14.4-Volt Cordless Drills

by Clayton DeKorne and Pete Young

In the maze of cordless tools, there are several different classes of drill/drivers. Those intended for professional use clearly set themselves apart from those intended for homeowners (the one homeowner-market 14.4-volt drill we tried out worked so poorly that we did not even include the results in this article). Professional cordless drills have standard features such as electric brakes and keyless chucks. They also have longer runtimes and higher durability.

Tradespeople have largely migrated to 12-, 14.4-, and 18-volt power classes during the past few years. We are focusing this tool review on 14.4-volt drills because this class offers a practical compromise between performance, cost, and weight. We collected most of the latest models on the market and put them through some tough tests. The Panasonic 15.6-volt model was included in this tool class because Panasonic does not offer a 14.4-volt model.

NiCad vs NiMH Batteries

We also included new 14.4-volt nickel metal hydride (NiMH) batteries. NiMH batteries, which hit the market in 1998, provide longer runtimes than the more common nickel cadmium (NiCad) batteries. Makita is the only manufacturer that currently has NiMH batteries available on the market. Most other manufacturers plan to introduce NiMH at some point in 1999.

We were able to test two drills using NiMH batteries — the Makita, with a 2.2 amp-hour (Ah) battery, and the Hitachi, with a prototype 3Ah battery (see Figure 1). Although the Hitachi prototype battery was the only 3Ah battery we tested, many NiMH batteries will show up for sale in 1999 with 3Ah ratings, which will increase runtimes.

This class of drill/driver offers good power in a lightweight tool, and at a moderate price

Figure 1. Nickel metal hydride (NiMH) batteries like the 2.2Ah from Makita and 3Ah prototype from Hitachi increase runtimes for each charge. However, they are more expensive than more common NiCad batteries and cannot be charged as many times before wearing out. With the added runtime, though, manufacturers are claiming that NiMH total runtime over the life of the battery is still greater than with NiCads.

These new NiMH batteries set the standard in our tests. In each of our tests, we ranked all drill models relative to the top performing NiMH model. However, enhanced runtimes will come with added costs. Not only will this next generation of batteries cost more than NiCads, but their lifespans will be shorter by as much as 20% fewer charge cycles. Nevertheless, because you get more runtime between charge cycles, manufacturers claim that total runtime over the life of the battery will still greatly exceed that of NiCads.

Performance Testing

To get ready for testing, we first conditioned two batteries for each drill by draining them and charging them five times (believe us when we say that 12 drills can make quite a lot of noise when they're all running together at full speed for an hour or so). Our tests were designed to objectively determine performance limits for both low- and high-torque applications. In the two high-speed tests, driving drywall screws and boring spade bit holes, we used plywood to provide a uniform base material. During both test runs, we also noted our subjective likes and dislikes. In the end, you should be able to find the information you need to make a good choice if you decide to shop for one of these 14.4-volt models.

