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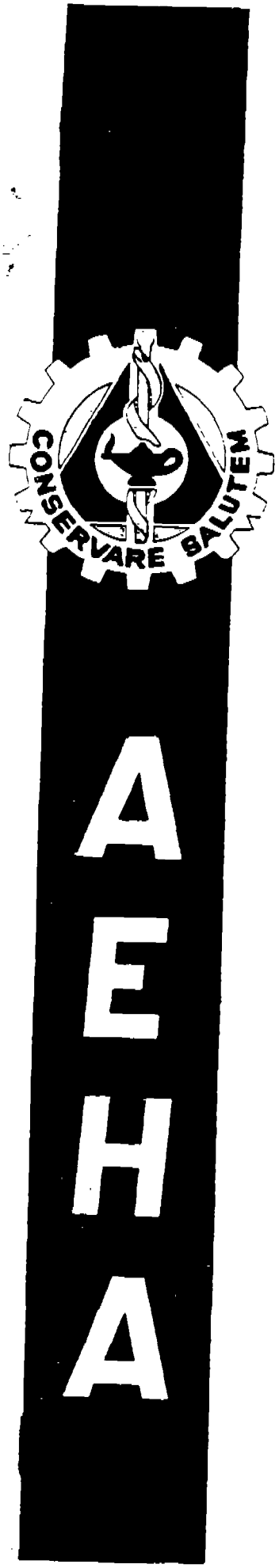

UNITED STATES ARMY ENVIRONMENTAL HYGIENE AGENCY

ABERDEEN PROVING GROUND, MD 21010-5422

PERSONAL HEARING PROTECTIVE DEVICES
FITTING, CARE, AND USE

UNCLASSIFIED

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HEARING CONSERVATION
HEARING PROTECTIVE DEVICES

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This technical guide gives guidance for the establishment of occupational hearing conservation programs and information deemed useful for personnel having the responsibility for fitting and issuing hearing protective devices.

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DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

OCT 1975

HSE-OB Technical Guide (Med)
Personal Hearing Protective Devices - Fitting, Care and Use

ACKNOWLEDGEMENT

Much of the material in this technical guide has been adopted with the permission of the American Industrial Hygiene Association from their Second Edition of the Industrial Noise Manual. Quoted material is indicated by *italicized* print. Additional material has been adopted from articles on hearing protective devices by Dr. Roger Maas.

This technical guide replaces guide dated December 1973.

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TABLE OF CONTENTS

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PERSONAL HEARING PROTECTIVE DEVICES
FITTING, CARE, AND USE

I. INTRODUCTION

A. Guidance for the establishment of occupational hearing conservation programs is furnished by TB MED 251 and applicable portions of AR 40-5.

B. Additional information deemed useful for personnel having the responsibility for fitting and issuing hearing protective devices is presented on the following pages.

C. Preservation of a person's ability to hear low level sounds or speech is of utmost importance to the fighting efficiency and safety of soldiers, particularly when their vision is limited, e.g., in situations such as sentry duty, ambushes, and patrols. The need for hearing conservation is, therefore, especially important during practice and test firings by men who may soon afterwards have to rely on their hearing for detection of enemy personnel.

D. In any instance where hazardous noise cannot be reduced through feasible engineering controls, personal protective measures must be taken. Measures for protection against steady-state noise are the same as for impulsive noise. Hearing protective devices should be worn when steady-state noise is above **levels of 85 dB(A), and when impulse noise exceeds 140 dB peak sound pressure** level (SPL). All small arms used in the military produce impulse noise above this level. Therefore, hearing protection must always be worn on firing ranges and during field firing exercises and other forms of weapons training practice or evaluation. It is not intended to imply that hearing protection should be worn when actually in combat, except where weapons are fired from positions out of the immediate zone of fighting. Even in the immediate zone of fighting, however, hearing protection may sometimes be advantageous.* The effective loss of hearing produced by use of a hearing protector can be quickly eliminated by removal of the protector. On the other hand, the loss of hearing produced by the action of noise on the unprotected ear can require many hours, sometimes even days, before recovery of hearing sensitivity. There is also the inevitable consequence that the hearing loss will become permanent if exposure continues.

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* The flight surgeon responsible for medical planning on the Son Tay prison camp raid in Viet Nam insisted that all troops wear earplugs while being airlifted. The result was that the troops arrived at the prison camp, removed their earplugs, and found their hearing unimpaired from the noise of the helicopters.

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II. THE PROPERLY WORN HEARING PROTECTOR

A. Good protection depends on a good seal between the surface of the skin and the surface of the ear protector. Any small leak can destroy the effectiveness of this protection.*

B. To fit earplugs and be able to instruct others in their proper use, the fitter should understand the subjective impressions of the user and some of the basic principles of sound transmission to the inner ear.

C. Remember the first time you heard your voice played back on a tape recorder? Didn't it sound higher in pitch than you thought it actually was? This was because you usually hear your voice by two different pathways, i.e., by air conduction and bone conduction, and you were hearing the tape-recorded voice primarily by only one of these pathways, namely air conduction. (See Figure 1)

D. When your ear canals are unblocked, the sound energy of your voice reaches your inner ear through (1) the bones and tissues of your head and (2) the air conduction route via your mouth, through your ear canals, to your eardrums, through your middle ear and finally to your inner ear. The sound of your voice conducted through the bones and tissues of your head, however, has low frequency emphasis. Since you hear your voice about as loud by air as by bone conduction, naturally your voice will sound lower in pitch to you than to anyone else.

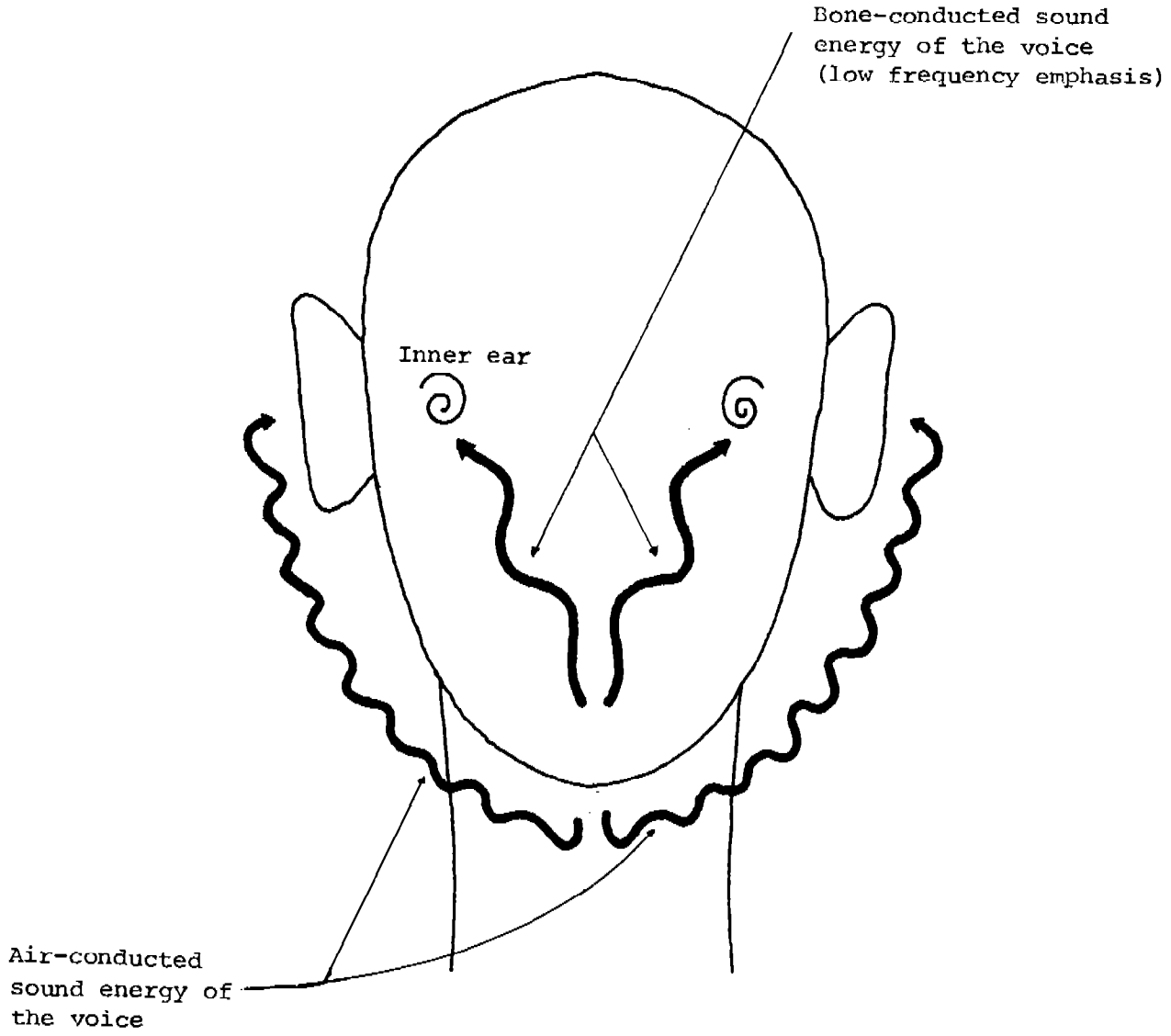
E. When your ear canals are completely blocked (occluded), the bone-conducted sound energy of your voice will sound louder to you. And since bone-conducted sound has this low frequency emphasis, your voice will sound lower in pitch and slightly muffled to you. Thus, if hearing protectors are properly fitted and seated, the user should experience a similar effect, i.e., his voice will sound muffled and lower to him, as if he were talking inside a barrel.

F. Other sounds inside the head will be similarly amplified. If there is a condition present such as tinnitus (a ringing sensation which is sometimes symptomatic of a noise-induced hearing loss) the individual wearing hearing protection might complain of a much louder ringing in his ears. Although you cannot guarantee him that the ringing will definitely go away, in time there is a good possibility that it will become less noticeable if hearing protectors are properly worn.

---

* Guide for Conservation of Hearing in Noise, A supplement to the Transactions of the American Academy of Ophthalmology and Otolaryngology, p. 25, 1973.

FIGURE 1
Air-Conducted vs Bone-Conducted Sound Energy of the Voice



EAR CANALS UNBLOCKED
Air-conducted sound energy to the inner ear is equal to the bone-conducted sound energy to the inner ear.

EAR CANALS COMPLETELY BLOCKED*
Bone-conducted sound energy to the inner ear is greater than air-conducted sound energy to the ear.

---

* Your voice will sound muffled to you, more low toned, more resonant.

G. The observation of these phenomena is significant and shows that some noise reduction has been obtained. However, they cannot be used to tell if optimum attenuation has been achieved. The individual's subjective impressions provide the best index of performance. For this reason, earplugs of other sizes and models should be tried so the individual can make the necessary comparisons.

III. COMMUNICATION WITH HEARING PROTECTORS

A. People who regularly wear hearing protectors notice that they hear speech and certain other sounds better in a noise environment. The reason for this is that the hearing mechanism is overloaded when the levels of speech and noise are high. Hearing protectors simply attenuate both speech and noise to a level that the ear handles more efficiently. Another way to explain this is that cutting down the overall noise level decreases the distortion so that speech and warning signals are heard more clearly. This is somewhat similar to wearing spectacles with tinted lenses (sunglasses), which cuts down excess glare thereby improving vision.

B. Since the sound of a machine frequently is a guide to its operation, many will ask whether they will be able to hear if their machine is running properly when they are wearing hearing protection. The answer is yes, for experience has shown that one soon becomes accustomed to the change of a familiar sound. This permits successful operation of a machine when the operator can be guided by a change in sound or a different characteristic of its sound.

C. Those with severe hearing losses may find difficulty in understanding speech and hearing warning signals and machines when hearing protectors are worn. The prevention of additional hearing loss must then take priority over the ability to understand speech and hear machines. Sometimes another warning device such as a flashing light device may be substituted for those individuals depending upon sound, or communication can be facilitated by the use of a bull horn.

D. Speech perception is not always improved by wearing hearing protectors in a noise environment of 130 dB(A) or more.* In such high level noise environments, communication must be made by interphone. Interphone communication (electronic headsets) may also solve communication problems in noise environments for those with substantial hearing loss.

