

QUESTION BANK ON EAR PROTECTIVE DEVICES

Reg. No.M8901

AN INDEPENDENT PROJECT WORK SUBMITTED IN PART FULFILMENT FOR  
FIRST YEAR MASTER OF SCIENCE (SPEECH AND HEARING) TO THE  
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ALL INDIA INSTITUTE OF SPEECH AND HEARING: MYSORE - 570 006

MAY 1990

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PARENTS AND SISTERS

**CERTIFICATE**

This is to certify that the Independent Project entitled "Question Bank on Ear Protective Devices" is the bonafide work em pert fulfilment for the degree of Master of Science (Speech and Hearing) of the student with Register No.M8901.



Mysore

May 1990 All  
Speech

Director  
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and Hearing  
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**CERTIFICATE**

This is to certify that the Independent project entitled: "Question Bank on Ear Protective Devices" has been prepared under my supervision and guidance.

Mysore  
May 1990

  
GUIDE

## DECLARATION

I hereby declare that this Independent Project entitled: QUESTION BANK ON EAR PROTECTIVE DEVICES is the result of my own study under the guidance of Dr.(Miss) S.Nikam, Prof. and Head of of the Department of Radiology, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier at any University for any other Diploma or Degree.

Mysore

May 1990

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## INTRODUCTION

What is noise to one, may be music to the other. But then these are some kinds of sounds which are always perceived as noise (which is annoying) and universally accepted to have hazardous effects on the auditory mechanism.

The increasing awareness of people towards noise and its related problems have given rise to a number of studies and research in this area. The motto "Prevention is better than cure" is assenting meaning.

Noise has been reported to have many effects on people working in noisy environment, namely auditory and non-auditory effects. The non-auditory effects range from annoyance, decrease in working efficiency, physiologic changes in heart rate, blood pressure and psychologic distress. Direct auditory effects include the obvious interference with speech communication, temporary threshold shift, permanent threshold shift and acoustic trauma. Whether a particular noise is hazardous depends on the intensity of the noise, the spectrum of the noise, the duration and distribution of exposure during a typical work day and the overall exposure during a work life. Since, there is no doubt about the hazards of noise a call for noise control and hearing conservation is inevitable.



Any hearing conservation program includes 3 aspects, namely:

- assessment of noise exposure.
- control of noise exposure.
- measurement/monitoring of hearing sensitivity.

One of the important aspects dealt with in a hearing conservation program is control of noise exposure and consequently, prevention of noise induce hearing loss. In many situations, control of noise at the source of reducing the exposure of the individual-to-noise is not possible, wherein the method of choice becomes the 'Ear protective devices'. Thus, it is only reasonable that people (ranging from the layman to professionals) become aware of the types of protection available and thus prevent noise hazards.

An ear protective device serves as a barrier between noise and the inner ear which is most vulnerable to noise damage. The protection provided by the ear protective devices depends on its design, damping characteristics and the physical characteristics of the user. However, use of ear protective devices does not mean complete isolation from the sound source, for sound energy is transmitted to the inner ear via the bone conduction pathway, if not air conduction. Thus the amount of attenuation provided by an ear

protective device indirectly depends on the individual's bone conduction sensitivity. Also other factors to be considered while choosing an ear protective device are the noise to which the individual is to be exposed and other environmental conditions.

Hence while considering various protection and conservation programs people are often at a loss for want of substantial information on the various options including ear protective devices and a majority are unable to decide on the kind of information they are seeking. Therefore, here in the forth-coming sections, an attempt has been made to crystallize and give a concrete body to the vagueness, confusion and ignorance in the queries arising regarding ear protective devices. In simple terms, it is an attempt to "voice" their queries and thus give a lead as they move ahead to seek information on ear protective devices or hearing conservation on the whole. It is hoped that this aim will be achieved in the following questionnaires.

**SOUND TRANSMISSION**

1. What is sound?
2. How does sound transmit?
3. In human beings sound transmit to the inner ear through
  - a)
  - b)
4. How sound transmit through bone conduction and air-conduction pathway?
5. What is the minimum sound pressure level which need to vibrate the skull?
6. Usually which frequencies have more effect on bone-conduction pathway?
7. Usually more sound energy transmit through which pathway?
8. What is role of pinna and external ear in sound transmission?
9. What is the role of middle and inner ear in sound transmission?
10. Which part of the ear get effected by the loud sound or noise?
11. How does noise damage the ear?

