

# **Ship Installation Of Insulated Bus Pipe**

Presented at the NSRP Meeting  
Newport News, Virginia  
October 5,2011

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# Insulated Bus Pipe

## Current Naval Military Applications



- The Mistral French Navy's first all-electric warship.
- two Alstom 7MW electric azimuth pods.
- 3 16V32 and 1 18V200 Wartsila diesel generators
- Total 20.8MW of power
- Incorporates PBP Insulated Bus Pipe for
- Medium Voltage Power to Azi-Pod Propulsors

Builders: DCN shipyard at Brest



- Royal Australian Landing Helicopter Docks
- 2 Ships scheduled to begin entering service in 2014
- Incorporates PBP Insulated Bus Pipe for
- Medium Voltage Power to 11 MW Azi-Pod Propulsors

Builders: Siemens Marine Solutions has been commissioned by the Spanish shipyard Navantia S.A.

# Insulated Bus Pipe

## Results of Royal Navy CVF Study

### HV analysis of CVF: IBP versus cable

At aquisition stage for a total distribution system including installation.

17700 feet of Busbar replaced 121400 feet cable.

- Weight saving is between 95 tons -140 tons.
  - U(Using IBP with Cast Resin Jacket)
- Space envelope is 42% smaller.



140 tons Al conductor HV only  
95 tons Cu conductor HV only

**With Al Saves 58% Weight (11 kV at 2400 amps)**

**With Cu Saves 42% Weight (11 kV at 2400 amps)**

**Compared with Cable**

# Insulated Bus Pipe

preissinger • busbar • production • pbp

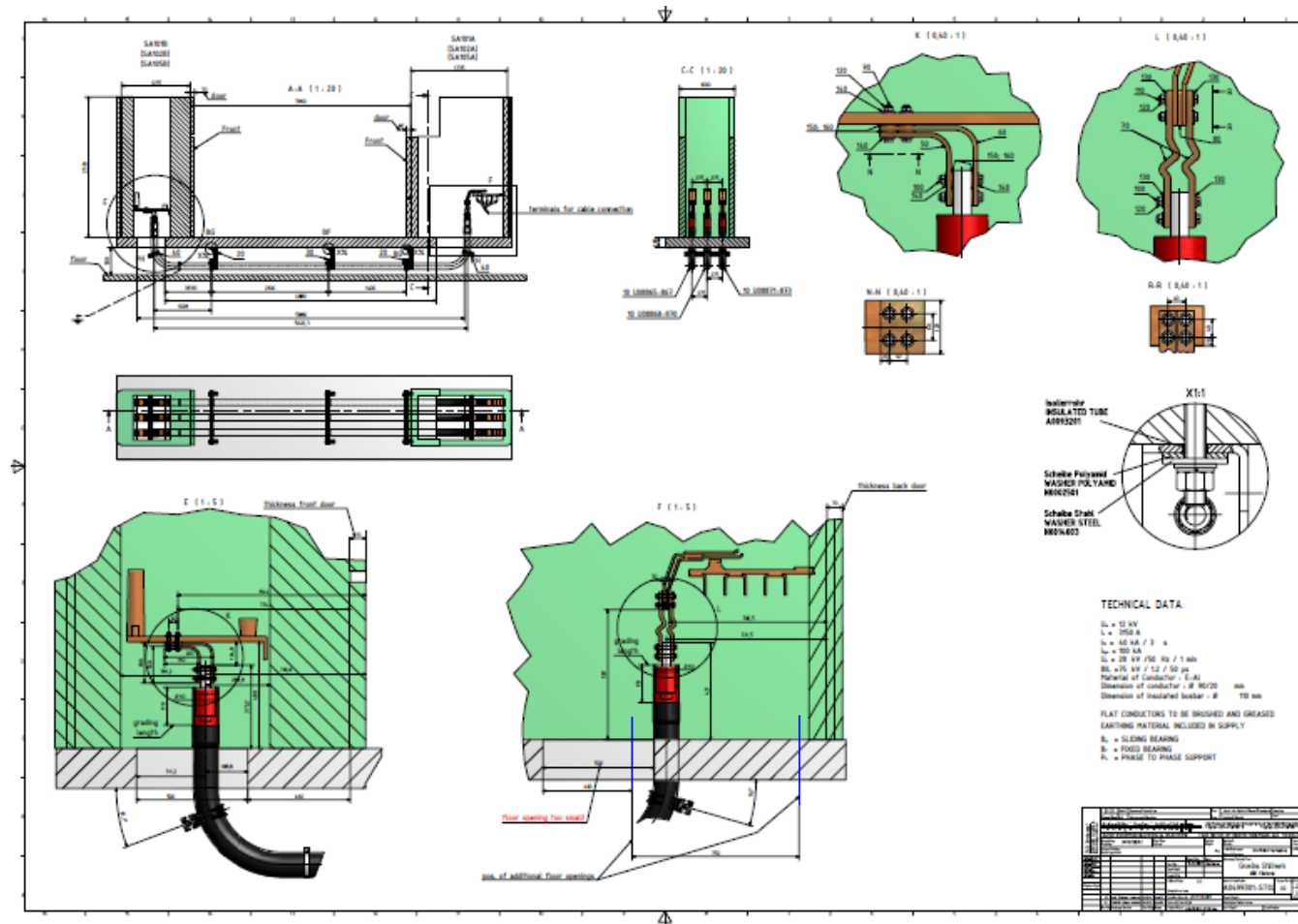


6.6kV 1600A

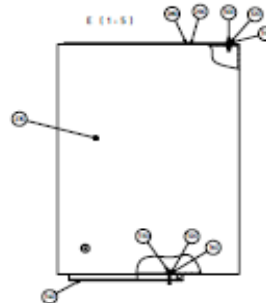
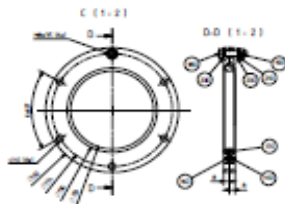
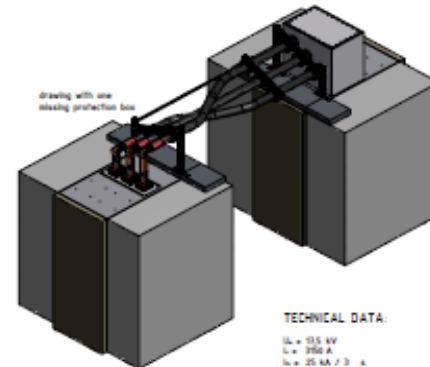
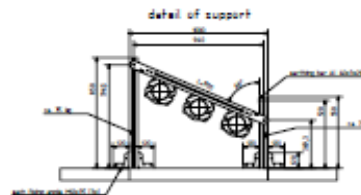
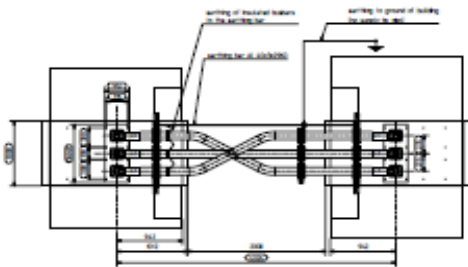
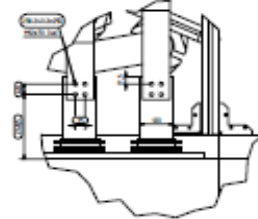
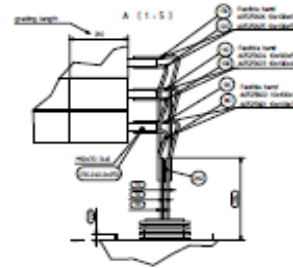
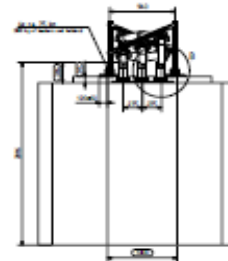
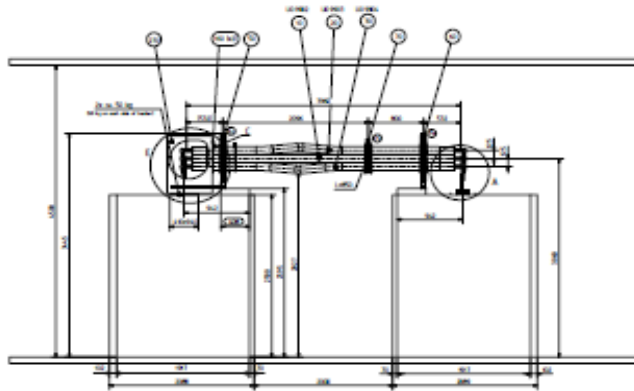




