We touch your electricity everyday!

GLOBAL SPECIALIST FOR POWER BUSBARS

Cast Resin Insulated Busway System

Eta-com

betobar

Eta-com

Manufacturing Facilities

Boom-Belgium, Plant

Haridwar - India

The Eta-com group was founded in 1979 and ever since markets a full range of cast resin insulated busway systems. The concept which was already in use in the sixties in industrial installations is now in the third generation form. Due to the typical characteristics, the system guarantees the integrity of many projects world-wide, providing safe and maintenance free electrical power supplies in both Low Voltage and Medium Voltage installations.

C&S Electric Ltd. was founded in 1966 and is amongst the leading suppliers of electrical equipment in India. It's wide range of electrical and electronic products find application in power generation, distribution, control, protection and final consumption.

C&S employs over 4000 people including 400 engineers, and has 17 state-of-the-art manufacturing plants. It has 22 sales/marketing offices across India and its products are exported to more than 80 countries. C&S Electric also has joint venture companies with global leaders.

The Power Busbar Division of C&S founded in 1982 has been meeting the evolving needs of power generating stations, process and manufacturing industries, infrastructure establishments, technology and technological centers and real estate developments with its complete and fully tested product line of Busduct, Bustrunking and associated equipment.

With the acquisition of Eta-com in December 2011, the co-operation between the two companies give birth to a Global Power Busbars Specialist.

betobar is the leading technology in the world for cast resin insulated busbars in low & medium voltage installations.

This concept is unique as it is based on the direct encapsulation of copper or aluminium conductors with an insulation compound, B.I.M. casting mix, consisting of epoxy-resin mixed under vacuum. This B.I.M. casting mix has excellent electrical characteristics and high mechanical withstand with specific physical properties. It is moisture-resistant, fire-resistant and self extinguishing. A flexible fabrication method, universal moulds and an integrated process controlled mixing technique allow the production of an almost unlimited number of element forms for L.V as for M.V applications. The prefabricated elements are self-supporting and are interconnected electrically by joining the conductors with 2-sided compression contacts, ensuring an excess of contact surfaces and a maximum of adjustment. Junctions and element extremities are overcast with a B.I.M. casting mix resulting in a homogeneous insulation over the full length of the connection.

betobar busbars can be supplied in the following standard types:

For Low Voltage

LA-LB series
Up to 1000 V AC / 1500V DC
Three phase conductors and/or
Protective earth / 50,100,150 % neutral

Al-conductors range up to 5040 A
Cu-conductors range up to 6300 A

DC application on request
Other frequencies on request

IP68
degree of protection

For Medium Voltage

Type	Current Rating	Voltage Rating
SH - Series	Al upto 1645A Cu upto 2030A	3.6 KV to 12 KV
PH - Series	Al upto 4967A Cu upto 6140A	3.6 KV to 17.5 KV

Other current and voltage ratings on request.

IP67
degree of protection

IK10
mechanical resistance

explosion proof
on request

isobar range covers Isolated Phase Busduct, Segregated Phase Busducts and Non-Segregated Phase Busducts.
C&S is a market leader in India and amongst the major global companies for design, manufacture, erection and commissioning of Isolated Phase Bus Ducts up to 1000MW power plants.

Today, we have an enviable track record of having associated with 14 Units of 660 MW, 25 Units of 500 MW, 35 Units of 250 MW, 30 Units of 150 MW Thermal Power Stations, Hydro Power Plants and Nuclear Power Plants, besides many Captive/Private Power Projects of capacity less than 100 MW. The largest proportion of power generated in India flows through C&S isobar busducts.

isobar Busduct have been successfully type tested for highest peak current during short circuit test and also for temperature rise test at world famous laboratories like KEMA-Holland and EDF-France, CPRI-Bhopal & Bangalore and at IIT-Roorkee (For Seismic tests)

Isolated Phase Busduct

C&S offers a wide range of natural air cooled Isolated Phase Busducts from 11 kV to 36 kV upto 30000A with a maximum Short Circuit Current withstand capability of 300 kA rms for 1sec. and 840 kA peak. These IPB's have applications in all generating station from 60 MW and above.

Segregated Phase Busducts

C&S offer a wide range of Segregated Phase Busducts for Medium Voltage applications from 3.3 kV to 33 kV upto 5000A. Segregated Phase Busducts find applications in Power Generating Stations and Industrial or Distribution Plants for lower capacity generator connections, inter-connections between switchgear and transformers.

Other Products

- Non-Segregated Phase Busducts (415 to 1100V upto 6500A)
- DC Busbar Systems
- PTSP Cubicles
- Generator Auxiliary Compartments (GAC)
- Neutral Grounding Cubicles
- Line & Neutral Side Terminal Boxes
- Pressurization System for IPB's
- Hot Air Blowing Equipment

metabar range cover Sandwich Bustrunking, Air Insulated Bustrunking & Lighting Trunking.

Energy Saver: Bustrunking has lower impedance in comparison to cable and conventional busducts for the same application. Lower impedance means less energy lost during distribution and this translates into cost savings.

Flexible Distribution: Plug-in type arrangement at regular intervals or as per customer design provides efficient power distribution.

Less Space: Bustrunking system require less space for Installation in a building / industry as compared to conventional busduct and cable system, so optimum utilization of space.

Conserves Raw-materials & Produces less waste: Material and manpower used in busway is lower than cable & conventional busduct. It saves money on raw materials and create less waste by buying pre-engineered lengths of busway.

Reusable: Bustrunking system comes with provision of expansions, changes, replacement and reusing.

SB - Sandwich Type

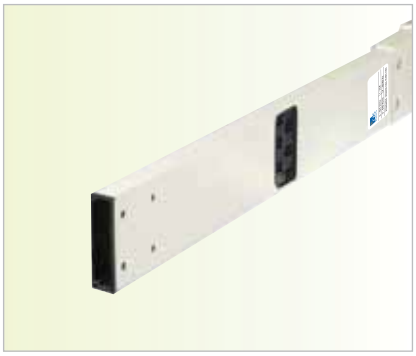
Compliance of Standard	IEC 61439 (1&6) & IS 8623 (1&2)
Independent Certificate Authority	ASTA - UK, CPRI-India
Conductor Material & Ratings	Copper 630A ~ 6600A, Aluminium 400A ~ 5000A
Rate Operational Voltage (Ue)	1000 Volt, AC
Rated Impulse Withstand Voltate (Uimp)	12 KV (1.2/50 s)
Enclosure Material	G.I/AL
Busbar Insulation	Multi layer Class - 'F' Insulation
Degree of Protection	IP 54/ IP55 /IP65 /IP67
Fire Rating	240Min. (ISO 834) 55
Seismic Compliance	Zone -5 (IS: 1893/IEEE 693)
Section Jointing	Uniblock Joint
Plug - in Box	32~800A

CB-Compact Air Insulated Type

Compliance of Standard	IEC 61439 (1&6) & IS 8623 (1&2)
Independent Certification Authority	ASTA-UK, CPRI-India
Conductor Material & Ratings	Copper 125~2000A, Aluminium 200~1250A
Rated Operational Voltage (Ue)	1000 Volt, AC
Rated Impulse Withstand Voltage (Uimp)	12 KV (1.2/50 s)
Enclosure Material	G.I
Busbar Insulator	Class-F
Degree of Protection	IP 54 /55
Fire Rating	120Min. (ISO 834) 55
Seismic Compliance	Zone-5 (IS:1893/IEEE 693)
Section Jointing	Uniblock Joint
Plug in Box	32 ~ 800 A

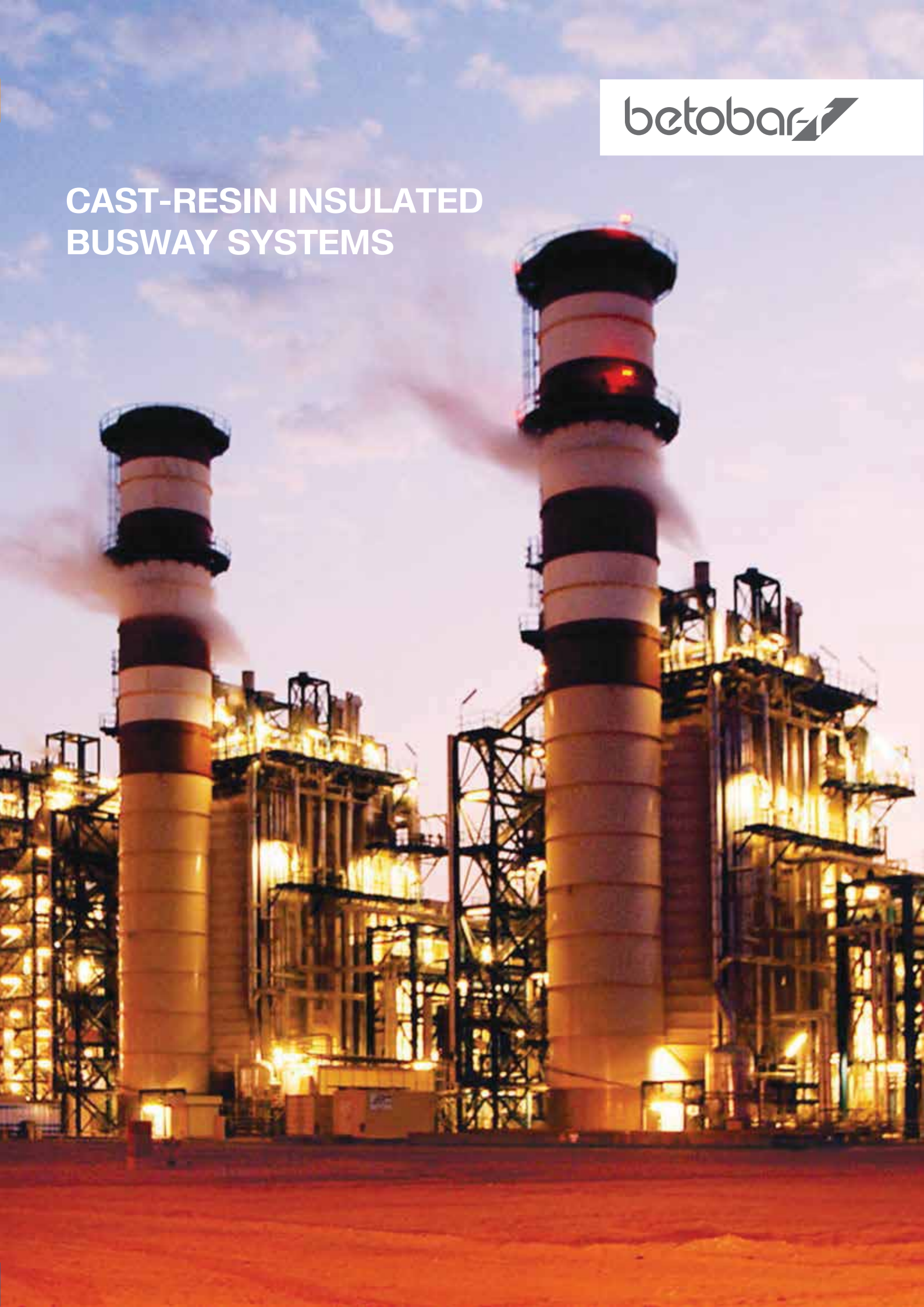
LB-Lighting Trunking

Compliance of Standard	IEC 61439 (1&6) & IS 8623 (1&2)
Independent Certificate Authority	CPRI - India
Conductor Material & Ratings	Copper - 25A, 32A, 40A, 63A
Rated Operational Voltage (Ue)	500 Volt, AC
Enclosure Material	Aluminium
Busbar Insulation	Flame Retardant PVC (Class 'A'-105 Deg C)
Section Jointing	Inbuilt push fit joint
Plug in Box rating	Upto 16 A (with/without fuse)
Degree of Protection	IP 55 / IP 54



betobar

CAST-RESIN INSULATED BUSWAY SYSTEMS



Extensive application and Element Range

betobar busbars are suitable for application in large buildings, industrial plants, power stations, sub-stations and large switchrooms, such as:

- Factory distribution of low and medium voltage power.
- Rising mains with tap-offs to sub-distribution boards in high rise buildings.
- Transformer switchboard connections.
- Main switchboard feeders to distribution panels.
- Generator and large motor feeders.
- 400 Hz distribution systems.
- Refineries, offshore and onshore platforms.
- Zone 2 & Zone 3 Explosive areas.

For special Application, contact our betobar agent.

betobar busway system is available in a wide range of standard element shapes, forms, and lengths which are fabricated to suit the typical project requirements. Our element range consists of :

- Straight elements.
- Flat and edge elbows.
- Z (double elbow) and T elements.
- Flanged terminal elements.
- Tap-off facilities and phase-transfer elements.
- Thermal expansion compensation elements.
- Tailor-made terminal elements for transformer or generator and switchboard connection.

High-Quality Production

betobar busbars have been developed as a modern, all-purpose means of efficient and safe transmission of electrical energy. They have been in manufacture for more than thirty-five years.

betobar system complies with all the requirements for current distribution at low and medium voltage.

The busbar consists of copper or aluminium conductors, embedded in an enclosure of a fire retardant, self extinguishing and homogeneous insulation mix based on epoxy cast-resin with mineral fillers, ensuring high mechanical strength and chemical withstand.

Standard types are available for current ratings up to 5000 A and voltage ratings up to 17.5kV. Systems for higher current ratings or DC applications are possible on request.

The busbar line consists of a number of prefabricated elements. The electrical joining of the conductors is achieved by means of double fish plates and high tensile steel bolts.

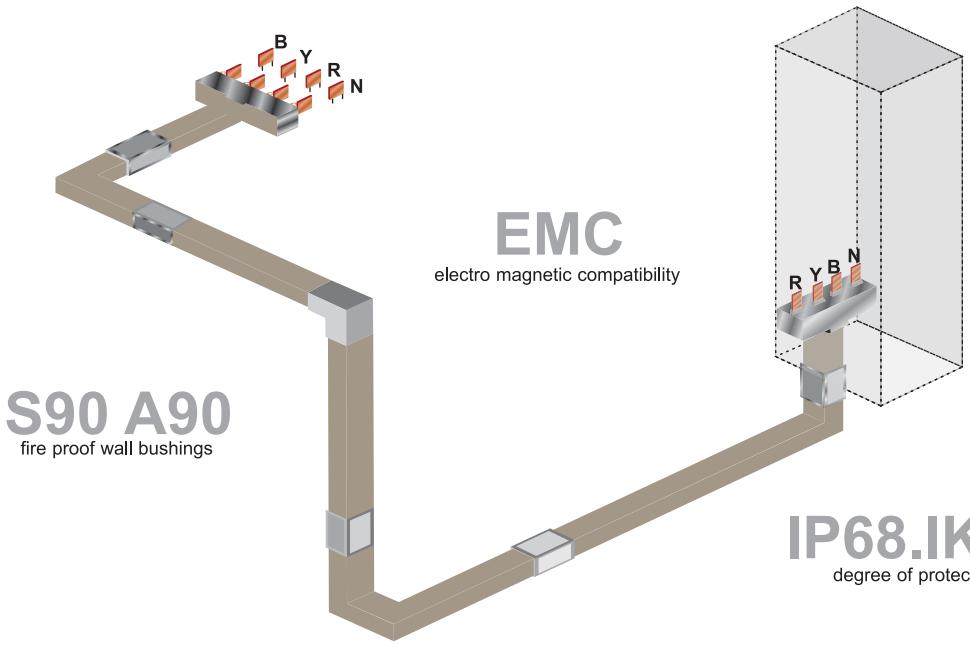
The junctions and the element ends are overcast with the same insulation mix as used for the elements. In this way an integral insulating enclosure to IP68.IK10 is guaranteed over the full length of the busbar run. Straight junctions and also elbow junctions are available, each facilitating installation adjustments of 0-20 mm per standard junction.

Major Advantages

- Compact Dimensions.
- Simple Installation.
- Low Voltage Drop and High Short-Circuit withstand Capacity.
- Overload Capacity of +20% for 2 Hours.
- Degree of Protection of IP68 for L.V bus ways and IP67 for M.V bus ways as per IEC 60529.
- High Mechanical Impact strength of IK.10 as per DIN 52453 & IEC 62262.
- Fire proof property : Tested for 750°C for 3 Hours in accordance with IEC 60331-21.
  Tested for 850°C for 2 Hours in accordance with pre-BS 7346.
- Fire Wall Bushings of S90 & S120 in accordance with EN1366-3 and NBN 713.020.
- Fire Retardant Bushings A90 for Normal fire and H60 for Hydrocarbon Fire In Offshore Applications.
- Self-extingusihing insulation as per IEC 60332.
- Electrical Continuity E30-E120 finishing available under fire conditions as per DIN 4102-12.
- EMC Compatible. (For sensitive environment)
- Insulation level of CLASS 'B', 130°C.
- Explosion Proof ATEX, & IEC Ex Certified on request.
- Excellent Resistance to atmospheric pollution & wide range of chemicals.

E30-E120
electrical continuity

explosion proof

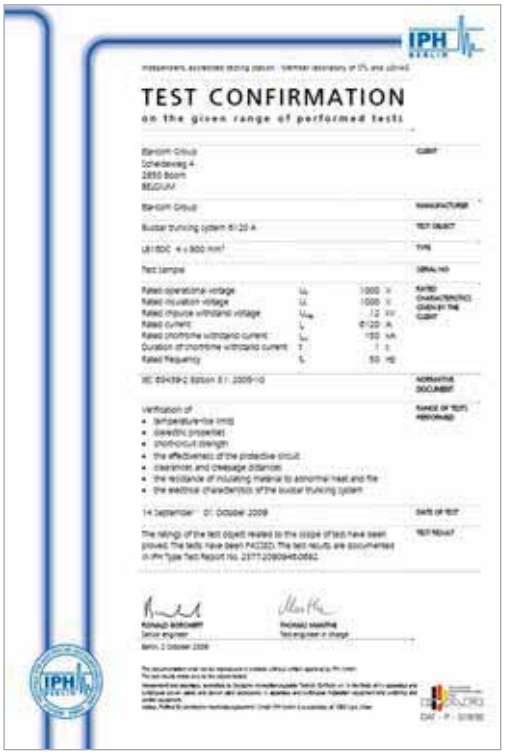


EMC
electro magnetic compatibility

S90 A90
fire proof wall bushings

IP68.IK10
degree of protection

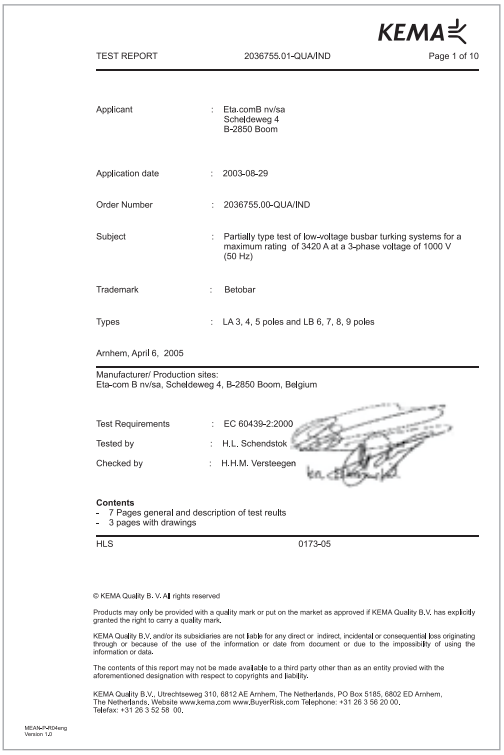
Product Certifications



TEST CONFIRMATION

on the given range of performed tests

IPH Type Test Certificate for L. V. Betobar



KEMA

TEST REPORT 2036755.01-QUA/IND Page 1 of 10

Applicant : Eta.comB nv/sa
Scheldeweg 4
B-2850 Boom

Application date : 2003-08-29

Order Number : 2036755.00-QUA/IND

Subject : Partially type test of low-voltage busbar tunking systems for a maximum rating of 3420 A at a 3-phase voltage of 1000 V (50 Hz)

Trademark : Betobar

Types : LA 3, 4, 5 poles and LB 6, 7, 8, 9 poles

Arnhem, April 6, 2005

Manufacturer/ Production sites:
Eta-com B nv/sa, Scheldeweg 4, B-2850 Boom, Belgium

Test Requirements : EC 60439-2:2000

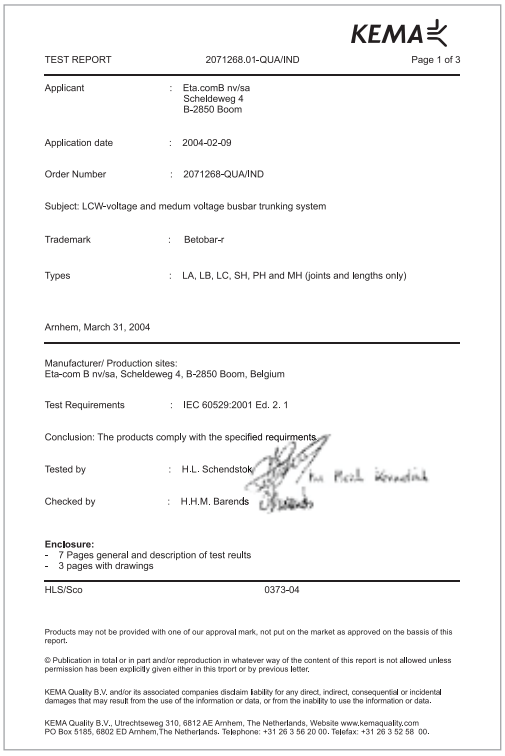
Tested by : H.L. Schendstok

Checked by : H.H.M. Versteegen

Contents
- 7 Pages general and description of test reults
- 3 pages with drawings

HLS 0173-05

KEMA Type Test Certificate for L. V. Betobar



KEMA

TEST REPORT 2071268.01-QUA/IND Page 1 of 3

Applicant : Eta.comB nv/sa
Scheldeweg 4
B-2850 Boom

Application date : 2004-02-09

Order Number : 2071268-QUA/IND

Subject: LCW-voltage and medum voltage busbar trunking system

Trademark : Betobar-r

Types : LA, LB, LC, SH, PH and MH (joints and lengths only)

Arnhem, March 31, 2004

Manufacturer/ Production sites:
Eta-com B nv/sa, Scheldeweg 4, B-2850 Boom, Belgium

Test Requirements : IEC 60529:2001 Ed. 2. 1

Conclusion: The products comply with the specified requirments.

