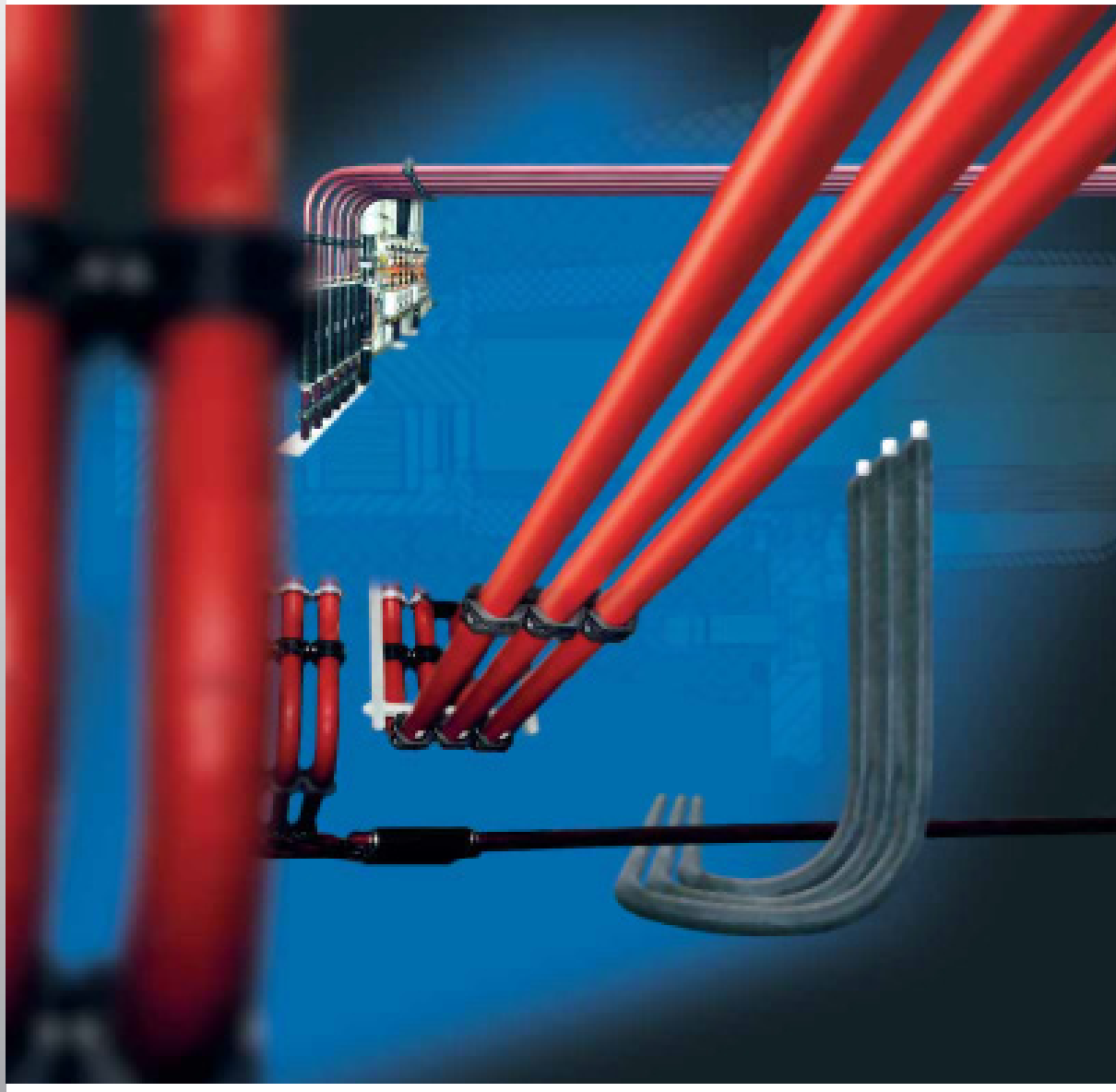
Manufactured by:

RITZ
Instrument Transformers

SOLID INSULATION SYSTEM



The SIS (Solid Insulation System) insulated bus-bar system offers an alternative to traditional bus system. Designs are available for application up to 69 kV and up to 7000 A for both indoor and outdoor installation.

SIS offers many advantages over other technologies, including:

- Ability to achieve complex bends and close phase spacing, enabling installation in tight areas
- Simple and quick installation – no welding required
- Ritz can supply complete turnkey solutions
- Installations require no maintenance