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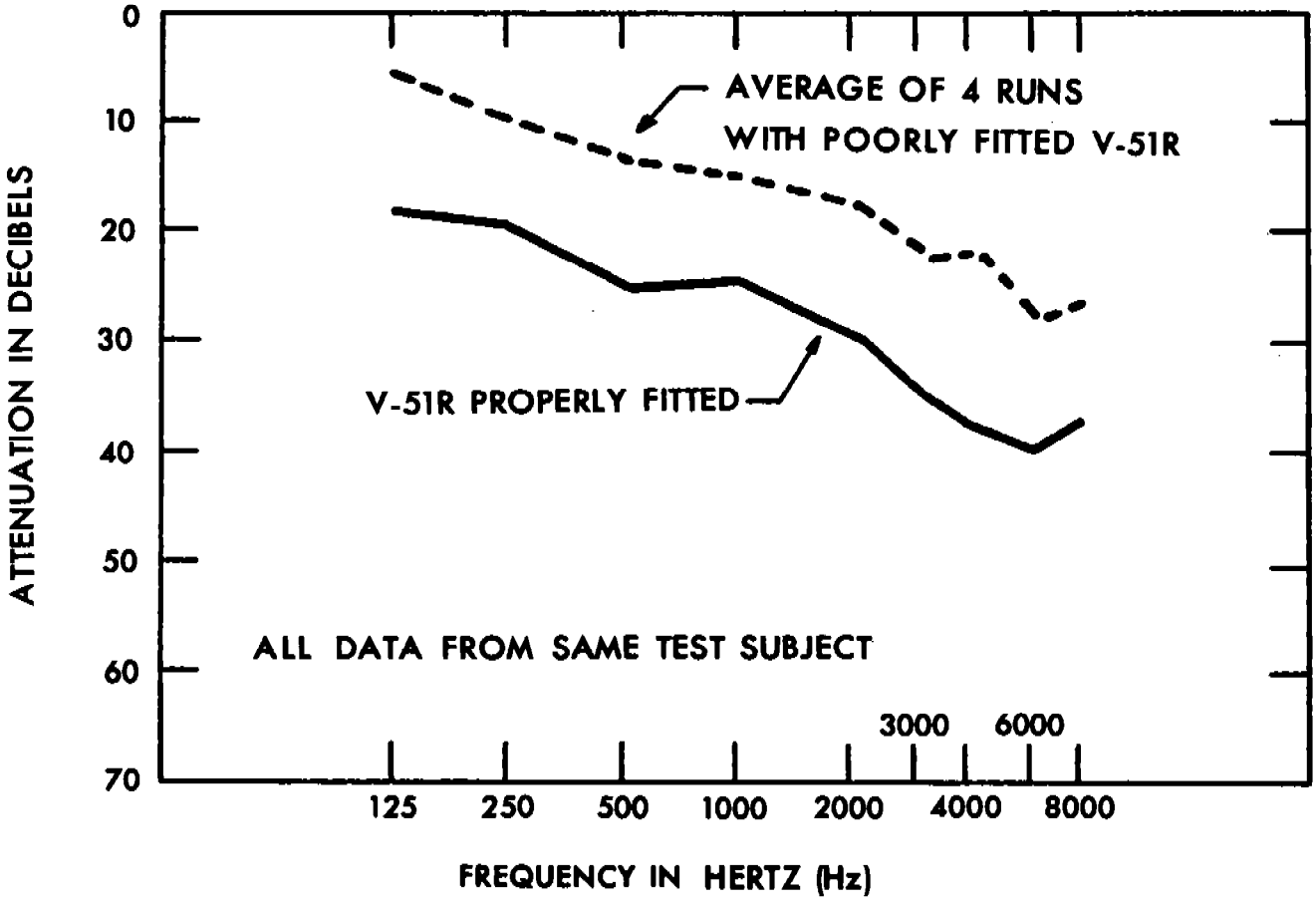
* Although Army personnel are rarely exposed to such high noise levels, additional precautions should be taken, such as wearing earplugs in combination with a headset and/or limiting the duration of exposure.

IV. DEGREES OF ATTENUATION WITH AVAILABLE DEVICES

A. If the maximum attenuation is to be achieved, acoustical leaks must be controlled. Figure 2 shows the loss in attenuation caused by poorly fitted earplugs. This loss results from leaks around the device. Acoustical leaks must also be controlled for ear muffs. The loss in attenuation increases as the leak becomes larger, i.e., as the fit becomes poorer. The loss could affect all frequencies as illustrated in Figure 2 or primarily the lower and mid-range frequencies, depending upon the physical dimensions of the leak. An earplug of dry surgical cotton allows noise to leak through and around it.

FIGURE 2

Reduction of Attenuation Resulting
from Poorly Fitted Earplugs

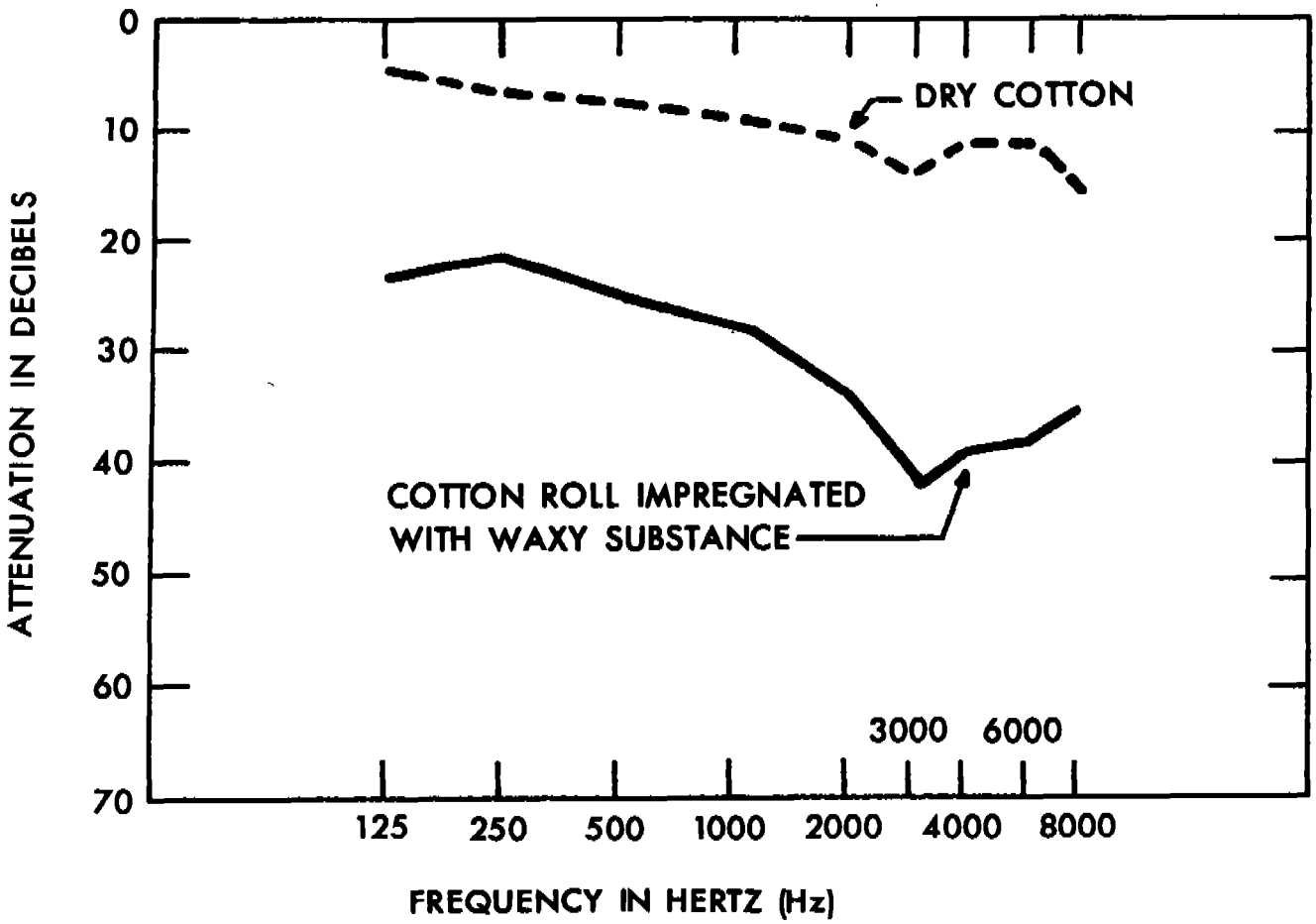


Adapted from American Industrial Hygiene Association, Industrial Noise Manual, 2nd Ed, 85, AIHA (1966).

B. As Figure 3 illustrates, dry cotton offers virtually no protection against noise.

FIGURE 3

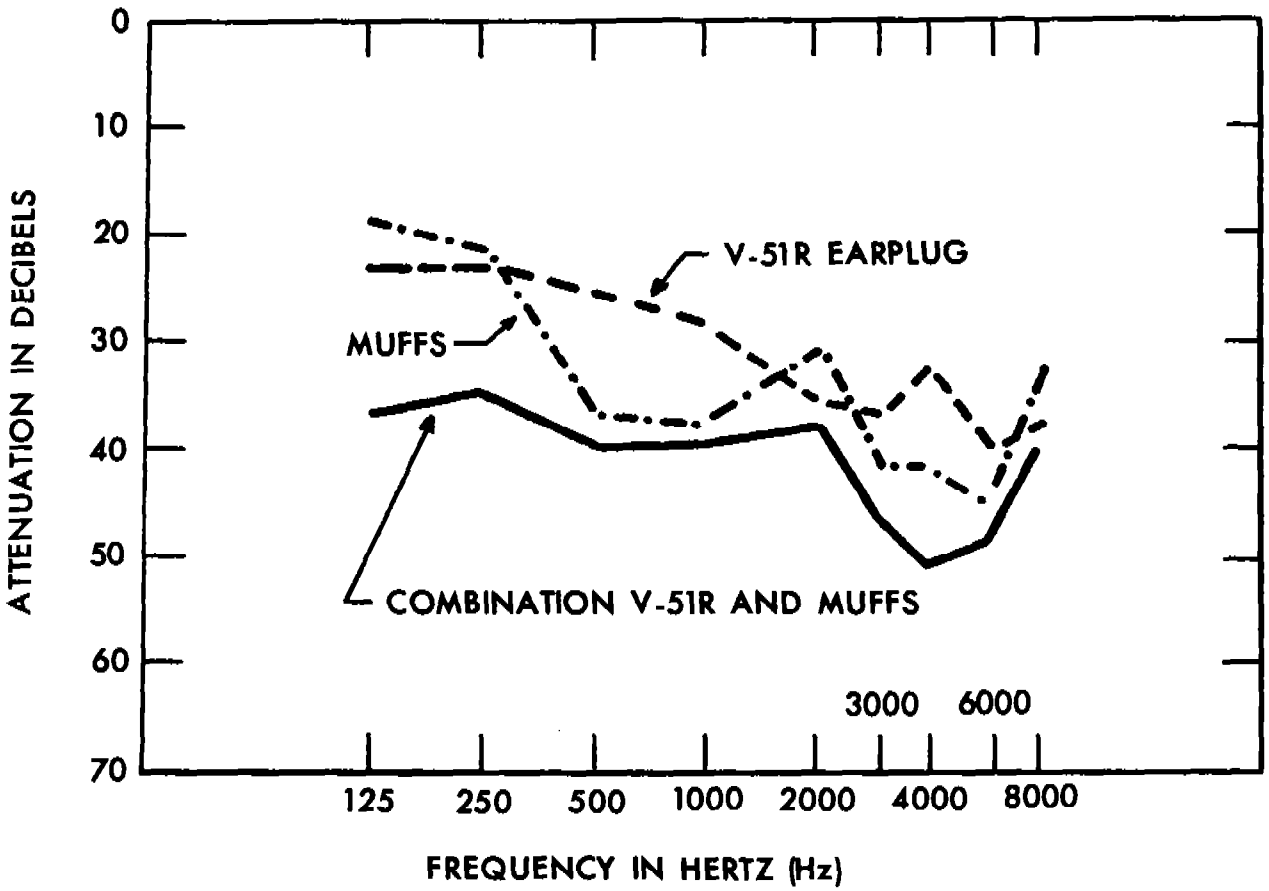
Comparison of Attenuations Obtained
from Dry Cotton and Cotton Impregnated Earplugs



Adapted from American Industrial Hygiene Association, Industrial Noise Manual, 2nd Ed, 85, AIHA (1966).

