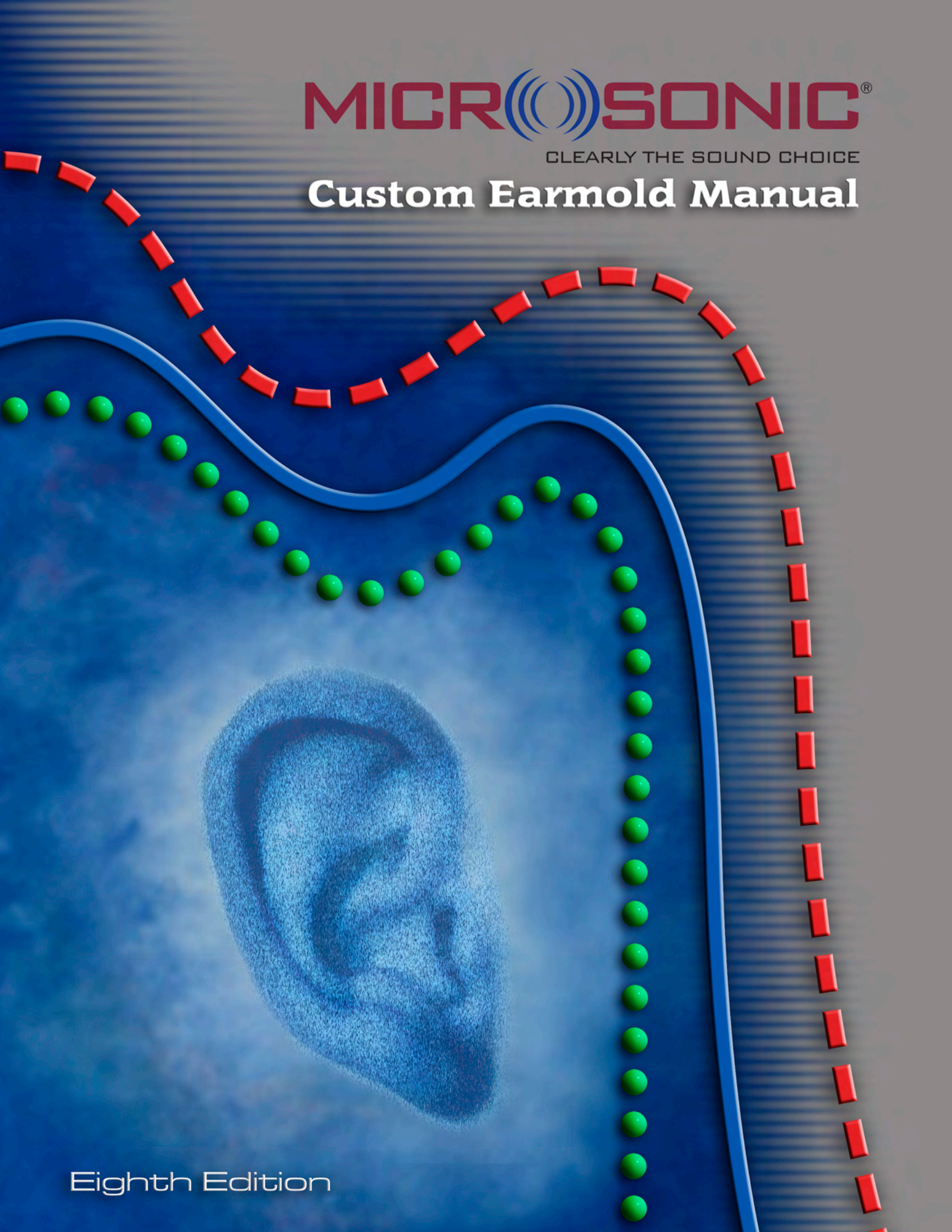
MICROSONIC®

CLEARLY THE SOUND CHOICE

Custom Earmold Manual



Eighth Edition

MICROSONIC®

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Custom Earmold Manual

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A LICENSED MEDICAL DEVICE MANUFACTURER AND DISTRIBUTOR

Copies of Microsonic's **Custom Earmold Manual** are available on CD-ROM. Check our Web site at **www.microsonic-inc.com** for additional information and for the latest updates to this manual.

NEW AMBRIDGE LABORATORY

Established in 1964, Microsonic sets high standards to provide quality service, craftsmanship, products and materials. As a result, Microsonic is recognized as one of the nation's leading full service earmold laboratories. Microsonic subscribes to a policy of mutual cooperation to guarantee satisfaction and to make every effort to share in the responsibility of assuring customer satisfaction in a quality fitting.

Using only the highest quality materials available, Microsonic's highly skilled craftsmen give each earmold individual attention. Following dispenser specifications we handcraft each mold to duplicate the finest details of the impression. Workmanship is guaranteed to be unexcelled, and rigid quality control assures the finest products available anywhere in the industry.

In addition to dedicated attention to quality, Microsonic is continually researching, testing and developing new ideas. Some of our innovations include the tragus earmold, stethoscope adapter mold, advanced design free field mold, the use of a silicone canal in conjunction with hard materials and the tube lock. We hold patents on the exclusive Tube Lock Plus and the popular Microsonic Universal Syringe, plus a design patent on our unique SOLOS package for individual portions of silicone impression materials. Microsonic has also introduced to America a number of established European materials and methods.

Our large Accessory Division is one of the industry's leading suppliers of top-quality impression materials and supplies, fitting supplies, office tools and accessories, as well as consumer products. A wide variety of these products is always in stock. In addition, Microsonic is among the world's largest suppliers of preformed earmold tubing. A separate *Accessories, Materials, Supplies & Tools* catalog is available upon request.

Another significant contribution is the **Custom Earmold Manual**. Although initially published as a guide for Microsonic's customers, audiology departments of many universities and colleges quickly saw the value of the clarity and completeness of the manual and began using it as a teaching guide and textbook.

We are proud to bring you this eighth edition of the **Custom Earmold Manual** which includes the most up-to-date information and the newest developments in the field. We at Microsonic continue to pledge our best — to assure you of consistent high quality, and to inform you of modern techniques, new materials and the most current technology so that together we can bring the hearing impaired the finest in acoustic performance, comfort and appearance.

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A MESSAGE FROM THE PRESIDENT

Over the past half-century, hearing aid manufacturers have utilized many new technologies to bring an enhanced quality of sound to hearing instrument wearers. Broader-band transducers and sophisticated circuitry, all in ultra-miniature packaging with greater durability, have resulted in better hearing instruments.

Microsonic has kept pace with the technological growth of the industry through the years, and has introduced numerous new materials, styles and acoustic options which allow for maximum utilization of the manufacturers' innovations. An important result of this work is that it is now easier for the dispenser to offer improved technologies to clients.

At Microsonic we have found that the best results in quality hearing aid fittings are achieved when the laboratory and fitter work together as a team. That relationship between lab and fitter is characterized by respect, trust and mutual suggestions for the benefit of the client. Microsonic adds additional aspects to that relationship with a willingness to innovate, and by taking the responsibility of disseminating new earmold technology information as it is developed and reported.

The production of an earmold involves a myriad of variables in a number of different areas. These begin with the anatomy of the external ear, and include the impression taking skills of the fitter, the fitter's critique of his or her own impressions, potential changes in the impression during shipment, careful selection of the lab's options, and the accuracy and precision of the laboratory technicians in the final processing.

To support and strengthen the relationship between fitters and Microsonic, and in the interest of our common goal of achieving the best results for your clients, we present this new edition of the **Custom Earmold Manual.** Originally published in 1968, it is now used in all 50 states and many foreign nations. It is also used as a standard text in many university audiology programs. This new eighth edition includes the most up-to-date and useful information on earmold technology and will guide the conscientious dispenser in the appropriate use of the currently available options.

Miklos Major
CEO

Monika Major
President

Earmolds: Background 1

Since the 1920s earmolds have been a part of most hearing aid fittings. The advent of button-type receivers made earmolds a necessity, and the early history was focused on increased physical comfort. It was not until the early 1960s that the acoustic effects of earmolds became a central issue in changing earmold design. Chapter 1 provides the basics that fitters must know about the theoretical aspects of hearing aid fittings and acoustics as they relate to earmold technology.

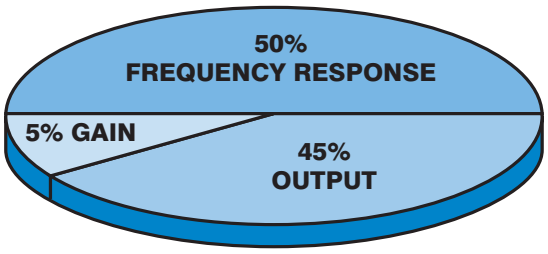
DEFINITIONS AND FUNCTIONS

An earmold is the individually fabricated ear insert that channels the sound reproduced by a hearing aid through the ear canal to the eardrum. In most fittings and most configurations, earmolds have several objectives:

- to provide a satisfactory acoustic seal
- to couple the hearing aid to the ear acoustically
- to retain the hearing aid on the pinna
- to modify acoustically the signal produced by the hearing aid
- be comfortable to wear for an extended period of time, and
- be aesthetically acceptable to the client.

HEARING AID FITTING CONCEPTS

Fitters in the field know that the success of their fittings depends heavily upon the adjustment and interaction of the three important parameters of hearing aid performance: **gain, output and frequency response.** All three of these can be controlled electronically by internal controls within the hearing aid. They are controlled acoustically by changing the earhook, tubing, earmold (and hearing aid shell when using in-the-ear instruments). The relative importance of gain, output and frequency response is shown in the chart below.



PARAMETER MOST ESSENTIAL TO A SUCCESSFUL FITTING (assuming UCL has not been exceeded)

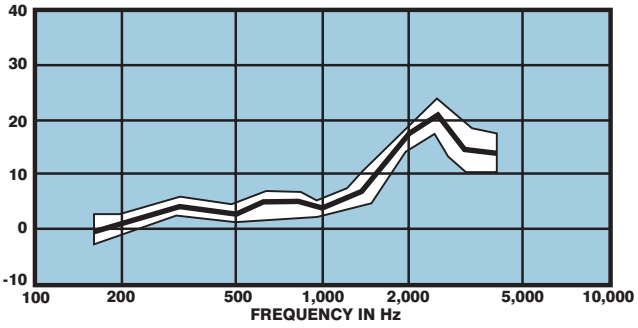
1 EARMOLDS: BACKGROUND

THE ORIGIN OF EARMOLD TECHNOLOGY

In the United States, Lybarger is credited with first defining the acoustic effects of an earmold on a hearing aid's response. From his work, fitters were made aware that the standard 2cc coupler responses reported on hearing aid specification sheets did not represent what the aid and mold actually delivered acoustically to the ear. Lybarger's work included acoustic studies of the effects of vents in earmolds. His work stimulated many other researchers in subsequent years to examine earmold effects. This ongoing study, research and product development in the area of earmold acoustics is commonly referred to today as earmold technology. In addition to the measurements made of earmold effects, measurements of natural ear canal resonance (which were first published in 1945) have been very important in furthering improvements in earmolds.

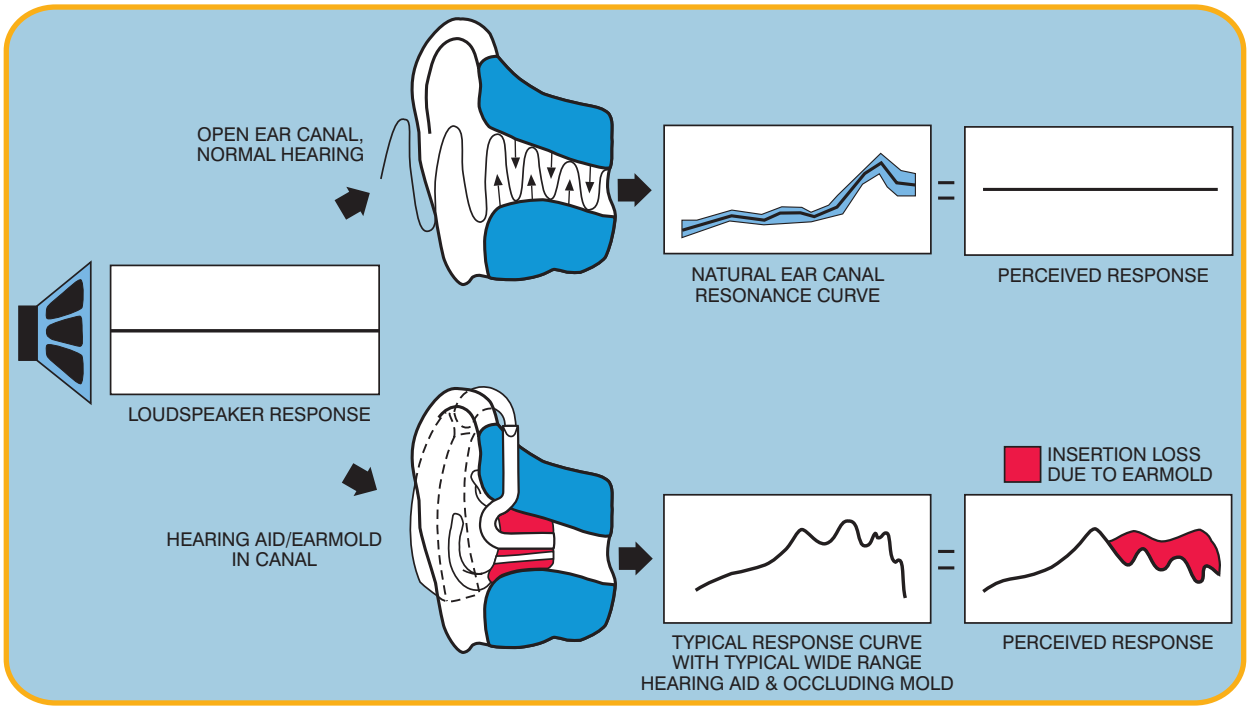
NATURAL EAR CANAL RESONANCE

Probe microphone measurements enabled earmold acoustic researchers to see the effects that earmold insertion have on the acoustic response of actual hearing aids. Part of the research was to determine the acoustic response of an ear without an earmold. The dark line in the chart to the right shows the median natural ear canal resonance found in a study of a group of individuals with normal hearing.



INSERTION LOSS

The drawings below show the effect of a hearing aid and earmold combined with natural ear canal resonance. Insertion loss must be factored into fittings or controlled through careful earmold acoustics.



EARMOLDS: BACKGROUND 1

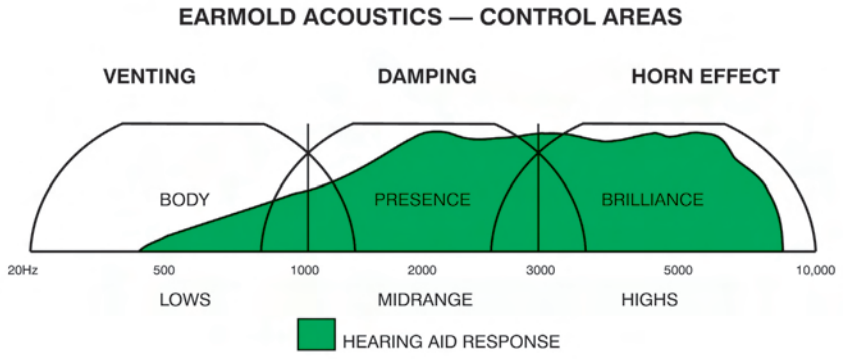
SPEECH ACOUSTICS

Research into the acoustics of speech has yielded valuable information for hearing aid development. It has shown that the high frequency formants and consonants are **very** important to the understanding of speech for both normal and hearing-impaired listeners. The frequency range from 2500-3500 Hz is the most critical.

The majority of speech energy occurs from 20-1000 Hz, but the majority of speech intelligibility occurs from 1000-8000 Hz. Thus, hearing aids must reproduce high frequencies in order for clients to achieve maximum intelligibility. Studies of insertion loss demonstrated that earmolds often were not allowing extended high frequency response because they were not designed to do so.

CONTROL AREAS OF EARMOLD ACOUSTICS

Current earmold technology encompasses control areas in the acoustics generated in the hearing aid and earmold. The illustration below clearly shows the relationships by frequency, and sound quality judgement, with an overlay of actual hearing aid response.



KILLION/KNOWLES CONTRIBUTIONS

For years, hearing aids were basically low fidelity devices with characteristic frequency ranges of 250-3900 Hz. Today's receivers now make possible a range of 50-9000 Hz and beyond. The role of the earmold in preserving and often enhancing this added high frequency response is critical. Killion developed a series of earmold constructions that maintain the benefit of newer receivers. Killion's earmold systems inspired further system developments by Bakke, Bennett, Goldberg, Johnson, Libby, Schlaegel, Macrea and others.

Knowles Electronics developed color-coded plastic mesh dampers housed in a metal shell designed to fit easily inside earmold tubing. Their six values make it easy for the dispenser to choose an appropriate level of damping. Further details on the Knowles Acoustic Dampers will be found in Chapter 5.

The essence of these systems is expanded discrete acoustic control via the earmold, for maximum benefit from applied amplification—in other words, **improved hearing.**

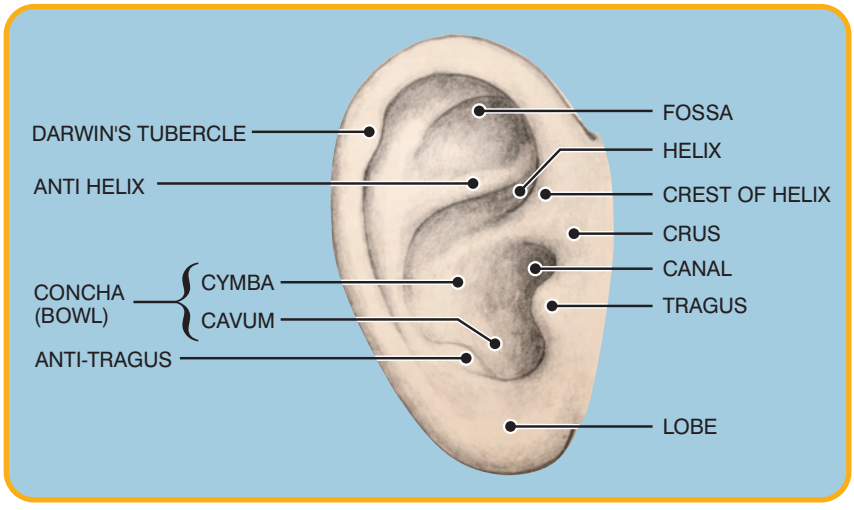
2 Impressions

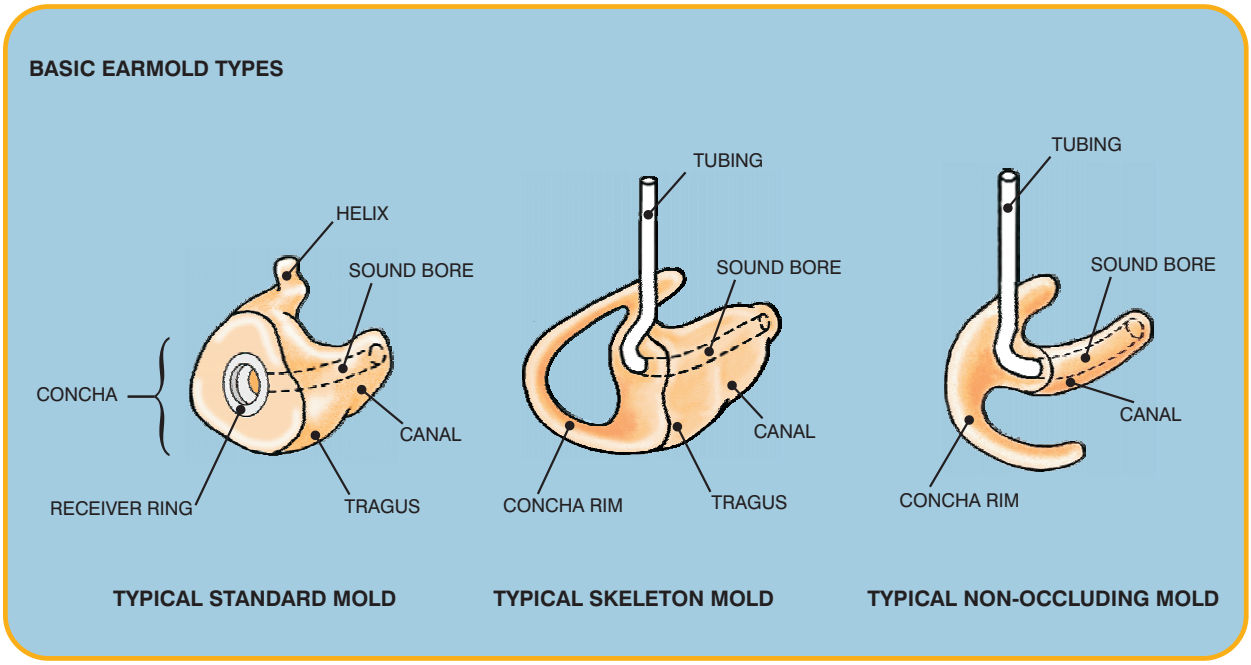
Earmolds are processed from impressions of portions of the pinna and the external auditory canal. Taking impressions for earmolds is a very important part of fitting hearing aids. The dispenser must have knowledge of important anatomical factors as well as possible medical problems. Understanding the impression-making process and developing a good impression technique through practice are the hallmarks of a competent hearing aid dispenser.

EXTERNAL EAR ANATOMY

In order to understand impression taking and the utilization of earmolds to fulfill their function, one must review the anatomy of the external ear. The drawings below define the important parts.

The external ear is made up of skin, cartilage, muscles and bony tissues. Fitters should note that the fatty tissue lining the auditory canal is firmly fastened in place, yet it can be stretched as much as 3/16 inch. When inserting the canal block prior to taking an impression, this tissue must not be distorted. Fitters should also note the configuration of the tragus.





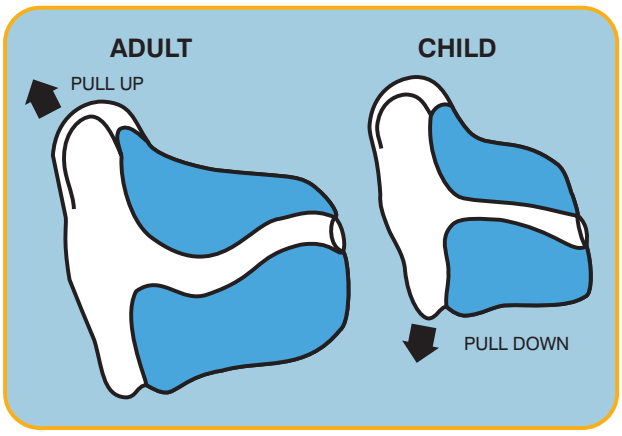
The drawings above illustrate how earmolds relate to the anatomy of the ear described on the previous page.

USE OF EARLIGHT AND OTOSCOPE

The first step in taking an ear impression is an examination of the external ear and its canal. This examination tells the dispenser several important things about the client:

- the size of the impression to be taken
- the length, direction and diameter of the canal
- the shape and contours of the external ear and canal
- the presence of any problems, such as wax, enlargement, trauma, disease, absence of the drum, etc.

Options for the dispenser in making an examination of the external ear are an earlight or an otoscope. The earlight (not recommended) provides illumination of the ear canal, while an otoscope provides illumination plus magnification. Modern video otoscopes allow the dispenser to view and record the condition of the external ear. These devices permit the patient to see his or her own canal, and with a printer attachment, can produce copies for physician referrals. With any instrument, though, the hand should be braced in such a way that the fitter has control over the instrument in the event the client's head suddenly moves during the otoscopic examination.



With adult clients the canal and drum can best be observed by pulling the pinna up to straighten the canal for viewing. With pediatric clients pull down on the lobe or pinna to open the canal for the otoscopic exam.

POSSIBLE OTOSCOPIC EXAMINATION FINDINGS

Some of the conditions or problems that can be identified by the otoscopic examination are:

ATRESIA OR STENOSIS

This involves the complete or partial closing of the ear canal. If the client has a medical clearance you may proceed. If not, medical referral is necessary.

IMPACTED EAR WAX (CERUMEN)

Wax can range from "wet" to "dry" in character. When wet, it can be yellow, brown or reddish in color. Dry wax appears as flaky scales in the outer ear and canal. If either type is present in quantity, the client should be referred to an otologist to have the cerumen removed.

AURAL DISCHARGE

There may occasionally be fluid running from the external ear canal. Presence of any liquid should act as a red flag for the dispenser, and the client should be referred to an otologist immediately.

BONY GROWTHS

Any bony growth is cause for referral to an otologist.

INFLAMMATORY CONDITIONS

A bacterial or fungal infection in the ear canal may make the ear red and sensitive. A pimple in the pinna or ear canal may also be sore. Both require medical attention prior to making an impression.

PROLAPSED CANAL

This refers to a flap of tissue that occludes the external canal. Lift the pinna back and the flap will open up. The foam plug should be inserted in the canal past the second bend before taking the impression. With this condition, be **absolutely** sure to allow the impression to set up for a full **ten minutes** before removing.

ENLARGED CANAL

This is usually due to past ear surgery. **Extreme** caution should be exercised by the fitter with this type of client. Often there will be no drum or ossicles, and the canal skin will usually be very sensitive. An enlarged canal will usually require multiple plugs placed by a physician.

FOREIGN OBJECTS

If the otoscopic examination reveals a strange color or shape, there may be a foreign object lodged in the ear canal. Examples are erasers, insects, cotton, peas, etc. Medical referral is necessary.

EARDRUM DISTENTION

This is most often due to fluid behind the drum, with the drum appearing to be ballooned out. Medical management is indicated.

EARDRUM RETRACTION

When middle ear problems cause eustachian tube dysfunction, normal pressure equalization of the drum does not occur. Abnormal middle ear pressure can cause the eardrum to retract and stretch back over the ossicles. Medical management is essential.

EARDRUM PERFORATION

If a tear or perforation in the eardrum exists, medical management is essential. In this case, a patient **must have medical clearance** for an impression to be made.

TAKING AN IMPRESSION: INFORMING CLIENTS

A major part of the impression taking technique is the ability of the hearing aid professional to put the client at ease. Always explain the procedures, as people fear the unknown. Inform the client that you are going to take an impression of the ear with a soft material that must set up for ten minutes. At this point also tell the client that if the impression you are now taking is not perfect, you will be making a second one to assure the success and comfort of the fitting. In some instances, two impressions may be *required* by the lab.

A poor impression will cause problems. The causes of poor impressions can be either the fitter's technique or the improper use of the impression material.

TRADITIONAL IMPRESSION MATERIAL

Microsonic offers the traditional impression material—Audalin—in bulk packages or pre-measured packets. Pre-measured packets can eliminate the problem of incorrect portions of powder and liquid. Traditional impression material can be negatively affected by age and by changes in temperature and humidity. Heat can be a problem when taking an impression with traditional material, because the material could set up before the impression can be completely formed into the ear's contours. **Never** change the proportions of powder and liquid. Cool (or warm) the materials first to compensate for temperature extremes. Be sure to work efficiently with this material.

SILICONE IMPRESSION MATERIALS

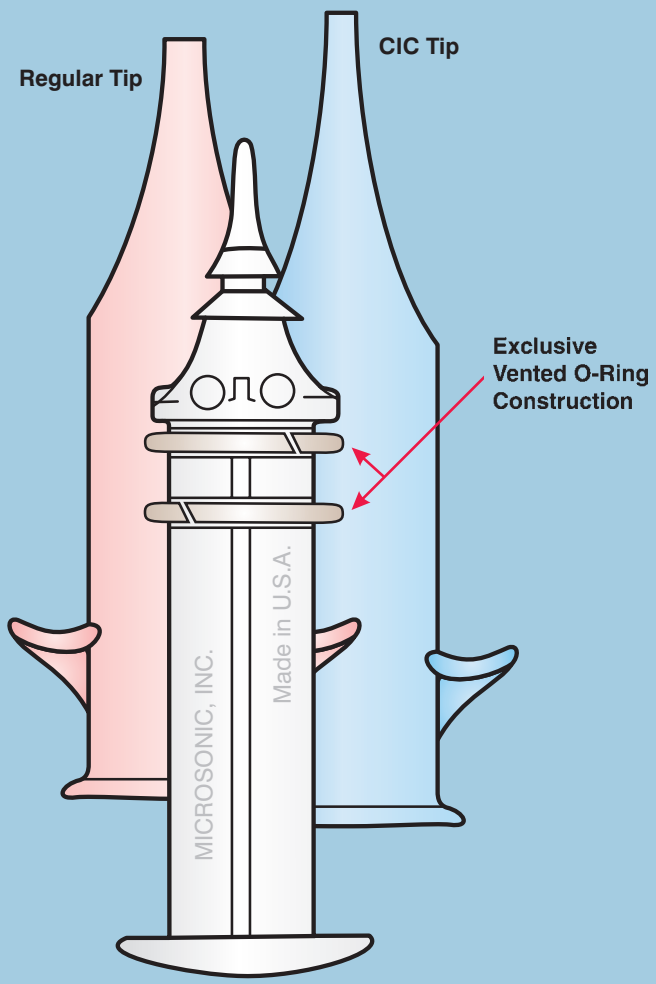
Mega-Sil, Microsonic's premium vinyl polysiloxane A+B impression material, is a pleasant smelling, putty-like material that is easy to measure, easy to mix and easy to insert. It is available in a variety of colors. Other choices include Mega-Press or Ready-Press, prepackaged self-mixing materials that offer the flexibility of silicone and the convenience of a cartridge and mixing tip. Still another option is Micro-Sil™, a traditional silicone material. Silasoft is a lower-viscosity A+B material, specially formulated for CIC impressions and sensitive ears.

The most impressive characteristic of a silicone impression is that it is flexible, yet has total memory. Unlike impressions made of traditional materials, silicone impressions will never sag or collapse and cannot generally be damaged by handling or shipping.

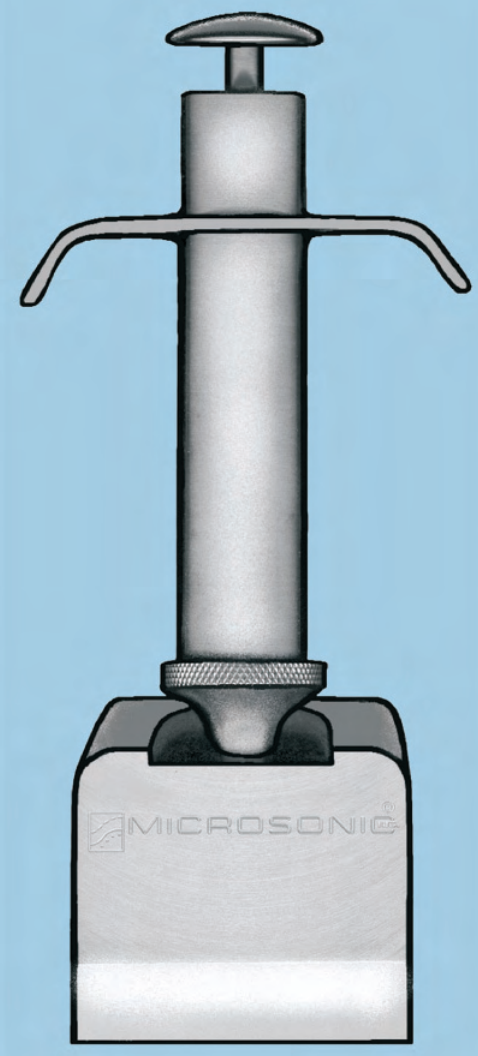
IMPRESSION-TAKING TECHNIQUES

Historically there have been four methods of taking an ear impression – the hand packing method, the tamper method, the syringe method and the gun/cartridge method. **We strongly recommend the syringe method,** since in our experience it has been proven that better impressions result from this technique. The Microsonic Universal Syringe (U. S. Patent # 5,865,803) is a premium product for this purpose, and is available with both a standard tip size and a reduced-diameter tip, the latter for pediatric use or CIC impressions. A durable stainless steel syringe with interchangeable tips is also available.

Microsonic Universal Syringe
(U. S. Patent # 5,865,803)



Microsonic Stainless
Steel Syringe



IMPRESSIONS 2

PREPARATION FOR IMPRESSION TAKING

Set up tools and materials in advance. Have clean hands. Examine the client's ear canal with the otoscope. If there is a growth of hair it should be trimmed. A canal block should then be placed in the ear canal just beyond the second bend, and must occlude the full diameter of the ear canal. The canal block serves the following vital functions:

- it prevents impression material from reaching the eardrum
- it acts as a safety catch if impression material sticks in the canal
- it assures a complete canal cross-section

Caution: Do not use a canal block that does not compress against the canal wall. Too small a diameter plug may permit impression material to flow beyond the block and encroach on the eardrum.

Canal blocks must be trimmed with scissors for narrow canals and enlarged for big canals by using more than one. Canal blocks are available in cotton and foam, either of which is quite satisfactory when used properly. Specially sized foam blocks are available for CIC (deep-canal) impressions and should be used to protect the eardrum from possible damage. Once the canal block is properly positioned, mix the impression material.

CAUTION: SPECIAL CASES

Certain patients have ears which have been surgically altered. The plugs for these ears **must** be placed by a physician prior to taking impressions.

CAUTION: AIDS AND OTHER COMMUNICABLE DISEASES

Precautions need to be observed when taking impressions of infected patients. It is also **imperative** that you inform the earmold lab if the condition is present. Put only the impression in a box clearly marked **"CAUTION,"** then put that box and the order form (also clearly marked **"CAUTION"**) in a second box for shipping. The paperwork must be **outside** the inner box.

THE OPEN-JAW IMPRESSION

As hearing aid manufacturers became experienced in the fitting of CIC (completely-in-the-canal) instruments where a precise fit (or lack of it) determines the success or failure of the fitting, research pointed to the flexibility of ear canal cartilage as the source of feedback-producing movement. Pirzanski (1996) recommends taking an open-jaw impression if any of these conditions exist:

- A significant mandibular displacement is seen externally during jaw movements.
- Changes in the auditory canal can be detected during the otoscopic examination.
- The patient complains of feedback or loose fit problems related to TMJ movement.
- The earmold or hearing aid lacks retention and slides out of the ear.
- The patient reports a noticeable loss of hearing aid power caused by mandibular movement.

A viscous, or not overly soft, silicone impression material is strongly recommended for these impressions, as it will properly expand the ear cartilage. Earmolds or hearing aid shells will fit comfortably because with the jaw closed, the cartilage relaxes and rests comfortably against them.

For best results, open-jaw impressions should extend beyond the second bend of the canal, even though the finished product may not fit that deep in the ear. This is so because a deep impression will permit adequate expansion of the cartilage at all depths, while a shorter impression will probably result in inadequate expansion of the canal by the tip of the earmold.

Pirzanski's guide to taking the open-jaw impression appears below:

1. Use an otoscope to detect changes in the auditory canal caused by mandibular movement. While the patient is moving the jaw, examine the ear carefully to determine any changes caused by the jaw movement. Potential changes can be observed at the ear canal aperture, at the middle canal section, and at the second turn of the canal. Most of them will be seen on the anterior ear wall. A video otoscope provides the clearest demonstration of these changes.

2. If the changes appear at the ear aperture and/or before the second turn only, taking one impression with the jaw open is sufficient. If the changes appear at the second turn of the ear canal, it is necessary to take two impressions — one with the jaw wide open and one with the jaw closed — in order to design an earmold or shell with a comfortable and secure fit.

3. Since the open-jaw impression documents the larger ear canal, it is critical to take it first, in case physical conditions make the second one difficult to complete.

4. For an open-jaw impression, place the mouth prop between the molars. If the mouth prop is not used, the patient must open his/her jaw before the impression material is released into the ear and hold the jaw open until the impression is cured. Often, this position is difficult for the patient to maintain, so a prop is highly recommended.

5. Take the impression following standard procedures and precautions. Use a viscous silicone material, because it provides the best reproduction of the ear.

6. When the material is fully cured, remove the mouth prop from the patient's mouth. Ask the patient to chew. This should break the seal between the impression and the ear wall, allowing for easier impression removal.

7. Remove the impression carefully from the ear, and examine it carefully to be sure that it is free of voids and that the second bend is fully visible.

8. Clearly mark on the impression any ear indentations and code the impressions by writing the letter "O" on the open-jaw impression and the letter "C" on the closed-jaw cast.

PREPARING TRADITIONAL IMPRESSION MATERIAL

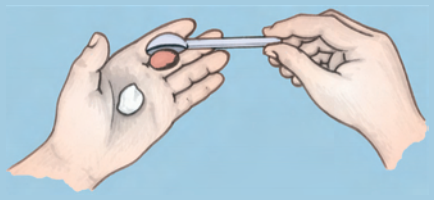
When using the traditional impression material, place the liquid in the mixing cup **first**, then the powder. Mix thoroughly with a spatula to remove all lumps of powder. When using the syringe technique the mixture should be placed in the syringe with the spatula as soon as it mixes smoothly. Work efficiently because of cure time, but **never use more liquid than called for in the instructions.** Don't rush this material.

PREPARING MEGA-SIL™ AND SILASOFT IMPRESSION MATERIALS

Mega-Sil and Silasoft are hand-mixed polysiloxane (silicone-addition) impression materials that are delivered to the ear through a plastic or stainless steel syringe. The catalyst is mixed with the base material for 20-30 seconds until an even, consistent color is achieved. Application instructions are outlined below.

1. **Important:** Two plastic spoons accompany bulk-packed Mega-Sil and Silasoft. **Never** alternate spoons between the materials; **Always** use the white spoon in the white material and the colored spoon in the colored material. **Never** store the spoons in the jars.

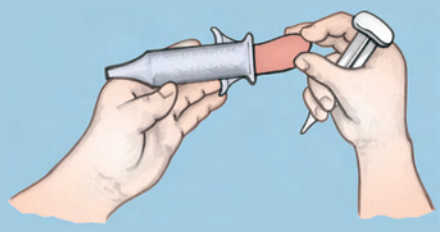
2. Scoop out one level spoonful each of "A" and "B" material. Transfer them to your hand, taking great care not to contaminate one spoon with the other material.



3. Knead the material together with your fingers or in your palms for 20-30 seconds, until it is of consistent color throughout.

4. Roll the material between the palms of your hands, insert into the syringe, and proceed with the impression procedure.

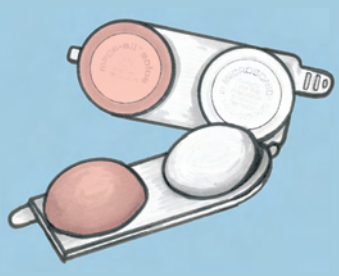
5. Allow to cure **at least** 5-6 minutes before removing the impression.

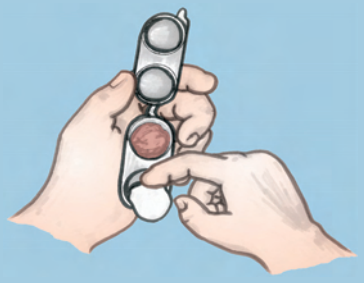


2 IMPRESSIONS

MEGA-SIL™ SOLOS (U. S. Design Patent # 404,642)

Many dispensers prefer the ultimate convenience of Mega-Sil or Silasoft SOLOS, a handy single-use package containing just enough material for one impression. SOLOS eliminate the measuring spoons, since the materials are contained in precisely sized cavities within the package.





Be certain to use silicone impression materials before their expiry dates.

SYRINGE TECHNIQUE

Place the mixed impression material into the barrel of a syringe such as the Microsonic Universal Syringe™. Insert the plunger and force the material into the nozzle to remove air pockets. Insert the syringe into the ear canal near the canal block and begin to inject the material. As impression material becomes visible, withdraw the syringe while continuing to release material as it moves. Keep the tip of the syringe in the impression material at all times. Continue filling the helix and concha completely and then cover the tragus. This should be accomplished in 30 seconds or less. Continue with finishing, timing and removal. See page 19 for details.

FINISHING, TIMING AND REMOVAL

Once the external ear has been filled, press **gently** with your finger in the concha and helix areas. **Be very careful not to press too hard, as this will distort the impression.**

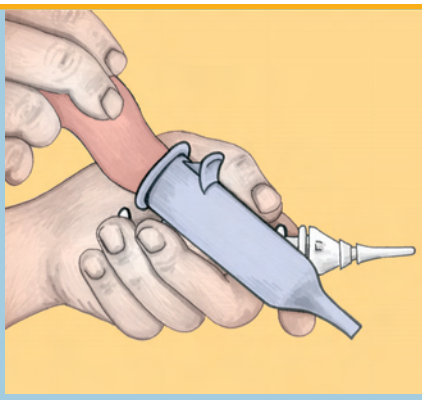
Allow the material to cure in the client's ear for **the full cure time.** The fitter should be aware that **impressions can be easily distorted if removed before the material has fully cured.** As each material is different, refer to the specific instructions.

The best technique for removing an impression is to pull up and back on the pinna with one hand. With the other hand grasp the impression in the anti-helix area and rotate upward and outward.

SYRINGE TECHNIQUE

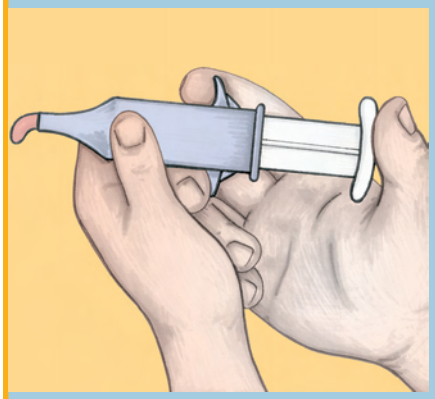
STEP 1

A cotton or foam block is an **absolute necessity** when using the syringe. Set a tight block just past the second bend. Foam blocks **must** be compressed to insure proper results. Be sure to use the correct size foam block even though it may appear to be larger in diameter than the ear canal.



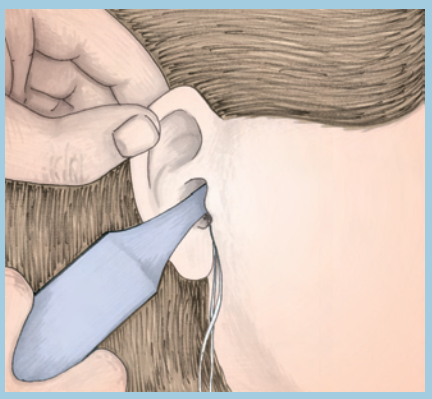
STEP 2

Mix the impression material according to instructions and place in the barrel of the syringe. The quicker you can use the material the better the impression.



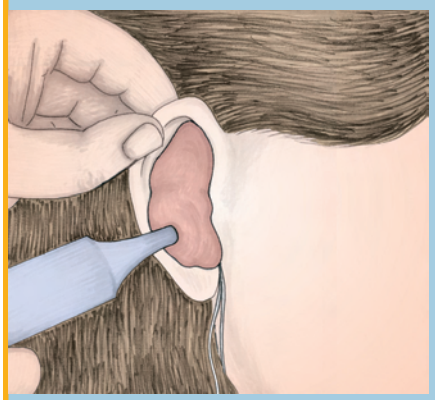
STEP 3

Insert the plunger and gently push the material into the nozzle to remove air pockets.



STEP 4

Place the nozzle into the canal and fill the canal. **Keep the syringe tip buried in the material at all times.**

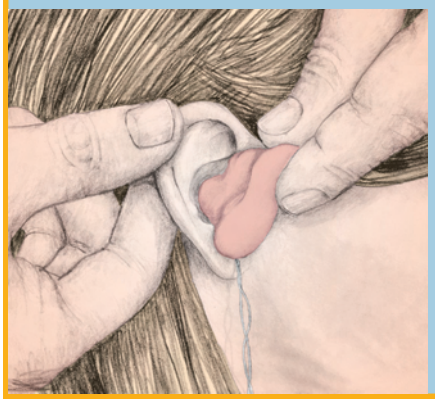


STEP 5

As the material fills the canal, slowly withdraw the syringe and fill the helix and concha areas completely. Then cover the tragus. **Never allow the tip to come out of the material until you are done.**

STEP 6

When the external ear has been filled completely, touch your finger **gently** in the concha and helix areas. **Be careful not to press hard as impression will distort.**



STEP 7

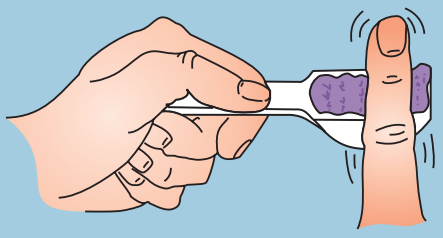
Allow a **full cure time** before removing. The impression will be distorted if removed too soon. To remove, gently press ear away from the impression. Remove helix curl slightly. Bring impression straight out while holding thread. Take your time. Don't strain the impression with a long steady pull.

HELPFUL TIPS FOR BETTER IMPRESSIONS

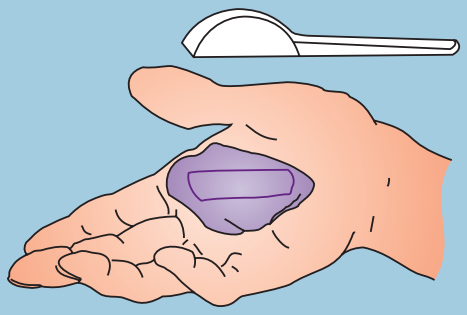
- If the client wears glasses or dentures, make sure these are in place while taking the impression.
- **Never** flatten or smooth out the finished impression with the palm of your hand while impression material is in the client's ear.
- Use the open-jaw impression technique, particularly if you detect cartilage movement within the canal walls.
- Children are sometimes fearful and can be hard to work with. Let the child watch you take an impression of Mother's ear to alleviate his fears. Let him play with a piece of the "dough." **Note:** It is difficult to use a block with **some** children. The impression may be better formed without it in these cases.

PREPARING MICRO-SIL™ IMPRESSION MATERIAL

Micro-Sil™ is a hand-mixed silicone impression material that is delivered to the ear through a plastic or stainless steel syringe. Its catalyst is mixed with the base material for 20-30 seconds until an even, consistent color is achieved. Mixing directions follow below.

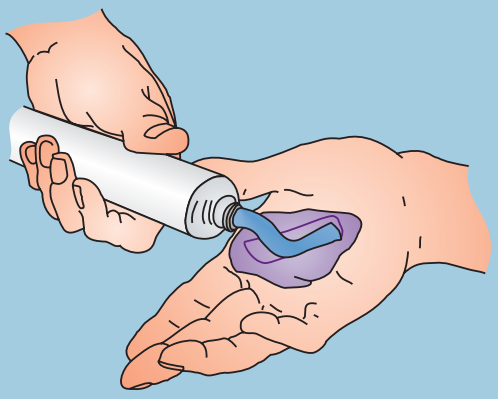


STEP 1: Remove one heaping scoop of the base material. Press material into scoop with your finger to remove any possible air and to be sure that the scoop is completely filled.



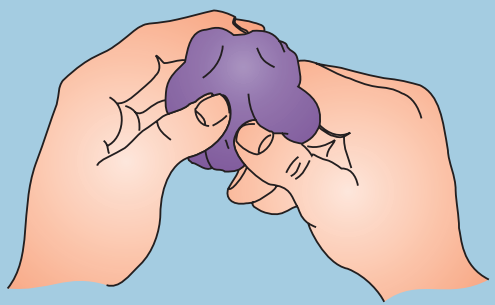
STEP 2: Level the material in the scoop by patting your finger along the top edge of the scoop. The excess material can be placed back into the jar for future use.

STEP 3: Roll the base material out of the scoop and flatten it in the palm of your hand. Make an indentation in it with the overturned scoop.



STEP 4: Squeeze one line of the catalyst the length of the indentation. (You will have approximately 1-1/2 minutes from this point to complete the ear filling procedure.)

STEP 5: Fold the edges of the base material over the catalyst and begin working the material with your fingers for 20 to 30 seconds, folding and kneading **until material is of consistent color throughout.**



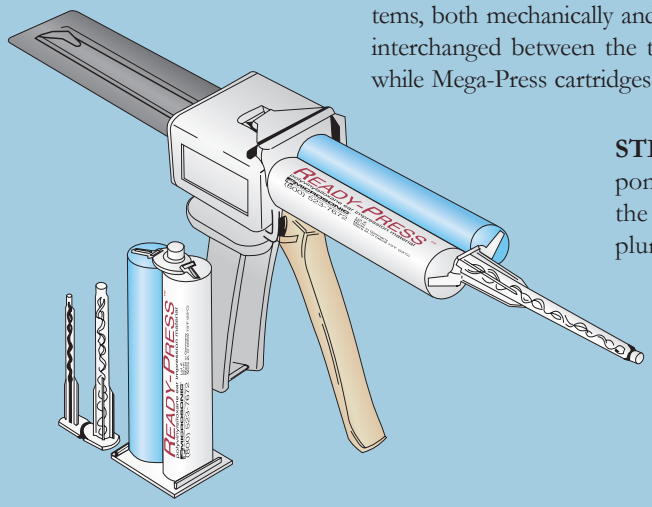
STEP 6: Roll the material between the palms of your hands, insert into syringe and proceed with syringe technique.

STEP 7: Allow to cure for 10 minutes before removing.

MEGA-PRESS AND READY-PRESS EARMOLD IMPRESSION SYSTEMS

These earmold impression systems combine automatic mixing delivery devices with free-flowing, highly accurate, dimensionally stable silicone impression materials. They take impressions quickly and easily with consistent, uniform results. The disposable tips provide ideal mixing, in-the-canal delivery and mess-free clean-up. The finished impressions will not change with time or shipping conditions. Since the viscosities (Mega-Press is higher) and set-up times are preset, Mega-Press and Ready-Press promote consistent high-quality impressions each time they are used.

NOTE: Mega-Press (yellow) and Ready-Press (blue) are separate, distinct systems, both mechanically and chemically. "Guns," tips and cartridges cannot be interchanged between the two. Ready-Press cartridges accept three tip sizes, while Mega-Press cartridges take two sizes.



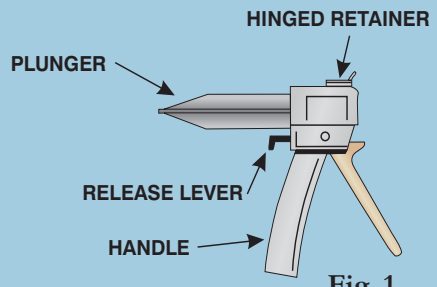


Fig. 1

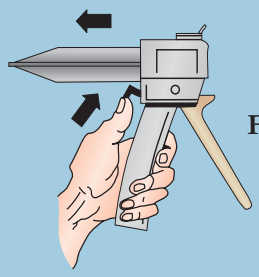


Fig. 2

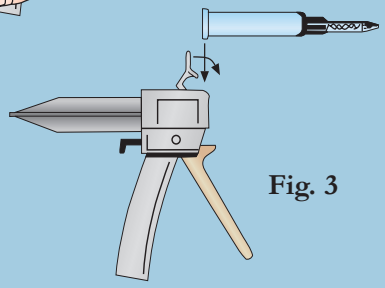


Fig. 3

STEP 1: The injector gun has two pre-assembled component parts—a handle and a plunger (Fig. 1). Hold the release lever up with your thumb and push the plunger all the way back in the handle (Fig. 2).

STEP 2: Slide the cartridge onto the handle (Fig. 3). The cartridge flange will fit directly behind the retainers on the handle. Lock it in place with the hinged retainer.

STEP 3: Twist the cap at the end of the cartridge and remove.

STEP 4: Press the plunger forward to fit into the cartridge. (If the plunger does not enter the cartridge, check to see that the cartridge is properly aligned.)

STEP 5: For best results, after placing a cotton or foam block, coat the client's ear with baby oil or earmold lubricant using a cotton swab before proceeding with the impression.

STEP 6: Squeeze out enough material to be sure that it is fluid and is flowing uniformly from both openings.

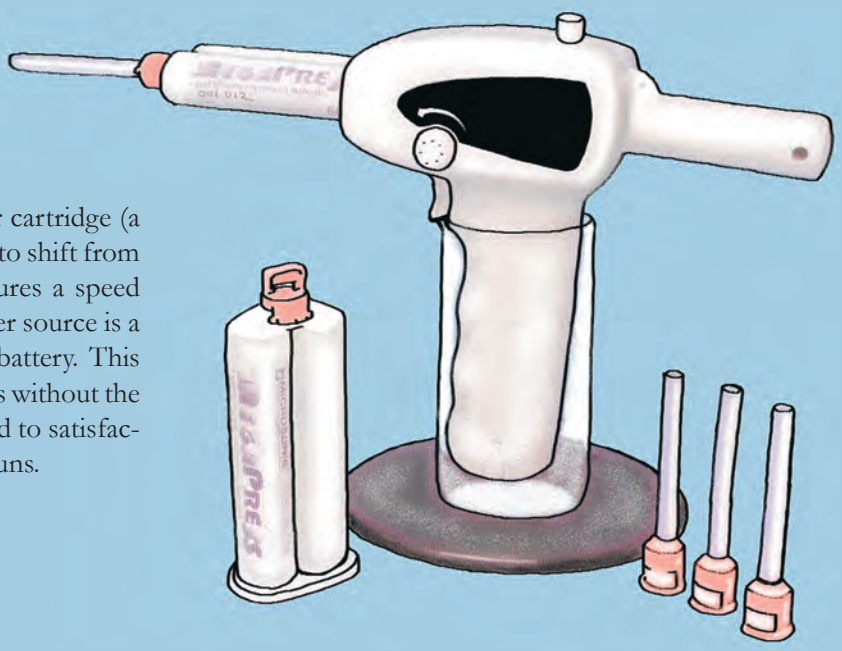
STEP 7: Place the proper size tip (small for children and small ears, or large for adults) where the cap was and twist, locking it into position.

STEP 8: Squeeze out and discard approximately 3/4" to 1-1/2" of the impression material through the end of the tip to insure that it is mixing properly.

STEP 9: Within 30 seconds, fill the entire ear canal as far as the block, making sure to also fill the tragus, concha and helix areas. **Do not underfill.** After 4 to 5 minutes, test the outer surface of the silicone material by indenting or scratching the surface. If the material does **not** retain the indentation, it is ready to be removed.

ELECTRIC IMPRESSION GUN

The electric gun uses either cartridge (a bracket change is necessary to shift from one to the other) and features a speed (pressure) control. Its power source is a self-contained rechargeable battery. This device is useful to dispensers without the hand size or strength needed to satisfactorily operate the manual guns.



IMPRESSION CRITIQUING

Earmold laboratories cannot stress enough the importance of a good impression. A good impression is a major factor in achieving a successful hearing aid fitting. It is important that the fitter critique his/her impressions before sending them to the lab.

Look to be sure that your impression has these features:

- Is the impression smooth and complete?
- Is the canal long enough to show the beginning of the canal's second bend?
- Is the helix portion of the impression clearly defined?
- Is the tragus portion of the ear clearly defined?
- Is the concha complete?

…and that it doesn't have these:

- Is the impression material itself unusually oily?
- Are there weld marks (caused by impression material drying too quickly or by failing to keep the tip in the material)?
- Are the edges of the folds in the ear's concha rounded and not sharp (due to mashing the material in the concha against the skull)?

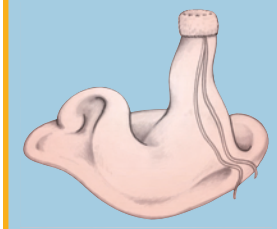
Special attention should be paid to the impression's canal length and diameter. Ideally, the best impression is one which fills the canal about 5-7 mm. beyond the second bend, but it may not always be possible to obtain this. In the finished earmold, the canal length may vary depending on the degree of hearing loss. For mild

losses, the canal may be short and reach just the first bend in the canal. For moderate losses, the canal should go beyond the first bend, and the diameter should be able to accommodate special acoustic options you may order. In severe losses, the canal needs to be long and extend beyond the second bend, and the diameter should always be full. Too much canal length on an impression is never a problem for the lab; too little is.

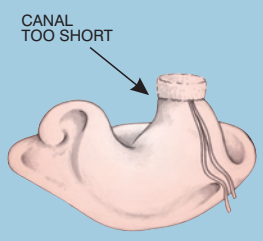
Remember too that in most cases the acoustic seal of an earmold occurs between the aperture and first bend of the canal, not deep within the canal. Too much canal length on a mold may be uncomfortable for the wearer, and can make the mold very difficult to insert and remove. Correct canal length depends entirely on the requirements of the individual client.

For additional information about proper impression-taking procedures, see Microsonic's Educational Video **"Perfect Earmold Impressions**."

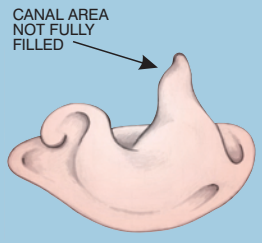
Occasionally we receive an impression which, in our opinion, cannot be properly processed. In these instances, we will call you and request that you obtain a new impression. Please be assured that we would not go to this added expense and delay if we felt we could do a proper job from the impression on hand.



