

6 SAFEGUARDING

ANSWERS—QUIZ 1

1. b
2. b
3. a
4. c
5. d
6. c
7. A nip point or bite is a hazardous area created by two or more mechanical parts rotating in opposite directions within the same plane and in close interaction.
8. An effective interlocking must:
 - guard the hazardous area before the machine can be operated,
 - stay closed until the rotating equipment is at rest, and
 - prevent operation of the machine if the interlocking device fails.
9. The point of operation where work is being done and the points where power or motion is being transmitted from one part of a mechanical linkage to another are the two general areas where rotating, reciprocating, and transverse motions create hazards.
10. Electro-mechanical, hydraulic, and pneumatic are the three means of power for robots.
11. Most makeshift safeguards offer little protection against mechanical or human failure. Yet they may give operators a false sense of security and thus may be more harmful than no safeguards at all. To make up for their inadequacy, operators must be constantly alert, which can make the job unnecessarily stressful and fatiguing.
12. The principal hazards in using robots include:
 - being struck by the moving parts of a robot while within the robot's operating envelope or movement zone
 - entrapment between a robot's moving parts and other machinery or objects within or near the robot's movement zone
 - being struck by objects or tools the robot has dropped or ejected

ANSWERS—QUIZ 2

1. a
2. b
3. a
4. a
5. a
6. b
7. Safeguarding is any means of preventing personnel from coming in contact with the moving parts of machinery or equipment that would potentially cause physical harm.
8. Examples of types of action and motion requiring protection include rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and impacting or shearing parts.
9. Actions or motions involving the most hazardous exposures may be classified as follows:
 - rotating, reciprocating, and transverse motion
 - inrunning nip points
 - cutting actions
 - punching, shearing, and bending actions
10. Robots are used in a variety of applications and processes, including:
 - spray painting
 - arc and spot welding
 - materials handling
 - assembly
 - machine loading and unloading
11. Built-in safeguards conform more closely to the contours of the machine, thus making them superior in appearance and placement. Built-in safeguards eliminate hazards completely and permanently while withstanding daily wear and handling. Built-in safeguards also tend to cost less than safeguards installed after a machine has been purchased because the cost is usually spread over a large number of machines.
12. The lack of durability and strength, relatively high maintenance cost, and flammability of wood guards are objectionable. Wood guards, especially when they become oil-soaked, can be ignited by nearby welding operations, overheated bearings, rubbing belts,

defective wiring, and other sources of heat. Wood is also subject to splintering that can contaminate products or cause injury.

ANSWERS—CASE STUDY

1. Safe operation of machinery involves more than eliminating or covering hazardous moving parts. The overall injury potential of the machine operation must be considered. Is there a materials-handling hazard? Are the limitations of a person's manual effort (lifting, pushing, and pulling) recognized? Is the design of existing or proposed safeguards based on physiological factors and human dimensions?
2. Provide and arrange machines and equipment so that the operator does a minimum amount of strenuous lifting and traveling. Use conveyors, skids, jacks, or other equipment to feed raw stock.
3. The position and design of machine controls, such as dials, push buttons, and levers, are important. Speed and on/off controls, in particular, should be readily accessible. In addition, controls should be standardized on similar machines so that operators can shift from one machine to another, as necessary, with having to use different controls.