DENON

DYNAMIC TONE ARM

DA-307

Innovation of Tonearm Engineering Model DA-307 with Dynamic Damping Mechanism

It is generally known that the tonal quality of record music reproduction largely depends on the quality of cartridges. The same can be said also about tonearms.
DENON has developed many models of cartridges and tonearms so far since having delivered a disc record player to a broadcasting station in 1939. The DA-307 is the very fruit of unique conceptions and ideas warmed by the long years of experience based on a well established designing philosophy. Please enjoy the high performance of the DA-307, an ambitious work of DENON engineering staff.

Vibrant Characteristic of Tonearm

Each of the head shell, the arm pipe and other parts constructing a tonearm are liable to make their peculiar vibrations. If external vibration energy is applied to the tonearm, therefore, it gives a delicate affection to the tonal quality of reproduction; causing their peculiar partial vibrations, this phenomenon is generally called "arm resonance" or "pipe resonance".
Vibration of the player cabinet due to the sound pressure of the speaker is transmitted to the tonearm through two routes.
One is the route of cabinet–turntable–disc–stylus, and the other is the route of cabinet–arm base–arm pipe–head shell.
In the former case, the vibration transmitted to the stylus is hardly conducted, to the tonearm due to the mechanical lowpass filter formed by the compliance of the cartridge and the mass of the tonearm, so the vibration of the stylus is converted into sound signal of the cartridge without influence of "arm resonance".
In the latter case, the vibration coming from the arm base can cause peculiar vibration to various parts, unless any preventive means is taken. The vibration of the head shell also makes out put signal from the cartridge relatively, including those partial resonances which affect to the tonal quality consequently.

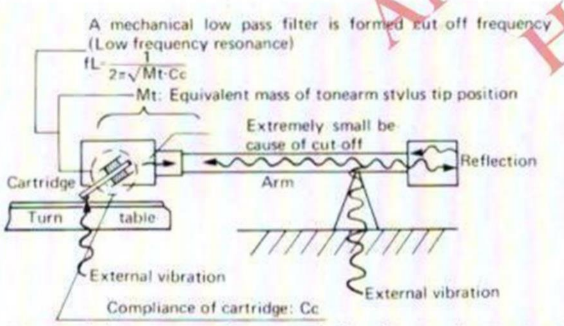


Fig 1 Transmission route of external vibration to the tonearm.

Besides the above-mentioned vibrations, the tonearm causes so-called low-frequency resonance at a frequency determined by the compliance of the vibration system of the cartridge and the equivalent mass of the tonearm. If the resonance frequency is too low, the stylus tip is liable to make an excessive amplitude under the influence of the warp of the record disc in playback (its frequency component is mainly 1–5 Hz), thereby causing cross-modulation distortion or output level fluctuation beyond the linear range of the cartridge. It is, therefore, not desirable that the compliance of the cartridge or the equivalent mass of the tonearm are excessively large although this depends on the ratio of their combination. The most proper frequency of the low-frequency resonance is around 8–12 Hz. Described above is the outline of the vibration characteristic of a tonearm.
Probably, many may have such an actual experience that the tonal quality of reproduction has been resulted by tonearm replacement (See Fig. 2).
The DA-307 is aimed at the positive solution of various problems of tonearms described above. Further, it employs a noncontact type inside force canceller developed by us.

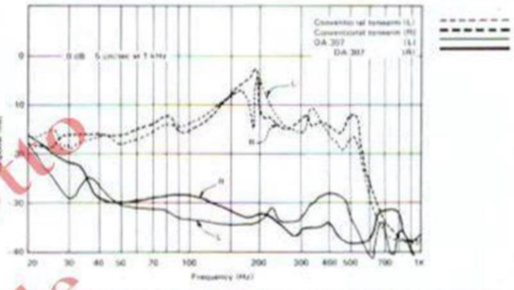


Fig 2 Resonance frequency characteristics of tonearm caused by arm base vibration

Features of the DA-307

Dynamic Damping Mechanism to damp Peculiar Vibrations of Various Arm Parts and Low-Frequency Vibration.
As shown is Fig. 3, the root of the tonearm pipe is divided into two parts and the damper rubber of a proper viscosity and elasticity is put in between. Further, the tonearm is of such a one-point supporting type that the arm pipe is pulled by suspension wire at a tension strength adjusted properly. It is the same construction as employed at the cantilever supporting mechanism of most of the DENON cartridge series such as the DL-103. This is "dynamic damping mechanism" of the DA-307. By use of this mechanism, the tonearm effectively damps the vibrations conducted from the arm base as described above and enormously reduces the peculiar vibrations of various component parts of the arm.