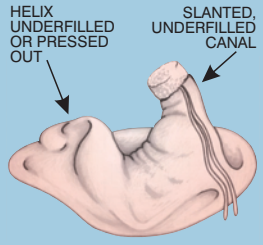
CORRECT
Canal, concha and helix adequately filled. Canal block left attached.



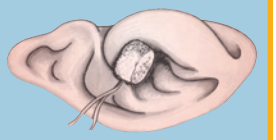
INCORRECT
Insufficient canal depth. Canal block not placed deeply enough in the ear.



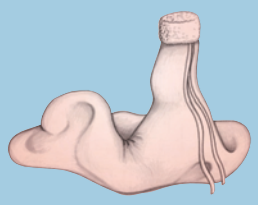
INCORRECT
Canal area not fully filled to canal block, or no block used.



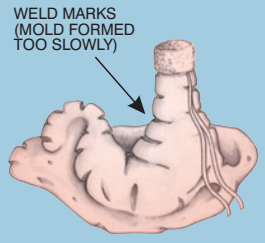
INCORRECT
Slanted underfilled canal due to improper placing of block in ear. Helix either underfilled or pressed out.



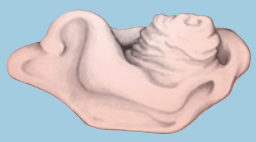
INCORRECT
Distorted due to insufficient curing time for impression, or too much liquid added to Audalin®.



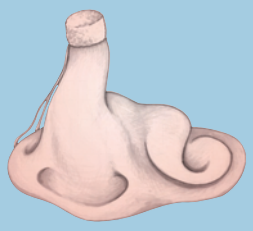
INCORRECT
Concha missing



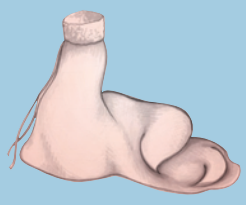
INCORRECT
Gaps or weld marks. Overall surface of impression not smooth.



INCORRECT
Mashed or bent due to improper handling or packaging. (Not usually a problem with the silicone-based materials unless the curing time was too short.)



INCORRECT
Underfilled tragus



INCORRECT
Helix missing

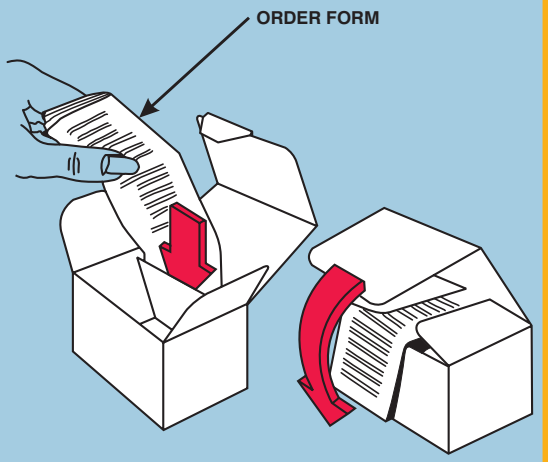
PACKAGING AND SHIPPING

STEP 1
TRADITIONAL MATERIAL (AUDALIN) – Be very careful with powder and liquid impressions when preparing to mail them. Remove the box liner and glue impressions to the bottom of liner with **Duco Cement.** (Two impressions will usually fit in one box.) Always put a straight pin in a thin canal to prevent collapse. **Do not use model (styrene) cement.**

MEGA-SIL, SILASOFT, MEGA-PRESS, READY-PRESS & MICRO-SIL™ – Do not glue silicone based impressions. They cannot be damaged by normal handling and shipping. Several of these impressions can be placed loose in a shipping box together, but do not overcrowd. Do **not** pack Audalin impressions in the same box with silicone impressions.

STEP 2
AUDALIN – When glue is dry (about 30 minutes), place liner with attached impressions in the shipping box. Check to be sure impressions do not touch side of box or ends of the liner. **Never** use any packing such as cotton or tissue. **Never** place any other object in the box with the impressions.

STEP 3
Fold and place earmold order form behind the flap marked for this purpose and fold it over top of box as shown. The order form must not touch Audalin impressions. Close the box and secure it.



MICROSONIC IMPRESSION MATERIAL MATRIX

Microsonic Impression Material Matrix	**MEGA-SIL** Blue, Yellow, Peach	**SILASOFT** Yellow	**MICRO-SIL** Purple or Beige	**READY-PRESS** Blue	**MEGA-PRESS** Yellow	**AUDALIN** Pink or White	**QUIKFLOATERS** Red/Blue
Shore-A Rating (cured)	30±3	28±3	35±3	32±3	30±3	26±3	25±3
Silicone-Addition (A+B) Material	✓	✓		✓	✓		✓
Silicone w/ Hardener			✓				
Powder and Liquid						✓	
Disposable Cartridge System				✓	✓		
Available in SOLOS packaging	✓	✓				✓*	✓
Makes **In-The-Office** Swim or Sound Plugs							✓
Automatic Mixing - **No Mess**				✓	✓		
Non-Shrinking	✓	✓	✓	✓	✓		✓
BTE & Full-Shell ITE Aids	✓	✓	✓	✓	✓	✓	
ITC Aids	✓	✓	✓	✓	✓		
CIC Aids	✓	✓	✓	✓	✓		
Open-Jaw Impressions	✓		✓		✓		✓
Relative Viscosity (at time of delivery)**	2	4	2	5	2.5	3	1
** 1=Highest Viscosity; 5 = Lowest Viscosity	* Available in premeasured units for proper proportions						

Earmold Materials

3

Earmolds are fabricated from different chemical compounds. The variety of different materials available for the various styles is described.

EVALUATING THE CLIENT'S NEEDS

Every fitter must evaluate the individual client before making the decision as to which material the mold should be made from. Several considerations must be evaluated in each case.

- Is the pinna hard, medium or soft? This is critical since the ease of insertion depends partly on the material selected. If the pinna is hard, soft materials like Synth-a-Flex or silicone are often dictated.

- What is the power range of the aid to be fitted? High gain/high output hearing aids require a good acoustic seal to prevent feedback. By far the most comfortable and effective material for high gain applications is M-2000, preferably in the Canal or Canal Shell style. Since BTE hearing aids are designed with front microphones, feedback *can* occur even with moderate gain/output aids. Options include Synth-a-Flex vinyl, or a hard body with soft canal, or dual-durometer M-2000 Plus, material combinations that Microsonic pioneered. For a mild or moderate gain aid with medium ear texture, acrylic can be used, and in actual practice, acrylic is the most commonly recommended material. Microsonic offers several different materials that have varying degrees of softness.

- Is there any allergic condition? The fitter knows this only if he or she asks the patient or receives the information from a referring source. The allergic reaction that can occur from otoplastics is a contact dermatitis. Microsonic offers proven non-allergic materials, both soft and hard.

- What color should the mold be? Choices are clear, translucent pink, opaque beige and brown. Some materials are also available in a variety of colors. Microsonic also supplies brown tubing as well as the clear type. The color factor in earmold materials is for cosmetic reasons and will be important to your clients.

3 EARMOLD MATERIALS

EARMOLD MATERIAL OPTIONS

Plastics come in many formulations. The variations relate to their properties of hardness, clarity, toxicity, water absorption, tensile strength, and density. All plastics are measured and defined by the American Society for Testing and Materials, and the FDA also approves plastics used for food or medicinal purposes. Earmold plastics are FDA regulated. The two ASTM properties that earmold labs are concerned with are water absorption and toxicity.

Microsonic offers a wide range of materials from which we can process earmold orders. Our product names are listed below followed by their chemical names:

ACRYLIC (Poly Methyl Methacrylate)	A fine grade dental acrylic that is available in clear, translucent tint, opaque beige or brown colors.
SUPER ALERITE (Poly Methyl Methacrylate)	An extra fine grade of heat cured acrylic that is effective for most allergy cases. Super Alerite is available in clear or opaque pink.
ACRYLIC BODY WITH VINYLFLEX I CANAL (Poly Methyl Methacrylate and Poly Ethyl Methacrylate)	A combination of hard and semi-soft material in the same mold.
SUPER ALERITE BODY WITH SILKY SILICONE CANAL	The latest and purest materials are incorporated in this heat-cured combination. The canal flexes instantly and naturally while the hard body holds the earmold firmly in place.
VINYLFLEX II (Poly Ethyl Methacrylate)	A heat cured semi-soft vinyl plastic that will soften with body temperature. It comes in clear, beige, or translucent tint, and can be used for any application.
SYNTH-A-FLEX II (Thermoplastic Polyvinyl Chloride)	A soft, proven thermoplastic that can be used for most earmold styles. This material is excellent for children and for improved acoustic seals in higher gain hearing aids. It provides many advantages of silicone but at a lower cost, and is available in translucent tint, brown, opaque beige or clear. An optional protective glaze is available.
MEDI-SIL II (Silicone)	A flexible inert silicone from which most earmold styles can be fabricated. Most allergy problems can be solved with clear silicone. This material is available in opaque clear, translucent pink, opaque beige and opaque brown.
M-2000 (Silicone)	The softest, most comfortable silicone available from Microsonic. M-2000 earmolds are proven in power aid applications. Canal or canal-shell styles are often sufficient to overcome acoustic feedback, and require less bulk in the client's ear. Available in opaque clear, beige and brown. Also available in **M-2000 Implant Grade,** a "super clean" silicone for allergy cases. Can be made to ***Glow In The Dark.***
M-2000 PLUS (Dual-Durometer Silicone)	Featuring a super-soft silicone canal combined with a special, firmer silicone body, this exclusive product permits easy use of Microsonic's Tube-Lock Plus coupler. Available in translucent pink tint, opaque clear, opaque beige and opaque brown.
POLYETHYLENE	This hard material is appropriate for severe allergy cases, and is available in opaque pink.
ACRYLIC BODY WITH SYNTH-A-FLEX II CANAL	This option offers a hard acrylic body with a soft Synth-A-Flex canal.
M-2000 Neon Lites	These floating swim plugs are available in a rainbow of colors and designs. Can be made to ***Glow In The Dark.***

EARMOLD MATERIALS 3

EARMOLD MATERIAL CROSS REFERENCE CHART

MICROSONIC MATERIAL	OTHER LABORATORIES REFER TO IT AS
ACRYLIC	Acrylic, Lucite®
SUPER ALERITE	Heat Cured Acrylic, Lucite®
VINYLFLEX II	Marveltex, Marvel Soft, Vinylflex, Vinyl Flesh, Formula II, Flexible Plastic
ACRYLIC BODY W/ VINYLFLEX CANAL	Flex Canal, Soft Canal, Acrylic w/Flexible Plastic
POLYETHYLENE	Polyethylene, Non-Toxic
SYNTH-A-FLEX II	Marveltex, Satin Soft, Formaseal, Superflex, Poly-Sheer, Rx
ACRYLIC BODY W/ SYNTH-A-FLEX CANAL	N/A
MEDI-SIL II, SILICONE	Silicone, Emplex, Mediflex, Frosted Flex
M-2000	MSL 90, JB-1000, Softech, W-1
M-2000 PLUS	N/A
ACRYLIC BODY W/ MEDI-SIL CANAL	Vogel
SUPER ALERITE BODY W/ SILKY SILICONE CANAL	N/A

WHAT MATERIAL SHOULD I SPECIFY?

Although each case must be considered individually, here are some general guidelines to help you choose an appropriate material:

APPLICATION	RECOMMENDED MATERIALS
General purpose (adult)	Acrylic
General purpose (child)	Synth-a-Flex
Facial flex problems	Acrylic/Soft Canal, Synth-a-Flex, M-2000
Higher gain aid	Synth-a-Flex, M-2000, M-2000 Plus, Medi-Sil II
Allergies	Super Alerite, Medi-Sil II, Polyethylene
Flabby ear texture	Hard mold
Hard ear texture	Soft mold

3 EARMOLD MATERIALS

GRINDING AND POLISHING SPEED ADJUSTMENT TABLES

Bench Grinder (Red Wing or Baldor Motors) without high speed attachment

MATERIAL	GRINDING		POLISHING	
	Speed R.P.M.	Tool-Stone	Speed R.P.M.	Buffing Compound or Solvent
Acrylic & Alerite	3,450	smooth	3,450	buffing compound•
Vinylflex II	3,450	coarse	3,450	buffing compound•
Polyethylene	3,450	smooth	3,450	buffing compound•
Synth-A-Flex II	3,450	coarse	—	solvent
Medi-Sil II, M-2000, M-2000 Plus	highest possible	very coarse	—	—

•Use with felt tool or buffing wheel.

Variable Speed Moto-Tool 370 or Dremel Moto-Tool M270-5 used with Dremel Solid State Motor Speed Control

MATERIAL	GRINDING		POLISHING	
	Set Motor Speed On	Tool-Stone	Set Motor Speed On	Buffing Compound or Solvent
Acrylic & Alerite	6	smooth	3-4	buffing compound•
Vinylflex II	5	coarse	3	buffing compound•
Polyethylene	4	smooth	3-4	buffing compound•
Synth-A-Flex II	5 to 6	coarse	—	solvent
Medi-Sil II, M-2000, M-2000 Plus	6	very coarse	—	—

•Use with felt tool or buffing wheel.

EARMOLD MATERIALS HARDNESS TABLE

Microsonic, Inc. Hardness Table of Earmold Materials: Shore "A-2" (Hand-held) Durometer Tester #67977; ASTM D-2240•

MATERIAL	Shore A Durometer		NOTES
	Canal Tip	Base	
Acrylic	—	Hard	>A and D scale reading
Super Alerite	—	Hard	>A and D scale reading
Acrylic w/Vinylflex I	A-94†	Hard	>A and D scale reading
Synth-A-Flex II	—	A-50	
Vinylflex II	—	A-88	
Medi-Sil	—	A-52	
M-2000	—	A-28	
M-2000 Implant Grade	—	A-40	
M-2000 Plus	A-30	A-52	
Polyethylene	—	Hard	>A and D scale reading
Acrylic Body w/Synth-A-Flex II	A-48	Hard	

•Note to ASTM D-2240 specification (of 1/4" thickness).
†Reading taken directly on canal tip.

4 Style Options

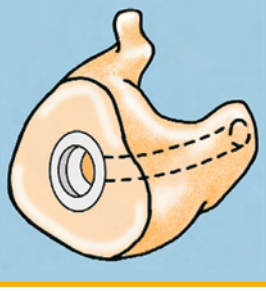
There is a very large variety of physical, acoustic and material options in earmold selection. This chapter gives detailed descriptions and graphics to assist in choosing physical styles.

Earmold style selection covers a range of choices for the dispenser to optimize the patient's fitting. Microsonic follows NAEL terminology, but where nomenclature has not been standardized, clear generic terms are used. Descriptive text and detailed drawings are provided to assist in understanding the options available. Since other laboratories sometimes refer to earmold styles by different names, an earmold style cross reference chart is provided at the end of this chapter.

In making style selections, do not underestimate the patient's attitude about the cosmetics of the earmold. While it is not always possible to give a patient what is wanted cosmetically due to the degree of hearing loss, the majority can be satisfied without sacrificing fitting goals.

OCCLUDING EARMOLDS

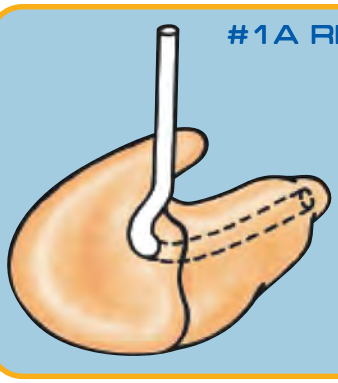
#1 REGULAR



Regular style earmolds are used with hearing aids that have an external receiver that is snapped into the earmold (usually body-type aids). Historically, this was the earliest type of custom earmold. The standard receiver ring is available in metal or plastic, and the earmold can be made in both hard and soft materials.

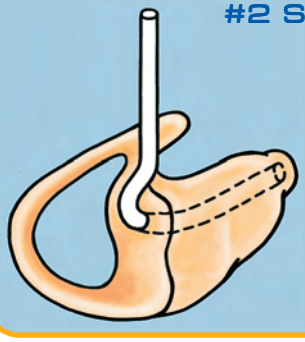
4 STYLE OPTIONS

#1A REGULAR WITH TUBING



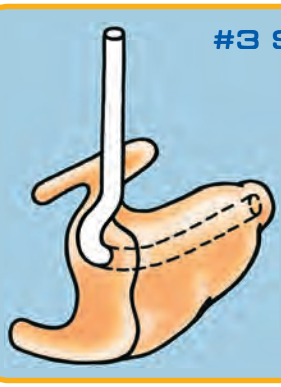
This economical earmold is similar to the regular style, but is for use with head-worn instruments. It fills the entire concha for maximum bulk, but is slightly shelled out for better appearance.

#2 SKELETON



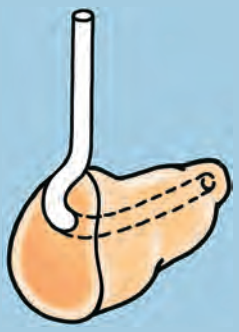
This is a popular style of earmold because it effectively seals the canal while leaving an open space in the concha to enhance appearance. This style can be made from most materials and can be ordered with most available acoustic options. This style is also chosen by many dispensers since it can be easily converted to other styles if necessary.

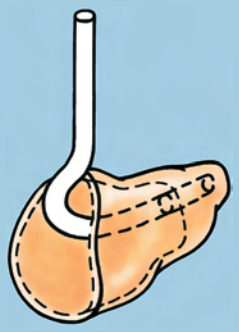
#3 SEMI-SKELETON



Clients may have difficulty with earmold insertion due to lack of manual dexterity or hardened ear texture. This earmold addresses these problems, as portions of the earmold's concha area are removed.

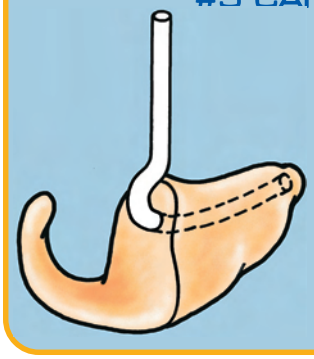
#4 CANAL #4A MICRO-CANAL





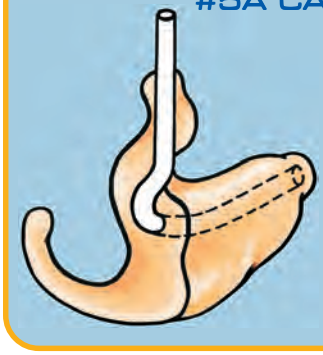
This type of earmold fills only the canal portion of the ear, as the helix and concha areas are removed. Experience indicates that a canal style earmold should generally have a long canal. Ultra-soft materials such as M2000 allow canal style molds to be used with power behind-the-ear hearing aids, providing the ultimate in comfort and acoustic seal in the ear canal. This style is also available as a #4A Micro-Canal in the same materials as the #6A Micro-Shell earmold.

#5 CANAL-LOK



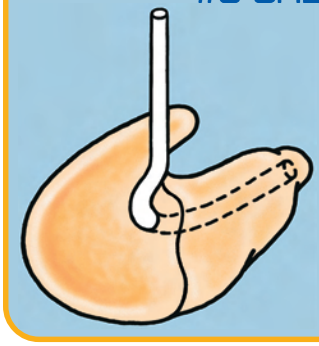
When canal shape or concha abnormalities make retention of the standard canal style not possible or desirable, this style can be used. A finger-like projection along the bottom of the concha holds the mold in place. This earmold is easy for the wearer to insert and remove.

#5A CANAL-LOK WITH HELIX



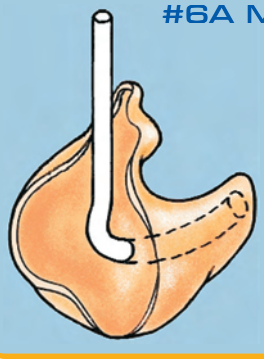
The addition of a helix to the canal-lok mold provides additional retention without sacrificing the cosmetic advantages of the canal-lok style.

#6 SHELL



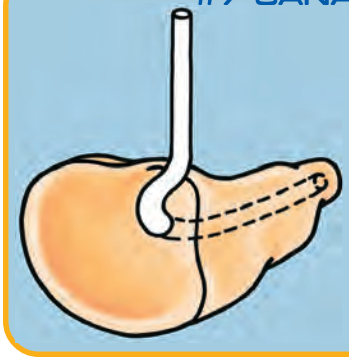
As its name implies, this earmold is deeply shelled out in the concha area. It is usually most effective when made from soft materials. The shell mold may be used when acoustic seal is an essential factor in achieving an effective hearing aid fitting, particularly in the application of high gain instruments.

#6A MICRO-SHELL



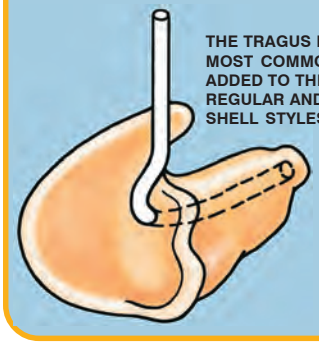
This style improves physical appearance and patient comfort, and is a Microsonic innovation. The molds are pressure molded to eliminate shrinkage, and are hollowed out in the concha and helix area to improve the cosmetics and reduce the weight of the mold. Available **only** in acrylic and acrylic with vinylflex canal. Also available in Micro-Canal configuration—specify mold #4A.

#7 CANAL-SHELL



In this half-shell mold style, the entire helix area is absent. It is recommended for clients with insertion problems due to lack of manual dexterity. This mold is also available as a 3/4-shell style – specify #7A.

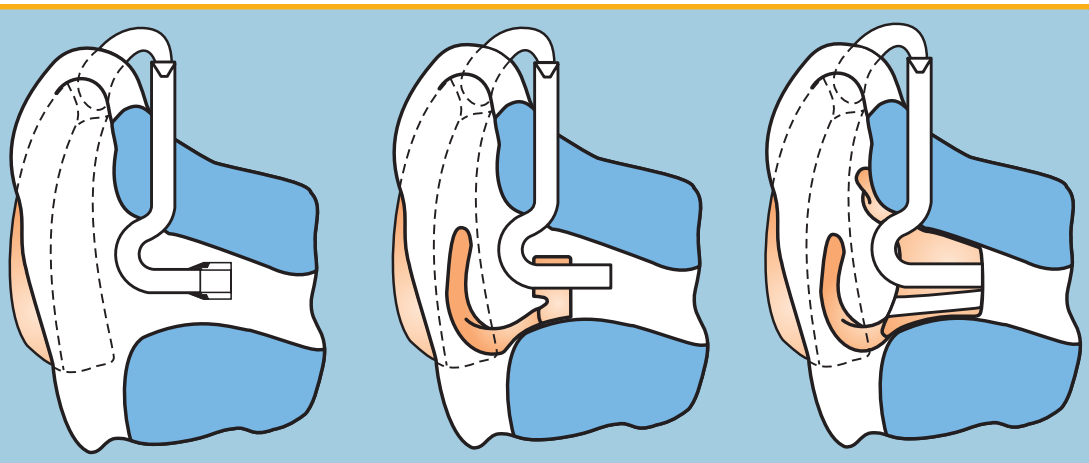
TRAGUS CONFIGURATION



THE TRAGUS IS MOST COMMONLY ADDED TO THE REGULAR AND SHELL STYLES

Fitting high gain, high output hearing aids often presents a problem with earmold seal and acoustic feedback. In 1975 Microsonic developed the "Tragus" option on earmolds. The Tragus configuration can be ordered with most physical styles and does not preclude additional acoustic options. It features a lip that extends over the tragus providing additional feedback control. Tragus molds require an impression which covers the entire surface of the tragus. A perfect impression is essential for a tragus mold; otherwise this application will not be effective.

NON-OCCLUDING EARMOLDS



TUBE FITTING | OPEN MOLD | FULL MOLD WITH LARGE VENT

THREE NON-OCCLUDING EARMOLD DESIGNS

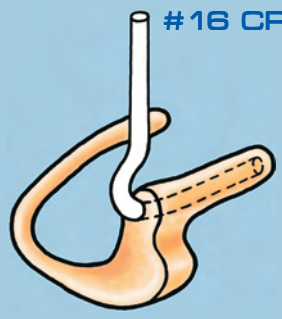
Non-occluding earmolds were developed for unilateral hearing losses in conjunction with CROS-type hearing aids. These molds feature a small outside diameter canal portion to allow amplified sound to pass around the mold as well as go through the tubing. When these molds are used with a single aid (behind-the-ear or eyeglass), the fitting is referred to as IROS. Non-occluding earmold fittings offer the client a more pleasing

sound by providing an "overlay" of amplification on the natural hearing. Non-occluding molds are also referred to in hearing aid literature as "open" molds.

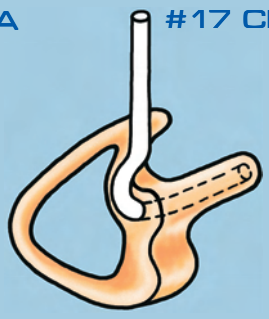
Microsonic offers the largest range of non-occluded earmold options to maximize the dispenser's potential use of this fitting approach. Non-occluded earmolds are effective for:

- unilateral hearing loss, i.e. CROS fittings
- maximizing the reduction of the "occlusion effect"
- use with patients who have a chronic drainage problem, since aeration of the ear canal is allowed.

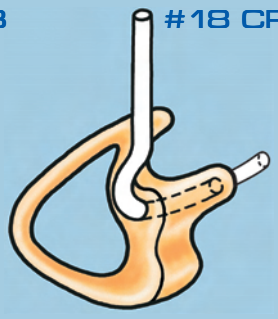
#16 CROS A



#17 CROS B



#18 CROS C



The CROS type of mold is designed for CROS and many IROS fittings. Acrylic is recommended for these mold styles.

In #16 CROS A and #17 CROS B, the canal portion is built with an extension of plastic finished down as close to the tubing size as possible. #18 CROS C combines skeleton design with a length of tubing directed into the center of the canal. The tubing is then cut according to the impairment. CROS molds are indicated when it is necessary to significantly reduce or eliminate frequencies below 1000 Hz. The opening of the canal is not occluded, and low frequencies are allowed to bleed off.

The #18 CROS C mold is specifically recommended for attaching the offside microphone or transmitter in a behind-the-ear CROS or BICROS fitting. The mold itself is strong enough to withstand everyday handling, and the tubing can be cut off short for comfort.

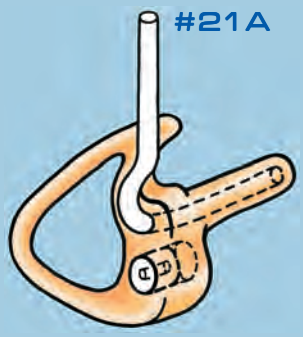
#19 FREE FIELD

The Free Field mold is the predecessor of the Janssen. It differs from the CROS mold in that it is more reduced in the concha ring and bridge area. Non-occluding earmolds present certain fitting restrictions. Since there is no seal, there is always the possibility of increased incidence of feedback.

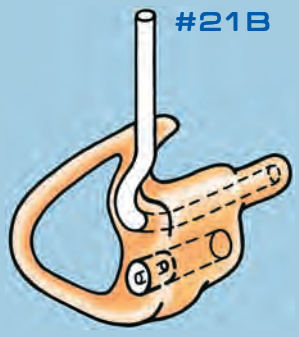
#21 ADVANCED DESIGN FREE FIELD

A Microsonic innovation, the Advanced Design Free Field was developed to assist dispensers in expanding the applications of non-occluded molds without encountering acoustic feedback. It seals the canal entrance while leaving the canal itself unoccluded. An SAV vent system allows dispensers to change the acoustic characteristics as required.

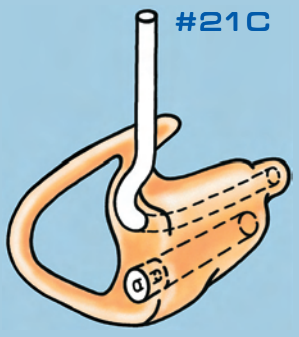
#21A



#21B



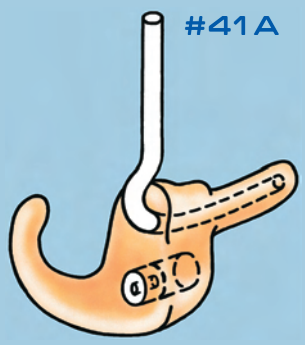
#21C



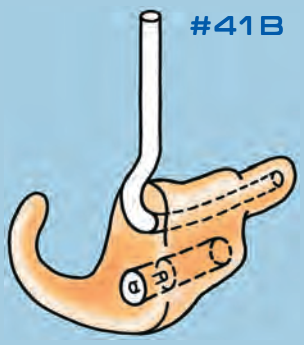
#41 CANAL-LOK ADVANCED DESIGN FREE FIELD

The Advanced Design Free Field earmolds are also available in a Canal-Lok style. Acoustically they are identical to #21A, B and C.

