Flexible Bus Systems

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Flexible Bus System

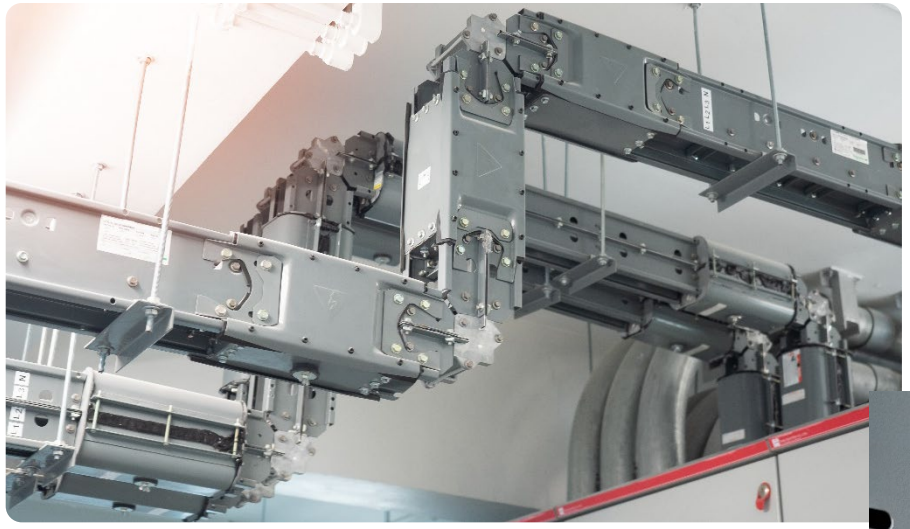
- The world continues to become increasingly electrified, and both the demand for energy and the requirements placed on that energy continue to expand.
- Some trends that this is driving includes:
- As power conversions, for example; EV and Battery charging technologies advance, power density will increase, both at power conversion and power distribution levels.
- Power density requirements in data centres, industrial plants and telecommunications facilities continue to grow leading to larger sized switchboards, generators and transfer switches.
- Continued advancement in power electronic devices and circuits

Power Conductors – Never Redundant

While most components of a power conversion equipment (UL1741), switchboard (UL891) or panelboard (UL67) are now delivering more power per unit of space thanks to technical innovation, **one part of the power system that has seen minimal improvement in power density are power conductors**.

Although improvement in insulation materials and innovative ways to strand conductors has occurred, we will continue to see large conductor used to interconnect equipment and paneboards unless further innovation occurs.

Rigid Busbar Systems (incl. Busways)



Significant innovation in increasing power density will require finding a better (more conductive) yet competitively priced material to replace copper. This seems unlikely in the near term.

Solid busbar-based conductor systems have better heat distribution due to a larger surface area and can assist in providing a partial solution to our problem. Nonetheless, these busbars have limitations in terms of rigidity and ease of installation. Periodic maintenance of the many bolted connections is a must.

Common Reason Rigid Busways Fail

- If low-price, poor quality insulating material is used in the production of a busduct or if the insulation material displays pinholes or an uneven thickness, electrical faults are likely to occur during use.
- If the copper bar of a busduct contains impurities in its composition, localized overheating can happen leading to potential insulation melting.
- If there are bumps, burrs, poor welds, occurrence of a short-circuit is also possible.
- If there is condensation, debris or dust inside the busway leading to an insulation breakdown and a short-circuit.
- Fire resistant busway shall be resistant to water sprays and jets (e.g. IP65) in order to avoid water ingress, corrosion and short-circuits.
- During busway installation, dust can enter the busway leading to degraded insulation particularly in humid conditions.
- Other reasons for failures also include and are not limited to: poor installation practices such as inadequate torquing, loose connections from a lack of maintenance, missing fastening hardware and more generally poor system design (e.g. under sizing of the conductor)

