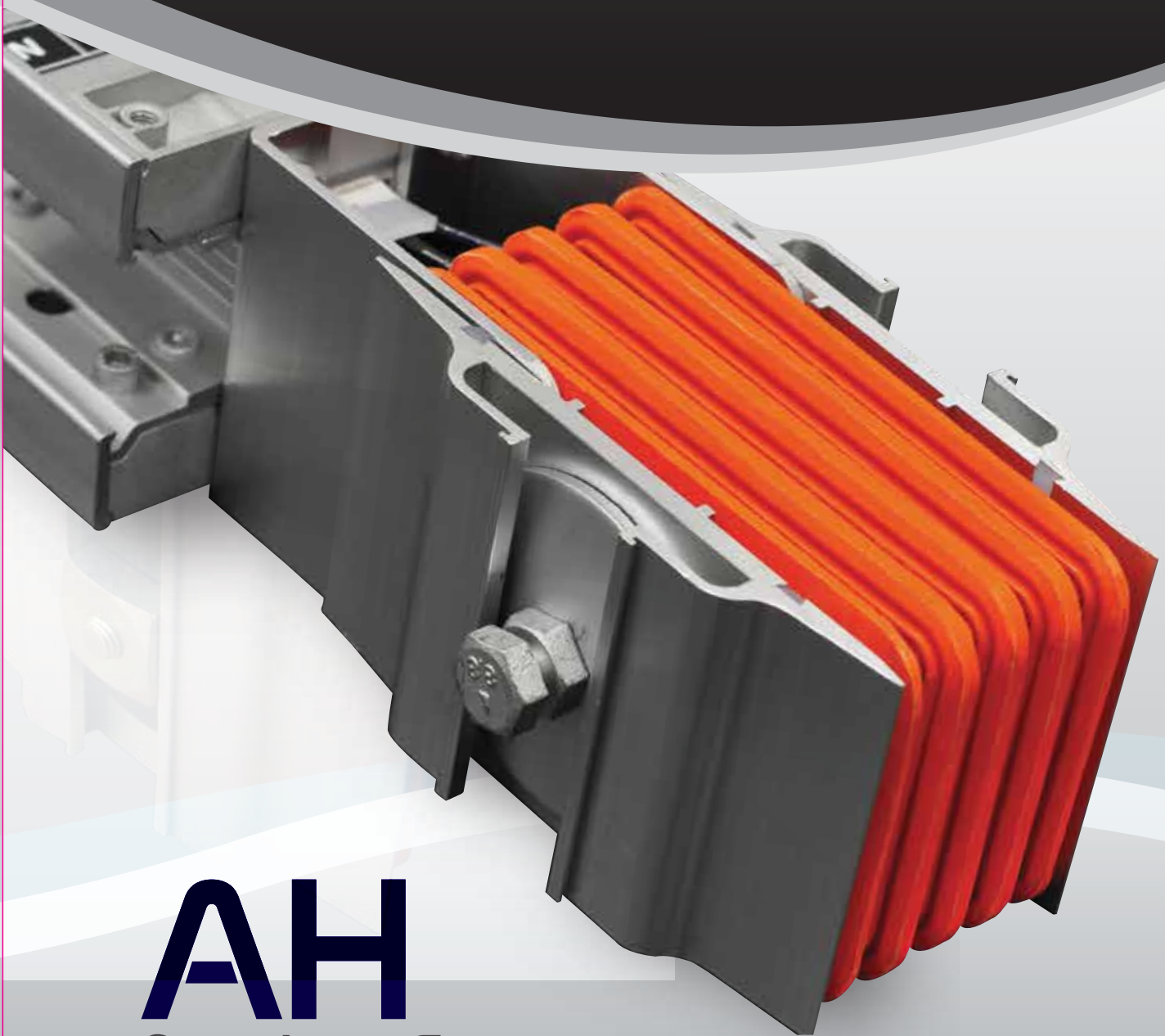


FURUTEC®



AH

Busduct System

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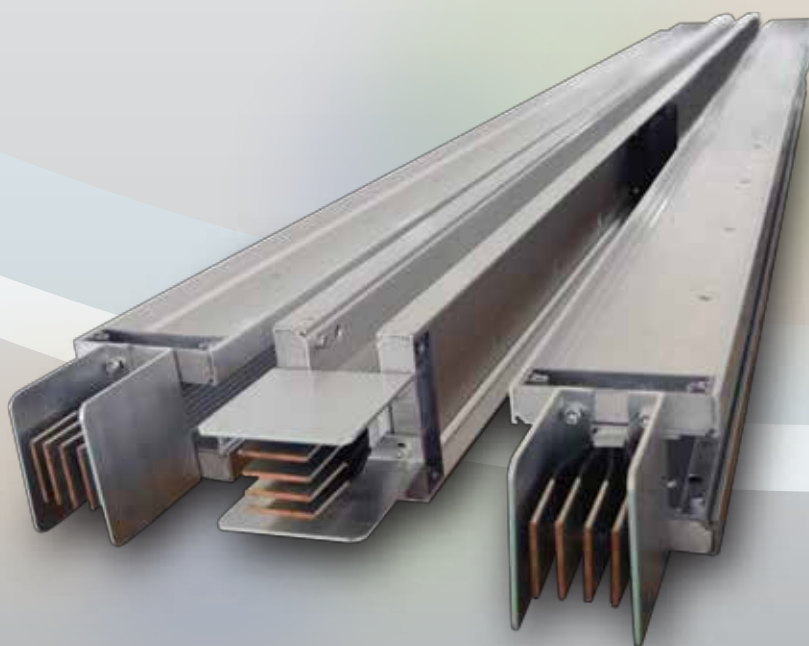
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ABOUT FURUTEC

Furutech's state-of-the-art manufacturing & testing technology provides a cost-effective, time-saving and less human error in the busduct manufacturing and assembly processes as well as the testing facilities at the manufacturing plant.