# Insulated Bus Pipe



# Insulated Bus Pipe



## TECHNICAL DATA

UL = 15 kV  
 L = 350 A  
 I<sub>th</sub> = 25 kA / 3 s  
 I<sub>th</sub> = 50 kA  
 UL = 30 kV / 50 Hz / 1 min  
 UL = 40 kV / 12 / 50 Hz  
 Material of conductor = Al  
 Dimension of conductor = Ø 100x5 mm  
 Dimension of insulated busbar = Ø 120 mm

FLAT CONDUCTORS TO BE BRUSHED AND GREASED  
 EARTHING MATERIAL INCLUDED IN SUPPLY  
 B = SLIDING BEARING  
 B = FIXED BEARING  
 P = PHASE TO PHASE SUPPORT

## Important note

All distances which are written inside a hexagon are very important and have to be proved accurately.  
 All distances which are written inside a circle are important distances for the construction and are predetermined by your drawings.  
 Additional is to examine whether the substructure is stable enough to hold the loads which are noted in that drawing.  
 If differences between drawing and the local conditions exist they are immediately to check with obp Präzisions GmbH in order to avoid costs and delays.

Drawing		Revision	
Author	...	Revision	...
Checked	...	Revision	...
Approved	...	Revision	...
...	...	...	...

# Insulated Bus Pipe



pbp Preissinger GmbH & Co. KG



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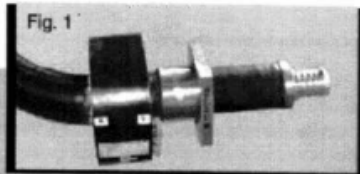


Fig. 1

## SPECIAL APPLICATION

Special solutions for busbars, E.g.: Marine technique, Instrument transformer integrated, Cable connections

Our core business is providing safe, reliable, value engineered solutions for medium and low voltage distribution. These solutions are minimal maintenance with a long life span. Innovation is one of the main driving forces within our company, and in close cooperation with clients & our suppliers we have developed, manufactured and installed a range of interesting solutions which could have application in your future projects. In the list below, we show a small sample of the many possibilities we can offer. We also show our latest innovations.

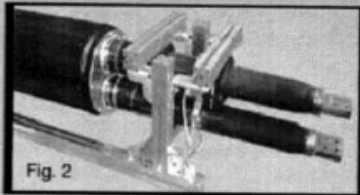


Fig. 2

### Sample References Busbar Innovations

- Current transformer integrated on busbar (Fig. 1)
- Current-and voltage sensor system integrated on busbar
- Capacitive tap off from busbar
- Fire proof, explosion proof bulkhead penetrations for marine and offshore projects (Fig. 2)
- Right angled switchgear-cable plug - in solutions (to eliminate the need for cable basements). These come with a range of different plug -ins up to 3150A. (Fig. 3)
- Adaptors which can interface between various insulation types E.g. SF6 air and oil.

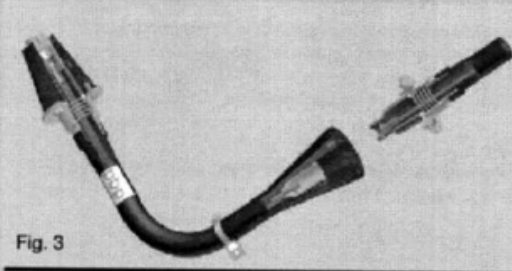


Fig. 3

This is only a small selection of various special solutions. If you have any connection problem, ask for a proposal or special solution from pbp.

