

below 100 rpm. Rumble originating from these motors is well below the low-frequency limits of any loudspeaker, or even of the human ear.

The old NAB standard for rumble measurement specifies a playback-equalization characteristic that is a slightly modified form of the standard RIAA characteristic. The reference level is a recorded velocity of 1.4 centimeters per second at 100 Hz. A test record with this level is played, and the output meter connected to the output of a preamplifier is adjusted to read 0 dB. Then, with the turntable playing a quiet band, the meter is read, and the noise level is expressed as "-X dB" referred to the standard level. Since -35 dB of rumble at 60 Hz may be quite audible, and the same -35 dB at 10 Hz completely inaudible, it would be highly desirable to weight the measurement to conform to the relative importance of the various frequencies. Several weighting curves have been developed, but none has any official industry sanction or acceptance, so we continue to use unweighted measurements. We do this not without some misgiving, but, lacking a weighted standard, we have no choice.

However, various manufacturers use their own preferred weighting curves in rating the rumble of their turn-

tables, and no comparison is possible between their specifications and others based on different systems. If the rating is according to NAB standards, and is so stated, comparisons can be made. Another problem becoming more serious as turntable quality improves is the lack of suitable test records. The residual rumble of even the best rumble-test records is higher than that of some of the better turntables now available. This reflects the difficulty of achieving very low rumble in a turntable suitable for use with a disc-cutting lathe.

Using the NAB method, a rumble of -35 dB (which meets NAB broadcast standards) is attained or bettered by a number of the better turntables, both manual and automatic. Some of these are rated by their manufacturers at -60 to -70 dB, using different weighting curves. When you see a rumble figure better than -40 dB you can assume that it is a weighted figure, and therefore not comparable to another manufacturer's figures. Medium-grade turntables frequently have measured rumble of -30 dB, and tolerably good results can be had with some turntables having -25-dB rumble. We would not recommend a turntable with a poorer rumble figure for serious listening.

≈ EQUIPMENT TEST REPORTS ≈

By Hirsch-Houck Laboratories

DUAL 1219 AUTOMATIC TURNTABLE



● GIVEN their present high level of performance, it is difficult to imagine how the better automatic turntables could be significantly improved. Nevertheless, the Dual 1019, widely regarded as one of the finest record players available, has now been superseded by the new Dual 1219. The 1219 has a 7-pound nonferrous platter 12 inches in diameter, and a nominal ± 3 per cent vernier adjustment for each of its three (78, 45, and $33\frac{1}{3}$ -rpm) speeds. It has a new motor with a "continuous-pole" section to bring the turntable up to speed in half a revolution, and a synchronous section to lock its speed to the line frequency independently of line-voltage variations.

The very accurate and effective anti-skating compensation of the 1019 has been retained in the 1219, with a minor improvement in convenience: it is no longer necessary to look up the proper setting for the compensator in a separate table when an elliptical stylus is being used (they require a different amount of correction from conical styli). The anti-skating dial has two scales, calibrated in grams to correspond to the tracking force in use. One is used for 0.7-mil conical styli, the other for 0.2×0.9 -mil elliptical styli. A table in the instruction manual provides setting information for other stylus dimensions.

The $8\frac{3}{4}$ -inch tone arm, which is claimed to be the longest presently being used on any automatic record player, is pivoted on low-friction gimbals. The pivots of the 1019 were already about as good as one could wish; the new ones are claimed to be even better (although we don't know how we could measure the improvement). At any rate, the Dual 1219 arm can operate at the lowest force that any cartridge can use, and will in no way limit the user's choice of cartridges, now or in the foreseeable future.

A new feature of the Dual 1219 is its provision for correction of vertical stylus angle for single play or automatic play. When playing single records, a short manual spindle that rotates with the platter is inserted in the turntable center hole. A mode-selector lever next to the arm base is set to SP (single play), and this adjusts the arm height so that the cartridge and arm are parallel to the record surface. If the cartridge is correctly designed and installed (a plastic jig supplied with the 1219 makes this a simple matter), it will have the required 15-degree vertical-tracking angle for lowest distortion. Single-play operation can be initiated either by pressing the START lever, which causes the arm to index to the selected record diameter, or by picking up the arm and cueing it manually (the turntable starts as the arm is moved toward the record).