pazifik power

www.ppi.ph

About Us

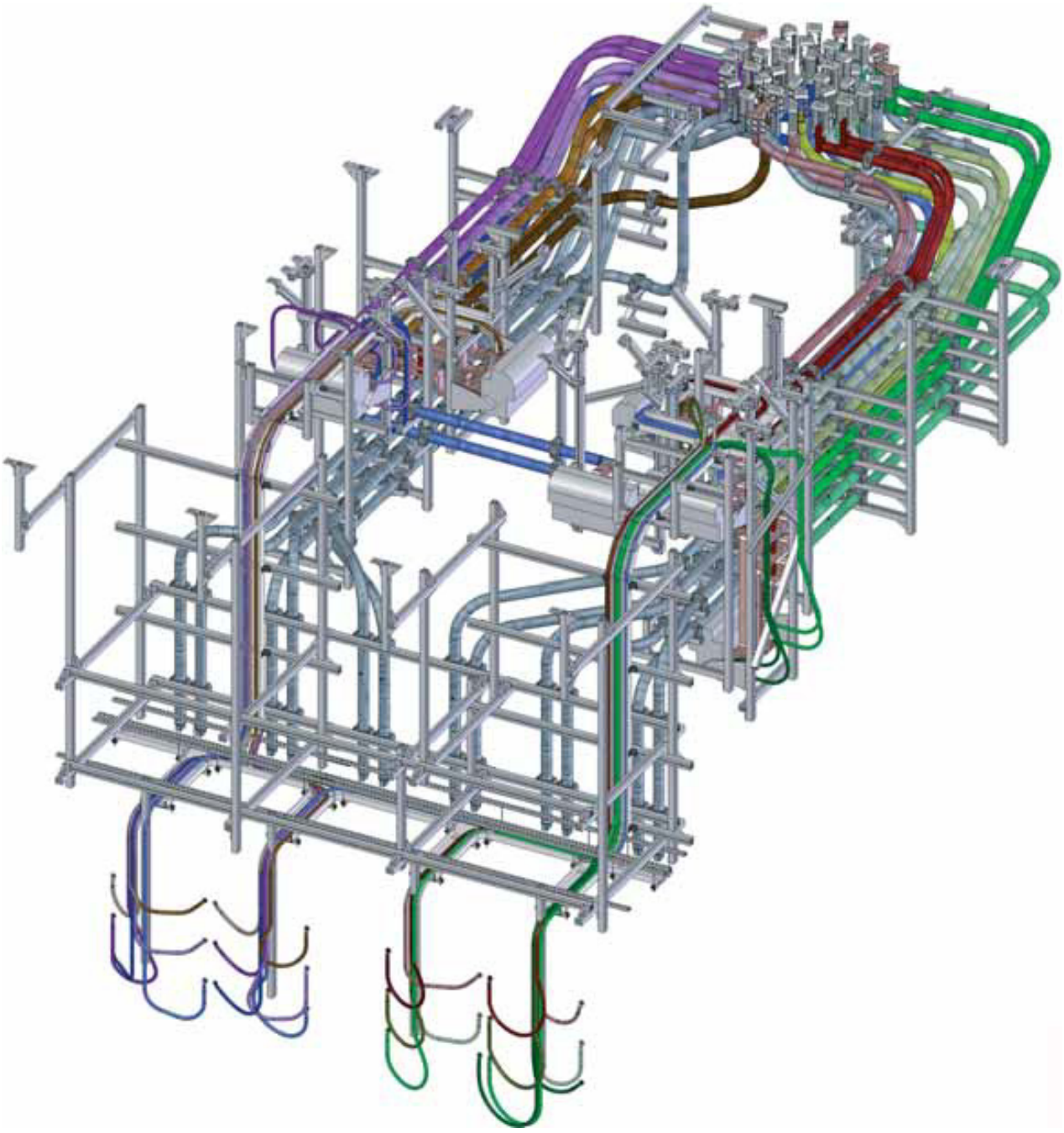
PPI Pazifik Power, Inc. is an engineering and marketing firm focused on the supply of power transmission equipment and complete substation to utilities and industrial users in the Philippines. The company was established in May 1995 by Mr. Wilhelm Hug. PPI also belongs to WiHu Electric, Pazifik Power Metering & Services and Exl Systems +, Inc.

The company has established its superiority in turnkey projects in the supply of substations with rated voltage of up to 230 kV. Aside from turnkey substations, PPI Pazifik Power, Inc. is also a major supplier of electricity meters, meter test equipment, instrument transformers, power transforms, fault indicators, surge arresters, switchgears, oil testers and cable diagnostics as well as batteries, UPS and AVR Systems.

PPI Pazifik Power, Inc. finds its strength in its lean and centralized organizational structure of professional and well trained staff particularly its engineering team. This strength enables PPI to install and service highly sophisticated electrical and technological equipment. The company gets excellent support from its partners mainly from Europe that provide them with valuable technical know-how and the newest trends in technology.

The company values its clients and knows that providing quality, efficient and reliable products is top priority. Service, support and willingness to reach all areas in the Philippines is also one of the important factors that PPI Pazifik Power strives to provide. Aside from this, ensuring comprehensive after sales service for all our supplied products is our standard practice.

Contents



General

The equipment produced plays an important part in energy manufacture and energy distribution. Therefore, highest demands are made with respect to industrial safety.
By constantly supervising the manufacturing process as well as ongoing modifications to the materials used, the highest degree of safety is guaranteed. The available test equipment allows all of the type and routine test necessary.

Before delivery each busbar segment and connecting sleeve gets routine testing.

