

any kind of inserts other than approved devices

Muff Type

Cup or muff type devices cover the external ear to provide an acoustic barrier (Fig 38-8c). The attenuation provided by ear muffs varies widely due to differences in size, shape, seal material, shell mass and type of suspension. Head size and shape also influence the attenuation characteristics of these protectors. The type of cushion used between the shell and the head has a great deal to do with attenuation efficiency. Liquid or grease filled cushions give better noise suppression than plastic or foam rubber types, but may present leakage problems.

Amount of protection

Commercially available earplugs if properly fitted and used, generally reduce noise reaching the ear by 25-30 dB in the higher frequencies (Fig 38-8a), which are conceded to be the most harmful. This will provide ample protection against sound levels of 115 to 120 dB. The better type of ear muffs may reduce noise an additional 10 to 15 decibels (Fig 38-8b), making them effective against sound levels of 130 to 135 dB. Combinations of ear plugs and muffs give 3 to 5 more dB of protection. In no case will total attenuation be greater than about 50 dB because at this point, bone conduction becomes significant.

Face and Eye Protection

The protection of the eyes and face from injury by physical or chemical agents, or by radiation is of prime importance in any industrial safety program.

The eye and face protection standard, *Practice for Occupational and Educational Eye and Face Protection* (Z87.1), is a fairly comprehensive document. It sets performance standards, including detailed tests, for a broad area of hazards—excluding only X rays, gamma rays, high-energy particulate radiations, lasers, and masers.

Besides general requirements, applying to "all occupations and educational processes," the standard provides requirements on the following:

- Rigid welding helmets

- Welding hand shields
- Nonrigid welding helmets
- Attachments and auxiliary equipment—lift fronts, chin rests, snoods, aprons, magnifiers, etc
- Flammability
- Face Shields
- Goggles—eyecup (chipper's), dust and splash, welder's, and cutter's
- Spectacles—metal, plastic, and combination

Some of the requirements are stated generally. For example "Aprons or bibs for helmets shall be of nonflammable, nonconducting material that is flexible and capable of withstanding disinfection."

Other requirements are more precise. As regards flammability, for example—"The thinnest section of the rigid helmet or hand shield shall not burn at a rate greater than 3 in per minute when tested by inserting one end of a 5 by 1½ in strip of the helmet material in a blue-flame Bunsen burner."

The most significant changes of Z87 from the previous Z2.1-1959 Standard are:

- An increase in the severity of the impact resistance test for lenses. The revision illustrates the test block with two figures and prescribes that "A 100-in diameter steel ball, weighing approximately 2.4 oz shall be dropped in free fall from a height of 50 in onto the horizontal upper surface of the lens, impinging the lens within a circular area of a 5/8-in diameter centered at the lens mechanical [geometric] center. The lens shall not be chipped and the lens shall not be displaced from the frame eye in this test." Supplementing this test for lens in frame—glass and plastic—are impact resistance tests for lens on block and breakage pattern. Also specified are tests for penetration resistance (plastic), flammability (plastic), haze (plastic), and ultraviolet, luminous, and infrared transmittance (plastic and glass).
- A new requirement for lenses in welder's and cutter's goggles to be hardened to meet impact resistance requirement. "All glass filter lenses or plates shall be heat-treated