CONSTRUCTION SAFETY

The Code of Federal Regulations (CFR)

This is a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. The Code is divided into 50 titles which represent broad areas subject to Federal regulation. Each title is divided into chapters which usually bear the name of the issuing agency. Each chapter is further subdivided into parts covering specific regulatory areas. Based on this breakdown, the Occupational Safety and Health Administration is designated Title 29-Labor, and Chapter XVII is set aside for the Occupational Safety and Health Administration. Each volume of the Code is revised at least once each calendar year and issued on a quarterly basis. OSHA's regulations (Title 29) are therefore issued as of July 1. The approximate revision date is printed on the cover of each volume.

The Code of Federal Regulations is kept up to date by the individual issues of the *Federal Register*. These two publications (the CFR and the *Federal Register*) must be used together to determine the latest version of any given rule. To determine whether there have been any amendments since the revision date of the Code volume in which the user is interested, the following two lists must be consulted: the "Cumulative List of CFR Sections Affected" which is issued monthly and the "Cumulative List of Parts Affected" which appears daily in the *Federal Register*. These two lists refer the reader to the *Federal Register* page where the latest amendment of any given rule can be found. The pages in the *Federal Register* are numbered sequentially from January 1 to January 1 of the next year.

The Title 29, Chapter XVII, the regulations are further broken down into Parts. For example, Part 1926, is titled *Construction Safety Standards*. Some Parts are considered general because they apply to any employer in any industry. Other General Parts that are applicable to Construction are *Part 1903 titled OSHA Inspections*, *Part 1904 titled OSHA Record Keeping*, specific portions of *Part 1910 titled General Industry* such as fire protection is pertinent to construction, and the General Duty clause under Section 5(a) (1) are additional regulations that the contractor must comply with according to the Occupational Safety and Health Administration.

OSHA Paragraph Numbering

The paragraph numbering for the *Code of Federal Regulations and the Federal Register* is shown below. We will use this citation number to describe each portion of the citation.

29 CFR 1926.950(c)(1)(iii)

From this example, the first number 29 is the Title 29 for Labor. The second abbreviation is CFR which is the abbreviation for Code of Federal Regulations. The third number is the Part number which is 1926 the Construction Safety Standards. Next you see a period. Following the period is an arabic number which is the Section Number. This Section Number is also related to a Subpart

Letter and a Subpart Name. These subpart letters are used to organize the OSHA Compliance officers Field Manual developed by the OSHA Training Institute (OTI). The OTI has taken the major blocks of information in Part 1926 and broken them into subparts and categorized them as A - Z. The OTI Compliance Officers Field Manual contains compliance (CPL) directives. Also, it contains formal interpretations of an OSHA regulation using acronym STD for the standards. In this example the Subpart V is titled, Power Transmission and Distribution case, and under the Section .950 it is titled, General Requirements. Continuing the citation numbering system for Subpart V is titled, Power Transmission and Distribution case, and under the Section .950 which is titled, General Requirements.

29 CFR 1926.950(c)(1)(iii)

After the 1926.950, the next breakdown is by paragraphs. As you can see, the first tier of paragraphs beneath the Section level will be numbered in parentheses using lowercase alphabetical such as (a), (b), (c), (d), etc. as will all further designations, so that if you only had three major paragraphs of information under a section, they would be numbered .950(a), .950(b), and .950(c).

Using Section Number **.950 General Requirements**, Complete the Descriptions for each Paragraph Number is 1926.950 (a) is titled Application, 1926.950 (b) is titled, Initial inspections, tests, or determinations, 1926.950 (c) is titled, Clearances and 1926.950 (d) is titled, De-energizing line and equipment.

The second tier of paragraphs beneath the section level will be numbered in parentheses using arabic numbers. As an illustration, if there were three paragraphs of information between subheadings (c) and (d), they would be numbered (c)(1), (c)(2), and (c)(3). In the Example, 1926.950(c)(1) states that “No employee shall be permitted to approach or take any conductive object without an approved insulating handle close to exposed energized parts than shown in Table V-1, unless”:

(iii) reads “The Employee is isolated, insulated, or guarded from any other conductive object(s), as during live-line bare-hand work.” Also, 1926.950(c)(2) reads, The minimum working distances and minimum clear hot stick distances shall not be violated.

The third tier of paragraphs beneath the section level will be numbered in parentheses using lowercase roman numeral. An example would be between paragraphs (1) and (2). If there were five paragraphs of information pertaining too arabic (1) they would be numbered (1)(i), (1)(ii), (1)(iii), (1)(iv), and (1)(v). Finally, OSHA maintains a record of the most frequently cited Serious Violations. For example, the serious violations in Subpart V - Power and Transmission Distribution for a given year were 1926.950 (c)(1) Minimum Clearances for Working Near energized parts were violated, and 1926.950 (c)(1)(I) Employees was not insulated.

OSHA Recordkeeping

According to the Occupational Safety and Health Administration (OSHA) Title 29 CFR PART 1904 - Recording and Reporting Occupational Injuries and Illnesses and according to Section number 1904.15 it states that "Employers who had no more than ten (10) employees at any time during the calendar year immediately preceding the current calendar year need not comply with any of the requirements of this part except the following."

(a) Obligation to report fatality or multiple hospitalization (3 or more employees, a catastrophe) incidents within 8 hours from a work-related incident; and

(b) Obligation to maintain a log of occupational injuries and illnesses and to complete an Occupational Injuries and Illnesses Survey requested in writing from the Bureau of Labor Statistics.

The regulation also states that an employer with eleven or more employees must maintain the following OSHA records.

1. *OSHA's Log of Work-Related Injuries and Illnesses* (OSHA's Form 300). This Log may be maintained at an alternate location if updates are sent to the specific job site within 6 days of any recordable or within 45 days of the previous update.

2. *OSHA's Injury and Illness Incident Report* (OSHA's Form 301). This record describes how the accident or illness exposure occurred, lists the objects or substances involved, and indicated the nature of the injury or illness and the part(s) of the body affected.

3. *OSHA's Summary of Work-Related Injuries and Illnesses* (OSHA's Form 300A). Each employer must post a copy of the company's summary in a location visible to all employees. The summary will cover the previous calendar year and it shall be posted no later than February 1, and shall remain in place until March 1 each year.

OSHA has also established some rules to determine if a case is recordable or non recordable. Therefore, you must inquire about the following.

1. Determine whether a case occurred; that is, whether there was a death, illness, or injury;
2. Establish that the case was work related; that it resulted from an event or exposure in the work environment;
3. Decide whether the case is an injury or an illness; and
4. If the case is an illness, record it and check the appropriate illness category on the log; or
5. If the case is an injury, decide if it is recordable based on a finding of medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job.

The first step in the decision making process is the determination of whether or not an injury or illness has occurred. Employers have nothing to record unless an employee has experienced a work-related injury or illness. In most instances, recognition of these injuries and illnesses is a fairly simple matter. However, two situations have troubled employers over the years. They are described below.

1. Hospitalization for observation. If an employee goes to or is sent to a hospital for a brief period of time for observation, it is not recordable, provided no medical treatment was given, or no illness was recognized. The determining factor is not that the employee went to the hospital, but whether the incident is recordable as a work-related illness or as an injury requiring medical treatment or involving loss of consciousness, restriction of work or motion, or transfer to another job.

2. Differentiating a new case from the recurrence of a previous injury or illness. Employers are required to make new entries on their OSHA forms for each new recordable injury or illness. However, recurrence of symptoms from previous case(s) is not recordable, and it is sometimes difficult to decide whether or not a situation is a new case or a recurrence. The guidelines below describe recurring injuries and illnesses and whether they are recordable.

   For instance, if a previous injury is aggravated, it almost always results from some new incident involving the employee such as a slip, a trip, a fall, or a sharp twist, etc. Consequently, when work related, these new incidents should be recorded as new cases.

   Another incident is an Illness. Generally, each occupational illness should be recorded with a separate entry. However, certain illnesses, such as silicosis, may have prolonged effects which recur over time. The recurrence of these symptoms should not be recorded as new cases on the OSHA forms. The recurrence of symptoms of previous illnesses may require adjustment of entries on the log for previously recorded illnesses to reflect possible changes of the particular case. Some occupational illnesses, such as dermatitis or respiratory conditions, may recur as the result of new exposures to sensitizing agents, and should be recorded as new cases.

A case is work related if it meets the following criteria. If an Injury or an illness results from an event or exposure in the employer's work areas of the premises, these are considered work related. Situations where the work area would not apply include the following. First, (1) When a worker is on the premises as a member of the general public and (2) when employees have symptoms that surface on the employer's premises, but is a result of a non work-related event. Also, the work premises excludes all employers controlled ball fields, tennis courts and other similar recreational facilities which are used by employees on voluntary basis for their own benefit. Finally, company parking lots are excluded as work premises.

Under the OSHA Record keeping regulations, all work-related illnesses must be recorded, while injuries are recordable only when they require medical treatment (other than first aid), or involve loss of consciousness, restriction of work or motion, or transfer to another job. The distinction between injuries and illnesses, therefore, has significant record keeping implications.

Whether a case involves an injury or illness is determined by the nature of the original event or exposure which caused the case, not by the resulting condition of the affected employee. Injuries are caused by instantaneous events in the work environment. Cases resulting from anything other than instantaneous events are considered illnesses. This concept of illnesses includes acute illnesses which result from exposures of relatively short duration.

Some conditions may be classified as either an injury or an illness (but not both), depending upon the nature of the event that produced the condition. For example, a loss of hearing resulting from an explosion (an instantaneous event) is classified as an injury; the same condition arising from exposure to industrial noise over a period of time would be classified as an occupational illness.

The OSHA record keeping regulations state that employers are required to record the occurrence of all occupational illnesses, which are defined in the instructions of the log and summary as:

> Any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion, or direct contact.

The instructions also refer to recording illnesses which were"diagnosed or recognized." Illness exposures ultimately result in conditions of a chemical, physical, biological, or psychological nature. Occupational illnesses must be diagnosed to be recordable. However, they do not necessarily have to be diagnosed by a physician or other medical personnel.

A Recordable Work-related Injury under the OSHA regulations requires that all work-related deaths and illnesses be recorded, It also requires the recording of nonfactual injuries, but it is limited to certain specific types of cases such as those which require medical treatment; or involve the loss of consciousness; or a restriction of work or motion; or transfer to another job. Also, any minor injury which requires only first aid treatment is not recordable. The OSHA regulations also distinguish between medical treatment and first aid treatment since many work-related injuries are recordable only because medical treatment was given.

The regulations and the instructions on the back of the OSHA Log and Summary defines medical treatment as any treatment, other than first aid treatment, administered to injured employees. Essentially, medical treatment involves the provision of medical or surgical care for injuries that are not minor through the application of procedures or systematic therapeutic measures.

The regulations also specifically state that work-related injuries which involve only first aid treatment should not be recorded. First aid is commonly thought to mean emergency treatment of injuries before regular medical care is available. However, first aid treatment has a different meaning for OSHA record keeping purposes. The regulations define first aid treatment as:

> ...any one-time treatment, and any follow-up visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care. Such one-time treatment, and follow-up visit for the purpose of observation, are considered first aid even though provided by a physician or registered professional personnel.

The distinction between medical treatment and first aid depends not only on the treatment provided, but also on the severity of the injury being treated. First aid is: (1) Limited to one-time treatment and subsequent observation; and (2) involves treatment of only minor injuries, not emergency treatment of serious injuries. Injuries are not minor if:

a. They must be treated only by a physician or licensed medical personnel;
b. They impair bodily function (i.e., normal use of senses, limbs, etc.);
c. They result in damage to the physical structure of a non superficial nature (e.g., fractures); or
d. They involve complications requiring follow-up medical treatment.

Physicians or registered medical professionals, working under the standing orders of a physician, routinely treat minor injuries, such treatment may constitute first aid. Also, some visits to a doctor do not involve treatment at all. For example, a visit to a doctor for an examination or other diagnostic procedure to determine whether the employee has an injury does not constitute medical treatment. Conversely, medical treatment can be provided to employees by lay person; i.e., someone other than a physician or registered medical personnel. The following procedures provide a guide for determining whether the injury is classified as medical treatment or first aid treatment.

Recordable Work-Related Medical Treatment

The following are generally considered medical treatment. These are Work-related injuries for which this type of treatment was provided or should have been provided. Medical Treatment cases are almost always recordable. The following items are considered medical treatment cases.

*Treatment of INFECTION

*Application of ANTISEPTICS during second or subsequent visit to medical personnel

*Treatment of SECOND OR THIRD DEGREE BURN(S)

*Application of SUTURES (stitches)

*Application of BUTTERFLY ADHESIVE DRESSINGS(S) OR STERI STRIP(S) in lieu of sutures

*Removal of FOREIGN BODIES EMBEDDED IN EYE

*Removal of FOREIGN BODIES FROM WOUND; if procedure is complicated because of depth of embedment, size, or location

*Use of PRESCRIPTION MEDICATIONS (except a single dose administered on first visit for minor injury or discomfort)

*Use of hot or cold SOAKING THERAPY during second or subsequent visit to medical personnel

*Application of hot or cold COMPRESS(ES) during second or subsequent visit to medical personnel

*CUTTING AWAY DEAD SKIN (surgical debridgement)

*Application of HEAT THERAPY during second or subsequent visit to medical personnel

*Use of WHIRLPOOL BATH THERAPY during second or subsequent visit to medical personnel

*POSITIVE X-RAY DIAGNOSIS(fractures, broken bones, etc.)

*ADMISSION TO A HOSPITAL or equivalent medical facility for treatment

Non-recordable Work-Related First Aid Treatment

The following are generally considered first aid treatment (e.g., one-time treatment and subsequent observation of minor injuries) and should not be recorded if the work-related injury does not involve loss of consciousness, restriction of work or motion, or transfer to another job:

*Application of ANTISEPTICS during first visit to medical personnel

*Treatment of FIRST DEGREE BURN(S)

*Application of BANDAGE(S) during any visit to medical personnel

*Use of ELASTIC BANDAGES(S)during first visit to medical personnel

*Removal of FOREIGN BODIES NOT EMBEDDED IN EYE if only irrigation is required

*Removal of FOREIGN BODIES FROM WOUND; if procedure is UNCOMPLICATED,

*SOAKING THERAPY on initial visit or removal of bandages by SOAKING

*Application of hot or cold COMPRESS(ES) during first visit to medical personnel

*Application of OINTMENTS to abrasions to prevent drying or cracking

*Application of HEAT THERAPY during first visit too medical

*Use of WHIRLPOOL BATH THERAPY during first visit to medical personnel
*NEGATIVE X-RAY DIAGNOSIS

*OBSERVATION of injury during visit to medical personnel.

The following procedure, by itself, is not considered medical treatment:
*Administration of TETANUS SHOT(S) or BOOSTER(S).

Other Nonfatal Criteria to Determine if an Injury is Recordable

Other nonfatal criteria utilized for determining if an injury is recordable or not are described below. First, if an employee loses consciousness as the result of a work-related injury, the case must be recorded no matter what type of treatment was provided. The rationale behind this recording requirement is that loss of consciousness is generally associated with the more serious injuries.

Second, is a restriction of work or motion. Restricted work activity occurs when the employee, because of the impact of a job-related injury, is physically or mentally unable to perform all or any part of his or her normal assignment during all or any part of the workday or shift. The emphasis is on the employee's ability to perform normal job duties. Restriction of work or motion may result in either a lost work time injury or a non-lost-work time injury, depending upon whether the restriction extended beyond the day of injury.

Third, is a transfer to another job. Injuries requiring transfer of the employee to another job are also considered serious enough to be recordable regardless of the type of treatment provided. Transfers are seldom the sole criterions for recordability because injury cases are almost always recordable on other grounds, primarily medical treatment or restriction of work or motion.

Once the employer decides that a recordable injury or illness has occurred, the case must be evaluated to determine its extent or outcome. There are three categories of *recordable cases*: They are fatalities, lost workday cases, and cases without lost workdays. Every recordable case must be placed in only one of these categories. A description of each category is provided below.

