

Business Case: Installation of Lightning Protection Systems

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

Why a Lightning Protection System is a Good Investment

Lightning strikes the earth more than 100 times each second, totalling 8 million times every day. If lightning strikes are not properly controlled or absorbed they can result in injuries, fires, degradation and destruction of machinery and assets, causing severe damage to industrial and business facilities. In the U.S. alone, lightning fires cause property damages of in average USD 108 million (about BDT 900 crore) every year¹ and according to a study from the University of Berkeley (2014), lightning strikes are expected to increase by 12 per cent for every degree Celsius of warming, with a 50 per cent rise in lightning expected by the end of the century.

As Bangladesh is a region classified by the NASA to have intense lightning activity², protecting staff and property from possible lightning incidents is of paramount importance for local RMG factories.

Advantages of a lightning protection system at a glance:

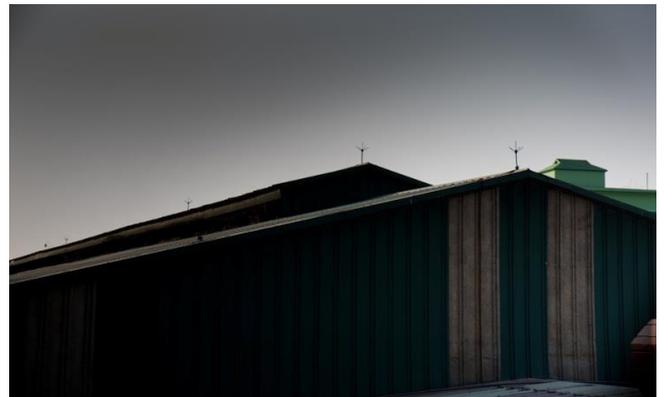
- Reduced asset damages in the event of a lightning strike
- Reduced Down-Time costs
- Reductions in insurance premiums can be negotiated
- Reduced risk of fines and withholding of license to operate

To reduce the risk of accidents, high costs and extensive damage associated with lightning incidents, it is recommended to invest in appropriate Lightning Protection Systems (LPS) which intercept the lightning discharge and safely conduct the lightning currents to the ground thereby minimizing the effects on the building.

Most commonly this is done by a combination of air termination networks, down conductors and earth terminations. Other options include the installation of faraday cages or early streamer emission-enhanced ionizing air terminals.

A cost benefit comparison for installing lightning protection systems shows that the expected direct and indirect benefits usually outweigh the projected implementation costs of the system, leading to an amortisation period of the investment that is estimated to be between 3 to 10 years.

On the next page, you can find detailed information about the cost and benefits of installing a lightning protection system, followed by real-life data from a case study example on page 3. For technical details on the installation and implementation process as well as legal requirements and possible means of financing, refer to page 4.



Air terminals on the factory rooftop of Devine Textile Ltd.



Conducting cable and air terminal at Divine Textile Ltd.

¹<https://www.iii.org/fact-statistic/facts-statistics-lightning>

² <https://geology.com/articles/lightning-map.shtml>

Protect Your Buildings, Lower your Costs

The installation of a lightning protection systems (LPS) does not only protect buildings and saves lives, but provides a range of additional direct and indirect benefits to the company

Direct Benefits

Reduced risk of fines and withholding of license to operate	The installation of lightning protection systems is required by Bangladesh National Building Code well as several other organisations (see section on legal requirements). Non-compliance with the defined requirements will/can lead to the termination of all business activities with the respective supplier's factories. Installations and retrofits in the area of building safety which go beyond the current requirements will most likely forestall future tightening of the electrical- and building safety laws, enabling companies to reduce the need for future retrofits.
Better standing with international buyers	International buyers prefer suppliers which meet not only the legal requirements of the country but also their own expectations. Lower fire risks in the factory imply lower business risks for international buyers.

Indirect Benefits

Reduced Asset Damages	During 2007-2011, U.S. local fire departments responded to an estimated average of 22,600 fires per year that were started by lightning. These fires caused an average of nine civilian deaths, 53 civilian injuries, and USD 451 million (around BDT 3762 crores) in direct property damage per year, not yet including asset damages from power surges and factory downtimes ³ . Installing a complete lightning protection system in a factory reduces the risk of lightning related fires, protecting the assets from fire, heat and smoke damage.
Reduced downtime costs	Critical system outages caused by lightning strikes can potentially cause significant losses due to unplanned production downtimes. Installing a LPS significantly reduces this risk.
Reduced risks of fatalities and injuries to staff/workers	Lightning impulses travel through ground. They may enter the body through one limb and exit via another, causing injuries like burns and paralysis. Injuries and death can even result from telephone usage while lightning. Apart from the risk of direct strikes on the factory premises, fires as a consequence of lightning strikes may also lead to injuries and even fatalities.