**DEFINITION**

1. Define ear protective device or hearing protective device.
2. What is adverse effect?
3. Define ear plug?
4. What is plugging effect?
5. What is a permanent ear plug?
6. What is a disposable ear plug?
7. What is prefabricated ear plug?
8. What is meant by individually moulded ear plugs?
9. Define semi-inserts.
10. Define ear muffs.
11. Define helmet.
12. Define:
  - a) Frequency selective device
  - b) Amplitude selective device
  - c) Insertion loss
  - d) Transmission loss
  - e) Helmholtz resonator
  - f) External validity
  - g) Internal validity

**GENERAL QUESTION ON EAR PROTECTIVE DEVICES**

1. What can be used to protect our ears from noise?
2. The ear protective device are also known as ....
3. List the names of the manufacturers of ear protective devices in India and outside?
4. Are the ear protective devices commercially available?
5. What are the factors to be considered while selecting the ear protective devices?
6. What are the problems that may arise in using hearing protective devices?
7. How do the ear protective devices perform in real world or is the performance of ear protective devices in real world similar to the lab?
8. How can we confirm it?
9. Why do the ear protective devices fail in real world?
10. What are the causes of poor ear protective device sealing?
11. How do the ear protective devices cause discomfort to the wearer?
12. Why is the ear protective devices utilization not common?
13. Do all ear protective devices fit all sizes and shapes of ear canal and head shapes?
14. When do we need readjustment of the ear protective devices?
15. How do the employees abuse the ear protective devices in use?

16. What are the ways in which sound energy reaches the inner ear of a person who is wearing a protective device?
17. Do the ear protective devices modify the air-conduction and the bone-conduction paths? How?
18. How can the air leakage be reduced when the ear protective devices are in place?
19. What is occlusion effect and how can this be made use of in fitting the ear protective devices?
20. Do the ear protective devices cause hearing loss? Why, When and How?
21. Can we use two ear protective devices simultaneously?
22. When should we use multiple ear protective devices simultaneously?
23. What is the main factor which determines the attenuation of the ear protective devices?
24. Normally, ear protective devices attenuate the passage of sound through which pathway?
25. Which ear protective devices do not attenuate the passage of sound through the bone conduction pathways?
26. Which type of ear protective device attenuates sound through the bone conduction pathway?
27. Which type of hearing protective device provides good attenuation in the high frequencies?

26. What non-acoustic criteria should be considered in the construction of ear protective devices?
29. What are the Bureau of Indian Standards specifications for the ear protective devices?
30. What is the minimum information that has to be provided for an effective ear protective device?
31. Is there any marking for the ear protective devices?
32. What are the accepted tests for the different types of ear protective devices?
33. How many primary and alternative methods are there for estimating ear protectors adequacy and what are those?

**CLASSIFICATION OR TYPES OF EAR PROTECTIVE DEVICES**

1. How can the ear protective devices be classified?
2. Different types of ear protective devices are:
  - a.
  - b.
  - c.
  - d.
3. The different types of ear plugs are:
  - a.
  - b.
  - c.
4. On what basis are the ear plugs classified?
5. Other classifications of ear plug are
  - a.
  - b.
6. On what basis can the prefabricated ear plugs be classified ?
7. What types of filled seals are provided in ear muffs?
8. Other types of ear protective devices are
  - a.
  - b.



**MATERIAL**

1. What are the factors to be considered for material selection in the construction of hearing protective devices?
2. What types of materials are used to make ear plugs?
3. Expanding vinyl foam ear plugs consist of what?
4. Which type of material is used for prefabricated ear plugs?
5. What is the material used for disposable and malleable ear plugs?
6. What is the material used to form individually moulded ear plugs?
7. What is the material used to form semi insert devices?
8. What do semi-insects consist of?
9. Ear muffs materials must be of
  - a.
  - b.
  - c.
  - d.

