ortofon

THE TESTS

Introduction

Before you start testing your turntable with this record, please check that the remaining components of your Hi-Fi system function correctly. Please refer to your instruction manual for the correct installation of your turntable and tone arm (overhang, anti-skating adjustment etc.). The left speaker system should be connected to the left amplifier channel, etc., and both your speakers should work in phase. If these connections are not correct, this will be revealed by the test signals on the recording. Furthermore, before you start using the test record, you should check that your speaker systems are optimally positioned in the room – please refer to suggestions in your loudspeaker instruction manual for speaker placement.

You may prefer to use a pair of high quality headphones for the evaluation, as other people and pets may not like the sound of some of the test signals.

The record is designed to be played through your system just as is done with all recordings (including the built-in RIAA equalization). You should set your volume control for a moderate signal level. As each test section contains its own run-in groove, you will have to move the tone arm manually each time you have finished one part of the cartridge evaluation.

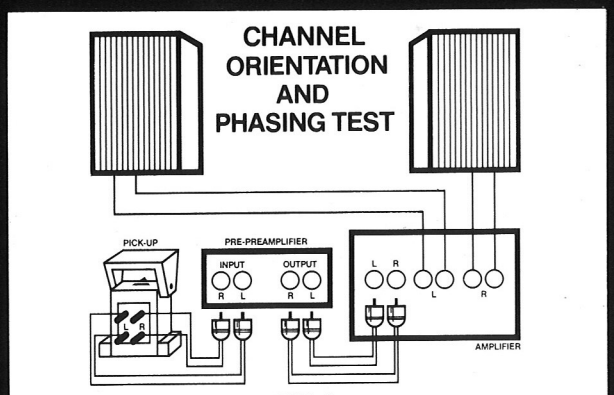

FIG 1.

1. Channel Orientation and Phasing Test

By means of a spoken comment and a white noise test signal you will be able to determine whether your system has proper left and right channel connections and whether both channels are in phase. Errors with respect to orientation and phasing can be due to either cartridge connections or loudspeaker connections. If the left and right channels appear to be reversed, the colour coded terminal leads in the pick-up shell should be checked together with the connections between turntable and amplifier and between amplifier and loudspeaker. In the event of phasing problems, the most likely cause is a reversal of the connection of the pick-up shell leads to the cartridge terminal pins for one of the channels, or a reversal of one of the set of wires to a loudspeaker. (Fig. 1).

2. Channel Separation Test

In an ideal Hi-Fi system, signals appearing in the two channels will not interact and a signal intended for one channel only will not appear in the other. The channel separation will be infinite, and there will be no crosstalk at all. In terms of channel separation, pick-up cartridges are much less than ideal, but correctly installed, a high quality cartridge can attain separation figures of 25 dB or more around 1,000 Hz.

The channel separation track of this record enables you to test crosstalk in both channels, independently. By following the spoken instructions on the record, and by comparing with Fig. 2, you can easily determine whether the channel separation of your cartridge is better or worse than 20 dB, 25 dB or 30 dB, respectively. The signal used has a bandwidth of 316 Hz centred at 1,000 Hz.

In order to turn off one channel so as to hear crosstalk, the balance control can be rotated to one or the other of its extreme positions. Follow the spoken instruction by switching off your left channel first. If this does not give a complete shut-off of the signal, it is also possible to remove the connecting cable from the turntable on one channel in order to hear crosstalk. When removing the cable, it is recommended that the volume control be turned down and restored to normal for the listening test.