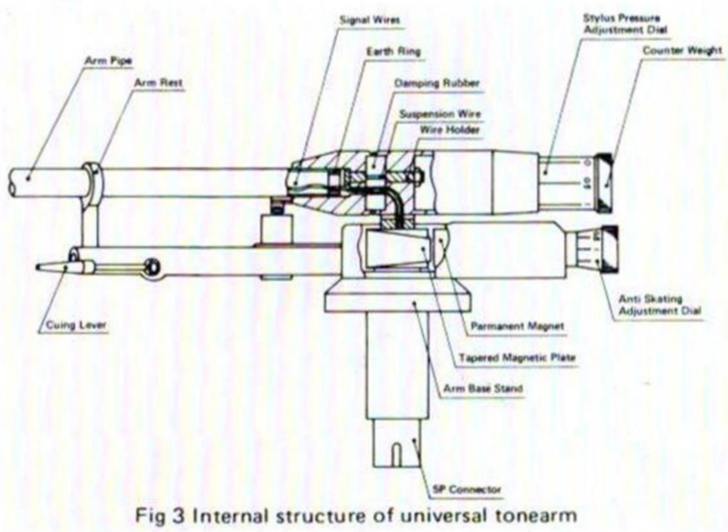


Fig 3 Internal structure of universal tonearm

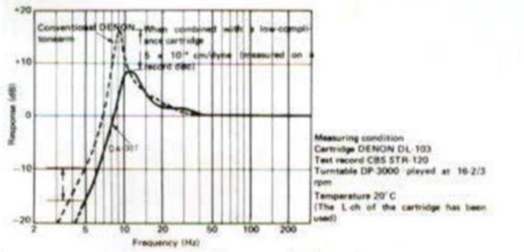


Fig 4 Low-frequency resonance characteristic of tonearm

Next, as to the low-frequency resonance of the arm, the vibration system of the DA-307 consisting of the compliance of the damper rubber and the suspension wire, and the each mass of the arm on both sides of the damper rubber can damp it to some degree with inverse resonance. Fig. 4 shows an example thereof. The peak around 10 Hz is well damped, the increase of the mechanical impedance being suppressed, the sensitivity under 5 Hz can be lowered with the response of around 20 Hz maintained similarly to the conventional models. Therefore, even if the record disc in playback is being warped, the above-described cross-modulation distortion will not come up, and the stylus tip will hardly shake and cause any variation of its tracking force on the record disc. Thus, stable tracing of the stylus tip is obtained.

Non-Contact Type Anti-Skating Device

To reduce the tracking error, a cartridge is generally mounted to have some angle to the central line of arm and some over-hang to the center spindle. The inside force caused thereby shows a variation of its value in accordance with the varied conditions of record playback. The value is proportional to tracking force and varies with the distance of the stylus tip from the center of the record disc (See Fig. 5 Shadowed curves). It can be said ideal that a tonearm which has an anti-skating device impressing a reverse cancelling force derived from the actual measurement data.

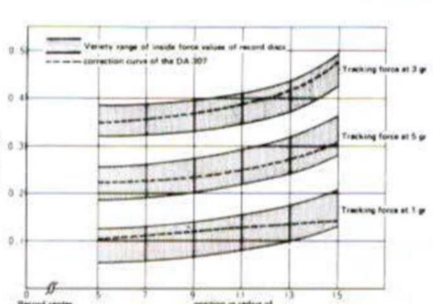


Fig 5 Inside force cancelling characteristics

When a horseshoe magnet is brought close to such a structure that a magnetic sheet having uniform thickness and a taper-shaped width is wound around a non-magnetic drum with little bearing friction, there occurs such a rotary force that the wider portion is more attracted within the covering angle of the magnetic sheet. This rotary torque can be utilized to cancel the inside force. (See Fig. 6)

The DA-307 adjusts and maintains the rotary torque corresponding to the tracking force by varying the distance between the rotary drum and the magnet, consequently varying the quantity of the outside force and selecting a proper taper shape of the magnetic sheet. Thus, the inside force is cancelled to form an anti-skating device.