First, are Fatalities. All *Work-related Fatalities* must be recorded, regardless of the time between the injury and the death, or the length of the illness. Second, are *Lost Workday Cases*. These occur when the injured or ill employee experiences either days away from work, days of restricted work activity, or both. In these situations, the injured or ill employee is affected to such an extent that: (1) Days must be taken off from the job for medical treatment or recuperation; or (2) the employee is unable to perform his or her normal job duties over a normal work shift, even though the employee may be able to continue working.

Lost workday cases involving days away from work are cases resulting in days the employee would have worked but could not because of the job-related injury or illness. The focus of these cases is on the employee's inability, because of injury or illness, to be present in the work environment during their normal work shift. Lost workday cases involving days of restricted work activity are those cases where, because of injury or illness, (1) the employee was assigned to another job on a temporary basis, or (2) the employee worked at a permanent job less than full time, or (3) the employee worked at his or her permanently assigned job but could not perform all the duties normally connected with it. Restricted work activity occurs when the employee, because of the job-related injury or illness, is physically or mentally unable to perform all or any part of his or her normal job duties over all or any part of his or her normal workday or shift. The emphasis is on the employee's inability to perform normal job duties over a normal work shift. Injuries and illnesses are not considered lost workday cases unless they affect the employee beyond the day of injury or onset of the illness. When counting the number of days away from work or days of restricted work activity, do not include the initial day of the injury or onset of illness, or any days on which the employee would not have worked such as holidays, vacations, etc.

Third, is *Cases Not Resulting in Death or Lost Workdays*. These cases consist of the relatively less serious injuries and illnesses which satisfy the criteria for recordability but which do not result in death or require the affected employee to have days away from work or days of restricted work activity beyond the date of injury or onset of illness.

OSHA Record Keeping Exercise

Each multiple choice question in this examination will be followed by four choices for an answer. Only one of these four choices is the correct answer. Please circle the correct answer.

1. What is the correct name for the acronym OSHA mean?

- ☐ A. Office of Safety and Health Administration.
- ☐ B. Occupational Safety and Health Association.
- ☐ C. Organizational Safety and Health Affiliation.
- ☐ D. Occupational Safety and Health Administration.

2. What is the purpose of the OSHA law?

- ☐ A. Protect companies from safety violations.
- ☐ B. Prohibit safety violations against individuals.
- ☐ C. Provide a place of employment free from safety hazards.
- ☐ D. Prohibit safety violations against individuals with disabilities.

3. The Safety Standards utilize the abbreviation 29 CFR Part 1926, What does the acronym CFR stand for?

- ☐ A. Code of Federal Register.
- ☐ B. Code of Federal Regulations.
- ☐ C. Construction Federal Register.
- ☐ D. Construction Federal Regulations.

4. Which document is utilized to keep the CFR up to date?

- ☐ A. Federal Register.
- ☐ B. Federal Regulations.
- ☐ C. Federal Compliance Standards.
- ☐ D. Federal Safety and Health Violations.

5. Which Part of the OSHA Standards is designated for Recordkeeping?

- ☐ A. 5(a)(1)
- ☐ B. 1904
- ☐ C. 1910
- ☐ D. 1926

OSHA Record Keeping Exercise

6. Which Part of the OSHA Standards is designated for Inspections?

- ☐ A. 5(a)(1)
- ☐ B. 1903
- ☐ C. 1910
- ☐ D. 1926

7. Which Part of the OSHA Standards is designated for General Industry?

- ☐ A. 1903
- ☐ B. 1904
- ☐ C. 1910
- ☐ D. 1926

8. What does the safety acronym CPL stand for?

- ☐ A. Compliance.
- ☐ B. Code Personnel.
- ☐ C. Competent Personnel.
- ☐ D. Construction Personnel.

9. What does the safety acronym STD stand for?

- ☐ A. Standard.
- ☐ B. Short Term Directive.
- ☐ C. Safety Training Directive.
- ☐ D. Safety Training and Development.

10. What is the purpose of an STD?

- ☐ A. To provide a formal interpretation of an OSHA Regulation.
- ☐ B. To provide advice about an OSHA Regulation.
- ☐ C. To protect companies from safety violations.
- ☐ D. To prohibit companies from safety violations.

OSHA Record Keeping Exercise

11. What does the safety acronym MSDS stand for?

- ☐ A. Master Safety Data Sheet.
- ☐ B. Material Safety Data Sheet.
- ☐ C. Material Standard Data Sheet.
- ☐ D. Management Safety Designated Standard.

12 Which of the following activities is considered a Work related recordable?

- ☐ A. A worker employed by you, is on the premises to visit and gets injured.
- ☐ B. You get ill from the fumes while working in a certain area of the project.
- ☐ C. You are playing Racquetball at the employer owned courts on your break with another employee and you are injured.
- ☐ D. You are coming to work and you get injured in the parking lot as you exit the car.

13. Which of the following is considered a Work related recordable?

- ☐ A. Employee loses consciousness.
- ☐ B. Treatment of first degree burn(s).
- ☐ C. Application of bandage(s) during any visit to medical personnel.
- ☐ D. Application of Antiseptics during first visit to medical personnel.

14. Which of the following is considered a Work related recordable?

- ☐ A. Removal of foreign bodies embedded in the eye.
- ☐ B. Removal of foreign bodies not embedded in the eye.
- ☐ C. Removal of foreign bodies from uncomplicated wound.
- ☐ D. Application of hot or cold compress(es) during first visit to medical personnel.

15. Which of the following is described in STD 3-1.1 of an accident prevention program?

- ☐ A. A log of all previous safety violations for the company.
- ☐ B. Written job safety analysis that must be available for OSHA inspector.
- ☐ C. Guidelines for the minimum elements of an accident prevention program.
- ☐ D. Evaluation of their accident program by a Certified Safety Professional (CSP).

OSHA Record Keeping Exercise

16. Which of the following is true of the OSHA training regulations?

- ☐ A. Employer must train all employees annually.
- ☐ B. Employer must maintain a record of training with date, time, and subject.
- ☐ C. Employer must train all employees regularly in safety recognition and avoidance.
- ☐ D. Employer must have an OSHA Approved Certified Trainer to teach employees.

17. According to OSHA, which document must be filled out immediately after an accident by the supervisor describing the accident in detail?

- ☐ A. Insurance forms.
- ☐ B. OSHA's Summary of Work-Related Injuries and Illnesses (OSHA's 300A)
- ☐ C. OSHA's Log of Work-Related Injuries and Illnesses (OSHA's Form 300)
- ☐ D. OSHA's Injury and Illness Incident Report (OSHA's Form 301).

18 According to OSHA, which information must be posted at the job site and easily accessible to all employees at all times?

- ☐ A. Company Safety Policy, OSHA Common Violations, Injury Log.
- ☐ B. Variance Approval, Rights and Responsibilities Form, Citations.
- ☐ C. Worker Compensation rules, Compliance Sheet, Supplemental Record of Injury.
- ☐ D. Job Safety/ Health Regulations, Material Safety Data Sheet Notice, Emergency #.

19. When and Where must the OSHA Summary (OSHA 300A) be posted?

- ☐ A. All year long and easily accessible to all employees at the job site.
- ☐ B. All year long and in the Project Manager's office in the main office.
- ☐ C. February 1 - April 1 and accessible to all employees at the jobsite.
- ☐ D. February 1 - April 1 and in the office employees break room in the main office.

20. The OSHA Act states that "each employer shall furnish too each employee a place of employment which is free from recognized hazards that are causing or likely to cause death or serious physical harm to an employee." Which section is this stated in?

- ☐ A. 5(a)(1)
- ☐ B. 1910.10 (a)
- ☐ C. 1926.10(a)
- ☐ D. 1903.10 (a)

OSHA Inspection Process

Under Section 5(a) (1) of the General Duty Clause it states that, "Each employer (and its representatives) shall furnish to each of its employees, employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to an employee."

What elements are necessary to prove a violation under the general duty clause?
According to OSHA for a violation to exist under the General Duty Clause, the compliance officer must prove that the following four elements existed.

1. The employer failed to keep the workplace free of a hazard to which employees of that employer were exposed.

2. The hazard was recognized.

3. The hazard was causing or was likely to cause death or serious harm.

4. There was a feasible and useful method to correct the hazard.

Element 1 - A Hazard to which Employees Were Exposed:
A general duty violation must involve both a serious hazard and exposure to employees. A hazard is a danger which threatens physical harm to employees. It is not the lack of a particular abatement method nor a particular accident.

The hazard was reasonably foreseeable.
The hazard must affect the cited employer's employees.

Element 2 - The Hazard Must Be Recognized:
Recognition of a hazard can be established on the basis of industry recognition, employer recognition, or "common sense" recognition.

Element 3 - The Hazard Was Likely to Cause Death or Serious Physical Harm:
This element of a Section 5(a)(1) violation is similar to the substantial probability element of a serious violation under Section 17(k) of the Act (P.L. 91-596).

Element 4 - The Hazard Must Be Corrected by a Feasible and Useful Method.
To establish a violation under 5 (a) (1), a method which is feasible, available and likely to correct the hazard must be identified. The information must indicate that a recognized hazard, rather than a particular accident, is preventable.

OSHA Inspection Priorities
OSHA has established a system of inspection priorities based upon the following criteria:

Imminent Danger situations are given top priority. An imminent danger is any condition where there is reasonable certainty that a danger exists that can be expected to cause death or serious physical harm immediately or before the danger can be eliminated through normal enforcement procedures. If an imminent danger situation is found, the compliance officer will ask the employer to voluntarily abate the hazard and to remove endangered employees from exposure.

The second priority for an inspection is a *Fatal Accident or a Catastrophe* resulting in the hospitalization of three or more employees. The third inspection priority is *Formal Employee Complaints* of alleged violations of standards or of unsafe or unhealthful working conditions. The fourth inspection priority is *Programmed Inspections* which are aimed at specific high hazard industries. Industries are selected for inspection on the basis of factors such as the injury incidence rates, previous citation history, employee exposure to toxic substances, or random selection. The fifth inspection category is *Follow-up Inspections* to determine if previously cited violations have been corrected. If an employer has failed to abate a violation, the compliance officer informs the employer that they are subject to a "Failure to Abate" citation for the alleged violations and proposed additional daily penalties while such failure to abate or violation continues.

The OSHA regulation also identifies the *Safety Notices or Postings* that must be posted at the job site. You must have the following posters visible to all employees at the job site**.**

1. A safety poster titled "Safety and Health Protection on the Job."
2. An MSDS poster indicating the location of all Material Safety Data Sheets.
3. An Emergency Information poster. This poster provides the local phone numbers for Fire, Police, Ambulance, Hospital.

Also, the OSHA Officers' compliance manual describes the Job site Safety Inspection process that the Safety Compliance officer will follow when they arrive at the job site. First, they will determine who is in charge or the person that is designated as the safety site representative. Then the Safety Compliance Officer will present their credential. Finally, the Safety officer will conduct an opening conference and they will explain the purpose of the visit and describe the inspection is based on an immediate danger, fatal accident, employee complaint, programmed inspection, or follow-up inspection. They will ask the Supervisor if the employees have a representative. If there is not an authorized employee representative, then the compliance officer must consult with a reasonable member of employees about Safety and Health at the job site.

Next, they will ask the supervisor if there were any recordable injuries of their workers on that job site for the current year. Also, they will ask the Supervisor if there were 11 or more workers on the job site at any time during the past calendar year. If 11 or more employees, they will ask to see the OSHA No. 300 Form titled, Log and Summary of Occupational Injuries and Illnesses and OSHA No. 301 Form titled Supplemental Record of Occupational Injuries and Illnesses. Finally, they will verify the location of the safety poster and that it is prominently displayed on the site.

Another step in the safety officer's inspection is they will conduct a walk through inspection of the job site. The OSHA compliance officer will conduct an inspection of the work place with the supervisor and the employees' representative (if required). The route and duration of the inspection are determined by the compliance officer while talking with employees, and the compliance officer makes every effort to minimize any work interruptions. The compliance officer observes safety and health conditions and practices; consults with employees privately, and if necessary; they can take photographs and instrument readings; examine records, collect air samples, measures noise levels, and survey existing engineering controls; and monitor employee exposure to toxic fumes, gases, and dusts. Employees are consulted during the inspection tour. The compliance officer may stop and question workers, in private, about safety and health conditions and practices in their workplaces. Each employee is protected under the Act from discrimination by the employer for exercising his or her safety and health rights.

Finally, the safety compliance officer will conduct a closing conference. At the conclusion of an inspection, the compliance officer also will give the employer a copy of *Employer Rights and Responsibilities*. If necessary, the supervisor and the employees' representative have the right to separate closing conferences.

Also, at the closing conference the compliance officer discusses with the employer all unsafe or unhealthful conditions observed during the inspection and indicates all apparent violations for which a citation may be issued or recommended. It should be understood that the actual citations issued and the notices of the proposed penalties will be sent to the employer by certified mail.

The purpose of *Citations* is to inform the employer and employees of the regulations and standards alleged to have been violated and of the proposed length of time set for their abatement. The employer must post a copy of each citation at or near the place of violation for 3 working days or until the violation is abated, whichever is longer.

There are four factors that OSHA will use to determine if a violation exists. They are the: 1) Type of Hazard, 2) Type of Exposure, 3) Type of Violation and, 4) the Severity Factor. OSHA has three definitions of *Types of Hazards*. First, a Recognized Hazard is a hazard that requires common knowledge or general recognition in construction. Second, a Detectable Hazard is a hazard that is recognizable by means of the senses and by means of generally known and accepted tests for its existence.

Third, is a Serious physical harm hazard which is any hazard that may cause Serious Permanent or prolonged impairment of the body or could inhibit an internal bodily system as to shorten life.

OSHA classifies *Exposure*, when conducting an inspection or investigation, as the number of employees that are exposed to a particular hazard. This exposure is one of the factors that determines the cost of the penalty. OSHA views exposure in three different manners. First, is the *Past Exposure* that could be repeated may be a factor for potential exposure. Second, is the *Present Exposure* as observed by safety officer. Third, is the Potential Exposure inferred from the work patterns or the anticipated work requirements indicate a possibility of exposure.

The Types of OSHA Safety Violations
OSHA classifies the *Types of Violations* according to the following guidelines: First, the *Other-Than-Serious Violation* (OTS) which is a violation that has a direct relationship to job safety and health, but probably would not cause death or serious physical harm. A penalty of up to $7,000 for each violation is discretionary. Also, a penalty for an other-than-serious violation may be adjusted downward by as much as 95 percent depending on the employer's demonstrated efforts to comply with the regulations. This is called the good faith credit.

Second, is the *Serious Violation* (S) which is a violation where there is a substantial probability that death or serious physical harm could result and that the employer knew, or should have known, of the hazard. A mandatory penalty for a serious violation could be assessed from $1,500 to a maximum of $7,000 for each occurrence. A penalty for a serious violation may be adjusted downward, based on the employer's good faith, history of previous violations, the gravity of the alleged violation, and the size of the business.

Third, is the *Willful Violation* (W) which is a violation that the employer intentionally and knowingly commits. The employer is aware that a hazardous condition exists, knows that the condition violates a standard or other obligation of the Act, and makes no reasonable effort to eliminate it. Penalties of up to $70,000 may be proposed for each willful violation, with a minimum penalty of $5,000 for each violation.

Fourth, is the *Repeat Violation* (R) which is a violation of any standard, regulation, rule, or order where the original citation has become a final order, and upon reinspection, a substantially similar violation is found. Repeat violations can bring a fine of up to $70,000 for each such violation. You should be aware of the long-term ramifications of receiving a second safety violation citation concerning the same safety violation occurring within the company. OSHA can categorize the second violation as a wilful violation. In essence, OSHA is evaluating the company's complete history to establish the violation category. To calculate each repeat violation, the initial penalty is adjusted for the size and then multiplied by a factor of 2, 5, or 10 depending on the size of the employer.

Fifth, is the *Failure to Abate* (FA) prior violation which is defined as the failure to correct a prior violation. This may bring a civil penalty of up to $7,000 for each day that the violation continues beyond the prescribed abatement date.