#41A



#41B

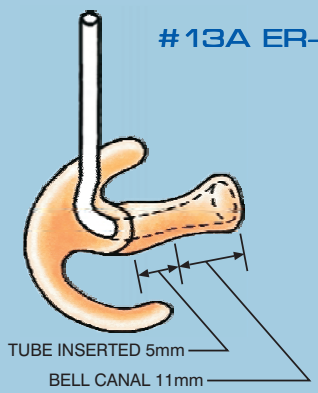


#41C

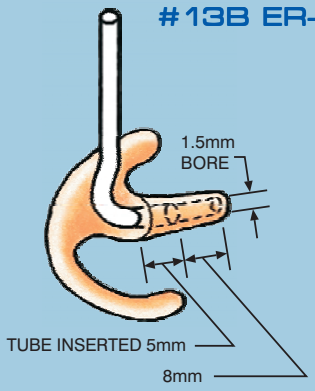
#13 JANSSEN MOLD

The Janssen mold is named after the dispenser who invented it and incorporates the acoustic benefits of the Free Field style and the retention benefits of a CROS style mold. It differs in that the canal portion of the finished mold runs along the top of the ear canal.

#13A ER-A



#13B ER-B



THE MICROSONIC "ER" EXTENDED RANGE EARMOLDS
(Similar to Janssen)

The Microsonic "ER" extended range earmolds provide two significant performance improvements when compared with a "tube-only" fitting:

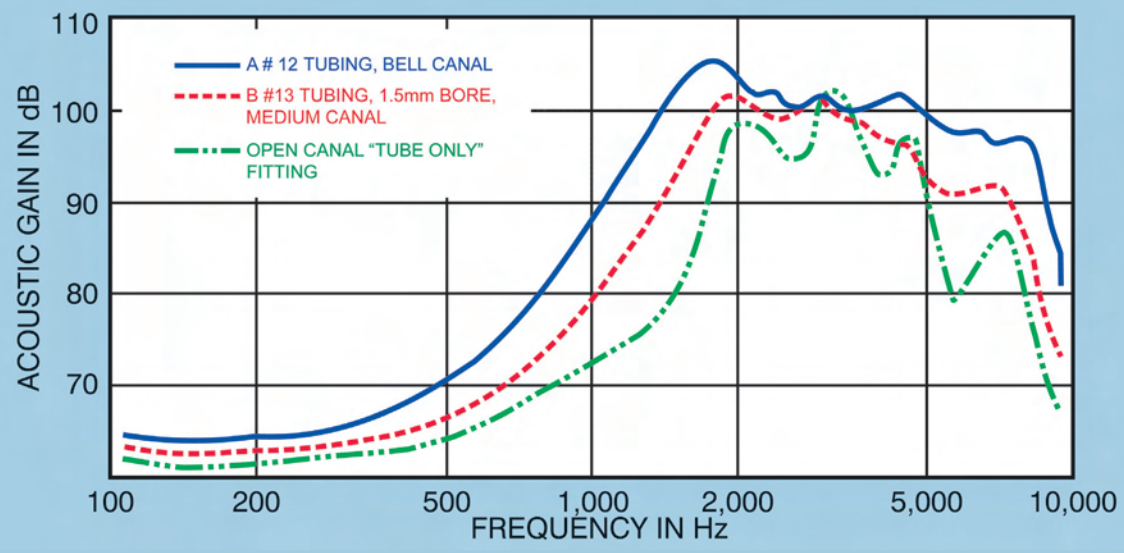
1. The in-situ response curve is greatly smoothed in the range between 2 KHz and 5 KHz, and

2. The in-situ response is greatly enhanced between 5 KHz and approximately 9 KHz.

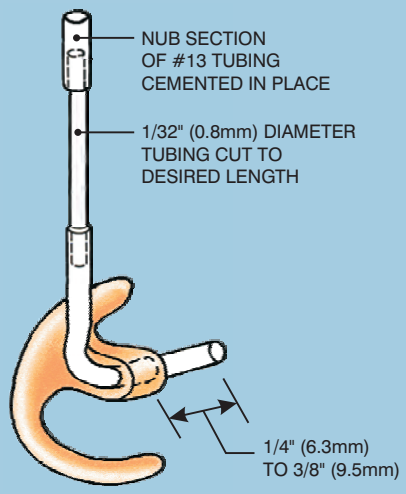
The "ER" mold is available in two versions. The "ER-A" features a large diameter bell canal coupled to the aid, and provides the best high frequency boost. It can be used whenever ear canal diameter and depth permit.

The "ER-B" will physically fit a larger percentage of clients, as it has a narrower and shorter canal. The 1.5mm bore offers only slightly less high frequency performance than the "ER-A".

Keep in mind that low frequency roll-off with the "ER" molds will be dependent on the diameter of the ear canal being fit. Obviously, the larger the ear canal, the less the mold will tend to occlude, thus the sharper the low frequency reduction. Curves were done on KEMAR'S large ear. The recommended material is acrylic or alerite.

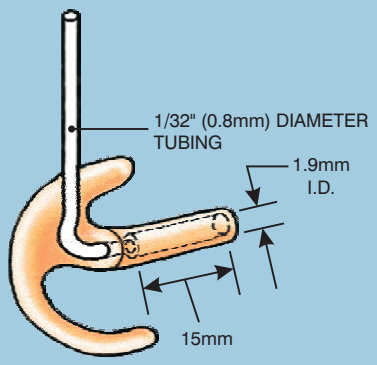


#14 LYBARGER DUAL DIAMETER EARMOLD SYSTEM



#14 LYBARGER MOLD
(use with 1500-ohm damped earhook)

#14A ADVANCED DESIGN LYBARGER DUAL DIAMETER EARMOLD SYSTEM



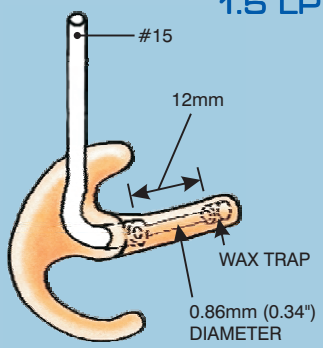
#14A MICROSONIC'S ADVANCED DESIGN LYBARGER MOLD
(use with ER12-3 earhook)

Lybarger's Dual-Diameter System employs a center section of 1/32" tubing in a non-occluding earmold to produce a resonator that provides an average of 12dB additional gain in the range from 4000 to 7000 Hz. This configuration is designed for losses that are normal out to 1500-2000 Hz and then drop off sharply.

This style of earmold combines the maximum effect of venting and the benefits derived from the resonator type earmold used with extended high frequency hearing aids.

Special earhooks must be used with either style of Lybarger mold to smooth the response and inhibit acoustic feedback. If a reduction in amplification is required between 2 and 3KHz, mold #14A is especially effective when used in conjunction with the Killion High-Pass earhook described in Chapter 5.

1.5 LP EARMOLD

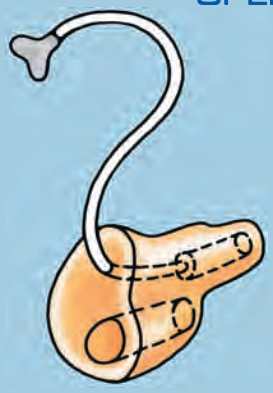


The use of a 1.5 LP earmold more effectively controls the insertion depth than a tube fitting. The 1.5 LP earmold is basically like the Free Field or Janssen style earmolds except that it is bored to 0.86mm as shown in the illustration and #15 tubing is inserted a minimum of 5mm. It is suggested that a deep impression be made so this minimum can be met.

#15 TINNITUS MOLD

This style of mold was designed for the American Tinnitus Association for use with tinnitus maskers. The mold has no canal and the tube entrance is near the crus.

OPEN-FIT MOLDS



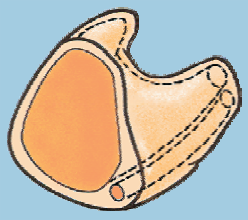
Custom earmolds are available for every manufacturer's open-fit and receiver-in-the-ear hearing aids. Custom molds offer superior retention and comfort while maintaining the characteristic response for which the instruments were engineered.

These earmolds utilize each manufacturer's proprietary rigid tubing and a stepped-bore sound channel in conjunction with a very large vent of reduced length. They are available in hard materials in the Canal-Lok configuration for retention and ease of removal, and in soft materials in the Canal style.

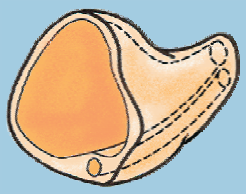
In order to ensure a perfect fit, please send the ***actual tubing unit*** selected for the patient along with the ear impression. The tubing will be returned with the earmold.

#10 A-D CUSTOM SHELLS FOR IN-OFFICE ITE ASSEMBLY

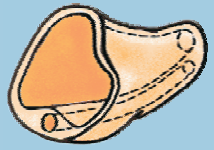
#10A FULL SHELL



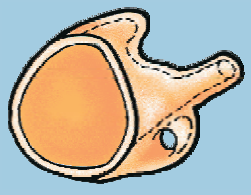
#10B CANAL SHELL



#10C CANAL



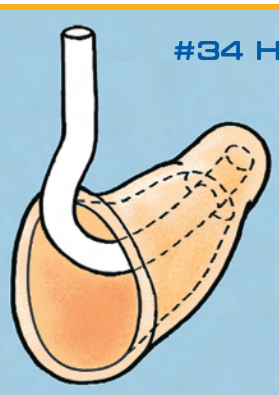
#10D IROS



For the dispenser who is specially trained to assemble ITE aids in the office, Microsonic offers a full line of custom shells for assembly of ITE aids.

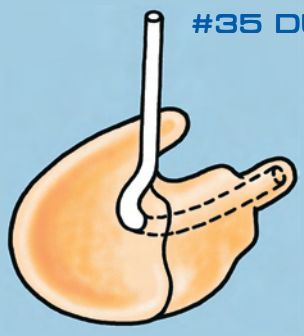
SPECIALTY MOLDS FOR PATIENTS WITH EXCESSIVE MANDIBULAR ACTION

#34 HOLLOW CANAL



For fitting severe hearing losses on patients with excessive mandibular action, the Hollow Canal mold offers a deep, flexible seal along with superior patient comfort. Recommended materials are Synth-a-Flex and Medi-Sil.

#35 DUAL-CANAL



In cases involving moderate hearing losses and excessive mandibular movement, the Dual-Canal mold reduces feedback potential by eliminating the portion of the earmold canal that is typically subject to displacement.

EARMOLD STYLE CROSS REFERENCE CHART

MICROSONIC	SOME LABS REFER TO STYLE AS
REGULAR	Standard, Receiver
SKELETON	Phantom, Silhouette, "Hyda"
SHELL	"Invisi"
CANAL-LOK	Canal
CANAL SHELL	Half Shell
CROS A, B & C	C.R.O.S., HF, Non-Occluding
ACOUSTIC MODIFIER	Hi Frequency, HF Mold
TRAGUS CONFIGURATION	Tragus Shell
HEARING PROTECTION MOLDS	Noise Braker, Hear Saver, Noise Plugs
SWIM PLUGS	Comfort Ear, Sentinel
FLOATING SWIM PLUGS	Floatable Sentinels
PILOT'S COMMUNICATION	Pilot Mold, PP

Acoustic Options

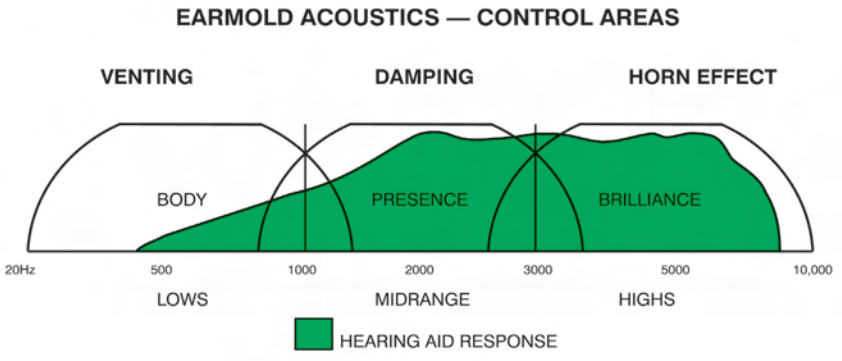
5

Acoustic options offer the dispenser easy and relatively predictable response modifications. Use of the techniques presented in this chapter can lead to more appropriate fittings for any given hearing impairment, thus maximizing client satisfaction.

ACOUSTIC EFFECTS

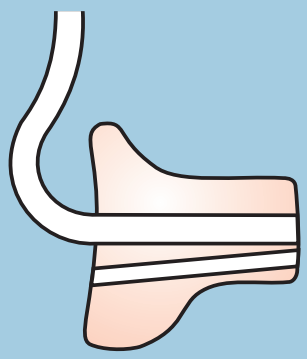
In the previous chapter on physical style options, the different earmold styles were detailed. This section covers the different ways to change the performance of a hearing aid with acoustic options. On the next page are time-proven options that may be ordered from Microsonic or created in the office.

The current range of acoustic options allow the dispenser the greatest amount of acoustical control that has ever been possible. These controls are relatively independent of one another and can be used separately or together.

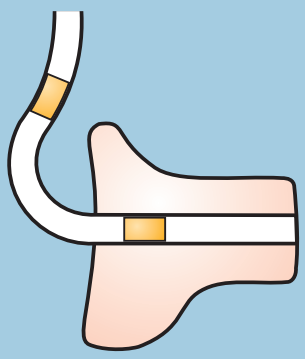


5 ACOUSTIC OPTIONS

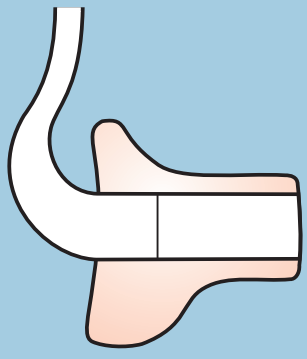
ACOUSTIC OPTIONS FOR DISPENSERS



VENTING
- Non-Occluded Physical Options
- Parallel Vent
- Diagonal Vent
- External Canal Vent
- P.V.V
- S.A.V.



DAMPERS
- Lamb's wool
- Knowles Acoustic Dampers
- Sintered Steel Inserts
- Damped Earhooks



HORN EFFECTS
- Acoustic Modifer
- Belled Bore
- Horn Bore
- Libby Horns
- C.F.A. Molds

When considering acoustic options, remember that hearing aid wearers most frequently complain about the apparent loudness and clarity of their instruments. Likewise, though you have extensively counseled your patients about reasonable expectations, some will always be looking for the hearing aids to perform miracles.

In general, and within the limits of each case, less low frequency amplification is perceived as "less loud," fewer peaks are perceived as "less harsh," and additional high frequency amplification is perceived as "adding sound quality." While there will of course be exceptions, your selection of acoustic options will usually follow these guidelines in the quest for the most natural, most acceptable sound.

Newer programmable hearing instruments, while having the capability of selectively altering the response curve, will still benefit from the careful choice of earmold acoustic options. The result will be, as with conventional instrumentation, a smoother, more comfortable sound to the wearer.

On the next page is our Classical Modification and Effect Chart. While it shows many possibilities, always be aware that some options – such as tubing length – may not be physically available to you for modification. The experienced fitter knows which options are available in each case, and how to effectively apply them.

Remember too that there may be differences between new fittings and repeat fittings, even with identical audiograms. The new wearer has nothing but "unaided" to compare the hearing aid to, while the repeat purchaser often initially expects a new hearing aid to resemble the old one, even though the new one does a better job acoustically. Your skills as a counselor are vital here, to insure that the patient's expectations are realistic.

CLASSICAL MODIFICATION AND EFFECT CHART

	Modification	Effect on Low Frequencies (Below 750 Hz)	Effect on Frequencies Between 750 and 1500 Hz	Effect on Frequencies Between 1500 and 3000 HZ	Effect on High Frequencies (Above 3000 Hz)
TUBING DIAMETER	Larger I.D. Tubing & Horn Tubing	Negligible	Moves peak to higher frequency	Increases height of peak and moves to higher frequency	Increases
	Smaller I.D. Tubing	May reduce below 1 KHz	Moves peak to lower frequency	Reduces height of peak and moves to lower frequency	Large reduction
TUBING LENGTH	Longer Tubing	Increases	Moves peak to lower frequency	Moves peak to lower frequency	Negligible
	Shorter Tubing	Slightly decreases	Moves peak to higher frequency	Moves peak to higher frequency	Negligible
LENGTH OF EARMOLD CANAL	Longer earmold canal	——— Increases level of response curve ———			
	Shorter earmold canal	——— Decreases level of response curve ———			
BORE DIAMETER	Larger diameter bore through earmold canal*	Negligible	Moves peak to higher frequency	Moves peak to higher frequency	Increases
	Smaller diameter through earmold canal*	Negligible	Moves peak to lower frequency	Moves peak to lower frequency	Decreases
BORE LENGTH	Longer bore through earmold canal*	Slightly increases	Moves peak to lower frequency	Moves peak to lower frequency	Decreases
	Shorter bore through earmold canal	Slightly decreases	Moves peak to higher frequency	Moves peak to higher frequency	Increases
VENTING	Small Vent (.031"/0.8mm)**	Negligible	Negligible	Negligible	Negligible
	Medium Vent (.064"/1.6mm)**	Decreases	Increases peak height	Negligible	Negligible
	Large Vent (.094"/2.4mm)**	Decreases	Increases peak height	Negligible	Negligible
NON-OCCLUDING MOLD	Non-Occluding Mold	Eliminates	Moves peak to higher frequency and increases height	Increases peak height	Negligible
OPEN VENT MOLD	Open-Vented (High Frequency) Mold	Decreases	Reduces peak height	Negligible	Negligible
FILTER INSERTS	Filter Insert at Hearing Aid Nub	Negligible	Reduces peak height	Reduces peak height	Negligible
	Filter Insert at Earmold Tip	Slightly decreases	Large reduction	Large reduction	Decreases

NOTE: Because of wide variation in earphone types and internal acoustical systems in hearing aids, this chart must be considered as a guide for average conditions.

* Applies to earmolds for conventional earphones

** Vents of short lengths are more effective in reducing low frequency response. Gain must be limited with larger size vents to avoid feedback.

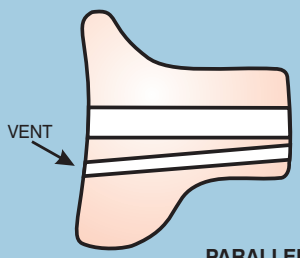
VENTING POSSIBILITIES

The history of present day advances in earmolds began with the vent. Most vents allow some low frequency acoustic energy to "leak out" through the earmold. The overall function of venting is to achieve one or more of the following results:

- to reduce a feeling of "fullness" caused by wearing an earmold
- to reduce resonating sound produced by the aid and mold, and
- to improve speech clarity.

We recommend that most molds have at least a small parallel pressure-relief vent of .031" (0.8mm) to allow for the client's acceptance and comfort. A vent of this size will have virtually no effect on the frequency response of a total amplification system.

Venting in earmolds is provided by labs in parallel, diagonal and external configurations. Research has shown parallel venting is preferred acoustically.

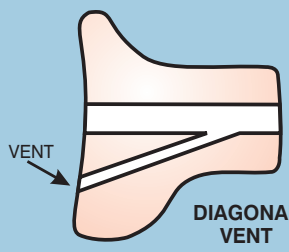


PARALLEL VENT

Parallel venting is an effective method of modifying the low frequency component of a total amplification system without having any effect on the high frequency area. Actual effects on the frequency response vary with the location, diameter and length of the vent. The chart below illustrates various combinations of length and diameter needed to roll off the hearing aid response curve at the frequency listed on the left. Note that some of the combinations may not be practical in any given earmold.

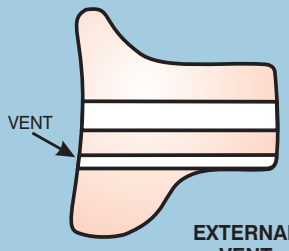
CUSTOM VENT EFFECT EQUIVALENTS
Frequency cut-offs determined by Diameter and Lengths

FREQUENCY	DIAMETER		LENGTH	
250	.042"	1.1mm	.7"	17.8mm
	.030"	0.8mm	.35"	8.9mm
	.021"	0.5mm	.175"	4.4mm
500	.085"	2.2mm	.7"	17.8mm
	.060"	1.5mm	.35"	8.9mm
	.042"	1.1mm	.175"	4.4mm
750	.120"	3.0mm	.7"	17.8mm
	.090"	2.3mm	.35"	8.9mm
	.063"	1.6mm	.175"	4.4mm
1000	.168"	4.3mm	.7"	17.8mm
	.120"	3.0mm	.35"	8.9mm
	.084"	2.1mm	.175"	4.4mm



DIAGONAL VENT

Diagonal venting is not recommended because of possible adverse influence on the high frequency area and introduction of feedback problems. In some cases, though, a diagonal vent may be required due to physical size restrictions.

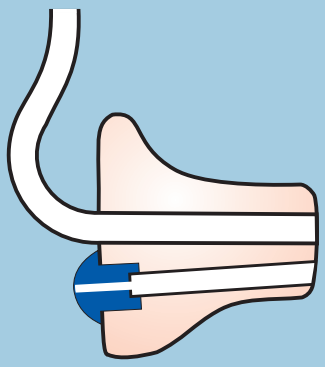


EXTERNAL VENT

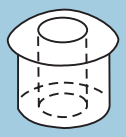
Often, if acoustic feedback occurs as a result of traditional venting techniques, an external vent may be required. This is simply an external channel that runs partially down the length of the canal and into the body of the mold. This venting could accommodate an S.A.V. plug.

VENTING SIMPLIFIED

Dispensers originally drilled their own vents on a trial and error basis, guided by experience. Today labs will drill a vent at the dispenser's request, but if a vent is drilled too big or too short, the mold may be ruined. To minimize this, earmold labs developed changeable venting systems. The S.A.V. eliminates drilling by the dispenser while allowing office modifications that are reversible if they are not successful.



S.A.V. INSERT IN POSITION



S.A.V. (Select-A-Vent)

#1 =	.031"	0.8mm
#2 =	.062"	1.6mm
#3 =	.095"	2.4mm
#4 =	.125"	3.2mm
#5 =	.156"	4.0mm
#6 =	Plug	

MINI S.A.V. (Select-A-Vent)

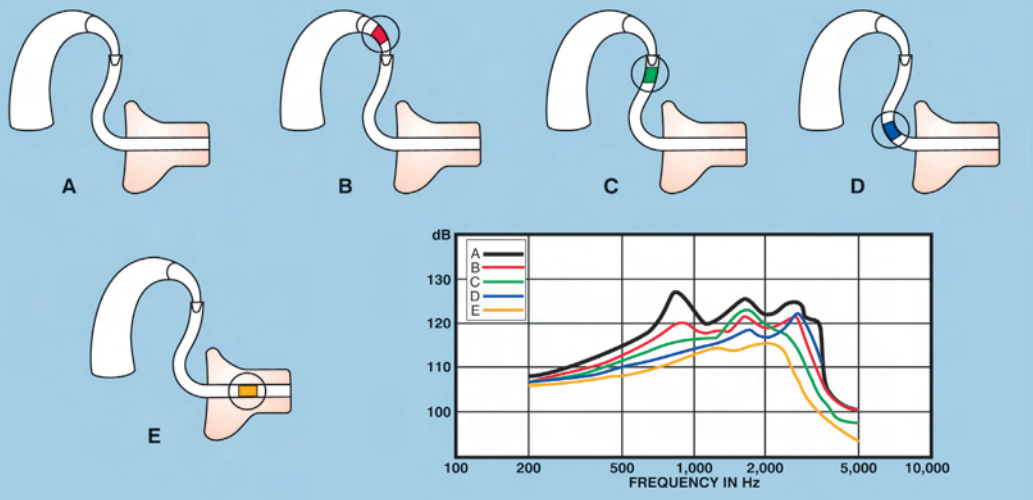
#1 =	.020"	0.5mm
#2 =	.030"	0.8mm
#3 =	.040"	1.0mm
#4 =	.060"	1.6mm
#5 =	.075"	1.9mm
#6 =	Plug	

In general, the vent hole diameter will be large (.094") whenever possible. The size of the canal will determine whether a smaller diameter is required.

Important Note: Research on the use of these venting systems shows there is little, if any, relationship between size of the venting cap hole and speech clarity. The fitter must evaluate the effect of various vents to find the one preferred by the client.

DAMPERS

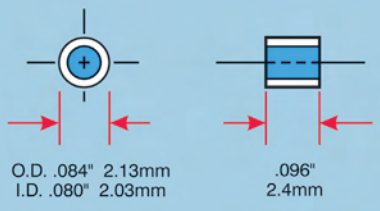
A damper causes acoustic resistance to the sound passing from a hearing aid. The purpose of using dampers is to smooth the frequency response in the mid-frequency range from 1000-3000Hz. Originally, dampers were used in the external receivers of body aids, but now most are used in the tubing or earhook of behind-the-ear aids. Research has shown that the placement of the damper in the tubing and earhook makes a considerable difference in which specific frequencies are damped. The graph below shows the effect of damper placement.



LAMB'S WOOL

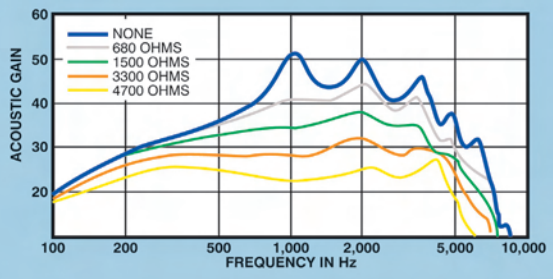
Lamb's wool is the oldest acoustic damper used with hearing aids. The lamb's wool is carefully placed into the earhook or the tubing, and the density of the wool once inserted determines the damper effect. It is effective but not easily controlled.

KNOWLES ACOUSTIC DAMPERS



Knowles Acoustic Dampers are a more advanced refinement of acoustic control. These dampers are in a metal housing with a color-coded plastic mesh screen at one end. There are six different Knowles dampers available: 680, 1000, 1500, 2200, 3300 and 4700 ohm values. The Knowles dampers are probably the most convenient damping system. **Please note:** The values of the various dampers are measured in ohms, not frequency.

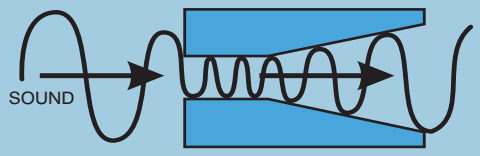
ACOUSTIC RESISTANCE	SCREEN COLOR CODE
680 ohms	White
1000 ohms	Brown
1500 ohms	Green
2200 ohms	Red
3300 ohms	Orange
4700 ohms	Yellow



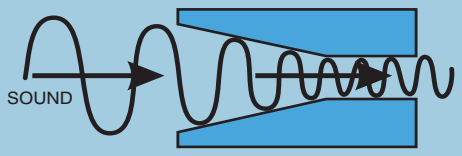
FREQUENCY RESPONSE OF WIDEBAND AND WITH EARMOLD

For optimal results as illustrated in the graph above, two dampers of the same resistance value should be used.

HORN AND REVERSE HORN



HORN



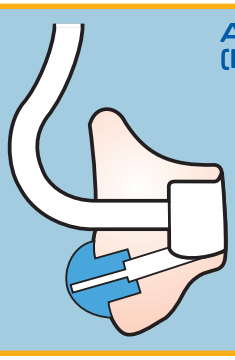
REVERSE HORN

In musical acoustics it has long been known that the "belling" of a tube will **enhance** a high frequency signal passing through that tube. The reverse is also true in that the narrowing of the end of a tube will **reduce** the high frequency components.

Killion demonstrated that by using stepped bore tubings in earmolds, large changes in frequency response could be obtained. His research resulted in a family of "acoustically tuned" earmolds incorporating venting, damping and horn effects. The characteristics of the Killion molds are achieved today through advanced horn developments.

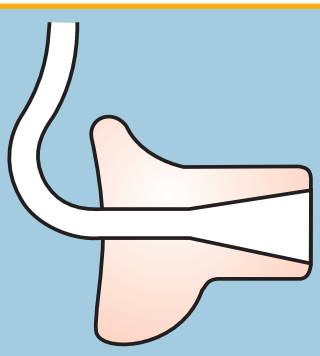
With many of today's hearing instruments reproducing high frequency signals out to 7000–9000 Hz it is particularly important that the tube and earmold not restrict the resonance in the sound channel and cut off high frequencies. With these instruments, incorporating a horn of some type is critical to achieving a successful fitting.