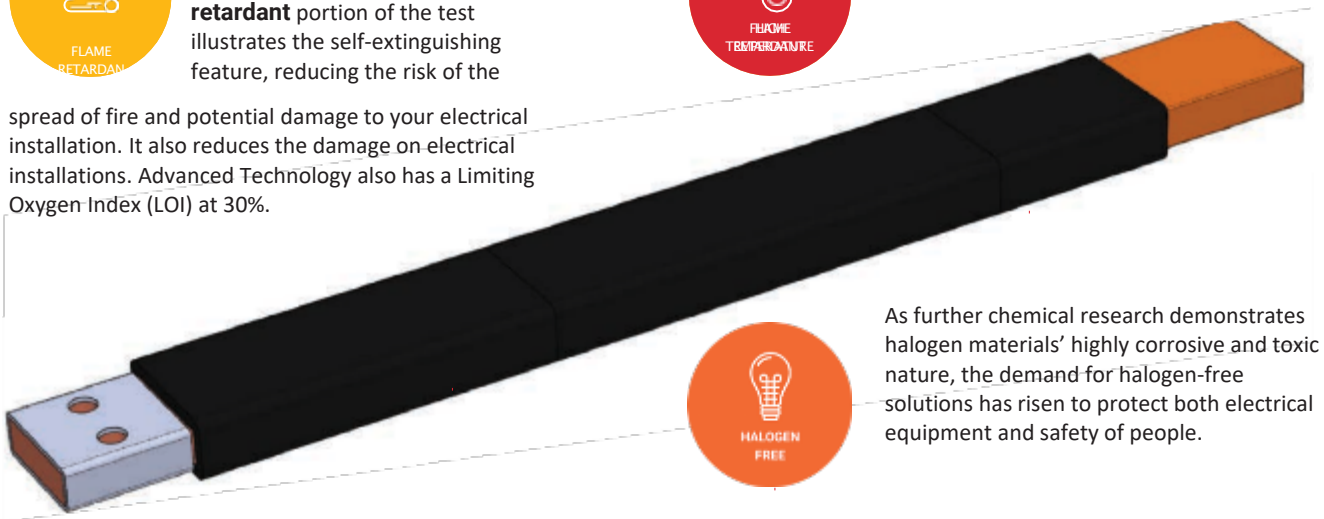
Common Limitations of Cables in Very High Power

- There are standard or manufacturers limitation on the cross-sectional area of cables leading to most high-power installations requiring multiple runs of parallel cables.
- Termination of round cables require lugged connections which take up space in tight locations like UPS and Static Bypass Switch terminals where a bulky adapter can be needed.
- Round cables require redundant insulating materials, fillers, tapes, textile wraps, additional layers, and lubricating agents, such as talc. Round cables tend to be bulkier than flat cables and take up more space and poor heat dissipation.
- Round cables have lesser surface-to-volume ratio than flat cables, resulting in the need for larger conductor sizes to handle higher current requirements due to increased heat.
- Specialized round cable (e.g. silicon) have different temperature ratings than the lugs they are used in conjunction with causing a hotspot at the connection
- Unproper round cable arrangement leads to unequal load sharing among all of the internal conductors which limits the current carrying capacity of the system as a whole.
- Internal wires found inside of round cables can rub against each other, which will wear and, in some cases, impede the overall functionality of the cable in flexing applications.
- When bent, the inner conductors of a round cable are not held securely within the round bundle causing wires to impede each other's movement, resulting in sticking, friction, and corkscrewing. Unlike a flat cable, the round cable tends to move in a different sequence during each flex cycle.

What Does Flexible Bus Look Like

Advanced Technology is compliant to UL 94 V-0 and/or IEC 60695-2-11Glow Wire Test 960°C). The **flame-retardant** portion of the test illustrates the self-extinguishing feature, reducing the risk of the spread of fire and potential damage to your electrical installation. It also reduces the damage on electrical installations. Advanced Technology also has a Limiting Oxygen Index (LOI) at 30%.

