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# NEWLY-FORMED CHECKLIST FOR ANALYSIS OF APPLICATION OF THE SAFETY SYSTEM ON TABLE SAWS

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*SUMMARY: The aim of paper is to analyze the application of the safety system on table saws. The research methodology used to analyze the application of the safety system on table saws is presented, using the method of description using a newly-formed checklist. The research was conducted on a sample of 18 table saws, where it was determined that over 50% of the analyzed machines are unsafe to use. The results obtained from the analysis of the application of the safety system on table saws were discussed and further research was proposed.*

**Key words:** *table saw, safety systen, methodology, analyze, newly-formed checklist*

## INTRODUCTION

Traditionally, wood has been used as the main raw material for centuries in production of furniture, joinery, interior design, wood structures, paper, packaging, transportation, toys, various tools, etc. Nowadays, various low-priced industrial panels (MDF – Medium Density Fiberboard, chipboard, plywood and laminated wood-based materials, etc.) are used instead of wood in these productions *(Çakmak et al., 2019)*.

Machines used in wood processing industries are dangerous, especially when handle without proper safeguards. Workers can suffer injuries from minor cuts to amputations and blindness, *(Okuma et al., 2020)*.

Table saws are very common machines for processing wood and similar sheet materials, primarily due to the simplicity of their construction and the possibility of application for different types of processing. It is used for transverse and longitudinal cutting of wood, *(Gavanski, 2015)*. Most operating manuals for table saws specify that you feed the workpiece into the saw blade against the direction of rotation (i.e., workpiece B). This implies you introduce the wood into the blade as the teeth are going downward. If you feed the wood into the table saw in the opposite direction, then both the workpiece and your hand could be pulled into the saw blade.

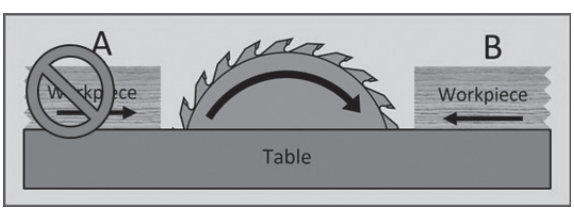


*Figure 1. Recommended feed direction on a table saw*
*Slika 1. Preporučeni smjer posmaka na stolnoj pili*

Table saw injuries can be grouped into blade contact injuries and non-blade contact injuries, which include blunt trauma due to kickback, eye or respiratory injuries due to sawdust, *(Chung et al., 2013)*. Accidental table saw injuries are common and approximately 30,000–40,000 injuries by table saw occur in the United States

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annually. While 85% of injuries are caused by unwanted contact with the blade, the remainder of injuries are caused by kickback, *(Simon et al., 2021)*. Deaths related to table saw injuries are uncommon. However, 10 percent of recorded incidents lead to permanent disability. There are 10 amputations every day due to finger and hand contact when using a table saw *(Table Saw Injury Statistics, 2023)*.

Statistical data, figure 2, displays the number of amputations due to table saw blade-contact injuries in the U.S. from 2004 to 2015. According to the data, in 2004, 5,100 amputations occurred due to table saw blade injuries. More recently, in 2015, table saw blade injuries resulted in 4,700 amputations.

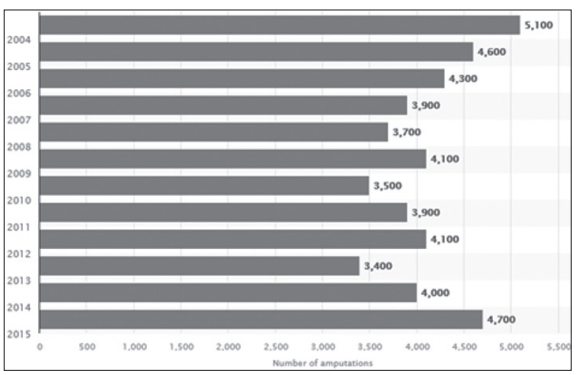


*Figure 2. Number of amputations due to table saw blade-contact injuries in the U.S. from 2004 to 2015*