In some cases audiograms show an upward slope, and the higher frequencies need to be reduced instead of enhanced. In these cases the reverse horn must be used.



ACOUSTIC MODIFIER (HIGH FREQUENCY SHORT CANAL/WIDE BORE)

The horn effect was first applied to earmolds in the late 1950s with the development of products similar to today's Acoustic Modifier or high frequency short canal/wide bore earmolds. This mold can be easily altered by the dispenser, allowing variable control over the high frequency response in any given fitting. For best results it is suggested that an S.A.V. venting system be used with this style.



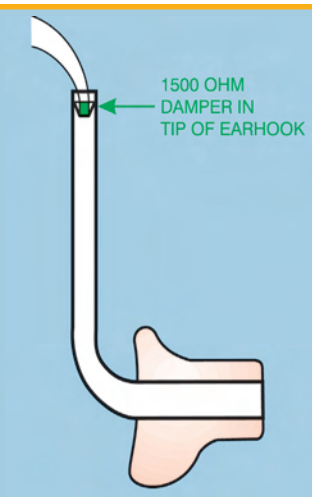
BELLED CANAL

HORN BORE

BELLED CANAL OR HORN BORE

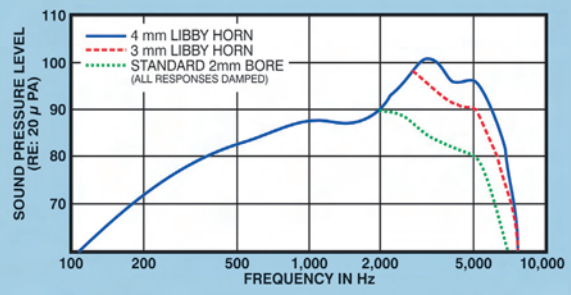
The most basic of horn effects are the laboratory belled bore canal and the simple horn bore. These are options in any earmold style and are especially important with wide band receiver aids to preserve the high frequency signal.

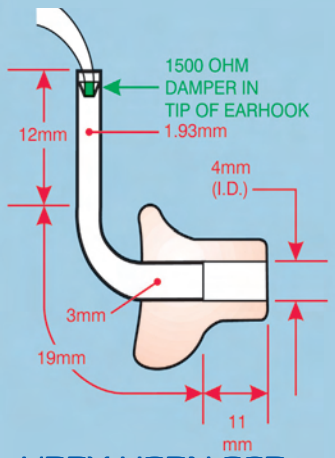
LIBBY HORN



TYPICAL APPLICATION

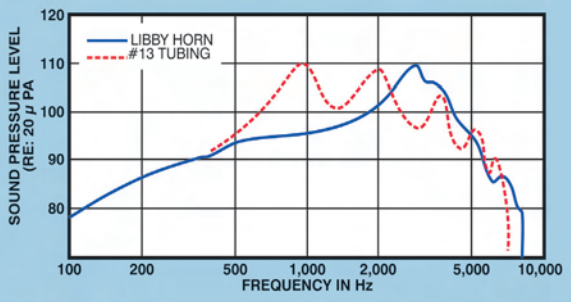
The Libby Horn is a smooth, tapered, one-piece sound tube of internal stepped-bore construction designed after the Killion stepped-bore construction tubing system. The Libby modifications of Killion's tuned earmold systems recommend placing the dampers in the earhook rather than in the tubing itself. From the dispenser's viewpoint, the Libby Horns make tubing replacement much simpler than with multiple tube constructions. These horn tubes are available in 3mm regular, 3mm thick wall and 4mm sizes. They can be used with Killion 8CR and 6AM designs. The effect of the 3mm size is a reduction of 5-6 dB in the 2500-3000 Hz range, as compared with the 4mm tube.

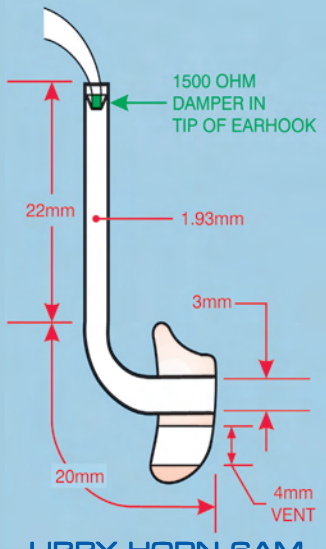




LIBBY HORN 8CR

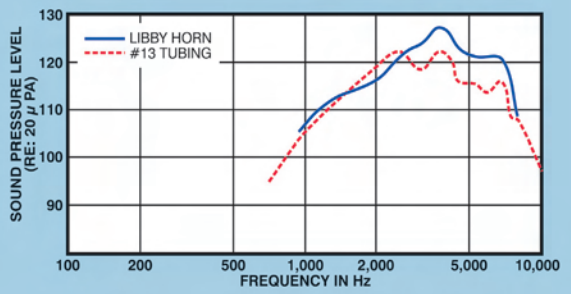
The 3mm Libby Horn is for smaller adult ear canals and for children, and provides an 8-10 dB high frequency boost above 2000 Hz. The 3mm Libby Horn can be shortened to accommodate smaller canals, but the length of the sound channel should be as long as is practical.





LIBBY HORN 6AM

The 4mm Libby Horn is similar to Killion's 8CR with a damped earhook, and was designed to provide a smooth response extended to 8 kHz and a maximum response at 2.7 kHz to compensate for the loss of canal resonance caused by the occlusion effect. One damper is used in the earhook. The last part of the horn is cut to permit the remainder of the sound channel of the earmold to serve as the last section of the horn.

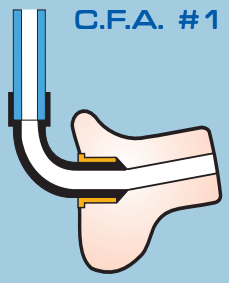
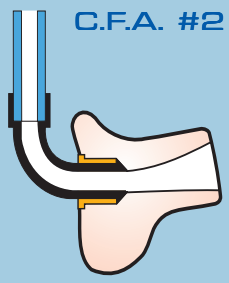
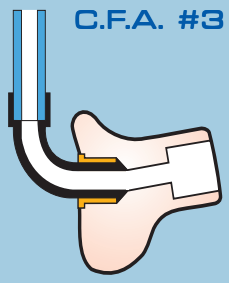
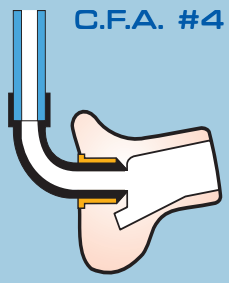


This Libby Horn is similar to Killion's 6AM, and is designed to be a damped, stepped-bore version of the acoustic modifier, a high frequency earmold with a 6 kHz cutoff frequency. This earmold does not compensate for insertion loss, but is useful where maximum highs and minimum lows are required simultaneously.

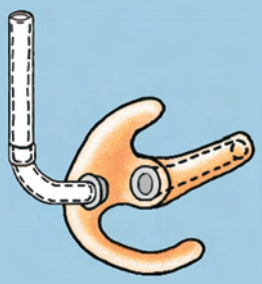
C.F.A. (CONTINUOUS FLOW ADAPTER)™ RATIONALE

The C.F.A. system incorporates the innovations of Killion, Libby and Janssen. This system is characterized by a single snap-in/snap-out tubing which does not crimp or change diameter. The C.F.A. system differs from the others in that:

1. Labs can standardize earmold bore.
2. Dispensers can grind and adapt C.F.A. molds without sacrificing the designed and desirable acoustic effects.
3. The C.F.A. mold has a constant interior tubing diameter.

	DESCRIPTION	ACOUSTIC INFORMATION	FITTING INFORMATION
 C.F.A. #1	SMALL OPEN BORE Sound bore .076"/1.93mm	• High frequency emphasis (2-5 kHz) • Some low end amplification • Very smooth frequency response curve • Venting slopes out lows	• Small vent is most commonly used • Used with flat and mixed losses • Usable with high gain aids • With high gain aids use with or without small vent and #13 thick tubing • With high gain aids at high volume control settings, the #5 adapter should be used to prevent feedback problems
 C.F.A. #2	BELL or HORN Sound bore .125"/3.2mm from canal end to mid-earmold, then .076"/1/93mm to CFA adapter	• Very smooth frequency response curve • High frequency emphasis • Low end amplification	• No vent (or very small vent) is most commonly used
 C.F.A. #3	1/2 BORED CUT Sound bore .187"/4.75mm from canal to mid-earmold, then .076"/1.93mm to CFA adapter	• High frequency emphasis • Good performance when vented	• Suitable for HF losses • Usable with HF aids
 C.F.A. #4	LARGE OPEN BORE Sound bore .187"/4.75mm	• High frequency emphasis • Little low frequency amplification	• One of the most commonly used CFA earmolds • Used with ski slope and high frequency losses • Small vent is most commonly used

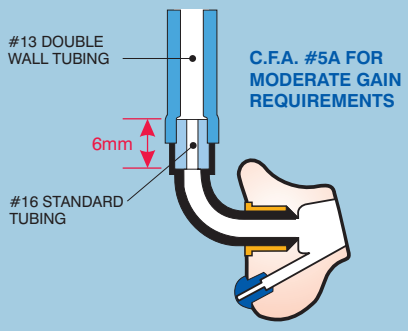
C.F.A. #MC (Similar to Janssen)

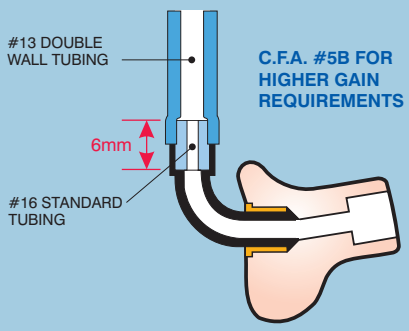


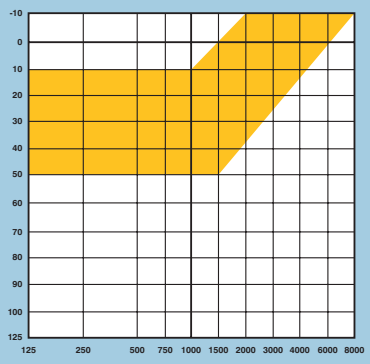
DESCRIPTION	ACOUSTIC INFORMATION	FITTING INFORMATION
MICRO CROS Non-occluding long canal, fits along top of canal	• High frequency emphasis • Smooth curve • Non-occluding earmold • Fits at top of canal • Long canal • More comfort and less feedback with greater amplification than other non-occluding molds	• Suitable for mild and moderate ski slope losses • Usable for those with tolerance problems or low frequency noise problems

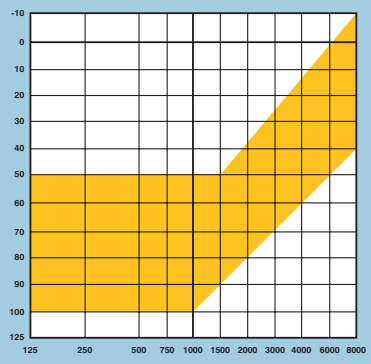
C.F.A. #5 FOR REVERSE CURVE FITTINGS

REVERSE CURVE Large open bore	• 6mm of #16 tubing removes 8 to 10 dB at 2-5 kHz and gives 8 to 10 dB more gain at low frequencies

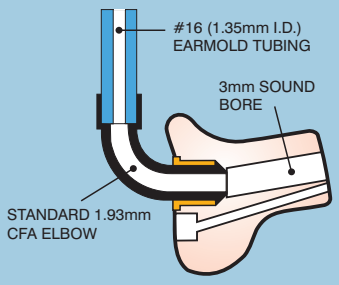








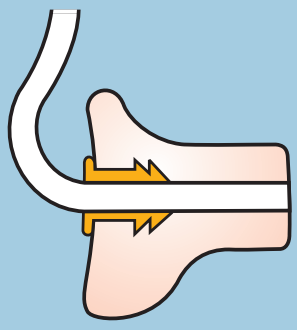
CFA/Lybarger Style (CFA/LS)



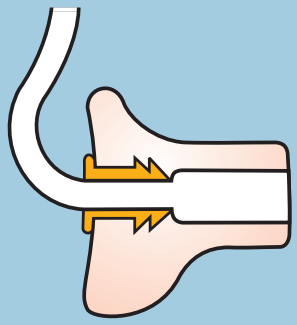
Killion has described an application, particularly effective with children, in which the CFA elbow is used in conjunction with #16 (1.35 mm I.D.) tubing to produce not only the high frequency boost described by Lybarger, but also a reduced-feedback earmold for high gain hearing aids. The small I.D. tubing is cemented into the CFA elbow, which fits into the earmold as illustrated below, while the other end connects to the earhook in the normal fashion.

This specialty configuration can be ordered with most styles of occluding earmolds. (It is important to note that #16 tubing is difficult to attach to some earhooks, and that care must be taken not to split the end of the tubing while expanding it to go over the nub at the end of the earhook.)

TUBE LOCK PLUS (U.S. Patent #5,488,205)



TUBE LOCK PLUS WITH CONTINUOUS BORE

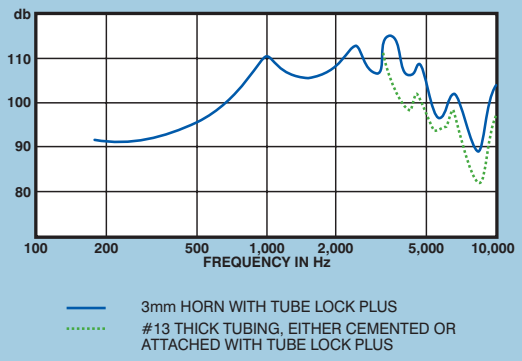


TUBE LOCK PLUS WITH HORN BORE

The patented Tube Lock Plus is designed for use with M-2000 Plus earmold material and allows tubing replacement as needed. Like the original tube lock, the need for cement is eliminated, and there is no shift of the gain curve when compared to conventional tubing.

The curves below were run on Kemar's large ear with a Zwislocki coupler. Soft earmolds were used to compare continuous-bore performance with that through a 3mm horn.

The testing demonstrated that hearing aid response through Tube Lock Plus is virtually identical to that through #13 (.076"/1.93mm I.D.) tubing. Additionally, when Tube Lock Plus is used in conjunction with a horn mold, the high- frequency boost between 3000 and 5000 Hz continues to be present. Tube Lock Plus introduces no unwanted acoustic deviations from accepted practice, while offering a wide range of advantageous applications.



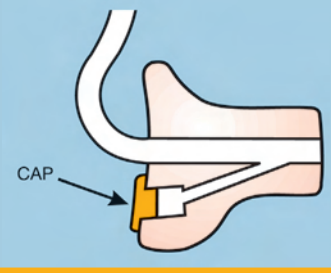
5 ACOUSTIC OPTIONS

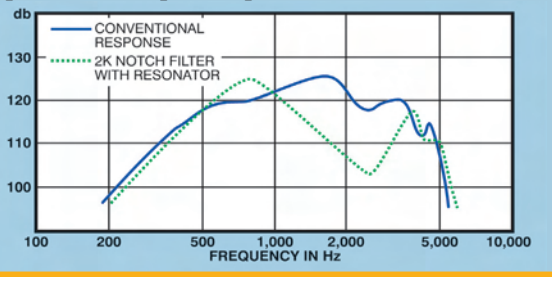
RESONATOR RATIONALE

Resonator theory is not new, but its application to earmolds has been growing in recent years. The resonator reduces low frequency performance and actually **increases** the gain and output in the higher frequencies. The way in which the sound channel is altered for the resonator design determines the high frequency area that will be boosted and the low frequency area that will be attenuated. When natural ear canal resonance was measured and the insertion loss caused by an earmold shown, it became a goal of researchers to acoustically restore some of the lost natural ear canal resonance. All of the resonator earmold options do this to varying degrees.

MACRAE 2K NOTCH FILTER

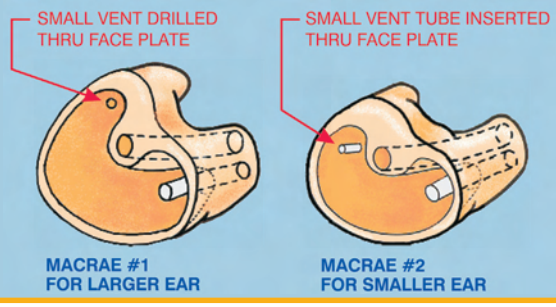
A variation of the reverse (or rising) slope hearing loss involves a peak (notch) of normal or near-normal hearing around 2kHz and sharply falling thresholds on either side of that frequency. This pattern occurs rarely, and does not justify design of a specific hearing aid to accommodate it. In 1982 John Macrae developed a notch filter built into the earmold as a means of fitting these patients. A Helmholtz Resonator is contained inside the mold itself, and produces coupler response as illustrated.

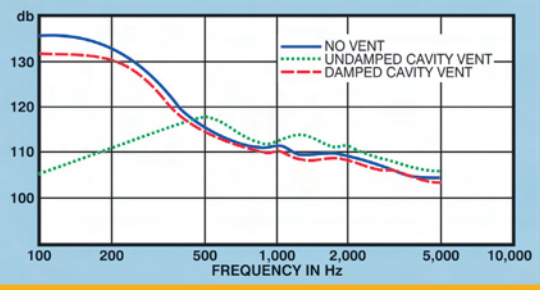




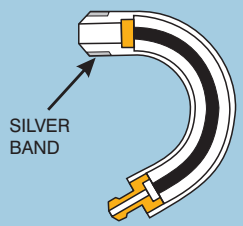
MACRAE CAVITY MOLDS

In addition to the 2K Notch Filter, Macrae has designed vented cavity molds that maximize low frequency performance in high gain fittings, yet minimize the possibility of acoustic feedback. The overall effect of these molds is to maintain the low frequency response as shown in the graph below.

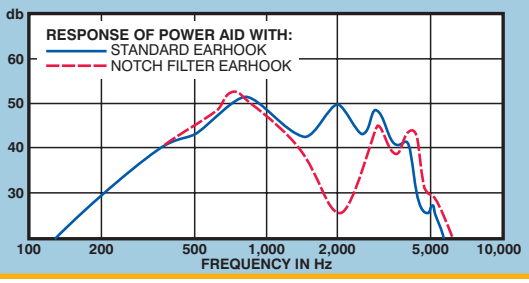




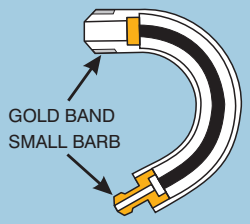
ER 12-2 2K NOTCH FILTER EARHOOK



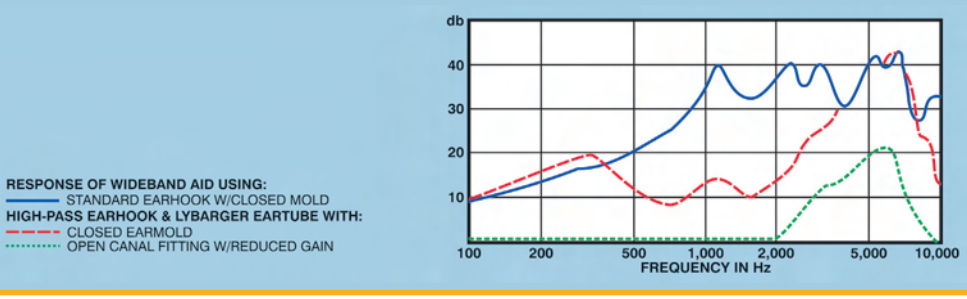
Killion's 2kHz Notch Filter Earhook is used with a conventional earmold, and provides the equivalent of Macrae's special notch filter mold. It can be evaluated easily without the need for special molds or test tips.



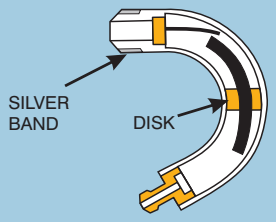
ER 12-3 HIGH-PASS EARHOOK

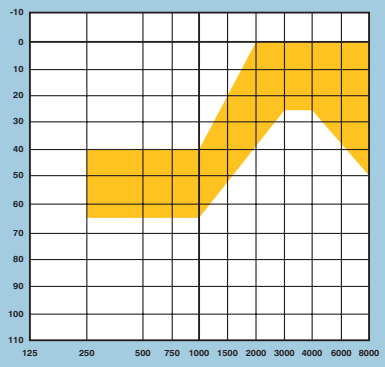


The High-Pass Earhook is a versatile tool adaptable to certain high frequency applications. Used with Lybarger molds in an open canal, it changes a wide band aid into a high-pass aid with greatly reduced output below 3kHz. This hook can also be used with other types of open canal tubes, and with closed canal fittings. In standard open canal applications, the output below 2kHz will be reduced to a level well below the natural sound entering the open ear. Thus, amplification will be heard only above 2kHz. In closed mold situations, the High-Pass Earhook provides high frequency boost above 2kHz which is not otherwise available, although some amplification below 2kHz will normally be audible.



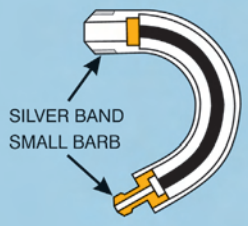
ER 12-1 LOW-PASS EARHOOK

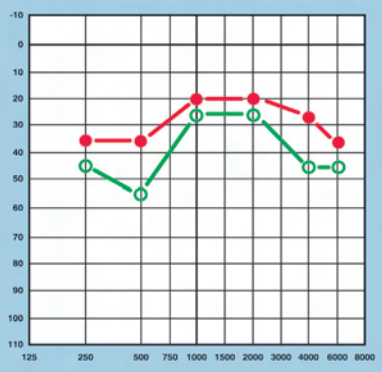




The ER 12-1 Low-Pass Earhook is used for both reverse slope and "cookie-bite" audiogram configurations, and works best with the 1.5 LP earmold style option.

ER 12-4 BAND-REJECT EARHOOK





The Band-Reject Earhook helps in cases where the hearing loss is greater in the low and high frequencies and less in the mid ranges (reverse "cookie bite"). The audiogram shows typical projected improvement in thresholds at various frequencies when this earhook is used in conjunction with an open earmold.

5 ACOUSTIC OPTIONS

EARMOLD TUBING

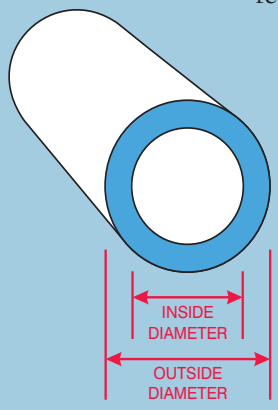
All hearing instruments' receivers are coupled to the ear with tubing of one fashion or another. With behind-the-ear aids, the fitter has a number of tubing options from which to choose in meeting the patient's acoustic or physical needs.

It is important to remember that not only does inside tubing diameter alter the hearing aid's response, but so does a **change** in diameter, such as the horns or stepped bores.

The complete list of NAEL tubing sizes follows below, as do descriptions of commonly used specialty tubes and attachment devices.

TUBING DIAMETER

Tubing diameter is a time-honored method of changing frequency response. There are ten tubing sizes standardized by the National Association of Earmold Labs (N.A.E.L.), although only six of them reflect differences in the inside diameter (only the inside diameter affects acoustic performance). The use of thick or double wall tubing is effective in reducing acoustic feedback in high gain hearing aid applications.



Standard NAEL Tubing Sizes

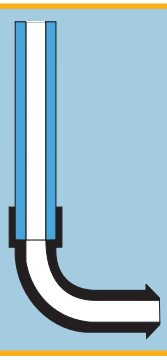
Size/Type	Inside Diameter		Outside Diameter	
9	.094"	2.4mm	.160"	4.1mm
* 12	.085"	2.2mm	.125"	3.2mm
13 Standard	.076"	1.9mm	.116"	2.9mm
* 13 Medium	.076"	1.9mm	.122"	3.2mm
* 13 Thick Wall	.076"	1.9mm	.130"	3.3mm
* 13 Double Wall	.076"	1.9mm	.142"	3.6mm
14	.066"	1.7mm	.116"	2.9mm
15	.059"	1.5mm	.116"	2,9mm
16 Standard	.053"	1.3mm	.116"	2.9mm
16 Thin	.053"	1.3mm	.085"	2.2mm

* Commonly used sizes. Other sizes are not stocked.

MOISTURE-FREE TUBING

Condensation of moisture in earmolds and tubing is a problem for some patients. Moisture-Free is a denser tubing material that greatly reduces and often eliminates moisture build-up. It is available from Microsonic in #13 Medium and #13 Thick.

C.F.A.



The C.F.A. tube and connector provide a constant interior diameter and ease of a single snap-in/snap-out connection. The male part snaps into a female seating ring that has been cemented into the earmold. As a result, tubing never is crimped or altered in diameter.

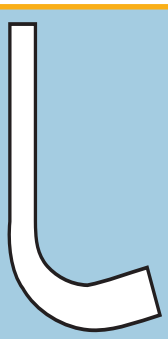
Replacement C.F.A. tubing is available as follows:

* Medium
* Thick
  Double-Wall

Reverse Curve
LS (Lybarger Style)

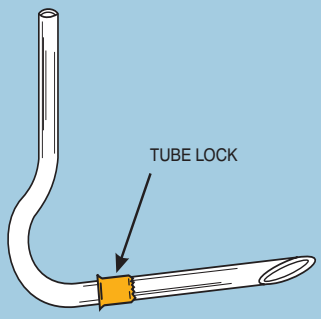
* also available Moisture Free

LIBBY HORN



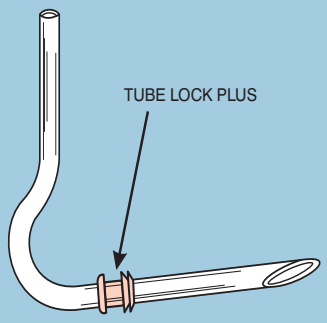
The Libby tube is a pre-molded stepped-bore construction available in 3 mm and 4 mm sizes. Acoustic adaptations and uses are covered in greater detail earlier in this chapter.

TUBE-LOCK



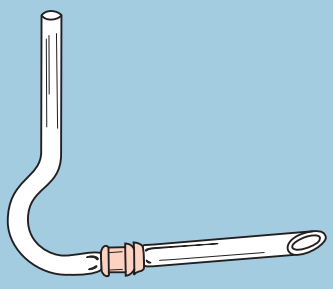
Developed by Microsonic, the Tube-Lock is a small ring with a flange, attached to the tubing at the lab. When the assembly is inserted into soft earmold materials, the flange seats into the material to create a secure seal. The development of the Tube-Lock has eliminated the need to cement tubing into soft earmolds. Independent tests have demonstrated that the Tube-Lock has minimal effect on the hearing aid's output—there is typically less than a 2 dB reduction, which is of little or no consequence in practical applications. Available in #13 Thick and #13 Double Wall.

TUBE-LOCK PLUS (U.S. Patent # 5,488,205)



This patented Microsonic development was especially designed for use with M-2000 Plus earmolds. Its unique pressure-fit retaining flanges hold the tube firmly in place without the need for cements or adhesives. Available in #13 Thick (including Moisture-Free) and #13 Double-Wall.

INVISI-LOCK



Microsonic's Invisi-Lock is similar to the Tube-Lock Plus but without the surface flange that limits insertion depth. It enhances cosmetic appeal while retaining its gripping capabilities.

TUBING REPLACEMENT

Virtually all earmold tubing will need to be replaced at one time or another. The frequency of replacement will usually depend on the amount of wear given the hearing aid by the user, and is influenced by such factors as age of the tubing, body chemistry, outside temperature, exposure to sunlight and air pollution.

Tubing replacement techniques will vary, depending on the earmold material, tubing retention method and acoustic options present:

TUBE-LOCK and INVISI-LOCK

1. Remove the old tube by pushing it all the way through the mold with the applicator tool.
2. Insert a new Tube Lock or Invisi-Lock assembly into the bore.
3. With the applicator tool, push the assembly to the proper depth.
4. Trim the quilled tube flush with the end of the canal, if necessary.
5. With the hearing aid on the pinna and the earmold in place, measure and cut the other end to mate with the earhook.

TUBE-LOCK PLUS

1. Remove the old tube by pulling the assembly from the earmold.
2. Insert a new Tube Lock Plus assembly into the bore.
3. Push the assembly into the bore until the flange is snug with the earmold's exterior.
4. Trim the quilled tube flush with the end of the canal, if necessary.
5. With the hearing aid on the pinna and the earmold in place, measure and cut the other end to mate with the earhook.

