The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

24-Year-Old Textile Worker Electrocuted in North Carolina

FACE 85-35

Introduction:

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), is currently conducting the Fatal Accident Circumstances and Epidemiology (FACE) Project, which is focusing primarily upon selected electrical-related and confined space-related fatalities. By scientifically collecting data from a sample of fatal accidents, the FACE Project will identify and rank factors that influence the risk of fatal injuries for selected employees.

On July 23, 1985, a 24-year-old male employee of a textile mill in North Carolina was performing routine duties involved in adding a new supply roll of warp to a weaving loom, when at approximately 5:00 a.m. he contacted a loom and a feeder that was operating with an electrical fault. The employee was electrocuted.

Contacts/Activities:

On July 23, 1985, officials of the North Carolina Occupational Safety and Health Administration in cooperation with NIOSH notified DSR concerning this fatality and requested technical assistance. This case has been included in the FACE Project. The DSR research team consisted of a safety engineer, a safety specialist, and a consulting engineer. The FACE evaluation consisted of a site visit, interviews with witnesses, and an interview with the North Carolina OSHA Compliance Officer.

Overview of the Employer's Safety Function:

The facility employs approximately 850 workers and is owned by a national corporation. The personnel officer is responsible for plant safety on a collateral-duty basis. The organization employs a corporate safety officer at corporate headquarters.

Job Safety Analyses (JSA) have been developed for all tasks including the task being performed at the time of the accident. Safety is actively promoted and periodic safety meetings are conducted. A plant-wide routine preventative maintenance schedule (every 60 days) is followed. This schedule includes inspection of the loom, feeders and receptacles.

Synopsis of events:

Two employees on the third shift had completed the task of tying the leading edge of a new supply roll of warp to the trailing edge of the completed roll of cloth. The victim was moving the feeder so that he would have enough room to insert a crank onto the driving lug of the loom. (To manually advance the knots through the machine and permit weaving operations to resume, the loom is equipped with a removable crank. This crank provides power to the drive mechanism at a faster rate than the weaving speed.) The victim's co-worker detected a burning odor and saw the victim draped over the feeder. The co-worker called to a nearby technician to "kill" the power. The technician disconnected the power at the end of the loom, and the co-worker eased the victim to the floor. Fellow employees attempted unsuccessfully to revive him. (Although a medical facility employing two registered nurses exists on the premises, neither were on duty at this time.) The victim was transported by ambulance to a local hospital where he was pronounced dead by a staff physician.

The feeder power is supplied from a receptacle located on the end of the loom adjacent to the feeder. The power source is three-phase, 550 VAC, 6OHz and provides power to the feeder through a four-prong "twistlock" plug and receptacle. The installation of the receptacle was a modification by the employer to permit changing feeders in the event of feeder problems. This design eliminated the need for an electrician to disconnect the "hard wiring." The facility electrician found the receptacle broken, upon inspection after the incident. The receptacle apparently was broken when undue force was applied to the plug and receptacle. The electrician related that he removed the plug from the receptacle, but did not notice the relative position of the plug to the receptacle. Prior to removal of the plug, he measured a voltage greater than 300 volts between the feeder and the loom.

Evidence indicates that the plug was inserted in the receptacle with the ground prong turned 90 degrees clockwise from the ground terminal. This is not possible with a receptacle that is complete and intact; however, because the melamine insulator was cracked, sufficient space was available for the tang on the ground prong to enter the x terminal of the receptacle. (The x, y, and z terminals are the three-phases, 550 VAC power and the ground terminal is the system ground.) When the plug is rotated 90 degrees the ground prong on the plug becomes energized. The frame of the feeder is then energized with a 550 volt potential. The feeder is electrically isolated, because it is mounted on rubber wheels; however, the victim established a path to ground when he contacted the grounded loom frame. The control cabinet on the feeder contained a stepdown transformer to reduce the three-phase, 550 VAC power to 64 VAC and the transformer was connected in a delta configuration. With the plug rotated 90 degrees the transformer had two phases and a ground terminal connected. Electrically it is feasible for the system to operate, but at some reduced efficiency.

Recommendations/Discussion:

Recommendation #1: The employer should install a strain relief grip on all feeder power cables and replace all melamine receptacles with industrial rated nylon receptacles.

Discussion: The strain relief grip is so designed to eliminate any possible stress on the electrical connection when undue forces are applied. Nylon receptacles can better tolerate the strain and abuse at contact than the existing melamine units.

Recommendation #2: The employer should mechanically bond the feeders to the looms by use of flexible bonding straps.

Discussion: Mechanical bonding straps will eliminate dependence upon the electrical ground conductor in the power cable for grounding protection.

Recommendation #3: Employees should be trained to recognize the hazards of electrical energy. Scheduled safety meetings and safety orientation for now employees could be used to provide this training.

Discussion: The employees interviewed did not appear to have adequate knowledge of electrical hazards. Training should include proper plug removal methods and the identification and reporting of electrical hazards.

Recommendation #4: The employer should instruct and require the employees to disconnect the power to the feeder using the toggle switch located next to the receptacle on the loom before removing the plug. Energizing and de-energizing tasks should be addressed in existing job safety analysis.

Discussion: The employer modified the electrical system to the feeder with the addition of a toggle switch and receptacle. However, the employees usually do not make use of the switch to de-energize the feeder when it is necessary to remove the plug. This safety hazard should be included in the existing job safety analysis.

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