C. Earplugs and muffs used in combination usually provide a 5-10 dB greater attenuation than either one used separately (see Figure 4). Their combined use is recommended whenever steady levels exceed 110 dB(A).

FIGURE 4
Attenuation Obtained from a Typical Ear Muff
and Earplug Used Individually and in Combination



Adapted from American Industrial Hygiene Association, Industrial Noise Manual, 2nd Ed, 85, AIHA (1966)

D. *The protection afforded by a certain protector for a given individual on a given occasion may vary considerably from the general average, as well as from the individual's own average, regardless of the evaluation method used. This variance points out that the exact attenuation provided to an individual employee at any given time cannot be known. An estimate of the degree of protection* provided *must be based on the protector's average performance* (mean attenuation) determined in accordance with American National Standards Institute Standard Z24.22-1957, "Method for the Measurement of Real-Ear Attenuation of Ear Protectors at Threshold," or American National Standards Institute Standard S3.19-1974, "Method for Measurement of Real-Ear Protection of Hearing Protectors and Physical Attenuation of Ear Muffs.

E. Figure 4 shows the real-ear attenuation obtained with a good insert earplug (V-51R) and a good ear muff. As illustrated, the earplug typically

provides somewhat more protection in the very low frequencies. A third curve on Figure 4 indicates the attenuation provided when the two devices are worn in combination. *In this case total attentuation is less than the sum of that provided by each worn separately, but is usually greater at each frequency than either one worn alone.* For example, as illustrated in Figure 4 the V-51R provides approximately 27 dB of attenuation and the ear muff approximately 37 dB of attenuation. The two together may be expected to provide approximately 40 dB of attenuation, not 64 dB.

F. *Both types of protectors* provide *comparable attenuation and can be used interchangeably for most applications. The data shown are representative.* Similar data have been obtained from a number of earplugs and several varieties of muffs.

V. COMFORT

A. A survey* concerned with the success or failure of hearing conservation programs found that the most frequent employee complaint (85 percent) was that earplugs hurt and were uncomfortable. Part of this may have been due to a tendency to fill the ear canal so tightly that they were overfilled.

B. Although many experts and neophytes alike have claimed that all hearing protectors are uncomfortable, many people can and do wear earplugs or muffs in high level noise environments for hours without discomfort. When the noise causes more annoyance or discomfort than the protectors, the protection is tolerable and welcome. Others will find that either earplugs or muffs sometimes cause irritation and occasional acute pain after long periods of wear. This is primarily due to poor blood circulation resulting from the continuous pressure of the protector on the tissue involved. Excessive friction between the ear canal and the earplugs may also cause discomfort if the canal lining is deficient in cerumen (ear wax). This infrequent and unusual situation can be alleviated by the use of a small amount of petroleum jelly. <u>This should be done only after consulting with a physician.</u>

C. *Most individuals who initially experience discomfort will eventually become accustomed to the protectors and will find that they are able to wear them for longer and longer periods without discomfort.* This tolerance is a result not only of a toughening of the skin, but also in most cases is due to a growing appreciation of the quieter environment afforded by the protectors.

D. When protectors are worn, temporary hearing loss, fatigue, and annoyance, once common to after work hours, disappear. Also, when personnel become accustomed to the reduced noise levels as perceived through their protectors, they will find the previously unattenuated noise levels most unpleasant.

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* Roger Maas, "Hearing Protection - Whose Failure?" <u>National Safety News</u>, September 1961.

VI. THE ENVIRONMENT FOR FITTING

A. The most logical site for fitting hearing protective devices is at the appropriate medical facility. Trained personnel and the necessary facilities for ear examination are available. Where indicated, ears with excessive cerumen can be cleaned on the spot. In the quiet medical facility, conditions are optimum for providing personnel with essential instructions about noise-induced hearing loss and hearing conservation.

B. However, fitting hearing protectors in the medical facility has the serious disadvantage of not being conducive for demonstrating the effectiveness of the protection afforded by the device under the noise conditions in which personnel work.

C. In the absence of his noisy work environment, the individual may not be able to select the device that provides him with maximum attenuation, nor will he be able to learn what noise level to expect with maximum protection. Donning hearing protectors in a dispensary only makes a quiet situation quieter for the individual being fitted. *The low noise level is seldom disturbing or objectionable in the first place, and* the employee *receives no relief by further reducing it. Therefore,* the individual *is more conscious of any slightly disagreeable or uncomfortable features of the protectors than of the noise reduction accomplished by them.*

D. *On the other hand, if hearing protectors are fitted in the work environment, the noise reduction accomplished is dramatic. Any discomfort that is experienced is, at least for the moment, far outweighed by the obvious benefit. In addition, if the fitting takes place on the job, decided advantages can be taken of the initial enthusiasm of the* individual *who has been successfully fitted. An* individual *satisfied with good protection will spread the word to his associates.*

E. If hearing protectors must be fitted in a quiet area, it is desirable that the fitter check each individual on the job shortly after the initial fitting. At this time, faulty practices can be corrected, and if necessary, another type of protector can be tried. A quick followup of this type will minimize the forming of bad habits and promote general acceptance and appreciation of the hearing protectors.

F. When fitting is to be done away from a medical facility, there are many suitable means of carrying a supply of protectors to the job. Earplugs of various types and sizes may be carried in tool or fishing tackle boxes. Each of the small compartments will hold several dozen plugs. One large compartment can be reserved for plugs dirtied during the course of fitting. (These are later washed thoroughly in a mild detergent solution, rinsed, air dried, sorted, and returned to stock.) An earplug fitting health education pack, similar to the one illustrated in Figure 5, can be easily constructed by medical personnel.

FIGURE 5

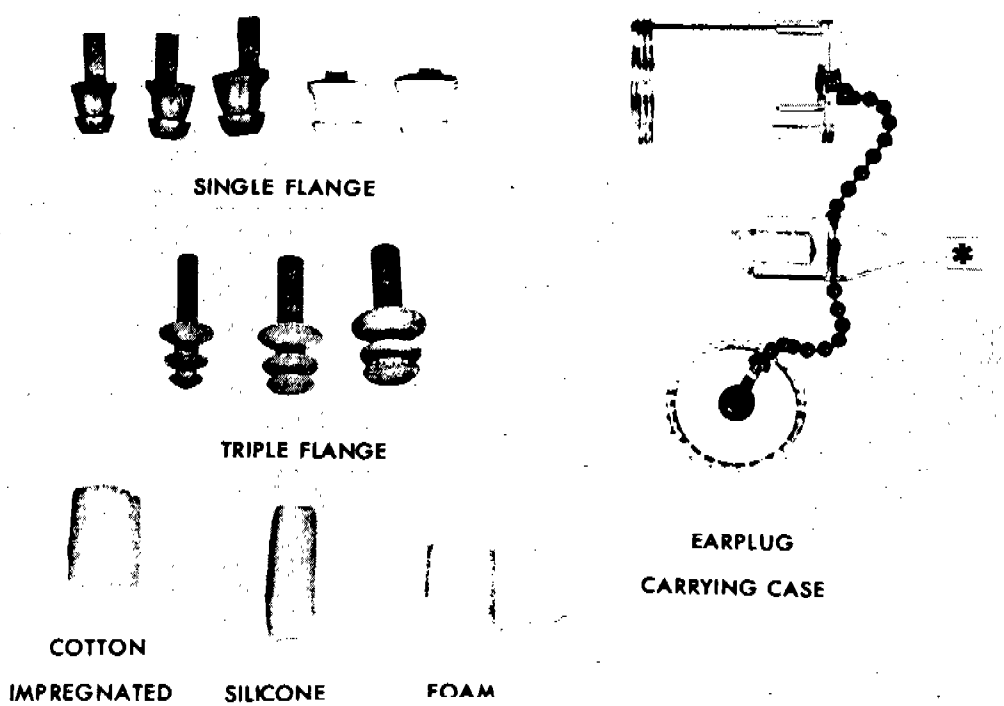
Example of an Earplug Fitting/Health Education Pack

VII. APPROVED EARPLUGS

The five types of earplugs pictured in Figure 6 represent an adequate selection of earplugs approved by The Surgeon General for use by Department of the Army personnel. They have been tested for attenuation characteristics in accordance with American National Standards Institute (ANSI) Standard Z24.22-1957, "Method for the Measurement of Real-Ear Attenuation of Ear Protectors at Threshold." They have also been tested for their durability and possible toxic effects. The use of commercially available earplugs is not recommended. Not all commercially available earplugs have been found to provide adequate attenuation or to be free from possible toxic effects. Commercially available items will also cost considerably more than those purchased through Federal supply channels.

FIGURE 6

Earplugs and Carrying Case Approved
for Use by The Surgeon General of the Army



* Earplug seating device not available in the Federal supply system at this time.

A. Single-Flange Earplug. Although the single-flange (V-51R) earplug was developed during World War II, it remains a very effective plug. The single-flange earplug owes its versatility to three features. First, it is available in five sizes, a range that is suitable for most ear canals except the very largest. *Second, its insert portion, shaped much like an average ear canal, is compliant and is tipped by a round flange or "umbrella" which ensures a seal even if canal irregularities prevent sealing by the body of the plug. Third, the outer end includes a firm shelf* with a tab *that rests against the relatively flat area toward the back of the ear and prevents the plug from being inserted too deeply.*

B. Triple-Flange Earplug.

1. The triple-flange earplug is available in three sizes: large, regular, and small. An advantage of this plug is that it generally requires less time for the fitting process than do the single-flange plugs. It is now made of a soft, pliable material and is receiving wide acceptance by users since previous issues tended to be harder and less comfortable to wear. (The hard, cream-colored, triple-flange plugs should not be issued.) The triple-flange plug is properly fitted and seated (and attenuation is significantly better) when two of the flanges enter and closely contact the ear canal and the third blocks off the opening.

2. Since ear canals vary widely in sizes and shape, it is necessary to have all sizes of both types of plugs (the single- and triple-flange) available for fitting and issue. For example, if the single-flange (V-51R) sizes are used for fitting, the distribution in a large population will be approximately 5 percent extra-small, 15 percent small, 30 percent medium, 30 percent large and 15 percent extra-large. About 5 percent of ears will be too large for the extra-large single-flange plug. Approximately 20 percent of those fitted with the single-flange plug will require a different size plug for each ear. The distribution of the triple-flange plug will be approximately 5 percent small, 75 percent regular, and 20 percent large. *If a particular population includes a high proportion of women or of young men, some shift toward the smaller sizes can be anticipated.* Single- and triple-flange earplugs are being color-coded according to size as follows:

Single-Flange	Triple-Flange
extra-large - red	
large - blue	large - blue
medium - orange	regular - orange
small - green	small - green
extra-small - white	

3. Furthermore, an important factor influencing the acceptance of hearing protectors is the provision of more than one type of device, thus allowing personnel an opportunity for choice. They should also be told to come back after a trial period and try another type of earplug if they are not satisfied with their present issue.

NOTE: Due to the shorter tab, the single-flange earplug may be more effective than the triple flange when worn under some communication headsets.

C. Silicone and Impregnated-Cotton Earplugs.

1. Malleable (disposable) plugs are prepared for insertion by simply softening them between the fingers and slightly tapering the end. *The tapered end is inserted into the canal opening and the excess material is pressed into surrounding space.* Cutting these plugs in half must be avoided since a half provides an inadequate mass and results in markedly reduced sound attenuation. For hygienic reasons, the hands should be relatively clean when preparing the plug for insertion. These plugs are discarded after being used once or twice.

2. Silicone and impregnated-cotton plugs can lose their seal with only slight jaw movement. Users should be aware of the need for frequent reseating of this device.

3. Since cotton impregnated with wax plugs will melt or freeze, their use is not recommended in extreme temperatures. The silicone plugs, however, are not so affected by extreme temperatures. Silicone plugs are also more reuseable than the impregnated-cotton plugs. These disposable plugs are useful for occasional short term exposures or are handy for someone who "forgot" his plugs.

