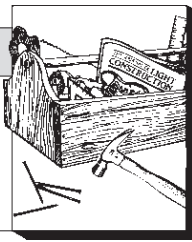


The Professional Tool Difference

by Clay Furtaw



Power tools are like books in one important way — they can't always be judged by their covers.

For instance, a pair of drills sitting side-by-side in a glass case at the hardware store appear to be exactly the same. But closer examination reveals that one is priced at \$25, while the other is priced at \$100.

The difference is that the expensive drill is the "professional" model and the other is the so-called "consumer" model: a distinction that runs deeper than the name and price.

Professional tools are designed to be more powerful, last longer, and perform better under stress than their consumer counterparts. They are built for carpenters, plumbers, electricians — anyone who uses a power tool every day to make a living.

Consumer tools — for some handymen — can perform the same tasks usually as well as the professional type, but they aren't built to last under full-time abuse.

The design of each class of tool reflects its intended use, which alters the manufacturing cost and the price.

For example, the motor in a professional power tool has to be able to handle an extremely heavy work load, so it must generate more power than a consumer tool. It also must withstand, as well as sustain, overloading for long periods of time without burning up.

Of primary importance are the ratio of power to weight and the physical dimensions of the motor. A professional uses his tool all day long, so the lighter and smaller it is, the more comfortable it will be to use. He wants the maximum power from the minimum package. The

proper designing of a professional tool is complex.

The selection of wire for winding the motor of a tool is important. The choices are aluminum or copper wire, with the latter usually used in professional tools and the former found in consumer tools. Copper wire is much more efficient than aluminum. If a length of copper wire and a length of aluminum wire are of the same diameter, at any given voltage more current will flow through the copper. So a motor wound with copper will provide more power than one of a comparable size wound with aluminum. Copper wire, however, is considerably more expensive than aluminum, so while it adds power to a professional tool, it also raises the price.

Power tools that are worked hard are susceptible to overloading and heat buildup. Several methods are used to compensate for this in professional tools. For example, the wire is insulated with a substance that resists high temperatures. Also, after the wire has been wrapped around the commutator and the armature, resin is dripped onto the windings. This resin finds its way by capillary action into the coils and coats every wire, bonding the wires together into a solid unit. At high temperatures and speeds up to 25,000 rpm, the resin prevents one wire from rubbing against another and causing a short circuit, as well as guarding against the entry of dust and grit.

The quality of the commutator in the motor assembly is a factor. The commutator is a ring of individual copper bars encircling the armature shaft, literally the drive shaft of the motor. It is through these copper bars that the armature receives elec-

tricity from the wall plug for turning.

Consumer tools contain 12 of these copper bars; professional tools typically contain 24. In both tool types, there are 12 slots in the lamination stack through which the coils of wire are wound. But because there are twice as many copper bars in the professional tool, it is possible to run not one but two coils of wire in each of the lamination slots. The result is less arcing of electricity at the commutator of the professional tool. Arcing, which generates considerable heat, is one of the major reasons motors wear out.

Superior motor brush design can also reduce arcing. Both professional and consumer tools contain two brushes, which are pieces of carbon that transfer electricity from the power source to the armature coils. Electricity passes from the first brush into the commutator bar, through the wire coils, out the opposing commutator bar, and into the second brush, completing a circuit. Precise positioning of the brushes in relationship to the commutator helps suppress arcing.

Another way to reduce arcing is to use ball bearings instead of less expensive sleeve bearings. At 25,000 rpm, vibration and lateral movement between the commutator and the brushes can cause excessive arcing. The use of ball bearings in professional tools, however, allows tolerances measured in ten-thousandths (.0001) of an inch — small enough to virtually eliminate bearings as a cause of arcing. The loose sleeve bearings in the consumer-grade tool allow more play, but since it is used infrequently and lightly, a certain amount of arcing and heat can be tolerated.

There is a difference in gears, too. The professional tool is usually built with wrought-steel gears that are heat-treated after machining to harden the metal so it can stand up to frequent overloading. Consumer tools, on the other hand, are often fitted with powdered-metal gears, which are inexpensive to manufacture but are not as tough as heat-treated machined wrought steel.

There are many more instances in which professional-grade tools are manufactured with more durable metal parts than the consumer type. A drill's chuck, for example, is one of the single most expensive components of the tool. Because the craftsman is constantly inserting and removing bits from his drill, the jaws must be made from durable, and expensive, case-hardened steel. The consumer drill can get away with cheaper heat-treated steel.

The chuck of a professional drill is also manufactured to be more precise than a consumer drill. Wobble in a consumer drill is acceptable at .01 inch off true, but for a professional drill it can be no more than .005 inch. Low tolerances require more exacting machine work.

Switches on professional tools have to be more durable than those on consumer models. The profes-

sional craftsman is constantly turning his tool on and off, which puts tremendous stress on the switch. In addition, the tool is used in harsh conditions, where abrasives in the air, such as dust, dirt and sawdust, can ruin a switch. A special switch-protection mechanism is generally necessary for a heavy-duty tool.

Many people think the use of plastics in power tools is a way for the manufacturer to save money. Yet plastics generally cost at least as much or more than comparable metal parts. Plastics are used in certain places or for particular components because they can do a better job than metal, and they provide much better electrical insulation.

But not all plastics are created equal. Some professional tools use a higher-grade, "super-tough" nylon. This material is almost indestructible — more so than some aluminum castings. The material is highly resistant to corrosives such as solvents and other chemicals that are prevalent around the workplace. It can also stand up to the high operating temperatures common for professional tools.

Alignment of parts is especially important in the assembly of power tools, which are normally made up of three external assemblies — the gear housing, the motor housing, and the handle. A consumer-grade drill is usually held together with one set of screws that go from the gear case through the motor housing into the handle. But for a professional tool, a more rigid and integrated structure is necessary.

Professional tools are consequently built like a Chinese puzzle — everything interlocks. Separate sets of screws are usually used to join the first assembly to the second, and the second to the third. If the tool is dropped or abused in operation, the rigidity of the structure should keep it in line.

Even the cord on a power drill will mark the difference between a consumer and a professional model. To avoid the need for extension cords on the job, most professional tools have a cord at least 8 feet, sometimes 10 feet, long. Consumer tools rarely are provided with a cord longer than 6 feet. The quality of the cord material is usually considerably better on the professional model as well, and the connection between the cord and the tool is better designed. Made in two parts, the connector allows easy replacement of an old, worn cord.

So the next time you're shopping for a new power tool, remember that there are clear differences between heavy-duty professional tools and light-duty consumer tools. Each has its place, but if you're intending to use the tool day in and day out, pay attention to the professional difference. ■

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Most of the features that distinguish this professional-grade drill from a consumer model are on the inside.