Automatic Polyester Insulation Forming Process



Shearing Process with Digital Controller



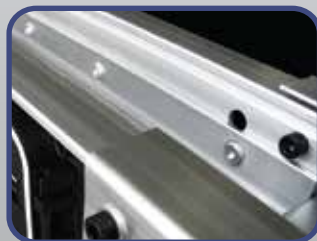
Automatic Welding Machine



Dielectric Test and Insulation Resistance Test Equipment



Busduct Housing Assembly by Automated RIVET Technology



Current Injector for Temperature Rise Test

ABOUT FURUTEC

Furutec Electrical is committed towards quality and services as stipulated in its ISO 9001:2008 Certification for Quality Management System. Our continuous R&D and product innovation on HP-ES busduct system have enabled us to stay ahead of the competition. We engineered a new and optimized product in AH busduct system encapsulating in an extruded aluminum-alloy housing. Our R&D effort continues to merit our customer's expectation and trust towards our products.

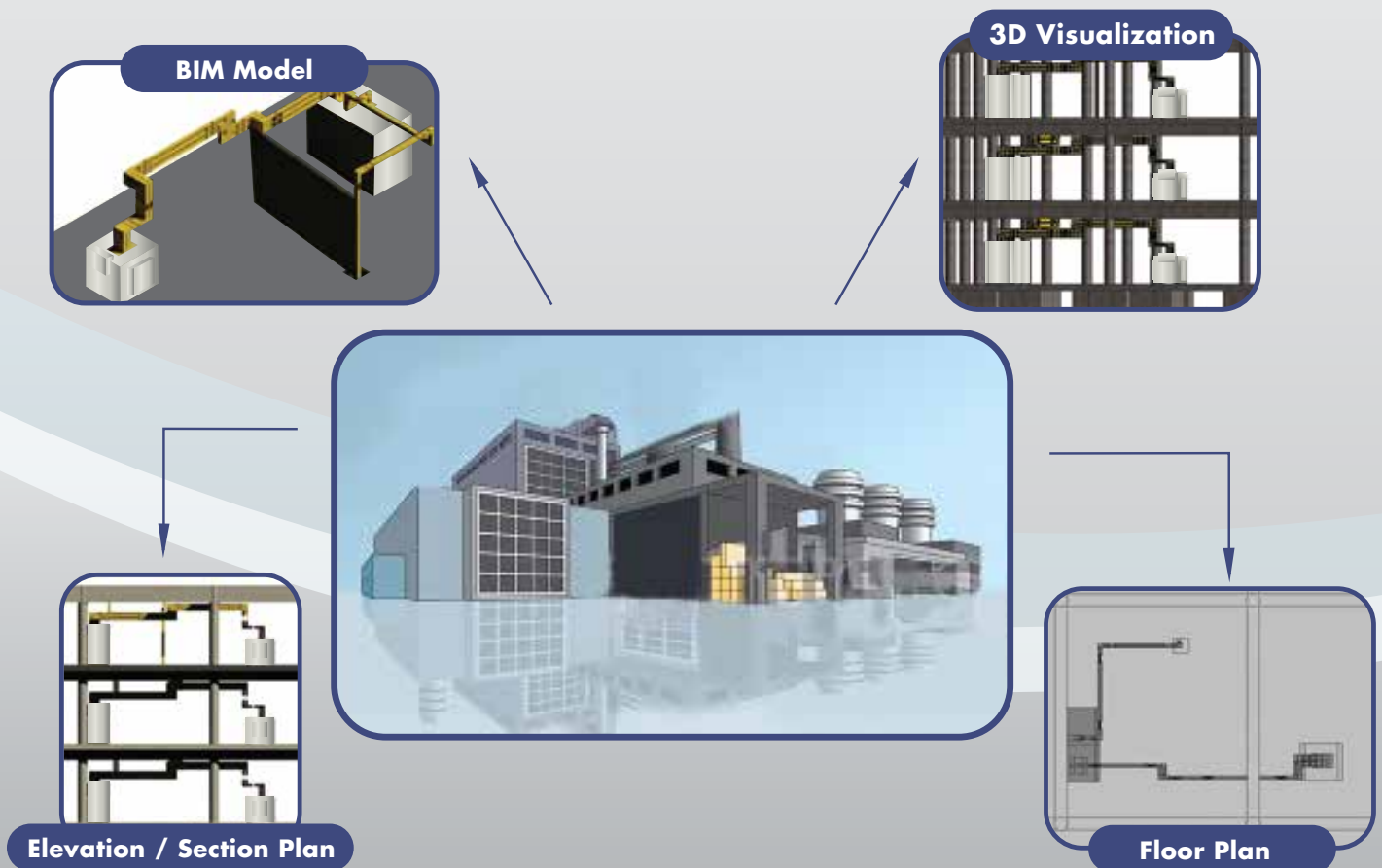
The technology advancement in Architecture, Engineering and Construction (AEC) communities have witnessed the migration from 2D drawing to today's 3D modeling capability. Also known as BIM technology, we foresee this to be a dramatic paradigm shift in the AEC world. Today, Furutec's BIM is poised to create success for our customers around the world.

