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SUBJECT: Evaluation of Prototype Tablesaw Safety Device

INTRODUCTION: The Directorate for Engineering Sciences received a sample of a prototype tablesaw safety device, as well as a detailed demonstration from its inventor, on July 11, 2001 to evaluate its potential to address injury. The inventor also provided an information package that combines the extensive technical information of the 26 different patents obtained in designing the safety system. The device consists of a modified commercial consumer-grade tablesaw, including an electrical blade contact detection circuit, logic circuit, and electromechanical device that stops blade rotation and lowers the blade below the table surface upon contact with a human body part. This system is under development and was demonstrated by SawStop LLC. of Wilsonville, OR.

BACKGROUND: Tablesaws account for approximately 30,000 injuries to the hand or finger per year, with approximately 10% of these injuries involving amputation. Tablesaw blades are typically 10 in. in diameter and rotate at about 4,000 rpm. A typical 40-tooth blade’s teeth cut at a rate of about 2,700 cuts per second; these saw teeth are travelling at about 120 mph. Resulting injuries are usually severe.

Review of In-Depth Investigations shows that typical incident scenarios involve inadvertent contact with the blade. The operator allows his hand to contact the blade while sawing due to inattention, or the workpiece slips or moves suddenly and the operator reaches, falls, or slips and contacts the blade from the top or rear of the blade. In some cases the work piece is kicked back by the blade and draws the operator’s hand into the blade.
below the surface of the table saw depends on the blade height set for the cut. An important factor is the fact that however long it takes for the blade to stop rotating, the hazardous cutting edge of the blade is already moving away from the contact point.

A 40 tooth, 10" carbide blade stopped in approximately 4 milliseconds. This was true whether it was contact made during a straight cut, during a compound cut, from the rear of the blade, or through a glove. A straight cut made with a 250 tooth, 10" plywood blade resulted in a longer blade stop time of 24 milliseconds. However, despite the longer blade stop reaction time, minimal damage to the hot dog occurred because the blade still retracted from the point of contact almost immediately. Similarly, cuts made with a 12 tooth, 10" rip blade resulted in a blade stop time of approximately 35 milliseconds (the blade retracted below the table saw surface before blade stop), but minimal damage to the hot dog occurred because of the immediate blade retraction.

As stated before, because the prototype design capacitively couples the arbor, conductivity between the blade and the arbor is necessary in order for the system to react to contact between the blade and a body part. Two different blades with plastic hubs were tested and resulted in operation of the table saw in an unsafe condition — if contact were made, the system would not have worked. The blades were specialized dado blades; however, their use is not uncommon among serious woodworkers.

The limited amount of time allotted for evaluation did not allow for electrical interference testing. Electrical interference transmitted through the electrical supply line or the air could potentially cause nuisance tripping or possibly prevent the circuitry from detecting someone touching the saw blade. If any of these types of interference should cause problems with the circuitry, the problems could likely be remedied by minor changes to the circuitry or how they are shielded from outside interference. Testing for the effects of electrical interference should be conducted in future evaluations of this product.

CONCLUSION

Based upon the evaluation reported here, it appears that the SawStop concept is valid and the prototype impressively demonstrates its feasibility. The electrical and mechanical components operated without failure in a time frame that would greatly reduce blade contact injury. The design concept is very flexible and can be modified to address foreseeable areas of concern.

The device that was evaluated is a prototype, with handmade, non-production components. Production products will include modifications due to design and manufacturing decisions that may result in different performance. In addition, the robustness and life-cycle details of production units will be different from those of the prototype. The evaluations that were performed therefore concentrated on the validity of the concept and the performance of the components used in the prototype system. A significant amount of further development work may be required before this device could be incorporated into production saws, both because of the need to adapt
the concept to mass production, and to address some issues that still require refinement.

Of highest concern are those areas where the SawStop may not perform, and more importantly, may not indicate to the user that it will not perform. As discussed earlier, the device is dependent upon electrical conductivity from the hand through the blade to the saw arbor and thence to the circuitry. There are tablesaw blades that have plastic or other non-conductive hubs or centers, and even a painted or coated metal blade may not make electrical contact with the arbor. In this event, the saw may be operated, but the SawStop will not work as presently configured. This failure may likely be addressed through further design refinement.

Of secondary concern are those areas where the SawStop system may be perceived as a nuisance and therefore a candidate for bypassing by the user. The prototype SawStop uses a brake cartridge that may only be used with a 10 inch blade. The cartridge location does not accommodate smaller diameter blades or thicker specialty blades. In addition, specialized blades such as molding sets, which only have one to three teeth, may not work with the current brake configuration. As stated before, these areas of concern would need to be addressed during production design of each specific table saw.