**ATTENUATION**

1. What is the standard frequency range for measuring the attenuation of ear protective devices?
2. How much attenuation is provided by different types of ear protective devices?
3. Usually how much attenuation do the ear plugs give in various frequencies?
4. At which frequency do the ear plug give good attenuation?
5. How much attenuation can one get from the combination of ear plug and ear defender?
6. How much attenuation is provided from the glass wool type of ear plugs?
7. How much protection can the individually molded plug provide?
8. How much attenuation can a semi-insert provide?
9. How much attenuation do ear muffs provide at different frequencies?
10. What does the attenuation of ear muff depend on?
11. What are the factors that can affect the attenuation of ear muff?
12. Why do ear muffs give more attenuation at high frequencies?
13. Does the size of the ear muff affect attenuation?
14. The head phone which is used by aircrew, provides how much attenuation at various frequencies?

15. What is the attenuation provided by ear muff, premolded inserts and foam inserts at 125 Hz?
16. How much attenuation does the helmet provide, when worn on the head?
17. Why is the combined practical attenuation of the ear plug and the ear muff lesser than the algebraic sum of the individual attenuation value?
18. What is the formula for predicting the attenuation given by the combination of ear plug and ear muff?

**METHODS OF MEASURING ATTENUATION.**

1. How is the attenuation of ear protective devices measured?
2. What is subjective measurement?
3. What are the subjective measurements?
4. What is objective measurement?
5. What are the objective measurements?
6. What are the instruments required for the objective measurement of the attenuation properties?
7. What instructions should be given to the subject for real ear measurement?
8. Describe the procedure for real ear measurement of the hearing protective devices?
9. What precautions should be taken for attenuation measurement?
10. How is the combined attenuation of ear plug and ear muffs measured?
11. What are the supra-threshold tests that can be used for measuring the attenuation of ear protective devices?
12. How is the threshold shift method used to measure attenuation of ear protective devices?
13. What are the two American National Standard methods of measuring attenuation of ear protective devices?
14. Explain the measurement procedure of these two methods.

15. What are the differences between these two methods?
16. What is the single number method of measurement? Explain the procedure used to measure the attenuation of ear protectors?
17. Does the attenuation value differ in this two methods of American National Standard Institution (ANSI)?
18. What is the latest American National Standard Institution (ANSI) method for measuring the attenuation of ear protective devices?
19. What is the scope of American National Standard Institution (ANSI) S12.6?
20. Compare and contrast the three American National Standard Institution methods of measuring the attenuation properties.

**EFFECT ON SPEECH**

1. Do ear plugs effect localization?
2. Which type of ear protective devices effect localization?
3. Why can ear muff be dangerous to an employee?
4. Do ear protective devices improve speech communication?
5. How and when do the ear protective devices improve speech communication?
6. How would you find out the effect of the ear protective devices? on speech discrimination scores?
7. What is the background noise level at which ear protective devices affect speech?
8. What is the minimum background noise level at Which ear protective deviees do not have any effect en speech discrimination?
9. From what level of background noise do speech discrimination scores increase of a person who is wearing ear protective devices?
10. Do ear protective devices affect the speech discrimination score of a hearing-impaired person?
11. Do ear ma#§s affect speech discrimination scores?  
Which type of earmuff and at what level does it affect speech discrimination scores?
12. Do ear plugs have any effect on speech discrimination scores?  
Which type of ear plug and at what level does it affect?

13. Do ear protective devices affect the quality of speech received by the user?
14. Do amplitude sensitive insert hearing protectors affect speech discrimination scores?

## MISCELLANEOUS CONDITIONS

### **I. Ear plug:**

- 1) How do the ear plugs give rise to vibrations inside the external auditory meatus?
- 2) Basically in which frequency is the effect more?
- 3) What is the synonym of occlusion effect?
- 4) What are the low frequency attenuation earplug devices?
- 5) Can we wash the ear plug? With what type of cleaning agent?
- 6) Can we change or modify the shape of the ear plug?
- 7) What is the shape of plastic ear plug?
- 8) In case of insert ear plug, does it cause occlusion effect?
- 9) How do the expanding vinyl foam ear plugs fit within the ear canal?
- 10) Why are ear plugs not used extensively?
- 11) What are ear defenders?
- 12) Can we use ear plug and ear defenders together?
- 13) When is it more useful to use both ear plug and ear defender?
- 14) How many sizes of prefabricated ear plugs are available?
- 15) Which is the more versatile and efficient type of prefabricated ear plug?
- 16) What are the advantages of V-51R?