D. Foam Earplug. A third type of earplug (yellow foam) has been approved for use by The Surgeon General of the Army and is now available (see Appendixes for the National Stock Number, nomenclature, and price). As with the impregnated-cotton and silicone earplugs, the yellow foam earplug is useful for individuals who "forget" their earplugs and for visitors to noise-hazardous areas. For hygienic reasons, the hands should be relatively clean when preparing the plug for insertion. To insert, the foam plug should be rolled between the thumb and forefinger to form a thin tapered cylinder. The tapered end is then inserted into the ear canal and gently held in position for 1 minute. This time is necessary to permit the earplug to form an effective acoustical seal. These plugs should not be used in those situations where hazardous chemical vapors could be absorbed into the earplug.

E. Earplug Case. An earplug case should be provided to everyone who is issued earplugs. It keeps plugs in good condition and readily available when needed. The cylindrical carrying case presently used by the military services (Figure 6) has a lid which screws on. It is serrated to allow a good grip even with large, greasy fingers. The chain which keeps the lid and case together is also used to attach the container to belt loops, buttonholes, etc. At some installations an earplug case with earplugs is required to be worn with the uniform.

VIII. THE FITTING PROCESS - EARPLUGS

A. The Well-Lighted Visual Inspection. All earplug fitting must be done under medical supervision. Therefore, before any device is placed in an ear, a well-lighted visual inspection is necessary to determine whether or not any condition is present that makes insertion inadvisable, e.g., a draining ear, sores, or occlusion due to ear wax (cerumen). To best reveal the canal opening, and to get an idea of its size and shape, the fitter grasps the pinna (the most visible part of the ear) and pulls it gently, but firmly, in the direction which is approximately straight out from the head. The commonly recommended method of pulling the ear up and back seldom gives the best view of the canal. Figure 7 illustrates these procedures.

B. The Trial Plug.

1. *When inserting* the *first trial plug, the fitter will easily detect gross errors in the plug size. If much too small, the plug tends to fall into the canal and its depth of insertion is limited by the excursion of the fitter's finger, not the shelf* (or flange) *of the plug. If much too large, the plug either will not enter the canal at all or will not penetrate far enough to allow contact of its outer rim* (or largest flange) *on the concha* (the hollow shell-like area at the canal opening). By greatly stetching the canal opening, the plug may also cause immediate discomfort. A plug which appears to make contact with the interior wall of the canal without appreciably stretching the tissues, and which seats itself, is probably the proper size.

2. Inexperienced personnel tend to select plugs that are too small. Among more experienced personnel, however, there has been too much concern with attenuation characteristics and not enough concern for comfort and acceptability. Emphasis has been to fill the ear canal too tightly; this practice only invites rejection.

3. Some people are embarrassed if a piece of ear wax sticks to the first trial plug as it is removed and are reluctant to practice in "public" or even proceed with the fitting. *To put them at ease, the fitter should assure them that the plugs penetrate deep into the canal, beyond the area that can be washed. Furthermore, they should be told that the wax is useful in providing lubrication for the plugs.* They can also be assured that a certain amount of wax is useful to trap foreign particles, repel insects, and prevent infections.

C. Ear Gauge.

An ear gauge to assist in the earplug fitting process is available and is listed in Federal Supply Catalog Number C-6515-1L under the nomenclature, Gauge, Earplug - NSN 6515-00-117-8552. Figure 8 illustrates this device.

FIGURE 7

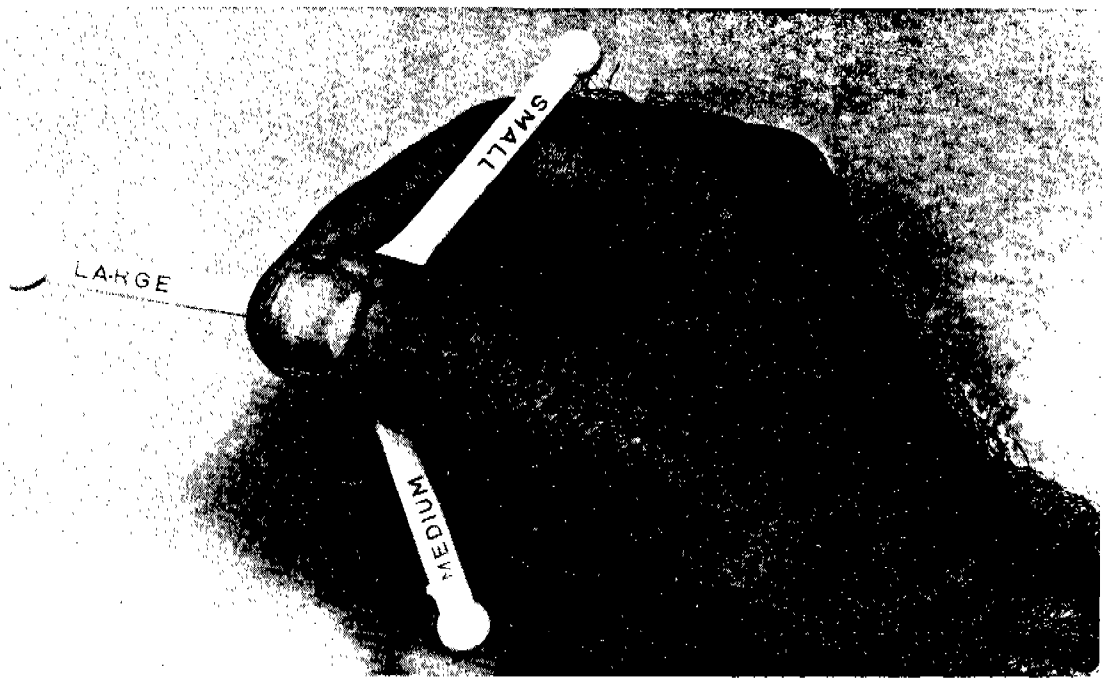
Correct and Incorrect Methods of Revealing the External Ear Canal

CORRECT

INCORRECT

FIGURE 8

Ear Gauge Available Through Federal Supply Catalog



The following instructions are recommended when this device is used.

1. Start with the medium-sized ball; insert it in ear canal with the tab (lug) pointing towards the back of the ear. Take care not to insert into ear canal past the tab. If the medium-sized ball either fits too loosely or too tightly, then try the next larger- or smaller-sized ball that obtains a good seal.

2. The use of an ear gauge, however, does not eliminate the need for the insertion of a trial plug in each ear. The ultimate test of a good fit is the insertion and seating of the plug itself. Experienced fitters find the ear gauge unnecessary and time consuming. They only need a visual inspection and a trial plug to achieve a proper fit.

D. The Properly Seated Earplug.

1. After one plug has been fitted and properly seated in the ear canal, ask the individual to count loudly to five and report in which ear his voice

sounds or feels louder or more resonant or more low toned. If the earplug is properly seated, these sensations should lateralize, i.e., be more strongly heard or felt in the ear with the earplug. If this has not occurred, reseat the plug. If these sensations are still not experienced try a different size or a different type of earplug. If the sensations are reported, tell the individual that this is what he should experience when an earplug is properly seated.

2. It must be noted that not everyone is able to hear or feel the lateralization of these sensations. Most people, however, are able to experience a change in the sound of their voice when both ears are properly sealed.

3. Gently pull the tab or stem of the trial plug. If you are able to pull the plug out of the ear with no resistance, the plug is the wrong size and/or it has not been inserted far enough into the canal.

4. Fit the other ear in a similar manner. It is possible that a different size earplug will be required for each ear.

5. Personnel being fitted with protective devices may also feel a vacuum sensation or a back pressure in their ear canals. *Frequently during plug insertion, the trapped air in the canal is compressed.* The fitter will know that this has occurred if he sees the individual swallow or move his jaws while attempting to alleviate this uncomfortable feeling. The fitter or the individual can quickly relieve this condition by momentarily breaking the seal, either by pushing the plugs sideways and stretching the canal or by moving the plug outward very slightly and then reseating it. Compression is less likely to occur if the plug is inserted with a slight twisting motion, or if the canal is straightened as the plug is inserted. Fit the other ear in a similar manner.

E. The Cough Reflex. *Occasionally a person will be encountered who coughs or chokes as a plug is inserted. In some cases this reaction ceases as soon as the plug is seated; in others, it continues until the plug is removed.* This is an involuntary response, and is not to be confused with the exaggerated wincing or grimacing sometimes displayed by those who simply do not "believe in" earplugs, and who feign pain to avoid using them. The exact mechanism of the phenomenon is not known, but it has been attributed to an irritation of certain nerve pathways to the pharyngeal area that pass close to the surface of the ear canals. *Persons whose coughing ceases with seating*

Note: Relieving compression by splitting the single-flange plug is not recommended. Although this procedure has been recommended in the literature, the "simple split" method is only applicable when plugs are worn in high performance (jet) aircraft - none of which are used in Army aviation.

of the plug can often learn to insert them without arousing this response. Those who cannot control the response must wear ear *muffs.* Although some personnel may feign pain to avoid using earplugs, all complaints of persistent pain should be referred to a physician.

F. Removal of Plugs. If a plug is abruptly pulled straight out, there can be an unpleasant or even painful suction exerted on the eardrum. Therefore, when removing a plug, it is advisable to break the seal by twisting the plug or by straightening the canal.

G. Practice of Insertion and Seating Technique.

1. After the fitter has demonstrated how to insert the plugs, the individual should practice the process in front of him. The important points in the Instructions of Appendixes A, B, and C can then be reinforced and reemphasized.*

2. The fitter must teach personnel how to handle the plug that offers the best protection. They must be taught how to reach behind their head with the right hand, grasp the pinna of the left ear, pull outward, and insert the plug with the other hand as shown in Figure 11. The procedure is reversed to insert the plug in the right ear. It is the fitter's task to teach the individual which angle of pull opens his ear canal best, and with the ear canal open, to show him how to insert the plugs. Many individuals are able to insert and seat earplugs without opening the canal as described.

3. *It is important that the individual insert the plug well into the ear canal. Overcoming the* individual's *reluctance to do this will be the greatest obstacle that the fitter encounters, primarily because most people have been taught since childhood not to "put anything in their ears smaller than their elbows." Partial insertion results in poor attenuation, poor retention, and discomfort because the loosely inserted plug continuously makes and breaks contact with the canal walls during jaw movement and swallowing.* Physical and mental irritation results and often the plug is removed.

4. After one or two trials, at least half of the individuals will easily *learn how to insert and remove plugs correctly. Those who do not will require additional attention, but the fitter will usually be able to explain the difficulty and suggest means of overcoming it.*

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* Additional copies of these instructions can be obtained from the US Army Environmental Hygiene Agency. Posters in two sizes are available: 8" x 10" and 16" x 20".

FIGURE 9

Examples of Poorly-Fitted/Poorly Inserted Earplugs
and Well-Fitted/Properly Seated Earplugs

GOOD
(Two flanges in ear canal and third flange appears to be blocking entrance)

GOOD
(Tab to rear and plug appears to be blocking ear canal)

POOR
(Too small and inserted too far)

POOR
(Too large and/or not inserted enough)

FIGURE 10

Examples of Poorly-Fitted/Poorly Inserted Earplugs
and Well-Fitted/Properly Seated Earplugs*

POOR
(Tab not to rear)

POOR
(Too Small)

POOR
(Too large and/or not inserted enough)

GOOD
(Tab to rear and plug appears to be blocking ear canal)

* A poster displaying these examples is available from the US Army Environmental Hygiene Agency.

FIGURE 11

Technique Used by Those Who Require the Ear Canal
to Be Straightened Before Earplug Can Be Properly Seated

5. If an individual requires a different size or type plug for each ear, it is important that he know which goes into each ear. With experience he will eventually be able to make the appropriate match.

6. Another task of the fitter is to teach supervisory personnel to recognize the appearance of a properly seated plug. Supervisors should be taught to recognize incorrect usage of protective devices when they see it, and to offer minimal assistance by properly seating a plug. If they feel that an individual is not getting adequate protection, they should refer them to the medical facility for refitting or further instruction.

7. *In view of the smallness of plugs, variations in finger size and shape also assume importance. Slim fingers handle plugs easily, but many men have wide, blunt fingers with extremely short nails, and a surprising number have missing fingers.* The hands rather than the ears sometimes determine choice of hearing protection, or whether or not it is possible to seat the plug.

