Machine Guarding

The Expert Approach

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MACHINE GUARDING

INTRODUCTION

This guide provides the basic information necessary to investigate and evaluate incidents concerning an individual who may have incurred injury by coming in contact with a machine part. Engineering safety principles to prevent such contact are outlined and a basic listing of hazard types and types of guarding is provided along with recommended documents and information which should be obtained through the discovery process.

PRINCIPLES OF SAFE ENGINEERING DESIGN AND PRACTICE

The basic principles for reducing exposure to workplace injuries, commonly known as the "hierarchy of safeguarding," have been recognized and published by the National Safety Council for many years. Briefly stated, these principles are to first, eliminate a hazard from the design, if a hazard cannot be reasonably eliminated, control the hazard by enclosing it or guarding it at its source, and finally, if a hazard exists, train and warn workers of the presence of the hazard.

The practical steps needed to achieve this goal of safe machinery are:

- Elimination or mitigation of potential hazards through the use of alternate designs
- Identification of potential hazards
- If an unavoidable hazard exists in the final design, it must be warned against
- If the necessary function of a machine involves an unavoidable hazard, guarding should be provided
- Machine operators should be thoroughly trained in safe operation
- Safe work practices must be developed and maintained for safe operation
- The equipment must be periodically inspected and maintained

COMMON HAZARD TYPES

In most cases a hazard will fall into one of the following common categories:

- Abrasive surfaces
- Cutting edges
- Hot surfaces
- Nip points
- Potential projectiles

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GUARDING TYPES

The presence of certain hazards is integral to the function of certain types of equipment and cannot be totally eliminated, e.g. boilers are hot and conveyor belts have roller and nip points. Where the basic function of the equipment requires the presence of a hazard, it must be guarded against. Such guarding can take the form of distance, shielding and controls.

If it is practical, the hazard should be located at a distance from the workers.

If distance is not practical, physical barriers should be in place to prevent contact with the hazard.

If the hazard involves powered equipment, electronic sensors, redundant controls and control interlocks can be employed to prevent a worker from exposure to the hazard.

Lockout/Tagout provisions are employed to protect maintenance workers from energized equipment.

Emergency shut off provision are provided should a worker become endangered.

TRAINING, SIGNAGE, AND WARNINGS

The operation of virtually all equipment requires an informed and qualified operator. With a self service elevator the information and training are minimal, with a complex industrial machine the training and information are much more involved and critical. Some form of employee or operator training is necessary in the form of formal instruction, on-the-job-training, supervisor mentoring, etc. The method of operating the equipment should be clearly laid out; ideally in a written procedure. The equipment should be well marked to identify controls and important components and, most importantly, the presence, nature, and location of hazards.

INCIDENT INVESTIGATION

Obviously the first step in investigation is determination of how the accident actually happened. The circumstances can only be obtained from witnesses or sometimes surveillance tapes. Who was there? Where were they? What were thy doing? What was the machine doing? Was the machine acting normally? Were they trained on the equipment?

It is essential to determine the configuration of the equipment, as it was designed, as it was installed and as it existed at the time of the incident. The original configuration must be determined from the manufacturers' design information, which could include specifications, drawings and purchase orders. Aided the descriptions of the incident, the actual configuration is best determined by inspection making use of photography and physical measurements.

MACHINE EVALUATION

The machine configuration and function must be evaluated against the principals of safe design and guarding. What hazards exist? Are they necessary for the function of the machine? Are the properly guarded against? Are they properly marked and warned against? Is the equipment consistent with the design information? Where any changes or modifications made by the owner or user? Was there any damage to the machine? Had the equipment been operating correctly and properly maintained? Is there evidence of operator training?

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DISCOVERY

How did it happen? The circumstances of an accident are often contained in employer accident reports or OSHA reports.

Who was involved? Industrial equipment is often quite complex and involves many parties to produce the final installation including the manufacturer, his sub-suppliers, the distributors, the installer and the owner. An incident may involve a component provided by a sub-supplier or a maintenance contractor could have altered the equipment.

What was the machine supposed to look like? It is necessary to have design information for a machine to determine how it was supposed to work and how it was supposed to look. This information is contained in design drawings, specifications, owners' manuals, maintenance manuals, purchase orders, etc.

How was the machine used and did it change? Maintenance logs, operators' logs, operator procedures, quality control programs, safety policy, training materials and training records all provide useful information concerning the circumstanced leading to the accident.

CODES AND STANDARDS

Virtually all types of industrial equipment can be related to the larger industry by standards. Often an industry group, such as the American Society of Mechanical Engineers (ASME) or American National Standards Institute (ANSI) will provide codes and standards to establish minimum levels of design and performance. These are often voluntary standards but they are always useful in comparing equipment conditions to the common practice. Some times these standards are formal requirements enforced by government regulation, such as OSHA, BOCA, and State Department of Labor & Industry.

Under the topic of machine guarding, OSHA provides the following requirements in 29CFR 1310.212(a)(2): "Types of guarding. One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are-barrier guards, two-hand tripping devices, electronic safety devices, etc."

Other commonly used resources include the National Safety Council, Underwriters Laboratories, the Canadian Standards Association.

ENGINEERING ASSISTANCE

Often the experience and training of an engineer are needed navigate the complexity of machinery and the technical issues involved in design, manufacture and operation of industrial equipment. An engineer with suitable industry and forensic experience can assess the equipment and the various technical and design data to provide a report which refines the pertinent issues and simplifies them for presentation to the courts.