ACRYLIC and VINYL — CEMENTED TUBING THROUGH CANAL

1. Remove the old tube. If it can be pulled out, do so. If not, use a reamer of the proper size to get the tubing out. **Caution:** Be certain not to use too large a reamer with acrylic materials, or the new tubing will not adhere to the wall. Also, tubing may be difficult to remove from vinyl earmolds. Patience is necessary.
2. Be certain that the inside of the bore is as clean and smooth as possible.
3. Coat the bore using a pipe cleaner dipped in tubing cement.
4. Quickly dip the quilled end of the new tube in tubing cement, then insert it into the bore. Pull the tube through to the proper position. Blow air through the tube to expel any remaining cement.
5. Allow the tubing cement to dry for 2-3 minutes. A warm air blower will help expedite this step.
6. Trim the quilled tube flush with the end of the canal, if necessary.
7. With the hearing aid on the pinna and the earmold in place, measure and cut the other end to mate with the earhook.
8. **Make certain that the tubing cement has completely evaporated before allowing the patient to wear the earmold for extended periods of time. It helps to wash the mold in an ultrasonic cleaner before returning it to the patient.**

TUBING PART WAY THROUGH CANAL

1. Follow steps 1 and 2 immediately above.
2. Cut the new tube to the desired length. Experience has shown that a 45° cut works better than a straight-across cut.
3. Coat the bore using a pipe cleaner dipped in tubing cement.
4. Quickly dip the cut end of the new tube in tubing cement, then insert it into the bore. Pull the tube

through to the proper position. Blow air through the tube to expel any remaining cement.

5. Allow the tubing cement to dry for 2-3 minutes. A warm air blower will help expedite this step.
6. With the hearing aid on the pinna and the earmold in place, measure and cut the other end to mate with the earhook.
7. **Make certain that the tubing cement has completely evaporated before allowing the patient to wear the earmold for extended periods of time. It helps to wash the mold in an ultrasonic cleaner before returning it to the patient.**

LIBBY HORNS

1. Remove the old tube. If it can be pulled out, do so. If not, use a reamer of the proper size to get the tubing out. **Caution:** Be certain not to use too large a reamer with acrylic materials, or the new tubing will not adhere to the wall. Also, tubing may be difficult to remove from vinyl earmolds. Patience is necessary.
2. Be certain that the inside of the bore is as clean and smooth as possible.
3. The Libby Horn is not inserted in the same manner as conventional tubing.
4. Dip the large end of the tube in tubing cement, and insert the small end through the canal end of the earmold bore. Pull the tubing into the mold until it is seated in the proper position. Be certain that the bend is properly positioned where the tubing emerges from the outside of the earmold.
5. Blow air through the tube to expel any remaining cement.
6. Allow the tubing cement to dry for 2-3 minutes. A warm air blower will help expedite this step.
7. Carefully trim the larger end of the tubing flush with the canal tip.
8. With the hearing aid on the pinna and the earmold in place, measure and cut the other end to mate with the earhook.
9. **Make certain that the tubing cement has completely evaporated before allowing the patient to wear the earmold for extended periods of time. It helps to wash the mold in an ultrasonic cleaner before returning it to the patient.**

CFA

1. While holding the CFA connector as close as possible to the earmold, pull while twisting back and forth.
2. Reverse the process to install a new tube, then measure and cut as with conventional tubing.

ELBOWS/CONNECTORS

1. Remove the old tubing by pulling it off the connector, or, if necessary, by heating or cutting.
2. Take a piece of new tubing slightly longer than the old one (remember, it probably shrank) and attach it to the connector. Expand it with a mechanical device or (very carefully) with a chemical expander, or use a drop of lubricant to help install it.
3. With the hearing aid on the pinna and the earmold in place, measure and cut the other end to mate with the earhook.
4. **Make certain that the chemical expander has completely evaporated before allowing the patient to wear the earmold for extended periods of time. It helps to wash the mold in an ultrasonic cleaner before returning it to the patient.**

6 Applications

Nothing succeeds like success. Proven, successful fittings teach both beginning and advanced professionals some effective techniques beneficial to patients.

We begin with our 1999 Quick Reference Guide to Earmold Selection, which simplifies the process in many instances and has led to a high degree of success. In addition, we have retained the fitting range recommendations and case studies from previous editions, as they are another way to observe skills in hearing and fitting. We offer some actual hearing aid cases with the earmold selection rationale. Please keep in mind that although these represent successful fittings, other approaches and earmolds may be equally successful in any given case.

QUICK REFERENCE GUIDE TO EARMOLD SELECTION

INTRODUCTION

The **Quick Reference Guide** and associated technical information are designed to provide the hearing aid fitting professional with a rapid earmold selection protocol designed for maximum clarity and effectiveness in achieving a fitting that encompasses the important goals of **comfort, performance** and **cosmetics.**

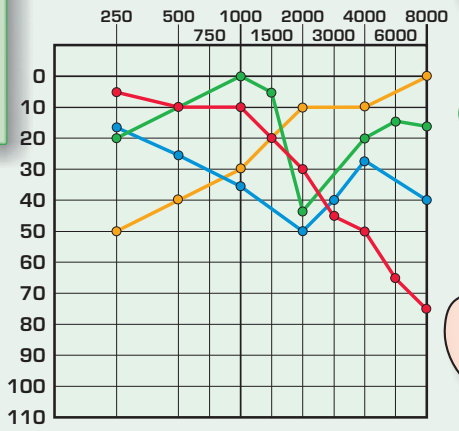
Microsonic's **Custom Earmold Manual** has for years provided basic electroacoustic information and considerable detail of various styles and materials. With the growth of digitally programmable and pure digital processing circuitry capable of multi-band-channel spectral shaping in addition to sophisticated compression manipulation, we have found that a simplified earmold selection process with fewer choices can be implemented with equally successful psychoacoustic outcomes for individual patients.

Our **Quick Reference Guide** combines a color-coded fast reference source with descriptive text for fitting ranges from minimum occlusion to maximum occlusion. Simply choose one of the styles based upon the desired combination of patient need and audiologic considerations. Note that many possibilities exist within a small number of styles. The fitter is urged to add any necessary modifications that will help insure a more successful fitting.

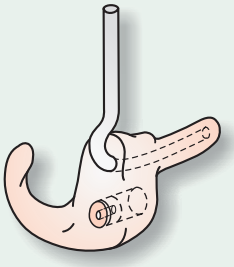
As always, never forget that hearing losses and individual ears may have complex variables that are sensory, anatomical and/or psychologic in nature. Amplitude compensation may or may not succeed using the suggestions here, although field experience has shown a high degree of success.

MICROSONIC's Quick Reference Guide To Earmold Selection

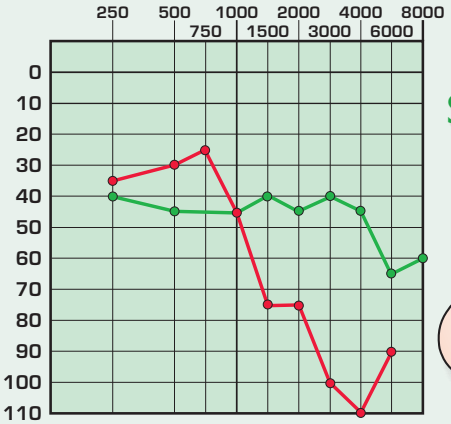
Minimal Occlusion



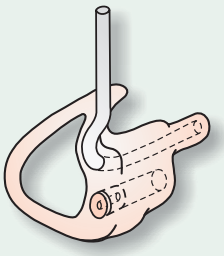
Canal-lok



Advanced Design Free Field



Skeleton



Advanced Design Free Field

Category:	**Mild-to-Moderate**
Configurations:	Flat — Mild Sloped — Ski-Sloped — Cookie Bite — Reverse Sloped
Material:	Acrylic preferred for durability and ease of cleaning, and for ease of insertion.
Tubing:	#13 Medium, or, if canal size permits, Libby Horn for increased HF performance.

Comments: Use to maximize physical comfort, to reduce occlusion effects, for ease of insertion and removal, to increase canal aeration. Can be used as primary mold for many types of mild-to-moderate losses. Use also to focus in the transition region of a severe ski-slope loss and avoid excessive gain in the most damaged cochlear area which could potentially cause downward spread of masking into more functional areas.

ADVANCED DESIGN FREE-FIELD APPLICATIONS

Not Just for Minimal High Frequency Loss!

Microsonic's minimally occlusive **Advanced Design Free-Field (ADF)** earmold has a potentially wide range of applications, and may, in fact, be the industry's best-kept secret when fitting mild to moderate losses of varying configurations. Additional fine tuning is easily accomplished using the standard Select-A-Vent feature.

For the patient who has voice distortion secondary to occlusion, this mold can be dramatic in reducing the "barrel effect." It can be fit to the narrowest and most sensitive ear canals. Patents who require continuous aeration of the canal/middle ear for medical reasons can often wear the ADF mold with minimal side effects. Insertion of the ADF mold is quite easy for many elderly hearing aid wearers who found previous molds too large and/or flexible.

Acrylic material makes this a very durable design, but more compliant materials can be options if needed for child safety, insertion problems, etc. The ADF mold should be considered for mild to moderate losses whenever comfort combined with minimal occlusion is a major goal of the fitter. Patient acceptance has been quite high for this mold.

Several versions of the ADF mold are available. Each provides a unique level of occlusion, making this a highly versatile family of custom earmolds.

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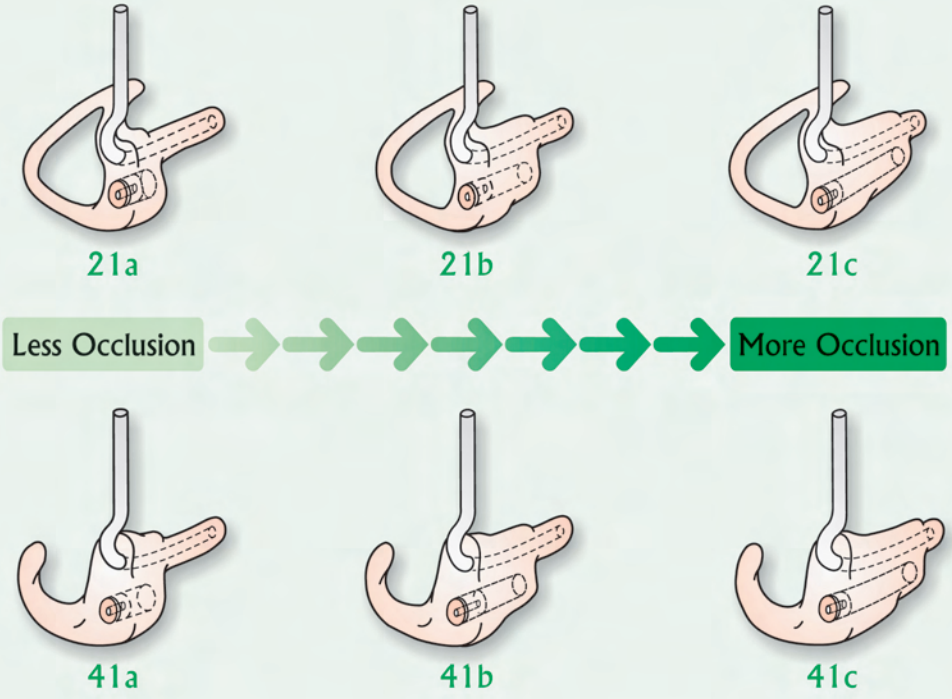
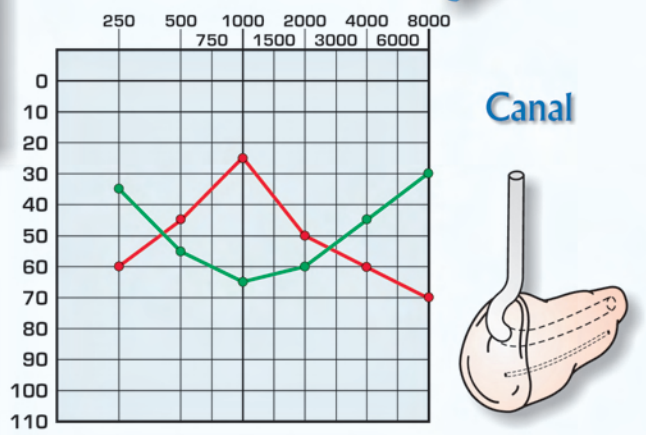
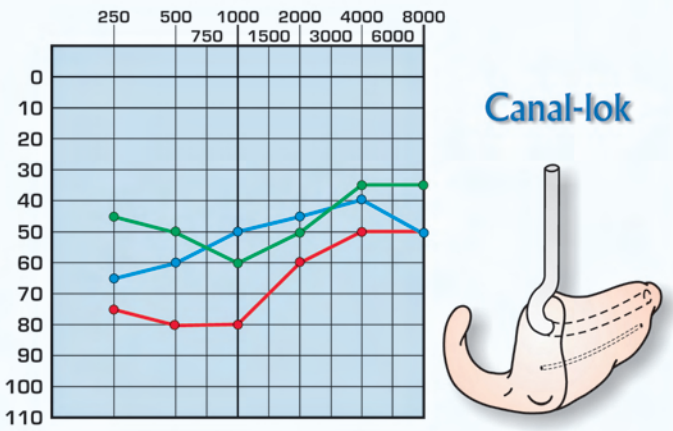


Moderate Occlusion



Canal



Canal-lok

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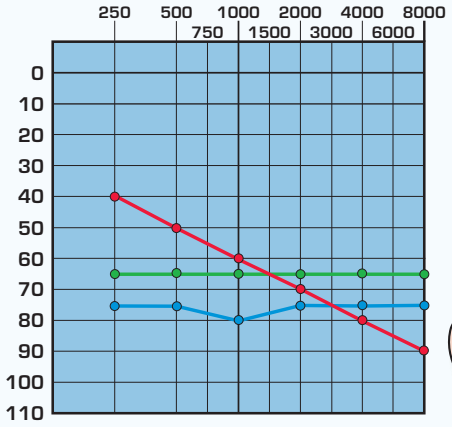
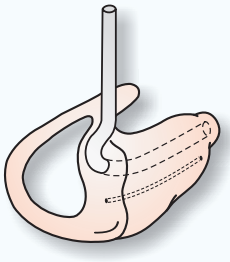


Skeleton



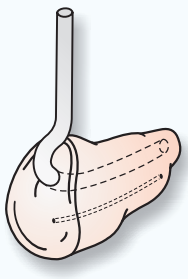
Category:	**Severe**
Configurations:	Flat — HF-Sloped — Reverse Sloped — Cookie Bite
Materials:	Acrylic preferred for durability and ease of cleaning. Synth-a-Flex preferred for children.
Tubing:	#13 Double Wall is suitable for most applications. A 3 or 4 mm. Libby Horn may be added for high frequency enhancement.
Comments:	Use when acoustic feedback with ADF minimally occluding earmold is likely. Easy insertion and removal; can be vented as needed. Very cost effective in Acrylic or Synth-a-Flex material. Soft material can be very effective in feedback control. Consider CFA option when ease of tubing replacement is desired or specific frequency shaping is needed. Use pressure relief venting (consider Select-a-Vent) as long as feedback does not occur.

CANAL, CANAL-LOK AND SKELETON APPLICATIONS

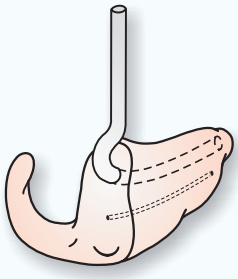
When fitting moderate to severe hearing losses and the minimally occlusive ADF mold cannot provide adequate in-situ gain prior to feedback, consider a moderately occlusive Canal, Canal-Lok or Skeleton type earmold. All three provide adequate feedback control for most losses, while ease of insertion and low profile characteristics will satisfy ergonomic as well as cosmetic needs.

If the patient's ear is large enough, consider a high frequency enhancement option such as the Libby Horn. For quick tubing changes and potentially useful frequency modifications, consider the CFA series outlined in Microsonic's **Custom Earmold Manual.** Venting can be employed based on subjective needs and acoustic principles detailed in the **Manual.**

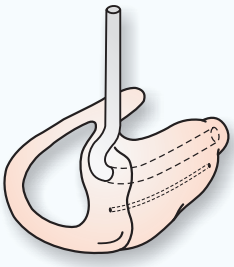
Remember: Given the precision of frequency shaping attainable in the newer multi-channel/band hearing aids, keep patient comfort and ease of insertion at the top of the priority list. And unless medically indicated, never change an earmold style and/or material that has been accepted and judged favorably by a patient. <u>This is especially important in a long-term fit and/or elderly client.</u>



Canal

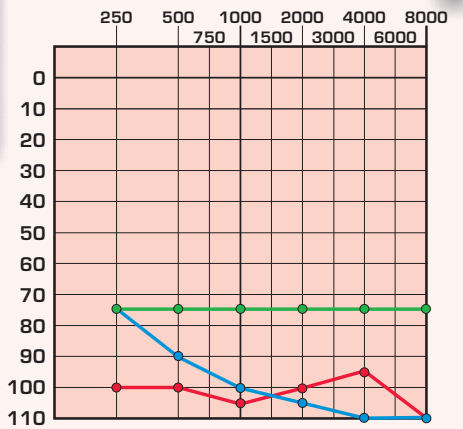


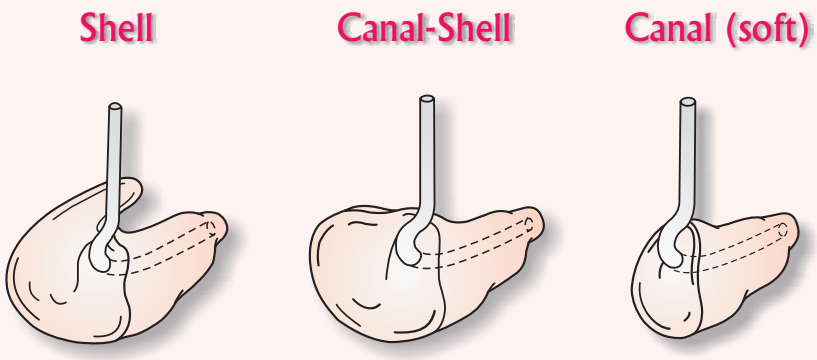
Canal-lok



Skeleton

Maximum Occlusion





Category: Severe-to-Profound

Configurations: Flat — Sloped

Materials: Medi-Sil, M-2000 Plus, Synth-a-Flex

Tubing: #13 Double Wall

Comments: Use for maximum feedback control. Long canal is preferable if patient can tolerate it. Silicone material can minimize leakage due to jaw movement. Medi-Sil and M-2000 Plus are heat/pressure cured for most exact fit; use as needed. Tube-lock option enables quick replacement and eliminates drill-out damage common with tubed vinyl molds. Patient comfort is the most important criteria. Use frequency shaping to enhance low-mid frequencies and notch filter to address troublesome feedback areas.

CANAL, CANAL-SHELL AND SHELL APPLICATIONS

When faced with a severe to profound loss requiring maximum occlusion, consider a deeply inserted M-2000 Plus Canal or Canal-Shell mold. If the patient experiences insertion difficulty due to canal flex, a shell mold in the firmer Medi-Sil or Synth-a-Flex will help to ease insertion. Should jaw movement create intermittent whistling, the soft silicone canal style is often successful in combination with electronic circuitry for feedback control.

Don't sacrifice comfort for a feedback-proof seal — given the precision of spectral shaping possible in current programmable hearing aids, a slight compromise will be more successful in attaining long-term patient satisfaction than will periods of feedback-free operation mixed with a nasty contact ulcer requiring medical treatment. Remember, the psychoacoustic usefulness of high frequency threshold compensation in the severe to profound category can be questioned due to cochlear interference effects.

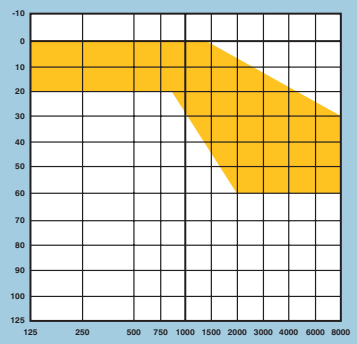
In addition, low- and mid-frequency temporal-spectral cues often provide sufficient information for adequate speech reception in cases of severe to profound high frequency loss that prevent either attainment of adequate gain and/or cochlear processing of place cues. Therefore, a feedback-containment-at-all-costs mentality is not advised. In combination with visual cues, patient everyday performance often exceeds predictions.

The use of double-wall #13 tubing is always a reasonable choice to enhance vibratory isolation. Do not hesitate to add or enlarge an equalization vent in this category should fullness/pressure/distortion complaints be persistent. Materials range from polyvinyls through silicones of varying hardness.

For children where molds will have to be replaced more frequently due to normal growth of the ear and where cost is a concern, Synth-a-Flex is the material of choice. In adults, M-2000 Plus for longevity and comfort should be considered. Adults who have appearance concerns (the materials absorb cerumen over time) and are not cost-conscious may prefer the polyvinyls with their normal replacement cycle. Medi-Sil and M-2000 Plus materials are cured with heat and pressure to capture each detail of the impression.

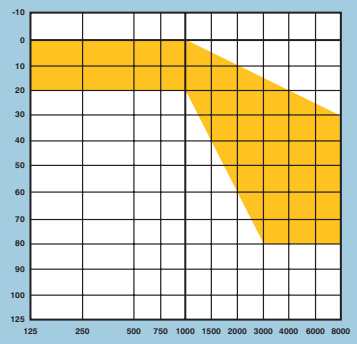
When digital phase cancellation feedback management becomes commonplace, the comfort-performance balance will be much less of an issue for individual hearing aid wearers.

FITTING RANGE – EXAMPLE A



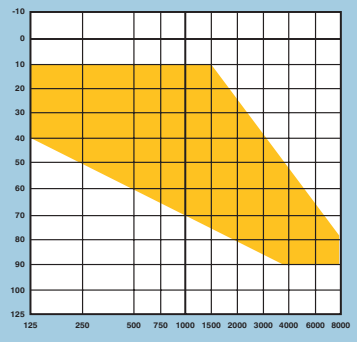
HEARING LOSS	Mild
RECOMMENDED STYLE	#13 Janssen
SUGGESTED MATERIAL	Acrylic
OPTIONS	#12 Standard or #13 Medium Tubing
CAN ALSO USE	#18 Cros C, #19 Free Field, #21 Advanced Design Free Field
REFER TO PAGE	33-34

FITTING RANGE – EXAMPLE B



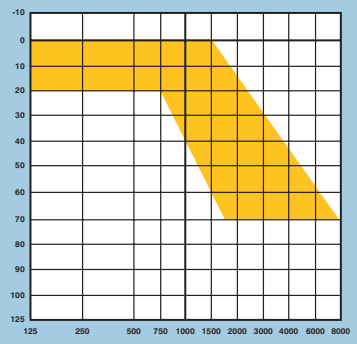
HEARING LOSS	Mild
RECOMMENDED STYLE	#21 Advanced Design Free Field
SUGGESTED MATERIAL	Acrylic
OPTIONS	#12 Standard or #13 Medium Tubing
CAN ALSO USE	#13 Janssen, #16 Cros A, #17 Cros B
REFER TO PAGE	33-34

FITTING RANGE – EXAMPLE C



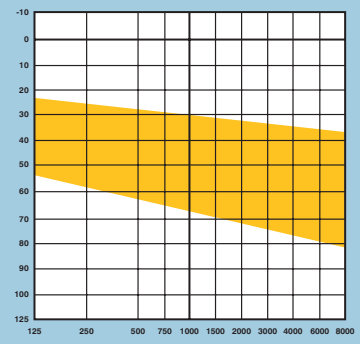
HEARING LOSS	Mild to Moderate 2000Hz to 5000Hz
RECOMMENDED STYLE	#21 Advanced Design Free Field
SUGGESTED MATERIAL	Acrylic
OPTIONS	#12 Standard or #13 Medium Tubing
CAN ALSO USE	CFA-LS, #13 Janssen, #13B or #13A Extended Range
REFER TO PAGE	34-35, 49

FITTING RANGE – EXAMPLE D



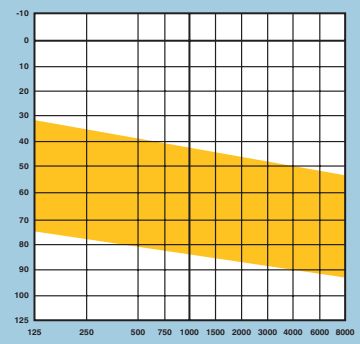
HEARING LOSS	Moderate to Severe 4000 Hz to 7000 Hz
RECOMMENDED STYLE	#14 or #14A Lybarger Dual-Diameter System
SUGGESTED MATERIAL	Acrylic
OPTIONS	1/32"/0.8mm. I.D. Tubing
CAN ALSO USE	xxxxxxxxxxxxxxxxxxxxxxxx
REFER TO PAGE	36

FITTING RANGE – EXAMPLE E



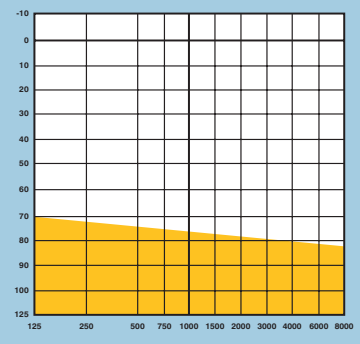
HEARING LOSS	Moderate 1000 Hz to 6000 Hz
RECOMMENDED STYLE	Skeleton
SUGGESTED MATERIAL	Acrylic
OPTIONS	#13 Medium or #13 Thick Tubing, Belled Bore, Libby Horn
CAN ALSO USE	#3 Semi-Skeleton, #5 Canal-lok, #5A Canal-lok with helix, Vinylflex II or Synth-a-Flex II
REFER TO PAGE	30-31

FITTING RANGE – EXAMPLE F



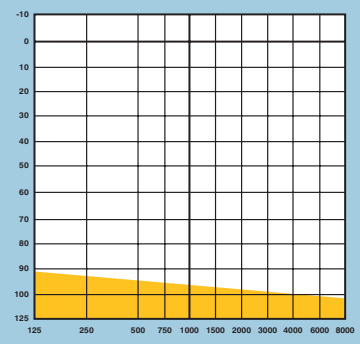
HEARING LOSS	Reverse Curve Moderate to Severe
RECOMMENDED STYLE	#6 Shell
SUGGESTED MATERIAL	Acrylic or Synth-a-Flex II
OPTIONS	CFA #5B, Killion Low Pass Earhook, reverse bore
CAN ALSO USE	#2 Skeleton, #5 Canal-lok, #7 Canal Shell
REFER TO PAGE	30-32, 48, 51

FITTING RANGE – EXAMPLE G



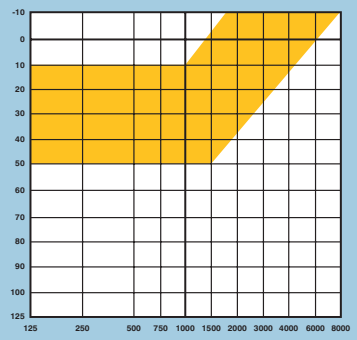
HEARING LOSS	Severe to Profound 125 Hz to 8000 Hz
RECOMMENDED STYLE	Canal
SUGGESTED MATERIAL	M2000
OPTIONS	#13 Thick or #13 Double Wall, standard bore, smallest vent if needed
CAN ALSO USE	#6 Shell, #7 Canal Shell, Synth-a-Flex II, Medi-Sil, M2000 Plus
REFER TO PAGE	30-32

FITTING RANGE – EXAMPLE H



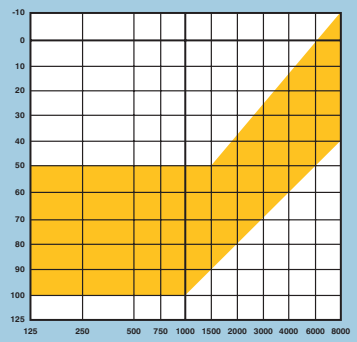
HEARING LOSS	Profound 125 Hz to 8000 Hz
RECOMMENDED STYLE	Canal Shell
SUGGESTED MATERIAL	M2000
OPTIONS	#13 Thick or #13 Double Wall, standard bore, smallest vent if needed
CAN ALSO USE	#5 Canal-lok, #6 Shell, Synth-a-Flex II, Medi-Sil, M2000 Plus
REFER TO PAGE	31-32

FITTING RANGE – EXAMPLE J



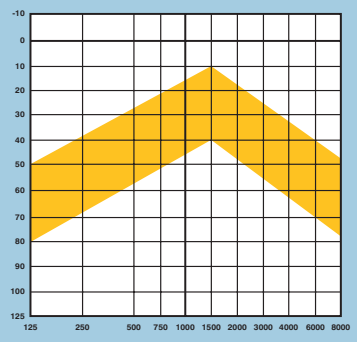
HEARING LOSS	Reverse Curve Mild to Moderate
RECOMMENDED STYLE	#5 Canal-lok
SUGGESTED MATERIAL	Acrylic
OPTIONS	CFA #5A, reverse bore
CAN ALSO USE	#2 Skeleton, #6 Shell, #7 Canal Shell
REFER TO PAGE	30-32, 48