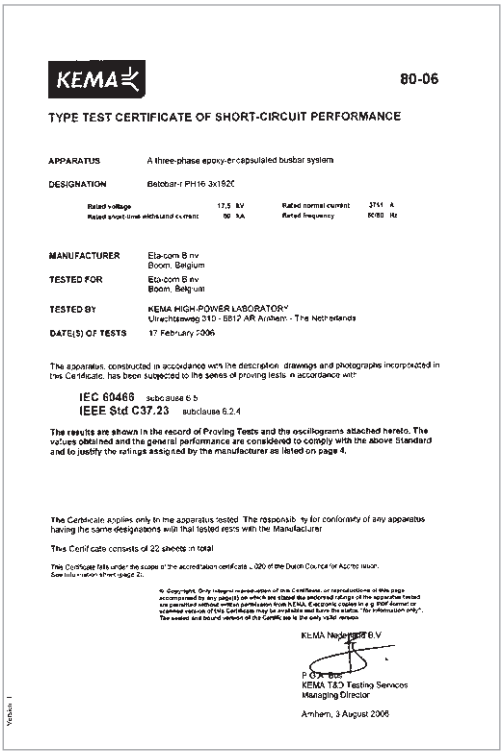
Tested by : H.L. Schendstok

Checked by : H.H.M. Barends

Enclosure:
- 7 Pages general and description of test reults
- 3 pages with drawings

HLS/Sco 0373-04

KEMA Type Test Certificate for Degree of Protection



KEMA 80-06

TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE

APPARATUS A three-phase epoxy-encapsulated busbar system

DESIGNATION Betobar-r PH16 3x1620

MANUFACTURER Eta-com B nv
Boom, Belgium

TESTED FOR Eta-com B nv
Boom, Belgium

TESTED BY KEMA HIGH-POWER LABORATORY
Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands

DATE(S) OF TESTS 17 February 2006

IEC 60439 subclause 6.5
IEEE Std C37.23 subclause 6.2.4

The results are shown in the record of Proving Tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above Standard and to justify the ratings assigned by the manufacturer as listed on page 4.

The Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

This Certificate consists of 22 sheets in total

This Certificate falls under the scope of the accreditation certificate L 020 of the Dutch Council for Accreditation.
See information sheet page 21.

KEMA Nederland B.V.

P.O. Box
KEMA T&D Testing Services
Managing Director

Arnhem, 3 August 2006

KEMA Type Test Certificate for M. V. Betobar

Product Certifications

Intertek

Certificate No. 18042

ASTA Certificate

of Short-Circuit Rating

Laboratory Ref. No: 2377.2110024.0006

APPARATUS: Medium voltage cast resin busbar system

DESIGNATION: PH24A 3x3840

MANUFACTURER: Eta-com Group
Scheldeweg 4
2850 Boom
BELGIUM

TESTED BY: Institut, Prüffeld für elektrische Hochleistungstechnik" GmbH
Landsberger Allee 378A
12681 Berlin, GERMANY

DATE(S) OF TESTS: 12 January 2011

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this certificate has been subjected to the series of proving tests in accordance with

IEC 62271-1: 2007-10

STL Principles and Objectives and STL Guides as appropriate

IEC 62271-1: 5.6 Short-time withstand current and peak withstand current tests

Refer to page 1 for ratings

The results are shown in the record of Proving Tests attached hereto. The values obtained and the general performance is considered to comply with the above Standard(s) and to justify the ratings assigned by the manufacturer as stated on the ratings page(s). This certificate applies only to the apparatus tested. Responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.

This Certificate comprises this front sheet, 1 rating page plus 21 other pages as detailed on page 3.

Only integral reproductions of this whole certificate or reproductions of this page accompanied by any ratings pages are permitted.
Issued by Intertek, Hilton House, Corporation Street, Rugby, CV21 2DN England
Contact: asta@intertek.com Tel: +44 (0)1788 578435

UKAS

ASTA Observer
H. Glabsch
Certification Manager

Date

Type Test Report

CRIF - WTCM
Collective Research Center for Technological Industry

TESTS REPORT **Ref: GT 4-3412**

Company : Etacom

CONCERNING : Bending tests on aged and reference samples.

Samples type : Bars

Receipt date : 08-09-01

Client reference :

CRIF Reference : 4-3412
Samples conditioning: according to ISO 291 : Temperature (23 _+2)°c
Relative humidity: (50+_5) %

Sampling: realised by the company

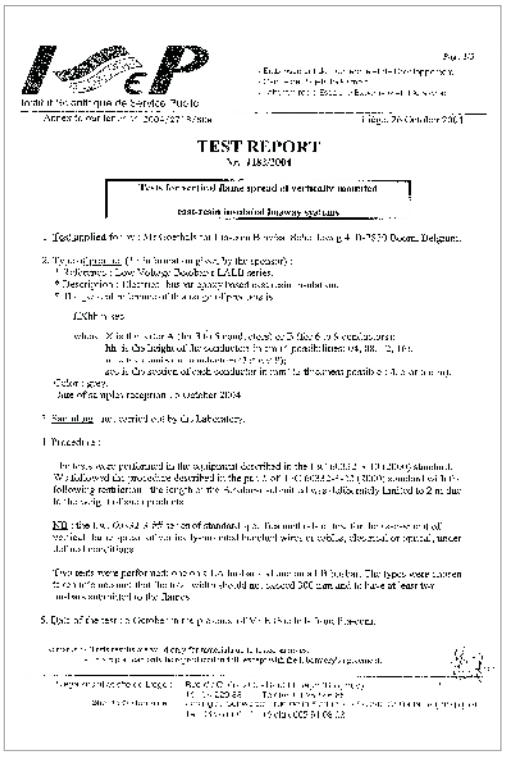
Note: Tests results are valid only for materials identical to the tested materials.

Revision 1 Reference 4-34 12etacomrap 102-angUdoc LAB-DT-608 4-3412etacom

Establishment acknowledged by decree of law dated January 30thrd 1947

CRIF , LIEGE science park, Rue du Bois St Jean, 12 B-4102 Seraing (LIEGE) • Tel: 32.4.361.87.00 • Fax: 32.4.361.87.02 • E-mail: crif-wtcm@crif.be
Site de Charleroi, Avenue Georges Lemaître, 22- B-6041 Gosselies (CHARLEROI) • Tel: 32.71.250.362
Registered office and administration: Boulevard A. Reyers 80, B-1030 Bruxelles • Tel:32.2.706.79.44 • G-Bank: 210-0723013-27 • BTW BE 406.606.380

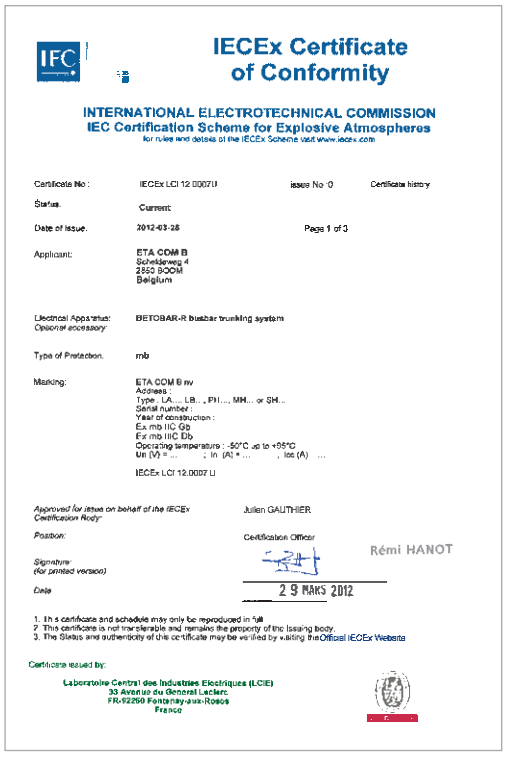
Ageing Test Report



TEST REPORT
Nr. 11822004

Tests for vertical flame spread of vertically mounted cable-resin insulated bunched wires

Flame Spread Test as per IEC 60332



IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No: IECEx LCI 12.0007U Issue No: 0 Certificate history

Status: Current

Date of Issue: 2012-03-28 Page 1 of 3

Applicant: ETA COM B
Scheldeweg 4
2850 BOOM
Belgium

Electrical Apparatus: BETOBAR-R busbar trunking systems
Optional accessory:

Type of Protection: mb

Marking: ETA COM B nv
Address :
Type : LA.... LB... , PH..., MH... or SH...
Serial number :
Year of construction :
Ex mb IIC Gb
Ex mb IIIC Db
Operating temperature : -50°C ,as to +95°C
Ui (V) = ... : Ii (A) = ... : Ioc (A) ...

IECEx LCI 12.0007 U

Approved for issue on behalf of the IECEx Certification Body: Julien GAUTHIER

Position: Certification Officer

Signature: (for printed version) Rémi HANOT

Date: 29 MARS 2012

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website

Certificate issued by:

Laboratoire Central des Industries Electriques (LCIE)
33 Avenue du General Leclerc
FR-92260 Fontenay-aux-Roses
France

IEC Certification for Explosive Atmospheres

Product Certifications

APPAREILS ET SYSTEMES DE PROTECTION POUR UTILISATION
EN ATMOSPHERES EXPLOSIBLES
EQUIPMENT AND PROTECTIVE SYSTEMS INTENDED
FOR USE IN EXPLOSIVE ATMOSPHERES

Le LCIE, organisme notifié sous la référence 0081 conformément à l'article 9,
LCIE, notified body number 0081 in accordance with article 9 of,

de la Directive 94/9/CE du Parlement Européen et du Conseil du 23 mars 1994,
the Directive 94/9/EC of the European Parliament and Council of 23 March 1994,

certifie que la Société, *certifies that the company :*

ETA-COM B
Scheldeweg 4
2850 BOOM - BELGIQUE

applique un système approuvé d'assurance qualité de production,
operates an approved production quality assurance system,

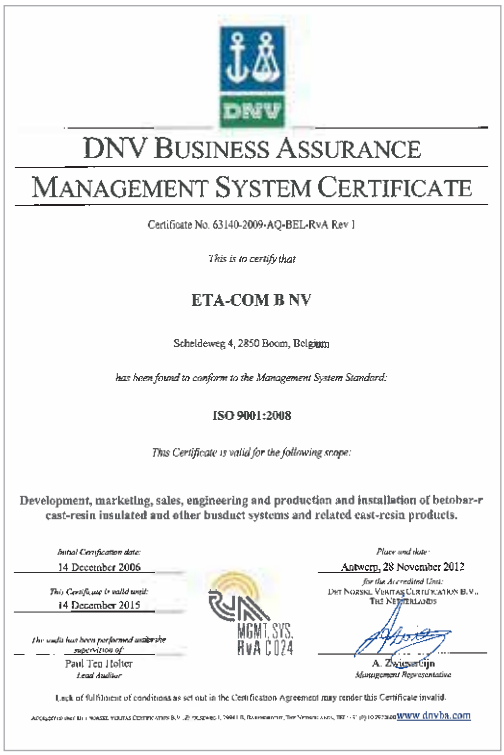
N° LCIE 08 ATEX Q 8016

Validité : du 05 mai 2011 au 04 mai 2014
Validity : from 5 May 2011 to 4 May 2014

Responsable de certification ATEX
ATEX Certification Manager

32-Diploma notification quality ATEX-rev0

ATEX Certification for Explosive Areas



DNV BUSINESS ASSURANCE
MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 63140-2009-AQ-BEL-RvA Rev 1

This is to certify that

ETA-COM B NV

Scheldeweg 4, 2850 Boom, Belgium

has been found to conform to the Management System Standard:

ISO 9001:2008

This Certificate is valid for the following scope:

Development, marketing, sales, engineering and production and installation of betobar-r cast-resin insulated and other busduct systems and related cast-resin products.

Initial Certification date: 14 December 2006
This Certificate is valid until: 14 December 2015
The audit has been performed under the supervision of: Paul Ten Holter, *Lead Auditor*

MGMT. SYS. RvA C 024

Place and date: Antwerp, 28 November 2012
for the Accredited Unit: DET NORSKE VERITAS CERTIFICATION B.V., THE NETHERLANDS
A. Zwijnenburg, *Management Representative*

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

www.dnvba.com

ISO 9001:2008 Certificate

KEMA

CERTIFICATE
ELECTROMAGNETIC COMPATIBILITY

Electromagnetic Compatibility

Product Certification

СИСТЕМА СЕРТИФИКАЦИИ ГОСТ Р

ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО ТЕХНИЧЕСКОМУ РЕГУЛИРОВАНИЮ И МЕТРОЛОГИИ

СЕРТИФИКАТ СООТВЕТСТВИЯ

№ РОСС BE.ГБ06.В01235

Срок действия с 01.10.2012 по 01.10.2015

№ 0813810

ОРГАН ПО СЕРТИФИКАЦИИ РОСС RU.0001.11ГБ06

ОРГАН ПО СЕРТИФИКАЦИИ ВЗРЫВОЗАЩИЩЕННЫХ СРЕДСТВ ИЗМЕРЕНИЙ, КОНТРОЛЯ И ЭЛЕМЕНТОВ АВТОМАТИКИ ФГУП «ВНИИФТРИ» ОС ВСИ «ВНИИФТРИ»

Россия, 141570, Московская обл., Солнечногорский р-он, п/о Менделеево,

ФГУП «ВНИИФТРИ», тел./факс (495) 744-8181

ПРОДУКЦИЯ Шинопроводы с литой изоляцией комплектные betobar-r типов LA..., LB..., PH..., MH..., SH...

серийный выпуск

см. Ex-приложение

34 4900

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ

ГОСТ Р 52350.0-2005, ГОСТ Р 52350.14-2006

8544 60 100 0

ИЗГОТОВИТЕЛЬ

Eta-Com II nv (Бельгия)

Schuldeweg 4, B-2850 Boom, Belgium

СЕРТИФИКАТ ВЫДАН

Eta-Com II nv (Eta-Com)

Schuldeweg 4, B-2850 Boom, Belgium

телефон: +32 3 8806400; факс: +32 3 8444238

НА ОСНОВАНИИ

1. Протоколов испытаний № 12.1306 от 27.09.2012 г.

ИЛ ВСИ «ВНИИФТРИ» (РОСС RU.0001.21ИЕ09)

2. Акт о результатах анализа состояния производства от 19.09.2012 г.

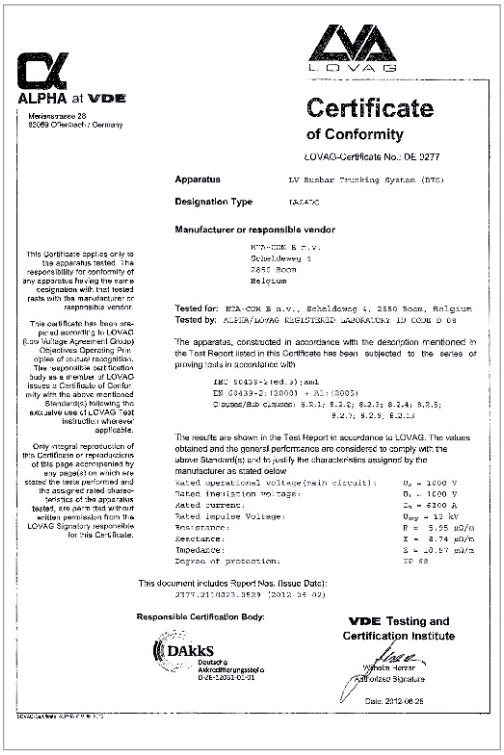
ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Руководитель органа Г.Е. Гуськова

Эксперт А.Н. Мартынов

Сертификат имеет юридическую силу на всей территории Российской Федерации

GOST Certificate



ALPHA at VDE

Meisenstrasse 28

63069 Offenbach / Germany

LOVAG

Certificate

of Conformity

LOVAG-Certificate No.: DE 0277

Apparatus LV Busbar Trunking System (BTS)

Designation Type BA40C

Manufacturer or responsible vendor

ETA-COM B n.v.
Scheldeweg 4
2850 Boom
Belgium

This Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designation with that tested rests with the manufacturer or responsible vendor.

This certificate has been awarded according to LOVAG (Low Voltage Agreement Group) Objectives Operating Principles of mutual recognition. The responsible certification body as a member of LOVAG issues a Certificate of Conformity with the above mentioned Standard(s) following the exclusive use of LOVAG Test Instructions wherever applicable.

Only integral reproduction of this Certificate or reproductions of this page accompanied by any page(s) on which are stated the tests performed and the assigned rated characteristics of the apparatus tested, are permitted without written permission from the LOVAG Signatory responsible for this Certificate.

Tested for: ETA-COM B n.v., Scheldeweg 4, 2850 Boom, Belgium

Tested by: ALPHA/LOVAG REGISTERED LABORATORY ID 0008 D 08

The apparatus, constructed in accordance with the description mentioned in the Test Report listed in this Certificate has been subjected to the series of proving tests in accordance with

IEC 60439-1(ed.3);am1
EN 60439-1:(2009) + A1:(2010)
Clause/Sub clause: 8.2.1; 8.2.2; 8.2.3; 8.2.4; 8.2.5; 8.2.7; 8.2.9; 8.2.10

The results are shown in the Test Report in accordance to LOVAG. The values obtained and the general performance are considered to comply with the above Standard(s) and to justify the characteristics assigned by the manufacturer as stated below

Rated operational voltage(main circuit):	U_e = 1000 V
Rated insulation voltage:	U_i = 1000 V
Rated current:	I_n = 6300 A
Rated Impulse Voltage:	U_{imp} = 12 kV
Resistance:	R = 5.05 mΩ/m
Reactance:	X = 8.74 mΩ/m
Impedance:	Z = 10.57 mΩ/m
Degree of protection:	IP 68

This document includes Report Nos. (Issue Date):
2377.3110025.0915 (2012-04-02)

Responsible Certification Body:

DAkkS Deutsche Akkreditierungsstelle D-PL-12001-01-01

VDE Testing and Certification Institute

Wilhelm Horner
Authorized Signature

Date: 2012-06-26

Type Test Report for L. V. Betobar

ASTA Certificate

of Short-Circuit Rating

Laboratory Ref. No: 2377.3110025.0915

APPARATUS: Medium voltage cast resin busbar system

DESIGNATION: PH24C 3 x 3840

MANUFACTURER: Eta-com B nv
Schuldeweg 4, B-2850 Boom, BELGIUM

TESTED BY: Institut „Prüffeld für elektrische Hochleistungstechnik" GmbH
Landsberger Allee 378A, 12681 Berlin, GERMANY
FGH Engineering & Test GmbH
Halberweg 40, 68219 Mannheim, GERMANY
KEMA Korl System Testing GmbH
Environmental Lab, 16761 Hennigsdorf, GERMANY
Eta-com B nv
Schuldeweg 4, B-2850 Boom, BELGIUM

DATE(S) OF TESTS: 09 March 2011 to 04 April 2012

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this certificate has been subjected to the series of proving tests in accordance with

IEC 62271-1: 2007-10

STL Principles and Objectives and STL Guides as appropriate

IEC 62271-1: 6.6
- Short-time withstand current and peak withstand current tests

This Certificate includes also:
- Temperature-rise test
- Dielectric tests
- Partial discharge tests
- Verification of the degree of protection
- Verification of the resistance of insulating material to abnormal heat and fire
- Verification of structural strength
- Verification of crushing resistance
- Verification of impact strength

Refer to page 1 for ratings

The results are shown in the record of Proving Tests attached hereto. The values obtained and the general performance considered to comply with the above Standard(s) and to justify the ratings assigned by the manufacturer as stated on ratings page(s). This certificate applies only to the apparatus tested. Responsibility for conformity of any apparatus bearing the same or other designations rests with the Manufacturer.

This certificate comprises this front sheet, 1 rating page plus 54 other pages as detailed on page 3.

Only integral reproductions of this whole certificate or reproductions of this page accompanied by any ratings pages are permitted.

Issued by Intertek, Hilton House, Corporation Street, Rugby, CV21 2DN England.
Tel: +44 (0)1788 578439

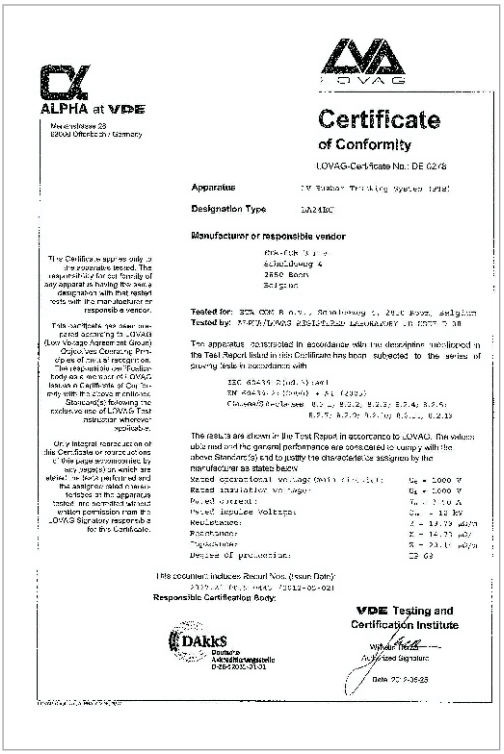
ASTA Observer
R. Gilabert

Certification Manager

25th May 2012

Date

Type Test Report for M. V. Betobar



ALPHA at VDE

Meisenstrasse 28

63069 Offenbach / Germany

LOVAG

Certificate

of Conformity

LOVAG-Certificate No.: DE 0276

Apparatus LV Busbar Trunking System (BTS)

Designation Type BA24BC

Manufacturer or responsible vendor

ETA-COM B n.v.
Scheldeweg 4
2850 Boom
Belgium

This Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designation with that tested rests with the manufacturer or responsible vendor.

This certificate has been awarded according to LOVAG (Low Voltage Agreement Group) Objectives Operating Principles of mutual recognition. The responsible certification body as a member of LOVAG issues a Certificate of Conformity with the above mentioned Standard(s) following the exclusive use of LOVAG Test Instructions wherever applicable.

Only integral reproduction of this Certificate or reproductions of this page accompanied by any page(s) on which are stated the tests performed and the assigned rated characteristics of the apparatus tested, are permitted without written permission from the LOVAG Signatory responsible for this Certificate.