Especially for the transmission of higher currents, the solid busbar insulation system is an alternative to parallel-connected cables and metal-enclosed busbar connections.
All requirements with respect to the protection of personnel and equipment are met. The following inherent benefits speak for the use of fully insulated busbars:

Design

System specific Benefits

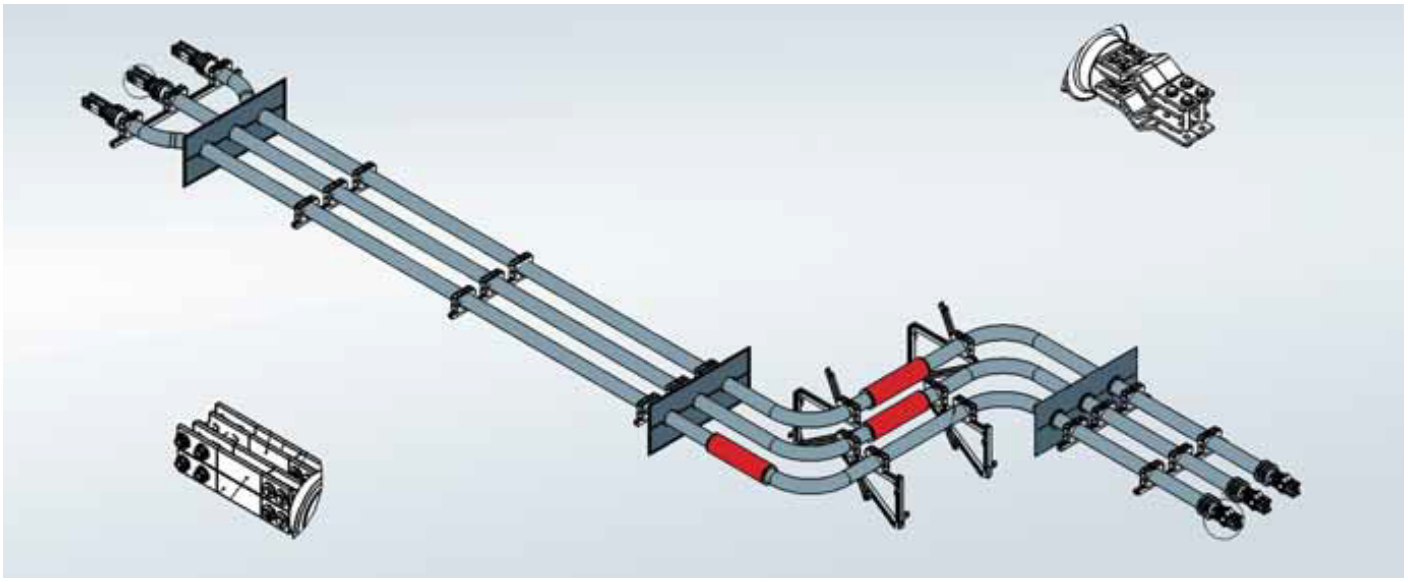
- Compact design
- Low space requirements
- Small bending radii
- 3-dimensional geometric shape is possible
- No maintenance

Safety Benefits

- Capacitive grading system
- Capable of withstanding high thermal and dynamic short circuit currents
- Safe to touch
- No short-circuit between phases due to full insulation
- Natural cooling due to effectual conductor design
- No toxic fumes in case of fire-self extinguishing
- High operating reliability due to factory routine test

Construction and Installation Work

- Easy Installation due to standardised installation and fixing parts
- Minimum project work for the user

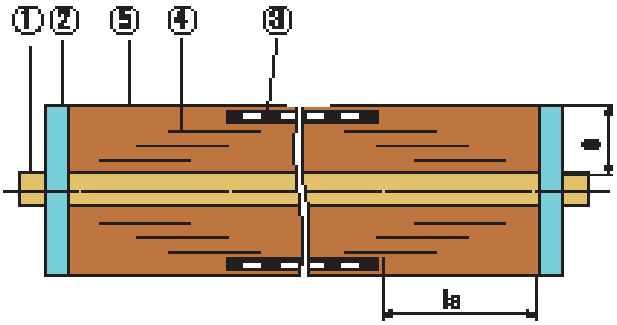


Busbar Design Principle

The busbar insulation is built up with Resin Impregnated Paper (RIP). Crepe paper is wound around the conductor (copper or aluminium) and impregnated under vacuum with epoxy resin.

This results in cavity free insulation which is free of partial discharge. To avoid partial discharge by delamination of the insulation from the conductor a conducting layer is wrapped around the conductor.

Layers of insulating crepe paper are built up on the high voltage layer according to the rated voltage. In these insulation layers of semi conducting paper, the capacitive grading at the ends of the busbars are included. These are dimensioned to reach an optimise electric field distribution on the surface of the busbar. Thus a minimised grading length can be reached. Along the whole length of the busbar, expect the grading area, an earth layer is wound on the insulating layers. This earth layer is built up by semi conducting paper, aluminium foil layers and axial copper strips to reach a high short circuit current capability. A connection device is soldered on the copper strips used as earthing point of the busbar. As protection of the earth layers additional protecting layers are added. The whole busbar is sealed vacuum tight with shrinking sleeve. After drying the insulation, the paper is impregnated with a low viscosity epoxy resin under vacuum conditions. The RITZ manufacturing technology permits to build a busbar with any geometrical shape.