Additional violations for which citations and proposed penalties may be issued as follows.

Falsifying records and reports can, upon conviction, bring a criminal fine of $10,000 or up to 6 months in jail, or both. A violation of the posting requirements may bring a civil penalty of up to $7,000. Finally, Assaulting or otherwise resisting, opposing, intimidating, or interfering with a compliance officer in the performance of their duties is a criminal offense and is subject to a fine up to $5,000 and imprisonment of up to 3 years.

OSHA has always taken the position that the penalty structure is not designed as a punishment for violations nor as a source of income. The fines are designed as an incentive toward correcting the violations voluntarily. Penalties are assessed on the basis of three factors. They are the: 1) the size of the business, 2) the seriousness of the violations and, 3) the employer's history of previous citations.

The *Gravity of the Violation* is the primary factor in determining penalty amounts. It shall be the basis for calculating the basic penalty for both serious and other violations. To determine the gravity of a violation the following two factors shall be considered. First, the *Severity* of the injury or illness which could result from the alleged violation. Second, the *Probability* that an injury or illness could occur as a result of the alleged violations. Finally, the size of the business and the history of previous violations shall be taken into account in deciding whether the gravity-based penalty shall be reduced.

The classification of the alleged violations as serious or other-than-serious, is based on the severity of the injury or illness which could result from the violation. This classification constitutes the first step in determining the gravity of the violation. The most serious type of injury or illness which is reasonably predictable as a result of the type of accident or health hazard exposure shall be assigned a *Severity Factor* in accordance with the following chart.

Injury and Illness Violations	Severity
Category I - Other-than-serious violations.	0
Category II - Injury and Illness violations *not* resulting in hospitalization or temporary, reversible illnesses requiring minor supportive treatment.	1 - 3
Category III - Injury and Illness violations resulting in hospitalization or temporary, reversible illnesses with a variable but limited period of disability.	4 - 7
Category IV - Injuries involving permanent disability or chronic, irreversible illnesses or death.	8 - 10

Categories II, III, and IV apply to serious violations.

The Supervisors Responsibilities under OSHA
The supervisor must provide, at the companies expense, personal protective equipment to employees when required by OSHA standards. If an employee requests, you must make available for them to inspect or copy any medical records that you have pertaining to that employee. Also, you must give an employee or an employee representative an opportunity to attend any meeting concerning a citation or disposition of a complaint. Third, you must permit a Compliance Officer to enter your workplace for the purpose of conducting an inspection.

During the Compliance Officer's walk, you must allow an employee representative to accompany the Compliance Officer during an inspection or investigation or allow the investigator to consult with the employees' representative and employees. Also, you cannot withhold wages or discriminate against any employee or their authorized representative for time spent participating in an inspection. After the Compliance Officer's inspection, the employer must post a copy of each citation at or near the place of violation for 3 working days or until the violation is abated, whichever is longer. Also, you must provide a copy of any citation appeal to the affected employees. Finally, you must post the notice of OSHA's decision concerning an appeal.

All supervisors must maintain accurate records of work related to illnesses and injuries. They must maintain accurate records of any employee exposure to potentially toxic substances. Also, they must provide Hazardous Communication training to all employees. Finally, before starting an activity, all employees must be trained in the proper safety procedures for the activities they are performing. Finally, if a fatality or catastrophe happens you must notify the Department of Labor within 8 hours of a fatality or, a catastrophe. A catastrophe is defined as hospitalization of three or more employees suffering injuries or illness resulting from the same incident.

Multi-employer Work Site Citations

According to OSHA Compliance Directive (CPL 2.45B CH-3), on a *Multi-employer Work site*, both construction and non-construction citations normally shall be issued to employers whose employees are exposed to hazards. This is referred to as the Exposing Contractor. Prior to issuing citations to an *Exposing Employer*, it must first be determined whether the available facts indicate that the exposing employer has a legitimate defense to the citation, as set forth below.

First, the exposing employer did not create the hazard. Second, the exposing employer did not have the authority to have the hazard corrected. Third, the exposing employer did not have the ability to correct or remove the hazard. Fourth, the exposing employer can demonstrate that the creating, the controlling and/or the correcting employers have been notified of the hazards to which their employees are exposed and that the Exposing contractor made an effort to persuade the controlling contractor to correct the hazard.

Fifth, the exposing employer has instructed their employees to recognize the hazard and informed them of how to avoid the dangers when the hazard was known or with the exercise of reasonable due diligence could have been known. This requires where feasible, that an exposing employer must have taken appropriate alternative means of protecting employees from the hazard. Also, when extreme circumstances justify it, the exposing employer shall have removed their employees from the job to avoid citation. If an exposing employer meets all the conditions in 5 above, that employer shall not be cited. If all employers on a work site with employees exposed to a hazard meet these conditions, then the citation shall be issued only to the employers who are responsible for creating the hazard and/or who are in the best position to correct the hazard. In such circumstances, the controlling employer and/or the hazard-creating employer shall be cited. Penalties for such citations shall be calculated using the exposed employees of all employers as the number of employees for probability assessment. Finally, in the case of general duty clause violations, only employers whose own employees are exposed to the violation may be cited.

Other Contractor's can be cited on a Multi-Employer Job site, but prior to issuing citations to other employers, the Inspector must prove that each employer to be cited has knowledge of the hazardous condition or could have had such knowledge with the exercise of reasonable diligence. Under these conditions the following employers normally shall be cited, whether or not their own employees are exposed. First, the employer who actually creates the hazard, the *Creating Employer* can be cited for the same hazard. Second, the employer who is responsible by contract or through actual practice for safety and health conditions on the work site. This is the employer who has the authority for ensuring that the hazardous condition is corrected can be cited. This is referred to as the *Controlling Employer*. Third, the employer who has the responsibility for actually correcting the hazard can also be cited for the same safety violation. This is referred to as the *Correcting Employer*. In conclusion each violation will be evaluated on a multi-employer and the Exposing Contractor, the Creating Contractor, the Controlling Contractor and the Correcting Contractor can all be cited for the same violation.

A Supervisor can protect their company and themselves from citations and safety liability on a multi-employer job site, if you can show that you have taken all necessary actions to protect your employees. Depending upon the circumstances, you may not be liable for serious hazards that you neither created nor controlled. But, to protect yourself you must have attempted the following activities. First, you must have requested, in writing, that the controlling contractor correct the hazard. Second, instructed your employees to avoid the hazard, you must prove that you have enforced the instructions. Third, you instructed your employees on an alternative means of protecting them.

Finally, the Contractor can appeal any and all citations and this is highly recommended practice for the contractor to appeal or downgrade the citations. The contractor can request an informal hearing to discuss with the review office. The contractor should describe in detail how they have abated each violation and ask that the violations be downgraded. Second, the contractor can contest each violation within 15 days and they must post the letter of contest at the job site. Third, the contractor can submit a formal written appeal to the Administrative Law Judge. Fourth, the contractor can submit a written appeal to the OSHA Review Commission. Finally, the contractor can appeal the rulings to the U.S. Court of Appeals.

OSHA Inspection Exercise

1. According to OSHA violations, what is the name of the violation where the firm or designated person is aware that a hazardous condition exists, knows that the condition violates a standard and makes no effort to eliminate the safety hazard?

- ☐ A. Willful Violation.
- ☐ B. Serious Violation.
- ☐ C. De Minimis Violation.
- ☐ D. Other-Than-Serious Violation.

2. Which of the following would be an example of Due Diligence?

- ☐ A. Reports violations to OSHA.
- ☐ B. Tells employees to be careful.
- ☐ C. Corrects the hazard(s) immediately.
- ☐ D. Screams and threatens the workers to comply.

3. The compliance officer notices a potential hazard that is likely to cause serious physical harm but a regulation does not exist, under which provision can the contractor be cited?

- ☐ A. Federal Register.
- ☐ B. General Duty Clause.
- ☐ C. Construction Safety Act.
- ☐ D. Code of Federal Register.

4. What type of inspection is given top priority by OSHA?

- ☐ A. Imminent Danger.
- ☐ B. Employee Complaints.
- ☐ C. Catastrophe or Fatal Accident.
- ☐ D. Programmed inspections.

5. In construction, What is the minimum number of employees that an employer must have before they are required to maintain records of occupational injuries and illnesses?

- ☐ A. 2
- ☐ B. 11
- ☐ C. 20
- ☐ D. 100

6. What is the minimum number of days for posting the De Minimis Violation?

- ☐ A. 1
- ☐ B. 3
- ☐ C. 15
- ☐ D. 60

7. Which of the following is the definition of a work-related catastrophe?

- ☐ A. The death of two or more workers.
- ☐ B. An injury or illness that requires first aid treatment.
- ☐ C. An injury or illness that requires medical treatment.
- ☐ D. An injury or illness that requires hospitalization of 3 or more workers.

8. What is the maximum number of hours for reporting a Death or Catastrophe to OSHA?

- ☐ A. 4
- ☐ B. 8
- ☐ C. 24
- ☐ D. 48

9. What is the maximum number of days that an employer has to contest any citations?

- ☐ A. 1
- ☐ B. 15
- ☐ C. 30
- ☐ D. 60

10. The Pipefitting Subcontractor is required to lay pipe in a trench that is 10 feet deep and 3 feet wide with vertical walls and no sloping or other protection. The trench was dug by the Excavators. The General Contractor supervised the work, but had no employees in the trench. The Concrete Sub told the General contractor and Excavator that the trench needed to be sloped or shored before their employees could work in the trench. During the OSHA inspection, OSHA observed the General at the trench supervising the pipefitter in the trench. Which contractor(s) would receive a citation for an unsafe trench?

- ☐ A. Pipefitter only
- ☐ B. Pipefitter and excavator.
- ☐ C. Pipefitter, excavator, and general contractor
- ☐ D. Pipefitter, excavator, general contractor, and concrete contractor

Personal Protective Equipment

The Bureau of Labor Statistics reports indicates that 22 percent of all injuries occur to workers' eyes, and 7 percent to feet and toes. Many of these injuries can be avoided if you wear Personal Protective Equipment. Personal protective equipment (PPE) should be thought of as the "last thin line of defense" and it is required if there is a "reasonable probability of an injury."

According to the OSHA regulations, you are required to wear suitable eye and face protection where eye injuries may occur. Protection is needed where hazards of flying particles, liquids, welding, and radiation exist. Normally, you are required to wear Eye Protection on tasks such as Sawing, nailing, cutting bands, or wires, grinding, handling chemicals, using compressed air, welding. It is probably a good safety habit to wear eye protection all of the time.

If the tasks you are working on have the potential to cut, blister, burn, or irritate the skin you should wear gloves. There are numerous types of hand protection from which you can select effective and comfortable protection. Glove materials include canvas, latex, rubber, neoprene, vinyl-impregnated, leather, plastic-coated, and nylon.

You should select the appropriate glove for the task at hand such as when grouting you should use a rubber glove. Also, when lifting and carrying objects such as metal wood, glass or where sharp edges pose a hazard you should wear leather gloves may be required. Another potential hazard is where flame and heat are a factor, and various types of heat-resistant gloves should be worn.

Chemical hazards may require rubber, neoprene, or plastic gloves. Wrists and arms may require protection from high-temperature materials, solvents, or metal chips. Such protection is provided by arm protectors or gloves that extend over the wrist and lower arm.

Most job sites require a hard hat to be worn at all times. In a recent case two workers were told by the supervisor to put on their hard hats but they disregarded the instructions because they figured that 100 feet was far enough away from the overhead dangers. Five minutes later, a gust of wind lifted a piece of lumber off the fifth floor and it hit one of the workers in the head. Your hard hat must have an ANSI-APPROVED emblem on the inside. When wearing the hard hat you must leave at least a 1-1/4 inch clearance between your head and the shell.

TABLE E-1 - Eye and Face Protector Selection Guide

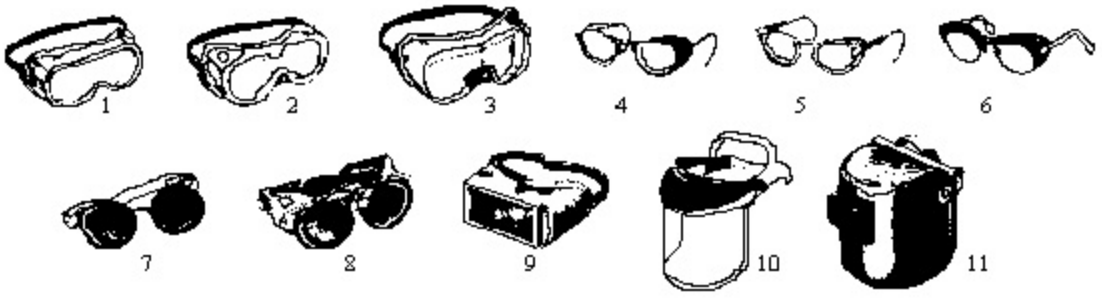


Table E-1 shall be used as a guide in the selection of face and eye protection for the hazards and operations identified below.

1.	GOGGLES, Flexible Fitting - Regular Ventilation
2.	GOGGLES, Flexible Fitting - Hooded Ventilation
3.	GOGGLES, Cushioned Fitting - Rigid Body
4.	SPECTACLES, Metal Frame, with Side shields (1)
5.	SPECTACLES, Plastic Frame - with Side shields (1)
6.	SPECTACLES, Metal-Plastic Frame - with Side shields (1)
7.	WELDING GOGGLES, Eyecup Type - Tinted Lenses (2)
7A.	CHIPPING GOGGLES, Eyecup Type - Clear Safety Lenses
8.	WELDING GOGGLES, Coversepc Type - Tinted Lenses (2)
8A.	CHIPPING GOGGLES, Coverspec Type - Clear Safety Lenses
9.	WELDING GOGGLES, Coverspec Type - Tinted Plate Lens (2)
10.	FACE SHIELD (Available with Plastic or Mesh Window)
11.	WELDING HELMETS (2)

Footnote: (1) Non-side shield spectacles are available for limited hazard use requiring only frontal protection.

Footnote: (2) See Table E-2, in paragraph (b) of this section, Filter Lens Shade Numbers for Protection Against Radiant Energy.

Recommended Protectors based upon the Operation and the Hazards

Applications		
Operation	***Hazards***	***Recommended protectors: bold type numbers signify preferred protection***
Acetylene-Burning, Acetylene-Cutting, Acetylene-Welding	Sparks harmful rays, molten metal, flying particles.	7, 8, 9.
Chemical Handling	Splash, acid burns, fumes.	2,10 (For severe exposure add 10 over 2).
Chipping	Flying particles	1, 3, 4, 5, 6, 7A, 8A
Electric (arc) welding	Sparks, intense rays, molten metal	9, 11,(11 in combination 4, 5, 6 in tinted lenses, advisable
Furnace operations	Glare, heat, molten metal.	7, 8, 9 (For severe exposure add 10)
Grinding-Light	Flying particles	1, 3, 4, 5, 6, 10
Grinding-Heavy	Flying particles	1, 3, 7A, 8A (For severe exposure add 10)
Laboratory	Chemical splash glass breakage	2 (10 when in combination with 4, 5, 6)
Machining	Flying particles	1, 3, 4, 5, 6, 10.
Molten metals	Heat, glare, sparks, splash	7, 8, (10 in combination with 4, 5, 6, in tinted lenses
Spot welding	Flying particles, sparks.	1, 3, 4, 5, 6, 10

Respirators Nonmandatory Table

HAZARD	RESPIRATOR
Oxygen deficiency	Self-contained breathing apparatus (SCBA). Hose mask with blower. Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Gas and vapor contaminants immediately dangerous to life and health.	Self-contained breathing apparatus (SCBA). Hose mask with blower. Air-purifying full face piece respirator with chemical canister. (Gas mask). Self rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Not immediately dangerous to life and health	Air-line respirator. Hose mask without blower. Air-purifying, half-mask or mouthpiece respirator with chemical cartridge.
Particulate contaminants immediately dangerous to life and health (IDHL).	Self contained breathing apparatus (SCBA). Hose mask with blower. Air purifying, full face piece respirator with appropriate filter. Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Not immediately dangerous to life and health	Air-purifying, half-mask or mouthpiece respirator with filter pad or cartridge. Air-line respirator. Air-line abrasive-blasting respirator. Hose-mask without blower.
Combination gas, vapor, and particulate contaminants Immediately dangerous to life and health (IDLH).	Self-contained breathing apparatus (SCBA) . Hose mask with blower. Air-purifying, full face piece respirator with chemical canister and appropriate filter (gas mask with filter). Self-rescue mouthpiece respirator (for escape only), Combination air-line respirator with auxiliary self-contained air-supply or an air-storage receiver with alarm.
Not immediately dangerous to life and health.	Air-line respirator. Hose mask without blower. Air-purifying, half-mask or mouthpiece respirator with chemical cartridge and appropriate filter.