Tested for: ETA-COM B n.v., Scheldeweg 4, 2850 Boom, Belgium

Tested by: ALPHA/LOVAG REGISTERED LABORATORY ID 0008 D 08

The apparatus constructed in accordance with the description mentioned in the Test Report listed in this Certificate has been subjected to the series of proving tests in accordance with

IEC 60439-1(ed.3);am1
EN 60439-1:(2009) + A1:(2010)
Clause/Sub clause: 8.2.1; 8.2.2; 8.2.3; 8.2.4; 8.2.5; 8.2.7; 8.2.9; 8.2.10

The results are shown in the Test Report in accordance to LOVAG. The values obtained and the general performance are considered to comply with the above Standard(s) and to justify the characteristics assigned by the manufacturer as stated below

Rated operational voltage(main circuit):	U_e = 1000 V
Rated insulation voltage:	U_i = 1000 V
Rated current:	I_n = 3150 A
Rated Impulse Voltage:	U_{imp} = 12 kV
Resistance:	R = 13.79 mΩ/m
Reactance:	X = 14.33 mΩ/m
Impedance:	Z = 23.11 mΩ/m
Degree of protection:	IP 68

This document includes Report Nos. (Issue Date):
2377.3110025.0915 (2012-05-02)

Responsible Certification Body:

DAkkS Deutsche Akkreditierungsstelle D-PL-12001-01-01

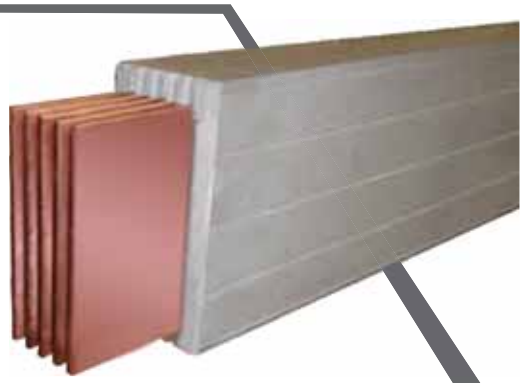
VDE Testing and Certification Institute

Wilhelm Horner
Authorized Signature

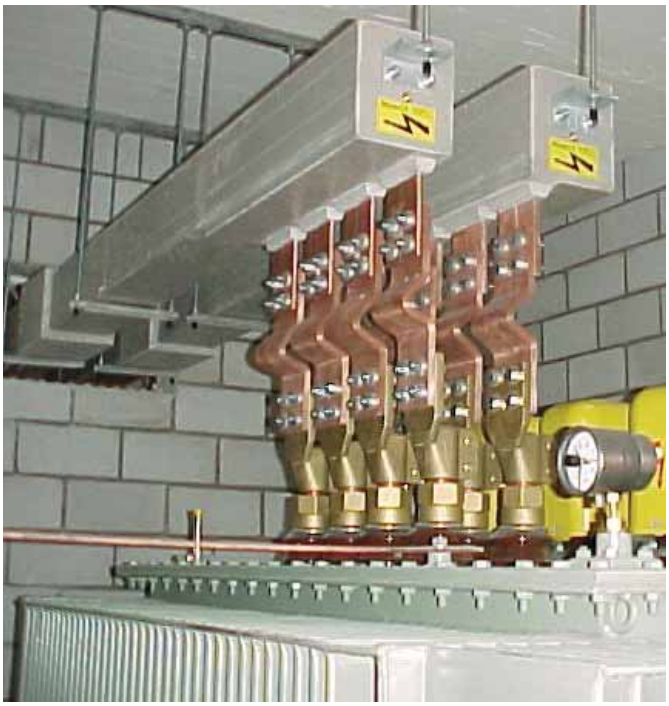
Date: 2012-06-26

Type Test Report for L. V. Betobar

Low Voltage



Applications



Technical Specifications for Low Voltage

Compliance Standard	IEC 61439 (1 & 6)
Independent Certification	KEMA, MPA (Germany), ISSeP, LCE, ASTA, IPH
Type of Series	LA - Single Duct & Double Duct - 3, 4 & 5 Pole LB - Single Duct - 6, 7, 8 & 9 Pole
Busbar Configuration	3 Phase 3 Phase + 100% Neutral 3 Phase + 100% Neutral + 100% Isolated Earth
Ratings	**LA Copper Series** 735A to 3375A (Single Duct) 3955A to 6300A (Double Duct) **LB Copper Series** 1795A to 3420A (Single Duct) **LA Aluminium Series** 513A to 2700A (Single Duct) 3159A to 5040A (Double Duct) **LB Aluminium Series** 1572A to 2736A (Single Duct)
Rated Operating Voltage	1000V, AC
Rated Insulation Voltage	1000V, AC
Rated Impluse withstand Voltage (U_{imp})	12kV (1.2/50 µs)
Rated Frequency	50Hz
Busbar Material	Copper - 99.9% Pure ETP Grade Aluminium - 99.5% Pure Grade
Insulation	CLASS 'B' (130°C)
Degree of Protection	IP68 as per IEC 60529
Mechanical Impact Strength	IK.10 as per DIN 52453 & IEC 62262
Tap Off Box	Upto 400A - Pluggable From 400A to 630A - Fixed Type
Conditions of use	Altitude upto 5000m, indoor as well as outdoor Ambient temperature ; -50°C/ +55°C Ambient Humidity : 0% - 100%

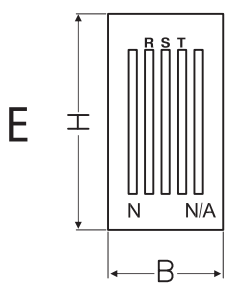
Aluminium betobar

Type	3-4 cond BxH (mm)	5 cond BxH (mm)	In 35/40°C A	Alum. N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m		
												3 cond.	4 cond.	5 cond.
E single duct														
LA 04EA	104 x 80	104 x 80	513	160	15	30	181.3	235.7	53.2	241.6	190	20.4	20.6	20.7
			571	200	18	36	145.0	186.6	54.0	196.2	190	20.5	20.7	20.9
			635	240	22	46	120.8	157.2	54.7	166.4	190	20.7	20.9	21.1
LA 08EA	104 x 120	104 x 120	893	320	24	50	90.6	117.8	32.1	122.1	280	30.9	31.2	31.5
			995	400	31	65	72.5	94.9	32.8	100.4	280	31.1	31.5	31.9
LA 12EA	104 x 160	104 x 160	1163	480	32	67	60.4	79.7	23.0	83	322	41.3	41.8	42.2
			1295	600	40	84	48.3	64.3	23.6	68.5	322	41.7	42.2	42.8
			1413	720	48	101	40.3	54.0	24.2	59.2	322	42	42.7	43.4
LA 16EA	104 x 200	104 x 200	1624	800	46	97	36.3	49.1	18.5	52.5	387	52.2	53	53.8
			1760	960	55	121	30.2	41.8	19.0	45.9	387	52.7	53.6	54.5
LA 20EA	104 x 240	104 x 240	1932	1000	59	130	29.0	40.1	15.2	42.9	448	62.8	63.7	64.7
			2092	1200	71	156	24.2	34.2	15.7	37.6	448	63.4	64.5	65.7
LA 24EA	104 x 285	104 x 285	2430	1440	76	167	20.1	27.0	13.3	30.1	475	75.3	76.7	78
		114 x 285	2700	1920	88	194	15.1	20.9	14.1	25.2	475	76.7	78.5	87.2

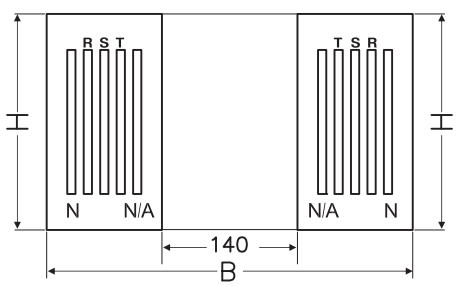
Type	6-7 cond BxH (mm)	8-10 cond BxH (mm)	In 35/40°C A	Alum. N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m		
												6/7 cond.	8 cond.	10 cond.
D double duct														
LA 16DA	344 x 200	344 x 200	3159	2 x 800	96	211	18.1	24.5	9.3	26.2	732	104.4	106	107.5
			3424	2 x 960	115	253	15.1	20.9	9.5	23.0	732	105.4	107.2	109.1
LA 20DA	344 x 240	344 x 240	3492	2 x 1000	98	216	14.5	20.1	7.6	21.5	735	125.6	127.5	129.4
			3783	2 x 1200	117	257	12.1	17.1	7.8	18.8	735	126.7	129	131.3
LA 24DA	344 x 285	344 x 285	4433	2 x 1440	112	246	10.1	13.5	6.7	15.1	796	150.6	153.3	156.1
		364 x 285	5040	2 x 1920	149	328	7.6	10.4	7.0	12.5	796	153.3	157	174.4

Type	6-7 cond BxH (mm)	8-9 cond BxH (mm)	In 35/40°C A	Alum. N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m		
												6 cond.	7 cond.	8/9 cond.
E single duct														
LB 08EA	138 x 120	168 x 120	1572	2 x 400	55	121	36.3	47.5	16.4	50.3	350	44.4	45.1	56.7
LB 12EA	138 x 160	168 x 160	1868	2 x 480	66	145	30.2	39.9	11.5	41.5	416	58.8	59.4	72.8
			2243	2 x 720	81	178	20.1	27.0	12.1	28.6	416	61.3	62.7	77
LB 16EA	138 x 200	168 x 200	2524	2 x 800	94	207	18.1	24.5	9.3	26.2	467	75.5	77	94.5
			2736	2 x 960	103	227	15.1	20.9	9.5	23.0	467	77.3	79.1	97.2

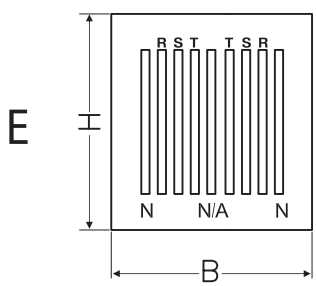
* Total average weight of the system with junctions and standard supports.



LA Single Duct



LA Double Duct



LB Single Duct

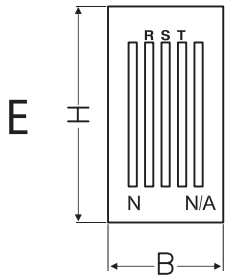
Copper betobar

Type	3-4 cond BxH (mm)	5 cond BxH (mm)	In 35/40°C A	Copper N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m		
												3 cond.	4 cond.	5 cond.
E single duct														
LA 04EC	104 x 80	104 x 80	735	200	25	53	87.5	113.4	54.0	125.6	190	24.9	26.6	28.2
			816	240	30	63	72.9	94.9	54.7	109.5	190	25.9	27.9	29.9
LA 08EC	104 x 120	104 x 120	1141	320	33	69	54.7	71.8	32.1	78.6	280	37.9	40.6	43.2
			1266	400	42	88	43.8	58.3	32.8	66.9	280	39.9	43.2	46.5
LA 12EC	104 x 160	104 x 160	1478	480	43	90	36.5	49.2	23.0	54.3	322	51.6	55.8	59.8
			1635	600	54	119	29.2	40.2	23.6	46.6	322	54.8	59.8	64.8
			1770	720	65	143	24.3	34.3	24.2	41.0	322	57.8	63.8	69.7
LA 16EC	104 x 200	104 x 200	2033	800	63	139	21.9	31.2	18.5	36.2	387	69.8	76.4	83
			2220	960	75	165	18.2	26.6	19.0	32.7	387	73.8	81.7	90
LA 20EC	104 x 240	104 x 240	2402	1000	81	178	17.5	25.8	15.2	29.9	448	84.7	93	101.3
			2600	1200	97	213	14.6	22.1	15.7	27.1	448	89.7	100	109.6
LA 24EC	104 x 285	104 x 285	2811	1200	86	189	14.6	20.1	12.9	23.9	475	100.9	110.9	120.8
			3044	1440	103	227	12.2	17.1	13.3	21.7	475	106.9	118.8	130.8
		114 x 285	3375	1920	120	264	9.1	13.3	14.1	19.4	475	118.8	134.7	157.5

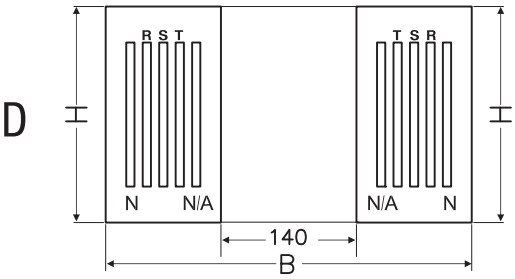
Type	6-7 cond BxH (mm)	8-10 cond BxH (mm)	In 35/40°C A	Copper N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m		
												6/7 cond.	8 cond.	10 cond.
D double duct														
LA 16DC	344 x 200	344 x 200	3955	2 x 800	131	288	10.9	15.6	9.3	18.2	732	139.6	152.8	166.1
			4280	2 x 960	157	345	9.1	13.3	9.5	16.3	732	147.5	163.4	179.3
LA 20DC	344 x 240	344 x 240	4343	2 x 1000	133	293	8.8	12.9	7.6	15.0	735	169.5	186	202.6
			4700	2 x 1200	160	352	7.3	11.0	7.8	13.5	735	179.4	199.3	219.2
LA 24DC	344 x 285	344 x 285	5128	2 x 1200	128	282	7.3	10.0	6.5	11.9	796	201.9	221.8	241.6
			5554	2 x 1440	153	337	6.1	8.6	6.7	10.9	796	213.8	237.7	261.5
		364 x 285	6300	2 x 1920	204	449	4.6	6.7	7.0	9.7	796	237.6	269.5	314.9

Type	6-7 cond BxH (mm)	8-9 cond BxH (mm)	In 35/40°C A	Copper N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m		
												6 cond.	7 cond.	8/9 cond.
E single duct														
LB 08EC	138 x 120	168 x 120	1795	2 x 320	60	132	27.3	35.9	16.0	39.3	350	76.8	90.8	96.1
			2000	2 x 400	75	165	21.9	29.2	16.4	33.5	350	86.1	101.4	108
LB 12EC	138 x 160	168 x 160	2373	2 x 480	90	198	18.2	24.6	11.5	27.2	416	108.6	128.1	136.1
			2625	2 x 600	100	220	14.6	20.1	11.8	23.3	416	122.5	144	153.9
			2810	2 x 720	110	242	12.2	17.1	12.1	21.0	416	136.5	159.9	171.8
LB 16EC	138 x 200	168 x 200	3160	2 x 800	128	282	10.9	15.6	9.3	18.2	467	159	186.6	199.9
			3420	2 x 960	140	308	9.1	13.3	9.5	16.3	467	177.5	207.8	223.7

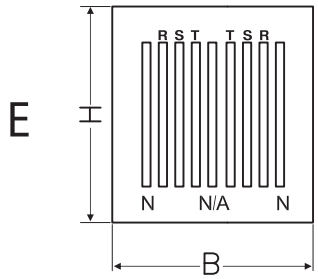
* Total average weight of the system with junctions and standard supports.



LA Single Duct



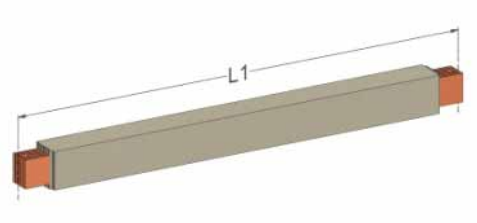
LA Double Duct



LB Single Duct

Straight Element

RE	L1 (mm)		
	Norm	Min	Max
RE1	1000	550	1000
RE2	2000	1001	2000
RE3	3000	2001	3000
RE4	4000	3001	4000

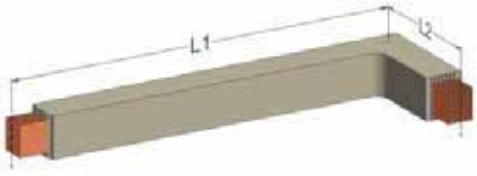


Brazed Elbow Element

HL		L1			L2			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Norm
HL1	L.04-./.	500	250	750	500	250	600	1000	500	1000
	L.08-./.		270	730		270			540	
	L.12-./.		290	710		290			580	
	L.16-./.		310	690		310			620	
	LA 20-./.		330	670		330			660	
	LA 24-./.		353	647		353			706	
HL2	L.04-./.	1500	401	1750	1000	250	600	2000	1001	2000
	L.08-./.			1730		270				
	L.12-./.			1710		290				
	L.16-./.			1690		310				
	LA 20-./.	1000		1670		330		1500		
	LA 24-./.			1647		353				

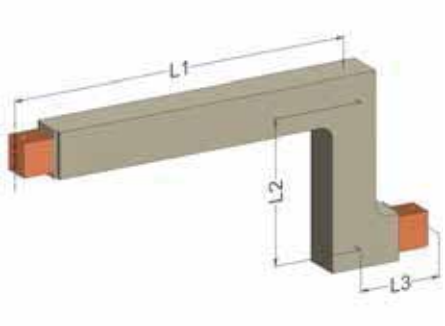
Bent Elbow Element

HB		L1			L2			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Norm
HB1	LA..-3/5 (104mm)	500	262	738	500	262	738	1000	524	1000
	LA..-3/5 (114mm)		267	733		267	733		534	
	LB..-6/7		279	721		279	721		558	
	LB..-8/9		294	706		294	706		588	
HB2	LA..-3/5 (104mm)	1500	262	1738	500	262	1738	2000	1001	2000
	LA20-3/5 (104mm)	1000	262	1738		262	1738	1500		
	LA24-3/5 (114mm)		267	1733		267	1733			
	LB..-6/7	1500	279	1721		279	1721	2000		
	LB..-8/9		294	1706		294	1706			



Brazed 'Z' Element

ZL		L1			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
ZL1	L.04-./.	450	250	705	300	45	500	250			1000	545	1000
	L.08-./.	430	270	685			480	270				585	
	L.12-./.	410	290	665			460	290				625	
	L.16-./.	390	310	645			440	310				665	
	LA 20-./.	370	330	625			420	330				705	
	LA 24-./.	360	353	595	280		397	360				751	
ZL2	L.04-./.	1250	250	1705	500	45	560	250			2000	1001	2000
	L.08-./.	1230	270	1730			540	270					
	L.12-./.	1210	290	1710			520	290					
	L.16-./.	1190	310	1690			500	310					
	LA 20-./.	670	330	1670			500	330			1500		1500
	LA 24-./.	640	353	1640			500	360					

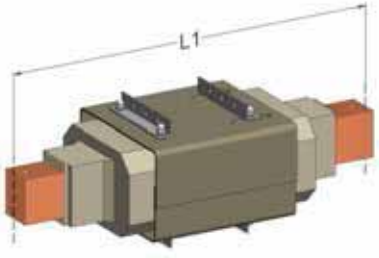


Bent 'Z' Element

ZB		L1			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
ZB1	LA..-3/5 (104mm)	350	262	638	300	100	476	350	262	638	1000	624	1000
	LA..-3/5 (114mm)		267	633			466		267	633		634	
	LB..-6/7		279	621			442		279	621		658	
	LB..-8/9		294	606			412		294	606		688	
ZB2	LA..-3/5 (104mm)	1000	262	1638	500	100	1476	500	262	1638	2000	1001	2000
	LA20-3/5 (104mm)	500	262	1638			1476		262	1638	1500		
	LA24-3/5 (114mm)		267	1633			1466		267	1633			
	LB..-6/7	1000	279	1621			1442		279	1621	2000		
	LB..-8/9		294	1606			1412		294	1606			

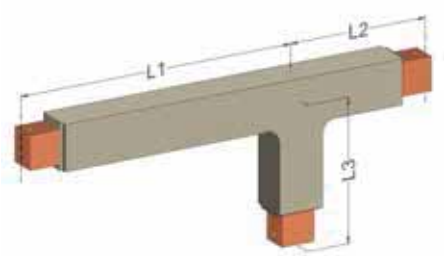
Expansion Element

EX	L1 (mm)		
EX1	Norm	Min	Max
	1000	1000	1000



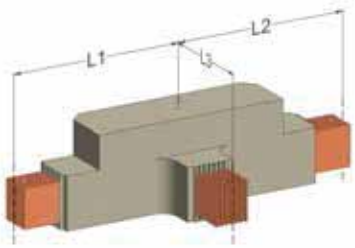
Brazed T Element

TL		L1			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
TL1	L.04-./.	330	250	500	330	250	500	340	250	600	1000	750	1000
	L.08-./.		270	460		270	460		270			810	
	L.12-./.		290	420		290	420		290			870	
	L.16-./.		310	380		310	380		310			930	
	LA20-./.		330	340		330	340		330			990	
TL2	L.04-./.	1000	250	1500	500	250	1500	500	250	600	2000	1001	2000
	L.08-./.		270	1460		270	1460		270				
	L.12-./.		290	1420		290	1420		290				
	L.16-./.		310	1380		310	1380		310				
	LA20-./.		330	1340		330	1340		330				
	LA24-./.	500	353	1294		353	1294		353		1500	1059	1500



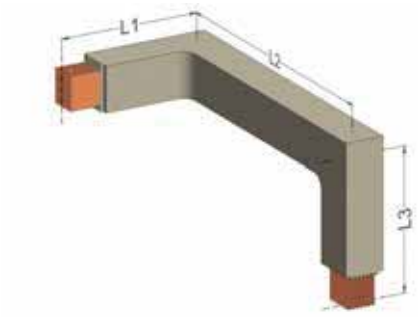
Bent T Element

TB		L1			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
TB2	LA04-3/5	380			380			280			1040		
	LA08-3/5	420			420						1120		
	LA12-3/5	510			510						1300		
	LA16-3/5	570			570						1420		
	LA20-3/5 (104mm)	610			610			280			1500		
	LA24-3/5 (104mm)	650			650			280			1580		
	LA24-3/5 (114mm)	655			655			285			1595		
	LB04-6/7	380			380			295			1055		
	LB08-6/7	440			440						1175		
	LB12-6/7	510			510						1315		
	LB16-6/7	570			570						1435		
	LB04-8/9	420			420			310			1150		
	LB08-8/9	460			460						1230		
	LB12-8/9	570			570						1450		
	LB16-8/9	610			610						1530		