Advanced Technology used with FleXbus conductors is also a Class II conductor with a**high-temperature resistance** up to 115°C.



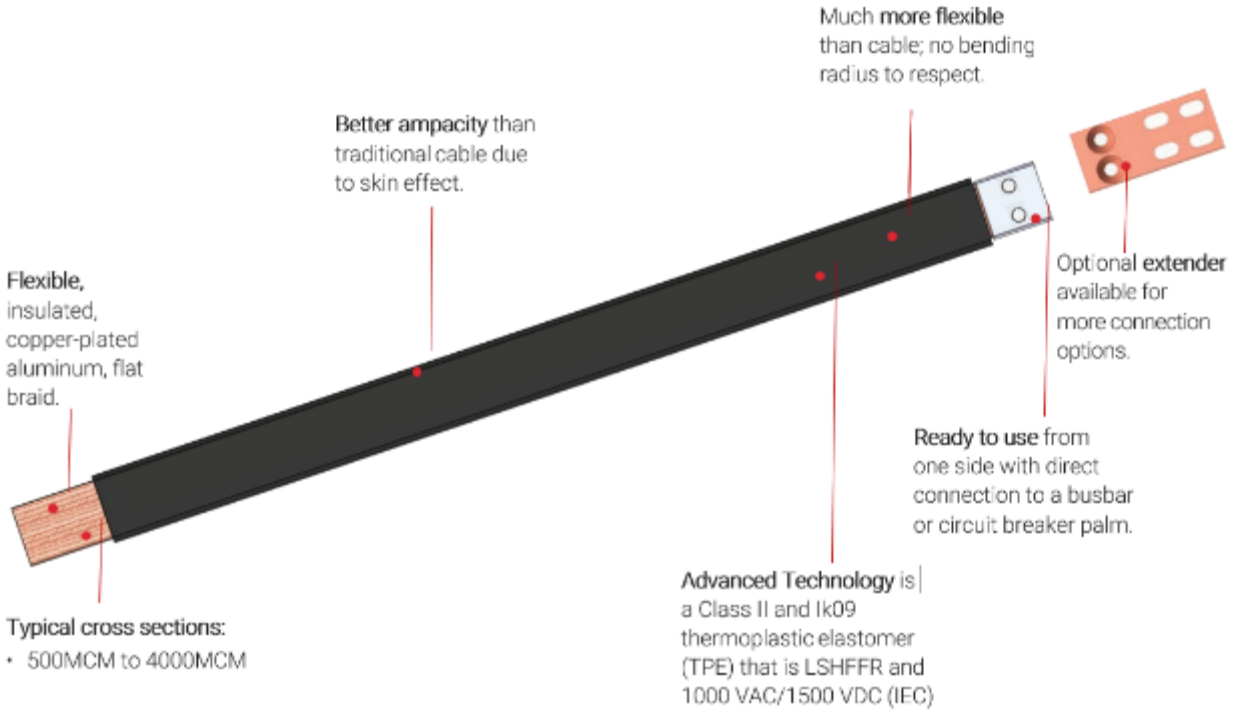
As further chemical research demonstrates halogen materials' highly corrosive and toxic nature, the demand for halogen-free solutions has risen to protect both electrical equipment and safety of people.

The **low-smoke** feature measures the quantity of smoke in case of an emergency such as combustion. This feature helps to determine the smoke density generated during a fire. This flexible conductors comply with UL 2885 and IEC 60754-2, meaning that the light transmittance improved the visibility

One recent innovation in this area is the development of insulated flexible flat conductor system. These system is an innovative and patented connection solution between two electrical equipment installations, such as transformers, switchboards, generators, transfer switches, DC Rectifiers, batteries or large uninterrupted power supplies (UPS).

The conductor used is stranded flexible , insulated copper-plated aluminum stranded braid.