What is Building Information Modeling (BIM)?

BIM is a process involving the generation and management of digital representations of physical and functional characteristics of a facility. The resulting BIM becomes shared knowledge resources to support decision-making about a facility from the earliest conceptual stages, through design and construction, through its operational life and eventual demolition.

Advantages of BIM:

- 3D visualization
- Change management
- Building simulation
- Data management
- Building operation
- Minimizing human error
- Lesser time consumption



TYPE TESTING & CERTIFICATION

Compliance to International Standards

Furutec AH Busduct is type tested to IEC 61439-6 and certified by independent testing authorities. The tests conducted include as follows:

- Strength of materials and parts (10.2)
- Degree of protection of assemblies (10.3)
- Clearances and creepage distances (10.4)
- Protection against electric shock and integrity of protective circuits (10.5)
- Dielectric properties (10.9)
- Verification of temperature-rise (10.10)
- Short-circuit withstand strength (10.11)
- Electromagnetic compatibility - EMC (10.12)

Short-Circuit Withstand Strength

Busdust Rating	Short Circuit (KA/ 1 Sec)	Short Circuit (KA/ 3 Sec)	Busduct Rating	Short Circuit (KA/ 1 Sec)	Short Circuit (KA/ 3 Sec)
500A	20	11	2000A	66	38
630A	20	11	2500A	66	38
700A	40	23	3200A	123	71
900A	40	23	3500A	123	71
1200A	56	32	4000A	123	71
1350A	66	38	4500A	123	71
1700A	66	38	5000A	123	71



Test Verification of Short Circuit Withstand Strength in 1 and 3 seconds.

TYPE TESTING & CERTIFICATION

Temperature Rise

The current-carrying capacity of a copper or aluminum conductor is determined by the maximum temperature at which the conductor is permitted to operate. According to IEC 61439-6, the temperature rise limit is illustrated as follows:

Parts of Busduct System

Temperature Rise Limit above Ambient Temperature

External metal surface

$\leq 55^{\circ}\text{C}$

Internal insulated conductor

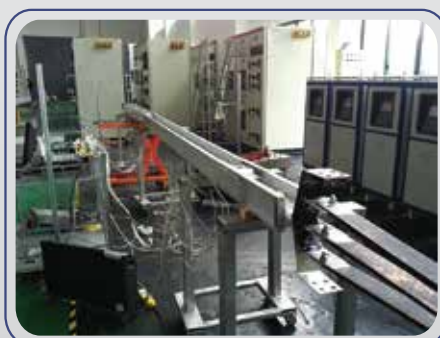
$\leq 105^{\circ}\text{C}$

External insulated conductor

$\leq 70^{\circ}\text{C}$

Furutech AH Busduct is able to operate at full rated current at a maximum ambient temperature of 40°C without having to apply the derating factor.

The temperature rise test setup at an independent testing laboratory

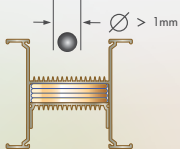
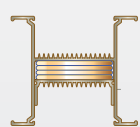
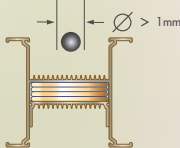
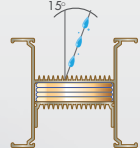
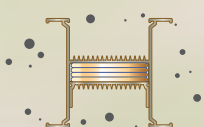
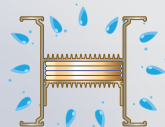
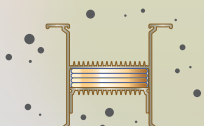
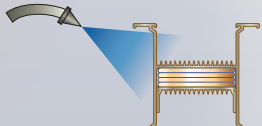
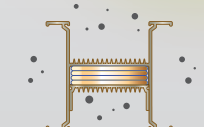
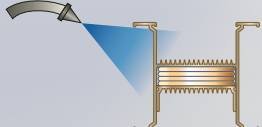
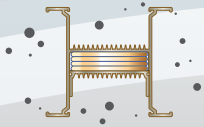
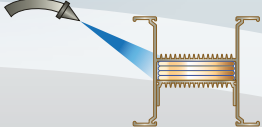
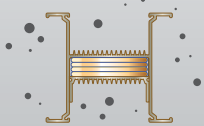
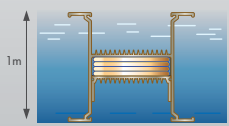
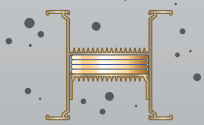
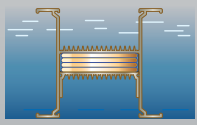


TYPE TESTING & CERTIFICATION

Degree of Protection

Furutec AH Busduct is designed with a standard of IP65 for busduct straight feeder and IP54 for plug-in feeder in order to provide an optimum performance in most of the demanding applications.