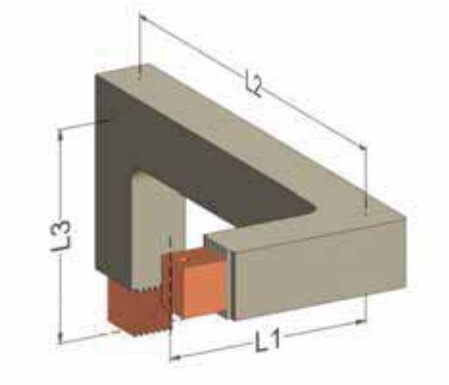


Double Elbow Element

XR/XL		L1			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
XR1/ XL1	La04- 3/5	330	262	558	330	192	488	340	250	546	1000	704	1000
	LA08-3/5			518		212	468		270	526		744	
	LA12-3/5			478		232	448		290	506		784	
	LA16-3/5			438		252	428		310	486		824	
	LA20-3/5 (104mm)			398		272	408		330	466		864	
	LA24-3/5 (104mm)	310		352		295	385	360	353	443		910	
	LA24-3/4 (114mm)	310	267	347		300	385	360	353	438		915	
	LB04-6/7	330	279	541		209	471	340	250	512		738	
	LB08-6/7			501		229	451		270	492		778	
	LB12-6/7			461		249	431		290	472		818	
	LB16-6/7			421		269	411		310	452		858	
	LB04-8/9		294	526		224	456		250	482		768	
	LB08-8/9			486		244	436		270	462		808	
	LB12-8/9			446		264	416		290	442		848	
	LB16-8/9			406		284	396		310	422		888	
XR2/ XL2	LA04- 3/5	500	262	1558	1000	192	1488	500	250	600	2000	1001	2000
	LA08-3/5			1518		212	1468		270				
	LA12-3/5			1478		232	1448		290				
	LA16-3/5			1438		252	1428		310				
	LA20-3/5 (104mm)			1398	500	272	1408		330		1500		
	LA24-3/5 (104mm)			1352		295	1385		353				
	LA24-3/5 (114mm)			1347		300	1385		353				
	LB04-6/7		279	1541	1000	209	1471		250		2000		
	LB08-6/7			1501		229	1451		270				
	LB12-6/7			1461		249	1431		290				
	LB16-6/7			1421		269	1411		310				
	LB04-8/9		294	1526		224	1456		250				
	LB08-8/9			1486		244	1436		270				
	LB12-8/9			1446		264	1416		290				
	LB16-8/9			1406		284	1396		310				



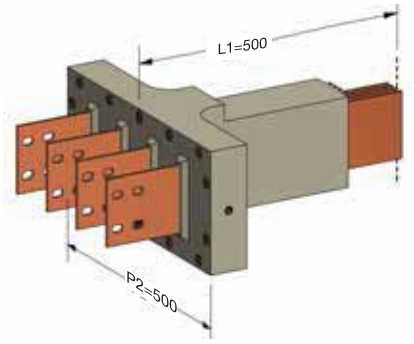
'XR' Type



'XL' Type

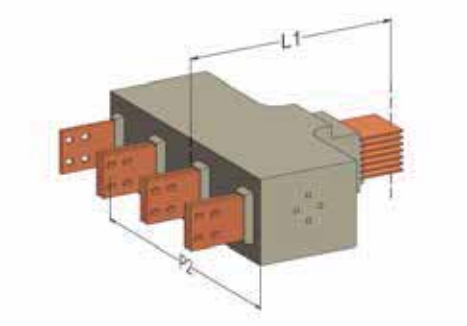
Terminal Elements

	L1** (mm)	P2* (mm)
	Norm	Norm
NG	500	500



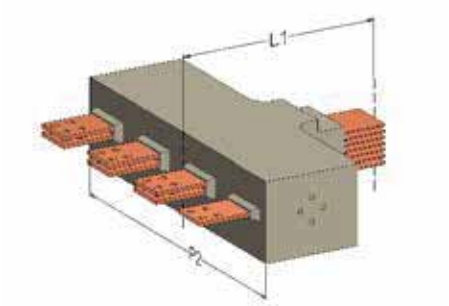
'NG' Type Standard Terminal Element

	L1** (mm)		
	Norm	Min	Max
AF1	500	400	1000



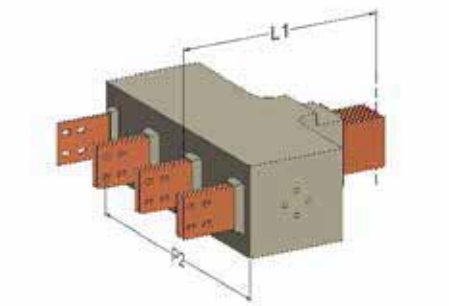
'AF' Type

	L1** (mm)		
	Norm	Min	Max
AH1	500	400	1000



'AH' Type

	L1** (mm)		
	Norm	Min	Max
AG1	500	400	1000

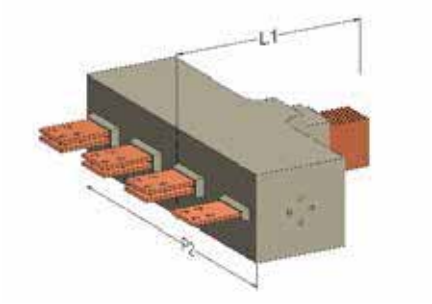


'AG' Type

**L1standard dimensions for terminal element with 4 poles, for all other configurations (3 or 5 poles) dimensions will be as per equipment lay-out, depending on the geometry of the terminal head

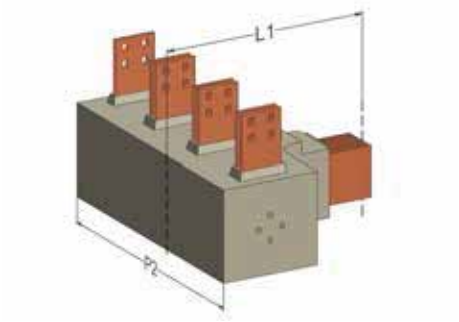
*P2dimensions will be as per equipment lay-out, depending on the geometry of the terminal head.

	L1** (mm)		
	Norm	Min	Max
AJ1	500	400	1000



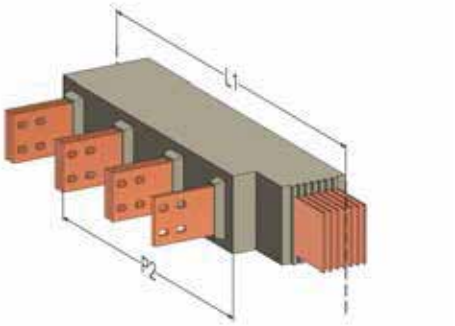
'AJ' Type

	L1** (mm)		
	Norm	Min	Max
AO1	500	400	1000



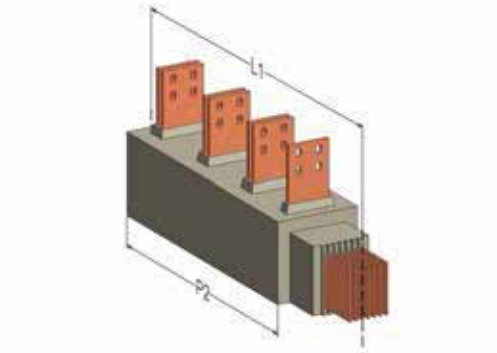
'AO' Type

	L1** (mm)		
	Norm	Min	Max
AC1	500	400	1000
AC2	1500	1001	2000



'AC' Type

	L1** (mm)		
	Norm	Min	Max
AP1	500	400	1000
AP2	1500	1001	2000



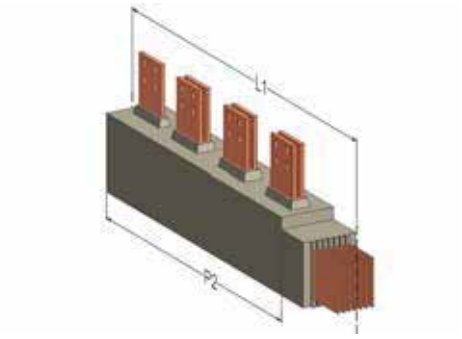
'AP' Type

**L1standard dimensions for terminal element with 4 poles, for all other configurations (3 or 5 poles) dimensions will be as per equipment lay-out, depending on the geometry of the terminal head

*P2dimensions will be as per equipment lay-out, depending on the geometry of the terminal head.

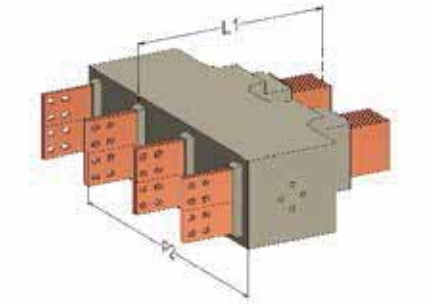
Terminal Elements

	L1** (mm)		
	Norm	Min	Max
AE1	1500	400	1000
AE2	1500	1001	2000



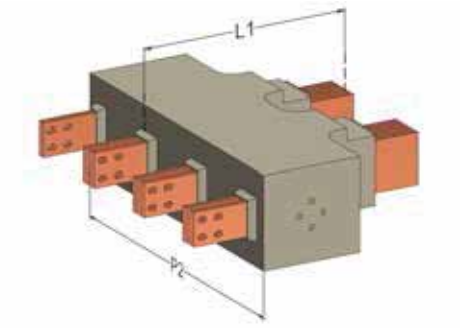
'AE' Type

	L1** (mm)		
	Norm	Min	Max
DGD1	500	480	1000



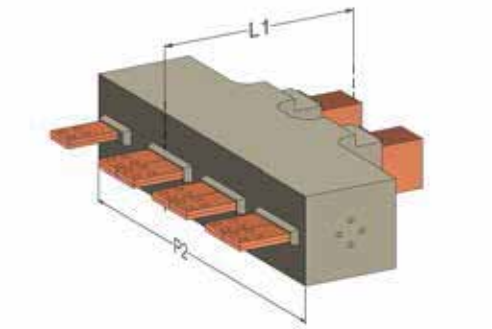
'DGD' Type

	L1** (mm)		
	Norm	Min	Max
DGF1	500	480	1000



'DGF' Type

	L1** (mm)		
	Norm	Min	Max
DJD1	500	480	1000



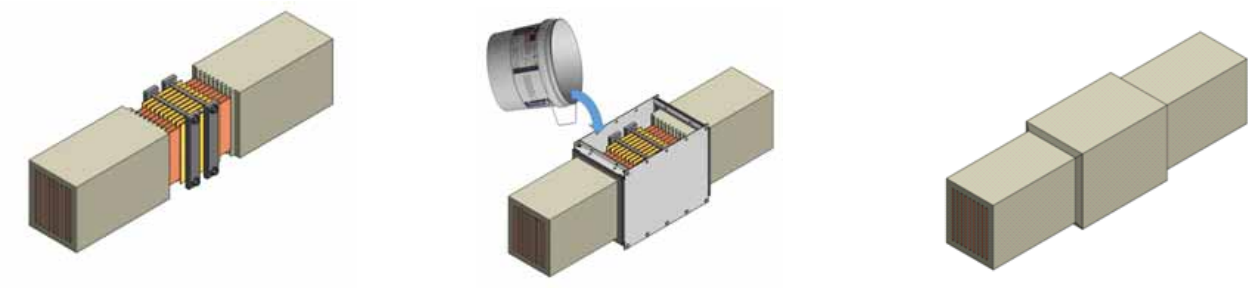
'DJD' Type

**L1standard dimensions for terminal element with 4 poles, for all other configurations (3 or 5 poles) dimensions will be as per equipment lay-out, depending on the geometry of the terminal head

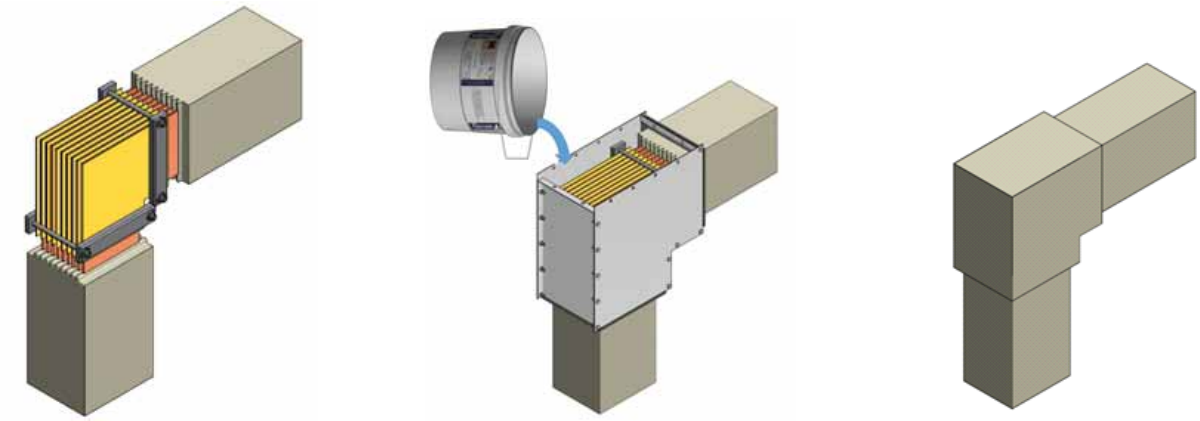
*P2dimensions will be as per equipment lay-out, depending on the geometry of the terminal head.

Joints for Low Voltage

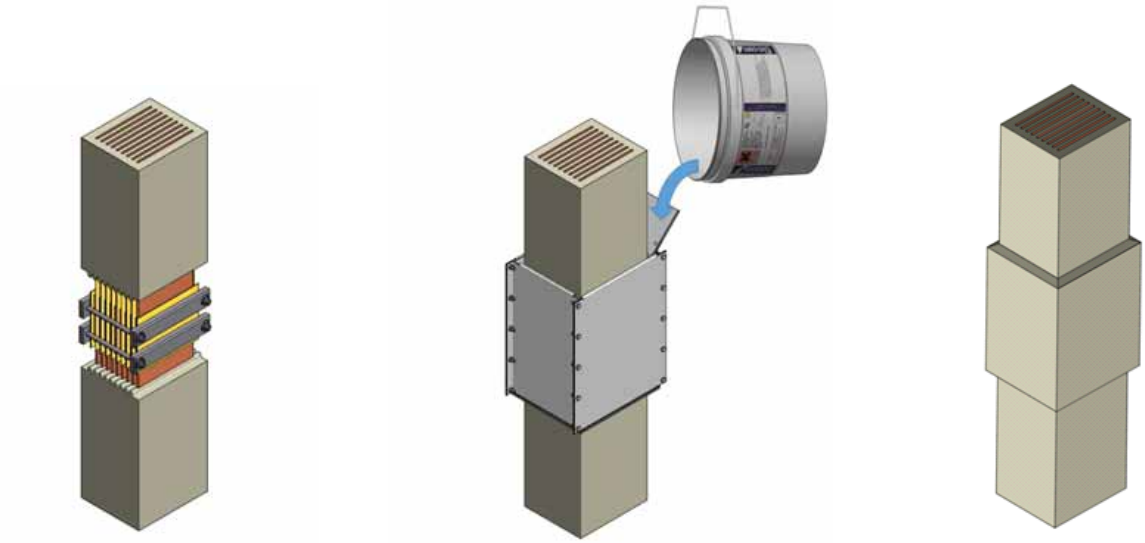
Assemble **Cast** **Result**



ST26 Joint

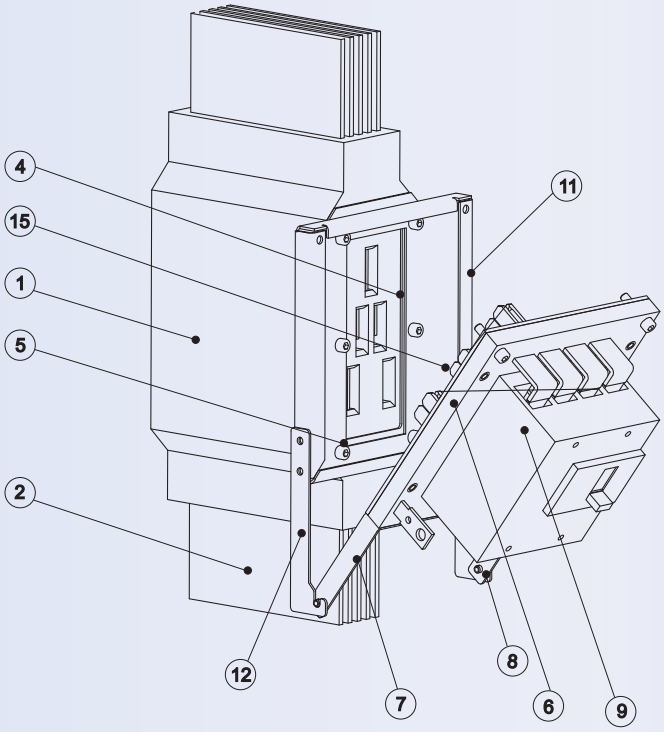


ST27 Joint



ST29 Joint

Pluggable Tap-off for betobar Low Voltage installation system



PARTS LIST		
ITEM	QTY.	DESCRIPTION
1	1	Bim Insulation
2	5	Conductor
3	1	Earth Connection
4	1	Sealing
5	6	Frame Fixing Bolts
6	1	Tap-off Unit
7	1	U-Bracket
8	2	Hinge
9	1	MCCB
11	1	Frame
12	2	Hinge
14	2	Tap-off Fixing Bolts
15	20	Contact - Finger

Major Advantages

- Compact, practical and safe way to tap off up to 400A under up to 1000V AC.
- Short-circuit current up to 80 kA 1s.
- Double sets of contacts to ensure low resistance.
- Quick and easy to install and remove.
- An 'open' safe to touch branch point.
- Available up to IP68.
- An unused branch point does not consume additional space and the ingress protection of the main line is maintained (up to IP68).
- The tension in the main line does not have to be interrupted to plug in or remove a Pluggable tap-off.
- To replace a switch, the main switch no longer has to be de-energized. The only part without current will be the part behind the switch. Possibility to foresee a spare switch in order to minimize the down time.
- Applications: modular production facility, high-rise building requiring a switch per floor, tunnels etc.
- Certified by LOVAG

Pluggable Tap-off for betobar Low Voltage installation system

All tap-off points are protected with a water- and dustproof cover. Keep all components at hand . Remove the cover at the last moment to reduce risk of contamination of the contact points.

Remove the cover .Make sure the rubber seal stays in place or replace with a new one .

Check for humidity (condensation) and wipe dry if necessary.

The aluminum frame contains hinges that guide the switch in place, but also secure the protection box.

Fix the frame and protection box to the busduct, always taking care to keep the rubber seal in place.

The removable unit can now easily be plugged in, using the hinges as guidance.

Gently apply pressure until the tap-off basis touches the frame. Then screw the bolts into the frame.

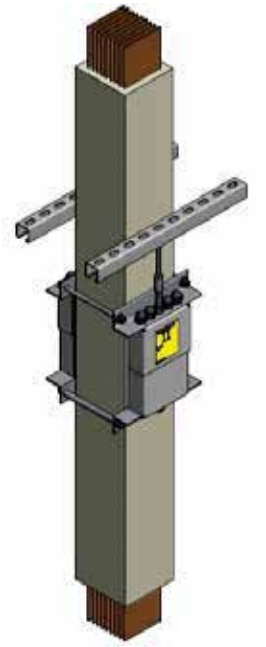
The MCCB is now ready for operation.

STEP 9

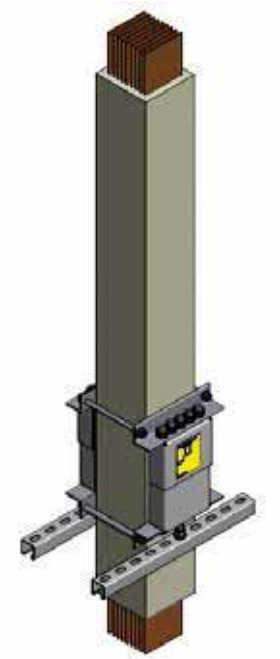
Complete pluggable unit including protection box. A pluggable tap-off with MCCB must be installed inside a box for safety reasons. This box can be chosen in function of required IP class and ambient conditions.

For more clarity the assembly of the pluggable unit as shown in steps 1 - 8 was demonstrated without protection box.