Light Load Runtime

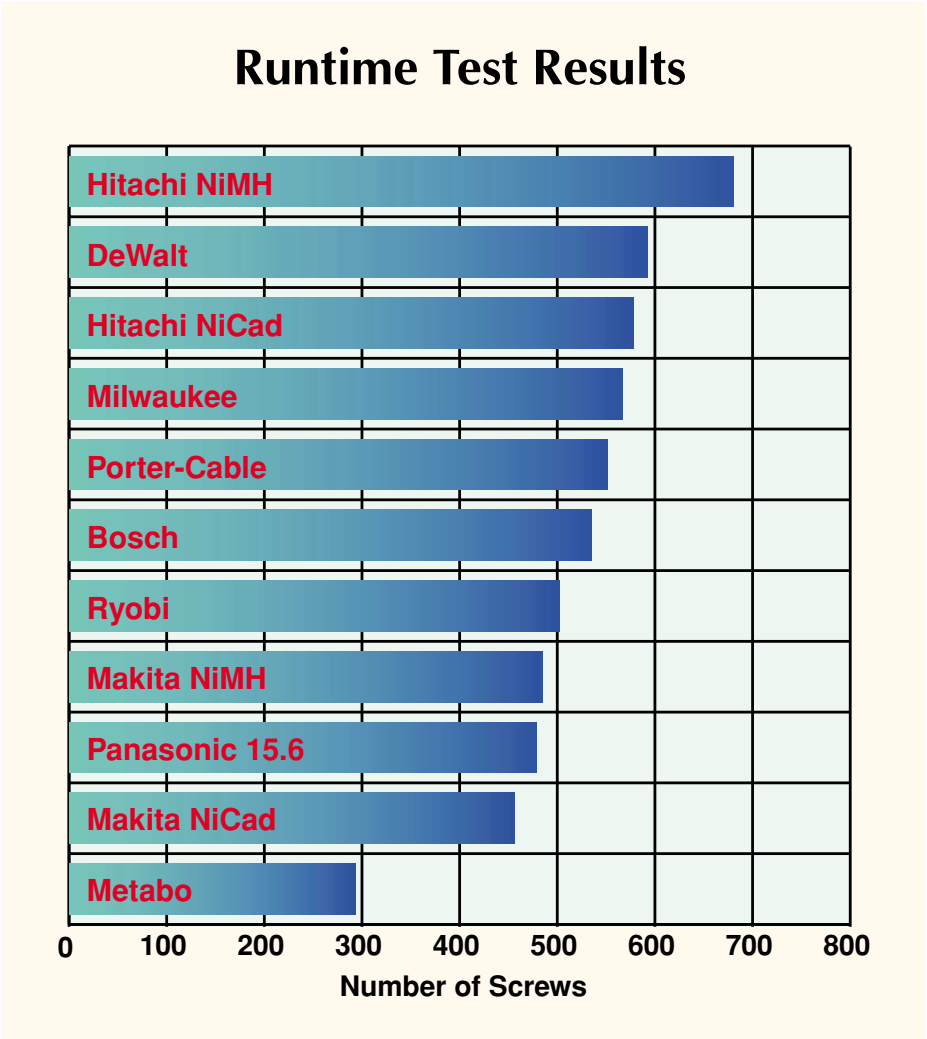
Our first test was designed to determine the runtime of the tools during a low-power application. We drove 1 1/4-inch drywall screws into two glued-together sheets of 3/4-inch plywood. We tested each drill twice, each time with a different battery, to see how many screws could be driven on one charge (see bar chart, left). Both of us had the chance to work with every drill and we took notes on how they felt during the task.

Most drills in our test drove between 450 and 600 drywall screws on one battery charge. Only the Hitachi NiMH broke the 600 barrier with an astounding two-run average of 680. On the low end, Metabo's two-run average was 293.

Given the length of time involved in this test, the weight and comfort of each drill was important. The Metabo is heavy, for instance, and tiring to use. Another drill that proved uncomfortable was the Milwaukee. The diameter of its grip is too small for even our average-sized hands, so that pulling the trigger for long periods was tiring. With several other models (Hitachi, DeWalt, Makita, Panasonic, Ryobi), the directional switch was too easy to change accidentally because of its close proximity to the trigger. This is especially true for left-handed operators, because the push-button switches in these drills are oriented to be pushed out of the way of right-handed operators when driving screws or drilling holes.

Torque Tests

We decided to perform two tests to evaluate how much torque the drills have. High-torque, high-speed applica-



tions, such as drilling large holes, are common in all trades. But low-speed, maximum-torque applications, such as driving long screws into wood, are just as important. A good cordless drill/driver needs to be able to do both well.

High-torque, high-speed test. We used a spade bit to drill 1 1/8-inch holes through doubled-up 3/4-inch plywood to test high-speed, high-torque capacity (see bar chart, below). Each drill was tested using a new bit, and most drills hogged out between 15 and 25 holes before running out of juice.