For automatic operation, an automatic spindle is inserted in the center hole, and the mode selector is moved to MP (multiple play). This raises the entire arm structure so that the 15-degree vertical angle will be obtained on the third record of a six-record stack. The actual variation in vertical angle over the full stack is a negligible ± 1.5 degrees.

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An interlock system helps to prevent operation of the unit with the mode selector in an incorrect position. If it is set to SP and the automatic spindle is installed, no record will drop, and the arm will not index. If it is set to MP with the single-play spindle installed, the cueing control lever will not function. (This, of course, would not necessarily be detected by the user unless he tried to use the cueing function.) The cueing lever, like that of the 1019, is viscous damped on both lift and drop, and operates with impressive smoothness. Unfortunately, the cueing function does not operate with the mode selector in automatic. This is a slight inconvenience in that it cannot be used to achieve a momentary pause when there is a stack of records on the spindle.

When we tested the Dual 1219, we found its performance to be much like that of the 1019. Its rumble was -37 dB in the lateral plane, and -33 dB including vertical components. Wow and flutter were 0.09 and 0.03 per cent, respectively, at the two lower speeds, and slightly

less at 78 rpm. The arm's tracking-force calibration scale was accurate to within 0.2 gram, and the anti-skating correction was optimum for equal distortion in both channels, which is the criterion for its proper adjustment. The arm tracking error was less than 0.8 degree per inch of record radius, a good figure.

Obviously, the Dual 1219 has a high degree of operating refinement, plus the fine performance that has long been associated with the Dual name. It is quite expensive—\$159.50 plus the base—and undoubtedly will have greatest appeal to those who dislike any compromise in their audio components. Its added cost has gone largely into technical and operating refinements—essentially the same performance is available in the much less expensive Dual 1209, as Dual readily admits. At any rate, the 1219 is a good illustration of how an already superior product can be further improved by intelligent and imaginative design and engineering.

For more information, circle 157 on reader service card

TANDBERG MODEL 11 TAPE RECORDER



● For many years, virtually all new components coming to us for test have been stereo models. In the case of tape recorders, mono models are still very much on the scene, but they are almost never meant for serious listening or professional use. An impressive exception to this rule is the new Tandberg Model 11, a professional-quality portable mono reel-to-reel recorder.



The Model 11 is fully transistorized, and can be operated from a self-contained battery pack from which it draws 2 to 3 watts. If ordinary dry cells are used (ten 1.5-volt D cells are required), the battery life is about 5 to 6 hours in continuous operation, or about 20 hours if the machine is used half an hour per day. Rechargeable nickel-cadmium cells can also be used for long-term economy. For a.c. line operation, Tandberg provides an optional battery eliminator that physically replaces the internal battery pack. It can also be used externally to recharge nickel-cadmium batteries in the recorder through an accessory connector. We tested the Model 11 with the a.c. power supply installed.

This is a half-track machine that takes 7-inch reels. It has three heads and separate recording and playback electronics for off-the-tape monitoring while recording. The microphone input, for a 200-ohm balanced dynamic microphone, uses a locking professional-type connector. Two line inputs are provided, for high- and low-level signals. Separate recording-level controls for the microphone and line inputs make it possible to mix signal sources.

There are two playback outputs using miniature phone jacks. One is a monitoring output for 200-ohm unbalanced headphones; the other is a 600-ohm balanced output. Both are controlled by a single playback-level control. A small built-in speaker can be switched on to monitor either incoming or outgoing signals, but the line outputs are disconnected when the speaker is on. A meter indicates recording level, and when the PLAY button is depressed, it indicates the level at the line output. A battery-test button switches the meter to check the condition of the batteries.

The tape-transport control is a single lever that provides fast-forward and reverse when pushed right or left; normal speed is obtained by pushing it up. A separate recording-interlock button must be pressed simultaneously to record. The STOP lever starts and stops the tape instantly without causing the machine to switch out of the record mode.

The three operating speeds of $1\frac{7}{8}$, $3\frac{3}{4}$, and $7\frac{1}{2}$ ips are selected by a rotary switch that sets the unique electronic speed-control circuits of the Model 11. Precise and consistent speed is a necessity for professional applications, and since when operating on batteries there is no a.c. power line to establish the motor speed, a very effective electronic substitute was developed by Tandberg engineers.

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