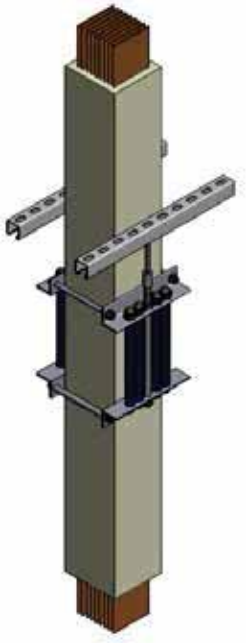
Spring Supports



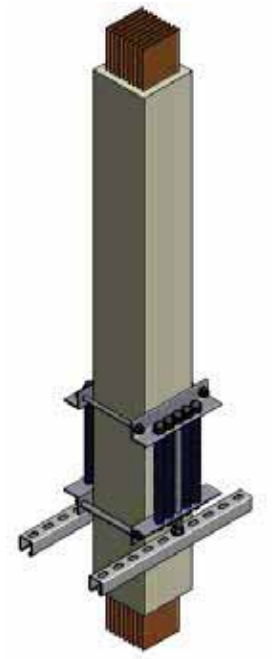
Closed Spring Support in Hanging Arrangement



Closed Spring Support in Standing Arrangement



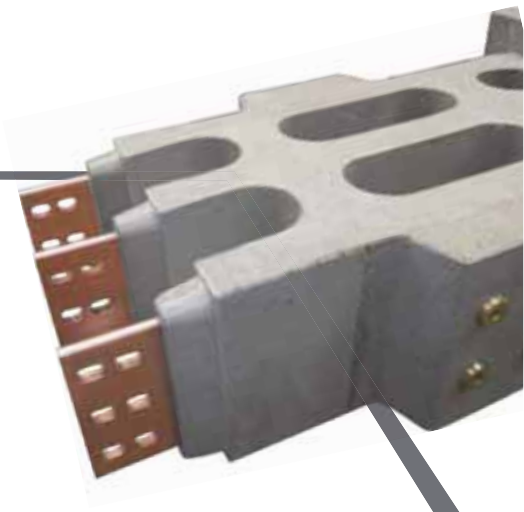
Open Spring Support in Hanging Arrangement



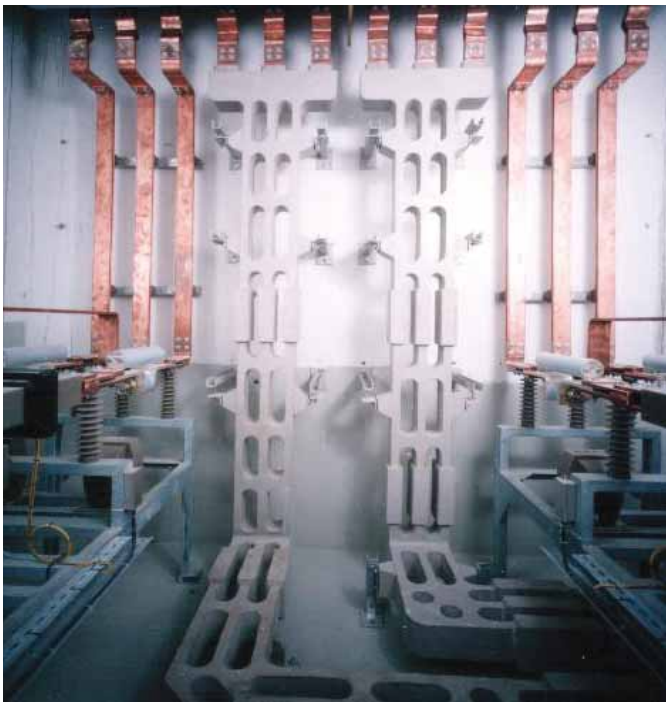
Open Spring Support in Standing Arrangement

betobar

Medium Voltage



Applications



Technical Specifications for Medium Voltage

Compliance Standard	IEC 62271
Independent Certification Authority	KEMA, MPA (Germany), ISSeP, ASTA, IPH
Type of Series	SH & PH Series
Ratings	**SH Series** Aluminium - 1368A to 1645A Copper - 1345A to 2030A **PH Series Unshielded** Aluminium- 1377A to 4967A Copper - 1939A to 6140A **PH Series Shielded** Aluminium- 1193A to 4303A Copper - 1680A to 5391A
Rated Operating Voltage	SH Series - 3.6 kV to 12 kV PH Series - 3.6 kV to 17.5 kV
Rated Frequency	50Hz
Busbar Material	Copper 99.9% Pure ETP grade Aluminium, 99.5% Pure grade
Insulation	CLASS 'B' (130^{0}C)
Degree of Protection	IP67 as per IEC 60529
Mechanical Impact	IK.10 as per IEC 62262 DIN 52453
Conditions of use	Altitude upto 5000m, indoor as well as outdoor Ambient temperature ; -50^{0}C / + 60^{0}C Ambient Humidity : 0% - 100%

SH Series

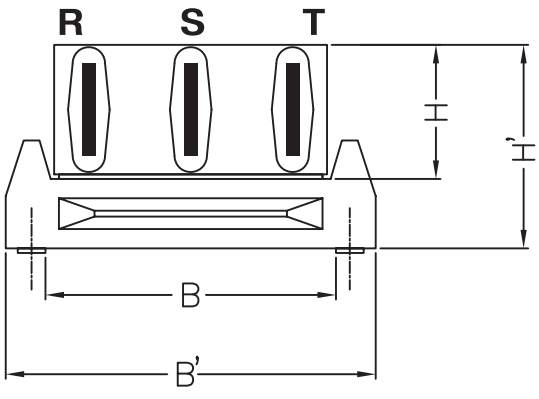
Aluminium betobar

Type	B x H (mm)	B' x H' (mm)	In 35/40°C A	Alum. N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m
3.6-12KV**, 50 Hz												
SH 10A	160 x 140	250 x 195	1368	800	38	95	36.3	48.0	79	92.4	270	57.6
			1511	1000	47	118	29.0	39.4	77.9	87.3	270	58.6
			1645	1200	57	143	24.2	33.0	76.8	83.7	270	59.5

Copper betobar

Type	B x H (mm)	B' x H' (mm)	In 35/40°C A	Copper N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m
3.6-12KV, 50 Hz												
SH 06C	160 x 100	250 x 155	1345	480	48	120	36.5	48.1	102.9	113.6	261	58.3
			1485	600	60	150	29.2	39.4	101.1	108.5	261	63.2
			1616	720	72	180	24.3	33.3	99.3	104.7	261	68.2
SH 10C	160 x 140	250 x 195	1718	800	52	130	21.9	30.3	79	84.6	270	86.9
			1882	1000	64	160	17.5	25.3	77.9	81.9	270	95.2
			2030	1200	77	193	14.6	21.7	76.8	79.8	270	103.4

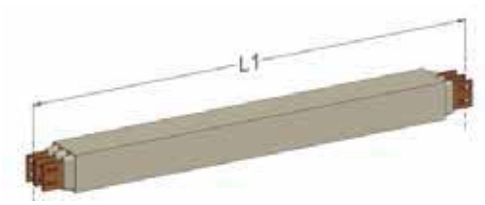
*Total average weight of the system with junctions and standard supports.



SH Series - Element Restricted Dimensions

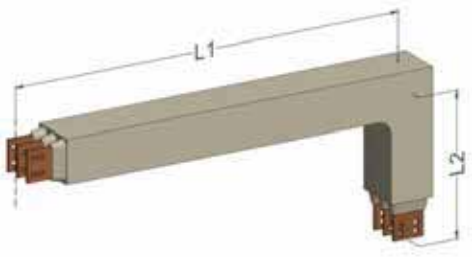
Straight Element

RE	L1 (mm)		
	Norm	Min	Max
RE1	1000	350	1000
RE2	2000	1001	2000
RE3	3000	2001	3000
RE4	4000	3001	4000



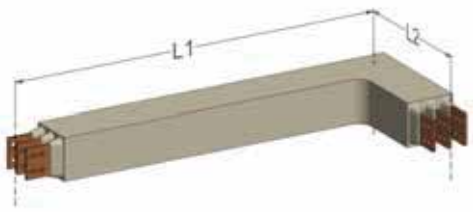
Brazed Elbow Element

HL		L1 (mm)			L2			L-Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
HL1	SH06	500	260	740	500	260	600	1000	520	1000
	SH10		280	720		280			560	
HL2	SH06	1500	401	1740	500	260	600	2000	1001	2000
	SH10			1720		280				



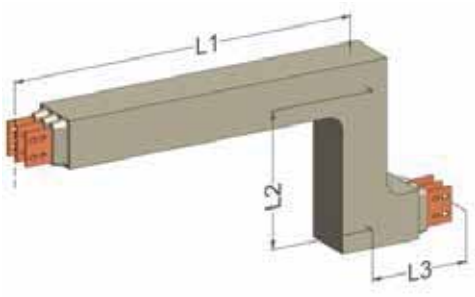
Bent Elbow Element

HB		L1 (mm)			L2			L-Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
HB1	SH06	500	290	710	500	290	710	1000	580	1000
	SH10		290	710		290	710		580	
HB2	SH06	500	290	1710	500	290	1710	2000	1001	2000
	SH10		290	1710		290	1710			



Brazed 'Z' Element

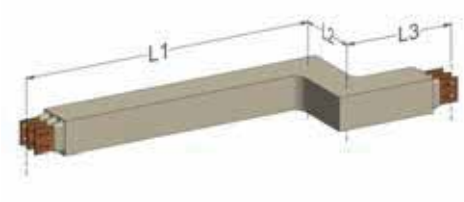
ZL		L1 (mm)			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
ZL1	SH06	440	260	695	300	45	560	260			1000	565	1000
	SH10	420	280	675			520	280				605	
ZL2	SH06	1240	260	1695	500	45	560	260			2000	1001	2000
	SH10	1220	280	1675			520	280					



*Depending on the geometry of termination head flange.

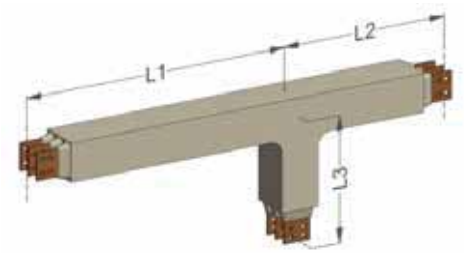
Bent ‘Z’ Element

ZB		L1 (mm)			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
ZB1	SH06	350	290	610	300	100	420	350	290	610	1000	680	1000
	SH10		290	610			420		290	610		680	
ZB2	SH06	1000	290	1610	500	100	1420	500	290	1610	2000	1001	2000
	SH10		290	1610			1420		290	1610			



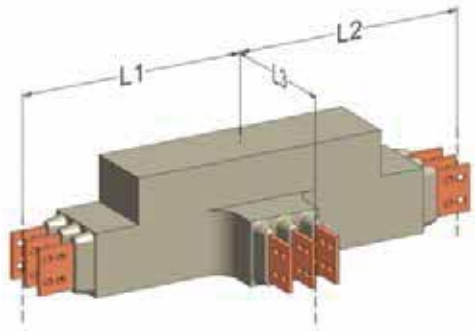
Brazed ‘T’ Element

TL		L1 (mm)			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
TL1	SH06	330	260	480	330	260	480	340	260	480	1000	780	1000
	SH10		280	440		280	440		280	440		840	
TL2	SH06	500	260	1480	500	260	1480	500	260	1480	2000	1001	2000
	SH10		280	1440		280	1440		280	1440			



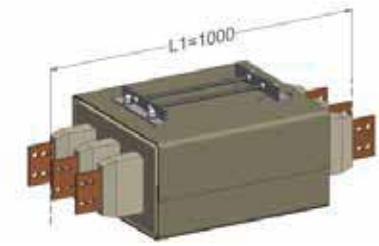
Bent ‘T’ Element

TB		L1 (mm)			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
TB2	SH06	460			460			315			1235		
	SH10	570			570						1455		



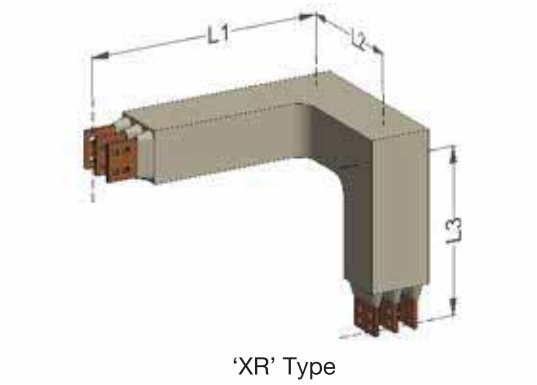
Expansion Element

EX	L1 (mm)		
	Norm	Min	Max
EX1	1000	1000	1000

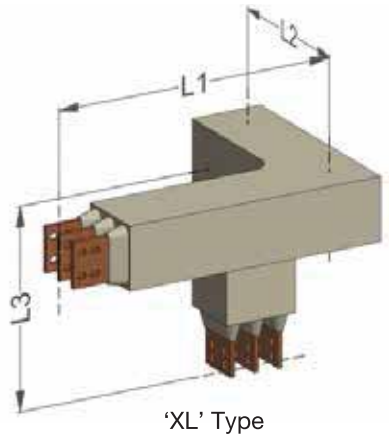


Double Elbow Element

XR/XL		L1 (mm)			L2			L3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
XR1/ XL1	SH06	330	290	450	330	290	450	340	260	420	1000	840	1000
	SH10		290	430		290	430		280	420		860	
XR2/ XL2	SH06	500	290	1450	1000	290	1450	500	260	600	2000	1001	2000
	SH10		290	1430		290	1430		280				



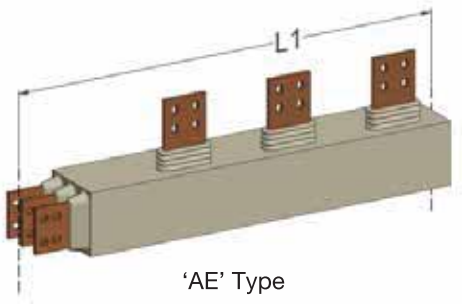
'XR' Type



'XL' Type

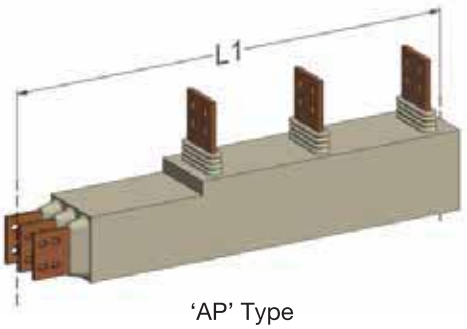
Terminal Elements

	L1		
	Norm	Min	Max
AE1	500	400*	1000
AE2	1500	1001	2000



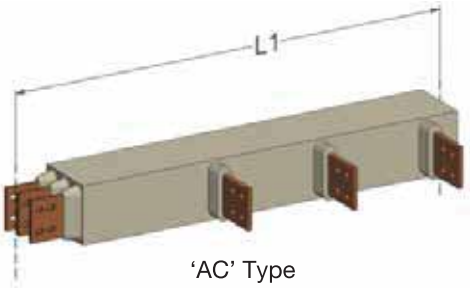
'AE' Type

	L1		
	Norm	Min	Max
AP1	500	400*	1000
AP2	1500	1001	2000



'AP' Type

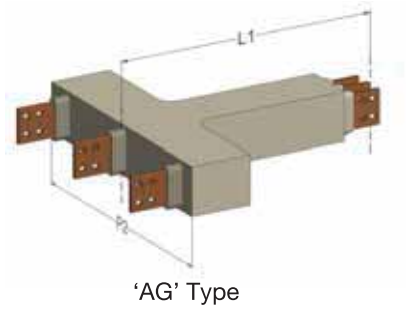
	L1		
	Norm	Min	Max
AC1	500	400*	1000
AC2	1500	1001	2000



'AC' Type

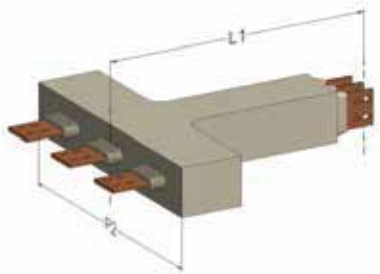
Terminal Elements

	L1		
	Norm	Min	Max
AG1	500	400*	1000



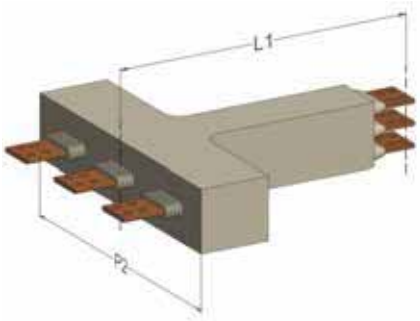
'AG' Type

	L1		
	Norm	Min	Max
AJ1	500	400*	1000



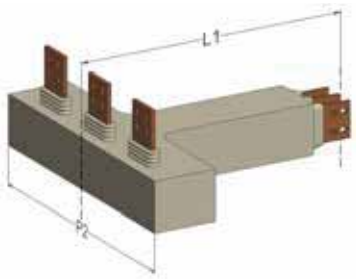
'AJ' Type

	L1		
	Norm	Min	Max
AM1	500	400*	1000



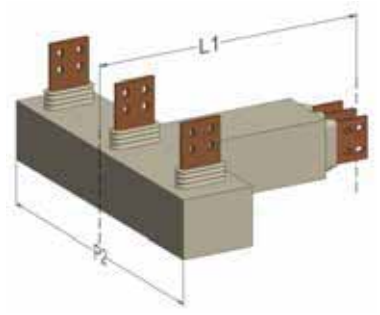
'AH' Type

	L1		
	Norm	Min	Max
AH1	500	400*	1000



'AM' Type

	L1		
	Norm	Min	Max
AO1	500	400*	1000



'AO' Type

*P2 dimension will be as per the equipment layout depending on the geometry of the terminal head.

PH Series

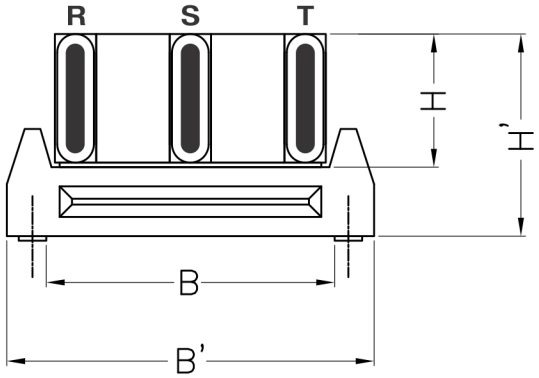
Unshielded Aluminium betobar

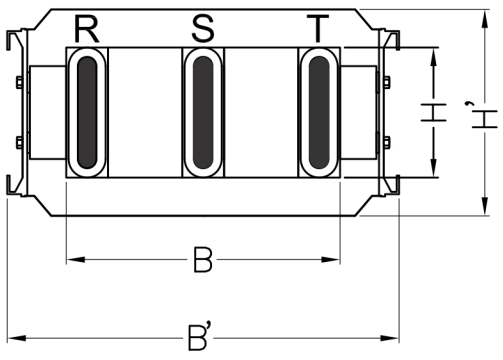
Type	B x H (mm)	B' x H' (mm)	In 35/40°C A	Alum. N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C μΩ/m	Rac OT μΩ/m	X μΩ/m	Z μΩ/m	P Losses @ In W/m	Element Weight *Kg/m
3.6-7.2-12-17.5KV, 50 Hz												
PH 10A	301 x 140	390 x 215	1377	400	29	73	72.5	92.1	130.6	159.8	521	59.7
			1675	600	44	110	48.3	62.2	129.5	143.7	521	60.3
PH 12A	322 x 170	390 x 245	1680	720	32	80	40.3	52.9	119.5	130.7	541	82.1
			1918	960	43	108	30.2	40.5	118.5	125.2	541	82.8
			2118	1200	53	133	24.2	33.2	117.6	122.2	541	83.5
PH 16A	322 x 210	390 x 285	2586	1280	55	138	22.7	31.5	103.4	108.1	628	102.6
			2854	1600	69	173	18.1	25.8	102.7	105.9	628	103.5
PH 20A	322 x 260	390 x 335	3131	2 x 800	49	123	18.1	24.0	92.1	95.2	706	127.1
			3461	2 x 1000	61	153	14.5	19.7	91.5	93.6	706	128.2
PH 24A	322 x 300	390 x 375	4079	2 x 1200	81	203	12.1	16.6	82.7	84.3	829	148.2
			4413	2 x 1440	98	245	10.1	14.2	82.2	83.4	829	149.6
			4967	2 x 1920	130	325	7.6	11.2	81.2	82.0	829	152.4

Shielded Aluminium betobar

Type	B x H (mm)	B' x H' (mm)	In 35/40°C A	Alum. N,L1,L2,L3 mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C μΩ/m	Rac OT μΩ/m	X μΩ/m	Z μΩ/m	P Losses @ In W/m	Element Weight *Kg/m
3.6-7.2-12-17.5KV, 50 Hz												
PH 10AS	301 x 140	500 x 252	1193	400	29	73	72.5	92.1	130.6	159.8	391	76.7
			1451	600	44	110	48.3	62.2	129.5	143.7	391	77.2
PH 12AS	322 x 170	522 x 342	1565	720	32	80	40.3	52.9	119.5	130.7	458	100.8
			1788	960	43	108	30.2	40.5	118.5	125.2	458	101.5
			1974	1200	53	133	24.2	33.2	117.6	122.2	458	102.2
PH 16AS	322 x 210	522 x 342	2240	1280	55	138	22.7	31.5	103.4	108.1	472	122.3
			2472	1600	69	173	18.1	25.8	102.7	105.9	472	123.3
PH 20AS	322 x 260	522 x 392	2712	2 x 800	49	123	18.1	24.0	92.1	95.2	531	127.1
			2998	2 x 1000	61	153	14.5	19.7	91.5	93.6	531	128.2
PH 24AS	322 x 300	522 x 432	3533	2 x 1200	81	203	12.1	16.6	82.7	84.3	622	173.9
			3823	2 x 1440	98	245	10.1	14.2	82.2	83.4	622	175.2
			4303	2 x 1920	130	325	7.6	11.2	81.2	82.0	622	178

* Total average weight of the system with junctions and standard supports





PH Series

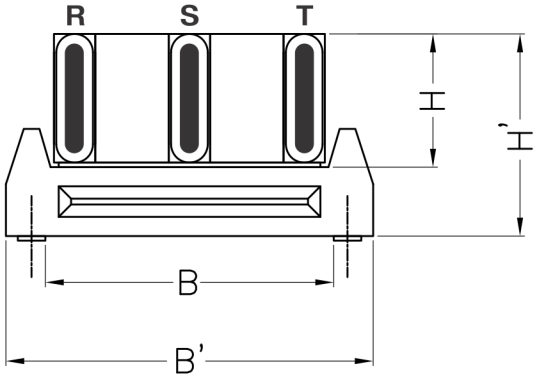
Unshielded Copper betobar

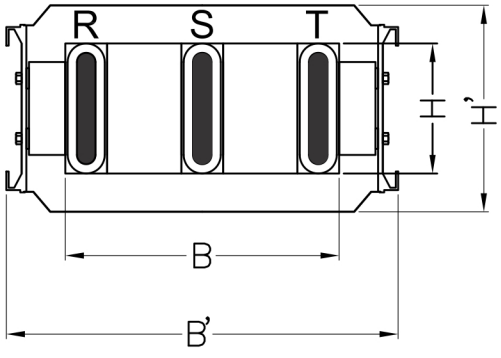
Type	B x H (mm)	B' x H' (mm)	In 35/40°C A	Copper RST mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m
3.6-7.2-12-17.5KV, 50 Hz												
PH 10C	301 x 140	390 x 215	1939	500	50	125	35.0	46.2	130.0	138.0	521	71
			2100	600	60	150	29.2	39.4	129.5	135.4	521	73.5
PH 12C	322 x 170	390 x 245	2114	720	44	110	24.3	33.2	119.5	124.0	541	98
PH 16C	322 x 210	390 x 285	2849	960	57	143	18.2	25.8	104.1	107.2	628	122.8
			3209	1280	75	188	13.7	20.3	103.4	105.4	628	130.7
			3523	1600	94	235	10.9	16.9	102.7	104.1	628	138.7
PH 20C	322 x 260	390 x 335	3939	2 x 800	67	168	10.9	15.1	92.1	93.3	706	162.2
			4323	2 x 1000	83	208	8.8	12.6	91.5	92.4	706	172.1
PH 24C	322 x 300	390 x 375	4613	2 x 960	77	193	9.1	12.9	83.2	84.2	829	189
			5063	2 x 1200	96	240	7.3	10.7	82.7	83.4	829	200.9
			5446	2 x 1440	116	290	6.1	9.3	82.9	83.4	829	212.8
			6140	2 x 1920	154	385	4.6	7.3	81.2	81.5	829	236.7