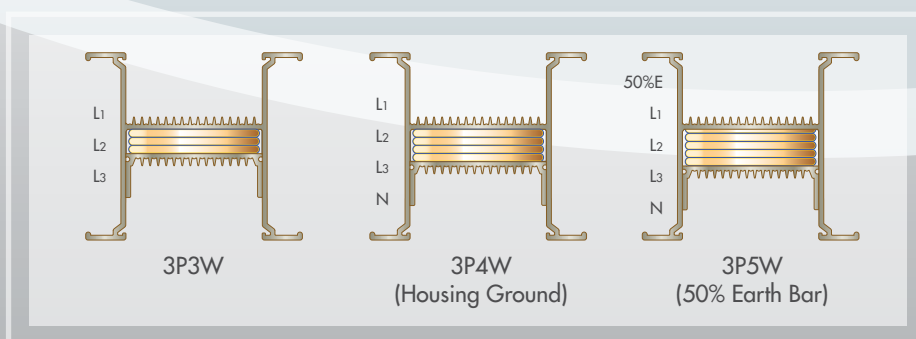
The IP classification is categorized into 2 parts; **The first digit denotes protection against ingress of solid objects and the second digit denotes protection against water.**

Protection against ingress of solid objects			Protection against water		
4	Protected against foreign objects greater than 1mm		0	No protection	
4	Protected against foreign objects greater than 1mm		2	Drops of water falling at up to 15° from the vertical	
5	Dust protected		4	Projected water from all directions (limited ingress permitted)	
5	Dust protected		5	Jets of water (limited ingress permitted)	
6	Dust tight		5	Jets of water (limited ingress permitted)	
6	Dust tight		6	Heavy jets of water (limited ingress permitted)	
6	Dust tight		7	Effects of immersion between 15cm and 1m	
6	Dust tight		8	Long period of immersion under pressure	

TECHNICAL & PHYSICAL DATA

Technical Data Sheet

Description	Specification
Model	AH
Type	Compact Sandwich
Compliance Standard	IEC 61439-6
Rated Current	500A – 5000A
Rated Operating Voltage	690 V (Maximum)
Frequency	50 Hz
Type of Earth	Integral Earth Bar/ Housing Ground
Earth Size	50% of Phase Conductor (Applicable to 3P5W)
Neutral Size	100% of Phase Conductor (Applicable to 3P4W & 3P5W)
Degree of Protection	IP 65 for Busduct Straight Feeder IP54 for Plug-in Feeder
Plating of Conductor	Tin Plating
Insulation Material/ Voltage	Polyester Film (-70°C to 150°C)/ 1000V
<u>Busduct Housing</u>	
• Material	Extruded Aluminum Alloy (6063-T5) (Electrical Conductivity is 55% based on IACS)
• Finishes	Phosphate Layer
• Thickness	3.0 mm
• Assembly Method	RIVET Technology
<u>Busduct Joint Section</u>	
• Type of Joint System	Joint Stack with Double Headed Joint Bolt
• Type of Joint Bolt	High Tensile Double Headed Joint Bolt
• Type of Insulator	Dough Moulding Compound (DMC)
• Standard Busduct Length	3000 mm
• System Configuration	3P3W (L1, L2, L3) 3P4W (L1, L2, L3, N) 3P5W (L1, L2, L3, N, 50% Earth Bar)



TECHNICAL & PHYSICAL DATA

Housing Construction

Furutec AH busduct system is constructed of extruded aluminum alloy. Aluminium alloy has superior properties in corrosion resistance, heat dissipation, and mechanical strength. It can be used as earth conductor with its low impedance and high electrical conductivity as compared with steel material.

During the manufacturing process, AH busduct is assembled by using automated RIVET technology which enables the housing to have a better mechanical strength to withstand short circuit. The pre-installed silicon sealant maintains the ingress protection consistency throughout the extruded aluminum alloy housing.



The extruded aluminum alloy housing of AH busduct offers the following technical advantages to address the concern of engineers & designers.

1. Lightweight

Aluminum has a weight of 2.72 g/cm^3 which is about one-third of steel (7.85 g/cm^3). It is the material of modern world, used for the aerospace construction, skyscrapers and automotive design applications.

2. Heat Dissipation

Refer to the *Thermal Conductivity Comparison Table* as below, aluminum has the significant higher value which is 215 W/m K as compared with steel (51 W/m K) at 125°C atmosphere temperature. It means that when the same amount of heat is transferred from the busduct, the aluminum housing will have a higher rate of heat transfer as compared with steel. Therefore, extruded aluminum alloy housing is the optimal choice to replace the steel housing as it provides excellent heat dissipation keeping the housing surface cool.

Material	Atmosphere Temperature ($^\circ\text{C}$)		
	25	125	225
Copper	401	400	398
Aluminum	205	215	250
Carbon Steel	54	51	47
Iron	80	68	60
Platinum	70	71	72
Stainless Steel	16	17	19

Thermal Conductivity of various materials

3. Integral Ground System (IGS)

The extruded aluminum alloy (6063-T5) housing provides a low impedance ground path as it has an electrical conductivity value of more than 50% based on IACS (International Annealed Copper Standard). In 3P4W busduct construction, the designer may opt for using the housing being the earth conductor to achieve cost optimization. Table below shows the electrical conductivity of various materials (sourced: IACS).

Material	Conductivity (%)
Silver	105
Copper	100
Gold	70
Aluminum Alloy (6063-T5)	55
Brass	28
Zinc	27
Nickel	22
Iron	17
Tin	15
Prospher Bronze	15
Nickel Aluminum Bronze	7
Steel	3 to 15

Electrical Conductivity of Materials

4. Corrosion Resistance

Aluminum material offers an excellent corrosion resistance. The housing is always protected by its own naturally generating oxide film. Additionally, an extra protection can be further enhanced by anodizing or other finishing techniques. By having this type of corrosion resistant housing, AH busduct is robust enough even in the most critical environments.