IX. EARPLUG SEATING DEVICE

A. An earplug seating device will soon be available to assist in the insertion and seating of the single- and triple-flange earplugs. The earplug seater is stored on the chain of the carrying case as illustrated in Figures 12-15. It was designed so neither the device nor the earplugs can be inserted too far into the ear canal.

B. The triple-flange plug is inserted as follows:

1. Insert the stem of the plug in the open end of the seater as illustrated in Figure 12.

2. Push and wiggle toward the rear center of the head until a seal is made (See Figure 13).

C. The earplug seater can be used with the single-flange plug as follows:

1. Grasp the plug tab between the thumb and forefinger, insert and twist the plug into the ear canal.

2. Verify and improve the seal by pushing the pointed end of the seater toward the rear center of the head as shown in Figure 15.

D. An alternative method is illustrated in Figure 14. The seating device can be used in the insertion process and the seal verified as previously described and shown in Figure 15.

X. THE FOLLOWUP

Although enforcement of the mandatory use of hearing protective devices is a command responsibility, medical personnel have the means of encouraging the

FIGURE 12

Earplug Seater and the Triple-Flange Plug

FIGURE 13

Inserting Triple-Flange Plug with Seater

FIGURE 14

Earplug Seater and the Single-Flange Plug

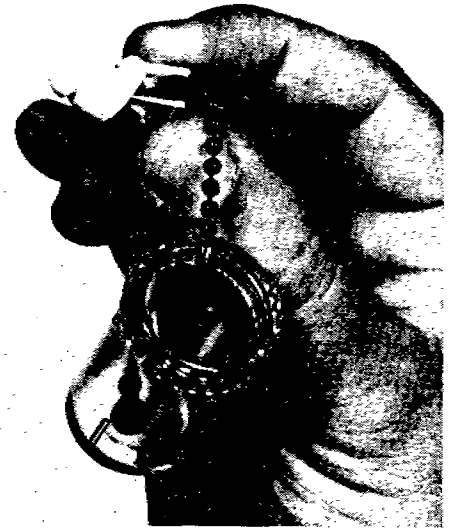

FIGURE 15

Inserting Single-Flange Plug with Seater

use of protectors in their ability to resolve any difficulties that personnel encounter while wearing them. A good idea is to provide a break-in period during which the user can come back for refitting if necessary. Despite care in fitting and indoctrination of personnel, the fitter will find those who have difficulty in learning the technique of proper insertion and seating. During periodic tours of noise-hazardous areas, the fitter should observe if, how, and when the protectors are used. The fitter can receive invaluable assistance from supervisory personnel who, through their interim observations, can call attention to persons needing special attention. Everyone should be rechecked at least once a year. Earplugs can lose their effectiveness by shrinking or swelling, and ear canals may enlarge from regular use of earplugs as well as from the natural aging processes.

XI. THE ADVANTAGES OF EARPLUGS

A. The major advantage of earplugs is their compatibility with glasses, earrings, a woman's coiffure, and different types of headgear.

B. Earplugs are not usually affected by external temperature or environment. An exception is the impregnated-cotton plug that will melt in extreme heat and freeze in extreme cold.

C. Earplugs can be easily cleaned with soap and water when an individual washes his hands. The disposable plugs are the exception.

D. Earplugs are the most economical initial protection. The Army can prevent hearing loss at a cost of less than $.30 with a pair of earplugs and an earplug case.

E. Earplugs do not interfere with work operations in close quarters.

F. Earplugs are easily carried or stored on the person.

XII. DISADVANTAGES OF EARPLUGS

A. Earplugs pose a monitoring problem. At a distance, supervisory personnel have difficulty checking for compliance. Even closeup, long hair interferes with visual monitoring. Even if the earplug is observed in the ear canal, only the user really knows if they are properly seated. Supervisory personnel have to be trained to more readily recognize the appearance of an improperly seated plug.

B. Earplugs are easily lost.

C. Earplugs cannot be worn in an unhealthy ear.

D. Earplugs can work loose with talking and chewing and must be reseated periodically.

E. Gloves must be removed to insert or remove earplugs.

F. Considerably more expertise is required by the user as well as the fitter.

G. Insertion of earplugs may contribute to a problem of impacted cerumen in the ear canal.

H. More time is required to fit earplugs and to insert them.

I. Infection may result from failure to keep the earplugs clean.

J. There is considerably more variance in the attenuation levels obtained from earplugs as compared to muffs.

XIII. APPROVED EAR MUFFS

The Army provides an adequate selection of ear muffs to offer the potential user. They have been thoroughly tested for attenuation characteristics and durability.

A. Effectiveness of Ear Muffs.

1. Generally the effectiveness of an ear muff (circumaural protector) is determined by its headband tension and its fit over the ear. If headband tension is decreased either by usage or by the individual, attenuation decreases. Moreover, if the same muffs are used by more than one person, tension will vary from good to bad in each case because of the difference in head sizes. If the cups are too small, the ear must be tucked inside the cushion for a good seal.

2. *The wearing of eyeglasses with ear muffs presents several problems. Glasses with very thick and wide temples will prevent a good acoustical seal and cause discomfort to the wearer. Thin and narrow temples are preferred. If bifocal or trifocal eyeglasses must be worn, it is important that the muffs do not shift the position of the lenses. As the muffs are put on, the glasses are sometimes shifted and cannot be adjusted. In other instances, the glasses move slightly as the head moves.*

3. *Generally, muffs should not be worn over caps.* However, the combination of cap and muff can be made to perform satisfactorily if one makes certain that no portion of the cap comes between the ear cushions (earcup seals) and the head. Personnel must be urged to check this by feeling along the edge of the cushions.

4. *In extremely cold climates, persons having muffs with liquid-filled cushions must be cautioned against letting the muffs "cold soak" for any length of time.* Otherwise, the liquid in the earcup seals will be unbearably cold when the muffs are placed on the head. *This is especially important if the need for protectors is intermittent.*

5. Although the front and back of ear muffs having contoured cups are always marked in some fashion, the markings are more often decorative than instructive. The difference should be pointed out. Often it is helpful to identify the front or back with a prominent mark.

B. Cleaning and Maintenance of Ear Muffs.

1. A problem which no manufacturer has yet completely overcome is that of eliminating the adverse effects of skin oil and perspiration on the earcup seals. After continuous use, the soft and compliant earcup seals tend to become hard. *Sometimes they even shrink, which results in poor comfort and seal. Additional problems are associated with liquid-filled* seals. *The material used to contain the fluid must be thin and compliant, yet tough enough to resist being easily torn or pierced.* It must be inert to the enclosed fluid. As completely satisfactory answers to these problems have not yet been found, most ear muffs in the Federal supply system are equipped with easily replaceable seals.

2. Earcup seals cannot be washed as conveniently as plugs in the wash room. Soap, warm water, and often a soft brush are required for removal of the skin oil and dirt which tend to harden the muff and impair their ability to seal. Ensure that the material inside the seals does not get wet. When not in use, muffs should be placed in open air so that any moisture which may have been absorbed within the cup evaporates. Because ear muffs are usually not carried home to be cleaned, the muff seals generally do not receive proper maintenance.

3. Since ear muffs must provide sufficient pressure in order to obtain a good seal without producing discomfort to the wearer, headbands may require periodic adjustment or replacement.*

C. The Advantages of Ear Muffs.

1. Ear muffs are convenient and practical for intermittent exposures. Anyone can don and remove them with ease, even if wearing the bulkiest gloves.

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* Instructional posters for the care and use of ear muffs can be obtained from the US Army Environmental Hygiene Agency (see Appendix D).

FIGURE 16

Examples of the Type II ear muffs designed to be worn either with the suspension over the head, back of the head, or under the chin. Note that no portion of the cap is between the earcup seals and the head. If this particular model is worn with the up side down, there is more room for a rifle stock.

2. Almost any individual can receive some degree of noise reduction with them without having any prior instruction regarding their use.

3. Compared to earplugs they provide less variance in attenuation levels.

4. Less time and expertise is required in the fitting process.

5. One size of ear muff fits almost any adult head.

6. Monitoring for compliance and proper use is considerably easier for supervisory personnel.

7. Their size and fit are warming and, therefore, welcomed in cold environments.

8. They can be worn even in the presence of minor ear infections.

9. Problems of impacted cerumen are avoided.

10. Stimulation of the cough reflex is avoided.

11. Unlike plugs, muffs are not apt to be left in the "other suit," lost from a pocket, or dropped and dirtied when being put on.

D. Disadvantages of Ear Muffs.

1. Ear muffs are bulky and more difficult to store on the person.

2. They may interfere with work operations in close quarters.

3. Sometimes they are incompatible with other types of headgear.

4. Excessive heat and sweat accumulation make them uncomfortable in hot environments.

5. Ear muffs are more difficult to maintain and clean.

6. Ear muffs are more expensive.

XIV. EAR-CANAL CAPS

Ear-canal caps are recommended only for very short term exposures, particularly in instances where ear muffs may be too warm or bulky. Although not noted for its comfort, the Sound Sentry can provide adequate protection from most hazardous noise sources if these manufacturer's instructions are carefully followed:

1. Pull adjustable headband to approximate head size.

FIGURE 17

Ear-Canal Caps (The Sound Sentry). Available through the Federal Supply Catalog C-6515-1L under the nomenclature, Plug, Ear, Rubber, Universal Size, Single-Flange (NSN 6515-00-181-8058). Also available, but not pictured, is the Willson Sound Band under the nomenclature, Plug, Ear, Plastic, Hearing Protection, Universal Size, Single-Flange (NSN 6515-00-392-0726).

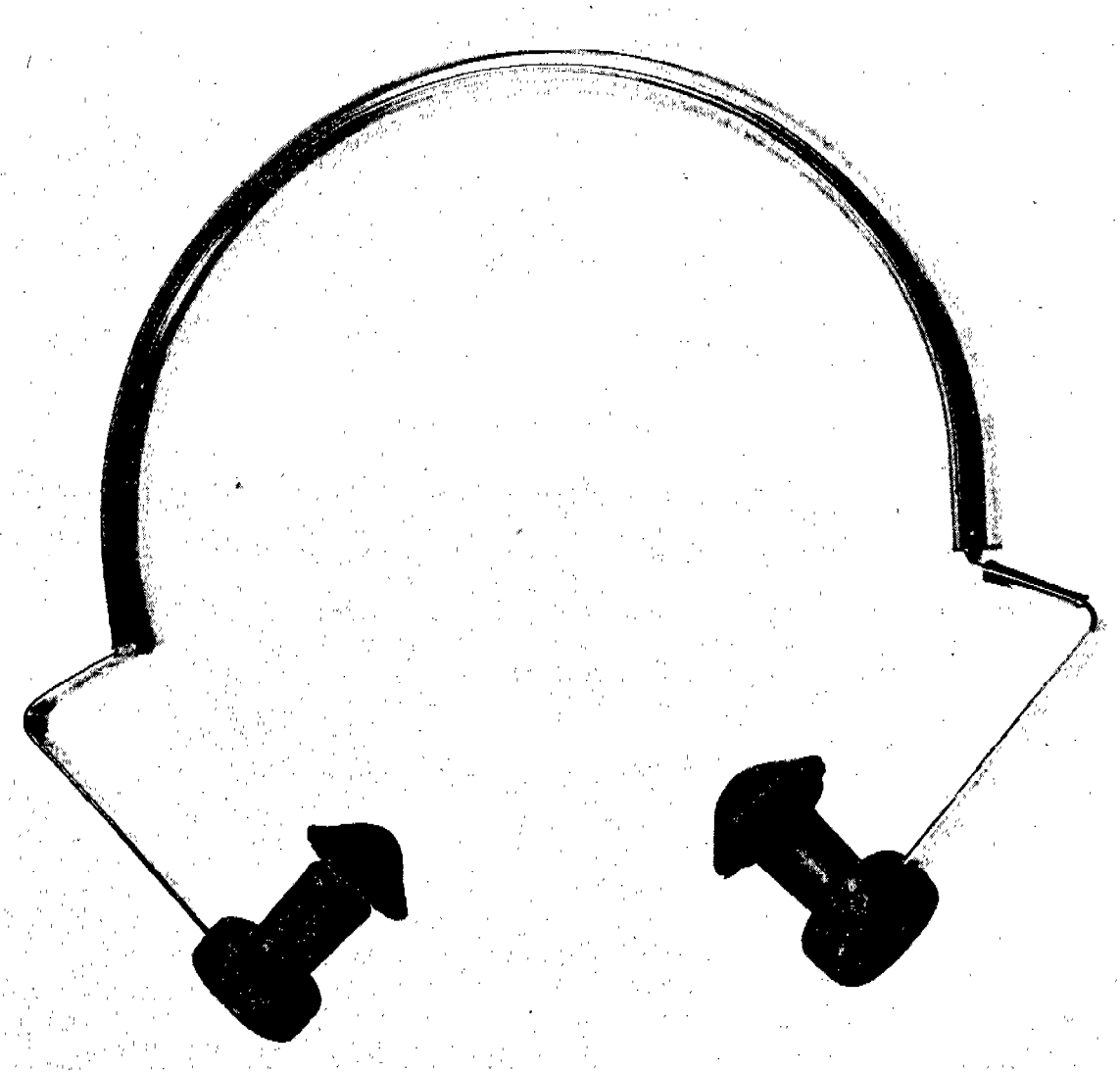


FIGURE 18

Helmet, Flying, Protective; Model SPH-4; Regular - NSN 8415-00-144-4981; Extra Large, NSN 8415-00-144-4985.