This test pushed the drills to their limits. Several motor housings became very hot to the touch. One drill, the Ryobi, burned out a battery, although according to the manufacturer, this was probably due to a faulty switch that was drawing too much juice at once. The replacement drill that Ryobi sent performed satisfactorily. Another drill, the Bosch, had some smoke coming out of its motor housing.

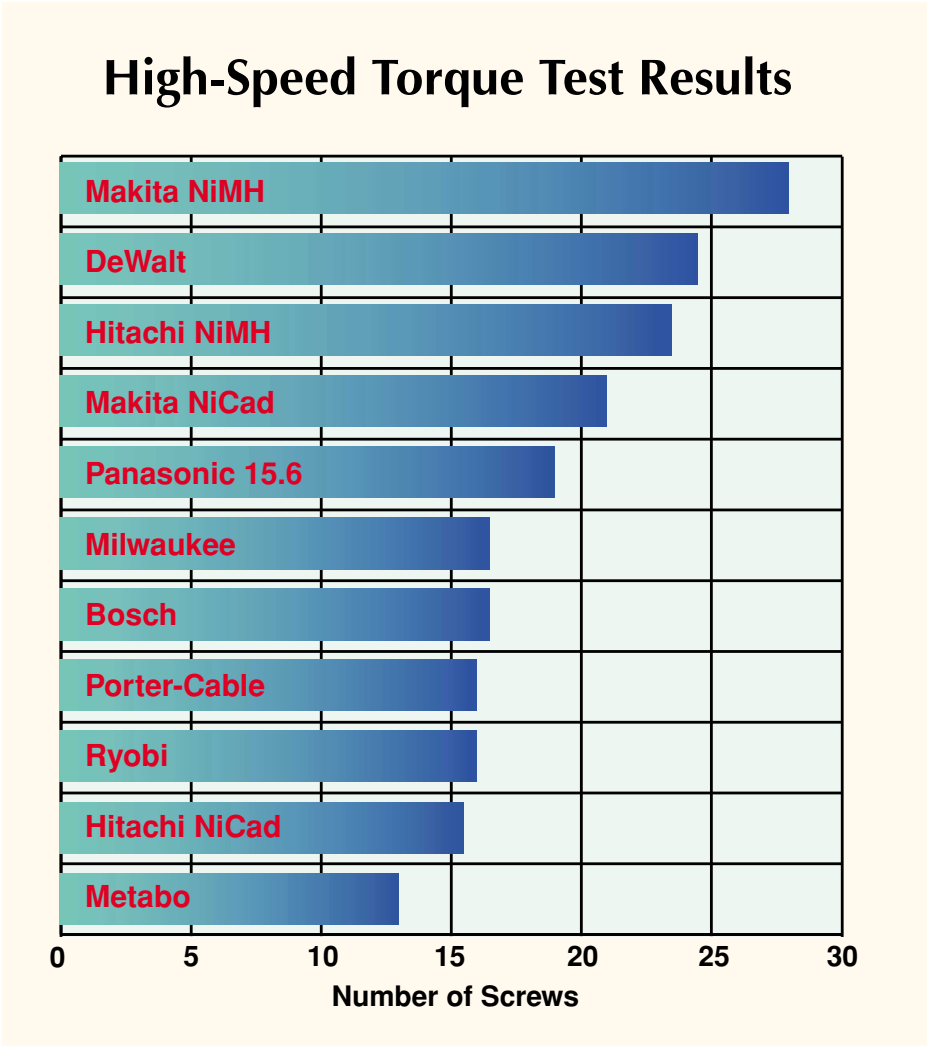
Boring spade-bit holes at high speed illustrates an important design factor that is never addressed in the manufacturers' specs. Ads almost always state the overall maximum torque, which a drill achieves at low speed. Yet many high-torque applications, such as boring an 1 1/8-inch spade-bit hole to run pipe, need to be done in high gear. In those cases, the maximum torque of a drill in high gear is very important. Only one drill, the Panasonic, provided this information in its general spec sheet. We had to contact manufacturers to get the spec for all of the other drills.