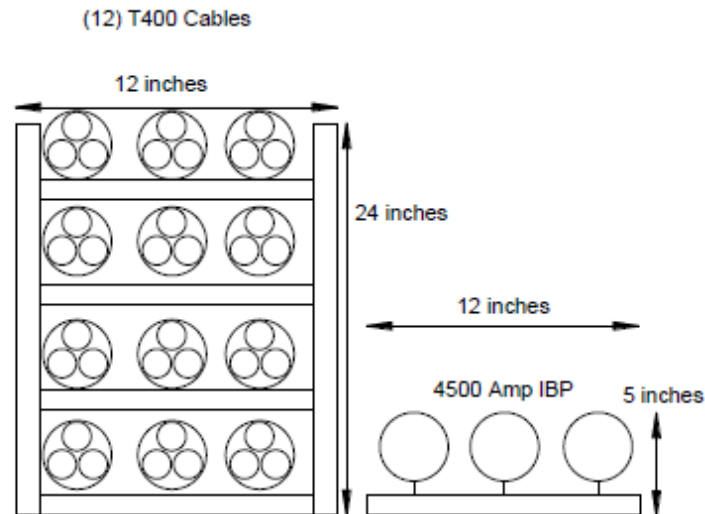
# Insulated Bus Pipe

## Ampacity and Space Requirements

4500 amp Bus Pipe can transfer

At 13,800 VAC, 108 MW

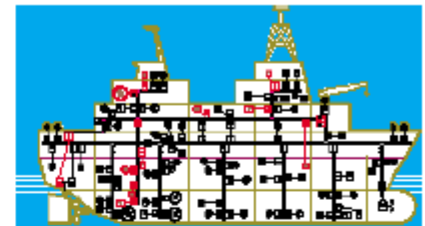
At 4160 VAC, 32 MW



# Insulated Bus Pipe

- Installed similar to pipe
- Can be installed in the modular assembly areas
- The modularity of IBP will reduce the time for installation of the distribution system.
- The modularity of IBP allows for energizing and testing portions of the distribution system prior to all units being installed.
- The installation of IBP in the modular assembly areas provides less to no trade interference and the installation teams are not under the time pressure or normally associated with cable installation.

# Insulated Bus Pipe



- Installed towards the end of build,
  - With maximum trade interference.
  - 
  - A job which takes 1 hour at outfitting takes 8 hours at this stage.
  - Commissioning takes place late in build
    - Involves cable pulling in confined space, under time pressure.
    - Involves cable terminations under time pressure.
  - Multiple cables per phase
  - Complex with many component systems
  - Foremen must calculate cable bending radii, cable lengths, cable protection, cable pulling etc. Many calculations on the job.
  - Cable pulling also causes injuries to backs, arms, shoulders etc.
- Installed early at outfitting, free from trade interference and time pressure.
  - A job which takes 1 hour. Really takes 1 hour.
    - Small portable HV testing system allows pre-testing at block stage
  - Involves placing of Busbars onto fixings, and subsequent bolting together. No time pressure.
  - 1 Busbar per phase up to 7000A.
  - Few component parts completely standardised.
  - Foremen receive prior training regarding installation Delivered with drawings and simply fits into place. Block build means that large sections can be lifted by crane.

# Insulated Bus Pipe

## **BENEFITS OF IBP OVER CABLE**

- IBP is a single copper bus pipe incased in an insulated material which is enclosed in a stainless steel pipe. Embedded in the insulating material is a ground plane which makes the IBP touch safe. One IBP run is installed for each electrical phase. This eliminates the need to run parallel cable for amperage, voltage, or voltage drop. IBP is manufacture in sections which are bolted together. It is installed the same as pipe is installed on ships.
- Cable on Navy ships has a defined tightest building radius of four times its diameter. IBP can be manufacture to make a ninety degree bend. This makes IBP a perfect solution for installation in small locations.
- The installation of IBP instead of jacketed cable leads to a significant weight (58%) and volume (30% to 42%) savings. Analysis of UK's CVF platform yielded savings of 95 tons with 17,700 feet of SDC replacing 121,400 feet of cable.

# Insulated Bus Pipe

## HOW DOES IBP IMPACT PRESENT SHIP DESIGN?

- It replaces portions of the present wireways and changes the bulkhead type penetrations
- Feeders will have to be determined more accurately earlier as a result of IBP being installed at an earlier production time.
- Feeder layouts will have to be determined earlier as relocation will be more difficult.
- IBP is manufactured for specific locations and to detailed specifications (a part numbering system will have to be established to ensure each piece is connected properly)
- Design decisions will have to be accomplished to ensure the best design for lengths of the conductors and connection points.
- Rework conductor entrance and connections to equipment.
- Recalculate weight

# Insulated Bus Pipe

## Additional Items for Future Consideration

- Create a different type of splice method and an onboard method of ship repair.
- Work with NSWC on their theory of “Switchboard-Less Shipboard Power Distribution”. NSWCCD has been studying the potential shipboard use of multi-node IBPs with an in-line circuit interrupter at each node to allow rapid configuration of electric power distribution either manually or through algorithm-based decision-making software
- Develop plug connections equipment and between conductor sections.