5. Compact Sandwich Construction

Furutec AH Busduct has a compact sandwich design which is light weight, low impedance, non-ventilated, naturally cooled and totally enclosed for protection against mechanical damages and dust accumulation. It occupies a lesser space as compared with the conventional wire or conduit for most of the applications. It is an ideal choice for skyscrapers, data centres, public utilities and industrial applications that demand for quality, durability, reliability, flexibility and efficiency in power distribution.

6. No Chimney Effect

The chimney effect is the natural phenomena that occurs when there is a density of difference between a hot and cold air column, creating a natural flow through a chimney. AH Busduct offers a compact sandwich construction which makes the busduct more streamlined & minimizing the chimney effect during a fire incident

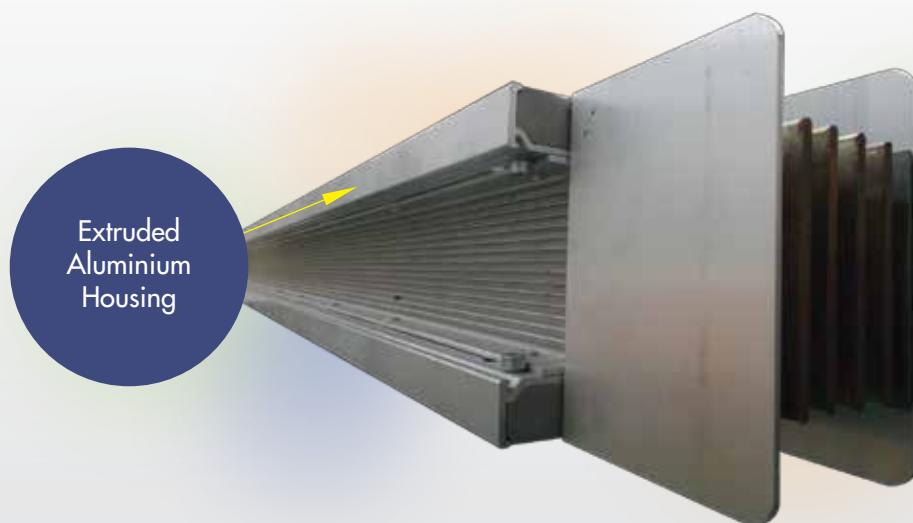
7. Overload & Short Circuit Protection

During a short circuit, the current will rise rapidly, generating extreme heat which can melt various elements. By using extruded aluminum alloy housing, AH busduct can withstand a higher rate of overload and thermal shock generated by the short circuit.

TECHNICAL & PHYSICAL DATA

8. Economical & Easy Installation

The lightweight extruded aluminum alloy housing coupled with a simple joint design, facilitates the installation works of Furutec AH busduct. It also reduces the installation cost significantly in term of workmanship, machinery and duration of installation.



Joint System

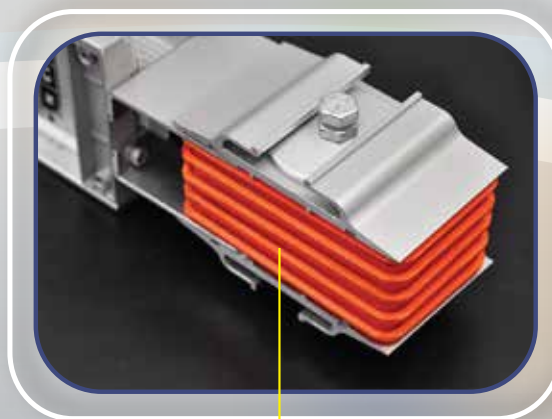
Furutec AH Busduct features a joint stack design that is maintenance free. This joint stack design has taken into the consideration of a bigger contact surface of the conductors in order to reduce power loss and improve cooling performance.

Double headed joint bolts together with Belleville washer ensure a sufficient pressure required to secure each joint connection. The double headed joint bolt is also designed with a specific torque value whereby the outer head of the joint bolt (which acts as tightness indication) will shear off when it reaches the limit and this will prevent over tightening of the joint section.



Belleville Washer

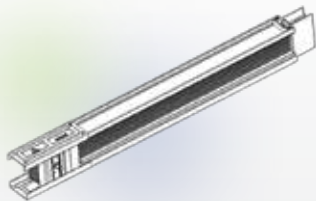
Double Headed Joint Bolt



Joint Stack Connector

TECHNICAL & PHYSICAL DATA

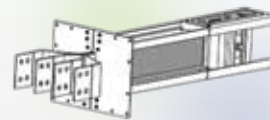
Busduct Accessories



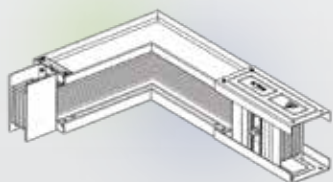
Straight Feeder (IP65)



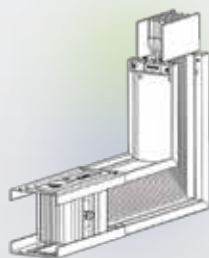
Plug-in Feeder (IP54)