Personal Protection Equipment Exercise

Using the Eye and Face Protection Chart from the Construction Safety Standards, select the Recommended Protector for the Operation and Hazards described below.

1. You are Spot Welding, Which of the following types of Eye and Face Protection can be worn?

   ☐ A. Welding Helmets.
   ☐ B. Goggles, Flexible Fitting, Regular Ventilation
   ☐ C. Goggles, Flexible Fitting, Hooded Ventilation.
   ☐ D. Welding Goggles, Eyecup Type, Tinted Lenses.

2. You are Chipping, Which of the following types of Eye and Face Protection can be worn?

   ☐ A. Welding Helmets.
   ☐ B. Goggles, Cushion Fitting, Rigid Body.
   ☐ C. Goggles, Flexible Fitting, Hooded Ventilation.
   ☐ D. Welding Goggles, Eyecup Type, Tinted Lenses.

3. You are Handling Chemicals considered severe exposure. Which of the following types of Eye and Face Protection can be worn?

   ☐ A. Spectacles, Plastic Frame, with Sideshields.
   ☐ B. Goggles, Cushion Fitting, Rigid Body.
   ☐ C. Goggles, Flexible Fitting, Hooded Ventilation.
   ☐ D. Goggles, Flexible Fitting, Hooded Ventilation with Face Shield.

4. You are performing light Grinding, Which of the following types of Eye and Face Protection can be worn?

   ☐ A. Spectacles with Sideshields.
   ☐ B. Goggles, Flexible Fitting, Hooded Ventilation.
   ☐ C. Welding Goggles, Coverspec Type, Clear Safety Lenses.
   ☐ D. Chipping Goggles, Coverspec Type, Clear Safety Lenses.

Personal Protection Equipment Exercise

5. You are performing Heavy Grinding considered a severe exposure, Which of the following types of Eye and Face Protection can be worn?

- ☐ A. Spectacles with Sideshields.
- ☐ B. Goggles, Flexible Fitting, Hooded Ventilation.
- ☐ C. Chipping Goggles, Coverspec Type, Clear Safety Lenses.
- ☐ D. Chipping Goggles, Eyecup Type, Clear Safety Lenses with Face Shield.

Using the Respirator Chart, Select the Recommended Protector for the Operation and Hazards described below.

6. You need a Respirator for an Oxygen Deficient environment, Which of the following types of Respirators must be worn?

- ☐ A. Air-purifying Respirator.
- ☐ B. Supplied-air Respirator (SAR).
- ☐ C. Powered air-purifying Respirator (PAPR).
- ☐ D. Self-contained breathing apparatus (SCBA).

7. You need a Respirator for a combination gas ,vapor, and particulate contaminants not immediately dangerous to life, Which of the following types of Respirators must be worn?

- ☐ A. Air-purifying Respirator.
- ☐ B. Supplied-air Respirator (SAR).
- ☐ C. Powered air-purifying Respirator (PAPR).
- ☐ D. Self-contained breathing apparatus (SCBA).

Portable Fire Extinguishers

Portable fire extinguishers are classified to indicate their ability to control specific classes and sizes of fires using a specific symbol and color for each fire classification in accordance with the National Fire Protection Association (NFPA). Fire extinguishers are all labeled using a Letter and/or a pictograph, according to the type of material being extinguished. They are described below.

A	is for ordinary combustibles such as wood, paper, trash, cloth, rubber and many plastics. Old extinguishers can be identified by a GREEN TRIANGLE containing the letter A. The New Extinguisher can be identified by pictograph of a trash can and wood fire.
B	is for flammable liquids such as fuel oil, gasoline, liquids such as fuel oil, gasoline, paint, and grease solvents. This extinguisher can be identified by a RED SQUARE containing the letter B. The New Extinguisher can be identified by a gas can pictograph.
C	is for fires in electrical wiring, overheated fuse boxes, or electrical equipment. This extinguisher can be identified by a BLUE CIRCLE containing the letter C. The New extinguisher can be identified by an electrical plug and receptacle pictograph.
D	is for combustible metals such as aluminum or magnesium. This extinguisher can be identified by a YELLOW FIVE-POINTED STAR containing the letter D.

The latest development in portable fire extinguishers is an all-purpose extinguisher that is effective on Class A, B and C fires or a combination of Fires such as B-C. Also, on the new portable fire extinguishers the prohibited applications are displayed as a pictograph with the background in Black and the Slash is shown in Bright Red.

There are four elements that must be present to start a fire. They are *Fuel* in the form of a combustible material for the fire to consume. The next element is *Oxygen* which must be in a sufficient volume for the fire to feed upon, and the supply must be continuous for the fire to grow. This element is a component of the air around us. The third element is an *Ignition Source* in the form of heat are needed to ignite the fire. These can be invisible or visible. An invisible ignition source is normally called Spontaneous Combustion and it can occur in the form of oily rags or loosely packed organic materials such as turpentine or top soil. A visible ignition source is an open flame. This could be matches, welding sparks or a light bulb. Finally, these three elements combine to produce a *Chain Reaction*, which is called a fire pyramid.

OSHA Standards Requiring Fire Extinguisher in Construction

STANDARD	LOCATION	Type of Extinguisher	DISTANCE (feet)
150(c)(1)(i)	Building area	2A	100'
150(c)(1)(iv)	Each floor	2A	-------
150(c)(1)(iv)	Multistory	2A	adjacent to stairway
150(c)(1)(vi)	5 gallons of Flammable/combustible or 5 pounds of flammable gas	10B	50'
151(c)(6)	Open yard storage	2A or suitable for hazard	100'
152(d)(1)	Flammable liquid storage room	20B	10', Outside
152(d)(2)	Outside Flammable liquid storage area	20B	25'-75'
152(d)(4)	Vehicles	20B:C	On vehicle for dispensing or transporting flammable or combustible liquids
152(g)(11)	Service or Fuel area	20B:C	75'
153(1)	LPG storage	20B:C	---------
352(d)	Welding, cutting, or heating areas	Suitable	----------
550(a)(14)(i)	Crane cabs	5B:C	On crane
800(m)(8) 800 (m)(11)	Tunnel machinery not using fire-resistant hydraulic fluid Underground belt conveyors at head and tail pulley	4A:40B:C	----
902(i)	Vehicles used for transportation of explosives	10A:B:C	----

Fire Extinguishers Exercise

1. Which type of fire extinguisher Letter, Old Symbol, Color and the New Symbol would be used for extinguishing a fire caused by a combustible metals such as aluminum?

   ☐ A. The old extinguishers can be identified by a Green Triangle around the letter A. The New Extinguisher pictograph is of a trash can and wood fire.
   ☐ B. This extinguisher can be identified by a Red Square around the letter B. The New Extinguisher can be identified by a gas can pictograph.
   ☐ C. This extinguisher can be identified by a Blue Circle around the letter C. The New extinguisher pictograph is an electrical plug and receptacle pictograph.
   ☐ D. This extinguisher can be identified by a Yellow Five-pointed Star around letter D.

2. Which type of fire extinguisher Letter, Old Symbol, Color and the New Symbol would be used for extinguishing a fire caused by a flammable liquid?

   ☐ A. The old extinguishers can be identified by a Green Triangle around the letter A. The New Extinguisher pictograph is of a trash can and wood fire.
   ☐ B. This extinguisher can be identified by a Red Square around the letter B. The New Extinguisher can be identified by a gas can pictograph.
   ☐ C. This extinguisher can be identified by a Blue Circle around the letter C. The New extinguisher pictograph is an electrical plug and receptacle pictograph.
   ☐ D. This extinguisher can be identified by a Yellow Five-pointed Star around letter D.

3. Which type of fire extinguisher Letter, Old Symbol, Color and the New Symbol would be used for extinguishing a fire caused by electrical wiring?

   ☐ A. The old extinguishers can be identified by a Green Triangle around the letter A. The New Extinguisher pictograph is of a trash can and wood fire.
   ☐ B. This extinguisher can be identified by a Red Square around the letter B. The New Extinguisher can be identified by a gas can pictograph.
   ☐ C. This extinguisher can be identified by a Blue Circle around the letter C. The New extinguisher pictograph is an electrical plug and receptacle pictograph.
   ☐ D. This extinguisher can be identified by a Yellow Five-pointed Star around letter D.

Fire Extinguishers Exercise

4. On the new fire extinguishers, what are the Color and Pictograph Symbol used displayed on the fire extinguisher to indicate that a specific class of fire is prohibited?

- ☐ A. The background is Green and a Slash is shown in Black.
- ☐ B. The background is Bright Red and a Slash is shown in Black.
- ☐ C. The background is Black and a Slash is shown in Bright Red.
- ☐ D. The background is White and a Slash is shown in Bright Red.

5. What is the maximum horizontal travel distance to retrieve a fire extinguisher in a Building Area?

- ☐ A. 10 Feet
- ☐ B. 25 Feet.
- ☐ C. 75 Feet
- ☐ D. 100 Feet.

6. What is the maximum horizontal travel distance to retrieve a fire extinguisher in a Fuel Service Area?

- ☐ A. 10 Feet
- ☐ B. 25 Feet.
- ☐ C. 75 Feet
- ☐ D. 100 Feet.

7. What is the location of a Fired Extinguisher on a Multistory building?

- ☐ A. On an Inside Wall.
- ☐ B. On an outside Wall.
- ☐ C. In the tool gang box.
- ☐ D. Adjacent to Stairway.

Slings and Rigging Equipment

Slings require special attention because they are almost always subjected to severe wear, abrasion, impact loading, crushing, kinking and overloading. They also merit special attention because seemingly insignificant changes in sling angle drastically affect the loading. When using slings exercise extreme caution because you are going to be developing unknown loads, under less than ideal circumstances, in less than perfect equipment. Failure to provide blocking or protective pads will permit sharp corners to cut slings. Pulling slings from under loads will result in abrasion and kinking. Dropping loads on slings or running equipment over them will cause crushing. Also, sudden starts and stops when lifting loads will increase the stresses in them. The improper storage will result in deterioration of the sling. Finally, numerous errors can occur while using a sling such as an error in determining load weight, the effect of the hook angle and the effect of sling angles on the loading. Therefore, it is recommended that all safe working loads be based on a factor of safety.

Sling Materials

According to 1926.251 (b), (c), (d) and (e), the slings are grouped as alloy steel chain, wire rope, natural rope and synthetic fiber, and synthetic webbing. The *Chain Slings* are made for abrasion and high temperature resistance. The only chain suitable for lifting is fabricated from alloy steel and identified by a letter “A” or the number “8" or a combination of the two. The chain slings must be padded on sharp corners to prevent bending stresses in the links.

The use of *Wire Rope Slings* for lifting materials provides several advantages over other types of slings. While not as strong as a chain, it has good flexibility with minimum weight. Breaking outer wires warn of failure and allow time to react. Properly fabricated wire rope slings are very safe for general construction use. The Wire Rope Slings are called Improved Plow Steel Grade Rope with an Independent Wire Rope Core (IWRC), an Improved Plow Steel Grade Rope with a Fiber Core (FC) and a construction Galvanized Aircraft Grade Rope. The Wire Rope sling can also be made into a Braided Rope, a Cable Laid Rope, a Strand Laid Grommet, a Cable Laid Grommet, a Strand Laid Endless Sling and a Cable Laid Endless Sling. The *Braided Slings* are fabricated from usually 6 or 8 small diameter ropes braided together to form a single rope that provides a large bearing surface, tremendous strength and flexibility in all directions. They are very easy to handle and almost impossible to kink. The braided sling can be used in all the standard configurations and combinations but is especially useful for basket hitches where low bearing pressure is desirable or where the bend is extremely sharp. The *Endless Slings or Grommet Slings* are endless ropes that are made from one strand of a rope laid or twisted around itself on each successive loop. There is only one tuck in the entire circumference where the two ends enter the rope. These slings can be used in a number of configurations, as vertical hitches, basket hitches, choker hitches and all combinations of these basic configurations. They are very flexible but tend to wear and deteriorate more rapidly than the other slings because they are not normally equipped with fittings and thus are deformed when bent over hooks and bear against themselves.

The *Natural Rope and the Synthetic Fiber Rope* slings may be used in a temperature range from minus 20 degrees Fahrenheit to 180 degrees Fahrenheit without decreasing the working load limit. According to1926.251 (d) (6) The Natural Rope and the Synthetic Fiber Rope slings shall be immediately removed from service if any of the following conditions are present: (i) Abnormal wear; (ii) Powdered fiber between strands; (iii) Broken or cut fibers; (iv) Variations in the size or roundness of strands; or (v) Discoloration or rotting; and (vi) Distortion of hardware in the sling.

The *Synthetic Webbing Slings* are made of Nylon, Polyester and Polypropylene. According to 1926.251 (e) (6) (i)it states that the Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present. Also, under 1926.251 (e) (6) (ii) it states that the Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present. In addition, paragraph1926.251 (e) (6) (iii) it state that Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present. Finally, under paragraph 1926,251 (e) (8) The Synthetic Web shall be immediately removed from service if any of the following conditions are present: (i) Acid or caustic burns; (ii) Melting or charring of any part of the sling surface; (iii) Snags, punctures, tears or cuts; (iv) Broken or worn stitches; or (v) Distortion of fittings.

Sling Configurations

The Sling Configuration and the sling angle are the most important considerations when deciding how to lift an object. The term “sling” includes a wide variety of configurations for all fiber ropes, wire ropes, chains and webs. The most commonly used *Sling Configurations* in construction rigging will be considered here because improper application can affect the safety of the lift.

The *Single Vertical Hitch* is a method of supporting a load by a single vertical part of leg of the sling. The total weight of the load is carried by a single leg, the angle of the lift is 90^{o} and the weight of the load can equal the maximum safe working load of the sling and fittings. The end fittings of the sling can vary but thimbles should be used in the eyes. Also, the eye splices on wire ropes should be Mechanical-Flemish splices for best security. This sling configuration must not be used for lifting loose material, lengthy material or anything that will be difficult to balance. Use them only on items equipped with lifting eye bolts or shackles such as concrete buckets. They provide absolutely no control over the load because they permit rotation.

The *Bridle Hitch* is the use of two, three or four single hitches to form a bridle hitch for hoisting an object that has the necessary lifting lugs or attachments. They can be used with a wide assortment of end fittings. They provide excellent load stability when the load is distributed equally among the legs, when the hook is directly over the center of gravity of the load and the load is raised level. In order to distribute the load equally it may be necessary to adjust the leg

lengths with turnbuckles. The use of a bridle sling requires that the sling angles be carefully determined to ensure that the individual legs are not overloaded. Unless the load is flexible, it is wrong to assume that a 3 or 4 leg hitch will safely lift a load equal to the safe load on one leg multiplied by the number of legs because there is no way of knowing that each leg is carrying its share of the load. With slings having more than 2 legs and a rigid load, it is possible for two of the legs to take practically the full load while the others only balance it.

The *Single Basket Hitch* is a method of supporting a load by hooking one end of a sling to a hook, wrapping it around the load and securing the other end to the hook. It cannot be used on any load that is difficult to balance because the load can tilt and slip out of the sling. On loads having inherent stabilizing characteristics the load on the sling will be automatically equalized with each leg supporting half the load. Ensure that the load dies not turn or slide along the rope during a lift because both the load and rope will become damaged.

