EAF Transformer Fall Protection

Hazards are ever-present in the steel plant environment, and a heightened awareness and emphasis on safety is a necessary priority for our industry. This monthly column, coordinated by members of the AIST Safety & Health Technology Committee, focuses on procedures and practices to promote a safe working environment for everyone.

Author

Garrett Page
safety coordinator,
Steel Dynamics Inc. — Flat Roll Group Butler,
Ft. Wayne, Ind., USA

Contact

Comments are welcome. If you have questions about this topic or other safety issues, please contact safetyfirst@aist.org. Please include your full name, company name, mailing address and email in all correspondence.

Fall protection has been a cardinal rule at Steel Dynamics Inc. (SDI) since its founding in 1995. In 2011, SDI recognized the need to improve its fall protection program. Initially, supervisors and engineers were trained to the American National Standards Institute (ANSI) Z359 Fall Protection Code's Competent Person level. The training gave supervisors and engineers the knowledge needed to properly assess fall hazards in their work areas and eliminate those hazards through engineering controls or selecting the needed fall protection equipment. Supervisors and engineers who completed the training started identifying areas beyond the site requirement for fall protection (4 feet) where engineering controls were needed to properly eliminate the fall hazard. During the evaluation, each area was assessed first and foremost for ways to eliminate the fall hazard through engineering controls; this approach helps to eliminate the need for an employee to wear a harness and other appropriate fall protection equipment. If an engineering control is not feasible, a harness and lanyard must be worn to prevent the employee from hitting the ground in the event of a fall. SDI has worked to eliminate areas where employees were traditionally required to wear a harness and lanyard. Each area has been documented to ensure proper installation of an engineered platform, handrail or anchorage point.

One area identified as a potential fall hazard by SDI was the electric arc furnace (EAF) transformer. Due to the design of the transformer, performing routine maintenance often required employees to access the top of transformer. Access to the transformer is required on down days and during outages to perform maintenance and cleaning activities. A fall hazard existed on top of the transformer and on the extension ladder used to access the top of the transformer. There were a few openings on top of the transformer that allowed the ladder to extend 2 feet beyond the top of the transformer, and many areas within the transformer vault did not allow for the ladder to be used at the proper 75° angle. It was difficult for employees accessing the transformer to transition from the ladder to a fall protection anchor point. Once on top of the transformer, employees would often anchor to the buss tube support framework or lifting eyes on the transformer itself and needed to be cautious to not damage components such as insulators, pipes or driveshafts of the transformer while moving about. These transformer components were also a trip hazard for anyone working on top of the transformer.

The hazards of accessing the EAF transformer were easily identified, but eliminating or reducing these hazards without impacting the operation of the transformer was difficult. Installing a permanent engineered platform around the EAF transformer helped to solve the many challenges employees faced while accessing and working around the transformer. With voltages inside the transformer vault reaching 75,000 volts, bolting traditional fall protection or any type of equipment or conductive platform was not an option. Implementing a non-conductive

Figure 1

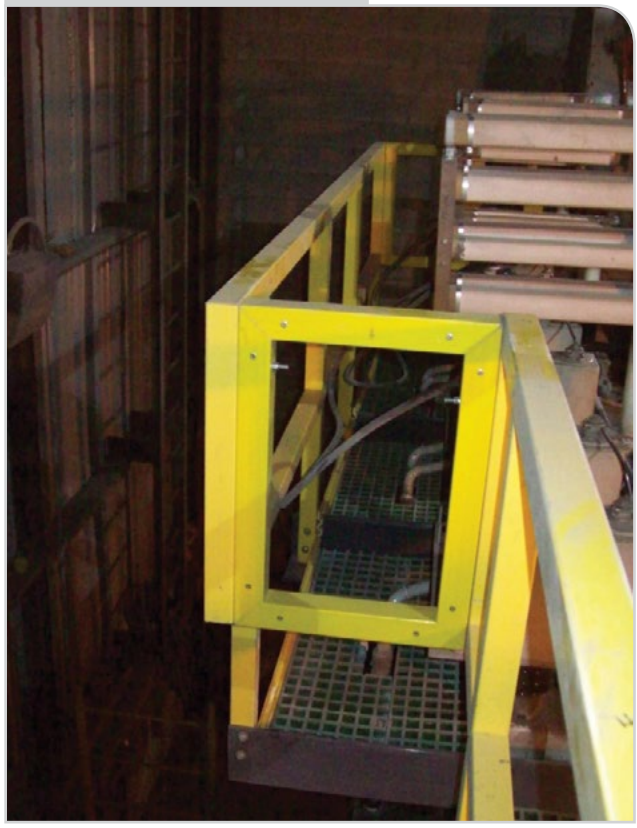
The fiber-reinforced polyester (FRP) platform installed on Steel Dynamics Inc.'s EAF transformer allows safe access to all sides and reduces potential trip hazards.

