



HEARING CONSERVATION

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Hearing conservation is a major issue in the construction industry and in roofing operations, as well. A wide variety of roofing equipment is capable of producing levels of noise that may be harmful. Drills, saws, gasoline-powered equipment such as gravel sweepers, roof cutters, planers, rock removers, pneumatic tools or power washers can create enough noise to present a hazard to nearby workers. Roofing workers also may be subject to other noise from equipment operated on the job site by other trades. This training is intended to address hearing-loss issues in the workplace and the procedures for ensuring compliance with the Occupational Safety and Health Administration's (OSHA's) hearing conservation requirements found at 29 CFR 1926.52.

SOUND

Sound is the result of rapid atmospheric pressure changes caused by agitation of the air. Imagine a cymbal being struck. As the cymbal vibrates, it alternately pushes and pulls the air, creating a compression and then a vacuum. The cycle repetition causes a wave to resonate in an outward direction.

The wave travels through the air, ultimately reaching the ear drum and causing it to vibrate. The vibration is transferred from the drum to the inner ear, which is comprised of three bones: the anvil, stirrup and hammer. These bones are attached to the cochlea, a liquid-filled tube with thousands of tiny hair cells. The vibrating inner ear bones move the cochlea, which disturbs the liquid and ultimately moves the hair cells. When the hair cells move, they transmit electrical impulses to the auditory nerve. Those impulses are interpreted as sound.

Under normal, quiet conditions, the hair cells are erect, or perpendicular, to the cochlea's wall. Exposure to loud noises causes the hair cells to lie down, or move closer to parallel, which creates the familiar "ringing" sensation. Over time, the hair cells move back to their perpendicular position, which ends the ringing sensation.

Human beings gradually lose hair cells in the cochlea as they age. These hair cells do not regenerate; once they die, they are gone forever. In the case of natural

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hearing loss, hearing aids can be used to amplify sound to the remaining hair cells, allowing the auditory nerve to continue to receive impulses. Excessive exposure to noise in the workplace also can lead to the loss of hair cells. However, this type of hearing loss does not benefit from the use of hearing aids.

OCCUPATIONAL NOISE EXPOSURE REQUIREMENTS

There are three scales by which noise is measured: A, B and C. The American Conference of Governmental Industrial Hygienists has adopted the A scale as the basis of all measurements. The action level mandated by OSHA in construction, where engineering controls, work practices or hearing protection must be provided, is when noise levels exceed an eight-hour time-weighted average (TWA) of 90 decibels in the A-weighted scale (dBA).

ENGINEERING CONTROLS

Roofing contractors should assess all options available for reducing noise generation. Many of the typical engineering controls, such as acoustical tile, sound-proof rooms and other noise-dampening controls, are primarily indoor measures and therefore may be impractical for roofing contractors. Mufflers, however, are a practical solution for combustion engine noise, and some new equipment is being manufactured with silencing devices to reduce noise.

ADMINISTRATIVE CONTROLS

Another option to reduce noise exposure is to implement administrative controls by rotating jobs so employees operate or work near noisy equipment for only a few hours at a time. Like engineering controls, administrative controls may be difficult for roofing contractors to implement because many crews do not have the manpower to support this procedure. Table D-2, reproduced from 29 CFR 1926.52(d)(2), illustrates the length of time an employee can be exposed to different noise levels.

Exposure Duration (Hours)	Noise Level (dBA)
8	90
6	92

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4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	

PERSONAL PROTECTIVE EQUIPMENT

The last option is the use of PPE. This is OSHA’s least favorite option because human error—for example, failing to insert earplugs properly—can greatly reduce the effectiveness of the protection. However, regardless of OSHA’s preferences, PPE is used extensively in the construction industry out of sheer necessity. If D&D Tech Systems, Inc. choose the PPE option must ensure ear devices are fitted to employees or the proper devices have been selected by a competent person, according to the requirements of 29 CFR 1926.101.