The cancelling function can easily be set to OFF by drawing the knob out.

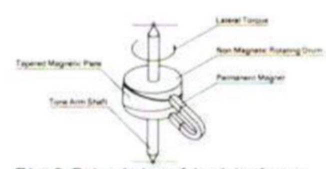


Fig 6 Principle of inside force cancelling (fuction)

Reduction of Moving Mass and High-Precision Bearings

The movable parts of the tonearm is made light and the bearing parts are made highly sensitive (movable with less than 25 mg force) thanks to the use of a high-precision high-grade bearings inherited from the DENON DA-302 tonearm for broadcasting stations.

Unique Tracking Force Adjusting Method

The tracking force adjusting mechanism employs a new type vernier dial knob. Fine adjustment can be set easily and accurately therewith.

Easy-to-Handlle New-Type Cueing Device

The cueing lever is provided on the front side for easy handling. Of course, it is of an oil damping type providing smooth stylus landing.

Hum-Noise Preventing Head Connector

The tonearm employs a mechanism for preventing unpleasant noise that occurs from speakers when the head shell is mounted on or removed from the connector.

Use of Gold-Plating Connecting Terminal

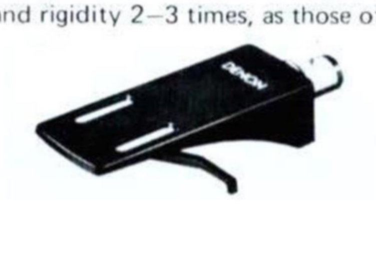
The contacts of the connector are all plated with gold for preventing malcontact.

Low-Capacitance Output Cord

A low-capacitance output cord is used so as not to affect the wide-range reproduction of the cartridge.

High-Performance Light-Weight Head Shell PCL-5

The head shell is made of magnesium-alloy diecasting. Its specific gravity is about 2/3, and rigidity 2–3 times, as those of aluminium. This is very effective for the suppression of the resonance of the head shell.



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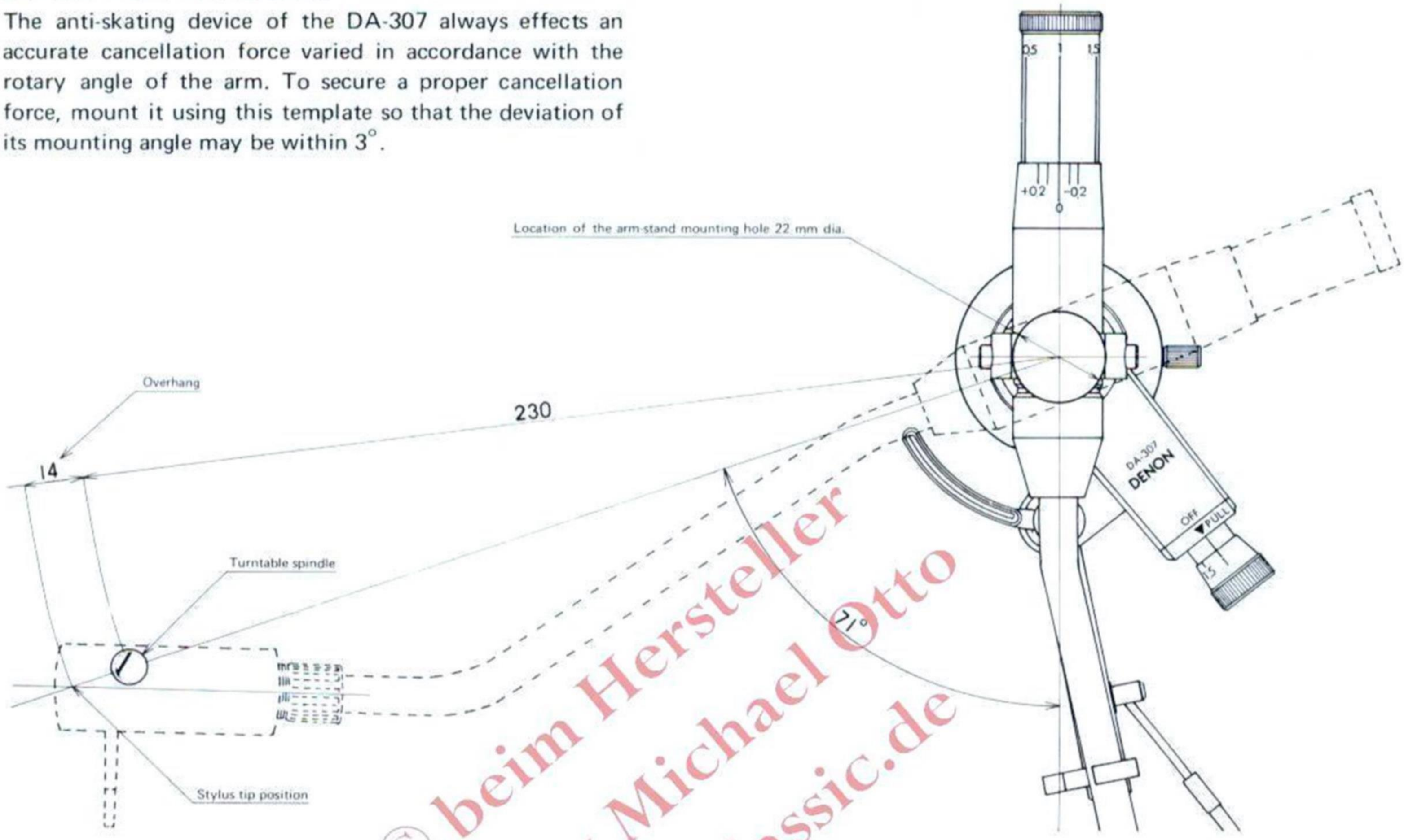
DA-307 TEMPLATE (mm)