The *Double Basket Hitch* consists of two single basket hitches passed under the load. They must be placed under the load so that it is properly balanced. The legs of the hitches must be kept far enough apart to provide balance but not so far apart that excessive angles are developed or to create a tendency for the legs to be pulled in toward the center. On smooth surfaces, both sides of the hitches should be snubbed against a step or change of contour to prevent the rope from slipping as load is applied. The angle between the load and the sling should be approximately 60^{o} or greater to avoid slippage.

The *Double Wrap Basket Hitch* is a basket hitch that is wrapped completely around the load rather than just supporting as does the ordinary basket hitch. The double wrap basket hitch can be used in pairs like the double basket hitch. This method is excellent for handling loose material, pipe, rod or smooth cylindrical loads because the rope or chain exerts a full 360^{o} contact with the load and tends to draw it together.

The *Single Choker Hitch* forms a noose in the rope that tightens as the load is lifted. It does not provide a full 360 degree contact with the load. Hence, it should not be used to lift loose bundles from which material can fall or loads that are difficult to balance. The single choker can also be doubled. When it is necessary to turn a load, the choker is made by placing both eyes of the sling on top of the load with the eyes pointing in the direction opposite the direction of the turn. The center of the sling is passed around the load, through both eyes and up to the hook. This hitch provides complete control over the load during the entire turning operation, and the load automatically equalizes between the two supporting legs of the slings. If, the choker is incorrectly made and the two eyes are placed on the crane hook and the supporting legs of the sling are not equal in length, the load may be imposed on one leg only.

The *Double Choker Hitch* consists of two single chokers attached to the load and spread to provide load stability. These like the single choker, do not completely grip the load but because the load is less likely to tip they are better suited for handling loose bundles of pipes or rods, etc.

The *Double Wrap Choker Hitch* is one in which the rope or chain is wrapped completely around the load before being hooked into the vertical part of the sling. This hitch is in full contact with the load and tends to draw it tightly together. It can be used either singly on short, easily balanced loads or in pairs on longer loads. The double wrap choker is made by placing both eyes of the sling on top of the load with the eyes pointing in the direction opposite to the direction of the turn. The center of the sling is passed around the load, through both eyes, and up to the hook. This hitch provides complete control over the load during the entire turning operation. The load automatically equalizes between the two supporting legs of the sling. Because the load is turned into a tight sling, there is no movement between the load and the sling. If the double wrap choker is incorrectly made, and the two eyes are placed on the crane hook, the supporting legs of the sling may not be equal in length and the load may be carried by one leg only.

Sling Inspection Requirements

According to Subpart H titled Materials Handling, Storage, Use, and Disposal and in section1926.251 titled Rigging Equipment Paragraph (a) titled *General* (1) it states that rigging equipment for material handling shall be inspected prior to use on each shift and as necessary during its use to ensure that it is safe. Also, under Paragraph1926.251 (a)(6) titled Inspections, it states that each day before being used, the sling and all fasteners and attachments shall be inspected by a competent person designated by the employer. Also, damaged or defective slings shall be immediately removed from service. Another paragraph under Subpart H 1926.251 (c) titled Wire Rope and subparagraph (4)(iv) it states that wire rope shall not be used if, in any length of eight diameters, the total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.

Angle of the Hook and the Sling Hook Lifting Capacity

The Sling Hook condition can affect the lifting capacity. You must know what hardware to use, how to use it, and how its safe working loads (SWL) compare with the rope or chain used with it. All fittings must be of adequate strength for the application. Only forged alloy steel load-rated hardware should be used for overhead lifting. Load-rated hardware is stamped with its SWL. Inspect hardware regularly and before each lift. The signs to look for in the sling hook are any wear, cracks, severe corrosion, deformation or bends, any mismatched parts and obvious damage to the hook. The *Sling Hook Capacity is effected by the angle of the hook*. For example, the table below provides the reduction of the rated load due to the angle of the hook.

Effect of Eccentric Load on Hook Capacity	% of Rated Load
A Balanced load with the load distributed evenly through the Hook can carry	100%
An Eccentric load on the hook that is 1/4 Off Center can carry	86%
An Eccentric load on the hook that is ½ Off Center can carry	80%
An Eccentric load on the hook that is 3/4 Off Center can carry	70%
An Eccentric load on the hook that is carried by the end of the hook can carry	40%

Angle of the Sling and the Effect on the Lifting Capacity

The *Sling Angles also affect the rated capacity* of any sling. The rated capacity depends on its size, its configuration and the angles formed by the legs of the sling and the horizontal. A sling with two legs that is used to lift a 1000 pound object will have a 500-pound load in each leg when the sling angle is 90 degrees. The load in each leg will increase as the angle is decreased and at 30 degrees the load will be 1000 pounds in each leg. If at all possible, keep the sling angles greater than 45 degrees. Also, sling angles that are approaching 30 degrees should be considered extremely hazardous and avoided at all costs. Some load tables list sling angles as low as 15 degrees, but the use of any sling at an angle less than 30 degrees is extremely dangerous. This is not only because of the high loads associated with them but because of the effect on the load of an error in sling angle measurement of as little as 5 degrees. The following table illustrates the effect of a 5-degree error in sling angle measurement on the sling load.

EFFECT OF SLING ANGLE MEASUREMENT ERROR ON LOADS				
Assumed Sling Angle	Assumed Load (Pounds per Leg)	Actual Angle (is 5° Less Than Assumed Angle)	Actual Load (Pounds Per Leg)	Error %
90°	500	85°	502	0.4
75°	518	70°	532	2.8
60°	577	55°	610	5.7
45°	707	40°	778	9.1
30°	1,000	25°	1,183	18.3
15°	1,932	10°	2,880	49.0

As you can see that there is almost a 50% error in the assumed load at the 15-degree sling angle. This illustrates how cautious you must be in not only ensuring the angle is greater than 45 degrees, but the importance of measuring it accurately. The easiest and most accurate way to determine the angle is by measuring it with a large plywood measure graduated in degrees.

Rigging Equipment Exercise

1. How often does a sling have to be inspected?

- ☐ A. Yearly.
- ☐ B. Monthly.
- ☐ C. Once per day at the beginning of the shift.
- ☐ D. Each day before sling use and during sling use.

2. A wire rope is designated as a 1-3/4 inch, 6 x 37 - IWRC. What does the 6 indicate?

- ☐ A. Strands.
- ☐ B. Diameter.
- ☐ C. Rated Capacity.
- ☐ D. The number of wires per strand.

3. A wire rope is designated as a 3/4 inch, 6 x 19 - IWRC. What does the 19 indicate?

- ☐ A. Strands.
- ☐ B. Diameter.
- ☐ C. Rated Capacity.
- ☐ D. The number of wires per strand.

4. A wire rope is designated as a 3/4 inch, 6 x 19 - IWRC. What does the IWRC mean?

- ☐ A. Improved Wire Rope Core.
- ☐ B. Improved Wide Rope Core.
- ☐ C. Independent Wire Rope Core.
- ☐ D. Independent Wide Rope Core.

5. What are the total number of broken wires that can be visible in any eight diameter lengths given a 3/4 inch, 6 x 19 IWRC wire rope sling before it must be removed?

- ☐ A. 0
- ☐ B. 6
- ☐ C. 11
- ☐ D. 19

Rigging Equipment Exercise

6. Which type of material is suitable for a chain sling?

- ☐ A. Carbon Steel 160.
- ☐ B. Structural Steel Grade 60.
- ☐ C. Improved Plow Steel Grade.
- ☐ D. Alloy Steel and identified by a letter “A” or the number “8" or a combination.

7. Which type of sling material cannot be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present?

- ☐ A. Chain Sling.
- ☐ B. Wire Rope Sling.
- ☐ C. Nylon Web Sling.
- ☐ D. Natural Rope and Synthetic Fiber.

8. Which type of sling material is best for abrasion and high temperature resistance?

- ☐ A. Chain Sling.
- ☐ B. Wire Rope Sling.
- ☐ C. Nylon Web Sling.
- ☐ D. Natural Rope and Synthetic Fiber.

9. Which type of sling material may be used in a temperature range from minus 20 degrees Fahrenheit to 180 degrees Fahrenheit?

- ☐ A. Chain Sling.
- ☐ B. Wire Rope Sling.
- ☐ C. Nylon Web Sling.
- ☐ D. Natural Rope and Synthetic Fiber.

10. Which type of sling configuration is better suited for handling loose bundles of pipe or rebar?

- ☐ A. Bridle Hitch.
- ☐ B. Single Basket Hitch.
- ☐ C. Single Choker Hitch.
- ☐ D. Double Choker Hitch.

Rigging Equipment Exercise

11. What is the Rated Load Capacity for a hook that is ½ Off center?

- ☐ A. 70%
- ☐ B. 80%
- ☐ C. 86%
- ☐ D. 100%

12. Assume you are lifting 1000 pounds, What is the load on each leg of two legged sling if the horizontal sling angle is 45 degrees?

- ☐ A. 500 Pounds
- ☐ B. 577 Pounds
- ☐ C. 707 Pounds
- ☐ D. 1000 Pounds

Using the OSHA Sling Tables Attached answer the following questions.

13. Given a single leg sling that is 3/4 inch in diameter, 6 x 19 construction, IWRC, used in a choker hitch with a Mechanical Splice. What is the rated lifting capacity?

- ☐ A. 3.3 Tons
- ☐ B. 3.6 Tons
- ☐ C. 3.9 Tons
- ☐ D. 4.9 Tons

14. Given a load of 7500 pounds, you will lift using a Wire Rope Sling in a 2 legged Bridle Hitch in a 60 degree horizontal angle using a 6 x 19 Improved Plow Steel Grade Rope with Fiber Core, Hand Tucked. What is the minimum Wire Rope Diameter?

- ☐ A. 3/8. inches
- ☐ B. 7/16 inches
- ☐ C. 1/2 inches
- ☐ D. 9/16 inches

Rigging Equipment Exercise

15. Given a 3 legged Bridle Hitch in a 30 degree horizontal angle using a 3/4 inch 6 x 19 Construction Improved Plow Steel Grade Rope with an Independent Wire Rope Core (IWRC) and connected using a Hand Tucked. What is the Lifting capacity?

- ☐ A. 5.8 Tons
- ☐ B. 6.3 Tons
- ☐ C. 6.6 Tons
- ☐ D. 6.8 Tons
- ☐ E. 7.3 Tons
- ☐ F. 10. Tons
- ☐ G. 11. Tons
- ☐ H. 13. Tons

Rigging Equipment Exercise using Table H - 3. Rated Capacities for Single Leg Slings
6x19 and 6x37 Classification Improved Plow Steel Grade Rope With Fiber Core(FC)

Rope Diameter (Inches)	Construction	Rated Capacities, Tons (2,000 lb)								
		Vertical HT	Vertical MS	Vertical S	Choker HT	Choker MS	Choker S	Vertical Basket HT	Vertical Basket MS	Vertical Basket S
¼	6 x 19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
5/16	6 x 19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
3/8	6 x 19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
7/16	6 x 19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
½	6 x 19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
9/16	6 x 19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6 x 19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
¾	6 x 19	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	6 x 19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6 x 19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1 1/8	6 x 19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1 ¼	6 x 37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1 3/8	6 x 37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1 ½	6 x 37	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1 5/8	6 x 37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	37.0	41.0
1 ¾	6 x 37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	6 x 37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

Footnote(1) These values only apply when the D/d ratio for HT slings is 10 or greater, and for
MS and S Slings is 20 or greater where:
D=Diameter of curvature around which the body of the sling is bent; d=Diameter of rope.
HT = Hand Tucked Splice and Hidden Tuck Splice. For hidden tuck splice (IWRC) use values in HT columns.
MS = Mechanical Splice.
S = Swaged or Zinc Poured Socket.

Rigging Equipment Exercise using Table H - 4. Rated Capacities for Single Leg Slings
6x19 and 6x37 Classification Improved Plow Steel Grade Rope with Independent Wire Rope Core (IWRC)

Rope Diameter (Inches)	Construction	Rated Capacities, Tons (2,000 lb)								
		Vertical HT	Vertical MS	Vertical S	Choker HT	Choker MS	Choker S	Vertical Basket HT	Vertical Basket MS	Vertical Basket S
¼	6 x 19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6 x 19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6 x 19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6 x 19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
½	6 x 19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6 x 19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6 x 19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
¾	6 x 19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6 x 19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6 x 19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1 1/8	6 x 19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1 ¼	6 x 37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1 3/8	6 x 37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1 ½	6 x 37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1 5/8	6 x 37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1 ¾	6 x 37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6 x 37	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

Footnote(1) These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:
D=Diameter of curvature around which the body of the sling is bent; d=Diameter of rope.
HT = Hand Tucked Splice. For hidden tuck splice (IWRC) use Table H-3 values in HT column.
MS = Mechanical Splice.
S = Swaged or Zinc Poured Socket.

Rigging Equipment Exercise using Table H - 7. Rated Capacities for 2-leg and 3-leg Bridle Slings
6x19 and 6x37 Classification Improved Plow Steel Grade Rope with Fiber Core (FC)

Rope		Rated Capacities, Tons (2,000 lb)											
		2-leg bridle slings						3-leg bridle slings					
Dia (Inches)	Constr	30 deg (1) (60 deg) (2)		45 deg. Angle		60 deg (1) (30 deg) (2)		30 deg (1) (60 deg) (2)		45 deg. Angle		60 deg (1) (30 deg) (2)	
		HT	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*
¼	6 x 19	0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.7
5/16	6 x 19	1.3	1.4	1.1	1.1	0.76	0.79	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6 x 19	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6 x 19	2.5	2.6	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.2	2.1	2.3
½	6 x 19	3.2	3.4	2.6	2.8	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6 x 19	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6 x 19	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.6
¾	6 x 19	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6 x 19	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	6 x 19	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
1 1/8	6 x 19	14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
1 ¼	6 x 37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.	23.0	15.0	17.0
1 3/8	6 x 37	20.0	23.0	17.0	19.0	12.0	13.	31.0	35.0	25.	28.0	18.0	20.0
1 ½	6 x 37	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
1 5/8	6 x 37	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
1 ¾	6 x 37	33.0	37.0	27.0	30.0	19.0	21.0	49.0	56.0	40.0	45.0	28.0	32.0
2	6 x 37	43.0	48.0	35.0	39.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

HT = Hand Tucked Splice.
MS = Mechanical Splice.
1 Vertical angles.
2 Horizontal angles.

Rigging Equipment Exercise using Table H - 8 Rated Capacities for 2-leg and 3-leg Bridle Slings
6x19 and 6x37 Classification Improved Plow Steel Grade Rope With Independent Wire Rope Core (IWRC)

Rope		Rated Capacities, Tons (2,000 lb)											
		2-leg bridle slings						3-leg bridle slings					
Dia (Inches)	Constr	30 deg (1) (60 deg) (2)		45 deg. Angle		60 deg (1) (30 deg) (2)		30 deg (1) (60 deg) (2)		45 deg. Angle		60 deg (1) (30 deg) (2)	
		HT	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*
¼	6 x 19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6 x 19	1.4	1.5	1.1	1.2	1.81	0.87	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6 x 19	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9
7/16	6 x 19	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5
½	6 x 19	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3
9/16	6 x 19	4.3	4.8	3.5	3.9	2.5	2.7	6.4	7.1	5.2	5.8	3.7	4.1
5/8	6 x 19	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1
¾	6 x 19	7.3	8.4	5.9	6.9	4.2	4.9	11.0	13.0	8.9	10.0	6.3	7.3
7/8	6 x 19	9.6	11.0	7.8	9.3	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9
1	6 x 19	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0
1 1/8	6 x 19	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0
1 ¼	6 x 37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	22.0	26.0	16.0	18.0
1 3/8	6 x 37	22.0	25.0	18.0	21.0	13.0	15.0	33.0	38.0	27.0	31.0	19.0	22.0
1 ½	6 x 37	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	32.0	37.0	23.0	26.0
1 5/8	6 x 37	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0
1 ¾	6 x 37	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0
2	6 x 37	46.0	53.0	37.0	43.0	26.0	30.0	68.0	79.0	56.0	65.0	40.0	46.0

HT = Hand Tucked Splice.
MS = Mechanical Splice.
1 Vertical angles.
2 Horizontal angles.