The channel separation figures of a high quality cartridge should be at least 25 dB in both channels. This means that you should hear the short reference signal

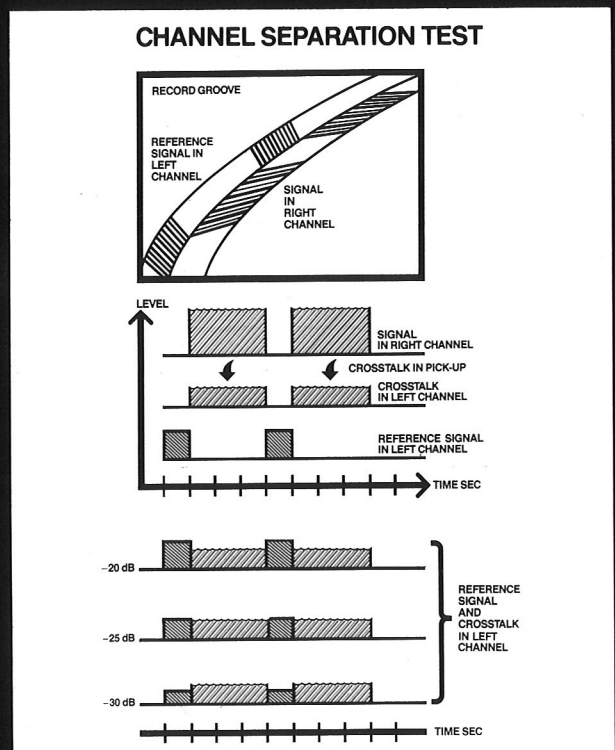

FIG 2.

louder than the crosstalk – the long signal – when listening to the –25 dB test. If this is not the case, or the separation figures differ widely between the channels, the reason could be that the stylus axis is not perfectly vertical in relation to the record as seen looking at the pick-up cartridge from the front. Please refer to the instruction manual for your turntable and tone arm concerning adjustment of the cartridge mounting.

3. White Noise Levels Test (Signal-to-Noise Ratio)

On this track, white noise with a bandwidth of 20 kHz has been recorded without RIAA correction at decreasing levels of –20 dB, –30 dB, –40 dB, –50 dB, –60 dB and more than –60 dB, with reference to a groove modulation of 3,54 cm/sec. RMS. The duration of each level is 5 seconds.

When you play back this track, you should be able to hear the difference between each of the six noise levels. If you cannot tell the difference between the –50 dB level and the –60 dB level for instance (Fig. 3), the signal-to-noise ratio of your entire Hi-Fi chain will be more than 50 dB and less than 60 dB. The signal-to-noise ratio of a high quality audio system should be at least 60 dB. However, some hiss on the recording may prevent hearing the difference between 50 dB and 60 dB. This is not a fault of your system, but is a limitation of the record manufacturing process.

4. Silent Groove Test

The silent groove on this record has been cut with a special cutterhead, the moving system of which has been locked. This technique ensures the lowest possible noise level, since it eliminates the effects of residual noise from the cutting amplifier and vibrations from the particles of the lacquer master record.

During the playback of the silent groove at your normal listening level, you should hear almost nothing if all conditions are ideal. In practice, however, three types of noise can be present, individually or combined.

Hum can be induced into the systems, typically by power transformers and mains cables. It is a constant, deep bass note of 50 (60) Hz and possibly multiples of the mains frequency. Normally, it will not disappear when you raise the cartridge from the record. The cartridge itself can pick up hum from the turntable motor or power transformer, but step-up transformers and pre-

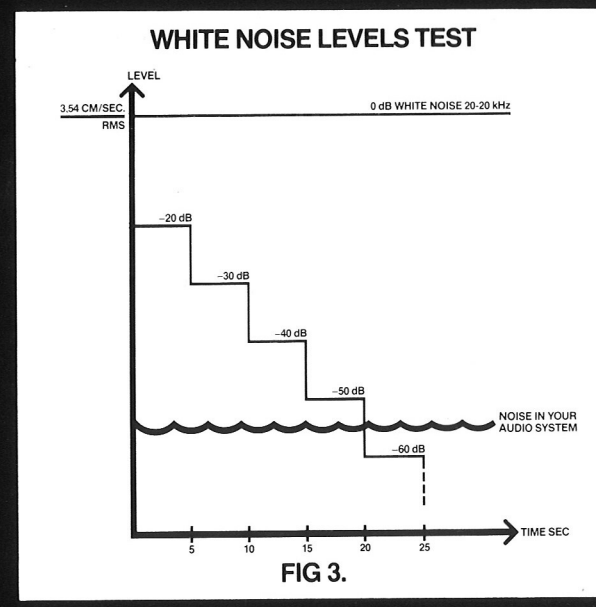

FIG 3.

preamplifiers for moving coil cartridges can also be sensitive to mains induced hum.