DETERMINING NOISE LEVELS

The first step in noise-level testing is to determine the noise levels generated by individual pieces of equipment, and this responsibility falls on the contractor. Hand-held sound meters measure noise exposure and are lightweight, easy to operate and relatively inexpensive—some cost less than \$100. However, many contractors prefer to hire a consultant to do more comprehensive testing to gauge noise exposure. If the noise level exceeds levels in Table D-2 of 29 CFR 1926.52, engineering controls, work practices or PPE must be implemented to reduce the exposures to safer levels. More detailed, professional monitoring of noise levels may be required to get a specific picture of the nature of the exposure so that appropriate action may be taken.

HEARING PROTECTION

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If hearing protection is necessary, D&D Tech Systems, Inc. or Company where employees are working must provide it at no cost to the employee. Employees may select from a variety of hearing protection options. There are two basic styles: over-the-ear protectors (ear muffs) and in-the-ear protectors (ear plugs or canal caps). Ear plugs can be reusable and fitted to a person's ear or disposable and made of expandable foam. Expandable foam plugs are generally the cheapest, most popular and most hygienic.

All hearing protectors have a noise reduction rating (NRR) that is required to be stated on the package containing the device. The method for determining the NRR was developed by the Environmental Protection Agency (EPA). To determine the effectiveness of a given hearing protector, take the NRR on the package and subtract seven from that number (which relates to an additional safety factor). Subtract the resulting number from the noise level determined from dosimetry. This value will approximate the noise level to which the employee is exposed when wearing the protector correctly.

For example, suppose the noise level is 104 dBA TWA and the hearing protectors have an NRR of 31. In order to measure their effectiveness, subtract 7 from 31, which gives an approximate 24 dBA reduction. If 24 dBA is subtracted from 104 dBA, an employee wearing the protectors properly would be exposed to an approximate noise level of 80 dBA, which falls within acceptable limits.

HEARING CONSERVATION PROGRAMS

General industry employers are required to create and administer a hearing conservation program when employees are exposed to noise levels in excess of regulatory maximums. The general industry hearing conservation program requirement, which is not present in the construction standard, outlines the specific elements that must be included in a hearing conservation program. Some of those elements may be of interest to roofing contractors in developing their safety program. These include:

- Monitoring employee exposure
- Instituting engineering, work-practice and administrative controls
- Fitting each employee exposed to excessive noises with hearing protection

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- Training each exposed employee to understand noise hazards and techniques to protect themselves
- Monitoring employee exposure through baseline and annual audiometry readings
- Taking measures to prevent further hearing loss when any loss has been detected during annual audiograms
- Keeping records

HEARING CONSERVATION PROGRAM

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D&D Tech Systems, Inc. recognizes that exposure to loud noise can damage employees hearing. The following work practices have been implemented to minimize the potential risks.

INTRODUCTION

- Appropriate hearing protection will be worn as specified by project supervisors. Hearing protection will be worn when it will provide greater safety and protection benefits.
- When working at a client's site, employees will adhere to the hearing-protection requirements of either the client or D&D Tech Systems, Inc., whichever requirements are more stringent.
- The requirements outlined below are mandatory while working in this company's workshop or on its projects. They apply to all employees, visitors and contractors.

IDENTIFICATION OF NOISE SOURCES

- Noise levels will be determined for all high-noise areas and equipment.
- Representative monitoring will be performed to determine personnel exposures where appropriate.
- Equipment or areas with noise levels equal to or exceeding 85 dBA will be identified with labels or signs, which will be posted on the individual pieces of equipment (whether owned and leased) or at the entrance to noisy areas.
- The sign or label will state either "Hearing Protection Is Required While the Equipment Is Operating" or "Hearing Protection Is Required While Working in the Area" or similar wording, as appropriate.
- Equipment typically requiring labels includes but is not limited to compressors, forklifts, generators and pneumatic tools.
- Labels will be placed where the operator can readily see the warning, such as next to power switches.
- The requirements of this policy will be included in specifications when purchasing, renting or leasing equipment.

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REDUCTION OF NOISE LEVELS

- Whenever practical, noise levels identified as exceeding 85 dBA will be reduced by means of engineering or administrative controls, including isolation, enclosure and application of noise-reduction materials.
- Noise reduction ratings (NRRs) must be considered when selecting the type of hearing protection (ear plugs, ear muffs or both) for a particular job.