OSHA Scaffolding

Under Paragraph 1926.450 (b) it groups all types of scaffolds as either a "supported" or a "suspension" scaffold. OSHA believes that adding this information will make it easier for employers to identify the appropriate general requirements in 1926.451. In paragraph 1926.451 (a) it sets the minimum strength criteria for all scaffolding components and in paragraph 1926.451 (a) *Capacity*. (1) requires that each scaffolding and scaffold component shall be capable of supporting, without failure, its own weight and at least 4 times the maximum intended load applied or transmitted to it. Paragraphs (a)(2), (a) (3), (a) (4), (a) (5) and (g) of 1926.451 provide exceptions to this general rule. Also Paragraph1926.451 (a) (2) requires that direct connections to roofs and floors, and counterweights used to balance adjustable suspension scaffolds, shall be capable or resisting at least 4 times the tipping moment imposed by the scaffold operating at the rated load of the hoist, or 1.5 (minimum) times the tipping moment imposed by the scaffolding operating at the stall load of the hoist, whichever is greater. Also, 1626.451 (c) establishes the *Criteria for supported scaffolds* and 1926.451 (d) establishes the *Criteria for suspension scaffolds*.

According to Subpart L titled Scaffolding under Part 1926 and section number .452 describes the typical types of scaffolding that are available. The major types are (a) pole scaffolds which consist of single-pole scaffolds and independent pole scaffolds. Also, under 1926.452 (b) is tube and coupler scaffolds, (c) is titled fabricated frame scaffolds. Some of the specialized scaffolds include Plasterers', decorators', and large-area scaffolds; Bricklayers' square scaffolds; Horse scaffolds; Form scaffolds and carpenters' bracket scaffolds; Roof bracket scaffolds, Outrigger scaffolds; Pump jack scaffolds; Ladder jack scaffolds; Window jack scaffolds; Crawling boards (chicken ladders); Step, platform, and trestle ladder scaffolds; Single-point adjustable suspension scaffolds; Two-point adjustable suspension scaffolds; A multi-point adjustable suspension scaffold which includes Stone setters' multiple-point adjustable suspension scaffolds and Mason's multipoint adjustable suspension scaffolds; Float (ship) scaffolds; Interior hung scaffolds; Needle beam scaffolds; Multi-level suspended scaffolds; Mobile scaffolds, and under 1926.453 is title Aerial Lifts.

Subpart L Scaffolding under section 1926.454 also addresses *Training for Employees* working with scaffolds. This section supplements and clarifies the training requirements of the existing paragraph 1926.21 (b) (2) which applies to all construction work and requires employers to "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to their work environment to control or eliminate any hazards or other exposure to illness or injury." Section 1926.454 clarifies the types of hazards to be addresses in all training programs given to employees working on scaffolds and establishes a framework for training programs while allowing employers to tailor the program to fit their workplace. Section .454 Paragraph (a) addresses employees who are working on scaffolds and paragraph (b) address employees who are erecting, dismantling, inspecting and maintaining scaffolds.

The scaffolding safety standards also define a *Competent Person* under 1926.451 and it utilizes the word "a competent person" numerous times throughout the section. It also contains the word *Qualified Person* several times throughout the standard and it establishes that certain types of scaffolding shall be designed by an engineer experienced in or a *Registered Professional Engineer*. Finally, under the compliance Directive Number (CPL 2-1.23) it establishes the guidelines for evaluating the duties and responsibilities of the competent person or qualified person at the job site.

Subpart L Scaffolding provides a non-mandatory Appendices A - E. These are provided as guides to assist employers in the general guidelines for design loads and allowable spans. The non-mandatory guideline also contains specific guidelines and tables for pole scaffolds, tube and coupler scaffolds and fabricated frame scaffolds, and numerous other types of scaffolding. For instance, supported scaffolds such as pole scaffolds, tube and coupler and fabricated frame scaffolds are classified according to their loading capacity and there are three types of classifications.

A *Light-duty* can handle a maximum load of 25 pounds per square foot of platform surface. You must be particularly careful when working on this type of scaffold because it can be easily overloaded. A light-duty scaffold requires the supports to be spaced not more than 10 feet apart along the length of the scaffold. The *Medium-duty,* scaffold can handle a maximum of 50 pounds per square foot of working surface. A medium-duty scaffold requires the supports to be spaced not more than 8 feet apart along the length of the scaffold. Finally, the *Heavy-duty* scaffold can handle a 75-pound load per square foot. A heavy-duty scaffold requires the supports to be spaced not more than 6 feet apart along the length of the scaffold.

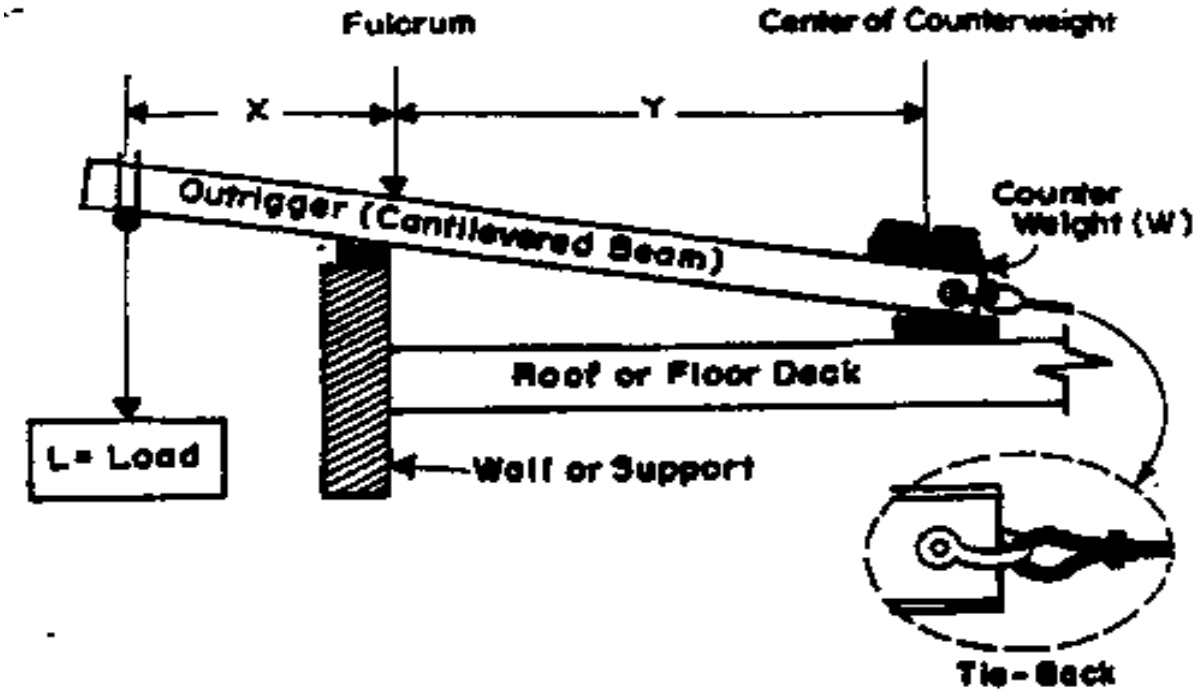
The maximum safe load of a scaffold is determined by measuring its platform area and multiplying the area by the platform's capacity per square foot. For example, if the platform of a medium-duty scaffold measures five feet by eight feet. To calculate the maximum loading capacity, you take the area 5' x 8' = 40 Square Feet x 50 pounds per square foot (medium-duty scaffold) = 2,000 pounds is the maximum loading capacity. However, this load must be evenly distributed and not concentrated in one area of the platform.

Mobile or Rolling Scaffolds also has some design limitations such as when it is moved, all tools, equipment, and workers must be secured or removed from the platform to prevent falling accidents. The floor should be level and free of obstructions. Also, overhead obstructions should be avoided. Once the scaffold has been positioned, the wheels must be locked to prevent any sudden movement of the scaffold. Rolling scaffolds must have design and construction features that will prevent their tipping. The height of the working platform must not exceed four times the smallest dimension of the base. For example, if the base of a rolling scaffold is eight feet by ten feet, the maximum height at which the scaffold can be used is 32 feet, which is four times the smallest dimension of the base. (4 x 8' = 32').

The *Suspension Scaffolds* are the two-point suspension scaffolds, sometimes called the swinging, or stage scaffold. The two-point suspension scaffold is suspended from the roof by roof hooks. Another suspension scaffold is the multiple-point suspension scaffold. This type is used for heavy-duty work and is designed to handle work loads of not more than 50 pounds per square foot. The work platform is supported by wire ropes suspended from overhead outrigger beams. The outrigger beam must be at least 15 feet long and should not extend more than six and one half feet beyond the bearing point. The outrigger beams must be made of structural metal, with the inside end anchored to the frame or floor system of the building by large U-bolts and anchor plates. Because suspension scaffolds can swing and move in the wind, the platform must be tied to the building while you are on it. All suspended scaffolds are hung from either fiber or wire ropes. These ropes must meet safety requirements. Any rope used for scaffold suspension must be able to support the weight of the scaffold, all workers and materials it carries.

The *rope requirements for a suspended scaffolding* supporting a swinging scaffold should not be less than 3/4 of an inch in diameter. They must be properly rigged into a set of six-inch blocks consisting of at least one double and one single block. If the scaffold is to be used with acids, torches, or open flames that will weaken manila rope, then wire rope, not less than 9/16 inch in diameter, must be used. Where wire rope is used, a hoisting mechanism must be provided on the end of the scaffold platform. The rope needs to be carefully checked for damage each time it is used. Otherwise, the damage will not be discovered until it is too late. Checking can be done by twisting the rope until the strands spread apart. If there are a powdery appearance or broken strands, the rope is damaged and must be thrown away. Knots and kinks cause damage to a rope and should be avoided. If usage requires that a rope be continuously twisted in one direction, compensating turns in the opposite direction should be made to avoid damage to the rope. When not in use, rope should be stored in dry, well-ventilated areas away from extreme temperatures, humidity, or dryness. A damp rope will rot, and a dry rope will become brittle, thus losing its strength and durability. As with any elevated working surface, the platform of a suspended scaffold must be equipped with a standard guardrail, toe board, and overhead protection where needed to protect you from being hit by falling objects.

Most suspended scaffolds are raised and lowered with some type of hoisting mechanism. This mechanism must be checked before each use to make certain it is operating safely. There should always be at least three turns of rope left on the hoisting drum, to reduce the force exerted on the rope where it connects with the drum. This measure will lessen the possibility of the rope slipping from the drum and breaking. Scaffold planks should be inspected before each use to ensure their safety. There are visible signs indicating that planks are unsafe. Some of the signs are large knots, excessive grain slope, and decay. Any plank that contains these or other defects should be discarded. Everyone on a suspended scaffold must wear a safety belt and lanyard. The lanyard must be fastened either to a substantial member of the structure to which the scaffold is suspended.



L = LOAD (IN POUNDS)
W = COUNTERWEIGHT (IN POUNDS),
X = LOAD LINE TO FULCRUM DISTANCE (IN FEET)
Y = CENTER OF COUNTERWEIGHT TO FULCRUM DISTANCE (IN FEET)
FORMULAS

LX - YW, BUT TO ADD 4 TO 1 SAFETY FACTOR, LX = 4 (YW)

$W = 4\ \frac{(LX)}{Y}$, AND $Y = 4\ \frac{(LX)}{W}$

EXAMPLE #1
L = 400 LBS., X = 2 FT., Y = 12 FT., W = ?
$W = 4\ \frac{(400 \times 2)}{12}$, $W = 4\ \frac{(800)}{12}$, W = 4 (66.6), W = 266.6 LBS.

EXAMPLE #2
L = 300 LBS., X = 2 FT., W = 100 LBS., Y = ?
$Y = 4\ \frac{(LX)}{W}$, $Y = \frac{(300 \times 2)}{100}$, $Y = 4\ \frac{(600)}{100}$, Y = 4 (6), Y = 24 FT

Scaffolding Exercise

1. A scaffold must be capable of supporting its own weight and what is the minimum factor that must be applied to the maximum intended load to determine the capacity?

   ☐ A. 0 times.
   ☐ B. 1 times.
   ☐ C. 2 times.
   ☐ D. 4 times.

2. OSHA has grouped all scaffolds into two groups and they have established certain criteria for each group. What are the two groups of scaffolds?

   ☐ A. Horizontal Scaffolds and Vertical Scaffolds.
   ☐ B. Supported Scaffolds and Suspended Scaffolds.
   ☐ C. Mandatory Scaffolds and Non-Mandatory Scaffolds.
   ☐ D. Required Scaffold Criteria and Not Required Scaffolds Criteria.

3. On scaffolds where platforms are overlapped to create a long platform, the lap shall occur only over supports. What is the minimum lap in inches if they are not nailed?

   ☐ A. 3 inches.
   ☐ B. 6 inches.
   ☐ C. 9 inches.
   ☐ D. 12 inches.

4. What is the minimum height to base ratio which requires guying, tying, bracing?

   ☐ A. 1:1
   ☐ B. 2:1
   ☐ C. 3:1
   ☐ D. 4:1

5. What is the maximum vertical tie-in distance range in feet for scaffolds that exceed the height to base ratio?

   ☐ A. 20 - 26 feet.
   ☐ B. 30 - 36 feet.
   ☐ C. 40 - 46 feet.
   ☐ D. 50 - 56 feet.

Scaffolding Exercise

6. What is the maximum horizontal tie-in distance in feet for scaffolds that exceed the height to base ratio?

- ☐ A. 30 feet.
- ☐ B. 35 feet.
- ☐ C. 50 feet.
- ☐ D. 75 feet.

7. What of the following scaffold descriptions describes an independent pole scaffolding?

- ☐ A. A supported scaffolding consisting of a platform(s) resting on bearers supported by ledgers and a double row of uprights without any support from any structure.
- ☐ B. A supported or suspended scaffold consisting of a platform(s) supported by tubing, erected by coupler devices connecting uprights, braces, bearers, & runners.
- ☐ C. A supported scaffolding of a platform resting on thrustouts projecting beyond the wall or face of the building or structure, the inboard ends are secured to inside the building or structure.
- ☐ D. A supported scaffolding consisting of a platform(s) resting on bearers, the outside bearers ends are supported on runners secured to a single row of uprights, and the inner bearer ends are supported on or in a structure or building wall.

8. At each end of a platform, what is the maximum extension range for extending the platform beyond its support?

- ☐ A. 12 - 18 inches.
- ☐ B. 19 - 24 inches.
- ☐ C. 25 - 31 inches.
- ☐ D. 32 - 36 inches.

9. What is the rated load capacity for a Medium-duty scaffold?

- ☐ A. 25 pounds per square foot applied uniformly over the entire span area.
- ☐ B. 50 pounds per square foot applied uniformly over the entire span area.
- ☐ C. 75 pounds per square foot applied uniformly over the entire span area.
- ☐ D. 250 pounds placed 18 inches to the left and right of the center of the span.

Questions 10 through 13 refer to the Non-Mandatory Appendix A in Subpart L, and the tables for various types of scaffolding.

10. Using an Independent Wood Pole Scaffold for a Medium Duty Rating. What is the size of the poles and the maximum on-center longitudinal pole spacing?

- ☐ A. 2 x 4 inches, spaced 6 feet on-center.
- ☐ B. 4 x 4 inches, spaced 8 feet on-center.
- ☐ C. 4 x 4 inches, spaced 10 feet on-center.
- ☐ D. Nominal 2 inch OD steel, spaced 4 feet x 7 feet.

