CLOSER LOOK: System Isolation Equipment

In large and often complex machines, repeated operation of disconnecting means for maintenance or servicing is inherent to the process, and the risk of injury to personnel is increased due to moving parts and multiple points of entry. This risk drives development of system isolation equipment (SIE). Safety procedures for personnel servicing this equipment include detailed lockout/tagout protocols for all sources of mechanical and electrical energy.

SIE helps simplify electrical lockout/tagout procedures; it can also be used to isolate energy sources such as pneumatic energy. In accordance with its definition in Article 100, system isolation equipment is "a redundantly monitored, remotely operated contactor-isolating system, packaged to provide the disconnection/isolation function." This type of equipment is covered in NFPA 79, Electrical Standard for Industrial Machinery, as a way to disconnect and isolate separately operable parts of a large industrial machine. With its inclusion in 430.109(A)(7) as a permitted type of disconnecting means, the NEC recognizes the use of this disconnection/isolation system in applications that do not fall within the scope of the industrial machinery standard.

In a typical configuration, the contactor is located within the system power and control panel and may control power to the entire machine or to portions of a large machine. The control equipment may be provided in several configuration options for distributing to lockout stations in single or multiplexed radial schemes according to the application.

Once an electrically safe condition is achieved (including discharge of any residual energy), verification of such condition is provided at the remote lockout station using an indicator light.

protection and its disconnecting means. The disconnecting means shall be one of the types permitted by 430.109(A)(1) through (A)(3).

Unlike other disconnecting means recognized by 430.109(A) where the operation of the disconnecting means directly opens the supply circuit at that specific location, system isolation equipment (SIE) employs a lockable control circuit switch(es) (lockout switch) and a verification indication at the disconnecting means location (lockout station). Also, operation of the lockout switch causes power components such as a monitored magnetic contactor to open and isolate the electrical equipment associated with the machine from its power supply circuit. The SIE is classified according to its intended application with parameters that include the load characteristics, the method used to monitor the controlled load-side power circuit, the number and maximum distance to the farthest lockout station, and the available control interface functions.

(B) Stationary Motors of 1/8 Horsepower or Less. For stationary motors of 1/8 hp or less, the branch-circuit overcurrent device shall be permitted to serve as the disconnecting means.

In equipment that uses lockable guarding, the same verification signal could also be used as part of the guard access system.

In contrast to a simple start/stop station and control circuit operating a magnetic contactor, the control panel for this system provides a sophisticated level of monitoring upon actuation of the remote lockout switch. If any portion of the safety system cannot be verified for proper operation, the safe condition indicator light will not illuminate at the remote lockout station. As part of the standard operating procedure, the failure to receive the safe condition signal must be considered as an indication of an unsafe condition.

Among the critical safety elements that are provided by the control panel for the isolation system are the diversity and redundancy that are integrated into the safe condition verification logic. Another element is the electrical isolation of the internal safety-related control circuits and the physical isolation of the equipment's internal components, which reduces the possibility of externally induced failure modes. The control panel modules are sealed, as are the circuits between the SIE component enclosures, to discourage tampering that could compromise the safe operation of the equipment and endanger personnel. Where the system includes multiple lockout stations, the controlled equipment cannot be re-energized until all the lockout switches are returned to the "on" position. Nominal configurations of the SIE include provisions to prevent power from unexpectedly reaching the machine upon the restoration of power from the utility source. To re-energize the machine, all lockout switches must be in the closed, or on, position while at least one lockout switch must have been in the open, or off, position or placed in the open, or off, position (and then moved to the closed, or on, position after the utility power had been restored).

- **(C) Stationary Motors of 2 Horsepower or Less.** For stationary motors rated at 2 hp or less and 300 volts or less, the disconnecting means shall be permitted to be one of the following devices:
 - (1) A general-use switch having an ampere rating not less than twice the full-load current rating of the motor
 - (2) On ac circuits, a general-use snap switch suitable only for use on ac (not general-use ac-dc snap switches) where the motor full-load current rating is not more than 80 percent of the ampere rating of the switch
 - (3) A listed manual motor controller having a horsepower rating not less than the rating of the motor and marked "Suitable as Motor Disconnect"
- **(D) Autotransformer-Type Controlled Motors.** For motors of over 2 hp up to and including 100 hp, the separate disconnecting means required for a motor with an autotransformer-type motor controller shall be permitted to be a general-use switch where all of the following provisions are met: