

Business Case: Electrical Distribution Systems

Support to Safety Retrofits and Environmental Upgrades in the Bangladeshi Ready-Made Garment (RMG) Sector

It is worth to upgrade your Electrical Distribution Systems.

According to the Bangladesh Fire Service and Civil Defence Department (BFSCD), around 75% of the fires in RMG sector in Bangladesh are electrical in nature¹, with electrical short circuits being the main cause of fires in the RMG sector. Ensuring electrical safety in a factory is therefore crucial to avoid associated fire hazard. However, interviews with key stakeholders in the industry, including BGMEA, indicate that a large share of the RMG factories in Bangladesh still need to carry out electrical remediation works.

Advantages of Electrical Distribution Systems at a Glance:

- Avoid hazard and financial loss
- Ensure safe working conditions at the factory
- Enhanced fire performance of retrofitted systems with minimised service interruptions
- Option to renegotiate insurance premium

After a series of fire triggered industrial disasters in Bangladesh, ILO conducted inspections across the sector to identify possible causes and develop strategies to avoid such incidents in the future. The findings of ILO show that an average of 59 non-compliance issues were identified per factory, with a majority (51%) being related to insufficient electrical safety measures. The most common issues are insufficient cabling and wiring works followed by earthing systems.

By implementing robust and safe electrical systems, a factory can not only reduce fire hazards but also avoid power outages and machine downtimes, ultimately increasing the overall productivity. Additionally, a sound electrical system assures compliance with all relevant local and international standards allowing better business with international buyers.

Necessary activities to retrofit the electrical distribution system usually include measures such as earthing, sealing cable penetrations with fire and water-resistant elements or insulating exposed cables. These measures tend to be the quick and easy to implement and – when compared to structural and fire issues—usually

do not require large investments. The costs are therefore mostly driven by installation or services rather than equipment costs.

Depending on the factory size and the number of electrical safety issues, the cost per factory can approximately range from BDT 9 lakh to BDT 2 crore¹.

The following pages provide detailed information about the cost and benefits of retrofitting the electrical distribution system, followed by a case study example on page 3. Technical details on the installation and implementation process as well as legal requirements and possible means of financing are given on pages 4 to 5.

Hazard-free and Safe Working Environment

Retrofitting the electrical distribution system will not only ensure a safe working environment, but it will also result in better system performance and minimised service interruptions. Further details are provided in the table below:

Improved Performance:

Avoiding fatal incidents, reduced fire hazard and property damage	There is a high probability of electrical short circuits turning into massive fire incidents taking lives and causing property loss. By fixing electrical issues, chances of fire can be reduced which in turn will result in fewer casualties and injuries, reducing compensation payments and medical costs and avoiding the damage to goods, properties and equipment.
Enhanced Performance	The upgradation power systems may include upgrading quality of breakers, surge protections and control technologies which result in an increases functionality whilst improving reliability and safety.
Minimised service interruptions	Improving the electrical distribution system within a factory significantly reduces the risks of electrical short circuits and subsequent power outages, therefore minimizing service interruptions and machine downtimes.
Increased Equipment Lifespan and Reduced maintenance cost	Upgraded electrical systems need less maintenance and have longer expected lifespan.

¹ILO (2016) Remediation Financing in Bangladesh's Ready Made Garment Sector

Other Benefits

Better goodwill with international buyers	International buyers prefer suppliers who not only meet the legal requirements of the country but also their own expectations. Factories with safe working conditions and ones following safety norms ensure better business with international buyers.
Enhanced reputation towards own employees and local community	Implementing electrical safety standards within the local community might significantly increase factories' reputation and standing as well as attractiveness as an employer, making it easier to find skilled workers and reduce employee turn-over rates.
Improved aesthetics	Cluttered electric cables are replaced which improves the aesthetic view.
Reduced noise emissions	Properly designed grounding can reduce unpleasant humming noise caused by outdated or old electrical systems, reducing the overall noise level within the factory.

As per international practice, insurance underwriters may take into account the reduced risks resulting from fixing the electrical safety issues in a factory i.e. by following electrical safety norms. In the international context, depending on the design of the system and the areas to be protected, the discounts can range from 5% to upto45%. High discount rates are usually only available when the factory has also installed features such as sprinkler protection, regular monitoring, installation of fire extinguishers and deadbolt locks. Such insurance savings might also depend on the fire resistance and occupancy risk level of the building.

In Bangladesh, initial discussions looking into the possibility of similar reduced insurance premium for adequately protected (low risk) buildings are already taking place with the representatives from the Insurance Association. In case such approach is accepted, retrofitting the electrical distribution systems might be helpful to renegotiate insurance premiums in the future and realise corresponding savings.



Sewing Floor of Pioneer Apparel Ltd.