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- Only company-approved hearing protection will be used.
- Hearing protection will be worn at all times when noise levels are suspected of equaling or exceeding 85 dBA.
- Use of portable radios with earphones is prohibited at all times.

AUDIOMETRIC TESTING

Audiometric testing monitors an employee's hearing overtime. It also provides an opportunity for D&D Tech Systems, Inc. to educate employees about their hearing and the need to protect it.

The D&D Tech Systems, Inc. must establish and maintain an audiometric testing program. The important elements of the program include baseline audiograms, annual audiograms, training, and follow up procedures. D&D Tech Systems, Inc. must make audio metric testing available at no cost to all employees who are exposed to an action level of 85 dB or above, measured as an 8-hour TWA.

The audiometric testing program follow up should indicate whether the D&D Tech Systems, Inc. hearing conservation program is preventing hearing loss. A licensed or certified audiologist, otolaryngologist, or other physician must be responsible for the program. Both professionals and trained technicians may conduct audiometric testing.

The professional in charge of the program does not have to be present when a qualified technician conducts tests. The professional's responsibilities include

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overseeing the program and the work of the technicians, reviewing problem audiograms, and determining whether referral is necessary.

The employee needs a referral for further testing when test results are questionable or when related medical problems are suspected. If additional testing is necessary or if D&D Tech Systems, Inc. suspects a medical pathology of the ear that is caused or aggravated by wearing hearing protectors, the D&D Tech Systems, Inc. must refer the employee for a clinical audio logical evaluation or otological exam, as appropriate. There are two types of audiograms required in the hearing conservation program: baseline and annual audiograms.

BASELINE AUDIOGRAM

The baseline audiogram is the reference audiogram against which future audiograms are compared. D&D Tech Systems, Inc. will provide baseline audiograms within 6 months of an employee's first exposure at or above an 8-hour TWA of 85 dB. An exception is allowed when the employer uses a mobile test van for audiograms. In these instances, baseline audiograms must be completed within 1 year after an employee's first exposure to workplace noise at or above a TWA of 85 dB. Employees, however, must be fitted with, issued, and required to wear hearing protectors whenever they are exposed to noise levels above a TWA of 85 dB for any period exceeding 6 months after their first exposure until the baseline audiogram is conducted.

Employees should not be exposed to workplace noise for 14 hours before the baseline test or wear hearing protectors during this time period.

ANNUAL AUDIOGRAMS?

D&D Tech Systems, Inc. must provide annual audiograms within 1 year of the baseline. It is important to test workers' hearing annually to identify deterioration in their hearing ability as early as possible. This enables D&D Tech Systems, Inc. to initiate protective follow up measures before hearing loss progresses. D&D Tech Systems, Inc. must compare annual audiograms to baseline audiograms to determine whether the audiogram is valid and whether the employee has lost

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hearing ability or experienced a standard threshold shift (STS). An STS is an average shift in either ear of 10 dB or more at 2,000, 3,000, and 4,000 hertz.

WHAT IS D&D TECH SYSTEMS, INC. REQUIRED TO DO FOLLOWING AN AUDIOGRAM EVALUATION?

D&D Tech Systems, Inc. must fit or refit any employee showing an STS with adequate hearing protectors, show the employee how to use them, and require the employee to wear them. D&D Tech Systems, Inc. must notify employees within 21 days after the determination that their audiometric test results show an STS. Some employees with an STS may need further testing if the professional determines that their test results are questionable or if they have an ear problem thought to be caused or aggravated by wearing hearing protectors. If the suspected medical problem is not thought to be related to wearing hearing protection, the D&D Tech Systems, Inc. must advise the employee to see a physician. If subsequent audiometric tests show that the STS identified on a previous audiogram is not persistent, employees whose exposure to noise is less than a TWA of 85 dB may stop wearing hearing protectors.

D&D Tech Systems, Inc. may substitute an annual audiogram for the original baseline audiogram if the professional supervising the audiometric program determines that the employee's STS is persistent. D&D Tech Systems, Inc. must retain the original baseline audiogram, however, for the length of the employee's employment. This substitution will ensure that the same shift is not repeatedly identified. The professional also may decide to revise the baseline audiogram if the employee's hearing improves. This will ensure that the baseline reflects actual hearing thresholds to the extent possible. D&D Tech Systems, Inc. must conduct audiometric tests in a room meeting specific background levels and with calibrated audiometers that meet American National Standard Institute (ANSI) specifications of SC-1969.