engineering fix allowed employees to safely access the EAF transformer and not interfere with the operations of the transformer. To do this, a platform was engineered by Ultra Fiberglass Systems, a structural fiberglass manufacturer based in Milwaukee, Wis., USA. (Visit the Appendix in the online version of this month's *Iron & Steel Technology* to view a technical drawing of the platform designed by Ultra Fiberglass Systems.) The platform was fabricated from fiber-reinforced polyester (FRP). FRP structural composites consist of a fiberglass-reinforced polyester or vinyl ester matrix, an approximately 50% resin-to-fiberglass ratio. The synthetic surface veil would be the outermost layer of the exterior surfaces. The synthetic surfacing veil was used to create protection against corrosion, abrasion and weathering. Adding a polyester surface veil would ensure superior impact strength. Continuous glass strand roving would be used internally for transverse strength.

A fixed ladder was designed to access the platform, which eliminated the need to set an extension ladder to access the platform. The ladder, designed and fabricated from the same FRP material as the platform, was positioned away from the top of the transformer, allowing the employees to safely transition from the fixed ladder to the platform. Another feature of the ladder was the slip-resistant coating on the rungs.

The platform provided safe access to all four sides of the transformer for maintenance purposes. Prior to the installation of the platform, employees had to step over and through the components on top of the transformer. The new platform allows employees to walk around to the other side of the platform without any obstructions or trip hazards (Figure 1). The platform also provides an area for employees to position themselves for work instead of standing on top of the components of the transformer. On one side of the transformer, a 20.5-inch-wide x 243.875-inch-long fiberglass platform was installed between the transformer and a concrete wall so the maintenance crew could work around the transformer without stepping on top of existing conduit or piping. A 22-inch-wide x 139-inch-tall, heavy-duty ladder was installed for ease of access to the top of the transformer, and a two-rail handrail system protected any maintenance personnel from falling off the platform. The handrail was designed to meet all safety requirements, with a 3-inch toe plate, 21-inch mid-rail and 42-inch top rail. The handrail was attached utilizing existing bolts on top of the transformer (Figure 2). With this design, modifications were not made to the transformer. Ultra Fiberglass Systems supplied a 6-inch x 6-inch x 0.5-inch equal leg angle, which was drilled out to fit over the existing bolts on top of the transformer. The angle was then bolted down and the fiberglass handrail system was bolted to the side of the angle. Mounting the handrail did not require welding or drilling, which made for an easy installation and did not void any operational integrity or warranty of the transformer. The second platform, measuring 37.25 inches

Figure 2



The handrails of the FRP platform were bolted onto the existing architecture of the transformer, avoiding unnecessary modifications.

wide x 79.125 inches long x 139 inches tall, was supplied with a 24-inch x 24-inch hatch in the middle so the maintenance crew could move parts up to the top of the transformer with ease. This platform is self-supported and does not need to be bolted to the side of the transformer.

Two key advantages of utilizing FRP structures are safety and ease of handling. These fiberglass structures are non-conductive and easily installed in difficult areas, as they are lightweight and do not require heavy equipment or cranes for installation. Fiberglass requires less maintenance, as the pigment is embedded in the pultruded material. The supplied components came pre-fabricated to size using field shop drawings, which made the handrail, heavy-duty ladder and platform very easy to install.

Installing the permanent engineered platform around the EAF transformer helped to solve many challenges that employees faced while accessing and working around the transformer. With the new platform installed, employees performing maintenance around the transformer now have a fixed ladder with a clear area to safely transition to the transformer to perform work. The addition of the transformer platform has also provided SDI employees with the needed space to stage tools and equipment for maintenance work. The addition of access platforms as an engineered fall solution will continue to be an ongoing process for Steel Dynamics and the Butler Flat Roll facility.

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