- 17) What are the advantages of prefabricated ear pings?
- 18) How can the individually moulded ear plugs be fitted?
- 19) For whom can be individually moulded ear plugs be fitted?
- 20) What are the advantages of individually moulded ear plugs?
- 21) What are the differences between disposable and malleable ear plugs?
- 22) Which is the most practical and efficient disposable ear plugs?
- 23) How are the glass wool fibres made usable?
- 24) How do the employees use the glass wool strips?
- 25) What is the advantage of glass wool ear plug?
- 26) What are the advantages of disposable and malleable plugs?
- 27) What are the advantages and disadvantages of ear plugs?

## **II. Semi-inserts:**

- 1) Is the sound transmission significant through the insert ear protective device?
- 2) How do semi-insert hearing protective devices different from the ear plug?
- 3) What is the synonym of semi-inserts?
- 4) What purpose do semi-inserts serve generally?
- 5) When are the semi-inserts found suitable for employees?
- 6) What are the advantages and disadvantages of semi-inserts?
- 7) For communication systems what is required with semi-inserts?

### **III. Ear muffs:**

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- 1) How do ear muffs generate vibration?
- 2) In case of ear muffs, is the sound transmission significant? If yes, why?
- 3) How do jaw movements affect the seal provided by ear muffs?
- 4) What is the advantage common to all these types of filled seal ear muffs?
- 5) What is the speciality of plastic filled seal ear muffs?
- 6) Can we use the combination of helmet and ear muff?
- 7) When do we use the combination of helmet and earmuff?
- 8) What are the advantages and disadvantages of ear muffs?

### **IV. Helmet:**

- 1) How do the helmet cause transmission loss?
- 2) Is it necessary to make helmets in difference sizes?
- 3) Is it possible to use a combination of helmets and other ear protective devices?
- 4) Why is a combination of helmet and other ear protective devices used?
- 5) Who uses the helmet more frequently?
- 6) What is the main function of a helmet?
- 7) Why people with recreational helmets used extra ear protective devices?

8) What are the advantages and disadvantages of helmets?

**V. Other types of ear protective devices:**

- 1) What are the advantages and disadvantages of frequency selective device?
- 2) What are the advantages and disadvantages of amplitude selective device?

**VI. Infrasonic and Ultrasonic sounds:**

- 1) Is there any standard for permissible exposure limits to infrasonic and ultrasonic sounds?
- 2) Can we use the general ear protective devices for infrasonic and ultrasonic sound attenuation?
- 3) Are the ear protective devices effective for attenuation of infrasonic and ultrasonic sounds?
- 4) What are the methods being used to measure attenuation of ear protective devices in case of infra and ultrasonic sounds?
- 5) Is it necessary to use ear protective devices to attenuate the infrasonic and ultrasonic sounds?

**FEW QUESTION OR COMPLAIN WHICH HAVE BEEN ASKED BY THE EAR PROTECTIVE DEVICES USERS OR WHO IS GOING TO USE.**

\* Being an audiologist what will be your answer or response to the question or complaint which have been asked by the ear protective device users or who is going to use"?

- 1) Ear protectors are confrontable.
- 2) I donot need ear protector, and I am used to expose noise.
- 3) I have already lost some or most of my hearing. Why should I have to wear ear protectors?
- 4) I cannot hear my fellow workers, If I wear ear protector.
- 5) My machine sounds different to me when I wear ear protectors.
- 6) Can ear plugs cause ear infection?
- 7) If I use my hearing protector, can I forget about it until I take it off for my break?
- 8) Will I hurt my ear if I blow my nose while wearing an ear plug?
- 9) Can hearing protectors cause headache, nose bleeding, ulcer, insomnia, or eyes train?
- 10) Can I use stereo ear phone for protection against noise and enjoy the music at the same time?
- 11) Is it important to wear ear muffs rather than ear plugs at high sound level?
- 12) Can ear drum hurt, if I insert a plug too deep or remove it too quickly?