Shielded Copper betobar

Type	B x H (mm)	B' x H' (mm)	In 35/40°C A	Copper RST mm²	Icw 1 sec kA	Ipk kA	Rdc 20°C µΩ/m	Rac OT µΩ/m	X µΩ/m	Z µΩ/m	P Losses @ In W/m	Element Weight *Kg/m
3.6-7.2-12-17.5KV, 50 Hz												
PH 10CS	301 x 140	500 x 252	1680	500	50	125	35.0	46.2	130.0	138.0	391	87.9
			1819	600	60	150	29.2	39.4	129.5	135.4	391	90.4
PH 12CS	322 x 170	522 x 342	1970	720	44	110	24.3	33.2	119.5	124.0	458	116.6
PH 16CS	322 x 210	522 x 342	2468	960	57	143	18.2	25.8	104.1	107.2	472	142.5
			2780	1280	75	188	13.7	20.3	103.4	105.4	472	150.4
			3052	1600	94	235	10.9	16.9	102.7	104.1	472	158.4
PH 20CS	322 x 260	522 x 392	3412	2 x 800	67	168	10.9	15.1	92.1	93.3	531	184.8
			3745	2 x 1000	83	208	8.8	12.6	91.5	92.4	531	194.7
PH 24CS	322 x 300	522 x 432	3996	2 x 960	77	193	9.1	12.9	83.2	84.2	622	214.6
			4386	2 x 1200	96	240	7.3	10.7	82.7	83.4	622	226.6
			4718	2 x 1440	116	290	6.1	9.3	82.9	83.4	622	256.4
			5319	2 x 1920	154	385	4.6	7.3	81.2	81.5	622	262.3

* Total average weight of the system with junctions and standard supports

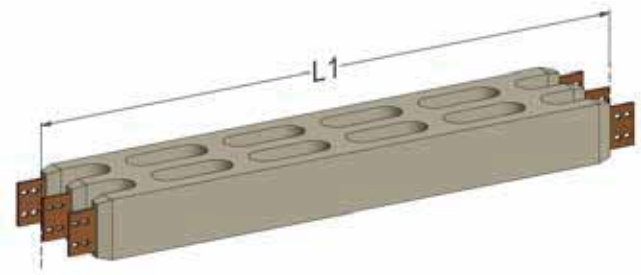


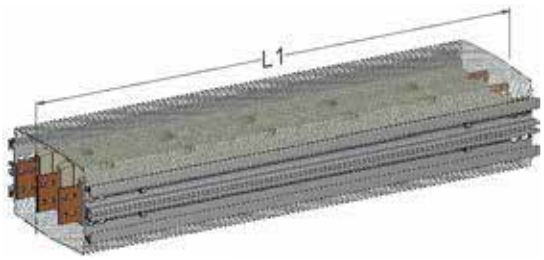


PH Series - Elements

Straight Element

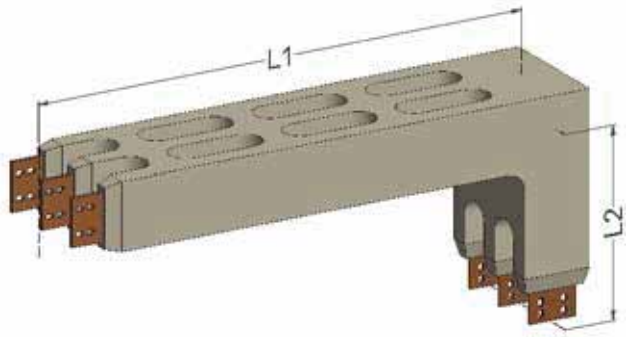
RE	L1 (mm)		
	Norm	Min	Max
RE1	1000	550	1000
RE2	2000	1001	2000
RE3	3000	2001	3000
RE4	4000	3001	4000

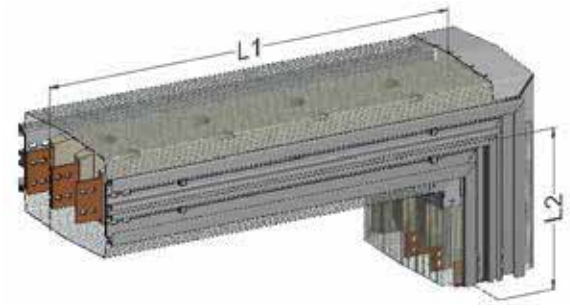




Brazed Elbow Element

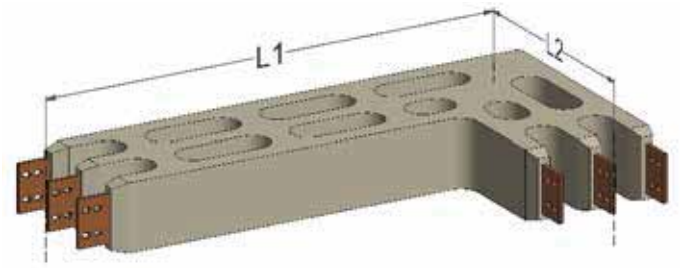
HL		L1			L2			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Norm
HL1	PH10	650	360	1000		350		1000	710	1000
	PH12	595	375			405			780	
	PH16	575	395			425			820	
	PH20	550	420			450			870	
	PH24	530	440			470			910	
HL2	PH10	1650	651	2000		350		2000	1001	2000
	PH12	1595	596			405				
	PH16	1575	576			425				
	PH20	1550	551			450				
	PH24	1530	531			470				

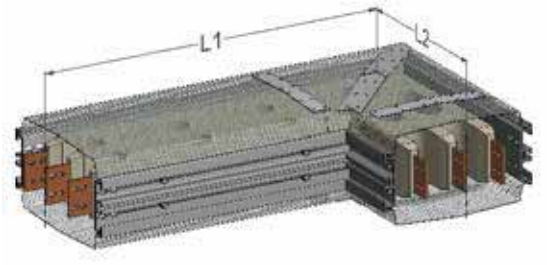




Bent Elbow Element

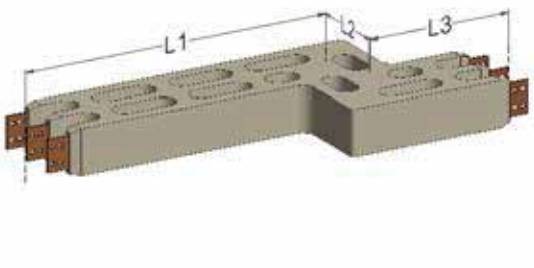
HB		L1			L2			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Norm
HB1	PH10	500	370	630	500	370	630	1000	740	1000
	PH12		380	620		380	620		760	
	PH16		380	620		380	620		760	
	PH20		380	620		380	620		760	
	PH24		380	620		380	620		760	
HB2	PH10	1500	370	1630	500	370	1630	2000	1001	2000
	PH12		380	1620		380	1620			
	PH16		380	1620		380	1620			
	PH20		380	1620		380	1620			
	PH24		380	1620		380	1620			

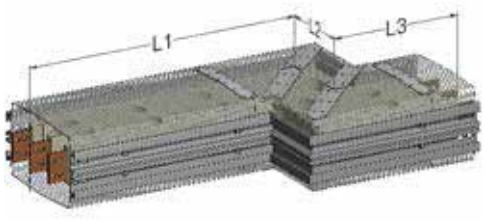




Bent 'Z' Element

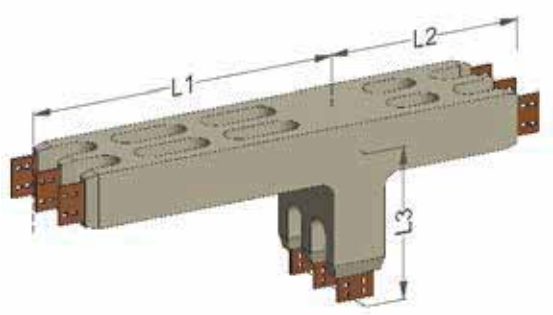
ZB		L1			L2			L 3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Norm	Norm	Min	Norm
ZB1	PH10	400	370	430	200	200	260	400	370	430	1000	940	1000
	PH12		380	575		45	240		380	575		805	
	PH16		380	575		45	240		380	575		805	
	PH20		380	575		45	240		380	575		805	
	PH24		380	575		45	240		380	575		805	
ZB2	PH10	1000	370	1430	500	200	1260	500	370	1430	2000	1001	2000
	PH12		380	1575		45	1240		380	1575			
	PH16		380	1575		45	1240		380	1575			
	PH20		380	1575		45	1240		380	1575			
	PH24		380	1575		45	1240		380	1575			

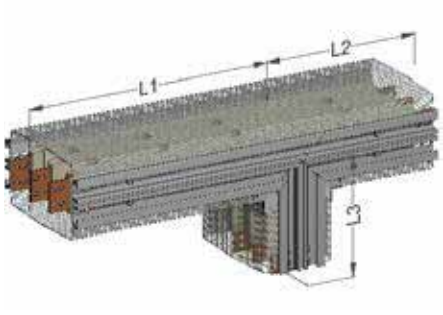




Brazed ‘T’ Element

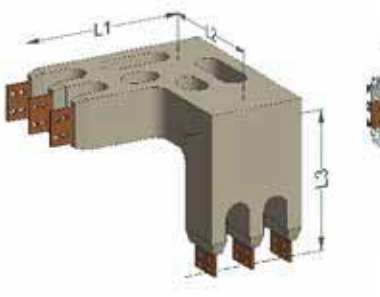
TL		L1			L2			L 3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
TL2	PH10	650	360	1290	500	360	1290	350			1500	1070	2000
	PH12	595	375	1220		375	1220	405				1155	
	PH16	575	395	1180		395	1180	425				1215	
	PH20	550	420	1130		420	1130	450				1290	
	PH24	530	440	1090		440	1090	470				1350	

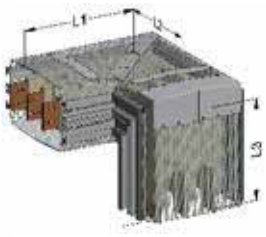




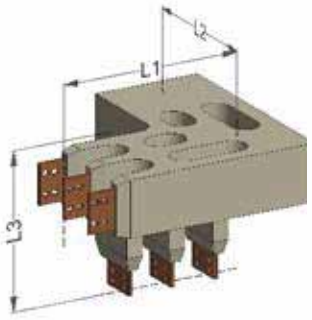
Double Elbow Element

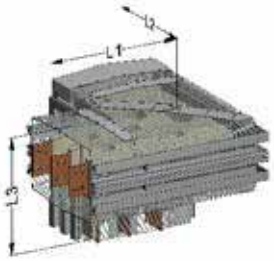
XR / XL		L1			L2			L 3			L Total		
		Norm	Min	Max	Norm	Min	Max	Norm	Min	Max	Norm	Min	Max
XR2/ XL2	PH10	650	370	1339	500	311	1280	350			1500	1031	2000
	PH12	595	380	1259		336	1215	405				1121	
	PH16	575	380	1219		356	1195	425				1161	
	PH20	550	380	1169		381	1170	450				1211	
	PH24	530	380	1129		401	1150	470				1251	





‘XR’ Element

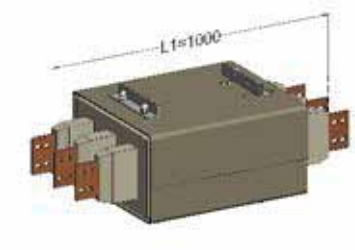


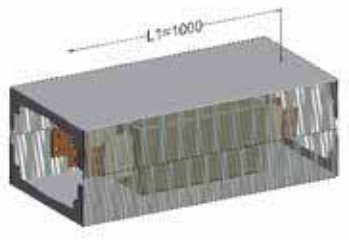


‘XL’ Element

Expansion Element

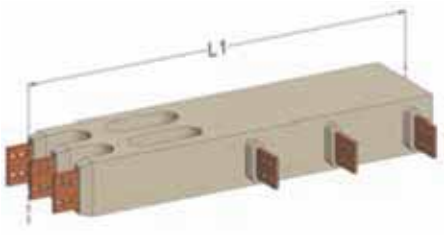
EX	L1 (mm)		
	Norm	Min	Max
EX1	1000	1000	1000



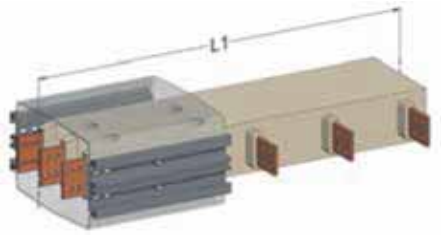


Terminal Elements

	L1		
	Norm	Min	Max
AC1	500	500	1000
AC2	1500	1001	2000



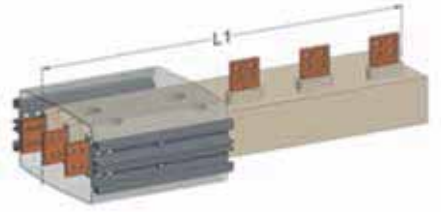
'AC' Type



'AC' Type (Shielding)

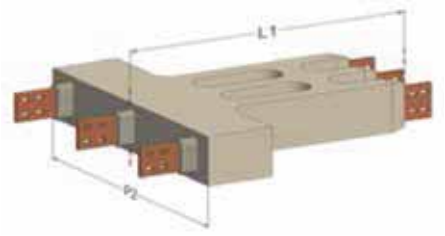
	L1		
	Norm	Min	Max
AE1	500	500	1000
AE2	1500	1001	2000

'AE' Type

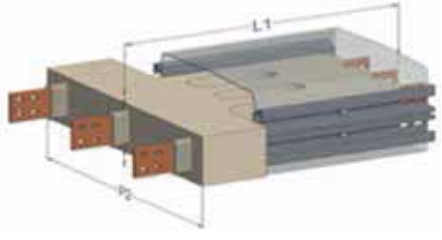


'AE' Type (Shielding)

	L1		
	Norm	Min	Max
AG1	500	450	1000



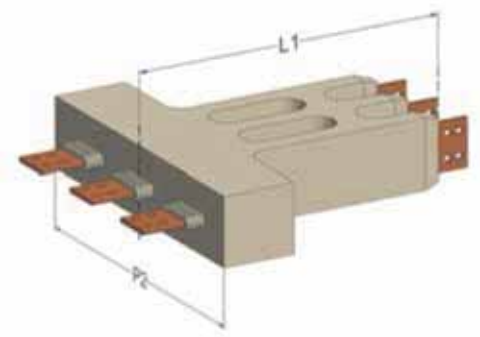
'AG' Type



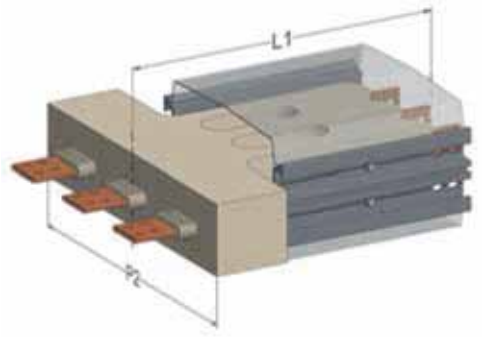
'AG' Type (Shielding)

*P2 dimension will be as per the equipment layout depending on the geometry of the terminal head.

	L1		
	Norm	Min	Max
AJ1	500	450	1000

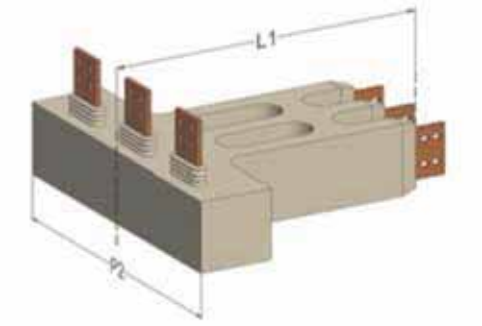


'AJ' Type

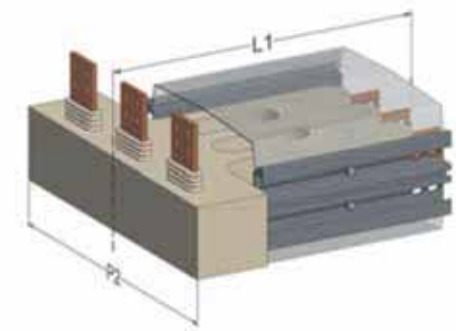


'AJ' Type (Shielding)

	L1		
	Norm	Min	Max
AM1	500	450	1000

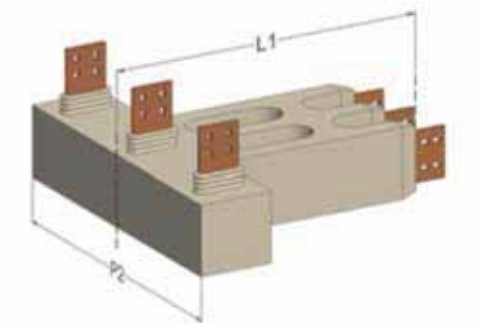


'AM' Type

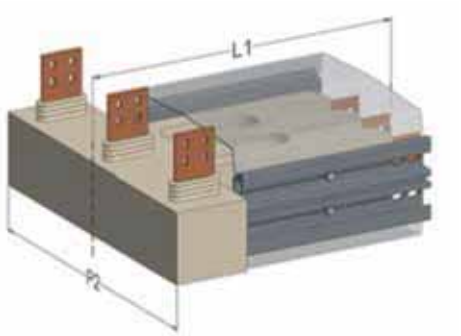


'AM' Type (Shielding)

	L1		
	Norm	Min	Max
AO1	500	450	1000



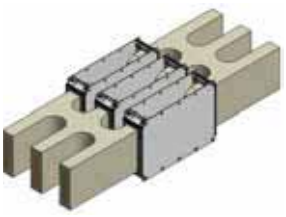
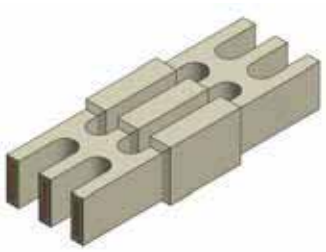
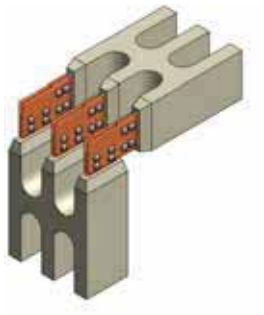
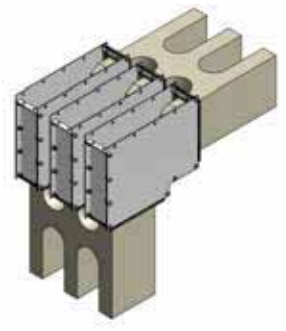
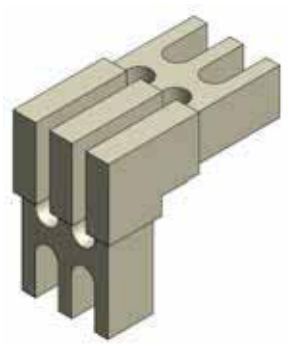
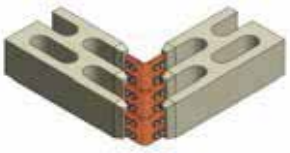
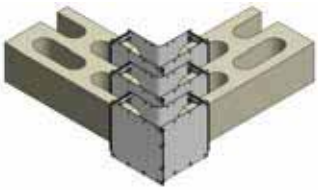
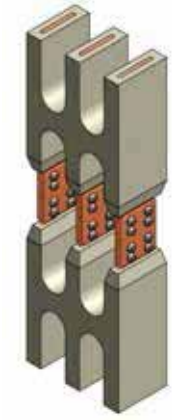
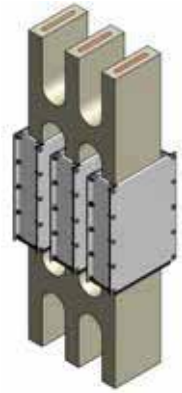
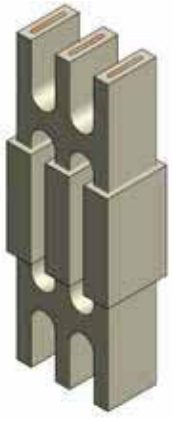
'AO' Type



'AO' Type (Shielding)

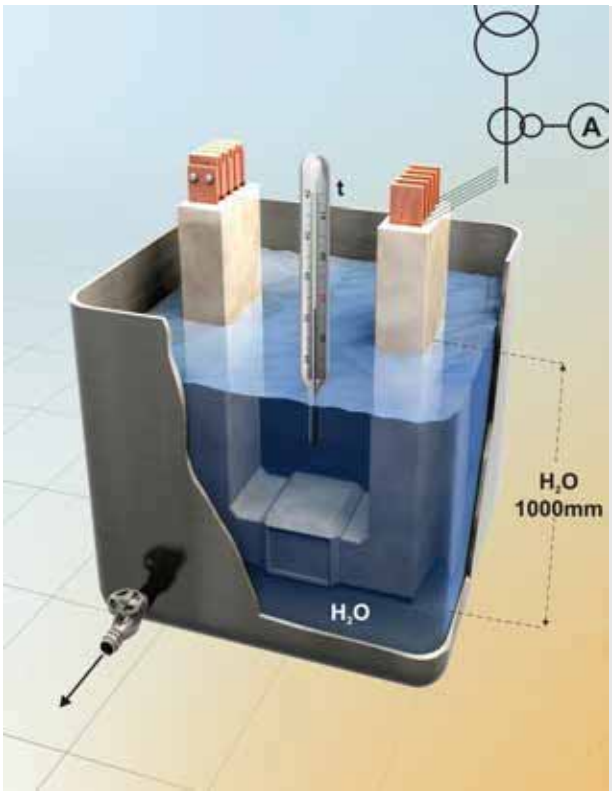
*P2 dimension will be as per the equipment layout depending on the geometry of the terminal head.

Joints for Medium Voltage

Assemble	Cast	Result
		
	ST 26 Joint	
		
	ST 27 Joint	
		
	ST 28 Joint	
		
	ST 29 Joint	

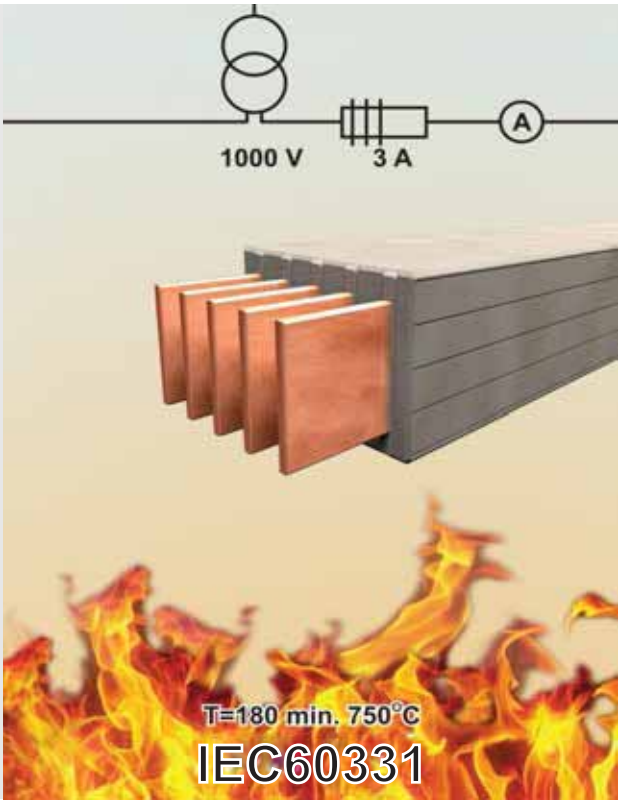
General Information

- Design Fundamentals
- Termination Details
- Bushings up till S120
- Chemical Resistance
- Standard Work Tests
- Reference Lists



Combined test
Heat run - Immersion
6 Cycles - Total 2592 hours

Fire resistance to IEC 60331
3 hours flame contact at 750°C
E30 to E120 as per NBN 713020 add 3
(Lab Luik Belgium)



General Low Voltage/Medium Voltage Design Fundamentals

1. IEC Standard - Temperature limits

In accordance with the IEC standard the betobar nominal rated currents are all based on a daily average ambient temperature of 35°C with daily peak of 40°C. For LV the design temperature rise is defined to be 60°C for the conductors, at a power frequency of 50Hz, limiting the surface temperature to 90°C. The MV system is designed to limit the conductor temperature rise at 50°C. If the operating conditions are different from the design values, the maximum permissible load current has to be correct by the factors in the table on page 49.