Calculating the Cost of Upgrading the Electrical Distribution System

The cost of retrofitting the electrical distribution system depends on factors such as the building size, type and construction. Experiences from Bangladesh show that the average cost per factory can range from BDT 9 lakh to BDT 2 crore. The following table provides an overview of possible investments. The cost of electric component inputs (cables, switches, etc.) are relatively low when sourced locally. Payments for installation and testing of equipment by professional electrical engineers and technicians account for a major part of the expected expenditures.

Possible Investments⁴:

Name	Unit	Rate(BDT)
Updated SLD matching existing installation at factory	m ²	100
Substation illumination	each	20,000
Rubber mats	each	2,500
Modify generator room to meet requirements	m ²	21,500
Distribution boards	each	20,000
Individual fuse protection	each	250
Switchboards made of non-flammable materials	each	25,000
Provide cable connections with properly soldered/welded lugs at DB's	each	1,000
Conductors and MCCB/MCB adequate sizing without exceeding permissible current carrying capacity for insulation	each	10,000
Use individual circuit and over current device for every incoming and outgoing circuit at the distribution boards	each DB	15,000
Provide circuit diagram/circuit list with proper current ratings and fuse size	each	1,000
Seal cable penetrations through walls with fire resistive elements.	each	5,000
Replace all flexible cables/wires with fixed wiring	per meter	980
Seal cable entry-exit points of DB's with non-flammable materials.	each	6,000
Generator earthing/grounding	each	30,000
DBs and doors earthing/grounding	each	16,000
Planned periodical inspection and testing	Lot	225,000
Silica gel refill	m ²	21,500
Provide and maintain clear and legible identifications numbers on all incoming and outgoing circuits of HT and LT panel.	per DB	300
Caution Boards at DBs	per DB	300
Vertical shaft of 200 x 400 mm for every 1500sq.m. of floor area, (For buildings > 20m high)	m ²	4800
Provide proper height of panel board (< 2m from floor level).	each board	5,000
Circuit Breakers	each	1,000
Neutral	m ²	3,200

Case Study Spotlight: Pioneer Apparels Ltd, Dhaka, Bangladesh

Description of the Factory

Pioneer Apparels Ltd is an export-oriented garment factory in Dhaka with 16 production lines and combined production capacity of 450,000 pieces per month. 2,400 employees are working in the facility, which spreads over 13470m². Cutting, Sewing, Ironing and packing are the main processes of the facility.

Implemented Measures

In order to improve electrical system safety throughout the facility, Pioneer Industries has retrofitted all relevant system components to comply with international good practice as well as Bangladesh building standards. Following measures have been implemented so far:

- Single Line diagrams (SLD) have been designed for each floor separately.
- When sub-contracting electrical installations and purchasing electrical cables, fire retardant cables have been selected as a first priority. Cable support tracks and trays have been installed when applicable.
- Resistive carpets provided at every main distribution panel board (MDB) to prevent static electric charges and electric shocks. Most of main panel boards are protected with transparent covers to prevent direct contact with current carrying bus bars.
- All electricians have been provided with electrical grade personal protecting safety equipment and were trained regarding proper health and safety practices.
- The electrical system is annually inspected by qualified electrical engineers/ inspector. The electrical engineer of the facility and the electrical supervisors are fully trained on all relevant safety aspects.
- Internal inspections and system maintenance for the Electrical system are conducted on a weekly basis. Further details are given in the table on maintenance.
- An IR (infra-red) thermography inspection is conducted on an annual basis to check for hotspots in the distribution panels and cables.

The electrical system upgradation has been carried out according to Electricity Licence Board requirements in Bangladesh and Accord has certified that the system is compliant with international standards and requirements.

Maintenance Schedule

Day	System maintenance
Monday	Load Inspection
Tuesday	Exhaust fan system
Wednesday	IPS
Thursday	Boiler & thermal system
Friday	Balance system
Saturday	Air Conditioning
Sunday	Generator

Challenges during Implementation

The main challenge faced during the implementation was undertaking the retrofitting work without interrupting the production. As the internal team undertook the various installations it was able to spread the work over a longer period of time with a flexible implementation plan.

Investments and Savings

The upgradation of the electrical distribution systems was undertaken over a longer period of time with no specific hardware installation other than the investment for various system components. The upgradation work was undertaken by the internal maintenance staff during their daily duties. Therefore, the company has no specific data available on the total investment needed for the retrofitting works.

However, the Pioneer Apparel Ltd. is fully convinced that the upgradation works undertaken are paying off since eliminating electrical safety hazards significantly reduced the risk electrical fire as well as damage to property and people.

Key Performance Measures

Factory fires caused by failures in the electrical distribution system are very common in Bangladesh. Through retrofitting the electrical distribution system Pioneer Apparel Ltd. has eliminated major sources of fire hazards such as heated panels and cables, damaged insulation, overloaded electrical distribution lines etc. and thereby significantly reduced the probability of outbreaks.