The anti-skating device of the DA-307 always effects an accurate cancellation force varied in accordance with the rotary angle of the arm. To secure a proper cancellation force, mount it using this template so that the deviation of its mounting angle may be within 3°.



Specifications

Type:	Static balance S type
Overall length:	332 mm (max.)
Effective length:	244 mm
Offset angle:	20.5°
Overhang:	14mm
Tracking error:	2.5° (max.)
Tracking force reading:	Vernier-dial direct reading; 2.5 gr. per rotation (with graduations in increments of 0.1 gr.)
Acceptable weight of cartridge:	5–10 gr.
Head shell (PCL-5):	Magnesium-alloy die casting, 6 gr. (without screws)
Shell connector:	4P connector
Output cord:	Low capacitance cord approx. 1.2 m (approx. 50 pF) with a 5P connector
Anti-skating device:	Magnetic control type (with release mechanism)
Cueing device:	Oil-damping type
Acceptable thickness of mounting board:	5–35 mm
Height adjustment range:	42–70 mm
Bearing:	High-precision pivot bearings and miniature bearings
Sensitivity:	Less than 25 mgr. both horizontally and vertically

* The specifications and the external appearance are subject to change without notice.

DENON STUDIO-PHONIE

Mehr als High Fidelity.

NEUHEITEN

Tonarm DA 401 (sh. Abb.)

Extrem leichtes Tonarmrohr einer Spezial-Leichtmetall-Legierung stellt die ideale Kombination aus geringer quivalenter Masse (6 g) und hoher Verwindungssteifigkeit dar.

Die gesamte Tonarmlänge beträgt 320 mm, die effektive 220 mm, der Tonarm ist dynamisch bedämpft, um maximale Resonanzfreiheit zu erzielen.

Der max. Spurfehlwinkel beträgt 2°, Auflagekräfte 0-2 g. Höhen universell justierbar von 30-70 mm.

Tonarm DA 309 (o. Abb.)

Dynamisch bedämpfter Tonarm, statisch ausbalancierte S-Form, extrem resonanzfrei, berührungslos arbeitende Antiskating. Länge über allês 340 mm, effektive Länge 244 mm. Auflagekräfte 0-2,5 g. Höhen justierbar von 42-70 mm. Spurfehlwinkel max. 2,5°. Montage Durchbruch 22 mm.

Tonarm DA 307 (o. Abb.)

Dynamisch bedämpfter Tonarm, statisch ausbalancierte S-Form.

Länge über alles 332 mm, effektive Länge 244 mm. Auflagekräfte 0-2,5 g in 0,1 Gramm-Schritten. Höhen justierbar von 42-70 mm. Spurfehlwinkel max. 2,5°. Montage Durchbruch 22 mm.