The DeWalt and Makita models displayed the best overall torque at high speed. They didn't bog down much during our test and maintained good power until virtually the last hole. Although the Makita (28 holes) and Hitachi (23 holes) NiMH-powered models performed very well, as expected, only two NiCad models exceeded 20 holes — the DeWalt (24 holes) and Makita (21 holes). Close behind, the Panasonic and Milwaukee models also performed well in terms of power, although their runtime was shorter. The Hitachi, which bogged down some and seemed to lack the power of these other models, did have very good runtime when equipped with the 3Ah NiMH prototype battery.

Overall, most of the drills did okay, but not great. They had enough power to do the job, but were prone to catching and bogging down so that we had to back off and re-engage the spade bit to finish many holes. With frequent use in these types of applications, having a drill bog down a lot tends to jar the user's wrist. Only the Metabo performed poorly. It lacked power, bogged down often, and was able to bore only 13 holes.

Maximum torque, low speed. Our second high-torque test involved driving 3-inch long, 1/4-inch lag bolts (without pilot holes) into 6x6 pressure-treated pine (Figure 2) to test low-speed, high-torque capacity. Results from this test mirrored the manufacturers' self-reported overall maximum torque

Figure 2. The DeWalt and the Makita drills had the best overall maximum power — evident from driving lag bolts into a pressure-treated pine 6x6.



capacities. DeWalt and Makita, whose ratings are around 330 inch-pounds, clearly had the most power. Most drills with ratings between 275 and 310 inch-pounds performed fairly well. The Bosch, rated at 250 inch-pounds, lacked power. Bosch hopes to remedy this in 1999 when it comes out with a new and more powerful line of cordless drills, the Blue Rage series (Figure 3). The pistol-grip Blue Rage will have 370 inch-pounds of torque while the T-grip will have 400 inch-pounds. Unfortunately, it appears that only the new 18-volt Bosch model will come with a NiMH battery option.

The only real disappointment in this overall maximum torque test was again the Metabo. Given its heft and girth, one would expect it to be a power dynamo. Yet, it is only rated at 209 inch-pounds and began to bog down after driving only a few lag bolts.

Figure 3. Bosch claims that its new Blue Rage, to be available in 1999, will have much more power than 14.4-volt drills currently on the market.

Overall Results

Attempting to rank tools after performing a variety of tests can be tricky. We've dealt with it by grading on a curve. We calculated the performance of each drill as a percentage of the best tool in both the screw and spade bit tests. This meant that the best drill in each test received a score of 100%. Next, we took an average of both curved test scores to determine the overall rating of each drill (see "Performance Ratings").

Ratings. Only the Hitachi, powered with the prototype NiMH 3Ah battery, scored above 90%. This is somewhat

Milwaukee 0512-21

Milwaukee Electric Tools
13135 West Lisbon Rd.
Brookfield, WI 53005
800/414-6527
www.mil-electric-tool.com
Speed Range (low/high): 0-450/0-1,250
Max Torque (low speed/high speed): 290/120
Weight: 4 lb., 5.5 oz.
Street Price: $189

Panasonic EY6230 15.6 V

Panasonic Industrial Tool
One Panasonic Way, 4A-3
Secaucus, NJ 07094
201/392-6655
Speed Range (low/high): 65-450/200-1,450
Max Torque (low speed/high speed): 273/73
Weight: 5 lb., 2 oz.
Street Price: $200

Porter-Cable 872 and 873

Porter-Cable Power Tools
P.O. Box 2466
Jackson, TN 38302
800/487-8665
www.porter-cable.com
Speed Range (low/high): 0-450/0-1,450
Max Torque (low speed/high speed): 307/116
Weight: 4 lb., 6 oz
4 lb., 8 oz.
Street Price: $190
$200

Ryobi CTH1442K2

Ryobi America Corp.
1424 Pearman Dairy Rd.
Anderson, SC 29625
800/525-2579
www.ryobi.com
Speed Range (low/high): 0-350/0-1,300
Max Torque (low speed/high speed): 300/92
Weight: 4 lb., 9 oz.
Street Price: $139