Rumble is a different type of low frequency noise, which typically appears in idler wheel drive, and, to a less degree, in belt drive turntables. Rumble will disappear when the cartridge is raised from the record. It can easily be distinguished from hum, because rumble in most cases has an inconstant "bumping" sound.

Hiss is the high frequency equivalent of hum and can originate from a worn stylus or record, but the most frequent causes of hiss are less than ideal phono equalizers and pre-preamplifiers, and some hiss is inherent in the recording process itself.

5. Difference Tone Distortion Test

Recent studies have shown that the human ear is very sensitive to difference tone distortion. Difference tones can appear as by-products, when two or more pure tones are played back at the same time and there is some non-linearity in the system. While the basic tones may be outside the hearing range of most people, such as 20,000 Hz and 19,000 Hz, their unwanted difference tone, 1,000 Hz in this example, will be clearly audible to anybody if it appears. See fig. 4.

This section of the record contains seven different two-tone test signals, covering the frequency range from 20,000 Hz to 7,000 Hz. The recording level is 5 cm/sec. RMS. For comparison, a 1,000 Hz reference tone has been recorded, which corresponds to a difference tone distortion level of 2 per cent.

The reference signal and the two tones, which produce the 1,000 Hz difference tone, have been recorded in such a way that the reference signal forms the Morse sign "A" (dot-dash), while the difference distortion signal fills in the space before the reference signal and forms the Morse sign "N" (dash-dot). If the difference tone distortion is higher than 2 per cent, the "N" sign will be dominant, and if it is lower than 2 per cent, the "A" sign will be stronger.

"A" = All right "N" = Not good

The application of this test requires some careful judgment. The "A" signal appears at 1,000 Hz. The "N" signal appears at various high frequencies ranging down to 7 kHz. These high frequencies can be heard, particularly the lower ones. For optimal evaluation, it is recommended that the volume control be turned down

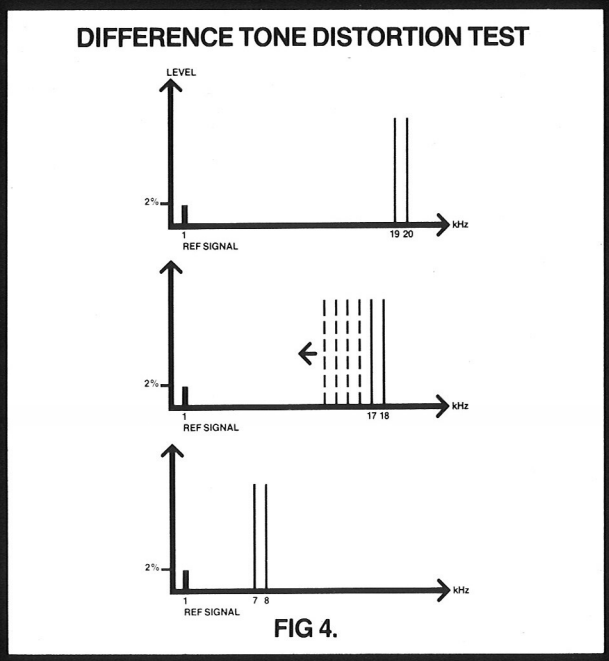

FIG 4.

so that the 1000 Hz signal is just about audible. The high frequency "N" signal does **not** represent difference tone distortion. However, if the "N" is heard at 1000 Hz, this represents distortion. Therefore, the listener must refer what he hears to the 1000 Hz reference signal both for level and for pitch. If the "N" signal sounds louder than the "A" signal and is of the same 1000 Hz pitch, then the difference tone distortion exceeds 2%. (Fig. 5).