Electrical works on circuit breaker with safety

References for the Upgradation of Electrical Distribution Systems in Bangladesh

In accordance with international good practices and the Bangladesh National Building Code (BNCB), all new and existing buildings and structures in Bangladesh shall fulfill the following requirements regarding electrical wiring and cabling:

- For existing buildings, a Single Line Diagram (SLD) shall be maintained and continuously updated to reflect as built conditions. The SLD shall show a correct power distribution path from the incoming power source to switchgear, switchboards, panel boards, MCCs, fuses, circuit breakers, automatic transfer switches, and continuous current ratings.
- Separate branch circuits shall be provided for the installation, which need to be separately controlled. These branches should not be affected by failure of other branch circuits. The number of final circuits required and the points supplied by any final circuits shall
 - the requirement of over current protection
 - the requirement for isolation and switching
 - the selection of cables and conductors
- Separate branch circuits shall be provided from miniature circuit-breaker (MCB) or fuse distribution boards (FDB) for general lighting automatic and fixed appliances with a load of 500 watt or more and plug receptacles. Each automatic or fixed appliance shall be served by an individual circuit.
- The size of the wire to be used in a branch circuit shall be at least one size larger than that computed from the loading if the distance from the over current protective device to the first outlet is over 15m.
- The use of common neutral for more than one circuit shall not be permitted.
- Circuits with more than one outlet shall not be loaded in excess of 50% of their current carrying capacity
- Connections between conductors and between conductors and other equipment shall provide durable electrical continuity and adequate mechanical strength and protection
- Surface/exposed wiring shall be run either horizontally or vertically, and never at an angle. Battens on ceiling shall run parallel to the edges in either orthogonal direction, or not at an angle.
- In case of concealed wiring, the wires shall be encased in metallic (GI) or non-metallic (PVC) conduits that are buried in roof or floor concrete and in brick/concrete wall. The conduits in the walls shall run horizontally or vertically, and not at an angle. Conduits in concrete slabs shall be placed at the centre of thickness and supported during casting by mortar blocks or 'chairs' made of steel bars or any other approved means. All conduits shall be continuous throughout their lengths
- Wiring for the connections to the machines shall be carried in steel pipes or cable tray hung from the ceiling or in concrete or steel cable tray running over the floor

For further requirements regarding the electrical distribution system it is recommended to refer to Chapter 8, Section 10 of the BNCB.



LT Panel & MDB (Main Distribution Board) Panel

Key Steps Required for Implementation

As per the experience, the implementation of complete electrical distribution systems will approximately take 2 months to install (including planning and design).

For the successful implementation of an electrical distribution system, one should consider the following steps:

- Sealing cable penetrations with fire- and water-resistant elements
- Replacing group wiring of cables with individual circuits, replacing flexible cables with fixed, soldering, crimping
- Insulating exposed cables
- Ensuring that all panels are provided with proper and separate earth connections, providing each generator with an earth connection, digging earth pits, as well as other activities.

For further details, refer to "Remediation Financing in Bangladesh's Ready-Made Garment Sector" by ILO and IFC.



Transformer & HT Panel

Availability of Materials in Bangladesh

While the majority of required materials can be sourced via local traders, certain components need to be still imported. You may contact Pioneer Apparels Ltd, Dhaka, Bangladesh for their recommendation.

Nature of Services Required to Support the Implementation

- Consultancy service for electrical risk assessment
- Engineering/electrical system design
- Installation services for wiring, cabling, electrical equipment and accessories
- Maintenance services

Sources of technical support/expertise used

- Accord (2014). Building Standard
- BNCB (1993) Part 8, Chapter 2: Electrical Installations
- ILO (2016). Remediation Financing In Bangladesh's Ready Made Garment Sector



MCCB (Molded Case Circuit Breaker) with CT for MDB

Possible Sources for Financing

SREUP credit line could be a good source of financing for such an investment.

Main Feature of SREUP Credit Line	
Loan Type	Normally Term Loan
Discount	Provision and possibility of 20% discount from loaned amount
Loan Tenure	3-5 years in general and in special case up to 7 years
Loan Limit	Normally up to 1 Million Euro and can be increased up to 3 Million Euro in special cases
Interest Rate	7% p.a. (maximum)
Grace period. Debt: Equity Ratio. Repayment	All issues are subject to agreement between borrower and lender

Conclusion

Some relevant equipments of electrical distribution system are shown here :



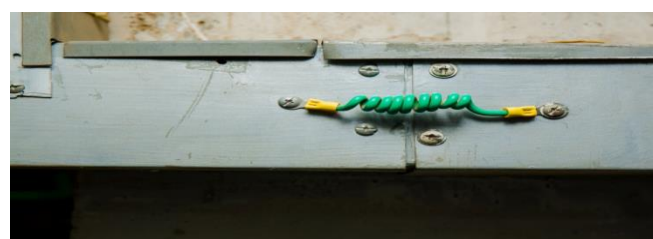
MDB & Automatic Charger / AVR Panel



MDB, Mini DB & Havel DB



Diesel Generator Set



Body Earth