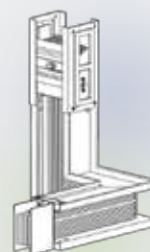
Flange End



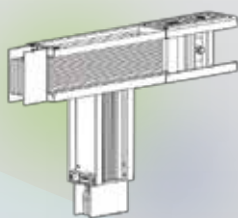
Edgewise Elbow



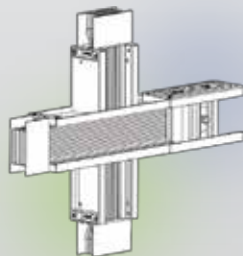
Flatwise Elbow



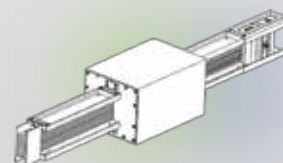
Combination Elbow



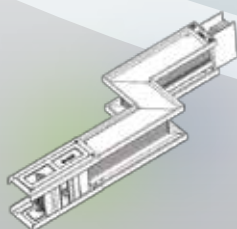
Flatwise Tee Elbow



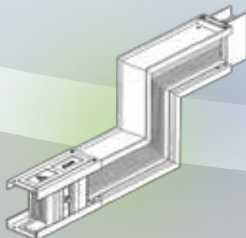
Flatwise Cross Elbow



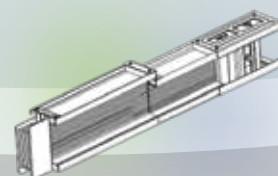
Expansion Unit



Edgewise Offset Elbow



Flatwise Offset Elbow

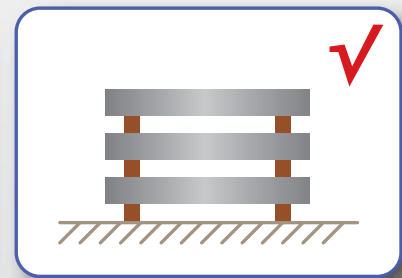
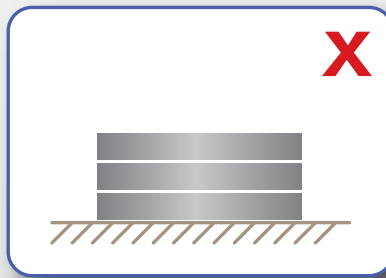
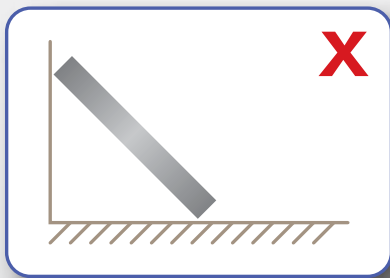


Reducer

INSTALLATION & MAINTENANCE PROCEDURE

Before Busduct Installation

1. When the busduct arrives at project site, check the type and quantity of busduct feeders and accessories from delivery orders. Inspect for any physical damages caused during transportation and unloading.
2. Keep the busduct in a dry place, away from water and moisture, preferably under a roof, protected from rain. Cover the busduct with water-proof material, if necessary.
3. Do not lay the busduct directly onto the ground or in an upright position. Always place pieces of wood under the busduct and stack up firmly.
4. For long periods of storage, ensure that the busduct is placed in a dry place, free from condensation.



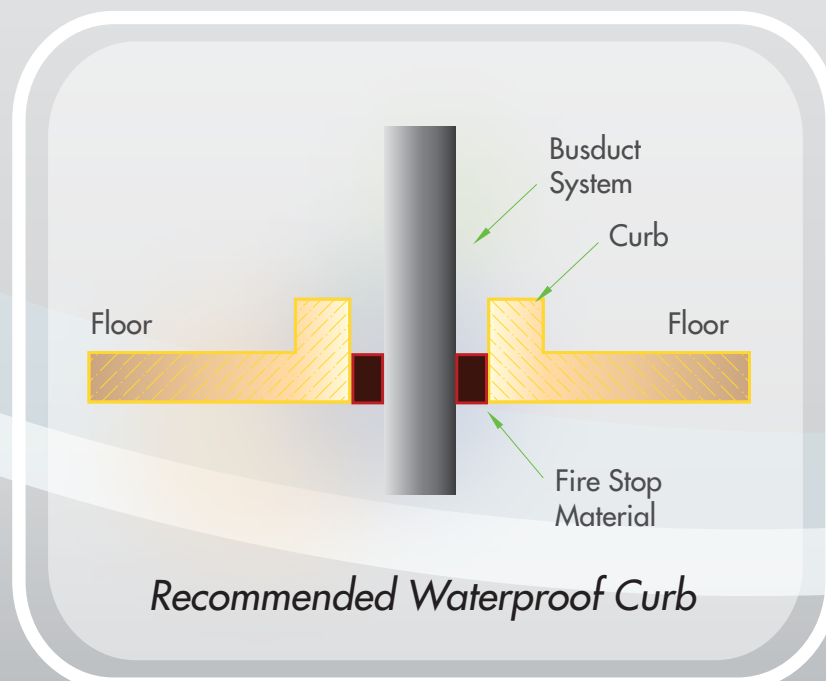
5. To prevent the busduct joint from being soiled, wrap both busduct ends with water-proof material while unpacking. Before busduct joint installation, examine the conductor contact surface or insulation materials for any damages. It is important to ensure that the joint sections are not soiled with dust, dirt and other foreign matter.
6. Sufficiently strong materials and equipment must be used during handling and lifting to reduce the risk of personal injury and equipment damage at site. Busduct must be handled with care to avoid damage to internal components and metal housing.
7. During unloading, do not drop it or let it hit other objects. Do not drag the busduct across the floor or across other busduct sections. A fork lift may provide a more convenient method of handling and has the added advantage of permitting it to be lifted between levels.
8. Platform/Scissor lifts or elevators, either manually or power operated, can be used advantageously in moving the busduct between elevations. Remember to check that the weight of the personnel plus busduct is within the capacity of the lift/elevator.
9. If a crane is used to move the busduct, use nylon straps and distribute the weight on each lift. If rope is used, insert thick pieces of rag, foam or corrugated cardboard between them to prevent the busduct from being damaged/scratched. Do not place slings, rope or chains around the busduct ends since damage can easily occur. For busduct rated 2500A and above, pieces of strong wood should be used when rope is applied, in order to prevent the busduct housing from being deformed.
10. If a fork lift or similar hoist is used, properly position the busduct on the fork to distribute its weight. Careful approach is a must to avoid any damage to the metal housing.