Design



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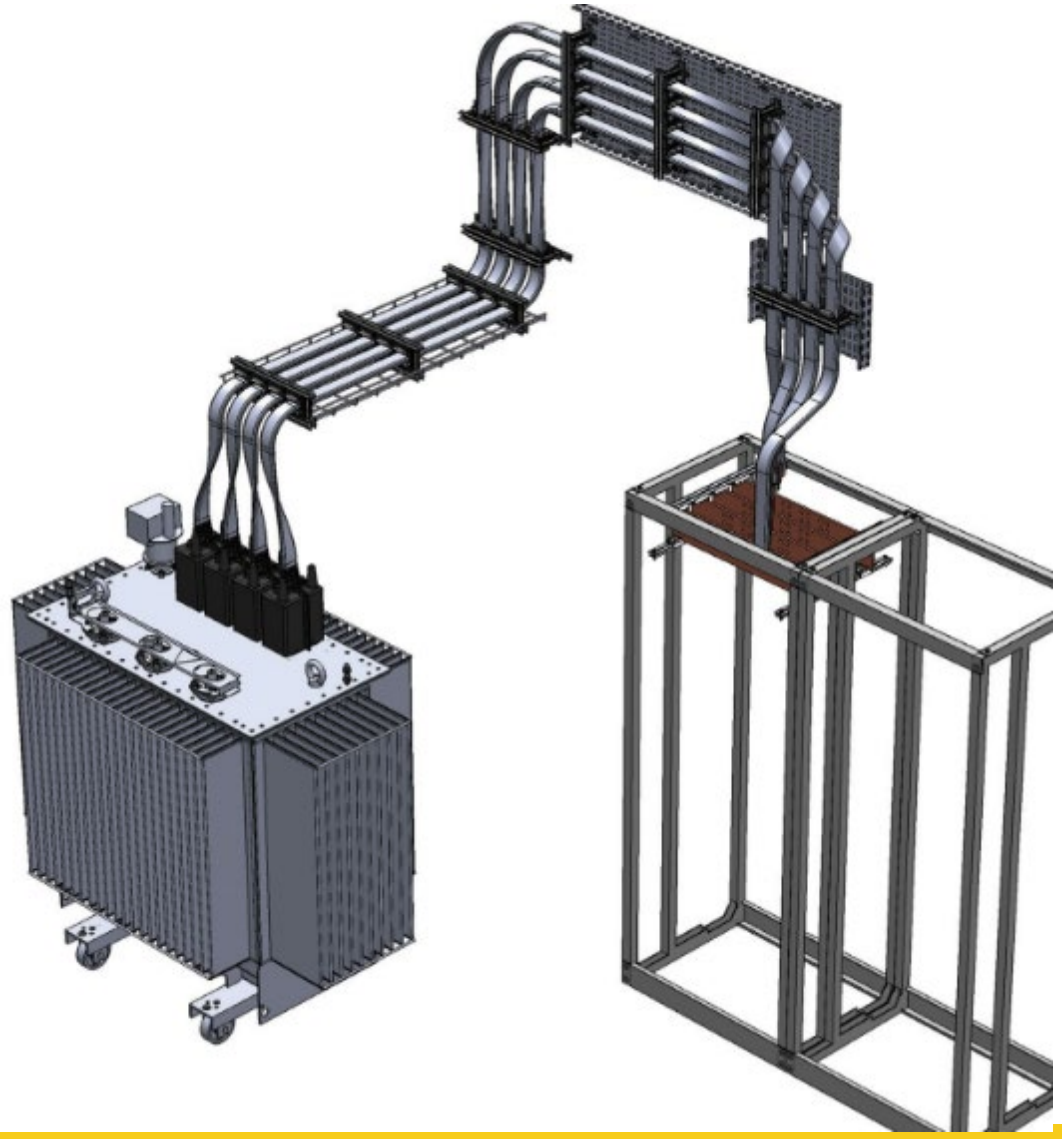
Typical Applications