WHEN IS D&D TECH SYSTEMS, INC. REQUIRED TO PROVIDE HEARING PROTECTORS?

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D&D Tech Systems, Inc. must provide hearing protectors to all workers exposed to 8-hour TWA noise levels of 85 dB or above. This requirement ensures that employees have access to protectors before they experience any hearing loss.

Employees must wear hearing protectors:

- For any period exceeding 6 months from the time they are first exposed to 8-hour TWA noise levels of 85 dB or above, until they receive their baseline audiograms if these tests are delayed due to mobile test van scheduling;
- If they have incurred standard threshold shifts that demonstrate they are susceptible to noise; and
- If they are exposed to noise over the permissible exposure limit of 90 dB over an 8-hour TWA.

D&D Tech Systems, Inc. must provide employees with a selection of at least one variety of hearing plug and one variety of hearing muff. Employees should decide, with the help of a person trained to fit hearing protectors, which size and type protector is most suitable for the working environment. The protector selected should be comfortable to wear and offer sufficient protection to prevent hearing loss.

Hearing protectors must adequately reduce the noise level for each employee's work environment. Most employers use the Noise Reduction Rating (NRR) that represents the protector's ability to reduce noise under ideal laboratory conditions. D&D Tech Systems, Inc. then adjusts the NRR to reflect noise reduction in the actual working environment.

D&D Tech Systems, Inc. must reevaluate the suitability of the employee's hearing protector whenever a change in working conditions may make it inadequate. If workplace noise levels increase, employees must give employees more effective protectors. The protector must reduce employee exposures to at least 90 dB and to 85 dB when an STS already has occurred in the worker's hearing. D&D Tech Systems, Inc. must show employees how to use and care for their protectors and supervise them on the job to ensure that they continue to wear them correctly.

TRAINING

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- A current copy of the Occupational Noise Standard, 29 CFR 1926.52, will be posted in the company's main office. Copies will be made available to employees on request.
- Once each calendar year, training will be conducted for all employees who may be exposed to noise levels of 85 dBA or greater.
- At a minimum, the training program will include a discussion of the following:
 - The purpose of hearing protection
 - The effectiveness, advantages and disadvantages of various types of hearing protection
 - Pertinent noise-monitoring results
 - Specific equipment and/or operations that produce high noise levels
 - The purpose of audiometric testing and an explanation of testing procedures
- Training records will be kept at the main office.

RESPONSIBILITIES

Each employee is responsible for:

- Following the instructions received in the training program
- Wearing proper hearing protection when needed

Foremen and supervisors are responsible for ensuring:

- Hearing protection is used in areas or operations where such use is required
- Affected employees receive appropriate training and participate in annual audiometry as required
- High-noise areas and equipment are identified and labeled accordingly

Management is responsible for:

- Determining whether noise reduction is feasible by means of engineering controls
- Ensuring adequate supplies of ear plugs or other well-maintained hearing protection devices are available
- Determining the adequacy of hearing-protection devices

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- Assisting in training as necessary
- Coordinating and overseeing all audiometric testing

WHAT EXPOSURE AND TESTING RECORDS MUST D&D TECH SYSTEMS, INC. KEEP?

D&D Tech Systems, Inc. must keep noise exposure measurement records for 2 years and maintain records of audiometric test results for the duration of the affected employee's employment. Audiometric test records must include the employee's name and job classification, date, examiner's name, date of the last acoustic or exhaustive calibration, measurements of the background sound pressure levels in audiometric test rooms, and the employee's most recent noise exposure measurement.

Beginning January 1, 2003, employers also will be required to record work-related hearing loss cases when an employee's hearing test shows a marked decrease in overall hearing. Employers will be able to make adjustments for hearing loss caused by aging, seek the advice of a physician or licensed health-care professional to determine if the loss is work-related, and perform additional hearing tests to verify the persistence of the hearing loss.

HEARING CONSERVATION CHECKLIST

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