FITTING RANGE – EXAMPLE K



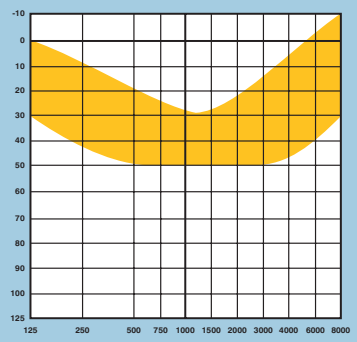
HEARING LOSS	Reverse Curve Moderate to Severe
RECOMMENDED STYLE	#6 Shell
SUGGESTED MATERIAL	Acrylic or Synth-a-Flex II
OPTIONS	CFA #5B, Killion Low Pass Earhook, reverse bore
CAN ALSO USE	#2 Skeleton, #5 Canal-lok, #7 Canal Shell
REFER TO PAGE	30-32, 48, 51

FITTING RANGE – EXAMPLE L



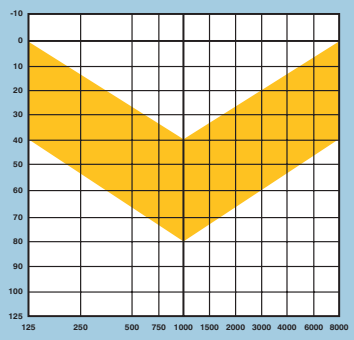
HEARING LOSS	A peak at 2000 Hz
RECOMMENDED STYLE	#2 Skeleton
SUGGESTED MATERIAL	Acrylic
OPTIONS	2KHz Notch Filter Earhook
CAN ALSO USE	Macrae 2K Notch Filter, 1500- or 2200-ohm Knowles Dampers
REFER TO PAGE	30, 44, 50

FITTING RANGE – EXAMPLE M



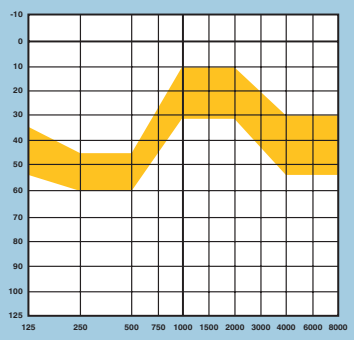
HEARING LOSS	A shallow drop and rise (Cookie Bite)
RECOMMENDED STYLE	#13 Janssen
SUGGESTED MATERIAL	Acrylic
OPTIONS	ER12-1 Low Pass Earhook, #13 Medium Tubing
CAN ALSO USE	#19 Free Field
REFER TO PAGE	33-35, 51

FITTING RANGE – EXAMPLE N



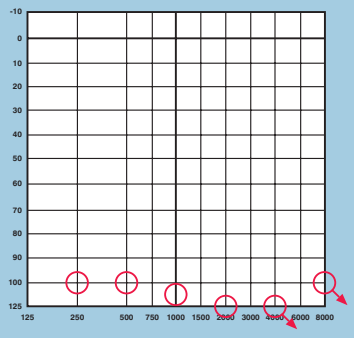
HEARING LOSS	A gradual drop and rise (Cookie Bite)
RECOMMENDED STYLE	#13 Janssen
SUGGESTED MATERIAL	Acrylic
OPTIONS	ER12-1 Low Pass Earhook, Lybarger 1/32" High Pass Tubing
CAN ALSO USE	#19 Free Field
REFER TO PAGE	33-35, 51

FITTING RANGE – EXAMPLE O



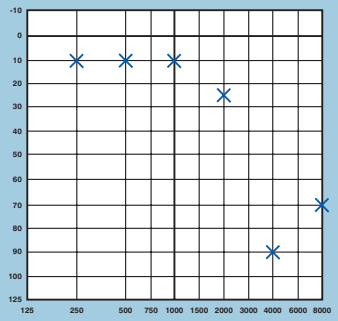
HEARING LOSS	Reverse Cookie Bite
RECOMMENDED STYLE	#13 Janssen
SUGGESTED MATERIAL	Acrylic
OPTIONS	ER12-4 Band-Reject Earhook
CAN ALSO USE	xxxxxxxxxxxxxxxxxxxxxxxxx
REFER TO PAGE	34-35, 51

CASE STUDY #1



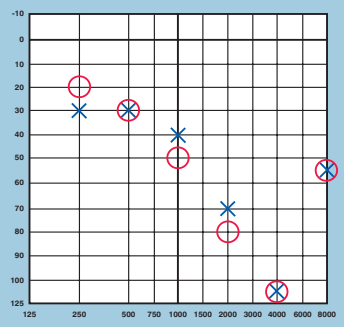
RIGHT EAR	SRT	100dB	**10 YEAR OLD FEMALE** **LOSS: Since birth** **CAUSE: Congenital factors**
	MCL	105dB	
	UCL	100dB	
Speech Discrimination		48%	
AID FITTED:		High gain adjustable power BTE type	
EARMOLD STYLE:		M-2000 Canal-Shell	
EARMOLD RATIONALE:		This child wears a high gain power aid where a tight acoustic seal is imperative. Soft materials are safer for children.	

CASE STUDY #2



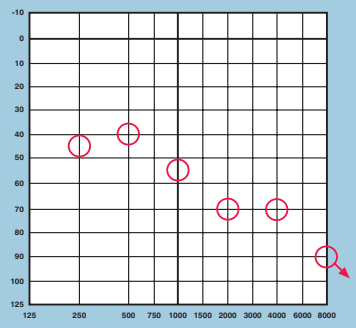
LEFT EAR	SRT	20dB	**59 YEAR OLD MALE** **LOSS: Past five years** **CAUSE: Probably occupational**
	MCL	55dB	
	UCL	100dB	
Speech Discrimination:		72%	
AID FITTED:		Moderate gain and output BTE with high frequency emphasis	
EARMOLD STYLE:		Lybarger dual-diameter non-occluding acrylic	
EARMOLD RATIONALE:		This patient hears well one-on-one, but in the presence of noise his loss is a problem. The dual-diameter mold attenuates at 1000-1500Hz and gives expanded high frequency response due to horn effect of dual-diameter tubing.	

CASE STUDY #3



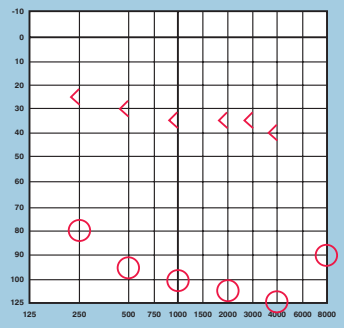
	RIGHT EAR	LEFT EAR	
SRT	50dB	45dB	**43 YEAR OLD FEMALE LOSS: Sudden; irreversible**
MCL	85dB	80dB	
UCL	100dB	100dB	
Speech Discrimination	40%	52%	
AID FITTED:	Binaural BTEs with moderate gain and power		
EARMOLD STYLE	Acrylic skeleton with belled bore		
EARMOLD RATIONALE:	The patient had poor speech discrimination both unaided and under phones. The binaural fitting and the belled bore earmolds provide the best signal-to-noise ratio application for this lady.		

CASE STUDY #4



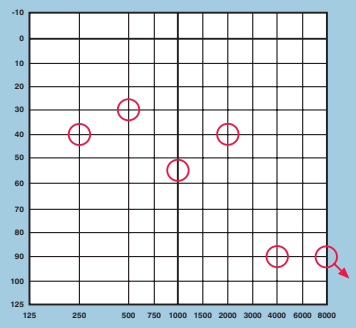
RIGHT EAR		
SRT	55dB	**52 YEAR OLD FEMALE LOSS: Sensorineural CAUSE: Diabetes**
MCL	65dB	
UCL	85dB	
Speech Discrimination	88%	
AID FITTED:	Binaural BTEs with AGC circuitry	
EARMOLD STYLE:	Acrylic Skeleton, Libby Horn 8CR	
EARMOLD RATIONALE:	The patient has a reduced dynamic range, and preferred the Libby Horn's smooth sound. A standard Skeleton mold was tried first.	

CASE STUDY #5



RIGHT EAR		
SRT	100dB	**69 YEAR OLD MALE LOSS: Conductive CAUSE: Otosclerosis**
MCL	110dB	
UCL	120+dB	
Speech Discrimination:	92%	
AID FITTED:	Body	
EARMOLD STYLE:	Regular acrylic with long canal	
EARMOLD RATIONALE:	This patient has long refused surgery and has used this type of mold for 15 years. Did not exhibit feedback problems.	

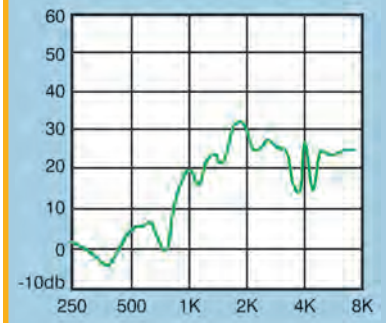
CASE STUDY #6



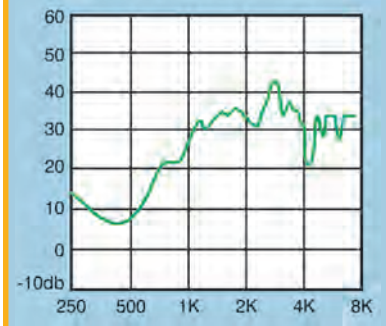
RIGHT EAR		
SRT	55dB	**71 YEAR OLD FEMALE LOSS: Sensorineural CAUSE: Trauma**
MCL	85dB	
UCL	95dB	
Speech Discrimination	48%	
AID FITTED:	BTE with moderate gain and output	
EARLOLD STYLE:	Super Alerite Canal-Shell with a 1500-ohm damper	
EARMOLD RATIONALE:	The patient has palsy; this style is easy to insert. She reported an allergy to acrylic molds. The damper smoothes the aid's response curve.	

CASE STUDY #7

INSERTION GAIN — FIGURE 1



INSERTION GAIN — FIGURE 2



AID FITTED:	Power BTE
EARMOLD STYLE:	Acrylic Shell with 2 mm long canal, 3mm Libby Horn and SAV

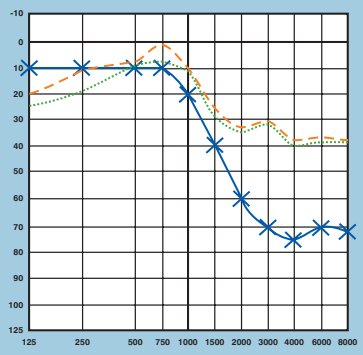
EARMOLD RATIONALE:
Patient experiences chronic ear drainage and cannot be fit with an unvented mold. Primary fitting objective is to maximize gain below feedback levels.

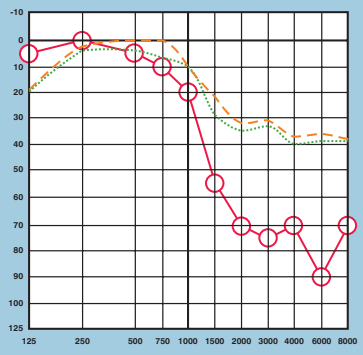
This case involves a patient who experienced a recent threshold shift requiring a more powerful hearing aid, but who has a chronic running ear. Audiometric and speech data are omitted as they are not germane to the concept illustrated. Previously, the patient used a non-occluding earmold, but now requires enough gain to create a feedback problem. The case study shows a way to provide increased gain to an ear which cannot be fully occluded.

Initially, a shell mold with a 13mm canal, a bell bore and a SAV was tried. Figure 1 illustrates the highest insertion gain available before feedback began.

Increased canal length and the addition of a 3mm Libby Horn enabled the hearing aid to be used at a higher volume setting without feedback, as shown in Figure 2. A 5-10 dB gain advantage was noted, enabling the patient to maintain adequate ear aeration and achieve satisfactory amplification levels. The SAV channel facilitates drainage, a vital concern in this fitting. **Caution: This fitting was performed under the supervision of an otologist. Do not apply earmolds to draining ears without the express approval of a physician.**

CASE STUDY #8





63 YEAR OLD MALE	
LOSS:	Precipitous
CAUSE:	Presbycusis (circulatory disturbance)
Speech Discrimination:	68% using HF words
AID FITTED:	Moderate gain programmable BTEs
EARMOLD STYLE:	Acrylic shell with 3mm Libby Horn, plus 3300-ohm damper
EARMOLD RATIONALE:	This fitting involved programmable hearing aids configured to closely match a modified NAL target for each ear. The probe mic measurement of the real-ear response illustrates the transparency of the LF response and the HF boost provided by the Libby Horn. Speech discrimination in high level noise was improved from 0% unaided to 70% aided.

X or O HEARING THRESHOLD LEVELS
TARGET GAIN
MEASURED REAL EAR RESPONSE

Special Products

7

Earmold products are used for some applications that are not associated with hearing aids. They are used by anesthesiologists, employees in industrial settings, children with "swimmer's" ear, hunters and persons with collapsed ear canals. Each special application is described and illustrated.

NON-AMPLIFIED APPLICATIONS

Currently there are available many types of custom-made hearing protection devices (HPDs) and communication molds. Here are the applications where they are most commonly used.

MUSIC INDUSTRY

Custom earmold HPDs offer good attenuation, but also tend to muffle the sound. So do compressible foam plugs. Etymotic Research has developed earplugs that address this problem – the ER-9, ER-15 and ER-25 Musicians Earplugs. Musicians will find the ER-9 and ER-15 attenuators useful in reducing discomfort without sacrificing clarity, and the ER-25 is even more useful to percussionists and rock musicians.

CONSTRUCTION AND INDUSTRIAL

An effective defense against very loud noise is Microsonic's custom Sound Defenders. These HPDs are molded in a thermoplastic called Synth-A-Flex II or in M-2000 silicone. The solid construction of the material provides a significant degree of attenuation. See the additional material in this chapter for more information on hearing protection devices.

SHOOTING

An acoustic filter is inserted into a vented HPD, allowing the user to communicate with other people, but still giving some protection against the high impact sound that a gun can produce. The exact performance of HPDs in impact noise is not known through standard testing, but the literature indicates that HPDs are beneficial in the prevention of noise-induced hearing loss when the wearer is exposed to gunfire.

MOTOR SPORTS

In sports where helmets are worn, a full shell sound plug that is dished out or a half shell style will aid in the comfort of the wearer. Where voice contact is needed, for example, between race car driver and pit crew, a communication mold is available.

7 SPECIAL PRODUCTS

SWIMMING

Swim molds are a healthy and effective way to minimize the chance for ear infections and keep most water from entering the ear canal. These solid ear plugs can be manufactured in many different colors, with added options such as handles, cords, or a combination of both.

COMMUNICATION

The most common molds used for this application are the skeleton and CROS styles. They feature a coiled or straight tubing with female adapter and collar clip.

MEDICAL PROFESSION

The Anesthesiologist's earmold uses a standard receiver ring and a male stethoscope adapter that connects to a listening device. Electronic stethoscope and conventional stethoscope adapter molds are also available. The conventional stethoscope mold is made of soft thermoplastic Synth-A-Flex II.

AIRCRAFT

A specially designed earmold allows the pilot to attach his or her microphone headset to a moveable bar which allows proper adjustment. The recommended material is acrylic.

MISCELLANEOUS

Probably the most inconspicuous and comfortable earplugs are the canal style. They offer good attenuation, and allow the user to wear the molds for long periods of time. Synth-A-Flex II and M-2000 are the materials we recommend for these applications.

Acoustic trauma and sustained exposure to noise are serious causes of hearing loss. Loud sounds can and do damage hearing, with the damage often undetected until it is too late. The list below gives examples of sound levels.

dB LEVEL	EXAMPLES
30	Quiet library, soft whispers
40	Living room, refrigerator, bedroom away from traffic
50	Light traffic, quiet office, moderate rainfall
60	Dishwasher, sewing machine, normal conversation
70	Vacuum cleaner, hair dryer, noisy restaurant
80	Average city traffic, garbage disposals, alarm clock at two feet.
THE FOLLOWING NOISES CAN BE DANGEROUS UNDER SUSTAINED EXPOSURE	
90	Subway, motorcycle, truck traffic, lawn mower
100	Garbage truck, chain saw, pneumatic drill
120	Rock band concert in front of speakers, thunderclap
140	Gunshot blast, jet plane taking off
180	Rocket launching pad

ABOUT HEARING PROTECTION

Industrial Hearing Conservation Programs have become common in America's workplaces, due to stringent, government-imposed noise exposure limits. Both disposable foam and custom-molded hearing protectors are widely used in industry, as are head-worn earmuff devices.

NOTE: Insert-type HPDs, both custom and compressible, are not recommended for persons who chronically generate large quantities of cerumen. The regular insertion of the HPDs may cause unintended wax impaction in these cases; earmuffs may be a more practical option.

When selecting a hearing protection device, it is imperative to match it to the required attenuation level. **Do not automatically look for the highest Noise Reduction Rating (NRR)** when selecting HPDs for clients. For some years, HPD manufacturers have tried to demonstrate through testing the highest possible NRRs for their products, and have then labeled the devices accordingly. This has led to unwarranted overconfidence in the NRR numbers, and to a quest for the highest of those numbers.

There are two important reasons why the highest NRR may not be appropriate. The first is that these ratings were derived under essentially ideal laboratory conditions, while the HPDs will probably be worn in less favorable conditions. For various reasons, wearers do not always insert HPDs properly, thus lowering considerably the protective value. Although OSHA accepts the published NRR as a measure of adequacy of hearing protection, there can be no assurance that the wearer will obtain that same value.

The second reason for not automatically choosing the highest available NRR is **to avoid overattenuation,** since some people do achieve the advertised values. Overattenuation can be harmful to the wearer if it prevents warning signals and important communication from being heard understandably.

A Guidance Document from the European Committee for Standardization clearly specifies appropriate attenuation for various noise levels, with the rule of thumb being "Don't attenuate more than it takes to keep the sound at 75-80 dB SPL," **unless there is cause to do so.**

You could incur liability by unnecessarily attenuating below 75 dB SPL; there has been in the United States at least one successful legal action for overprotecting. Be careful and accurate in selecting the right HPD. The HPD manufacturer will disclaim liability for overprotecting if he has clearly listed the protective values of his product and cautioned practitioners against improper use of them. Remember that there is no method for predicting absolute results on any given individual without the use of an objective field monitoring system.

Remember too that when tightly and completely inserted, compressible foam HPDs have potentially higher NRRs than custom molded devices, simply because there is less bulk in the ear (especially in the concha) to cause possible shifting of the device, and also because the seal takes place entirely within the ear canal. In practice, though, the custom molded device is probably more effective than the throwaway because it is harder to insert incorrectly or incompletely. Furthermore, because the custom device fits more comfortably, it is more likely to be worn as intended.

Most HPDs will supply the 10 dB of attenuation that is needed to be effective in most industrial environments, though it may be difficult to obtain that same 10 dB through workplace noise control. A comfortable, properly fitted, properly worn HPD is an effective hearing conservation tool.

A new standard looms on the horizon for measuring the effectiveness of HPDs. Although accepted by ANSI,

it has not yet been adopted by EPA as the law of the land. You should be aware, though, that all attenuation numbers will likely be significantly lower that at present, because the new procedure will attempt to more closely reflect the way groups of people ("populations") wear HPDs, rather than how well HPDs work when installed ideally.

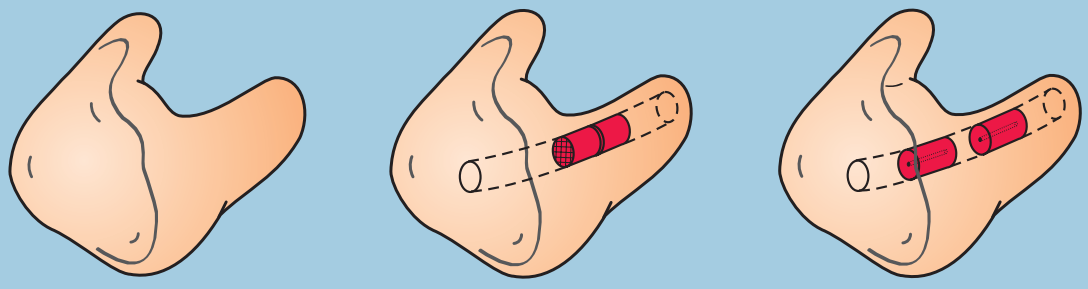
Programs exist to assist the hearing conservationist with both selection and verification of HPDs, such as the modern CHiPS and FITCHECK systems available from Michael & Associates, Inc. in State College, Pennsylvania. They, as well as more traditional methods, may be of great benefit in determining the actual appropriateness of a hearing protection device.

#22 HEARING PROTECTION MOLDS

Microsonic offers custom **Sound Defenders,** molded from ear impressions made by an industrial hygienist, audiologist or hearing aid dispenser. They are available in Synth-a-Flex (vinyl) or M-2000 (soft silicone), and can be ordered as solid plugs or with ***Double-Damped*** vents for differing requirements. Easy-to-insert canal-shell models are also available. The information that follows includes the attenuation data and noise reduction ratings (NRRs) of tested products. Attenuation tests have been performed according to the American National Standards Institute (ANSI) Specifications S3.19-1974.

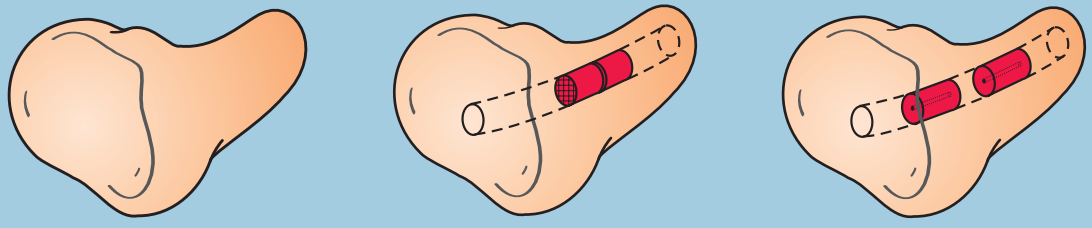
Notice that fairly predictable control over the level of attenuation of low frequencies can be obtained through the use of various damper values. Dampers used in pairs offer smooth curves and controlled attenuation well into the mid-frequencies. "B" dampers will be supplied unless "A" dampers are requested.

FULL SHELL SOUND DEFENDERS



SOLID | DOUBLE-DAMPED "A" | DOUBLE-DAMPED "B"

CANAL SHELL SOUND DEFENDERS



SOLID | DOUBLE-DAMPED "A" | DOUBLE-DAMPED "B"

NRR (noise reduction rating) for solid M2000 Silicone is 26 dB; for solid Synth-A-Flex Vinyl, 25dB.
Measurements were made according to American National Standards Institute Specifications ANSI S3.19-1974

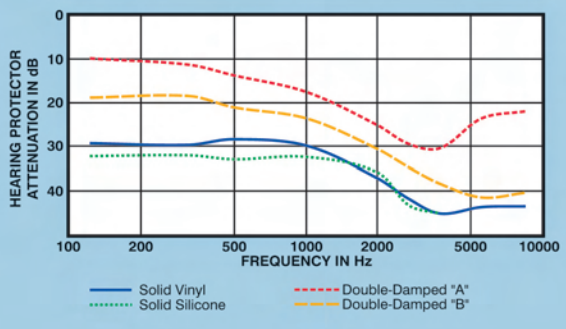
Center Frequency in Hertz	Mean Attenuation in dB		Group	Group Attenuation in dB		Standard Deviation in dB	
	SILICONE	VINYL		SILICONE	VINYL	SILICONE	VINYL
125	32.4	29.2	A	64.5	59.0	5.9	4.1
250	32.1	29.8				5.6	4.0
500	33.8	28.3	B	192.0	183.5	4.2	4.8
1000	32.5	30.5				3.9	4.6
2000	35.9	37.0				3.7	3.3
3150	44.5	42.4				4.1	4.5
4000	45.2	45.3				4.2	4.6
6300	44.8	44.3	C	89.4	88.4	5.0	4.6
8000	44.7	44.1				3.7	5.6

Use these laboratory-derived data for comparison purposes only. The amount of protection afforded in field use is often significantly lower depending on how the protectors are fitted and worn. These data were obtained through measurements made at the laboratories of Michael & Associates, Inc., State College, Pa., USA. Michael & Associates, Inc. is accredited to test ANSI S3.19-1974 and ANSI S12.6-1984 by the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP).

NRR (noise reduction rating) for DOUBLE-DAMPED SOUND DEFENDERS: "A"= 11 "B"=19
Measurements were made according to American National Standards Institute Specifications ANSI S3.19-1974

Center Frequency in Hertz	Mean Attenuation in dB		Group	Group Attenuation in dB		Standard Deviation in dB	
	"A"	"B"		"A"	"B"	"A"	"B"
125	9.9	19.3	A	21.7	37.8	3.5	5.0
250	11.7	18.5				3.2	2.3
500	13.6	21.3	B	117.4	148.0	2.8	2.4
1000	17.1	23.8				2.8	2.6
2000	26.6	30.6				3.6	3.7
3150	29.6	34.6				4.0	3.9
4000	30.6	37.7				3.0	4.4
6300	24.3	42.1	C	46.3	82.8	2.5	4.8
8000	22.0	40.7				3.3	5.1

Use these laboratory-derived data for comparison purposes only. The amount of protection afforded in field use is often significantly lower depending on how the protectors are fitted and worn. These data were obtained through measurements made at the laboratories of Michael & Associates, Inc., State College, Pa., USA. Michael & Associates, Inc. is accredited to test ANSI S3.19-1974 and ANSI S12.6-1984 by the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP).



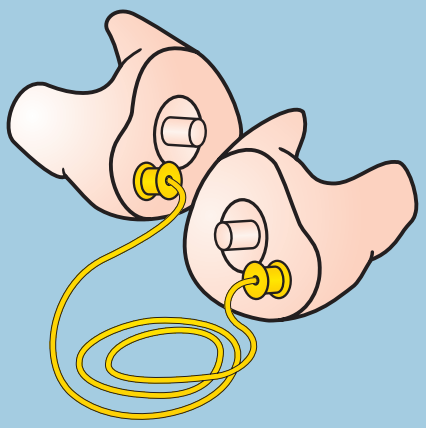
Curves are shown for four specific configurations of hearing protection molds, and illustrate the wide range of attenuation available with **Sound Defenders.** This will make it easier for the fitter to select the appropriate model.

Double-Damped Model "A" Sound Defenders employ a pair of 1000-ohm Knowles dampers. By increasing the resistance value of the dampers, greater amounts of attenuation can be obtained as needed, while still maintaining the added comfort of a vented HPD.

Double-Damped Model "B" Sound Defenders contain a matched pair of exclusive Microsonic-designed dampers, and are available in this single value. These HPDs are easier to keep clean and functional than the Model "A," due to the differences in damper design. Model "B" offers additional attenuation, as well.

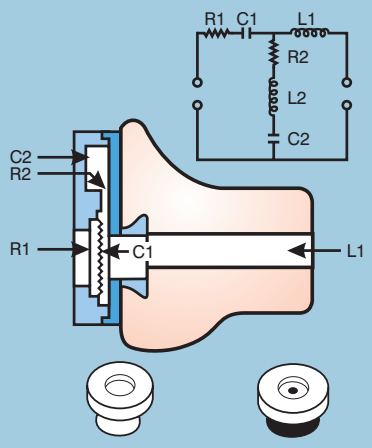
For greater attenuation requirements, specify the traditional solid **Sound Defenders** with their still higher NRRs.

You can use Microsonic's NRRs with the confidence of knowing that the ratings were obtained through careful testing at one of the nation's most highly respected independent laboratories. Remember, though, to use NRRs for comparison purposes only, as the amount of protection afforded in field use can be significantly lower depending on how the protectors are fitted and worn.



SOUND DEFENDERS ARE AVAILABLE WITH OPTIONAL HANDLES AND/OR AN OPTIONAL CORD AS SHOWN.