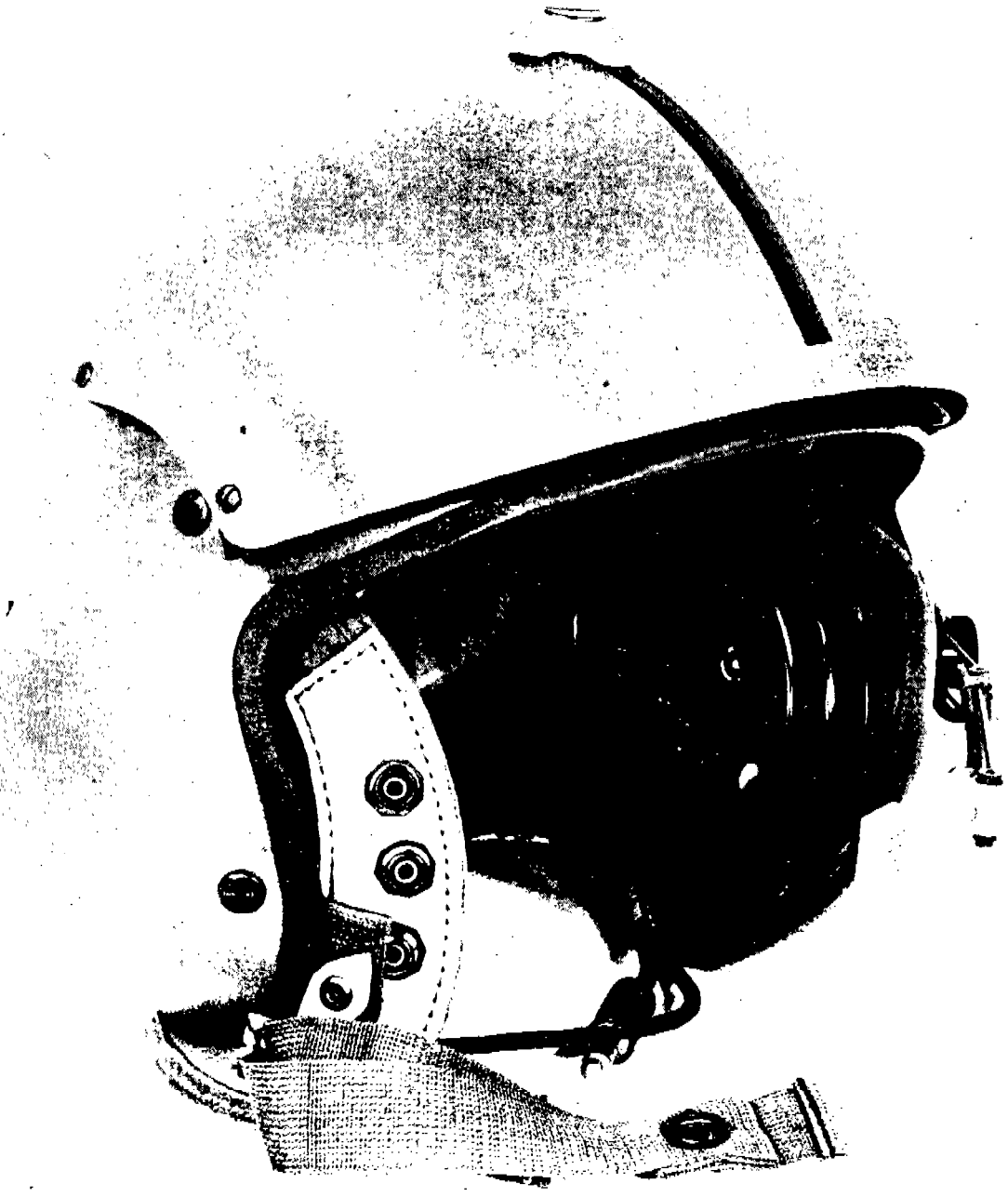


FIGURE 19

The Tanker's Helmet, Model DH-132; Small - NSN 8415-00-094-2679; Medium - NSN 8415-00-094-2691; Large - NSN 8415-00-094-2684. (Communication equipment not shown.)

2. Place headband in position; be sure letter R and L on steel arms correspond to right and left ears. (Red marking always on right)

3. Adjust headband for snug, comfortable fit over head with canal caps covering ear openings; be sure widest dimension of oval shaped canal caps aligns parallel to the head strap.

4. When worn under chin reverse R and L; close headband completely to assure effective fit.

5. Push canal caps against ear openings until sealed; slight suction when caps are removed indicate proper fit.

NOTE: Do not adjust by bending headband; tension has been preset at time of manufacture. Wash with any handsoap or mild detergent. After cleaning, relubricate headband with two drops of mineral oil to assure easy adjustment.

XV. THE AVIATOR's HELMET, SPH-4

A. The SPH-4 was made to protect the pilot against impact, as a crash protection device, and to provide the pilot with a maximum of sound attenuation and comfort. The SPH-4 comes in two sizes, regular and extra-large. As a general rule, the regular is designated for those head sizes up to 7 1/4, and extra-large for 7 1/4 and larger.

B. Order of adjustment: 1. Adjust the crown straps to position the ear cups. If necessary, adjust the cross-web straps which varies the earcup compression for maximum attenuation, retention and comfort. 2. Adjust the headband suspension to fit head size. 3. If necessary, adjust nape strap for ease of donning. 4. Adjust chin strap.

C. Always keep helmet dry and clean. Inspect the components frequently; if parts appear frayed or worn, replace them. See Appendix H for earcup seal replacement.

XVI. THE TANKER's HELMET, DH-132

A. The DH-132, like the SPH-4, was designed for head protection and maximum sound attenuation. The DH-132 comes in three sizes, small, regular and large.

B. Order of adjustment: 1. Adjust the crown straps to position the earcups. 2. Adjust the nape strap to fit head size. If necessary, entire suspension system may be angled to accomodate goggles, gas masks, etc. 3. Adjust the chin strap.

C. Always keep helmet dry and clean. Inspect the components frequently; if parts appear frayed or worn, replace them. See Appendix H for earcup seal replacement.

XVII. TECHNIQUES FOR PROMOTING THE USE OF HEARING PROTECTIVE DEVICES

A. First, educate command and supervisory personnel of the need for personal hearing protective devices. Often when command and supervisory personnel wear hearing protectors it arouses interest in their subordinate personnel.

B. Maintain an ongoing health education program. The promotion of the use of most protective equipment requires periodic long-range education emphasis.

C. Offer a variety of insert type devices. You are inviting unfavorable reaction when someone is told, "This is the kind of plug we have decided you will wear."

D. Provide a trial period. Tell them, "Try this type and come back in a week and report how it works."

E. Present personal testimonials from peers. Many are impressed with the importance of hearing protection when their peers testify to hearing loss and other difficulties they incurred from exposure to noise. Some can report, after using hearing protection, that the ringing in the ears has gone, and that they feel less tired at the end of the day.

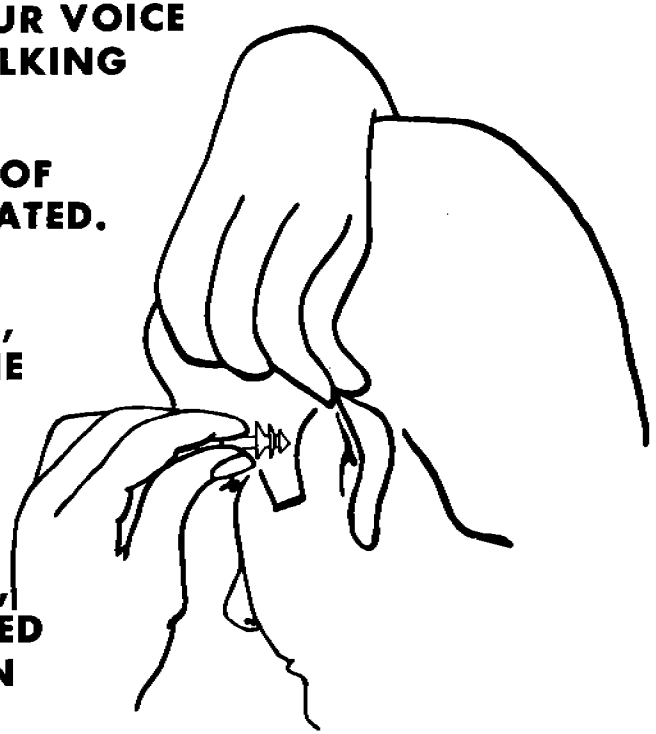
F. An interpretation of the status of an individual's hearing sensitivity (audiogram) is a particularly convincing approach for selling the need for hearing protection.

G. Provide personal demonstrations of the effectiveness of hearing protection. Put someone in front of a noise source and <u>suddenly remove</u> the hearing protection. Demonstrate that you can converse in noise-hazardous areas while wearing hearing protective devices.

H. Require use of hearing protectors by <u>everyone</u> entering noise-hazardous areas, particularly supervisory personnel. As a last resort refer habitual offenders for disciplinary action. For civilian offenders see Chapter 751 of the Federal Personnel Manual, Civilian Personnel Regulation 700 (Change 14), 12 March 1973, Chapter 751.A, Appendix A, Offense 13b.

EARPLUGS: GENERAL INFORMATION

1. MAKE THE EAR CANAL ACCESSIBLE BY REACHING OVER THE HEAD WITH OPPOSITE HAND AND PULLING EAR OUTWARD.
2. A GOOD SEAL SHOULD BE ACCOMPANIED BY A VACUUM SENSATION(A BACK PRESSURE). ALSO, YOUR VOICE SHOULD SOUND MUFFLED TO YOU AS IF TALKING INSIDE A BARREL.
3. PLUGS TEND TO WORK LOOSE AS A RESULT OF TALKING AND CHEWING AND MUST BE RESEATED.
4. LITTLE DIFFICULTY IS EXPERIENCED UNDER-STANDING SPEECH WHEN PLUGS ARE WORN, IF THE VOICE IS RAISED SLIGHTLY ABOVE THE LEVEL OF ORDINARY CONVERSATION.
5. EVEN A SMALL LEAK DEFEATS THE PURPOSE OF WEARING PLUGS.
6. KEEP PLUGS CLEAN WITH SOAP AND WATER, BUT INSURE PLUGS ARE DRY WHEN RETURNED TO CASE. WHEN NOT IN USE, KEEP PLUGS IN PLASTIC CARRYING CASE PROVIDED.
7. EARPLUGS ARE PART OF YOUR PERSONAL ISSUE AND ARE TO BE RETAINED UPON CHANGE OF STATION.