In addition to the benefits mentioned above, international insurance practices show that lightning protection systems are generally recognized as "protection for the entire external perimeter of the building" and as such insurance underwriters will usually offer reduced premium for protected buildings. In the international context, depending on the design of the system and the areas to be protected, the discounts can range from 5% to upto 45%⁴. High discount rates are usually only available when LPS are combined with features like sprinkler protection, smoke detection, monitoring of the systems, installation of fire extinguishers and

³Ahrens, Marty (2013). Lightning Fires and Lightning Strikes

⁴ Data based on: City of Scottsdale (1997), Automatic sprinklers - a 10 Year study

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, the installation of a LPS might be helpful to renegotiate insurance premiums in the future and realise corresponding savings.

Calculating the cost of a Lightning Protection System

The cost of a complete Lightning Protection System (LPS) depends on many factors, such as the building height, the type of LPS and the area which has to be covered. Based on experiences from the Bangladesh textile sector, it can be estimated that the installation cost for a standard LPS is BDT 1000 per m². To determine what kind of lightning protection components are required for a building, refer to standards such as the NFPA 780.

In addition to the initial costs incurred for the installation of the LSP, annual costs for maintenance and inspection have to be taken into consideration.

Indicative average investments needed for implementing a Lightning Protection System by unit:

Type of Investment	Cost
Air Terminal	12,000 BDT/unit
Main Conductor, Cable	300 BDT/kg
Bonding Conductor, Cable	
Surge Protective Device	4,000 BDT/unit
Ground Rods/ Termination	Minor
Utility bonding clamps (for water pipes, sprinkler, & gas and/or oil pipes)	Minor
Average Total Costs	BDT 1000/m²
Estimated pay-back period	n.a.



Air terminals on the factory rooftop of Devine Textile Ltd.

Case Study Spotlight: Devine Textiles, Dhaka, Bangladesh

Description of the Factory

Divine Textile Limited. (Unit-2) is one of the 14 factories that are under the umbrella of the Divine Group. Divine Group is a vertically integrated textile company whose supply chain includes spinning, yarn dyeing, knitting, fabric dyeing, cutting, sewing, finishing as well as printing. The production capacity of the Divine Textile Limited (Unit-2) is 900,000 pieces per month. The factory spreads over 205,000 square feet and about 2,000 employees are working in the unit.

Implemented Measures

During the design phase of the lightning protection systems Divine textile used the NFPA 780 (2014) and BNBC (2006) standards as main guidance documents.

Four buildings were selected to be equipped with a LPS based on factors such as the average lightning strike rate in the Bangladesh



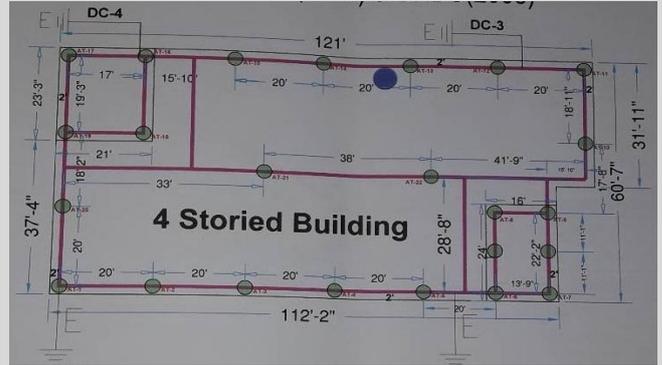
Conducting air terminal at Divine Textile Mills Ltd.

area, the building height, the height of surrounding structures, building and roof structures and the building purpose. None of the buildings exceeds a height of 34m, therefore class-I lightning protection materials were selected. The installed air terminals cover a radius of approximately 3m each. To achieve sufficient coverage the maximum distance between two terminals was kept at 6.1m. A detailed overview of the factors included in the risk assessment is given in the table below:

	4 storey Building	Dyeing Unit 2	Finishing Unit 2	Storage 6&8
Area (sq. m)	630	753	2894	
Height (m)	20.5	7	10.6	33.5
Roof	Non metal	Prefabricated	Prefabricated	Non - Metal
Risk	47	48	49	
Air terminals	23	24	57	58
Conductors /Terminals	4	4	10	9

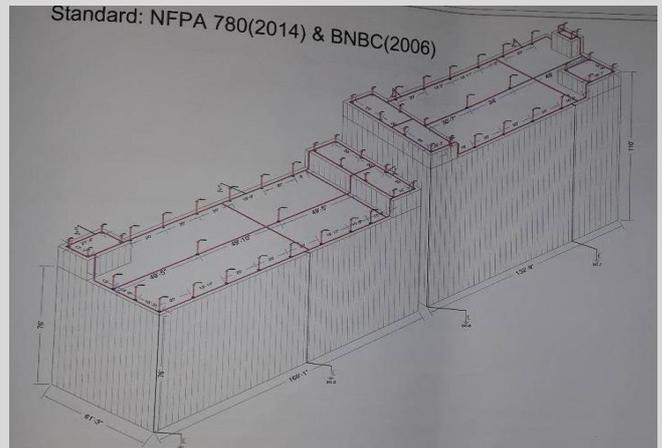
Investments and Savings

The total investment for installing lightning protection system for covering 32m radius protected area was around BDT 30 lakh.



Key Performance Measures

Divine textile has not collected and analysed disaggregated cost data on damages, making it difficult to evaluate the economic impact of reduced damages caused by lightning strikes after the retrofit.



Conducting cable for earthing which is a part of Lightning Protection system at Devine Textile

Features of a Lightning Protection System

The purpose of a lightning protection system is to protect buildings from direct lightning strikes and thus prevent fire and other damages related to lightning currents (non-igniting flash). LPS usually consist of air terminals, conductors made either of aluminium or copper and an earth termination. The system intercepts the lightning discharge and safely guides the lightning currents to the ground thereby minimizing the effects on the building. Although industrial and commercial LPS are made from similar components as LPS for residential housing, they are usually more extensive and complex, given the complexity of industrial building structures. In addition, once the buildings exceed a certain height, the required cables and components become significantly larger and heavier.

Legal and other references in Bangladesh

International standards as well as the Bangladesh National Building Code (BNBC) require all new buildings to be equipped with adequate protection against lightning based on the individual risk of the building. In this connection, an objective assessment of the risk and the possible magnitude of the consequences of lightning strikes following BNBC Part 8, section 2.9 needs to be conducted. Structures which are higher than 53 m (174 ft.) require protection in all cases. As per the BNBC, a complete lightning protection system shall consist of air termination network, down conductors and earth termination.

Air termination networks intend to intercept the lightning strike and connect it with the protection system. They consist of vertical and horizontal conductors arranged to protect the required area. No part of the roof should be more than 9m (30 ft.) from the nearest horizontal conductor.

The down conductor is the conductor which runs from the air termination to the earth termination. A building with a base area not exceeding 100 m² (1,076 ft²) shall be provided with one down conductor. For larger buildings, one down conductor for the first 100m² (1,076 sqft) and one conductor for every additional area of 300m² has to be installed. Alternatively, for a larger building one down conductor may be provided for every 30m (100 ft.) of perimeter.

The material used for lightning conductors must be aluminium or copper. The criterion for design is to keep the resistance from air termination to earth to a minimum. The earth termination is that part which discharges the current into the general mass of the earth. The total resistance of an electrode for a lightning protection system must not exceed 10 ohms.

Key Steps Required for Implementing

As per the experience, the implementation of complete lightning protection systems takes 1 - 3 weeks to install (including planning and design). For the successful implementation of a lightning protection system, one should consider the following steps:

Conduct a Lightning Risk Assessment to determine the necessary level of protection for your buildings

1. Prepare and submit the LPS design to the institution in charge of monitoring. If the installation work is done without a review of designs, the system may not be recognized.
2. Once the LPS design is approved begin with the physical installation of the necessary LPS components.
3. Monitor and maintain the LPS to ensure its effectivity at any time

Availability of materials in Bangladesh

The required materials can be sourced via local traders. You may contact Divine Textile Ltd. for their recommendation.

Nature of Services Required to Support the Implementation

- Consultancy service for lightning risk assessment
- Engineering/system design
- Installation services
- Maintenance services

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 10% 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



Conucting System for earthinging at ivine Textile Ltd.