*Slika 2. Broj amputacija zbog kontakta s oštricom stolne pile u SAD-u od 2004. do 2015. godine*

Table saw safety systems include: blade guard, riving knife, guard around the transmission mechanism, rip fence, a chip and dust removal system and pushers (push stick / demountable power feed). The paper presents an analysis of the application of safety systems on table saws

## MATERIAL AND WORKING METHODS

### Defining the research problem

In the available literature we can find information about identified hazards, risk assessment, safety measures and injuries at work when using table saws. The research problem is the lack of data in the available literature related to the existence and correctness of the safety system in the table saw. The paper *(Gavanski, 2022)* provides an analysis of the application of four safety systems, such as: blade guard, riving knife, guard around the transmission mechanism and rip fence. The aforementioned research was extended by two more safety systems, such us: a chip and dust removal system and pushers (push stick/demountable power feed).

### The aim of the research

The first aim of the research is to determine the percentage of table saws in the observed companies that have non-conformities in relation to: blade guard, riving knife, guard around the transmission mechanism, rip fence, a chip and dust removal system and pushers (push stick / demountable power feed). Another research problem is the lack of data on whether more safe or unsafe table saws are used.

### Research hypothesis

The assumption is that over 50% of the table saws analyzed are unsafe to use, because they lack the three most important safety systems: blade guard, riving knife and guard around the transmission mechanism.

### Research methods

In the paper *(Gavanski, 2022)* a checklist was used with the offered answers "Dangerous", "Not Relevant" and "Safe". A modified, expanded checklist with 6 instead of 4 questions related to table saw safety systems is proposed. After completing the checklist, answers of the type "Safe" and "Not Relevant" do not require taking corrective measures, while answers of the type "Dangerous" require analysis and proposed measures that are entered in the column "Corrective measures which should be applied". The method of description was used, that is, the procedure of describing by giving comments on the questions asked, *(Gavanski, 2022)*. An example of a completed newly-formed checklist for the analysis of safety systems on table saws is given in Table 1.

**Table 1. Analysis of the application of the safety system on table saws (D – Dangerous, N/R – Not Relevant, S – Safe)**

**Tablica 1. Analiza primjene sigurnosnog sustava na stolnim pilama (D – Opasno, N/R – Nije relevantno, S – Sigurno)**

| ANALYSIS OF THE APPLICATION OF THE SAFETY SYSTEM ON TABLE SAWS | | | | | 14/18 | 23.11.2022. |
|---|---|---|---|---|---|---|
| Name and registered office of the employer | | | | / | | |
| Activity (business area) | | | | / | | |
| Type of machine | | Table saw | | Manufactures | | / |
| Type / model | | / | | The year of production | | / |
| Serial number | The question | Comment | D | N/R | S | CORRECTIVE MEASURES which should be applied |
| 1. | Blade guard | There is a blade guard. | | | | |
| 2. | Riving knife | There is no riving knife behind the saw blade | | | | Install riving knife |
| 3. | Guard around the transmission mechanism | There is a guard around the transmission mechanism | | | | |
| 4. | Rip fence | There is a rip fence. | | | | |
| 5. | A chip and dust removal system | There is a chip and dust removal system | | | | |
| 6. | Push stick / Demountable power feed | There is a plastic push stick. | | | | |

### A sample research

The duration of the research is limited to a maximum of one month and was carried out in 18 companies during November 2022. The research included a sample of 18 table saws for which data on the existence of a safety system was collected.

## RESEARCH RESULTS AND DISCUSSIONS

The results of research related to the existence of a safety system on table saws: a blade guard around the saw blade, a riving knife, a guard around the transmission mechanism, a rip fence, a chip and dust removal system and pushers (push stick / demountable power feed) are given in Table 2.