Busbar design principle

1. Conductor
2. Epoxy-impregnated paper wrapping
3. Earth layer
4. Capacitive layer
5. Metal ring

Umax	min. length of grading (l_S)	Insulation wrapping (S)
12 kV	175 mm	10,0 mm
24 kV	215 mm	12,5 mm
36 kV	330 mm	17,5 mm

Production Process

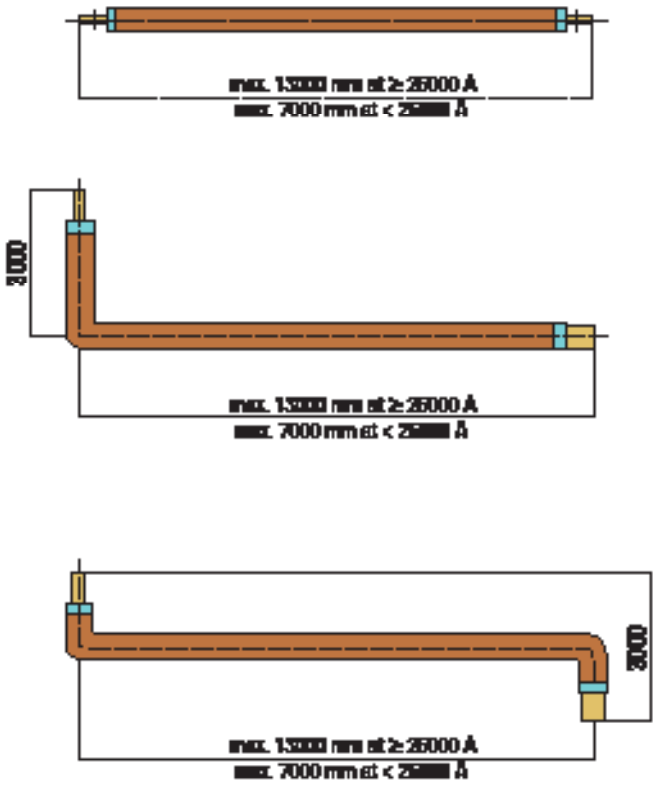
The bandaged conductor with paper insulation will be vacuum sealed with a shrink sleeve. A vacuum system will be connected through a hole in a ring at each end of the busbar. The vacuum process dries the paper insulation. After the drying process one end will be connected to the resin tank. The other end still remains connected to the vacuum pump. Due to the depression the low viscose and slow hardening resin flows through the paper insulation. Based on this production technology any busbar shape is possible. Impregnation by using fixed mould is not necessary. For special application requirements a stainless steel shell is available.

Outdoor Application

For Outdoor applications the busbar will be covered with a weatherproof stainless steel tube. To increase the creepage distance, the capacitive grading of the busbar insulation is covered on the outside by cast-on sheds.

Production Length

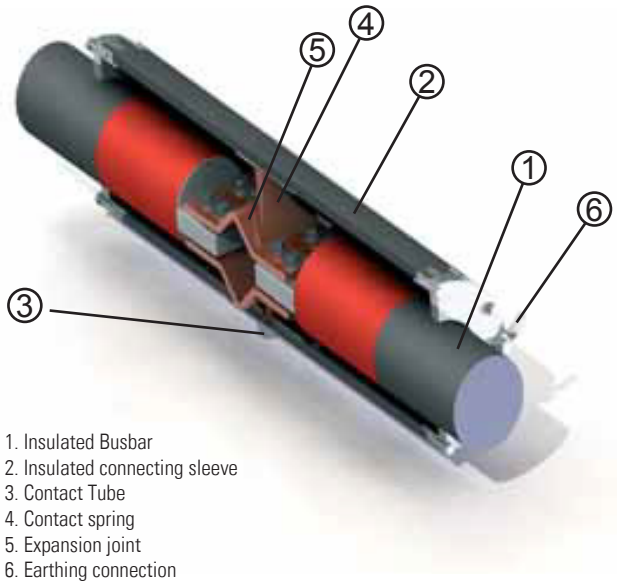
The length and geometric shape is limited by the size of the equipment (such as the kiln), the leans of transportation and the local facilities (building construction). RITZ manufactures different busbar shapes and lengths as shown in the picture below.



Multiple Busbar Connections

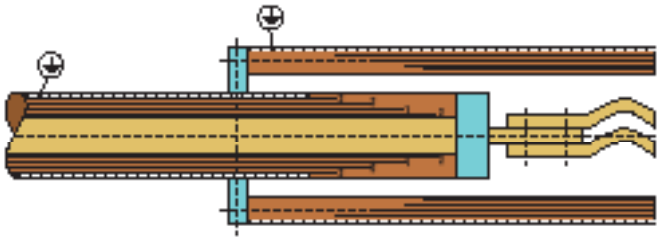
The length of the individual busbars is limited by the manufacturing process, transportation and installation conditions. For complex installations the busbars have to be connected. The connection is performed with flexible connectors between the busbars to allow thermal expansion and to compensate for tolerances during installation. These joints are fully insulated by connection sleeves, which cover the capacitive grading at the busbar ends. These connecting sleeves are also fully insulated and guarantee absolute safety upon contact throughout the whole length of the busbar installations. For voltages above 12 kV the sleeves are also capacitive grading. The high voltage connection to the sleeves is realised by an contact spring installed have protection class[1] IP 45. Higher protection classes are available upon request.

Outdoor connecting sleeves are manufactured with an aluminium or stainless steel protection tube. the sealing between bus bar and connecting sleeve is made by a rubber bellow and achieves the ingress protection class[2] IP 65.



1. Insulated Busbar
2. Insulated connecting sleeve
3. Contact Tube
4. Contact spring
5. Expansion joint
6. Earthing connection

The drawing shows the insulated conductor and the insulated tube. The capacitive layer of the busbar and connecting sleeve are laid in the opposite direction which guarantees a homogenous electrical field inside the connecting sleeve.