2. Weights

The weights of the betobar for the LV-types are the average weights as indicated in the tables including the junction and the casting mix per system length of 2 m. For MV-type the supporting insulators and any possible screening is included. If partitions for a full phase segregation are needed they have to be added as extra weight.

3. System impedance

The busduct resistance values (A.C. resistance) Rdc20 are based on a copper temperature of 20°C and a power frequency of 50Hz in accordance with the IEC standard. The Rac95 for LV and the Rac85 for MV are the more realistic values for the conductor resistance at max operating temperature. The reactance values (X) of the LB-types are based on the standard phase sequence RST-TSR for 3 -phase system.

For other configurations, frequencies or extreme temperatures, please consult Eta-com or your betobar agent.

All impedances have been calculated with physical values :

For copper :

Specific resistance at 20°C	=	0.0175.mm²/m	Conductivity 57 MS/m
Temperature coefficient	=	0.00392 1/K	
Standard EN 13601 (2002)			

For aluminium :

Specific resistance at 20°C	=	0.029Ω.mm²/m	Conductivity 35.4 MS/m
Temperature coefficient	=	0.0041/K	
Standard En7552 (1997)			

4. Maximum voltage

betobar is designed for a maximum voltage of 17.5 kV. Rated voltage 12kV & above is provided with self - supporting safety screen.

5. Short circuit

LV	MV	I_{cc} values in the technical data
Icw	Ik	Symmetrical short circuit current (1 second effective value if no further indications)
Ipk	Ip	Asymmetrical (dynamic) short circuit current (peak value)

The betobar busbars type tested reports of the official and independent laboratories (mostly at KEMA, IPH, ASTA) defines the I_{cc} rating.

Phase distance and support-shoulder distance can be chosen for each project taking into account the production possibilities. Consult Eta-com or your betobar agent on this matter.

6. Temperature correction factors

Current for different ambient temperatures

	Temperature [°C]								
Peak temp	20	25	30	35	40	45	50	55	60
Max average*	15	20	25	30	35	40	45	50	55
LV	1.173	1.133	1.092	1.050	1.000	0.960	0.912	0.861	0.807
MV	1.192	1.146	1.099	1.050	1.000	0.944	0.866	0.825	0.760

* **Temperature**: the maximum daily average temperature, with a daily peak temperature of 5K extra allowed during 2 hours.

7. Correction factors 60 Hz

Current rating for a power frequency of 60 Hz

	copper height [mm]							
	40	60	80	100	120	160	200	240
LV	0.998		0.995		0.989	0.988	0.988	0.988
MV		0.993	0.986	0.986	0.982	0.982	0.982	0.982

	aluminium height [mm]							
	40	60	80	100	120	160	200	240
LV	1.000		0.997		0.996	0.989	0.988	0.988
MV		0.995	0.994	0.994	0.987	0.982	0.982	0.982

8. Voltage drop calculation

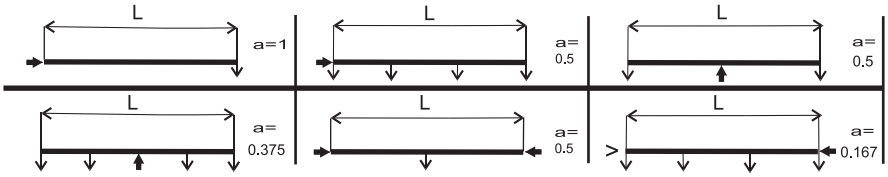
Generally long busduct connections have to be checked for voltage drop with the following formula:

$\Delta U = \sqrt{3} \times I_s \times a \times L \times (Ra \cos\varphi + X \times \sin\varphi) \times 10^{-6} V.$

Whereby :				
	ΔU	=	voltage drop (between phases)	[Volts]
	Is	=	Normal Full Load Current	[Amps]
	a	=	current distribution factor[1]	see graph.below
	L	=	total busduct length	[m]
	Rac	=	A. C. Resistance at operating temperature[2])	[μΩ/m]
	cosφ	=	power factor	
	X	=	reactance (mean value[3]	[μΩ/m]
	sinφ	=	reactive factor (=√1-cosφ2)	

Notes :

1) For distribution lines, the max. average load current which can be indicated as a % of the full load has to be used in this calculation.
2) The operating temperature is the sum of the ambient temperature and the temperature rise as a result of the load current . For critical calculations Ra has to be corrected according to the tables (Ra_{20} or Ra_{85})
3) For 60 Hz: X . 6/5 = X . 1,2



9. Phase sequence

Phase sequence in documentation and product documents :

is indicated as	R	S	T
to be equal to	R	Y	B
or	L1	L2	L3

10. General

For all information or technical calculation, please consult Eta-com or your betobar agent.

Chemical Resistance betobar Insulation

The results of the tests carried out at the betobar laboratories are given in the table below. They are based upon the conditions prevailing during these tests : carried out at 20°C and fully immersed for at least one year.

The details given in this list have been prepared with maximum care and to the best of our knowledge. However, we cannot assume liability for usage in very specific cases.

Each individual application has to be considered by the factory.

Chemical agents		Results		
		E	G	F
Boric acid	H_3BO_3	X		
Hydrochloric acid 10%	HCl			X
Citric acid 10%	$C_3H_4OH(CO_2H)_3$			X
Lactic acid 10%	CH_3-CHOH-CO_2H			X
Alcohol (ethyl-)	C_2H_5OH		X	
Beer		X		
Ketone (acetone)	H_3CCOCH_3			X
Calcium chioride 50%	$CaCl_2$	X		
Liquid combustibles (petrol, oil,...)		X		
Water (distilled)	H_2O	X		
Water (mineral)		X		
Esters			X	
Ether	$C_2H_5OC_2H_5$			X
Formalin 37%	HCOH		X	
Glycerin			X	
Lubricating grease and oil		X		
Greases and oil		X		
Vegetable oil		X		
Aliphatic hydrocarbide (petroleumether)	C_5H_{12}	X		
Aromatic hydrocarbide (toluene)	C_5H_{12}			X
Chloride carbon	CCl_4			X
Ammonium hydroxide 10%	NH_4OH		X	
Ammonium hydroxide 30%	NH_4OH			X
Millk (fresh and sour)				X
Soda-lime 10%	NaOH		X	
Soda-lime 50%	NaOH		X	
Blood		X		
Soap and detergents		X		
Sugar (saturated solution)		X		
Urine		X		

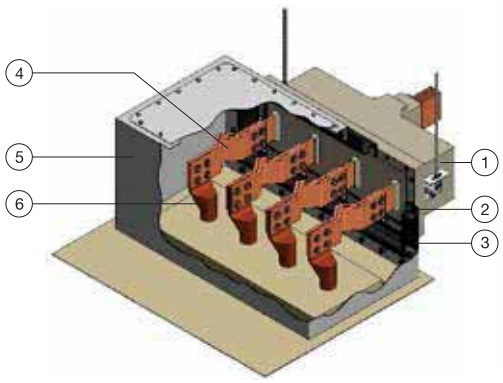
E = Excellent, suitable even for uninterrupted and prolonged exposure
G = Good, suitable for prolonged exposure
F = Fair, suitable for repeated but brief exposures

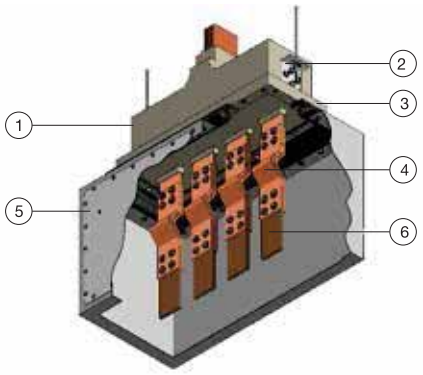
In the event of consultations or enquiries regarding chemical resistance, please always state the following :
1. The chemical material, if possible with formula, and in case of trade names, the manufacturer.
2. The mixing ration with a solvent, usually water.
3. The temperature, including temperature changes with the corresponding time intervals.
4. Period of exposure.

Examples For LV Terminations

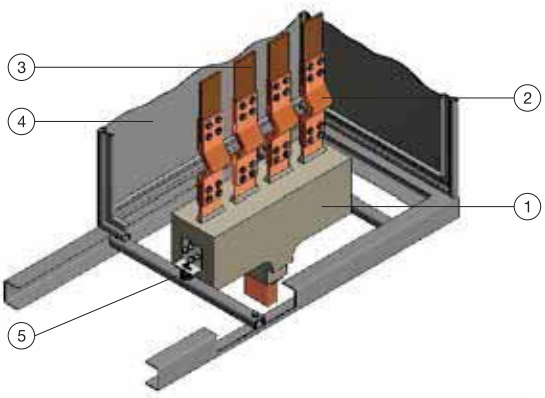
Standard flexible connection with bellow and laminated flexibles

1. betobar
2. Flange
3. Bellow
4. Flexibels
5. Switchgear or connection box
6. Terminals



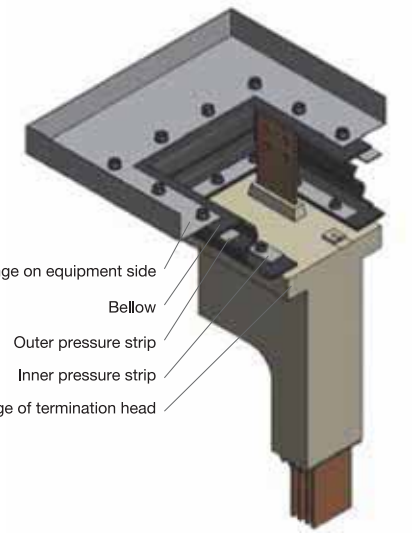


Bottom entry :
with flexibles or shunts
and bottom plate
IP class 54

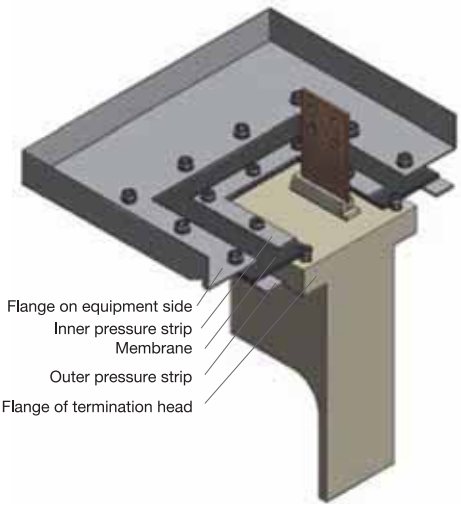


1. betobar
2. Flexibels
3. Terminals
4. Switchgear panel
5. Support

Terminations with bellow



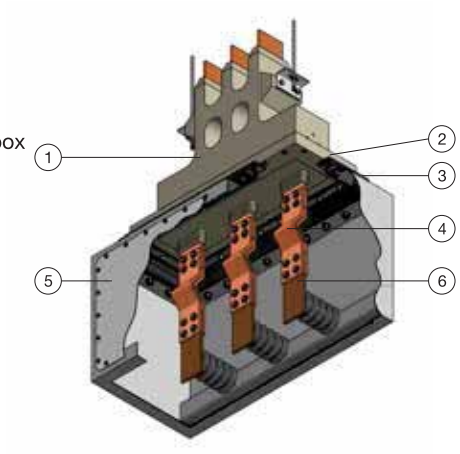
Terminations with membrane

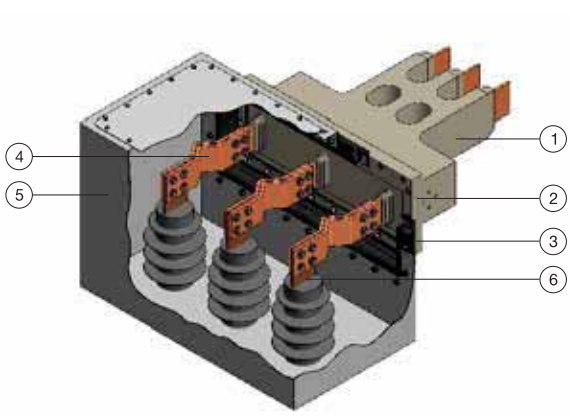


Examples For MV Terminations

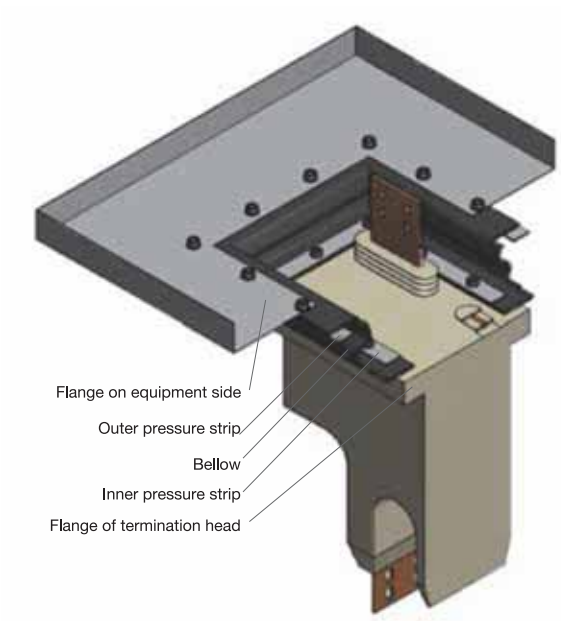
Standard flexible connection with bellow and laminated flexibles

1. betobar
2. Flange
3. Bellow
4. Flexibels
5. Switchgear or connection box
6. Terminals

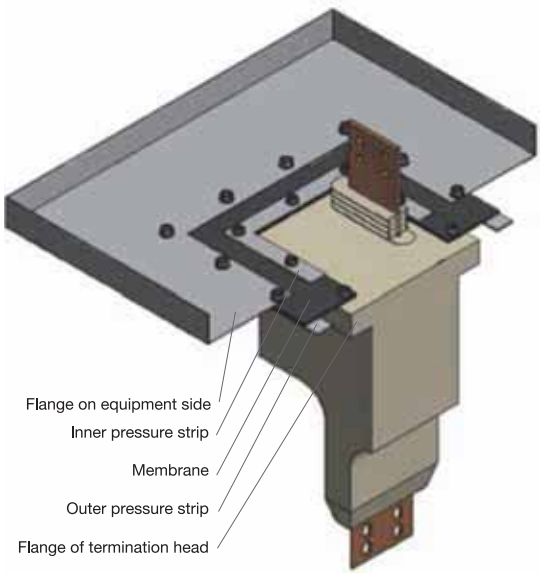




Terminations with bellow



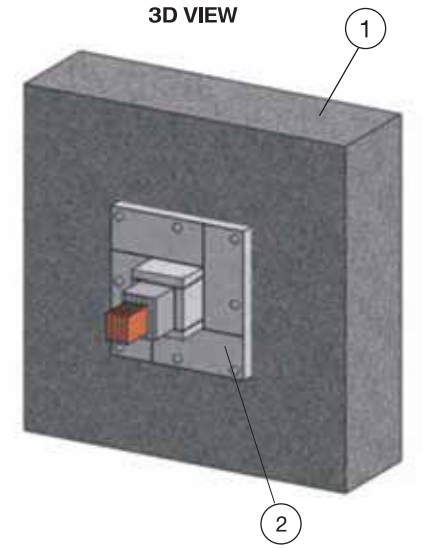
Terminations with membrane

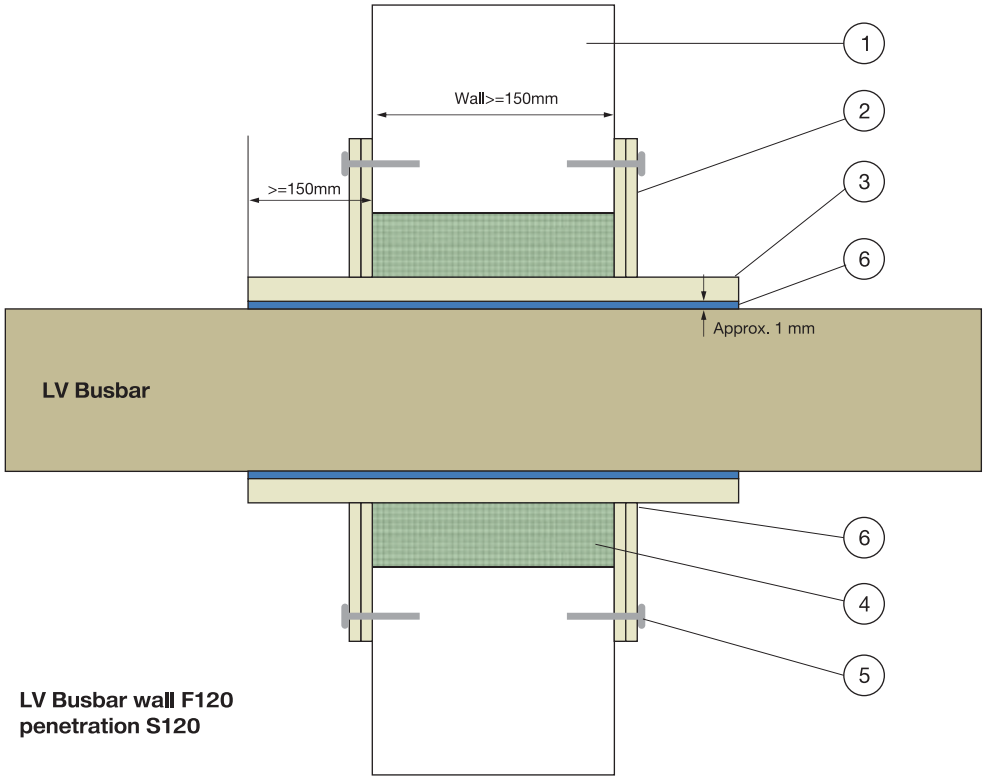


Wall Bushing Till S120

Low Voltage Systems

1. Fireproof wall or floor
2. Promaxon plate 20mm, 2 staggered layers
3. Promaxon plate 25mm
4. Rockwool, density>=100kg/m^3
5. Steelbolt anchor
6. Promaseal and promacol





LV Busbar wall F120 penetration S120

LV Busbar wall F120 penetration S90

LV Busduct with Copper conductor

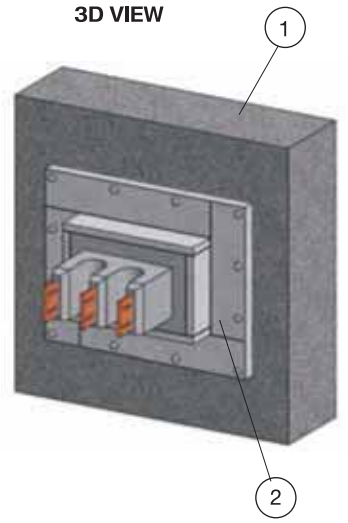
LV Busduct with Aluminium Conductor S120

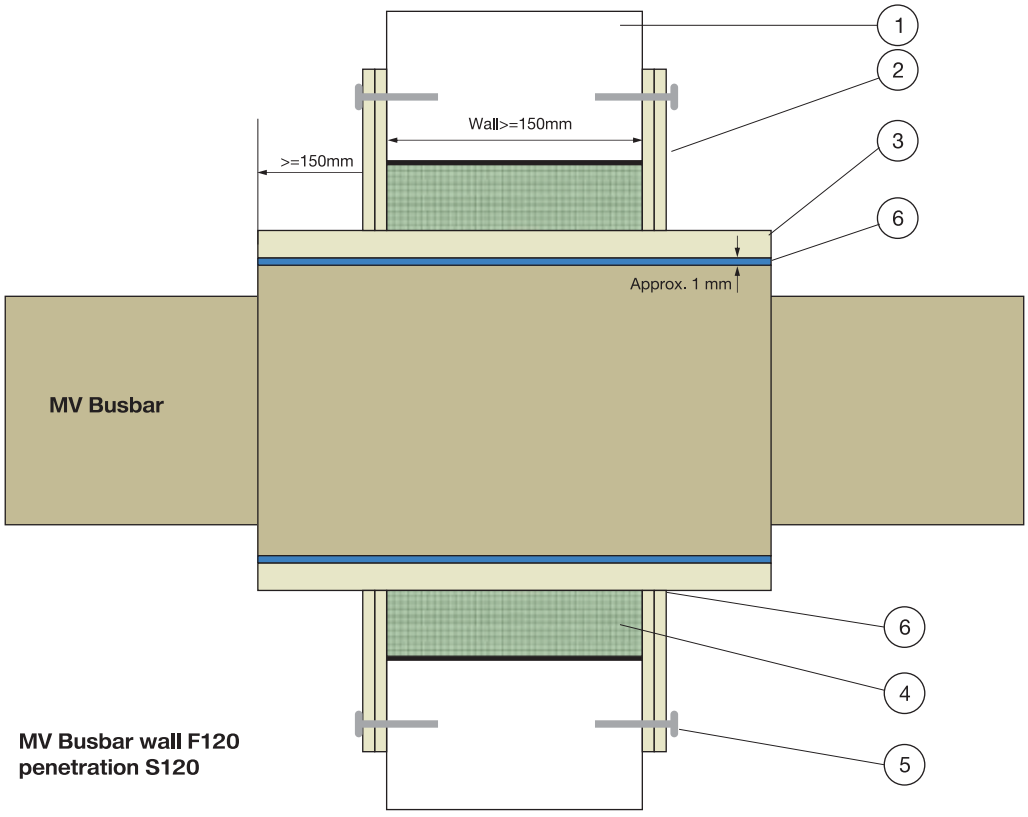
Floor penetration Alu + Cu = S120

Wall Bushing Till S120

Medium Voltage Systems

1. Fireproof wall or floor
2. Promaxon plate 20mm, 2 staggered layers
3. Promaxon plate 25mm
4. Rockwool, density>=100kg/m^3
5. Steelbolt anchor
6. Promaseal and promacol





MV Busbar wall F120 penetration S120

MV Busbar wall F120 penetration S120

MV Busduct with Copper or Aluminium conductor

Floor penetration Alu + Cu = S120

* The fire resistance class is highly dependent on thickness and quality of wall or floor.