The difference tone distortion level depends upon the tip radius of the stylus, the condition of the stylus, and the vertical tracking angle and tracking force of the cartridge. Furthermore, the highest difference tones are subject to record wear which will also increase the level of distortion. If the record is played with a worn stylus or with excessive tracking force, wear will cause permanent deterioration of high frequency signals, and the "N" tone will predominate regardless of the fact that playing conditions are correct. Finally, it should be noted that some phono equalizers may generate some difference tone distortion, which consequently cannot be referred to the cartridge.

6. and 7. Tracking Ability Test

315 Hz lateral modulation

This track contains a 315 Hz signal, recorded at increasing peak amplitudes of 40, 50, 60, 70 and 80 micrometres (accuracy ±2 micrometres). In order to cope with commercially available records, your cartridge should be able to track all these levels without audible distortion. Inability to track can be heard as a departure from a pure tone or a sputtering and intermittent tone. If this is heard, the balance control can be rotated to determine if it is one or both channels. In case of differing tracking ability in the left and right channels it is probably necessary to readjust the anti-skating correction of the tone arm. If both channels fail to track properly, then vertical tracking force should be increased until no further improvement of tracking force can be obtained. (Fig. 6).

315 Hz vertical modulation

This track also contains a 315 Hz tone, but it has been vertically modulated at levels of 20, 30, 40 and 50 micrometres. Otherwise, the test signals do not differ from the laterally modulated track described above, and they should be applied in the same way. (Fig. 6).

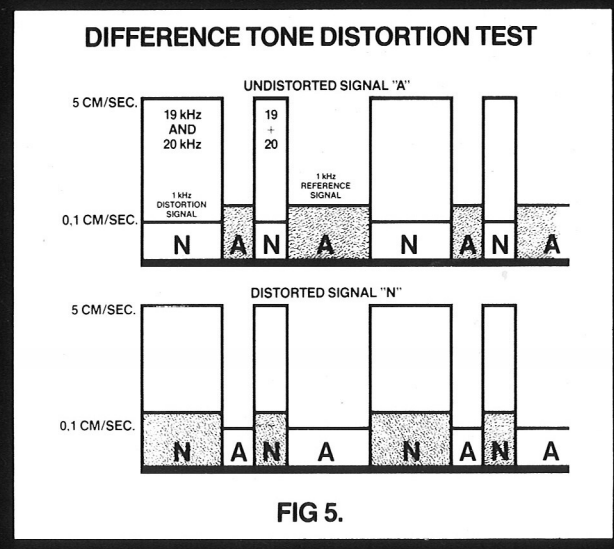

FIG 5.

8. and 9. Tone arm Resonance Test

Any combination of a tone arm and a cartridge will have a resonance frequency which will typically appear in the subsonic range between 4 Hz and 15 Hz. Although a resonance frequency below 20 Hz is inaudible in itself, it is very important for other reasons that it does not occur in a range that can influence the reproduction of records. Below 5 Hz, all records contain warps and other irregularities. If the tone arm resonance frequency is much lower than 8 Hz, the record warps can excite resonance, and the audible results can be increased rumble, reduced tracking ability and a marked sensitivity towards acoustical feedback. Therefore, the resonance frequency should be higher than 8 Hz (preferably in the 10-12 Hz range), but not so high as to appear in the audio spectrum above 20 Hz.

The tone arm resonance test section of this record is divided in two tracks, one to determine the lateral resonance frequency and one to determine the vertical resonance frequency. The test signals in both tracks cover the frequency range from 25 Hz to 4 Hz and have been cut with a constant amplitude of 17 micrometres. In order to provide a clear identification of the resonance frequencies, a tone complex consisting of 2,349 Hz and 2,960 Hz signals has been superimposed on the subsonic test signal. The two high frequencies have been placed in a range where the human ear is particularly sensitive to frequency variations or wow. This means that when the tone arm resonance is excited by one of the subsonic frequencies, the high frequency tone complex will become frequency modulated, and its pitch will change rapidly up and down, giving a warble effect to the signal.

If the tone arm and cartridge combination is not well-damped, you will probably be able to determine the resonance frequency by watching the pick-up shell. Around the resonance frequency, it may start vibrating visibly, and you should be able to see this effect as well as hear it.