1 Ingress protection rating against dust and water according to IEC 60529 corresponding to NEMA 3/3s.

2 Ingress protection rating against dust and water according to IEC 60529. A corresponding NEMA rating does not exist.

Busbar Connection

There are several variations of rigid or flexible connections between busbar segments or between the busbar and other equipment parts. The standard connection between the busbar is a standardised flat terminal in accordance with the rated current.

For connecting the busbar with other equipment parts the following options are available.

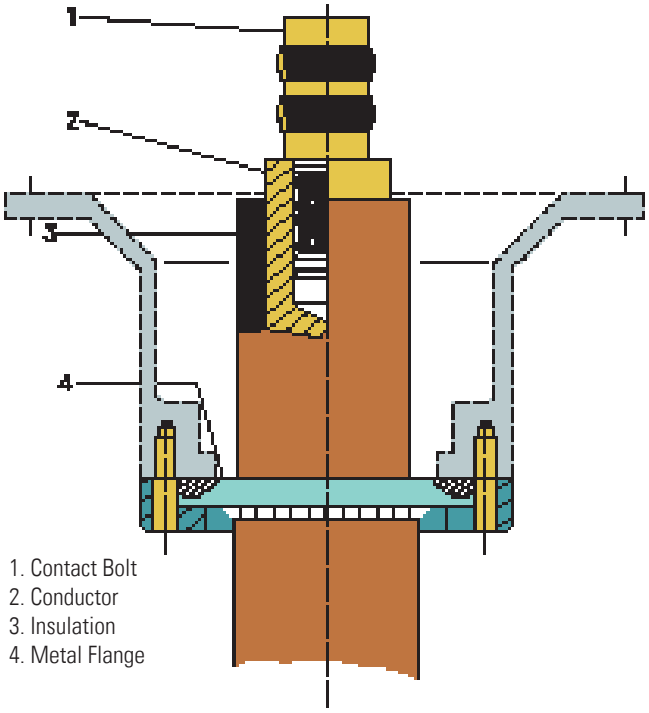
- Conductor end with flat terminal according to DIN 42 206
- Conductor end with round bolt.
- According to customer's specification.
- If the insulated busbar is to be connected gas-tight to an SF_6-insulated switchgear, a metal flange is fitted at the earthed portion of the busbar. Current connection can be done in an economical way by means of contact bolts or according to customer requirements.

Through the use of a fixed connection at both ends of the busbar, a connecting sleeve should be attached to compensate for construction tolerances and thermal expansion of the busbar during operation.

Earthing

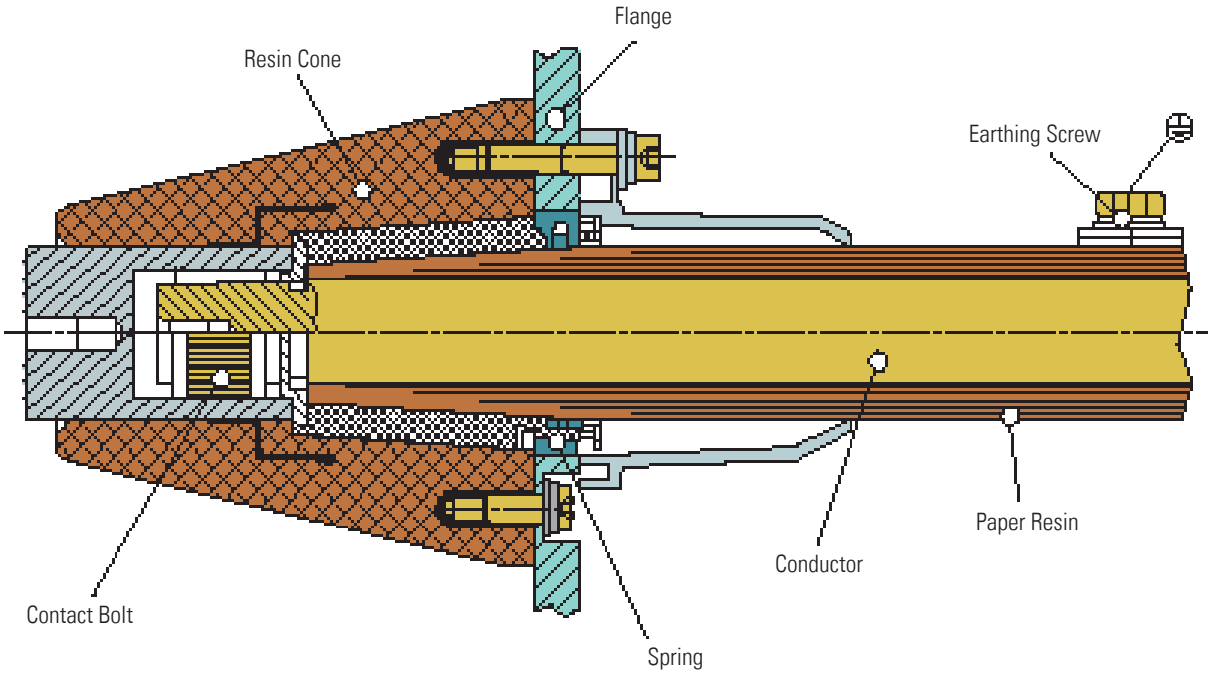
A separate earthing connection dimensioned in accordance with the required short circuit current generally has to be installed parallel to the busbar system. Every single busbar, connection sleeve and metallic fixation material has to be earthed on this earthing connection. If a busbar or a connecting sleeve is not earthed correctly these elements will be destroyed after a certain amount of time.