- 13) Are all foam ear plugs the same?
- 14) Can I use ear plugs for swimming?
- 15) Can I use cotton or my fingers to reduce harmful noise exposure?
- 16) Can I modify my ear protectors according to my need and for comfort?
- 17) Ear protectors make my voice sound strange to me and make me more conscious of other body noise such as breathing and walking. They also make it difficult for me to judge how loudly to talk?
- 18) How can I judge the noise may be harmful for ear?
- 19) Do ear muffs keep out noise better than ear plugs?
- 20) Do your ear protectors meet the national standards?
- 21) Why should I use American National Standard Institution (ANSI) or Occupational Safety and Health Act (OSHA) Standard ear protectors because Damage Risk Criteria (BBC) may not be the same as climate differs?
- 22) Most ear protective devices give good attenuation at high frequencies rather than low frequencies so chances are there to get low frequency hearing loss. So why should I use ear protective devices?
- 23) Since sound transmit through bone conduction also, so to avoid this can we use helmet type protectors instead of using ear plugs or other types of ear protective devices.

- 24) I use helmet type device, in the industry, while going home I carry it, but people tease me what shall I do?
- 25) I am ready to use only ear plugs because other types causes cosmetic abnormality but the noise level is too high what shall I do for that?
- 26) I am using ear protective device eventhough I am losing my hearing what are possible causes for this and what should I do now?
- 27) I am working in an industry. After joining there I am losing my hearing. What is the cause for it and with whom should I consult.
- 28) Is there any rule or act regarding protection or employed who are all working in the industry?
- 29) I have lost my hearing after joining the industry. Can I claim for damage? What information should I have to make the claim?

**FILL IN THE BLANKS**

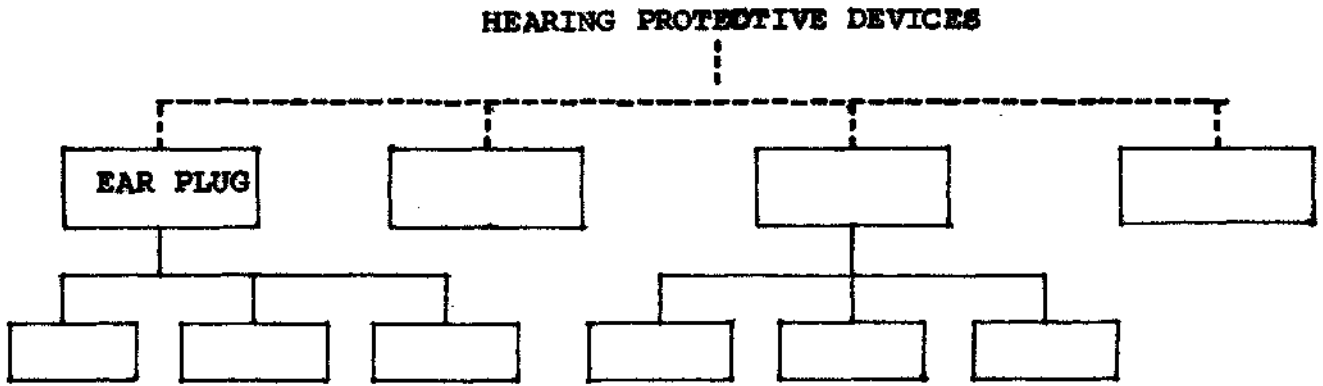
1. Transmission of the sound to the protected ear can be expressed by an ..... network analogous to the ..... system
2. .... mobiles are reported to cause hearing loss.
3. The absolute limit of ..... provided by ear protective device depends upon the sensitivity of the ..... pathway.
4. The attenuation of the combination at individual frequencies at least ..... dB better than either device alone.
5. Generally ear plugs give attenuation between ..... to ..... dB.
6. Ear plug often give better ..... in the ..... frequencies than will ear defenders.
7. Disposable and malleable plugs gives an attenuation of between ..... to ..... dB according to frequencies.
8. The attenuation achieved by combination of ..... and ear defender does not exceed ..... dB.
9. .... is the most versatile and efficient type of prefabricated ear plug.
10. .... are only marginally suitable for noise level of 96-98 dB - A.
11. .... filled cushion is better for noise protection.