INSTALLATION & MAINTENANCE PROCEDURE

11. While installing vertical busduct, it may be easier to lower the busduct feeder from one floor above where it will be installed. The busduct feeders are usually stored on the floor above their final location to facilitate lowering them into position. Protect both busduct ends when rising from horizontal to vertical positions.
12. When the installation work is suspended or halted at job site, the end section of the connecting busduct feeders should be protected against water and dust by covering them with polythene or other appropriate materials.

During Busduct Installation

1. In vertical busduct installation, busduct feeder which will be supported by vertical hanger should be installed before other busduct feeders in order to prevent a downward weight or load from concentrating on the busduct at the lower floor.
2. Flange end box must not be fixed permanently to the wall and floor. However, flange end box can only be permanently secured provided that all the busduct installations are completed (if unavoidable).
3. Vertical hanger/vertical spring hanger must be installed to the busduct system to allow for busduct elongation/expansion & contraction as well as the shrinkage of the building.
4. Waterproof curb is recommended to be installed at each floor opening where the busduct passes through. It prevents water (caused by plumbing leaks, fire sprinkler system leaks, fluid spills, etc) from seeping into the busduct system. Additionally, the floor opening should be sealed with fire stop material to prevent fire from passing through the floors in case of fire in the building.



INSTALLATION & MAINTENANCE PROCEDURE

Installation Guideline Of Busduct Joint

1



Identify the correct joint stack (either 4W or 5W) and its phase orientation before joint installation.

2



Align and connect both busduct terminal with joint stack connector.

3



Joint stack stopper acts a guideline to ensure a full contact surface of the overlapping conductors.

4



Tighten the double headed joint bolt by using socket wrench.

5



6



The double headed joint bolt is tightened until the outer head shears off.

7



8



INSTALLATION & MAINTENANCE PROCEDURE

Installation Guideline of Tap Off Unit (Plug-In Type)



Identify the correct location of TOU by verifying from the as-built drawings.



Plug In Hole Cover

Open the cover of the plug in hole.

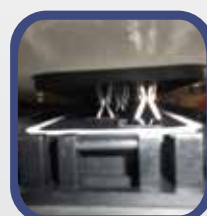


Tap Off Unit (TOU)

Ensure that the MCCB handle is in "OFF" position before commencing the installation of TOU



Plug in clips of TOU must be fully inserted into the plug in hole.

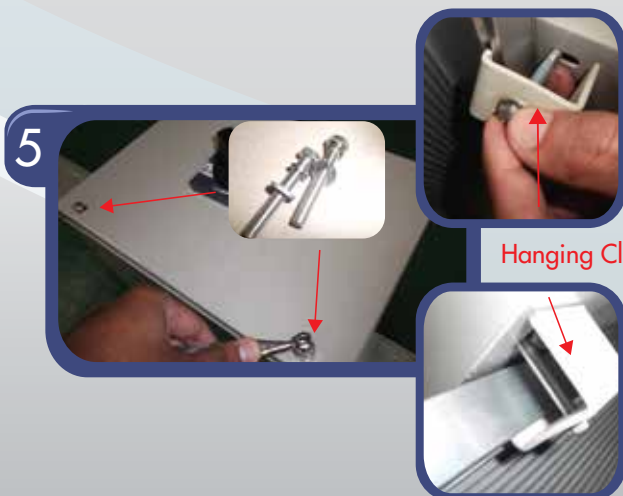


Before insertion



After insertion

Verify the phase indication of TOU before inserting the plug in clip of TOU into the plug in hole of the busduct. Afterwards, TOU should be fully inserted to the busduct's plug in hole.



Hanging Clamp

Loosen the fasteners on the door of the TOU and fix the hanging clamp at each corner of the TOU.



The TOU shall be attached firmly to the busduct by 4 of the hanging clamps to complete the installation of TOU. Afterwards, cable shall be terminated to the outgoing terminal of the MCCB and insert the interpole barrier to prevent any accidental contact with the live parts of the MCCB terminal. Finally, close the TOU door by means of both fasteners.

INSTALLATION & MAINTENANCE PROCEDURE

After Busduct Installation

1. After the completion of busduct installation at project site, it is advisable to carry out a thorough inspection of the whole busduct route, followed by measurement of insulation resistance/Megger.
2. Before conducting the measurement of insulation resistance, all the equipment connected to busduct system should be disconnected and MCCB rotary handle of tap-off units should be in 'OFF' position.
3. The insulation resistance value cannot be specified due to different length of the busduct and environment condition. But if it is installed in a dry atmosphere, the value of resistance should be approximately 100 M Ω (500V Megger).
4. The following inspection procedures should be carried out. Determine whether:-
 - 4.1 The busduct feeders are physically damaged.
 - 4.2 All the connecting parts are fixed precisely (e.g. flange end box, tap-off units, etc)
 - 4.3 The bolts for connecting the equipment are securely fastened.
 - 4.4 The busduct joint are tightened in accordance to Furutec's requirement and recommendation.
 - 4.5 The busduct is supported securely by the hangers.
 - 4.6 Conduct Thermal Scanning Test on busduct housing, joint section and other connections to detect any abnormal heat or hot spot.