Connection of Busbar to GIS



1. Contact Bolt
2. Conductor
3. Insulation
4. Metal Flange

Special Design According to Customer Requirements



Busbar Fixing

For installation of the busbar system a flexible mounting system is used. The Adjustment can easily be done at site. The busbar fixing elements include aluminium C-profiles, angles, T-screws and fixing clamps. The fixing elements are adjustable with respect to each other and adjustable in all directions therefore allowing compensation for building tolerances. The fixing clamps include fixed bearing and movable bearing, allowing the busbar to move axially within the fixing clamps in case of thermal expansion. In the first instance, the capability of the equipment to withstand a short-circuit, must be considered for the busbar fixing. Another criterion is the natural frequency of the busbar.

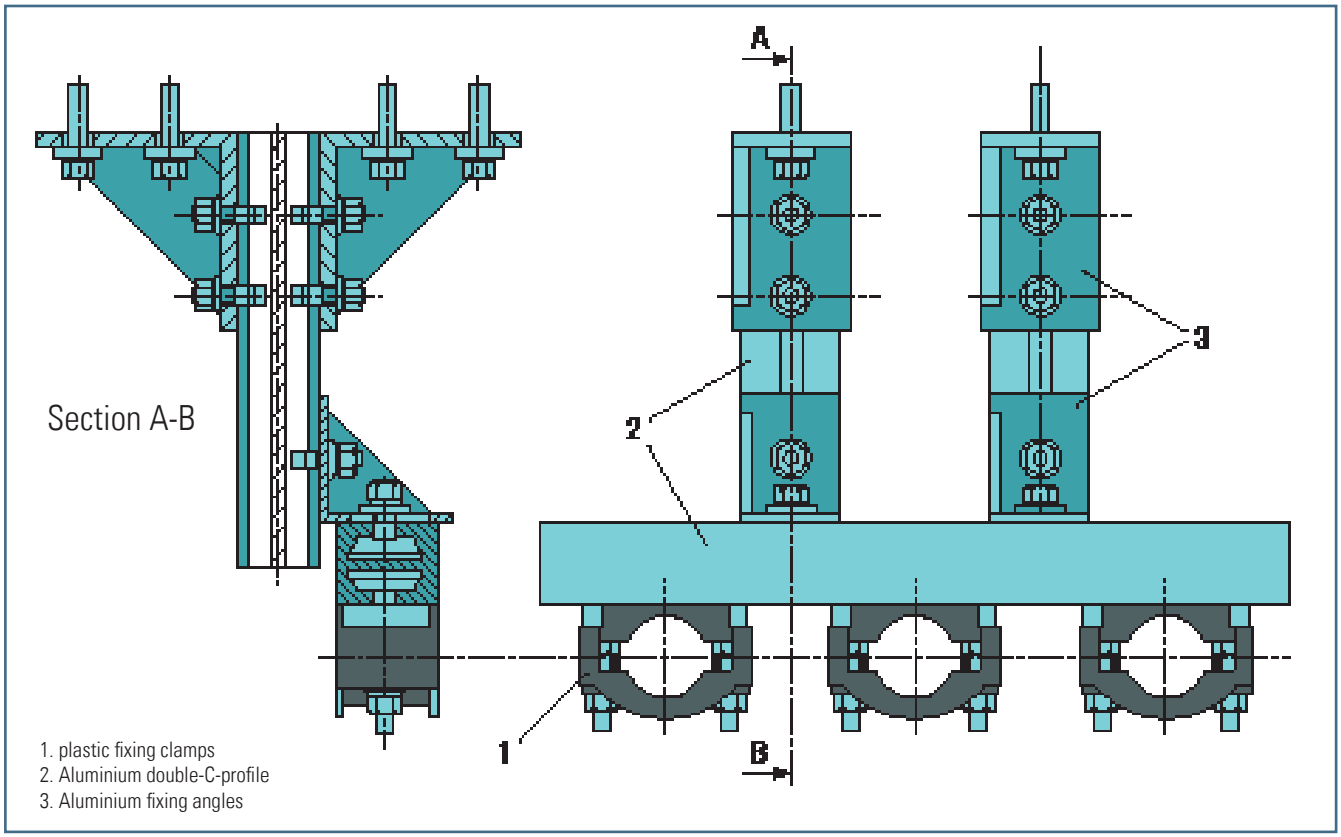
The distance between fixing points must be chosen to avoid resonance with respect to the power frequency of the system and its harmonics. The Distance between the fixing points of the busbar is individually calculated for each order.

A respective calculation tool is available, which includes:

- Busbar diameter
- Phase distance
- Mass of the busbar
- Bending strength

Fixing Clamp

The fixing clamps are differentiated between slide bearing and fixed bearing clamps. The use of fixed or slide bearing clamps is determined by the fixing points given by the calculation tool. The construction of a slide bearing clamp is designed with a rubber washer and a metal washer is used for the fixed bearing clamp.