Flexible bus system are a connection solution between two electrical equipment installations, such as transformers, switchboards, generators or large uninterrupted power supplies (UPS)



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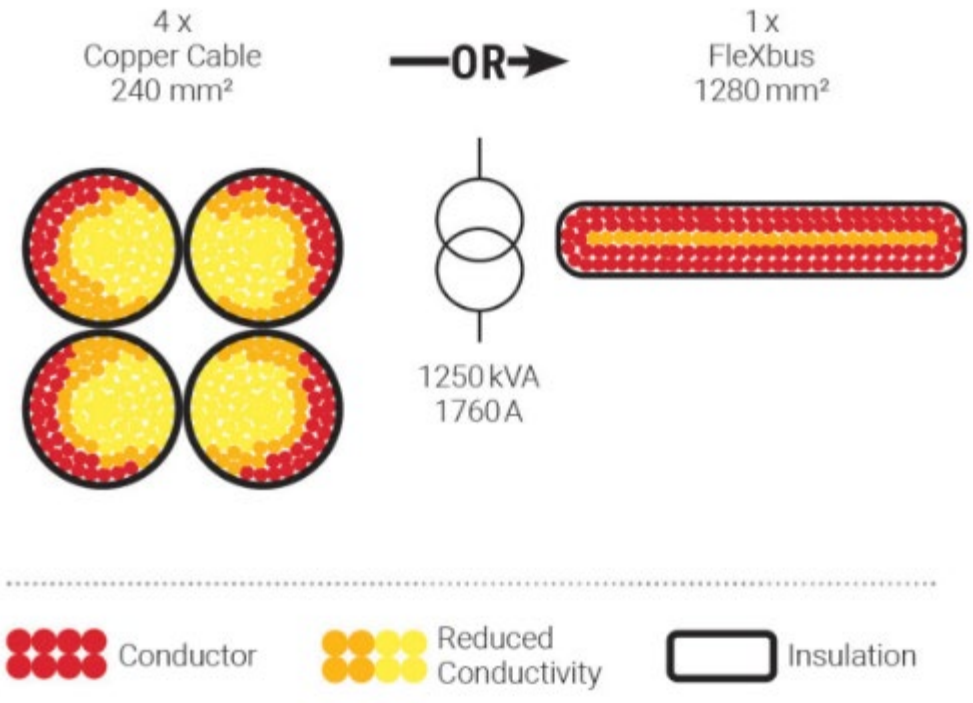
Optimized Power Density

The Flexible busbar system is made of the following core components: conductors, supports, connection components and accessories.
The conductor is made of a rectangular-shaped (flat) copperplated aluminum braid which drives two immediate benefits for designers and contractors: a flat conductor has an optimized power density (skin-effect) which leads to configurations where only two conductors per phase can carry more than 4000A of current per phase as in a 3150kVA transformer connection. For the sake of comparison, a cable installation would use up to 10 240mm2 cables per phase. From a contractor standpoint, a flat braided conductor allows for greater flexibility (no minimum bending radius) and therefore an easier installation, especially since one end of the conductor is prefabricated and allows for direct connection onto the busbar system of a switchboard or onto the back of an ACB.