Bosch 3615

S-B Power Tools
4300 W. Peterson
Chicago, IL 60646
877/267-2499
www.boschtools.com
Speed Range (low/high): 0-400/0-1,420
Max Torque (low speed/high speed): 250/80
Weight: 4 lb., 6.5 oz.
Street Price: $200

DeWalt 991

DeWalt Industrial Tools
P.O. Box 158
Hampstead, MD 21074
800/443-9258
www.dewalt.com
Speed Range (low/high): 0-450/0-1,400
Max Torque (low speed/high speed): 334/120
Weight: 4 lb., 13 oz.
Street Price: $220

Hitachi DS14DV (NiCad)

Hitachi Power Tools
3950 Steve Reynolds Blvd.
Norcross, GA 30093
800/546-1666
Speed Range (low/high): 0-350/0-1,200
Max Torque (low speed/high speed): 305/65
Weight: 4 lb., 10.5 oz.
Street Price: $225

Makita 6233D (NiCad)

Makita USA
14930 Northam Street
La Mirada, CA 90638
800/462-5482
Speed Range (low/high): 0-400=0-1,300
Max Torque (low speed/high speed): 330/117
Weight: 4 lb., 8.5 oz.
Street Price: $240

Makita 6233D (NiMH)

Makita USA
14930 Northam Street
La Mirada, CA 90638
800/462-5482
Speed Range (low/high): 0-400/0-1,300
Max Torque (low speed/high speed): 330/117
Weight: 4 lb., 8.5 oz.
Street Price: $280

Metabo BEAT214/2 R+L

Metabo
1231 Wilson Drive
West Chester, PA 19380
800/638-2264
www.metabo.com
Speed Range (low/high): 0-400/0-1,400
Max Torque (low speed/high speed): 209/75
Weight: 5 lb., 11.5 oz.
Street Price: $300

Performance Ratings

Rank	14.4 Cordless	Screws	% Screws	1 1/8 in. Holes	% Holes	Overall Score	Comments
1	Hitachi NiMH	680	100	23.5	84	92%	Best overall performer, but not available till mid-late 1999. Same drill with NiCad battery gave average performance. Best one-handed chuck in class. Good all-around clutch range.
2	DeWalt	592	87	24.5	88	87%	Best available drill in testing, with no NiMH help. Workhorse that will only get better with NiMH.
3	Makita NiMH	485	71	28	100	86%	Runner-up to DeWalt. Significantly better than NiCad-powered.
4	Milwaukee	567	83	16.5	59	71%	Good power, decent overall performer. Grip only comfortable for people with smaller hands. Best all-around clutch range.
5	Makita NiCad	456	67	21	75	71%	Good power, decent overall performer.
6	Hitachi NiCad	578	85	15.5	55	70%	Good for low torque applications. Great one-hand chuck. Good all-around clutch range.
7	Panasonic 15.6	479	70	19	68	69%	Good choice, but pricey. Variable speed switch could be better. Great 12-minute charger. Good all-around clutch range and good one-handed chuck.
8	Porter-Cable	551	81	16	57	69%	Mediocre, but acceptable. Comfortable to use and available with Pistol or T-grips.
9	Bosch	535	79	16.5	59	69%	Good compact ergonomics. Lacked power. Good one-handed chuck.
10	Ryobi	502	74	16	57	65%	Mediocre, but good bang for your buck.
11	Metabo	293	43	13	46	45%	Steer clear.

misleading, however, because the same Hitachi drill, when powered with its standard issue NiCad battery, scored only 70%. What this means is that the increased Hitachi runtime, when using the prototype 3Ah battery, masked the mediocre performance of the actual drill (minus the battery). To figure out which drill (minus the batteries) performs best, results from the NiCad powered models are the best indicator. Batteries will change during the coming year, but drill design will remain largely the same.