Recommended Maintenance Procedures

The following maintenance procedures and periodical inspection are recommended to ensure a safe operation of busduct system for long terms.

1. Period of Inspection

An inspection on the busduct once a year or once every two years is recommended. If the busduct system is installed in unfavourable conditions such as, temperature and/or humidity is high, there is a lot of dust or in similar environment; the periodical inspection must be conducted.

In the event of the following unusual conditions, inspection must be carried out immediately in each case:

- a) After severe earthquake
- b) After a fire has occurred
- c) After being exposed to water
- d) After an electrical fault

INSTALLATION & MAINTENANCE PROCEDURE

2. Maintenance and Routine Inspection

2.1 [Inspection on External Appearance](#)

Check whether:-

- ✓ There is any deformation, damage, dirt, etc throughout the whole length of the busduct systems
- ✓ There is any dislocation, bending and other abnormality of the connecting covers, hangers and plug-in appliances

2.2 [Environmental Inspection](#)

The environment, where the busducts are installed, could change after its installation. Check whether the environment has become hazardous due to water, moisture, high temperature, corrosive gas, immoderate vibration, dust, etc.

2.3 [Inspection for Abnormal Heat](#)

An Infra Red Thermography instrument is recommended to detect any abnormal heat and to measure the operating temperature of busduct system. As an option, a thermal indicator can be placed onto the busduct housing. If the temperature rise of the busduct housing exceeds the limit, the colour of the indicator will change.

2.4 [Inspection on Connections Sections](#)

Check whether:-

- ✓ The outer head of the double headed joint bolt shears off at each busduct joint section.
- ✓ Busduct is supported by vertical spring hangers, vertical hanger, edgewise/flatwise horizontal hangers according to manufacturer's requirement and recommendation.
- ✓ All the connecting parts, such as double headed joint bolt, hangers, busduct joints, joint covers, etc are fixed precisely.

2.5 [Inspection on Load Condition](#)

After the busduct installation, increase of load is expected. An inspection has to be carried out to ensure that the total connected load does not exceed the rated current of the busduct before the load is increased.

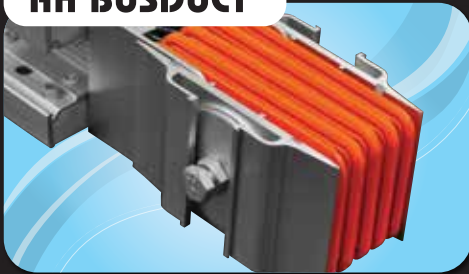
2.6 [Measurement of Insulation Resistance](#)

Measure the insulation resistance between each conductor and between conductor and housing. When the measurement is carried out, the electrical loads and connected equipment should be disconnected.

2.7 [Inspection on Busduct Housing](#)

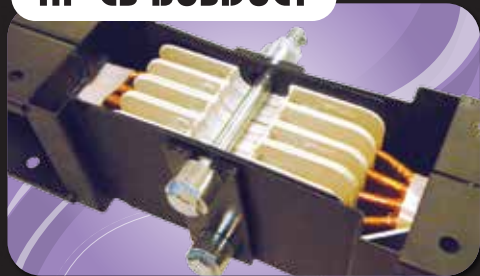
The busduct housing must not be dismantled by any parties without the official authorization from the manufacturer for any purposes. Any violation or abuse will result the respective party to be responsible for all the consequences and compensation. Furthermore, the manufacturer reserves the right to void the warranty if any violation or abuse occurs to the busduct system.

AH BUSDUCT



- Extruded Aluminium-Alloy Housing
- Compact Sandwich Type
- Excellent Heat Dissipation
- Corrosion Resistant
- Low Impedance Ground Path (with electrical conductivity of more than 50% IACS)
- Light Weight and Easy Installation
- Type Tested to IEC 61439-6
- Maintenance-Free
- EMF and EMC verified

HP-ES BUSDUCT



- Inherited Japanese Design & Technology
- Double Bolt Joint Design
- Compact Sandwich Type
- Electro Galvanized Steel with Epoxy Powder Coating
- Polyester Film Insulated
- Type Tested to IEC 61439-6 and Certified by DEKRA / KEMA Quality
- Fire Resistance certified to BS 6387 and CNS 14286 (Equivalent to JIS C 8364 & JIS A 1304)
- Weather Shield Design for Outdoor Installation
- Eco-Labeling certified to MS 2237:2009 as an Environmental Friendly Product
- Maintenance-Free
- Experienced in the Stringent Requirement of Data Centre
- BIM Ready - REVIT
- EMF and EMC verified

CR BUSDUCT



- Corrosion resistant & Self Extinguished Cast Resin Type
- Applicable to Low, Medium and High Voltage Requirement
- Type Tested to IEC 60439-2 (LV) and IEC 62271-200 (MV)
- Degree of Protection certified to IP68
- Fire Resistance certified to CNS 14286 (Equivalent to JIS C 8364 & JIS A 1304)
- IK10 Mechanical Impact certified to IEC 62262
- Seismic Protection certified to withstand 2.2g Peak Ground Acceleration (PGA)
- Overload current capacity of 25% for 4 hours
- Aluminium Profile along busduct body ensuring earth continuity
- Certified as Environmental Friendly Product
- Maintenance-Free
- EMF and EMC verified



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