** L in 3 standard dimensions available 320mm, 420mm and 520mm.

Installation by Experienced Technicians

In order to better assist you in the successful realization of your projects, Eta-com puts its Installation & Service Department at your disposal.

The Installation & Service Department is in charge of the installation of betobar-r cast-resin insulated and other busduct systems, as well as related cast-resin products. To reach and guarantee the quality of our installation service, the installation team consists of skilled technicians with an educational background in industrial engineering or electricity.

Throughout their careers, our senior supervisors have gained extensive experience in site supervision for projects worldwide, often involving large-scale and complex installations such as offshore platforms, petrochemical power stations, refineries, oil tankers, nuclear power plants, hydropower plants, desalination plants, etc. Having built up this know-how over 20 years time, the technicians are capable of assessing and handling on- site betobar-r installation projects with efficiency.

Our Installation & Service Department and our engineers are SHE Checklist Contractors, VCA 2004/04 certified.

The Installation & Service Department and engineers can provide following services:

- Supervision to ensure safe and efficient reception of the busbars on-site:
- Installation of betobar cast-resin insulated and other busduct systems, as well as related cast-resin products
- Realization of casting junctions
- Connection of the equipment
- Inspection and testing of the installation, including measuring the insulation and resistance values

Inspection and testing is carried out on completion of installation and maintenance activities, with results being documented. Should items not be acceptable against the agreed contract criteria, they will either be repaired, replaced or identified for a subsequent evaluation and decision. All repaired items are subject to a re-inspection to ensure acceptability.

On completion of installation and maintenance works, you as customer are also invited to check the work performed to ensure full acceptability.

Busway Route Planner

Customer : _____ Date : _____

Information required for quotation. Please, photocopy this form and attach to your inquiry.

In	Un	Freq.	Temp. t_0	t_{max}	Project :
A	V	Hz	°C	°C	Job nr :

Conductors	3P	N	PE	+ -	Line	Length total	Outdoor	ΔU	%	Tap off's In
Cu ☐ Al ☐	☐	☐	☐	☐	nr	m	m			nr

betobar

FACTORY TEST REPORT L.V.

Project
Project no.
Client
Ext. ref

A. PRODUCT IDENTIFICATION

Element no.		**Nominal voltage Un**	1.000 V
Line no.		**User voltage Us**	
TAG NR.		**Nominal current In**	(at 40 °C)
Type		**User current Is**	(at 40 °C)
Element form		**Frequency**	50 Hz

B. VISUAL INSPECTION

Property	Value	Criteria	Checked
General aspect	-	client requirements in PO, Eta-com specs	☑
Element colour	RAL7032		☑
Surface finishing flags			☑

C. DIMENSIONAL CHECK

Property	Value	Unit	Criteria	Checked
General aspect	-	-	client requirements in PO, Eta-com specs	☑
Busduct L1 dimension		mm		☑
Busduct L2 dimension		mm		☐
Busduct L3 dimension		mm		☐
Busduct L4 dimension		mm		☐

D. ELECTRICAL TESTS

The electrical properties are checked conform IEC 61439-1 & 6, the PO and the client approved drawings

Property	Test value	Criteria	Checked
Power frequency test	5kV AC, 1min	No breakdown, no flash over	☑
Insulation resistance test	1kV DC	>= 5 Gohm	☑
Phase sequence test	-	Client approved drawings/order sheet	☑

E. CONCLUSION

Tests	The element complies with the requirements	Yes ☑ No ☐
Packing	Material approved as ready for packing	Yes ☑ No ☐
Shipment	Material approved as ready for shipment	Yes ☑ No ☐

Test engineer	Company	Test date	This document has been generated automatically from data of our quality system and does not require a signature.
	ETA-COM B	**26/09/13**	
Witness	Company	Date	Signature

betobar

FACTORY TEST REPORT M.V.

Project
Project no.
Client
Ext. ref

A. PRODUCT IDENTIFICATION

Element no.		**Nominal voltage Ur**	17500 V
Line no.		**User voltage Us**	
TAG NR.		**Nominal current Ir**	(at 40 °C)
Type		**User current Is**	(at 40 °C)
Element form		**Frequency**	

B. VISUAL INSPECTION

Property	Value	Criteria	Checked
General aspect	-	client requirements in PO, Eta-com specs	☑
Element colour			☑
Surface finishing flags			☐

C. DIMENSIONAL CHECK

Property	Value	Unit	Criteria	Checked
General aspect	-	-	client requirements in PO, Eta-com specs	☑
Busduct L1 dimension	464	mm		☑
Busduct L2 dimension	N/A	mm		☐
Busduct L3 dimension	N/A	mm		☐
Busduct L4 dimension	N/A	mm		☐

D. ELECTRICAL TESTS

The electrical properties are checked conform international standards, the PO and the client approved drawings

Property	Test value	Criteria	Checked
Power frequency test	Conform IEC62271 and IEC60060	No breakdown, no flash over	☑
Partial discharge test	Conform IEC60270	P.D. level maximum 20pC at 1.1 x Umax (Eta-com std)	☑
Phase sequence test	-	Client approved drawings/order sheet	☑

E. CONCLUSION

Tests	The element complies with the requirements	Yes ☑ No ☐
Packing	Material approved as ready for packing	Yes ☑ No ☐
Shipment	Material approved as ready for shipment	Yes ☑ No ☐

Test engineer	Company **ETA-COM B**	Test date **26/09/13**	This document has been generated automatically from data of our quality system and does not require a signature.
Witness	Company	Date	Signature

Eta-com	Doc.no.: FF-QC-030V4	TEST REPORT No:

Reference List

Country	City	Project Name	Industry	LV/MV	Year
Algeria	In Salah	Insalah Gas	Oil & Gas	LV	2008
Algeria	Sidi Ben Adda	Terga	Power Plant	LV	2009
Aruba	Oranjestad	Aruba Medical Centre	Hospital	LV	2010
Australia	Onslow	Wheatstone Project LNG Plant	Oil & Gas	MV & LV	2013/14
Australia	Onslow	Gorgon Onplots Project	Oil & Gas	MV & LV	2011/13
Austria	Ös	Telekom Vienna	Telecommunication	LV	2003
Austria	Vienna	Kaiser Franz Jozef Spital	Hospital	LV	2009
Azerbaijan	Caspian Sea	CA-CWP Platform Azeri	Oil & Gas	LV	2003
Bangladesh	Mymensing	Mymensing Power Plant	Power Plant	MV	2005
Belgium	Leuven	UZ Leuven - Cabine 403	Hospital	LV	2008
Belgium	Antwerp	ITC Rubis Terminal	Petrochemical	LV	2009
Belgium	Antwerp	Total Petrochemicals	Petrochemical	MV	2008
Belgium	Mechelen	KBC Data Centre	Data Centre	LV	2008
Belgium	Lommel	Hansen Transmissions	Manufacturing	MV	2008
Belgium	Antwerp	BASF	Chemicals	MV	2009
Belgium	Antwerp	AHPHT - ESSO	Oil & Gas	LV	2009
Belgium	La Hulpe	SWIFT	Banking	LV	2009
Belgium	Leuven	UZ Leuven	Hospital	MV & LV	2009
Belgium	Zwijndrecht	Borealis	Chemicals	LV	2010
Belgium	Feluy	AFTON Chemicals	Chemicals	LV	2010
Belgium	Feluy	TOTAL	Petrochemical	MV	2010
Belgium	Mechelen	DuPont	Chemicals	LV	2010
Belgium	Mechelen	Dow Belgium	Chemicals	LV	2010
Belgium	Mechelen	P&G Mechelen	Manufacturing	LV	2011
Belgium	Tessenderlo	Chevron Philips	Chemicals	LV	2012
Brasil	Offshore	Petrobras P-50 offshore	Oil & Gas	MV	2003
Colombia	Cartagena	Ecopetrol Cartagena Refinery	Petrochemical	LV	2010
Colombia		Petrominerales	Oil & Gas	LV	2010
Colombia	Montelibano	Cerromatoso	Mining	MV	2011
Colombia	Ayacucho	Ecopetrol Ayacucho Colombia	Petrochemical	MV	2011
Congo	Offshore	Libondo Platform Congo	Oil & Gas	LV	2009
Egypt	Damietta	LNG Train 2	Oil & Gas	MV & LV	2004
Egypt	Cairo	Nile Tower 2	Real Estate	LV	2007
Egypt	Alexandria	Sidi Kerir Petrochemicals	Petrochemical	LV	2009
France	Feyzin	TOTAL Feyzin Poste 2	Petrochemical	LV	2009
France	Feyzin	TOTAL P2 - GAB MT	Petrochemical	MV	2009
France		Traversées Etanches - Projet BPC3	Manufacturing	LV	2009
France	Drusenheim	DOW France Drusenheim	Chemicals	LV	2009
France	Pierrelatte	Usine Rec II Pierrelatte	Nuclear Power Plant	LV	2010
France	Lyon	Hôpital Neuro-Cardio Lyon	Hospital	LV	2010
France	Donges	Total Donges	Petrochemical	MV	2011
Germany	Frankfurt	Papermill WEPA	Paper Mill	LV	2003
Germany	Boxberg	Kraftwerk Boxberg	Power Plant	LV	2008
Germany	Frankfurt	Ticona Tiger	Chemicals	LV	2009
Germany	Datteln	Eon Kraftwerk Datteln	Power Plant	LV	2011
Germany	Köln	RWE Kraftwerk Fortuna	Power Plant	LV	2012
Germany	Mannheim	Grosskraftwerk Mannheim	Power Plant	LV	2012
Germany	Gaggenau/Rastatt	Daimler Trucks	Manufacturing	LV	2012

Reference List

Country	City	Project Name	Industry	LV/MV	Year
Germany	Wendefurth	Vattenfall Pumpstation Wendefurth	Substation	MV	2012
Germany	Offshore	Amrumbank	Wind Farm	LV	2013
Greece	Thinon	Wind Hellas Thinon	Telecommunication	LV	2008
Greece	Metamorfosi	Wind Hellas Metamorfosi	Telecommunication	LV	2008
India	Offshore	Offshore Platform	Oil & Gas	MV	2005
India	Greater Noida	JP Sport City Greater Noida	Utility	LV	2011
India	Bangalore	Oracle Bangalore	IT	LV	2011
Iraq	Majnoon	Shell Majnoon	Petrochemical	LV	2011
Ireland	Coolkeeragh	Power Station Coolkeeragh	Power Plant	LV	2003
Ireland	Belfast	BBC Belfast	Media	LV	2003
Ireland	Dublin	IBM SOR 37 IRELAND	Data Centre	LV	2008
Malaysia	Offshore	FPSO-MSE offshore	Oil & Gas	LV	2003
Malaysia	Bukit Rajah	Mox Bukit Rajah	Oil & Gas	MV	2010
Malaysia	Kerteh	Petronas	Oil & Gas	LV	2010
Malaysia	Peninsular Tapis Field	Exxon Mobil Tapis-R CCP Platform	Oil & Gas	LV	2011
Malaysia	Teluk Rubiah	Vale Miop	Mining	MV	2012
Malaysia	Sipitang	Samur Project	Chemicals	MV & LV	2013
Myanmar	Offshore	Yetagun platform	Oil & Gas	LV	2009
Myanmar	Offshore	Zawtika	Oil & Gas	LV	2012
Nigeria	Offshore	Bonny Island Refinery	Oil & Gas	LV	2003
Nigeria		NIPP	Oil & Gas	LV	2010
Norway	Oslo	Stortinget	Utility	LV	2003
Norway	Offshore	Hammerfest LNG plant	Oil & Gas	LV	2003
Norway	Offshore	Ekofisk offshore	Oil & Gas	MV	2004
Norway	Odda	Norzink	Chemicals	MV	2004
Norway	Stavanger	Navion Stavanger	Transportation	MV	2006
Norway	Glomfjord	Sitech Glomfjord	Manufacturing	LV	2008
Norway	Offshore	Valhall Aker	Oil & Gas	LV	2010
Norway	Ulsteinvik	Kleven	Transportation	LV	2012
Norway	Bodø	Kulturkvartalet Bodø	Utility	LV	2012/13
Oman	Qalhat	LNG Oman	Oil & Gas	MV	2003
Qatar	Offshore	Qatar Gas II	Oil & Gas	MV	2007
Qatar	Ras Laffan	Qatar Gas Common Sulphur	Oil & Gas	LV	2007
Qatar	Ras Laffan	Shell Pearl C4 - C5 - C6	Oil & Gas	LV	2007
Qatar	Ras Laffan	Ras Laffan	Oil & Gas	MV & LV	2007
Qatar	Offshore	Al Shaheen Maersk Oil	Oil & Gas	LV	2007
Qatar	Ras Laffan	Ras Gas Train 6&7	Oil & Gas	LV	2009
Qatar	Ras Laffan	Ras Laffan CCWP-II	Oil & Gas	MV	2010
Romania	Campulung	Holcim Cement Campulung	Manufacturing	MV	2010
Russia	Offshore	Sakhalin II Offshore	Oil & Gas	LV	2004
Russia	Moscow	Moscow City	Power Plant	MV	2006
Russia	Moscow	Substation Beskudnikovo	Power Plant	LV	2009
Russia	Khanti-Mansi	Priobskaya	Oil & Gas	MV	2009
Russia	Kodinsk	Boguchanskaya Hydro	Power Plant	MV & LV	2009
Russia	Novosibirskaya	Novosibirskaya	Power Plant	MV	2009
Russia	Nizhny Novgorod	Novogorkovskaya	Power Plant	MV	2009
Russia	Egorlykskaya	Egorlykskaya	Power Plant	MV	2010
Saudi Arabia	Shoaiba	Shoaiba Power Plant Units 1,2,3, 4, 5	Power & Desalination Plant	MV	2000/02

Reference List

Country	City	Project Name	Industry	LV/MV	Year
Saudi Arabia	Shoaiba	Shoaiba Power Plant stage II phase 1 & 2	Power & Desalination Plant	MV	2004/05
Saudi Arabia	Shoaiba	Shoaiba Power Plant stage III	Power & Desalination Plant	MV	2009
Saudi Arabia	Rabigh	Rabigh Power Plant	Power Plant	MV	2012
South Africa	Lephalale	Medupi	Power Plant	LV	2009
South Africa	Mpumalanga	Kusile	Power Plant	MV & LV	2010
Spain	Olivenza	Astexol-2 Solar Plant Badajoz	Power Plant	MV	2010
Spain	Alcazar de San Juan	Solar Power Plant Alcazar de San Juan ASTE 1A/1B	Power Plant	MV	2010
Sweden	Kaarstoe	IBM Kaarstoe	IT	LV	2004
Sweden	Kista	IBM Kista	IT	LV	2005
Switzerland	Gösgen	KKW Gösgen	Power Plant	LV	2009
Syria	Aleppo	Nahas Tower	Real Estate	LV	2007
Syria	Ebla	GTP Syria Project	Power Plant	LV	2010
Taiwan	Hualien	Bi Hai	Power Plant	MV	2004
Thailand	Offshore	Bongkot - Central Facilities	Oil & Gas	LV	2010
Thailand	Mae Moh	Egat Mae Moh Power Plant	Power Plant	MV	2011
The Netherlands	Hengelo	Akzo Salinco	Petrochemical	MV	2005
The Netherlands	Amstelveen	ABN Amro Computer Centre	Data centre	LV	2006
The Netherlands	Amsterdam	AMC Amsterdam	Hospital	LV	2006
The Netherlands	Amsterdam	KPN Amsterdam	Telecom	LV	2007
The Netherlands	Amsterdam	ING Treasury	Data centre	LV	2008
The Netherlands	Sluiskil	Yara	Manufacturing	MV	2009
The Netherlands	Rotterdam	Power Station Maasvlakte	Power Plant	MV & LV	2010
The Netherlands	Zwolle	Enexis Substation Zwolle	Power Plant	MV	2010
The Netherlands	Amsterdam	Schiphol Backbone & KWS 2	Airport	LV	2010
The Netherlands	Almelo	Urenco Hal 7	Manufacturing	LV	2010
The Netherlands	Maastricht	Academic Hospital Maastricht	Hospital	LV	2010
The Netherlands	Rotterdam	ING Wilgenplas	Data centre	LV	2010
The Netherlands	Amsterdam	Nuon Powerstation Hemweg	Power Plant	LV	2011
The Netherlands	Amsterdam	Global Switch Phase 1 - 3	Data centre	LV	2011
The Netherlands	Bergen op Zoom	Sabic MCC 501 en 502	Petrochemical	LV	2011
The Netherlands	Apeldoorn	Taxoffice Walter Bos & Quintax	Data centre	MV & LV	2011
The Netherlands	Arnhem	Duiventil	Data centre	LV	2012
The Netherlands	Terneuzen	Dow Chemical	Petrochemical	LV	2011
The Netherlands	IJmuiden	Motorvessel Carolien	Maritime	LV	2012
The Netherlands	Groningen	Enexis Substation Groningen	Substation	MV	2013
The Netherlands	Beilen	Domo Friesland Campina	Food Industry	LV	2013
U.A.E	Sharjah	Millennium Hotel	Real Estate	LV	2002
U.A.E	Sharjah	Bin Sabath Tower	Real Estate	LV	2005
U.A.E	Abu Dhabi	DIFC Gate Village	Utility	LV	2006
U.A.E	Abu Dhabi	Al Nasser Tower	Real Estate	LV	2006
U.A.E	Dubai	Between the bridges	Real Estate	LV	2007
U.A.E	Sharjah	Sharjah Gate Tower	Real Estate	LV	2007
U.A.E	Abu Dhabi	Yas Island DCP8,9	Disctrict Cooling Plant	LV	2008
U.A.E	Abu Dhabi	BOROUGE 2	Oil & Gas	LV	2008
U.A.E	Abu Dhabi	Gasco Ruwais	Oil & Gas	LV	2009
U.A.E	Ruwais	Green Diesel	Oil & Gas	LV	2009
U.A.E	Habshan	Habshan - 5 Process Plant	Oil & Gas	MV & LV	2010
U.A.E	Dalma Island	Dalma Island	Real Estate	LV	2011

Reference List

Country	City	Project Name	Industry	LV/MV	Year
U.A.E	Abu Dhabi	Shah Gas Project 4	Oil & Gas	LV	2011/12
U.A.E	Ruwais	Ruwais Refinery Expansion 3 - 3.3kV	Oil & Gas	MV	2011/12
U.A.E	Abu Dhabi	Borouge 3 PP/PE	Oil & Gas	LV	2011/12
U.A.E	Abu Al Abyadh	Shah Sulphur Station & Pipelines Project	Oil & Gas	LV	2012
U.A.E	Abu Dhabi	Satah Full Field Development Project	Oil & Gas	LV	2012/13
U.A.E	Habshan	NGI (Pure Case) Project	Oil & Gas	LV	2012/13
U.A.E	Abu Dhabi	LIWA Pumping Station	Water Treatment	LV	2012/13
United Kingdom	Warwick	IBM Warwick	Data Centre	LV	2006
United Kingdom	Cardiff	IDC Cardiff PH2	Data Centre	LV	2006
United Kingdom	Bletchley	BT Bletchley	Telecommunication	LV	2006
United Kingdom	Wynyard	Wynyard (EDS)	Commercial	LV	2008
United Kingdom	Walsall	Walsall Hospital	Hospital	LV	2009
United Kingdom	Cruachan	Cruachan II	Power Plant	MV	2009
United Kingdom	London	Nomura Bank Project Shinkyo	Commercial	LV	2009/10
United Kingdom	Isleworth	BSkyB Harlequin 1	Data Centre	LV	2010
United Kingdom	Fawley	Esso Fawley	Oil & Gas	LV	2010
United Kingdom	Sunderland	EDS DOXFORD	Data Centre	LV	2011/12
United Kingdom	London	Blackfriars Station	Rail	LV	2011/12
United Kingdom	London	79-97 Wigmore Street	Commercial	LV	2012
United Kingdom	Beckton	Beckton STW	Water Treatment	LV	2012
United Kingdom	Gartcosh	Scottish Crime Campus	Utility	LV	2012
United Kingdom	Fife	Markinch Biomass CHP Plant	Biomass	MV	2012
United Kingdom	Shetland Islands	Laggan Tormore	Oil & Gas	LV	2013
Yemen	Kharir	Kharir Project Phase 1 & 2	Oil & Gas	MV & LV	2009
Yemen	Kharir	Total E&P Yemen Kharir Power Plant	Oil & Gas	MV & LV	2011/12

C&S electric + Eta-com

GLOBAL SPECIALIST FOR POWER BUSBARS

Corporate Office:

222, Okhla Industrial Estate,
New Delhi-110 020, India
Tel.: +91-11-30884912, 30887520-29
Fax: +91-11-26848241, 26847342
email: info@etacomcs.com

Review 8 d.d.02/2014

Works:

Belgium Plant

Scheldeweg 4,
2850, Boom,
Belgium
Tel.: +32-3-880.64.00
Fax.: +32-3-844.4 2.50
email: busduct@etacom.be

India Plant:

Plot No. 1C, Sector 8C,
Integrated Industrial Estate
(SIDCUL), Ranipur, Haridwar
Uttarakhand - 249403, India

Sales Office:

Belgium Office:

Scheldeweg 4,
2850, Boom,
Belgium
Tel.: +32-3-880.64.00
Fax.: +32-3-844 .4 2.50
email: busduct@etacom.be

Netherland Office:

Zwarte Zee 2-6,
3144, DE MAASSLUIS,
The Netherlands
Tel.: +31-1059-16422
Fax: +31-1059-20673
email: info@etacom.nl

UK Office:

Unit 19/20, Horsham Court,
City Business Centre, 6, Brighton Road,
HORSHAM, West Sussex, RH13 5BB,
United Kingdom
Tel.: +44-1-403265767
Fax: +44-1-403254131
email: busduct@eta-com.co.uk

www.cselectric.co.in
www.etacomcs.com

www.facebook.com/CSElectricLimited

We touch your electricity everyday!