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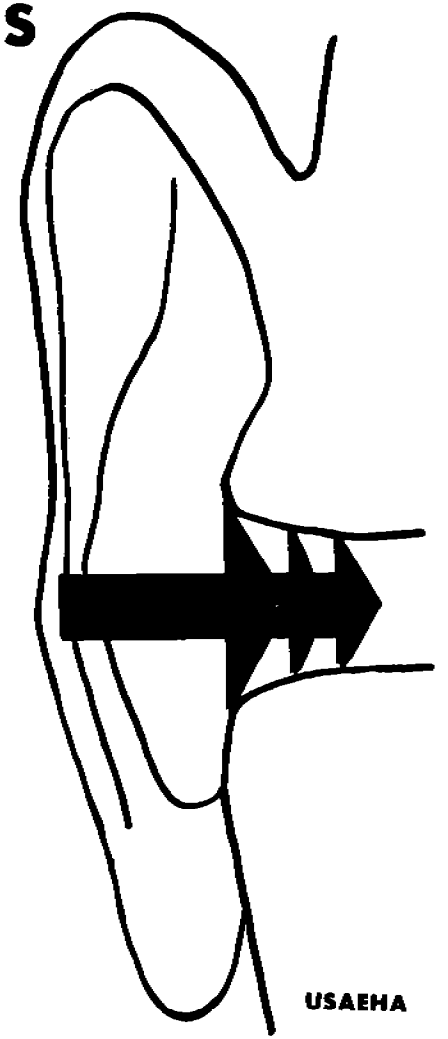
FOR MAXIMUM PROTECTION AND COMFORT INSERT TRIPLE FLANGE EARPLUGS AS FOLLOWS:

1. MAKE THE EAR CANAL ACCESSIBLE BY REACHING OVER HEAD WITH OPPOSITE HAND AND PULLING EAR OUTWARD.

2. GRASP PLUG FIRMLY BEHIND LARGEST FLANGE.

3. INSERT SMALLER FLANGE IN EAR CANAL. PUSH AND TWIST TOWARD REAR-CENTER OF HEAD.

4. IF A GOOD SEAL IS NOT OBTAINED, USE SMALLER OR LARGER SIZE. TRIPLE FLANGE PLUGS ARE AVAILABLE IN THREE SIZES- LARGE, REGULAR, AND SMALL.



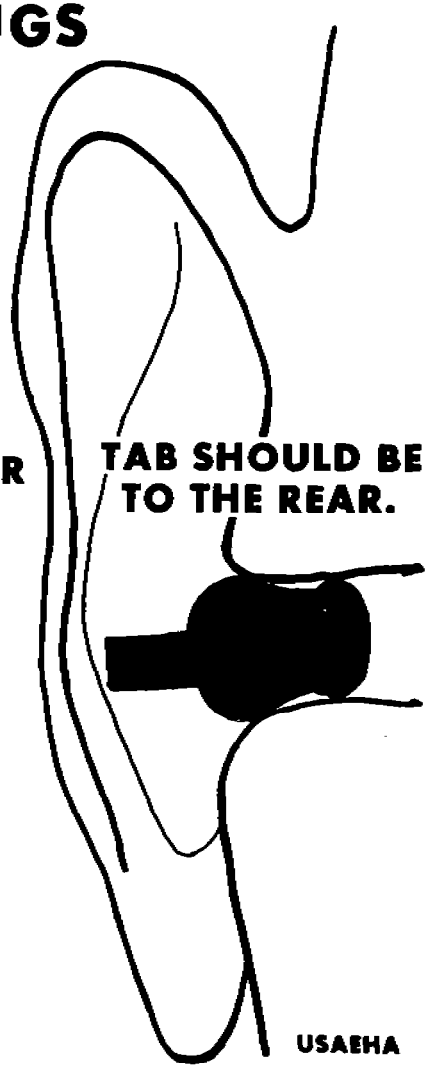
FOR MAXIMUM PROTECTION AND COMFORT, INSERT SINGLE FLANGE EARPLUGS AS FOLLOWS:

1. MAKE THE EAR CANAL ACCESSIBLE BY REACHING OVER HEAD WITH OPPOSITE HAND AND PULLING EAR OUTWARD.

2. GRASP PLUG TAB BETWEEN THUMB AND FOREFINGER AND INSERT PLUG INTO EAR CANAL.

3. PUSH AND TWIST PLUG TOWARD REAR-CENTER OF HEAD UNTIL SEAL IS MADE.

4. IF A GOOD SEAL IS NOT OBTAINED, USE SMALLER OR LARGER SIZE. SINGLE FLANGE PLUGS ARE AVAILABLE IN FIVE SIZES- EX. SMALL , SMALL, MEDIUM, LARGE, AND EX. LARGE.



HSE-OB Technical Guide (Med)
Personal Hearing Protective Devices - Fitting, Care and Use

EAR MUFFS: GENERAL INFORMATION

1. ADJUST HEADBAND TO INSURE EARCUP SEALS ARE IN COMPLETE CONTACT WITH HEAD.

2. EARCUP SEALS MUST FIT WELL AROUND TEMPLES OF EYEGLASSES.

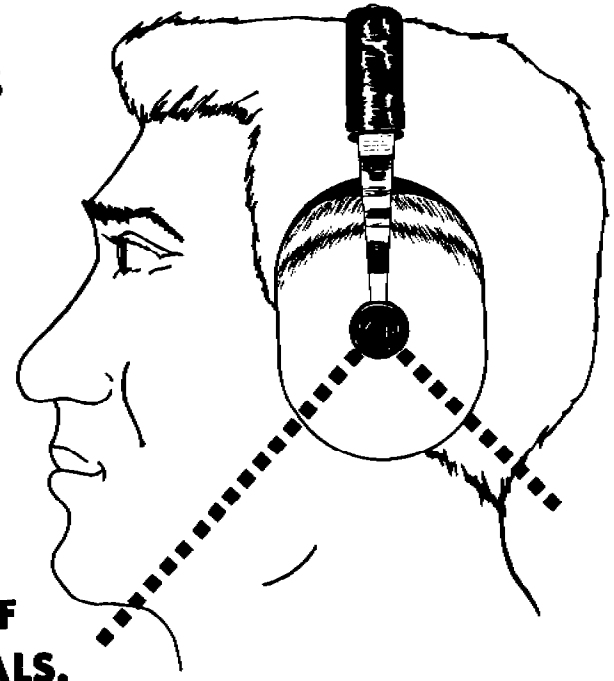
3. THE TYPE II EAR MUFF CAN BE WORN OVER THE HEAD, BEHIND THE HEAD OR UNDER THE CHIN. ➤

4. WHEN EAR MUFFS ARE PROPERLY WORN, YOUR OWN VOICE SHOULD SOUND MUFFLED TO YOU AS IF TALKING INSIDE A BARREL.

5. DO NOT BEND, ALTER OR MODIFY ANY PART OF HEADBAND, CUPS, CUP LINING OR EARCUP SEALS.

6. REPLACE EARCUP SEALS THAT HAVE BECOME HARDENED, DAMAGED OR OTHERWISE UNSERVICEABLE.

7. EVEN A SMALL LEAK ELIMINATES THE PROTECTION PROVIDED BY EAR MUFFS.



AURAL PROTECTOR, SOUND, TYPE II
NSN 4240-00-022-2946

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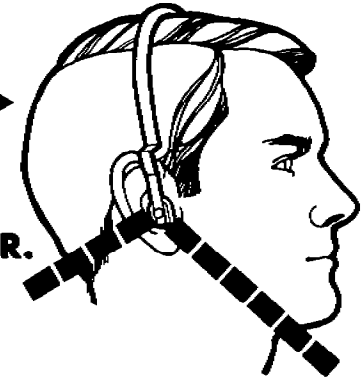
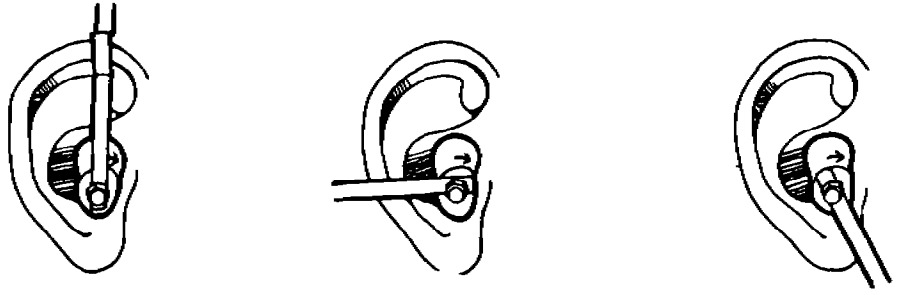
HSE-OB Technical Guide (Med)
Personal Hearing Protective Devices - Fitting, Care and Use

EAR CANAL CAPS: GENERAL INFORMATION

1. **EAR CANAL CAPS CAN BE WORN OVER THE HEAD, BEHIND THE HEAD OR UNDER THE CHIN.**
2. **FOR PROPER FITTING:**
   - **A. TURN HEADBAND TO DESIRED POSITION THEN ADJUST CAPS SO ARROW IS ON TOP POINTING FORWARD WHEN SET IN EAR.**



PLUG, EAR, PLASTIC, HEARING PROTECTION, UNIVERSAL SIZE, SINGLE FLANGE (NSN 6515-00-392-0726)



   - **B. GRASP EACH CAP WITH THUMB AND INDEX FINGER AND WORK THEM INTO EAR UNTIL EAR CANAL IS COMPLETELY SEALED.**
3. **WHEN EAR CANAL CAPS ARE PROPERLY WORN, YOUR OWN VOICE SHOULD SOUND MUFFLED TO YOU AS IF YOU ARE TALKING INSIDE A BARREL.**
4. **EVEN A SMALL LEAK ELIMINATES THE PROTECTION PROVIDED BY EAR CANAL CAPS.**
5. **KEEP CAPS CLEAN WITH SOAP AND WATER.**

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HAND-FORMED EARPLUGS

NOTE: ENSURE THAT HANDS AND PLUGS ARE CLEAN BEFORE USING. DO NOT CUT THESE PLUGS IN HALF SINCE A HALF PROVIDES AN INADEQUATE MASS FOR EFFECTIVE NOISE REDUCTION.

1. **YELLOW FOAM EARPLUGS (NSN 6515-00-137-6345).**
   - **A. ROLL RATHER THAN SQUEEZE EACH PLUG INTO AS SMALL A DIAMETER AS POSSIBLE.**
   - **B. INSERT QUICKLY INTO EAR CANAL.**
   - **C. HOLD GENTLY IN PLACE WITH FINGERTIP FOR 1 MINUTE UNTIL EXPANSION IS COMPLETE.**
   - **D. KEEP PLUGS CLEAN BY WASHING IN MILD SOAP AND RINSING THOROUGHLY IN WATER. DISCARD IF DISCOLORATION OR DISFIGURATION OCCURS AFTER CLEANING.**
   - **E. DO NOT USE WHERE HAZARDOUS CHEMICAL VAPORS COULD BE ABSORBED INTO PLUG.**
2. **SILICONE EARPLUGS (NSN 6515-00-133-5416).**
   - **A. SOFTEN AND MOLD BETWEEN FINGERS INTO A CONE-SHAPED PLUG.**
   - **B. INSERT TAPERED END INTO EAR CANAL AND PRESS FIRMLY.**
   - **C. SEAL EAR CANAL BY PRESSING EDGES OF EXCESS MATERIAL INTO SURROUNDING SPACE.**
3. **WAX-IMPREGNATED COTTON (NSN 6515-00-721-9092).**
   - **A. ROLL AND SOFTEN BETWEEN PALMS INTO A BALL-SHAPED PLUG.**
   - **B. INSERT INTO EAR CANAL AND PRESS FIRMLY.**
   - **C. SEAL EAR CANAL BY PRESSING EDGES OF EXCESS MATERIAL INTO SURROUNDING SPACE.**

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APPENDIX G

ORDERING EARPLUGS

The following are the nomenclatures and NSN for ordering earplugs and earplug cases from Federal Supply Catalog C-6515 IL, 1 February 1977, page 129, Medical and Surgical Instruments, Equipment, and Supplies (costs as of January 1978):

a. Preformed Earplugs.

(1) Plug, Ear, Hearing Protection, Single-Flange, 24s.		Distribution of Sizes (percent/100 individuals
NSN 6515-00-442-4765 (extra small, white)	$ .79/package	5%
NSN 6515-00-467-0085 (small, green)	.82/package	15%
NSN 6515-00-467-0089 (medium, international orange)	.84/package	30%
NSN 6515-00-442-4807 (large, blue)	.84/package	30%
NSN 6515-00-442-4813 (extra-large, red)	1.36/package	15%

(2) Plug, Ear, Hearing Protection, Triple-Flange, 24s.