11. Using an Independent Wood Pole Scaffold for a Medium Duty Rating. What is the maximum traverse pole spacing in feet?

- ☐ A. 5
- ☐ B. 6
- ☐ C. 8
- ☐ D. 10

12. Using an Independent Wood Pole Scaffold for a Medium Duty Rating. What is the maximum vertical spacing of the horizontal members?

- ☐ A. 5' - 0"
- ☐ B. 6' - 0"
- ☐ C. 6' - 6"
- ☐ D. 7' - 0"

13. Using an Independent Wood Pole Scaffold for a Light Duty Rating. What is the maximum post spacing using a nominal 2 inch OD?

- ☐ A. 4 feet x 7 feet.
- ☐ B. 4 feet x 10 feet.
- ☐ C. 6 feet x 6 feet.
- ☐ D. 8 feet x 8 feet.

14. What is the minimum ladder extension above the point of contact?

- ☐ A. 1
- ☐ B. 2
- ☐ C. 3
- ☐ D. 8

Scaffolding Exercise

15. What is the maximum height in feet before a pole scaffolds must be designed by a Registered Professional Engineer?

- ☐ A. 20
- ☐ B. 50
- ☐ C. 60
- ☐ D. 125

16. What is the maximum height in feet before a tube and coupler scaffolds must be designed by a Registered Professional Engineer?

- ☐ A. 25
- ☐ B. 50
- ☐ C. 75
- ☐ D. 125

17. What is the maximum height in feet before a fabricated frame scaffolds must be designed by a Registered Professional Engineer?

- ☐ A. 25
- ☐ B. 50
- ☐ C. 75
- ☐ D. 125

18. Given the following information concerning a Swing Stage Scaffold, the Load (L) is = 600 pounds, the load line to the fulcrum distance (X) = 2.5 feet, and the length of the outrigger from the counterweight to the fulcrum point (Y) is 16 feet. What is the weight (W) of the counter weight in pounds?

- ☐ A. 94
- ☐ B. 375
- ☐ C. 500
- ☐ D. 600

19. What is the maximum height in feet of a ladder jack platform?

- ☐ A. 20
- ☐ B. 30
- ☐ C. 60
- ☐ D. 125

Scaffolding Exercise

20. When free-standing mobile (manual rolling Scaffolding) scaffold towers are used, the height shall not exceed how many times the minimum base dimension?

- ☐ A. 2
- ☐ B. 9
- ☐ C. 45
- ☐ D. 60

21. A manual rolling scaffolding has a base of 7' x 9', What is the maximum height in feet?

- ☐ A. 14 Feet
- ☐ B. 30 Feet
- ☐ C. 60 Feet
- ☐ D. 125 Feet

22. Using the Non-Mandatory Appendix A in Subpart L, and the Allowable spans table. What is the minimum nominal size planking that can be used for scaffold planks?

- ☐ A. 2 x 6
- ☐ B. 2 x 8
- ☐ C. 2 x 10
- ☐ D. 2 x 12

23. Using a maximum loading for a medium duty scaffold, What is the maximum permissible span for a nominal plank 2 x 12?

- ☐ A. 4 feet
- ☐ B. 6 feet
- ☐ C. 8 feet
- ☐ D. 10 feet

24. The point of contact for your ladder is 16' above the ground, What is the proper horizontal distance from the wall?

- ☐ A. 03.33 Feet
- ☐ B. 04.00 Feet
- ☐ C. 12.00 Feet
- ☐ D. 16.00 Feet

Scaffolding Exercise for Single Wood Pole Scaffolds

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Maximum intended load(lbs/sf	25	25	50	75
Poles or upright	2 x 4 in.	4 x 4 in.	4 x 4 in.	4 x 6 in.
Maximum pole spacing (longitudinal)	6 feet	10 feet	8 feet	6 feet
Maximum pole spacing (transverse)	5 feet	5 feet	5 feet	5 feet
Runners	1 x 4 in.	1 ¼ x 9 in.	2 x 10 in.	2 x 10 in.
Bearers and maximum spacing of bearers:				
3 feet	2 x 4 in.	2 x 4 in.	2 x 10 in. or 3 x 4 in.	2 x 10 in. or 3 x 5 in.
5 feet	2 x 6 in. or 3 x 4 in.	2 x 6 in. or 3 x 4 in. (rough)	2 x 10 in. or 3 x 4 in.	2 x 10 in. or 3 x 5 in.
6 feet	----	-----	2 x 10 in. or 3 x 4 in.	2 x 10 in. or 3 x 5 in.
8 feet	----	-----	2 x 10 in. or 3 x 4 in.	2 x 10 in. or 3 x 5 in.
Planking	1 ¼ x 9 in.	2 x 10 in.	2 x 10 in.	2 x 10 in.
Maximum vertical spacing of horizontal members	7 feet	9 feet	7 feet	6 ft. 6 in.
Bracing horizontal	1 x 4 in.	1 x 4 in.	1 x 6 in. or 1 ¼ x 4 in.	2 x 4 in.
Bracing diagonal	1 x 4 in.	1 x 4 in.	1 x 4 in.	2 x 4 in.
Tie-ins	1 x 4 in.	1 x 4 in.	1 x 4 in.	1 x 4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with 3/16 x 2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

Scaffolding Exercise for Independent Wood Pole Scaffolds

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Maximum intended load	25 lbs/ft (2)	25 lbs/ft (2)	50 lbs/ft (2)	75 lbs/ft (2)
Poles or uprights	2 x 4 in.	4 x 4 in.	4 x 4 in.	4 x 4 in.
Maximum pole spacing (longitudinal).	6 feet	10 feet	8 feet	6 feet
Maximum (transverse).	6 feet	10 feet	8 feet	8 feet
Runners	1 ¼ x 4 in.	1 ¼ x 9 in.	2 x 10 in.	2 x 10 in.
Bearers and maximum spacing of bearers:				
3 feet	2 x 4 in.	2 x 4 in.	2 x 10 in.	2 x 10 in (rough).
6 feet	2 x 6 in. or 3 x 4 in.	2 x 10 in. (rough) or 3 x 8 in.	2 x 10 in.	2 x 10 in. (rough).
8 feet	2 x 6 in. or 3 x 4 in.	2 x 10kn. (rough) or 3 x 8 in.	2 x 10 in	
10 feet	2 x 6 in. or 3 x 4 in.	2 x 10in. (rough) or 3 x 3 in.		
Planking	1 ¼ x 9 in.	2 x 10 in.	2 x 10 in.	2 x 10 in.
Maximum vertical spacing of horizontal members	7 feet	7 feet	6 feet	6 feet
Bracing horizontal	1 x 4 in	1 x 4 in.	1 x 6 in. or 1 ¼ x 4 in.	2 x 4 in.
Bracing diagonal	1 x 4 in.	1 x 4 in.	1 x 4 in.	2 x 4 in.
Tie-ins	1 x 4 in.	1 x 4 in.	1 x 4 in.	1 x 4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with 3/16 x 2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

Scaffolding Exercise for Tube and Coupler Scaffolds

(b) MINIMUM SIZE OF MEMBERS

	Light duty	Medium duty	Heavy duty
Maximum intended load	25 lbs/ft (2)	50 lbs/ft (2)	75 lbs/ft (2).
Posts, runners and braces	Nominal 2 in. (1.90 inches) OD steel tube or pipe.	Nominal 2 in. (1.90 inches) OD steel tube or pipe.	Nominal 2 in. (1.90 inches) OD steel tube or pipe.
Bearers	Nominal 2 in. (1.90 inches) OD steel tube or pipe and a maximum post spacing of 4 ft. x 10 ft.	Nominal 2 in. (.190 inches) OD steel tube or pipe and a maximum post spacing of 4 ft x 7 ft. or Nominal 2 ½ in. (2.375 in.). OD steel tube or pipe and a maximum post spacing of 6 ft. x 8 ft.*	Nominal 2 ½ in. (2.375 in.). OD steel tube or pipe and a maximum post spacing of 6 ft. x 6 ft.
Maximum runner spacing vertically	6 ft. 6 in.	6 ft. 6 in.	6 ft. 6 in.

Footnote(*) Bearers shall be installed in the direction of the shorter dimension. Note: Longitudinal diagonal bracing shall be installed at an angle of 45 deg. (+/- 5).

Allowable spans for 2 x 10 inch (nominal) or 2 x 9 inch (rough) solid sawn wood planks as shown in the following table which is in compliance with the National Design Specification for Wood Construction published by the National Forest Products Association.

Maximum intended nominal load (lb/sf)	Maximum permissible span using full thickness undressed lumber (feet)	Maximum permissible span using nominal thickness lumber (feet)
25	10	8
50	8	6
75	6	------

OSHA Soil Classification System

The *Unconfined Compressive Strength* is the load per unit area at which soil will fail in compression. This measure can be determined by laboratory testing, or it can be estimated in the field using a pocket penetrometer, Torvane Soil Tester or a thumb penetration test. OSHA has established a *Soil Classification System* for categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of the exposure. A *Type A Soil* is defined as a Cohesive soil with an unconfined compressive strength of 1.5 tons per square Foot (tsf) or Greater. Cohesive soil examples are clay, silty clay, sandy clay, clay loam. However *no soil is Type A if*:

1. The soil is fissured; or
2. The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
3. The soil has been previously disturbed; or
4. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
5. The material is subject to other factors that would require it to be classified as a less stable material.

A *Type B Soil* means a cohesive soil with an unconfined compressive strength greater than 0 .5 tons per square foot but less than 1.5 tsf; or Granular Cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam. Also, a soil is a Type B if previously disturbed soil except those which would otherwise be classified as a Type C soil. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or dry rock that is not stable; or material that is part of a sloped, layered systems where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

A *Type C soil* means a cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or granular soils including gravel, sand and loamy sand; or submerged soil or soil from which water is freely seeping; or submerged Rock that is not Stable; or material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper. Also, OSHA defines the *Stable Rock* classification as natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Finally, according to the OSHA standards whenever you are classifying a soil and if any of the following characteristics are encountered, then the soil type must be dropped. For example, if the soil is: 1. Fissured or tension cracks on the surface or in the wall of the trench; 2. Vibrated from nearby traffic, equipment or blasting; 3. previously disturbed or excavated areas; 4. Water freely flowing into the trench; 5. sloped layers with a 4H: 1V or steeper; 6. excavation is below the water table; 7. a rock layer is above a weaker soil layer; or 8. Blasting occurs nearby then the soil type must be lowered. Below is a summary of the OSHA Soil Classification System.

SOIL TYPE	CHARACTERISTICS				
	Water Table	Visual	Tilted Soil Layers	Soil Layers	Unconfined Compressive Strength
TYPE A SOILS Intact Hard Soils *cohesive soils *unconfined compressive strength *Examples of Type A Soils clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam & sandy clay loam.	Above water table Not saturated	No fissures, cracks, or weak layers	No tilting layers dipping into the trench with a slope of 4H: 1V or steeper	No soil layers below bed rock layers	More than 1.5 tons per sq. ft.
TYPE B SOILS * cohesive soils *unconfined compressive strength Examples are: angular gravel; silt; silt loam; fissured or subject to vibration; dry unstable rock;	Above water table Not saturated	May have Fissures or Cracks	No tilting layers dipping into the trench with a slope of 4H:1V or steeper	No soil layers below bed rock layers	Between 0.5 - 1.5 tons per sq. ft.
TYPE C SOILS *cohesive soils *granular soils such as gravel, sand and loamy sand, submerged soil, soil from which water is freely seeping, and submerged rock that is not stable.	May be within water table or Saturated	May not be able to stand on slope of 3H:1V without slumping	May contain layers tilting in at 4H:1V slope or greater		
Stable Rock					

Soil Classification Exercise

1. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 12 feet deep
Soil Observation:	Angular Gravel
Unconfined Compressive strength:	1.12 tsf
Surrounding Area & Trench Conditions:	an open field

- ☐ A. Type A soil
- ☐ B. Type B soil
- ☐ C. Type C soil
- ☐ D. Stable Rock

2. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 16 feet deep
Soil Observation:	Sand
Unconfined Compressive strength:	0.43 tsf
Surrounding Area & Trench Conditions:	an open field

- ☐ A. Type A soil
- ☐ B. Type B soil
- ☐ C. Type C soil
- ☐ D. Stable Rock

Soil Classification Exercise

3. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 6 feet deep
Soil Observation:	Clay
Unconfined Compressive strength:	1.73 tsf
Surrounding Area & Trench Conditions:	An open Field

☐ A. Type A soil
☐ B. Type B soil
☐ C. Type C soil
☐ D. Stable Rock

4. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 14 feet deep
Soil Observation:	Sandy Clay
Unconfined Compressive strength:	1.73 tsf
Surrounding Area & Trench Conditions:	water is freely seeping

☐ A. Type A soil
☐ B. Type B soil
☐ C. Type C soil
☐ D. Stable Rock

Soil Classification Exercise

5. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 9 feet deep
Soil Observation:	Silty Clay
Unconfined Compressive strength:	2.40 tsf
Surrounding Area & Trench Conditions:	Previously Disturbed Soil

☐ A. Type A soil
☐ B. Type B soil
☐ C. Type C soil
☐ D. Stable Rock

6. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 16 feet deep
Soil Observation:	Sandy Clay
Unconfined Compressive strength:	0.47 tsf
Surrounding Area & Trench Conditions:	Sloped Layered system with 4H:1V

☐ A. Type A soil
☐ B. Type B soil
☐ C. Type C soil
☐ D. Stable Rock

7. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 13 feet deep
Soil Observation:	Clay Loam
Unconfined Compressive strength:	1.56 tsf
Surrounding Area & Trench Conditions:	Vibration Nearby

- ☐ A. Type A soil
- ☐ B. Type B soil
- ☐ C. Type C soil
- ☐ D. Stable Rock

8. You have performed the following Visual inspection and manual tests. How would you classify a soil that has the following properties?

Visual Observations:	Trench 7 feet deep
Soil Observation:	Sandy Loam
Unconfined Compressive strength:	1.05 tsf
Surrounding Area & Trench Conditions:	Previously Disturbed

- ☐ A. Type A soil
- ☐ B. Type B soil
- ☐ C. Type C soil
- ☐ D. Stable Rock

9. What is the maximum lateral travel distance to a means of egress in a 5' deep trench?

- ☐ A. 25 feet
- ☐ B. 50 feet
- ☐ C. 75 feet
- ☐ D. 100 feet

OSHA Timber Shoring

A *Support System* is a structure such as a timber shoring system or hydraulic shoring system that supports the sides of an excavation and protects employees against cave-ins. According to the OSHA Excavation Safety Standards, anytime a worker enters a trench at least five (5) feet deep you must provide protection from cave-ins. After a qualified person has determined the type of soil, they have a few options. First, they can design a shoring system using the Shoring Designs provided in the Standards. The Second option is to design a support system using a Manufacturer's system. Finally, they can use a trench box. Below we will define the shoring options outlined in the excavation safety standards for shoring systems under twenty feet deep. According to the OSHA Construction Standards, for excavations over twenty (20) feet deep you must contact a Registered Professional Engineer (RPE) to design the protection system.

Subpart P titled Excavations under Paragraph1926.650, .651, .652 and Appendix C to Subpart P titled Timber Shoring for Trenches contain information that can be used to design timber shoring Systems or Aluminum Hydraulic Shoring. According to OSHA the Shoring Timber Tables are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations."

Shoring Tables Classified by Soil Type

OSHA has classified shoring tables as C for Timber shoring and D for Aluminum Hydraulic shoring. The Timber Shoring Tables C are further broken down by the type of material: Mixed Oak or Douglas Fir. The C-1.1, C-1.2 and C- 1.3 are based on using *Mixed Oak* with actual dimensions. Table C-1.1 is for a Type A soil. Table 1.2 is for a Type B soil. Table 1.3 is for a Type C soil. Another group of Timber Shoring Tables C-2.1, C-2.2 and C-2.3 are based on using *Douglas Fir* with nominal sizes (S4S). Table C-2.1 is for a Type A soil. Table 2.2 is for a Type B soil. Table 2.3 is for a Type C soil.