The DeWalt was the only NiCad powered drill to approach an overall rating near 90%. Most of the drills, when running on NiCad batteries, came in between 69% and 71%. Slightly behind this group, Ryobi had a rating of 65%. This is noteworthy because the Ryobi, at the low end of professional-quality tools, costs $60 to $140 less than most other professional drills, even though its performance drops off only slightly. At current prices, you can buy two Ryobi drills for the price of one Makita with NiMH batteries. But remember, don't be tempted to go buy the even cheaper homeowner units, because their performance completely fails to meet the needs of a professional.

Which drill you buy depends largely on what kind of work you do and how much you're willing to spend. DeWalt currently makes the best overall 14.4-volt drill according to our tests. But it is also one of the more expensive. Makita and Panasonic also make good all-around models for both high- and low-torque situations. For high-torque applications specifically, the Makita NiMH and the Panasonic were good performers. Makita has the added advantage of being the only manufacturer to currently offer a NiMH battery option for its drill, which increases runtime. For low-torque applications, the Hitachi and the Milwaukee drills worked well.

Keep in mind that as NiMH batteries become available, they will alter these recommendations. If you put a better battery into the same drill, it will run longer. But remember, it will not perform better in other respects. So, if you put the same quality NiMH batteries into the current DeWalt drill as well as the other currently available drills, the DeWalt will still be that much better than the rest.

Who comes out with the best batteries, however, remains to be seen. Many manufacturers will be introducing NiMH batteries with 3Ah ratings during 1999. The promising Hitachi prototype that we tested here is slated to be on the market by mid-to-late 1999. How these new batteries perform will need to be evaluated in the future.

Figure 4. Chucks on the Bosch, Panasonic, and Hitachi (shown here) are easy to grasp and adjust with one hand.

The only possible threat to the DeWalt 14.4-volt design at this point is the soon-to-be-released Bosch Blue Rage series. If Bosch is able to increase the maximum torque to almost 400-inch-pounds, as claimed, they will likely become the new top dog of the cordless pack.

Clutch Settings and Chucks

Among the models we tested, the clutches performed very differently. More important than the actual number of clutch settings (most models have around 20) is the range of torque from lowest to highest settings. At the lowest setting, a drill driver should start to slip in time to prevent stripping out something like a strike-plate screw. The Bosch, Hitachi, and Milwaukee performed well at lower settings. At the highest setting, a drill should not prematurely slip during a high-torque application such as driving a 2 1/2-inch hinge screw. In our tests, however, several models lacked power in the highest clutch setting (Bosch, Metabo, Porter-Cable). For high-torque applications with these models, you have to use the full-power *drill* setting, relying on "feel" to determine tightness when driving longer screws or lag bolts. The best high clutch performers were DeWalt, Milwaukee, and Ryobi.

Overall, the Hitachi, Milwaukee, and Panasonic drills had both good low and high settings, indicating an extensive clutch range. The Milwaukee was the best performer, displaying sensitivity in low clutch settings and high torque in high settings.

Chucks. How easy it is to use the different drill chucks changes a lot from model to model. Most chucks have to be grasped with two hands. Some of the drills have enough gear resistance when not being used that the chucks can be loosened or tightened with just one hand in high clutch settings (Makita, Metabo, Milwaukee, Porter-Cable, Ryobi). However, only the Bosch, Hitachi, and Panasonic have taken full advantage of this potential by redesigning their chucks for exclusive one-hand use in all clutch settings (Figure 4).

Future Trends

While we feel 14.4-volt models currently offer the best value to the trades, 18-volt tools may become the future norm because many new tools, such as circular and recip saws, are becoming available only in 18-volt models. Some manufacturers are heavily marketing multiple tool combination kits that only run on the 18-volt battery platform. The issue seems to be a question of brawn vs. comfort. If 18-volt tools continue to be uncomfortably heavy, demand will continue for 14.4-volt tools. If, however, 14.4 volts is not enough power for decent circular, reciprocal, and jigsaws or hammer drills, then the 18-volt platform will probably emerge as the norm.

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