NSN 6515-00-442-4818 (regular, international orange)	2.94/package	75%
NSN 6515-00-442-4821 (small, green)	2.94/package	5%
NSN 6515-00-467-0092 (large, blue)	2.76/package	20%

(Preformed single- and triple-flange earplugs are now being color-coded according to the size and have been assigned NSN as above).

b. Earplug Case.

Case, Earplug, Plastic

NSN 6515-00-299-8287 (C-6515-IL, page 45)	1 3/4" high by 1 1/8" diameter with screw cap. Bead chain on cap for attaching to buttonhole or belt loop. Accommodates one pair of earplugs, $.15 each.

c. Hand-Formed Earplugs.

(1) Plug, Ear, Hearing Protection Universal Size, Yellow, 400s.

NSN 6515-00-137-6345	200 pairs, each pair in paper container, $17.26/box.

(2) Plug, Ear, Silicone Rubber, Hearing Protection, Cylindrical, Disposable, 48s and 200s.

NSN 6515-00-135-2612	24 pairs, each in a plastic box, $4.27/box.
NSN 6515-00-133-5416	100 pairs sealed in a blister pack, $7.51/box.

(3) Plug, Ear, Cotton, Impregnated, Disposable, 100s.

NSN 6515-00-721-9092	50 pairs stored in bulk, $2.10/box.

d. Ear-Canal Caps.

(1) Plug, Ear, Plastic, Hearing Protection, Universal Size, Single Flange.

NSN 6515-00-392-0726 (Willson Sound Ban)	Two plugs mounted on a metal adjustable headband enclosed in a plastic tube, approximately $3.01/pair.

(2) Plug, Ear, Rubber, Hearing Protection, Universal Size, Single Flange.

NSN 6515-00-181-8058 (Sound Sentry)	Two plugs mounted on a metal adjustable headband enclosed in a plastic tube, approximately $3.23/pair.

NOTE: The Surgeon General of the Army has approved three types of disposable (hand-formed) earplugs listed above for use by Department of the Army personnel. These hand-formed plugs are useful for occasional, short-term exposures and are handy for visitors or individuals who "forgot" their earplugs. Unlike fitted earplugs, hand-formed plugs do not require a medical fitting and an inventory of multiple sizes. The wax-impregnated cotton and the silicone plugs are prepared for insertion by simply softening them between the fingers and slightly tapering one end. The tapered end is inserted into the canal opening and the excess material is pressed into the surrounding space. Cutting these plugs into halves must be avoided since a half provides an inadequate mass and results in markedly reduced sound attenuation. To insert the third type of hand-formed plug (yellow foam), the plug is rolled between the thumb and forefinger to form a thin tapered cylinder. The tapered end is then inserted into the ear canal and gently held in position for 1 minute. This time is necessary to permit the plug to form an effective acoustical seal. For hygienic reasons, the hands should be relatively clean when preparing hand-formed plugs for insertion. Wax-impregnated cotton plugs and silicone plugs are discarded after being used once or twice, whereas the yellow foam plugs can be washed in a mild soap and used repeatedly until discoloration or disfiguration occurs. The yellow foam plug should not be used in those situations where hazardous chemicals or vapors could be absorbed into the plug.

APPENDIX H

ORDERING EAR MUFFS

The following are the nomenclatures and NSN for ordering ear muffs from the Army Master Data File (AMDF). Costs are as of January 1978.

Ear Muffs

a. Aural Protector, Sound, Type II.

NSN 4240-00-022-2946 (AMDF)	Designed to be worn with the suspension system over the head, back of the head, or under the chin. $4.18 each

b. Aural Protector, Sound, Type I (with communication headset).

NSN 5965-00-168-9624 (AMDF)	Model-David Clark 19LB-87, boom-mounted microphone, H-312/AIC. $61.88 each
NSN 5965-00-226-7870	Model-David Clark mush-mouth microphone, H-133/AIC. $58.24 each

APPENDIX I

ORDERING HELMETS

The following are the nomenclatures and NSN for ordering the Aviator's Helmet (SPH-4) and the Tanker's Helmet (DH-132) from the Army Master Data File (AMDF) and Supply Bulletin 700-20, 1 January 1976, page 8-36.

1. Aviator's Helmet.

Helmet Flyers: Crash Type, Glass Outer Shell OG 106 (SPH-4)

NSN 8415-00-144-4981	Regular Size	$170.00 each
NSN 8415-00-144-4985	Extra-Large Size	$170.00 each

2. Tanker's Helmet.

Helmet, Armored Vehicle Crewmans: DH-132 w/communications

NSN 8415-00-094-2679	Small Size	$260.00 each
NSN 8415-00-094-2691	Medium Size	$260.00 each
NSN 8415-00-094-2684	Large Size	$260.00 each

APPENDIX J

EARCUP SEALS: REPLACEMENT INFORMATION (EAR MUFFS)

Manufacturer	Address	Ear muff Model	Earcup Seal Model Number	Cost	Remarks
American Optical Corporation	Government Bid & Contract Division 14 Mechanic Street Southbridge, MA 01550	1200	Catalog No. 1269 Product Code No. 85430	$1.30 pr	2% discount if paid within 30 days of billing
David Clark Co., Incorporated	360 Franklin Street Worcester, MA 01604	19A, E600 (117) or E310	Pair: 12192G-02 Case: 12192G-08 (100/case) NSN 4240-00-979-4040	$1.00 85.00	$15.00 minimum order unless paid by check or cash at time of order
Mine Safety Appliances Co.	201 Braddock Ave. ATTN: Defense Products Department Pittsburgh, PA 15208	Mark II	Part No. 82206	$1.30 pr	2% discount if paid within 30 days of billing
Willson Products Division, ESB	PO Box 662 ATTN: Government Sales Reading, PA 19603	258	EM9 (Fluid filled) EM124 (Vinyl covered sponge)	$2.60 pr $2.24 pr	None

Replacement Seal, Aural Protector

NSN 4240-00-979-4040 (AMDF) — For David Clark ear muffs only.* $1.03 pair

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* With the exception of the David Clark ear muffs listed above, none of the ear muffs have been assigned NSN for their replaceable earcup seals. At least two models, David Clark's E600 (117) and the MSA, Mark II, are shipped with one additional set of earcup seals (costs as of January 1978).

APPENDIX K

NOISE MEASUREMENT EQUIPMENT

1. Sound Level Meters. NSN 6625-00-003-9714, Sound Level Meter, General Purpose. A battery powered portable instrument to measure noise levels up to 140 decibels. Meets the specifications for a Type II instrument set forth in ANSI Standard S1.4-1971, (C-6515-IL) page 180.

2. Sound Level Calibrator. NSN 6625-00-438-0626. A battery powered portable unit for making accurate field calibrations on microphones and noise measuring instruments. An acoustical calibrator must be available for the calibration of noise measuring instrumentation, prior to, during, and after each noise measuring session.

3. Test Set, Audiometer Calibration. NSN 6515-00-236-1204, in carrying case. Consists of sound level meter and sound level calibrator previously listed and an earphone coupler. For testing and determining the calibration of audiometers, and for routine noise measurement. (C-6515-IL, page 180). Note: the earphone coupler and the microphone of the General Radio 1565 sound level meter does not meet the ANSI Standard, S3.6-1969, Specifications for Audiometers.

APPENDIX L

AUDIOMETRIC EQUIPMENT

1. Audiometers.

a.	NSN 6515-00-584-3057 (MIL-A-36247)(C-6515-IL,* page 29; SB 700-20†, page 2-17; or AMDF§)	Audiometer, Automatic, Portable 110v, 50 or 60 Hz, AC, $1,799.20. (Tracor, Model 4A)
b.	NSN 6515-00-533-6644 (AMDF)	Audiometer, Automatic, Portable, 115v, 50 or 60 Hz, AC, $1,475. (Tracor, Model 4B)
c.	NSN 6515-00-243-4708 (C-6515-IL, page 29 or AMDF)	Audiometer, dual channel, 115v, 60 Hz, $3,160. (MAICO, Model MA 24)
d.	NSN 6515-00-536-5056 (C-6515-IL, page 29 or AMDF)	Audiometer, Automatic, 115-230v, 50 to 60 Hz, AC, Solid State, $1,450. (Grason-Stadler, Model 1703)

2. Attenuating Earphones.

NSN 6515-00-935-3990 (C-6515-IL, page 61)	Cup, Earphone, Audiometer. Each pair with headband and cords. Each cup fitted with plastic sealing cushion to attenuate air conduction of background noise, $100 (approximately).

3. Audiometric Examination Booth.

NSN 6515-00-065-9600 (C-6515-IL, page 37)	Booth, Audiometric Examination, 90" high, 48" wide, 44" deep. Designed for easy erecting and dismantling. One-person type booth of single-wall construction; with floor mat, jack panel, light fixture, and ventilation system. Requisition should indicate whether left or right hand door is desired, and whether contractor installation is or is not required. 110 or 220v, 50 or 60 Hz, AC, $1,300 (approximately).

4. Audiometric Recording Charts.*

a. NSN 6515-00-113-8332 (ISO-1964 and ANSI-1969 values) (C-6515-IL, page 52)	Chart, Recording, Instrument, 1000s, with separate grids for right and left ear. Replacement chart for Portable Automatic Audiometer, NSN 6515-00-533-6644 $10.61 per package.
b. NSN 6515-00-536-5059 (ISO-1964 or ANSI-1969 values) (AMDF)	Chart, Recording Instrument, Audiometer (for Grason-Stadler, Model 1703 only)

5. Otoscope.

NSN 6515-00-550-7200 (C-6515-IL, page 122)	Otoscope, battery type, in case. With battery handle, three aural and one nasal specula, and three lamps. $56.16 each. Note: Disposable plastic ear specula are available as a local purchase item.

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* Federal Supply Catalog Number C-6515-IL.
† Supply Bulletin 700-20, 1 January 1976.
§ Army Master Data File.

REFERENCES

1. ANSI, (American National Standards Institute), Standard Z24.22-1957 (Revised 1971), Method for Measurement of the Real-Ear Attenuation of Ear Protectors at Threshold.

2. Guide for Conservation of Hearing in Noise, A supplement to the Transactions of the American Academy of Ophthalmology and Otolaryngology, p 25, 1973.

3. "Personal Protection," Industrial Noise Manual, second edition, American Industrial Hygiene Association, 1965.

4. Roger Maas, "Hearing Protection - Whose Failure?" National Safety News, September 1961.

DEPARTMENT OF THE ARMY

5. AR 40-5, Health and Environment, September 1974. This regulation prescribes a comprehensive preventive medicine program for the Army including the hearing conservation program.

6. AR 385-32, Protective Clothing and Equipment, 27 August 1965. This regulation specifies responsibilities and established policy and procedures for providing protective clothing and equipment. (Ear protectors and TB MED 251 are specifically mentioned).

7. TB MED 251, Noise and Conservation of Hearing, 7 March 1972. This document outlines and describes all the basic elements of a comprehensive hearing conservation program.

8. CTA 50-900, Clothing and Individual Equipment (Active Army, Reserve Components and DA Civilian Employees), 15 November 1973, page 11-37. This CTA is to be used as an authorization document under the provision of AR 310-34. The SPH-4 helmet is authorized for individuals on flying status, in the passenger seat in observation aircraft, test pilots, instructors, and allied students attending flying courses. The tracked vehicle driver, crewmen, and instructors in tracked vehicle instruction are authorized the combat vehicle helmet with an FM radio.

9. CTA 50-970, Expendable Items, 1 July 1974, page II-5. The nomenclature and NSN's for four, type I ear muffs are included.

10. C-4230/40, Federal Supply Catalog, Safety and Rescue Equipment, 2 August 1971, Change 7, page 31. The nomenclature and NSN's for two, type I ear muffs are included.

11. C-6515-IL, Federal Supply Catalog, Medical and Surgical Instruments, Equipment, and Supplies, 1 January 1975. Descriptions, NSN's, and nomenclatures are listed for audiometers, earplugs, sound level meters, and recording charts. The NSN for the large triple-flange earplug is not listed. The sound level meter can be found under the nomenclature - Test Set, Audiometer Calibration. This set consists of a sound level meter, a sound level calibrator, an earphone coupler, and a carrying case.