ER-9, ER-15 & ER-25 MUSICIANS EARPLUGS™ FROM ETYMOTIC RESEARCH



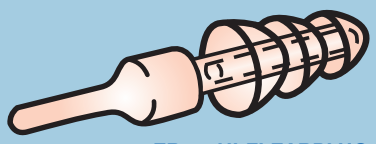
ER-9, ER-15 & ER-25 ER-15SP

ER-9, ER-15 and ER-25 Musicians Earplugs attenuate musical sound levels with a minimum change of tone quality. Because the attenuation is essentially flat across the entire sound spectrum, the fidelity of the original sound is preserved and the world doesn't sound muffled. Where sound levels regularly exceed 105 dB, the ER-25 is generally recommended, as there is 10dB more attenuation than in the ER-15. Recommended for musicians, sound crews, recording engineers, night club employees, and individuals who experience post-noise-exposure tinnitus, the ER-9, ER-15 and ER-25 are installed in custom-manufactured molds. They require an impression past the second canal bend and a diameter large enough to accommodate a 4mm bore. A short impression can result in unwanted occlusion effect.

Attenuators are available in clear, beige, brown, red and blue.

ER-15SP SPORTS PLUGS™

A variant is the ER-15SP Sports Plugs™. The colorful attenuator is countersunk into a custom deep-fitting mold to provide the smallest possible size. It is beneficial to persons exposed to 90-105 dB sound levels who need to hear accurately, such as industrial employees, sports players, motorcycle riders and non-commercial pilots. Again, an impression beyond the second canal bend is required in fitting this product.



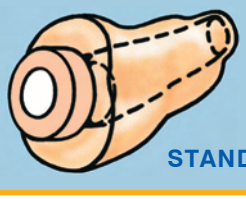
ER-20 HI-FI EARPLUG

ER-20 HI-FI EARPLUG

The ER-20 Hi-Fi Earplug, which protrudes from the ear, attenuates the higher frequencies more than the ER-15 does. It is available in a standard configuration with a soft tip, as illustrated. The ER-20 is available in a variety of colors.

#32 MUSICIANS EARPLUGS

Depending on ear size and shape, Musicians Earplugs inserts can be installed in the molds in various ways.

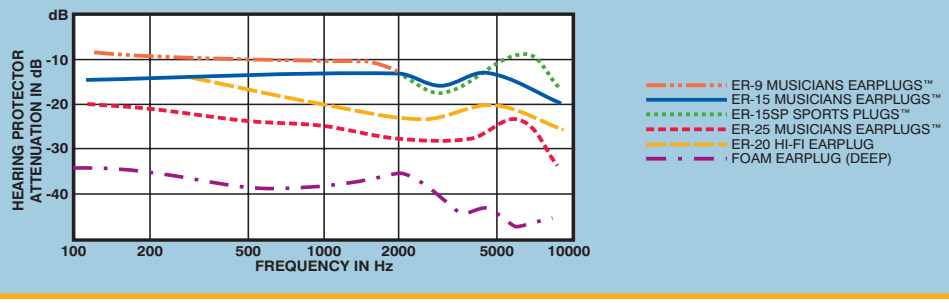


STANDARD

PARTIALLY COUNTERSUNK

COUNTERSUNK

EARPLUG ATTENUATION (MEAN)



RECOMMENDED EARPLUGS FOR MUSICIANS

Musicians practice and perform in a variety of different settings and they are exposed to high levels of sound, sometimes for long periods. They require different amounts of protection depending on the sound levels they encounter during rehearsals and performances.

	ER-9 Musician Earplugs	ER-15 Musician Earplugs	ER-25 Musician Earplugs	ER-20 Ready-fit Earplugs	Harmful Sound Comes From:
Small strings	●	●		●	Own instrument, other strings
Large strings	●	●		●	Brass
Woodwinds		●		●	Brass, percussion
Brass		●	●	●	Own instrument, other brass
Flutes		●		●	Percussion
Percussion		●	●	●	Own instruments, other percussion
Vocalists	●	●		●	Own voice, speakers, monitors
Acoustic guitar	●	●		●	Drums, speakers, monitors
Amplified instruments		●	●	●	Speakers, monitors
Marching bands		●		●	Multiple sources
Music teachers		●		●	Multiple sources
Recording engineers		●		●	Speakers, monitors
Sound crews		●		●	Speakers, monitors

CHART COURTESY OF ETYMŌTIC RESEARCH, INC.

MORE INFORMATION

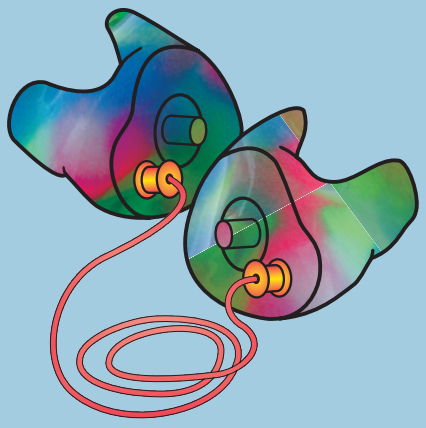
Further information regarding hearing conservation and hearing conservation programs is available from the National Hearing Conservation Association, 611 East Wells Street, Milwaukee WI 53202. NHCA reminds that "…there really is no such thing as a one-size-fits-all HPD. Each person must be individually evaluated to determine the best match of HPD for their environment, noise exposure, anatomy and hearing ability."

SWIM PLUGS

Many persons recovering from ear infections or ear surgery, as well as those with chronic conditions such as drainage, must keep their ear canals dry to prevent more severe problems from developing. While no swim plug can create an absolutely watertight seal in the ear canal, properly fit Microsonic swim plugs will keep out most of the moisture that can aggravate outer ear conditions. Ideal for bathing, showering or swimming, swim plugs are simply soft custom earmolds without any bore or tubing. Microsonic pioneered the floatable swim plug, currently available in M-2000 Neon Lites. A color chart is available on request. Swim plugs can be made to ***Glow In The Dark.***

Microsonic does not manufacture custom swim plugs or Neon Lites from unacceptable impressions, as they may not seal properly. Recommended material for Solid Swim Plugs: Synth-A-Flex II. Recommended material for Floating Swim Plugs: M-2000 Neon Lites.

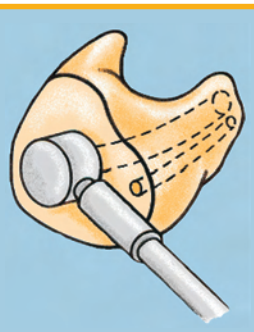
In-the-Office swim plugs are easily made with Microsonic Quikfloaters™ material. Packaged both in bulk and in SOLOS, Quikfloaters™ is used like a silicone-addition impression material (such as Mega-Sil), but produces wearable plugs. Trimming after removal is necessary for proper appearance, and glazing is recommended for longevity. The material comes in both red and blue colors, for instant identification by the wearer.



SWIM PLUG STYLES

#23	**Solid Swim Plugs**
#23A	**Solid Swim Plugs with Handles**
#23B	**Solid Swim Plugs with Cord**
#23C	**Solid Swim Plugs with Handles and Cord**
#24	**Floating Swim Plugs**
#24A	**Floating Swim Plugs with Handles**
#24B	**Floating Swim Plugs with Cord**
#24C	**Floating Swim Plugs with Handles and Cord**

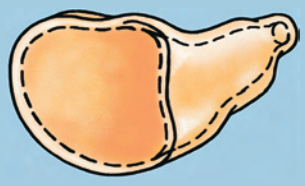
#25 ANESTHESIOLOGIST'S EARPIECE



Anesthesiologists must monitor several vital signs of their patients during surgery. The irritation of constantly wearing a stethoscope can be avoided by using a custom-made earmold. These molds are recommended to be made from acrylic and can be sterilized. Each anesthesiologist's mold comes with an anodized aluminum earmold adapter. Venting is recommended for maximum comfort. Special 1/8"/3.2mm I.D. silicone tubing may be ordered. Please specify tubing length (3 ft. minimum recommended).

#26 SKELETON UPLIFT
#27 CANAL SHELL UPLIFT

#26 SKELETON UPLIFT

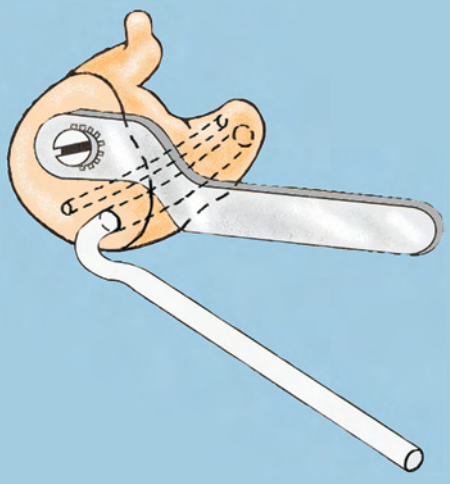


#27 CANAL SHELL UPLIFT

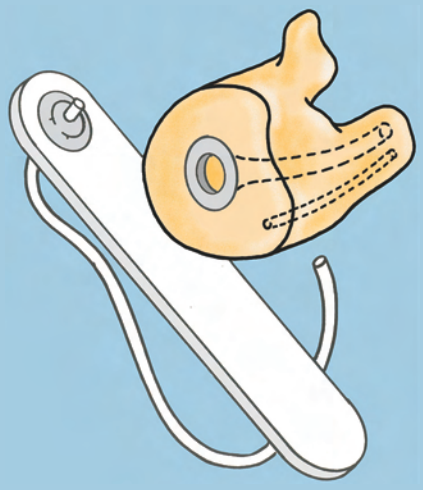
For normal hearing persons with prolapsed ear canals. The opening of the sound channel is shaped like a funnel with as large a bore as possible in the center to allow a maximum amount of sound to reach the eardrum. Most earmold styles can be used for this special need.

#28 PILOT COMMUNICATION MOLDS

These earpieces are designed to support a combination listening device/boom microphone headset. Popular models include the Pacific Plantronics brand, the Telex 5 x 5 Pro III and the Telex 5 x 5 Mark II headsets. (Telex PEM-77 and PEM-78 use only a Regular (style #1) earmold). Each earpiece is custom vented depending on individual ear anatomy.



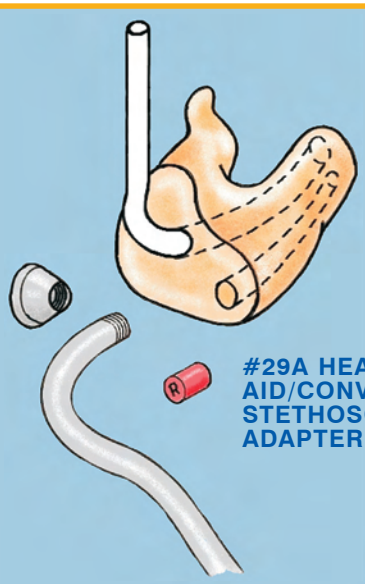
#28 CRIMPED BAR



#28A STRAIGHT BAR

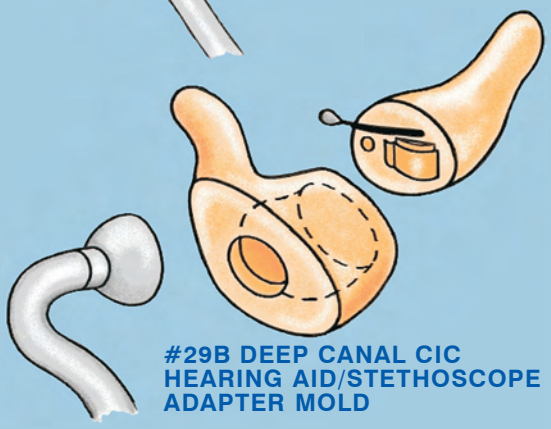
HEARING AID/STETHOSCOPE ADAPTER MOLDS

Microsonic has developed specialized earmolds for medical professionals who must use a hearing aid in conjunction with either an electronic or a conventional stethoscope. The first (#29A) uses a full tubed mold with a separate sound channel into which the stethoscope's earpiece is inserted (after the tip is removed). When not using the stethoscope, the professional inserts a solid plug into the mold.



#29A HEARING AID/CONVENTIONAL STETHOSCOPE ADAPTER MOLD

The second earmold (#29B) is especially configured to permit the use of a stethoscope in conjunction with deep canal CIC hearing aid. It directs the sound from the stethoscope tip directly into the microphone port of the hearing aid. **Note:** A different impression method is required for this earmold, as the hearing aid must be in position in the ear. Do **not** cover the hearing aid faceplate with any tape or wrapping before taking the impression; the impression material will not damage it. Use **only** hand-mixed, two-part (A+B) silicone impression material, and allow it to cure fully before removing. Mark the location of the microphone opening with a felt-tip pen or similar device prior to mailing the impression. It is not necessary to send a stethoscope tip to the lab unless it is going to be used with the mold.



#29B DEEP CANAL CIC HEARING AID/STETHOSCOPE ADAPTER MOLD

PERSONAL LISTENER MOLDS

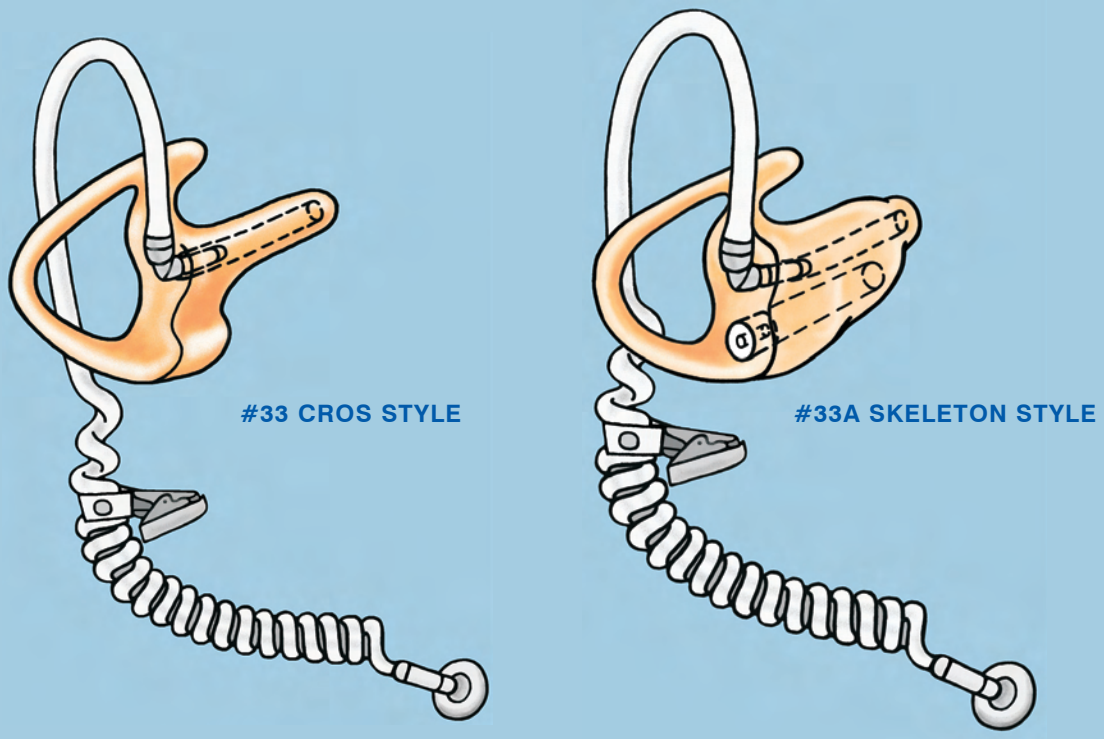
Style #30 attaches to the earphones provided with portable radios, tape and CD players, and the like. The earphone is pressure-fit into the mold and provides increased comfort as compared with the headband normally supplied with such devices. Available in Synth-a-Flex II and Medi-Sil II.

Variants of Style 30 are available for all universal in-ear monitors (IEMs).

Style #30A uses an expandable adapter that will accommodate any size earphone bud.

#30 **#30A**

#33 AND #33A TELECOMMUNICATIONS MOLDS WITH COLLAR CLIP



Telecommunications earmolds are ideal for receptionists, radio station staff, television newscasters and directors, law enforcement officers, telemarketers, sports team personnel or any individuals extensively using a telephone or radio device in a work setting.

This specialty configuration provides a comfortable coiled sound tube and a convenient clip to anchor it to the wearer's collar while allowing maximum flexibility of movement. The loose end attaches to the audio output connection of the telephone or other device.

Because maximum venting is desirable in most applications of this product, either the CROS style or a skeleton mold with a large vent is recommended. This allows the reception of the communication signal without the fullness associated with a closed earmold, and at the same time permits normal face-to-face conversations with other individuals.

8 Earmold Counseling

The delivery of a hearing aid system is a rehabilitative process. The fitter must clearly explain to the patient what he or she must know and do to achieve satisfaction with the hearing instrument. Part of the patient information must include the care and management of the earmold. This section presents a format that may be helpful.

EARMOLD COUNSELING FOR YOUR PATIENTS

The hearing aid delivery process is very important in your dispensing practice because you are training the patient to be successful in wearing a hearing aid. At Microsonic we feel that information for the new patient about the earmold and its care is essential.

The first point to cover with the patient is insertion of the earmold. A suggested format follows (for behind-the-ear aids):

1. Have the aid turned off to eliminate feedback when inserting the aid (once the mold is in, turn the hearing aid on).

2. Show the position of the mold in the fingers. It should be held between the thumb and forefinger with the aid in between the finger and thumb.

3. Slide the mold into the ear canal. Use a rocking motion until the patient feels the mold "pop" into place. Pull down on the ear lobe gently to facilitate insertion.

4. Demonstrate "incorrect" insertion by having the patient view this in a mirror.

5. Place the mold into the patient's ear several times explaining the steps each time. The repetitions are helpful with the hearing impaired in the event they have not heard all you have said.

6. Ask the patient to remove and insert the earmold several times to become familiar with the procedure.

7. Inform your patient that some people require a few days to learn insertion. This will relieve and reassure the patient who has difficulty with this part of the hearing aid orientation.

8. Stress that positioning is what they are learning. Custom earmolds do fit, but they must be correctly positioned by the patient to make insertion easy. Most patients quickly learn what feels right, and will know that the mold is correctly inserted by the feel of it.

CARING FOR AN EARMOLD

Explain and demonstrate to your patient that wax may form on or in the earmold, and that to minimize this, the mold should be wiped each night with a dry tissue or one lightly dampened with an antiseptic solution. Emphasize that alcohol should **never** be used to clean a mold. The second area of care for the earmold is tubing change. If the tubing becomes cracked, yellow or stiff, it must be replaced. Likewise, the patient should not remove the mold from the ear by pulling on the tubing itself. Another factor in earmold care is moisture development in the tubing. If moisture does develop, a silica gel dehumidifier kit should be used.

Caution: Zinc-Air hearing aid batteries should never be placed in a dehumidifier kit as it will dry out the active chemicals and cause short battery life.

REPLACING THE EARMOLD

Several conditions dictate earmold replacement:

1. A patient's weight has markedly changed.
2. A patient's hearing thresholds have changed.
3. An earmold innovation promises improvement for a given fitting.
4. The ear canal tissue stretches due to earmold usage.
5. An earmold is damaged.
6. In the case of children, the ear has grown.

In general, a mold needs to be replaced when it feels loose or if frequent acoustic feedback occurs.

9 Measuring Acoustics

Since the earmold has such an important acoustic effect upon the hearing aid's response, it is important for the dispenser to be able to measure that response in the office. Hearing aid test sets make it possible to see the combined effect of the aid and earmold. Some hearing instrument manufacturers, in fact, report their acoustic curves using various earmold options.

INTRODUCTION TO HEARING AID TEST SETS

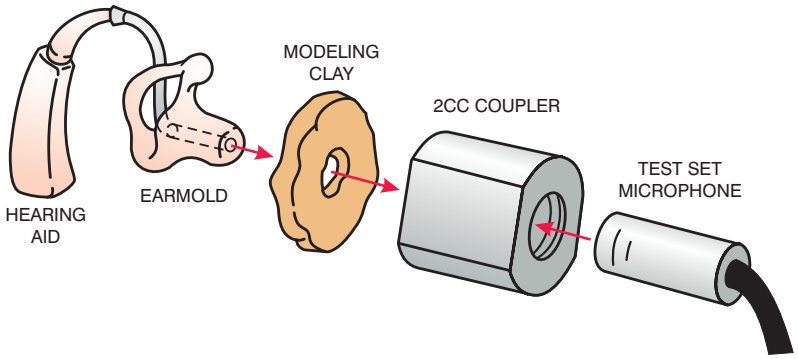
The acoustic effects of the earmold on overall hearing aid response have been measured in laboratories for many years. However, in-the-office measurement of earmold effect on response is a more current practice. Many of the recent earmold innovations were discovered by dispensers by evaluating their clients while wearing different earmold options. An electro-acoustic hearing aid test set for a dispensing practice includes an electronics module to generate the source signals, and provides a read-out of gain, output and distortion percentages. A quiet test chamber provides the interface between hearing aid and test set. Below is a photo of such a test set.

FONIX 6500-CX hearing aid analyzer. (Photo courtesy of Frye Electronics, Inc.)

EARMOLD SET-UP PROCEDURE FOR ELECTRO-ACOUSTIC MEASUREMENT

The procedure of evaluating the earmold system's effect upon the hearing aid is as follows:

1. Mount the earmold to the coupler by using modeling clay rolled into a donut shape.
2. With the microphone removed from the coupler, check the positioning of the bore of the mold.
3. Slide the microphone into the coupler.
4. Place the aid, mold and coupler into the sound chamber at the reference spot for the aid's microphone.
5. Run a standard test battery in accordance with the manufacturer's instructions.



It should be emphasized that the responses obtained through hearing aid test sets are not exactly what will be found in the real ear. However, they are repeatable and do give a good indication to the fitter of the compilation effect of earmold acoustic variables.

ARE EARMOLD ACOUSTICS STILL VALID WHEN FITTING DIGITAL PROGRAMMABLE HEARING AIDS?

Today's programmable hearing aids have filtering capabilities that far exceed the flexibility and range of traditional instruments. The goal of these recent design changes is to create a more favorable signal to noise ratio. Earmold acoustic options such as belled canal, Libby horn and resonator molds also aim at improved signal to noise effects as well, but the fundamental difference is that computers are used to control the performance characteristic of the aids.

Digitally programmable hearing aids allow the hearing professional to electronically modify the frequency response, output, and in certain instruments, the release time, compression ratio and crossover frequency in two or three independent bands. Given this high degree of computer adjustment brings into question the usefulness of traditional earmold acoustic options. **Are earmold acoustics still valid?**

9 MEASURING ACOUSTICS

In 2005, digital hearing aids accounted for approximately 90% of the market, with behind-the-ear types rebounding to 35%. Open-fit instruments, including those featuring the receiver in the ear, have captured 17% of hearing aid sales, and appear to be growing in popularity. In these units, earmold considerations like venting, style selection and material selection all remain part of the fitting process. Advances in materials and design enable the fitter to maximize the impedance match between aid and ear. The coupling between receiver and ear canal determines the smoothness of the sided response, the effective real ear HF gain, and, in the final analysis, the patient's acceptance of the hearing aid. A patient will not wear the best of aids unless the fit – both acoustic and physical – is comfortable.

The newer silicone-based impression materials and earmolds have been indispensable in the hearing professional's efforts to provide the most hearing and comfort with the least feedback. Additionally, the controlled venting and/or canal length reduction to maintain adequate aeration of the canal and middle ear in chronic ear conditions can significantly affect real ear response, as well.

Electroacoustic assessment of the total amplification system – aid plus earmold – is often accomplished in the office using computerized real ear probe tube microphone instrumentation. Measurement of in situ aided response and insertion gain can be a powerful tool in the fine tuning of an earmold's response and in the objective verification of hearing aid benefit. In combination with the articulation index, the hearing professional can be reasonably assured that the most important cues for understanding speech are within a user's residual dynamic range.

Our customers tell us that their findings show that a combination of electrical and acoustical control most often gives the best results for the client. Thus we don't hesitate to say that the subject of earmold acoustics as reported in this manual is still quite valid.

GALLERY OF EARMOLDS

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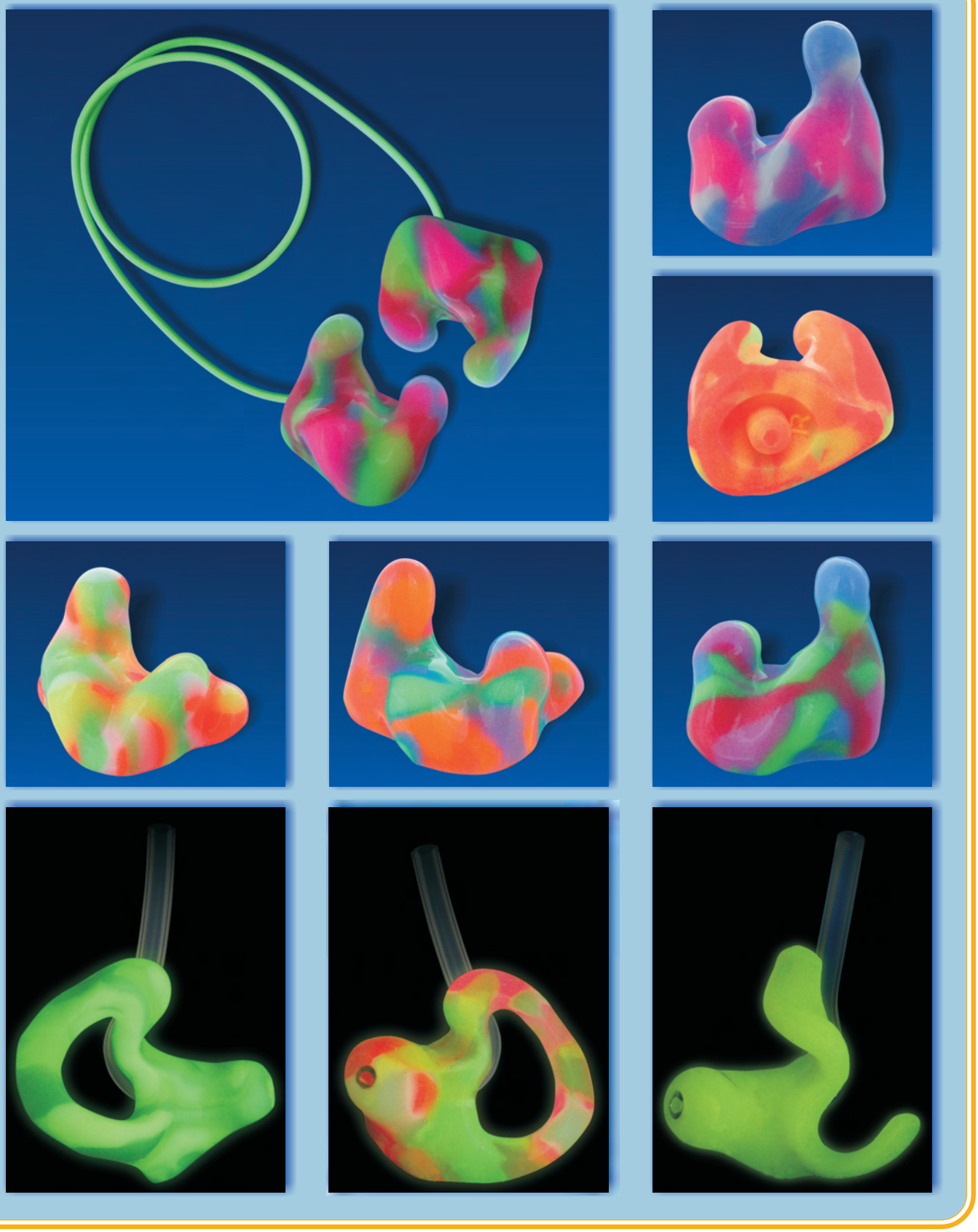

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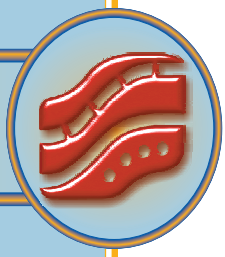

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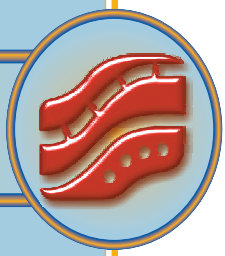

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INTRODUCING MICRO-FIT™

For decades, Microsonic has been respected for its innovative, high-quality earmolds that provide customers with the utmost satisfaction. In 2005, Microsonic proudly introduced **Micro-Fit™** to further strengthen its reputation as the finest earmold manufacturer in the industry.

Micro-Fit™ combines state-of-the-art technologies to produce perfectly fitting custom earmolds. The integration of precision laser scanning, specialized CAD modeling and computer-controlled photopolymer earmold building work to ensure unconditional comfort and optimized acoustics.

Micro-Fit™ Process

Benefits:

Better Fit
- More accurate digitized shapes
- Lower shrinkage

Better Quality
- Constant wall thickness
- Much smoother vents and sound bores

Better Options
- New designs not possible by hand
- New vent and bore designs possible
- Remakes without additional impressions

At Microsonic, your satisfaction is our **Number 1** goal.

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