Busbar fixing

Dimensioning | Conductor Materials

The busbar conductors are dimensioned according to DIN 43670/671. The following criteria are taken into consideration:

- Thermal conductivity of the insulation
- Heat transmission between the insulation and ambient air (through convection and radiation)
- Natural cooling
- Skin effect

The busbars are dimensioned for an ambient temperature of 35°C with a maximum temperature increase of 50°C in the conductor. Accordingly, the maximum temperature of the conductor is 85°C under natural cooling conditions. Deviations from the above dimensioning criteria shall be specified and can considered when the design calculation is made. The conductor material can be copper (E-Cu) or aluminium (E-Al-MgSi 0,5).

Dimensions for conductor material E-Al-MgSi 0,5					
$U_{(max)}$ / I_N	12-24 kV	12 kV	17,5-24 kV	36 kV	
	Ø Conductor (mm)	Ø Busbar (mm)	Ø Busbar (mm)	Ø Conductor (mm)	Ø Busbar (mm)
1250 A	40	65	70	40	80
1600 A	50	75	80	50	90
2000 A	60	85	90	70/15	110
2500 A	80/15	105	110	80/15	120
3150 A	100/15	125	130	100/15	140
4000 A	120/15	145	150	130/15	170
5000 A	150/15	175	180	160/15	200
6500 A	200/15	225	230		

Dimensions for conductor material E-Cu					
$U_{(max)}$ / I_N	12-24 kV	12 kV	17,5-24 kV	36 kV	
	Ø Conductor (mm)	Ø Busbar (mm)	Ø Busbar (mm)	Ø Conductor (mm)	Ø Busbar (mm)
1250 A	33	57	62	33	72
1600 A	40	65	70	50	90
2000 A	50	75	80	60	100
2500 A	70/10	95	100	70/10	110
3150 A	90/10	115	120	90/10	130
4000 A	110/10	135	140	110/10	150
5000 A	140/10	165	170	140/10	180
6500 A	180/10	205	210	190/10	230

Other voltages and currents on request.

Quality

Before use in production, the material is subjected to the following test:
a) Conductor material
- Measurements of specific resistance

b) Insulating paper:
- Verification of purity
- Tearing strength test

c) Impregnating resin:
- Measurement of viscosity increase (with temperature as parameter)
- Measurement of gelation time

The impregnating process is checked by the following measurements:
- Conditioning (degassing) of the resin compound
- Temperature in vacuum kiln
- Continuous evacuation controls
- Gelation temperature and time Post-curing temperature and time

In the development stages, general investigation were made and the following was determined:
- Temperature of deflection underload (Martens method)
- Flexural strength
- Deflection
- Impact strength
- Module of elasticity
- Co-efficiency of thermal expansion
- Thermal conductivity

A differential thermal analysis (DTA) and life test was also performed.

Test

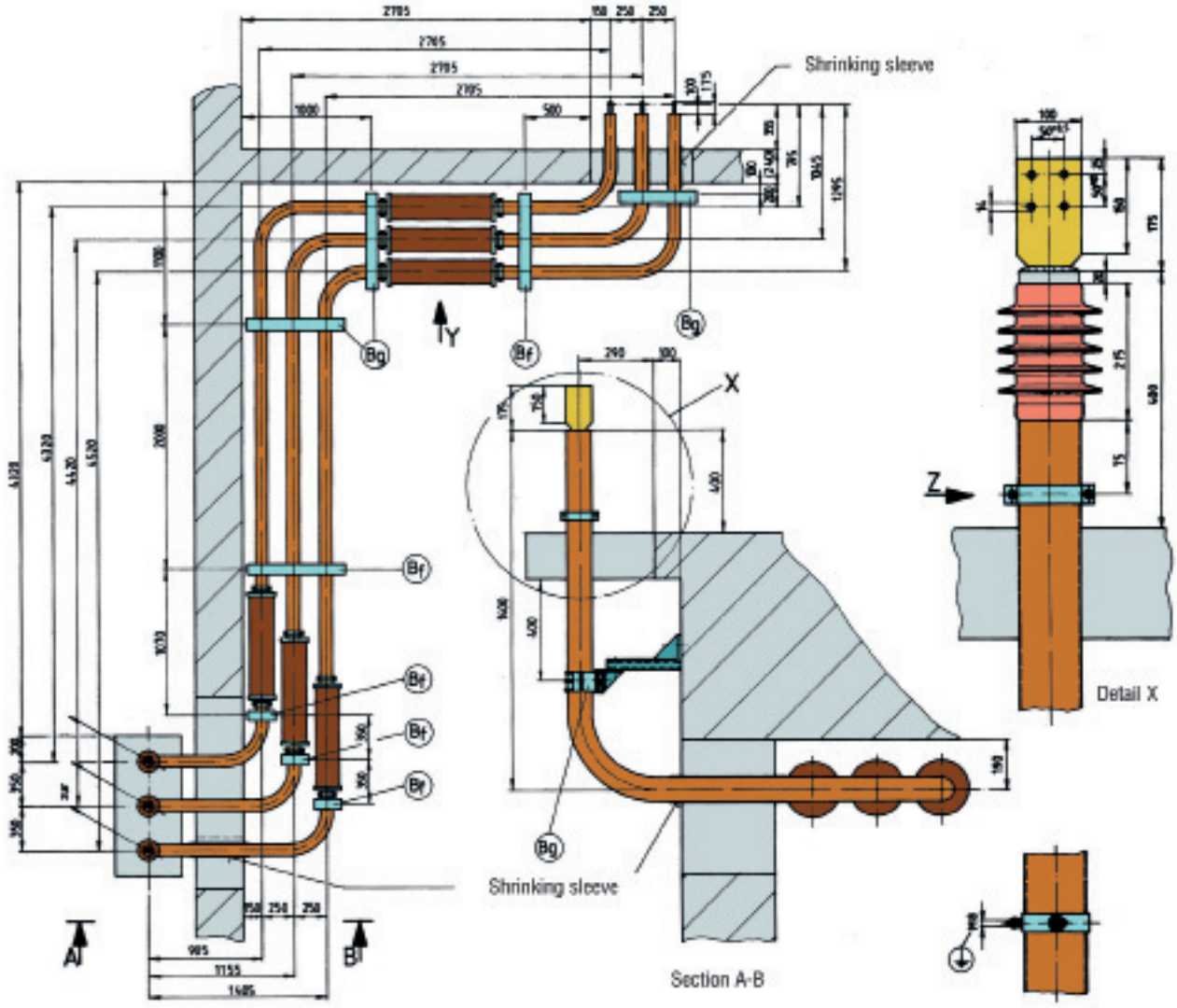
Each busbar and each connection sleeve is subjected to an electrical routine test, namely:
- One-minute power frequency test, 50 Hz according to current standards (IEC, VDE etc.)
- Measurement of partial discharges
- Measurement of capacitance and loss factors
- Visual inspection