**Table 2. The result of the analysis of safety systems on table saws**

**Tablica 2. Rezultat analize sigurnosnih sustava na stolnim pilama**

| SAFETY SYSTEMS | ANALYSIS OF THE APPLICATION OF THE SAFETY SYSTEM ON TABLE SAWS | | |
|---|---|---|---|
| | The total number of analyzed table saws | Number of negative (dangerous) answers | % negative answers |
| Blade guard | 18 | 5 | 27,78 |
| Riving knife | 18 | 9 | 50 |
| Guard around the transmission mechanism | 18 | 7 | 38,89 |
| Rip fence | 18 | 11 | 61,11 |
| A chip and dust removal system | 18 | 17 | 94,4 |
| Push stick / Demountable power feed | 18 | 0 | 0 |

The main danger of injuring the worker while working on a table saw is the rotation of the saw blade. Protection is achieved by using and properly fitting a blade guard, which prevents accidental contact of the worker's hand with the saw blade, as well as material particles flying into the worker's eyes.

Of the total number of analyzed table saws, five, that is, 27.78%, were not equipped with a blade guard around the saw blade, Figure 2/left. Thirteen table saws have a blade guard around the saw blade, that is, this protection measure is fulfilled by 72.22%, Figure 3/middle/right.

*Figure 3. Blade guard*
*Slika 3. Štitnik oštrice*

Riving knife, which is placed directly behind the saw blade, has the basic function of preventing narrowing of the resulting slot in the workpiece and possible kickback *(Trbojević, 2015)*.

Examples of table saws with a riving knife are given in Figure 4. The riving knife has nine analyzed table saws, so 50% of these machines meet this safety measure.

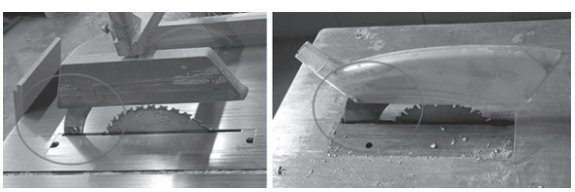

*Figure 4. Riving knife*
*Slika 4. Nož za rascjep*

Seven, i.e. 38.89% of the analyzed table saws, do not have a guard around the transmission mechanism, Figure 5/left. A closed case (Figure 5/middle) or protective armor (Figure 5/right) is used to protect the worker from catching the saw blade under the work table or transmission mechanism.

*Figure 5. Guard around the transmission mechanism*
*Slika 5. Zaštita oko prijenosnog mehanizma*

On the working table of the table saw there are rip fence that ensure the guidance of the workpiece, whether it is cut longitudinally, transversely or at an angle *(Trbojević, 2015)*. Eleven, or 61.11% of analyzed table saws do not have a rip fence.

Modern constructions of table saws have mechanisms that can instantly stop the rotation of the saw blade - the cutting plate in case of need *(Trbojević, 2015)*.

SawStop technology, Figure 6, stops the saw blade when contact with skin is made, resulting in a small cut, rather than a more complicated laceration or amputation *(Chung, 2013)*.

SawStop is a table saw manufacturer that has developed the first passive safety system for table saws *(Decoding SawStop's Finger ..., 2022)*. The SawStop safety system is designed to stop the blade within five milliseconds of detecting contact with skin. Its key to the system's success is its ability to quickly and accurately sense when the skin has come into contact with the blade. The blade itself carries a small electrical signal. Because the human body is conductive, the signal changes when skin contacts the blade. By activating the safety system, the blade stop system is activated, wghich stops the spinning blade by contacting aluminum brake springs *(How Do Table Saws Detect Fingers, 2023)*. SawStop is not designed to replace traditional blade guards and safe practice, but to add an extra level of protection when cutting wood *(Chung, 2013)*.