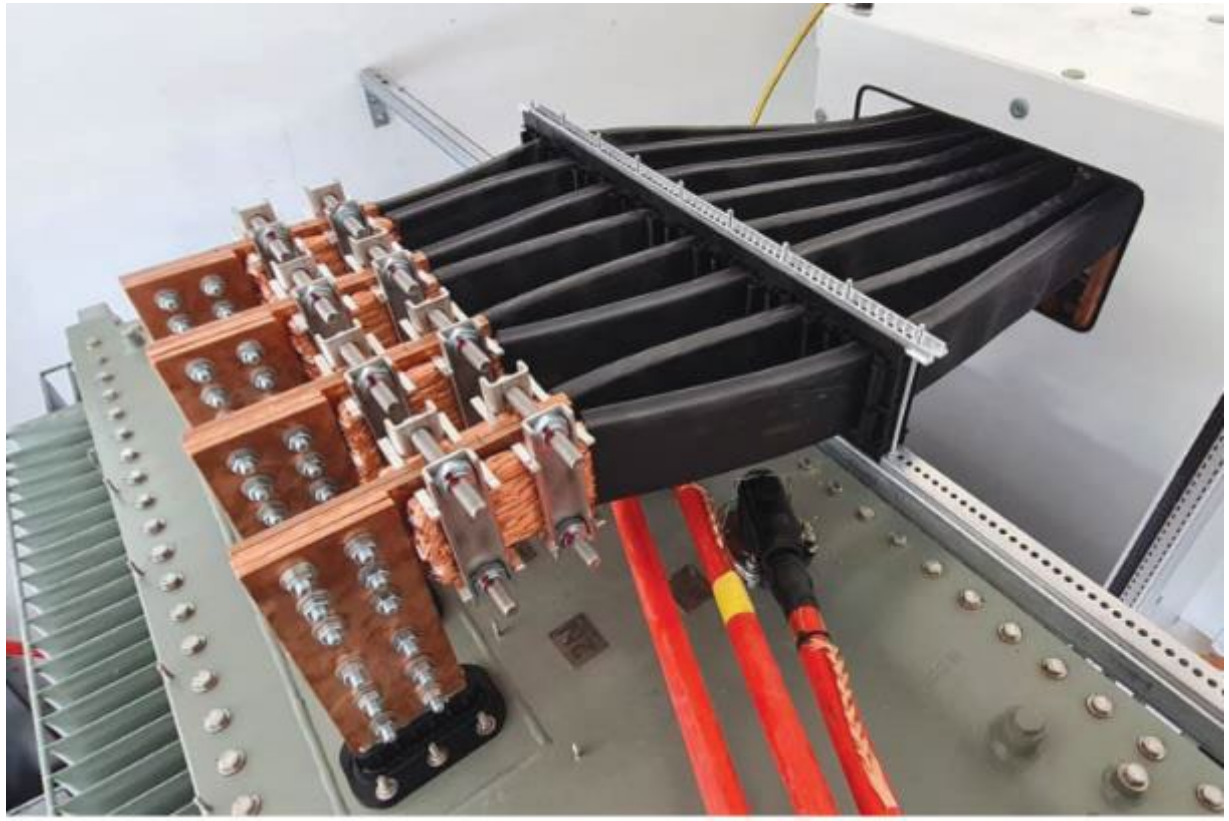


Operating Benefits

Versatile, customizable, user friendly and no specific tool required.

- No specialized labor force necessary with a ready-to-use solution.
- Very flexible conductor with no bending radius to follow.
- Achieve virtually any layout and overcome any imperfections that may be found on site.
- No cable tray necessary to support Flexible busbar.

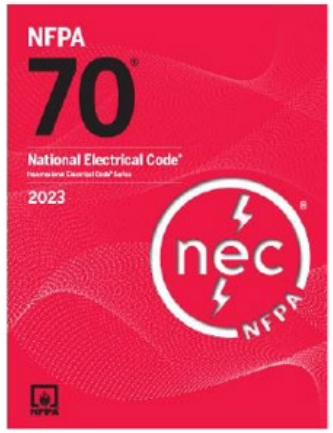
Installation Examples



Installation Photos

Applicable UL Standards – Update

- UL Outlines of Investigation (standards) are complete:
- UL 1386 = Flexible Bus Systems – required for UL Listing of the entire system (conductor, tray support, bracing, terminations, etc.)
- UL 1387 = Flexible Insulated Bus – required for UL Listing of the Flexible Bus conductor
- At this stage suppliers are working on getting UL Listing



- The NEC2023 now contains chapter relating to Flexible Bus Systems, Article 371