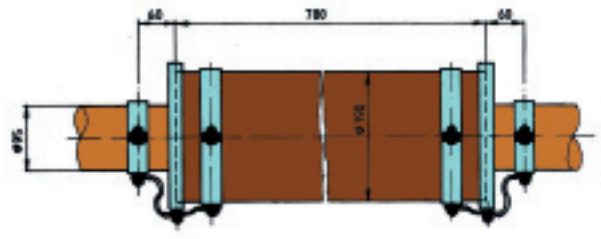
The following type test have been made:
- Power-frequency test and measurement of partial discharges
- Impulse voltage test
- Power-frequency test and measurement of partial discharges(rep.)
- Temperature rise test
- Temperature cycle test
- Power-frequency test and measurement of partial discharges (rep.)
- Life test

Ordering Information

Customers are kindly requested to supply the following information in their orders to enable to enable quick processing in the factory:

- Rated voltages
- Rated current
- Short-circuit currents
- Frequency
- Max. Ambient temperature
- Dimensions of busbar (local facility-building construction)
- Distance between phases
- Definition of busbar terminals
- Available earthing facilities
- Possible fixing method (wall or ceiling)
- Conductor material (aluminium or copper)





View in direction of arrow Y

Custom-made busbar connection

“Quality and Efficiency that you can count on.”

Power your business with complete services from PPI Pazifik Power, Inc. For the last 15 years we’ve offered quality power transmission products to the top utility and electric cooperatives.

Unlike other suppliers, we have a wide choice of top brand of meters, switchgears, energy transformers, UPS systems and more. Our experts will share their engineering know-how to help your business truly take off.

HAPAM

Disconnecting Switches
15kV up to 800kV
(Hapam, Netherlands)

ORMAZABAL
Focus on Medium Voltage

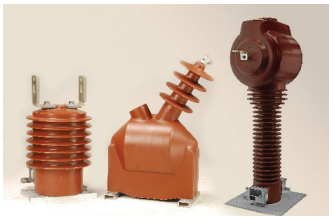
Hermetically sealed and SF6 insulated compact switchgear up to 36kV
(Ormazabal, Spain)

Landis+Gyr
manage energy better

Single HighPrecision Superstatic and Tamper Proof Meter
(Landis+Gyr, Switzerland)

Automation System

A solution package for system integration, substation automation and energy management system.
(SCADAFLEX, PPI Pazifik Power Inc., Phils.)



RITZ
Instrument Transformers

Dry-Type Resin Insulated Out-door/Indoor Current Transformer and Potential Transformer
(RITZ, Germany)

BAUR

Fully Automatic Measurement of the dielectric strength of liquid insulators up to 100 kV.
(BAUR, Austria)

GAMATRONIC
Our Power Your Confidence

Modular UPS solutions in multiple capacity options
(Gamatronics, Israel)

RITZ
Instrument Transformers

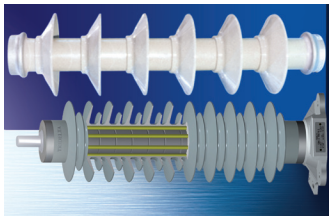
Glass Fibre reinforced vacuum technology (GVT) for various applications
(RITZ, Germany)

SUNLIGHT
creating energy

Batteries that are robust energy storage solutions, with a proven technology that has been used for decades.
(Sunlight, Greece)

MTE

State of the art Meter Testing and Calibration Equipment and Instrument Test Set
(MTE, Switzerland)



TRIDELTA

Protection of transformers, switch-gears and plants against atmospheric and switching overvoltages
(Tridelta, Germany)

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Turnkey Substation up to 100MVA
(PPI Pazifik Power, Inc., Philippines)

Discover how we can help you with quality and efficient solutions that will improve you business. Contact us at (02) 867 5620 or email us at info@ppi.ph.

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