The *Aluminum Hydraulic Shoring* Tables D-1.1 through D-1.4 state the maximum vertical and horizontal spacings that may be used. Tables D 1.1 and D-1.2 are for vertical shores in Type A and Type B soils. Tables D-1.3 and D-1.4 are for a Horizontal Waler Systems in Type B and Type C soils. In conclusion, all of the tables are arranged by Soil Type and the data was developed to apply to the situations that are most commonly experienced in current trenching practice. Finally, all of the tables only apply to Timber and Hydraulic shoring systems that do not exceed 20 feet deep excavations.

Shoring Components

The *OSHA Standards for the Construction Industry 29 CFR Part 1926.650(b)* titled, Definitions applicable to subpart P - Excavations defines the following shoring terms. *Sheeting* means the individual members of a shoring system that are closely spaced together to retain the earth. Sheeting is also called Uprights or Sheet Piling. *Uprights* mean the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other (p 253).

Wales are the horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or set perpendicular to the sheeting. *Crossbraces or Struts* are the horizontal members of the shoring system that span across the width of an excavation. They are installed perpendicular to the sides of the excavation and the ends are connected to either uprights or wales.

Tight Sheeting refers to the use of specially-edged timber planks (e.g. Tongue and Groove) at least three inches thick when conditions are saturated or submerged in water as defined in the OSHA 1926.652(g), titled Notes for all Tables, paragraph 2.. Steel sheet piling when driven must provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. According to 1926 Subpart P Appendix C (g) *Notes for all Tables.* 2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least 3 inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. According to 1926 Subpart P Appendix C (g) *Notes for all Tables.* 2. Close Sheeting refers to the placement fo planks side-by-side allowing as little space as possible between them. *Close Sheeting* refers to the space between the timber planks not to exceed ½ inch when placed edge to edge according to OSHA 1926.652(g), titled Notes for all Tables, paragraph 2.

Finally, under the Depth of Trench (Feet) column at the Over 20 (feet) row it says, See Note 1 and Note 1 under OSHA 1926.652(g), titled Notes for all Tables paragraph (1) states that members sizes at spacings other than indicated are to be determined as specified in 1926.652(c) titled, Design of Protective Systems. This section goes on to say that “designs of supports systems, shield systems and other protective systems shall be selected and constructed by the contractor or their designee and shall be in accordance with the paragraph (c) (1) titled, Option (1) - *Designs using Appendices A, C and D*. Another alternative in paragraph (c)(2) titled, Option (2) - *Designs Using Manufacturer’s Tabulated Data*. A third alternative in paragraph (c)(3) titled, Option (3) - *Designs using other tabulated data.* A fourth alternative in paragraph (c)(4) titled, Option (4) - *Design by a Registered Professional Engineer*.

Given the Soil type, the depth and width of the trench and the type of timber available, below is an example on how to utilize the timber tables to determine the size of the members and the on-center spacing of each component.

Soil Type	C
Depth	13 Feet
Width	5 Feet
Timber Species Available	Mixed Oak

From the information above, there are two acceptable arrangements from using the table selected.

Example of Timber Shoring Requirements for Arrangement #1

Type of Soil Identified	Type of Material Utilized	Shoring Table Number Selected
C	Mixed Oak	C - 1.3
MEMBERS	SIZE	ON-CENTER SPACING
Cross braces	8" x 8"	Horizontal _____6 Feet__ Vertical _____5 Feet__
Wales	10" x 12"	Vertical 5 Feet
Uprights	2" x 6"	Spacing Close

Arrangement #2

Type of Soil Identified	Type of Material Utilized	Shoring Table Number Selected
C	Mixed Oak	C - 1.3
MEMBERS	SIZE	ON-CENTER SPACING
Cross braces	8" x 10"	Horizontal _____8 Feet Vertical _____ 5 Feet
Wales	12 " x 12"	Vertical 5 Feet
Uprights	2" x 6" Water Tight: Tongue & Groove	Spacing Close

OSHA Soil Classification System is outlined below. Type A is a cohesive soil with an unconfined compressive strength of 1.5 ton per square foot (Tsf) or Greater. *Cohesive soil* examples are clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, *No soil is classify as a Type A If:*

(1) The soil is fissured.

(2) The soil is subject to vibration from heavy traffic or pile driving.

(3) The soil has been previously disturbed soil.

(4) The soil is a part of a sloped, layered system where the layers dip into the Excavation on a slope of four horizontal to one vertical (4H:1V) or greater

E. The material is subject to other factors that would require it to be classified as a less stable material.

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Type B Cohesive Soil with an unconfined compressive strength greater than .5 tons per square foot but less than 1.5 tsf. *Granular Cohesionless soils* including angular gravel, silt, silt loam, sandy loam and in some cases silty clay loam and sandy clay loam. Also,

(1) Previously disturbed soils except those which would otherwise be classified as Type C soil.

(2) Soil that meets the unconfined compressive strength or cementation requirements of a Type A soil, but is fissured or subject to vibration.

(3) Dry rock that is not stable.

(4) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C Cohesive soil with an unconfined compressive strength of .5 Tsf or less. *Granular soils* include gravel, sand and loamy soil or

(1) Submerged soil or Soil from which water is freely seeping

(2) Submerged Rock that is not Stable.

(3) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

OSHA Shoring Tables Exercise

1. What does the term Uprights from the timber shoring tables mean?

- ☐ A. The vertical supports that separate the wales.
- ☐ B. The vertical sheet piles that restrain the soil.
- ☐ C. The studs or braces that support the vertical shoring system.
- ☐ D. The posts or shores that support the horizontal shoring system.

2. What is the Difference between the C series and D series Tables?

- ☐ A. Table C is for Aluminum Hydraulic Shoring. and Table B is for Soil Type A.
- ☐ B. Table C is for Steel Sheeting and Table D is for Aluminum Hydraulic Shores.
- ☐ C. Table C is for Maximum Allowable Slopes and Table D is for Sloping.
- ☐ D. Table C is for Timber Shoring and Table D is for Aluminum Hydraulic.

3. What is the difference between Table C-1.1 and C-2.1?

- ☐ A. Table C-1.1 is for Mixed Oak and Table C-2.1 is for Douglas Fir.
- ☐ B. Table C-1.1 is for Douglas Fir and Table C-2.1 is for Mixed Oak.
- ☐ C. Table C-1.1 is for Soil Type A and Table C-2.1 is for Soil Type B.
- ☐ D. Table C-1.1 is for Steel Sheeting and Table C-2.1 is for Aluminum Hydraulic.

4. What is the difference between Table C-1.1 and C-1.2?

- ☐ A. Table C-1.1 is for Mixed Oak and Table C-1.2 is for Douglas Fir.
- ☐ B. Table C-1.1 is for Douglas Fir and Table C-1.2 is for Mixed Oak.
- ☐ C. Table C-1.1 is for Soil Type A and Table C-1.2 is for Soil Type B.
- ☐ D. Table C-1.1 is for Steel Sheeting and Table C-1.2 is for Aluminum Hydraulic.

5. What is the maximum depth that you can use shoring tables C and D?

- ☐ A. 20 Feet
- ☐ B. 60 Feet
- ☐ C. 100 Feet
- ☐ D. 125 Feet

OSHA Shoring Tables Exercise

Questions 6 and 7 refer to the Timber Shore Tables C & the Hydraulic Shore Tables D attached.

6. A trench is excavated in a Type A soil, 13 feet deep and 5 feet wide. The cross braces available are a 6" x 6" and the shoring available is a Mixed Oak. What is the horizontal and vertical spacing of the cross braces, the size and spacing of the wales and the size and spacing of the sheeting?

- ☐ A. Cross braces are spaced 6 feet horizontally and 5 feet vertically. The wales are 8" x 8" spaced 5 feet vertically, and the uprights are 2" x 6" spaced 2 feet horizontally.
- ☐ B. Cross braces are spaced 8 feet horizontally and 4 feet vertically. The wales are 6" x 8" spaced 4 feet vertically, and the uprights are 4" x 6" spaced 4 feet horizontally.
- ☐ C. Cross braces are spaced 10 feet horizontally and 4 feet vertically. The wales are 8" x 10" spaced 4 feet vertically, and the uprights are 2" x 6" spaced 5 feet horizontally.
- ☐ D. Cross braces are spaced 10 feet horizontally and 4 feet vertically. The wales are 8" x 8" spaced 4 feet vertically, and the uprights are 4" x 8" spaced 5 feet horizontally.

7. A trench is excavated in a Type B soil, 19 feet deep and 5 feet wide. The cross braces available are a 8" x 8" and the shoring available is a Douglas Fir. What is the horizontal and vertical spacing of the cross braces, the size and spacing of the wales and the size and spacing of the sheeting?

- ☐ A. Cross braces are spaced 6 feet horizontally and 5 feet vertically. The wales are 10" x 12" spaced 5 feet vertically, and the uprights are 3" x 6" spaced close horizontally.
- ☐ B. Cross braces are spaced 6 feet horizontally and 5 feet vertically. The wales are 6" x 8" spaced 4 feet vertically, and the uprights are 4" x 6" spaced close horizontally.
- ☐ C. Cross braces are spaced 10 feet horizontally and 4 feet vertically. The wales are 8" x 10" spaced 4 feet vertically, and the uprights are 3" x 6" spaced close horizontally.
- ☐ D. Cross braces are spaced 10 feet horizontally and 5 feet vertically. The wales are 12" x 12" spaced 5 feet vertically, and the uprights are 4" x 6" spaced close horizontally.

OSHA Shoring Tables Exercise using Table C-1.1 Timber Trench Shoring — Minimum Timber Requirements
Soil Type A $P_a = 25 \times H + 72$ PSF (2 FT Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	NOT REQ'D					2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	NOT REQ'D						2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	NOT REQ'D					3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X6	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6x8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

OSHA Shoring Tables Exercise using Table C-1.2 Timber Trench Shoring — Minimum Timber Requirements *
Soil Type B $P_a = 45 X H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6x6	6X6	6X6	5	6x8	5			2x6		
	UP TO 8	6x6	6x6	6x6	6x8	6x8	5	8x10	5			2x6		
	UP TO 10	6x6	6x6	6x6	6x8	6x8	5	10x10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6x6	6x6	6x6	6x8	6x8	5	8x8	5		2x6			
	UP TO 8	6x8	6x8	6x8	8x8	8x8	5	10x10	5		2x6			
	UP TO 10	8x8	8x8	8x8	8x8	8x10	5	10x12	5		2x6			
	See Note 1													
15 TO 20	UP TO 6	6x8	6x8	6x8	8x8	8x8	5	8x10	5	3X6				
	UP TO 8	8x8	8x8	8x8	8x8	8x10	5	10x12	5	3X6				
	UP TO 10	8x10	8x10	8x10	8x10	10x10	5	12x12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

OSHA Shoring Tables Exercise using Table C-1.3 Timber Trench Shoring — Minimum Timber Requirements*
Soil Type C P_a - 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6x8	6x8	6x8	8x8	8x8	5	8x10	5	2x6				
	UP TO 8	8x8	8x8	8x8	8x8	8x10	5	10x12	5	2x6				
	UP TO 10	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8x8	8x8	8x8	8x8	8x10	5	10x12	5	2x6				
	UP TO 8	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2x6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8x10	8x10	8x10	8x10	10x10	5	12x12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

OSHA Shoring Tables Exercise using Table C-2.1 Timber Trench Shoring — Minimum Timber Requirements *
Soil Type A P_a = 25 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4x6	
	UP TO 8	4x4	4x4	4x4	4x6	4x6	4	Not Req'd	Not Req'd					4x6
	UP TO 10	4x6	4x6	4x6	6x6	6x6	4	8x8	4			4x6		
	UP TO 12	4x6	4x6	4x6	6x6	6x6	4	8x8	4				4x6	
10 TO 15	UP TO 6	4x4	4x4	4x4	6x6	6x6	4	Not Req'd	Not Req'd				4x10	
	UP TO 8	4x6	4x6	4x6	6x6	6x6	4	6x8	4		4x6			
	UP TO 10	6x6	6x6	6x6	6x6	6x6	4	8x8	4			4x8		
	UP TO 12	6x6	6x6	6x6	6x6	6x6	4	8x10	4		4x6		4x10	
15 TO 20	UP TO 6	6x6	6x6	6x6	6x6	6x6	4	6x8	4	3x6				
	UP TO 8	6x6	6x6	6x6	6x6	6x6	4	8x8	4	3x6	4x12			
	UP TO 10	6x6	6x6	6x6	6x6	6x8	4	8x10	4	3x6				
	UP TO 12	6x6	6x6	6x6	6x8	6x8	4	8x12	4	3x6	4x12			
OVER 20	SEE NOTE 1													

* Douglas Fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

OSHA Shoring Tables Exercise using Table C-2.2 Timber Trench Shoring — Minimum Timber Requirements *
Soil Type B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4x6	6X6	6X6	5	6x8	5			3 x 12 4 x 8		4 x 12
	UP TO 8	4x6	4x6	6x6	6x6	6x6	5	8x8	5		3 x 8		4 x 8	
	UP TO 10	4x6	4x6	6x6	6x6	6x8	5	8x10	5			4 x 8		
	See Note 1													
10 TO 15	UP TO 6	6x6	6x6	6x6	6x8	6x8	5	8x8	5	3 x 6	4 x 10			
	UP TO 8	6x8	6x8	6x8	8x8	8x8	5	10x10	5	3 x 6	4 x 10			
	UP TO 10	6x8	6x8	8x8	8x8	8x8	5	10x12	5	3 x 6	4 x 10			
	See Note 1													
15 TO 20	UP TO 6	6x8	6x8	6x8	6x8	8x8	5	8x10	5	4 X 6				
	UP TO 8	6x8	6x8	6x8	8x8	8x8	5	10x12	5	4 X 6				
	UP TO 10	8x8	8x8	8x8	8x8	8x8	5	12x12	5	4 X 6				
	See Note 1													
OVER 20	SEE NOTE 1													

*Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

OSHA Shoring Tables Exercise using Table C-2.3 Timber Trench Shoring — Minimum Timber Requirements *
Soil Type C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6x6	6x6	6x6	6x6	8x8	5	8x8	5	3x6				
	UP TO 8	6x6	6x6	6x6	8x8	8x8	5	10x10	5	3x6				
	UP TO 10	6x6	6x6	8x8	8x8	8x8	5	10x12	5	3x6				
	See Note 1													
10 TO 15	UP TO 6	6x8	6x8	6x8	8x8	8x8	5	10x10	5	4x6				
	UP TO 8	8x8	8x8	8x8	8x8	8x8	5	12x12	5	4x6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8x8	8x8	8x8	8x10	8x10	5	10x12	5	4x6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

*Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may by substituted for wood.

OSHA Shoring Tables Exercise using Table D - 1.1 Aluminum Hydraulic Shoring - Vertical Shores for Soil Type A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

OSHA Shoring Tables Exercise using Table D - 1.2 Aluminum Hydraulics Shoring - Vertical Shores for Soil Type B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

OSHA Shoring Tables Exercise using Table D - 1.3 Aluminum Hydraulic Shoring - Waler Systems for Soil Type B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN')	WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE (2)	8.0	3 IN	---	---	3X12
		7.0	9.0	2 IN	9.0	2 IN NOTE (2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)	6.0	3 IN	---	3X12	---
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE (2)	5.5	3 IN	3X12	---	---
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in appendix D, Item (g)

Notes: (1): See Appendix D. item (g) (1).

Notes: (2): See Appendix D. item (g) (2). *Consult manufacturer/Qualified engineer for Section Modulus of wales.

OSHA Shoring Tables Exercise using Table D - 1.4 Aluminum Hydraulic Shoring - Waler Systems for Soil Type C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN')	WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)	6.0	3 IN	3X12	---	---
		7.0	6.5	2 IN	6.5	2 IN NOTE (2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE (2)	4.0	3 IN	3X12	---	---
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE (2)	3.5	3 IN	3X12	---	---
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in appendix D, Item (g)

Notes: (1): See Appendix D. item (g) (1).

Notes: (2): See Appendix D. item (g) (2). *Consult manufacturer/Qualified engineer for Section Modulus of wales.