12. In case of ear muffs leakage between the ..... and the ..... is generally the most important factor reducing the acoustic attenuation.
13. A combined plug and muff provide attenuation ranging from ..... to ..... at all frequency, with maximum attenuation at .....Hz.
14. the all ear muffs attenuation ranged from .... to .... dB.
15. Ear muff gives maximum attenuation at ..... frequency
16. Usually muffs offer greater protection with frequency greater than ..... Hz.
17. The other combination (except ear plug, and ear muff) gives an attenuation at individual frequencies is ..... to ..... dB over the better of the individual ear protective devices except at ..... KHz where no combination exhibited a gain of greater than .....dB
19. The gain in the noise reduction rating for the double protection combination range from ..... to ..... dB when compared to the plug above, ..... to ..... dB when compared to the earmuff alone and ..... to ..... dB when compared to the better of the 2 individual devices.
20. Ear muff cups are made of ..... or ..... cases lined inside with .....
21. Ear muffs are sealed to the head with ..... seals.



22. Ear muffs are made from ..... which are usually formed of a ....., ....., ..... material.
23. Semi-inserts are supported by .....
24. Semi-inserts also called ....., ..... ear protectors or ..... caps.
25. Helmets are the ..... and usually the most ..... of all ear protectors
26. An acoustic ..... filter usually fitted with frequency selective devices ensuring relatively small attenuation below about ..... Hz.
27. Sound level below ..... dB the amplitude sensitive in-ear hearing protectors behave as a ..... ear mold with almost no attenuation below ..... KHz and attenuation increasing to as much as 30 dB at ..... frequencies.
28. Background noise with less than ..... dBA causes poor speech discrimination. Noise above the ..... dBA causes good speech discrimination.
29. In case of infrasound the exposure limit range from ..... dB at a low frequency of ..... Hz to ..... dB higher frequency of ..... Hz for ..... hours
30. For ultrasonic exposure criteria is ..... dB SPL for the frequencies at and above ..... KHz which has been translated to a ..... octave band criteria of ..... dB SPL for the band at and above ..... KHz and ..... dB SPL for the ..... KHz to a ..... octave band.

31.



ACRONYMSExpand and explain the following acronyms

1.ASD		16.	KEMAR
2.BIS		17.	LAPT
3.CC		18.	LT
4.CHS		19.	LTIT
5.CSEP		20.	NIOSH
6.CT		21.	NRR
7.	DMP	22.	OTA
8.DEC		23.	PEP
9.EPD		24.	RCTT
10.FSD		25.	REAT
11.FSP		26.	REM
12.HBT		27.	REPT
13.HPD		28.	RIF
14.IME		29.	TT
15.ISI		30.	VEE

MATCH THE FOLLOWING

A

B

- |   |                                       |
|---|---------------------------------------|
| 1. Attenuation of earplug above 1 KHz.  | a. V-51R                              |
| 2. Attenuation of earmuffs above 1 KHz  | b. ANSI 224-22-1957                   |
| 3. Prefabricated ear plug   | c. 25 dB                              |
| 4. Specification of ear protective device   | d. AAPP 1959                          |
| 5. Original American National Standard Method   | e. ANSI 224.22                        |
| 6. Modified ear protector attenuation atandard  | f. IS: 9167/1979                      |
| 7. Latest American National Standard Method   | gi ANSI S12.6                         |
| 8. NRR-31 is the value for ear plug tested according to                                 | h. ANSI 5319-1974 (ASA-STD1-1975)     |
| 9. The NRR of 29 is the value for ear plug according to                                 | i. 35 dB                              |
| 10. Noise level (dBC)-NRR   | j. ISO 4869, SFS 4431, 4432, DINI 35I |
| 11. Employee noise exposure must be limited to an equivalent level of 90 dB for 8 hours | k. ANSI 53-19                         |
| 12. Mechanical properties and acoustic attenuation                                      | l. Effective exposure dBA             |
| 13. Formula which averages 0, 5, 1 and 2 KHz  | m. AAO 1979                           |
| 14. Formula which average 0, 5, 1, 2 and 3 KHz regulation.                              | n. Existing federal                   |

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