*Figure 6. SawStop passive safety system for table saw*
*Slika 6. SawStop pasivni sigurnosni sustav za stolnu pilu*

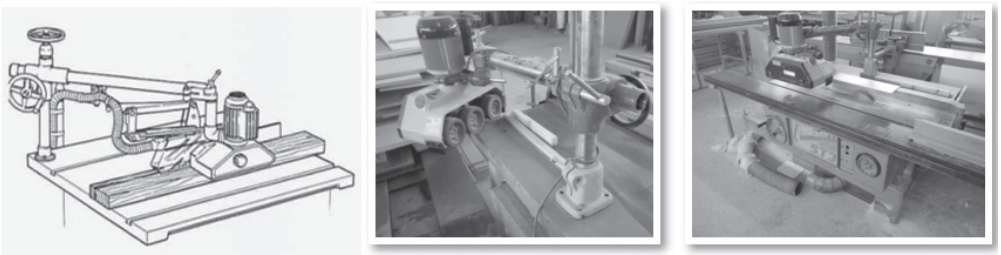

*Figure 7. Using a demountable power feed*
*(left - Circular saw benches – Safe working practices / middle and right)*
*Slika 7. Korištenje mehaniziranog potiskivača*
*(lijevo - Stolovi za kružne pile – Sigurne radne prakse / sredina i desno)*

A push stick (manual pusher) and/or a demountable power feed (a mechanized movable pusher) can be used to push the workpiece. The demountable power feed has the task of preventing contact of the worker's hand with the blade and kickback. All analyzed table saws had a push stick, and none of them had a demountable power feed, Figure 7. A chip and dust removal system has only one table saw, Figure 5/middle.

**Table 3. The result of the analysis of safety systems on table saws – Blade guard, guard around the transmission mechanism and riving knife**

**Tablica 3. Rezultat analize sigurnosnih sustava na stolnim pilama – štitnik oštrice, štitnik oko prijenosnog mehanizma i noža za rascjep**

| SAFETY SYSTEMS | TABLE SAWS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Blade guard | + | - | + | + | - | - | + | + | - | + | + | - | + | + | + | + | + | + |
| Riving knife | + | - | + | + | - | - | - | - | - | - | - | - | + | + | + | + | + | + |
| Guard around the transmission mechanism | + | - | + | + | - | - | + | + | - | + | - | - | - | + | + | + | + | + |

Of the 18 analyzed table saws, eight (44,44%) have the three most important safety systems: (blade guard, riving knife and guard around the transmission mechanism) and five (27,77%) has none of these three safety systems, Table 3. Further, three (16,66%) table saws do not have a riving knife, one do not have a guard aroung the transsmision mechanism and one do not have riving knife and guard around the transsmision mechanism.

## CONCLUSION

The paper analyzes the application of the safety system on table saws, which are among the most common woodworking machines. Analysis of the application of the safety system, such as the blade guard, riving knife, guard around the transmission mechanism, rip fence, a chip and dust removal system and pushers (push stick / demountable power feed) was done for 18 table saws.

In those 18 analyzed table saws, the blade guard around the saw blade is absent in five (27.78%), the guard around the transmission mechanism is absent in seven (38.89%), the riving knife is absent in nine (50%), eleven (61.11%) do not have a rip fence. All analyzed table saws have a push stick and only one equipped with chip and dust removal system

The research hypothesis was proven based on the analysis of the application of the safety system on 18 table saws, where it was determined that ten (55.55%) table saws are unsafe to use because they are not equipped with a blade guard, riving knife and guard around the transsmisin mechanism.

Further research should be focused on the analysis of the application of safety systems on table saws on a much larger sample in order to obtain more relevant data.

## LITERATURE

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## *NOVI POPIS STAVAKA ZA ANALIZU PRIMJENE ZAŠTITNIH MJERA ZA STOLNE PILE*

*SAŽETAK: Cilj rada je analiza primjene sigurnosnog sustava za rad na stolnim pilama. Predstavljena je metoda istraživanja za potrebe analize zaštitnih mjera i to uporabom novoformuliranog popisa. Istraživanje je provedeno na uzorku od 18 stolnih pila i utvrđeno je da je preko 50 % strojeva nesigurno za uporabu. Prikazani su rezultati analize primjene zaštitnih mjera za rad na stolnim pilama i predloženo je daljnje istraživanje.*

***Ključne riječi:*** *stolna pila, sustav zaštitnih mjera, metodologija, analiza, novi popis*

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