As mentioned above, the tone arm resonance frequency of your tone arm and cartridge should, ideally, occur in the 10-12 Hz range, and its amplitude should be well-damped. This latter point implies that the frequency modulation of the high frequency tone complex should be barely audible around the resonance frequency, and pick-up shell vibrations should be almost invisible.

If the tone arm resonance frequency is too low, a common phenomenon, three different solutions are

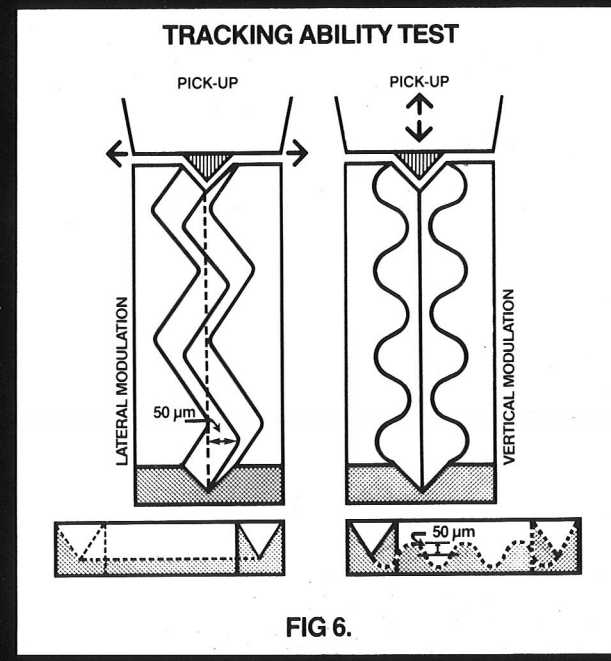

FIG 6.

possible. The pick-up shell can be changed to a lighter type. The tone arm can be changed to a low mass model, or the cartridge itself can be changed to a type with lower compliance.

10. A long and winding road

The technical part of the Ortofon Demonstration Record contains one of the most demanding evaluation programmes for Hi-Fi cartridges that has so far been designed for non-professional purposes. Unless your phono cartridge belongs to the very small group of true state-of-the-art cartridges and is well matched to a high quality tone arm and turntable, it is not very likely that it will respond satisfactorily to all test signals on the record.

A cartridge of the highest technical and musical standards will make the most out of the direct cut concert programme on the second side of this record. You can then experience the highest degree of musical realism in your home. However, if you are not completely satisfied with the performance of your present audio equipment, the first side of the record may help you in pin-pointing one or more possible sources of distortion and sound colouration.

Additional Technical Information

1. Channel Orientation and Phasing Test

Test signal:	White noise
Pre-emphasis:	RIAA

2. Channel Separation Test

Test signal:	316 Hz band noise, centre frequency, 1,000 Hz
Modulation level:	3.54 cm/sec RMS each channel
Reference signal:	3.54 cm/sec RMS –20, –25 and –30 dB

3. Signal-to-Noise Ratio Test

Test signal:	White noise 20-20 kHz
Reference level:	3.54 cm/sec RMS each channel
Modulation:	Lateral
Pre-emphasis:	Linear

4. Silent Groove Test

No comments

5. Difference Tone Distortion Test

Test signals:	20/19, 18/17, 16/15, 14/13, 12/11, 10/9, 8/7 kHz.
Modulation level:	5 cm/sec RMS Vertical
Pre-emphasis:	Linear
Reference signal frequency:	1 kHz
Reference signal level:	2%~ 0.1 cm/sec RMS Vertical
Two-tone generator:	Brüel & Kjær 1902 Distortion Measurement Control Unit

6. Tracking Ability Test

Test signal:	315 Hz
Modulation levels:	
Lateral:	40, 50, 60, 70, 80 µm peak
Vertical:	20, 30, 40, 50 µm peak
Level accuracy:	±2 µm

7. Tone Arm Resonance Test

Test signals:	25-4 Hz
Modulation levels:	
Lateral:	17 µm
Vertical:	18 µm
Superimposed frequencies:	2,349/2,960 Hz

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