

KOKKUVÕTE

Käesoleva lõputöö eesmärgiks oli tutvustada braking chopperi koostejaamas toodetavate toodete tööpõhimõtet, analüüsida kasutusel oleva koostejaama ohutust ning seejärel projekteerida parendatud koostejaam koos puhversüsteemiga.

Kuna tegu ei ole eriti laialt tuntud tooteklassiga ja inglisekeelsele sõnaühendile braking chopper puudub isegi eestikeelne tõlge, alustati esmalt tööd nende tutvustusega. Välja toodi antud elektrilise pidurdamise meetodi eelised ja puudused ning olukorrad, kus on seda mõistlik kasutada.

Seejärel analüüsiti ABB ajamite tehases toodetavaid braking chopperi tooteid ning nende tootmiseks seni kasutusel olnud tootmisala. Ohutuse analüüsi tulemusena toodi välja kolm peamist puudust: toote jahutuselementide kinnitamise puudulik protsess, valmistoodete kukkumisoht lõppkontrolli alale transpordi käigus ja oht tootmistööliste tervisele raskete valmistoodete tõstmisel. Välja arutati riskihinne töötajate tervisele ning võeti eesmärgiks viia see kõige madalamale tasemele.

Teises peatükis alustati kõigepealt antud koostejaama tähtsaima osa projekteerimisega, milleks on suuremõõduliste toodete koostamiseks kasutatav pöördlaud. Välja töötati lahendus, kus toote korpus kinnitatakse laua külge ja selle peale fikseeritakse jahutuselemendid spetsiaalse rakise abil. Laua pealmise osa saab 90-ne kraadi ulatuses üles tõsta ning seejärel sisestada ja kinni keerata jahutuselementide kinnituspoldid. Samuti sai teises peatükis projekteeritud valmistoodete puhver, kuhu mahub kuni 10 toodet.

Töö lõpus sooritati uuesti terviseriski arvutus ning leiti, et toodete koostamise alal vähenes see eesmärgiks püstitatud madalaimale tasemele. Samuti vähenes riskihinne lõppkontrolli alal, kuid riskitase ei muutunud.

Lõputöö tulemusena valmis koostejaama 3D mudel, mis sai edastatud ettevõtte ABB käsutusse. Samuti sai tellitud ning kokku pandud töötav prototüüp jahutuselementide fikseerimise rakisest.

Lõputöö autor tõdeb, et ettenähtud ajaraami jooksul loodud lahendus ei ole veel kasutuselevõtu seisukohalt piisavalt valmis ning vajab edasist arendustööd. Sellele vaatamata andis tehtud töö ettevõttele palju infot, et millises suunas tuleks antud projektiga edasi liikuda.

SUMMARY

The aim of this thesis was to introduce the working principle of the products produced in the braking chopper assembly station, to analyze the safety of the assembly station in use, and then to design an improved assembly plant with a buffer system.

Since it is not a particularly widely known product class, and the English word combination braking chopper does not even have an Estonian translation, the work first started with their introduction. The advantages and disadvantages of the considered electric braking method and the situations where it makes sense to use it were brought out.

Then, the braking chopper products produced at the ABB drives factory and the production area used for their production until now were analyzed. As a result of the safety analysis, three main shortcomings were pointed out: an incomplete process of assembling the product's cooling elements, the risk of finished products falling when being transported to the final inspection area, and the risk to the health of production workers when lifting heavy finished products. The risk score for employees' health was calculated and the goal was to bring it to the lowest level.

In the second chapter, firstly, the most important part of this assembly station was designed, which is the rotary table used for assembling large-sized products. A solution was developed where the product body is attached to the table and the cooling elements are fixed on top of it using a special jig. The top part of the table can be raised up to 90 degrees, and then the fixing bolts for the cooling elements can be inserted and tightened. Also, in the second chapter, a buffer of finished products was designed, which can hold up to 10 products.

At the end of the thesis, the health risk calculation was performed again, and it was found that in the area of assembly station it was reduced to the lowest level that was set as a goal previously. The risk score in the final inspection also decreased, but the risk level did not change.

As a result of the thesis, a 3D model of the assembly station was completed, which was handed over to the company ABB. A working prototype of the jig for fixing the cooling elements was also ordered and assembled.

The author of the thesis acknowledges that the solution created within the prescribed time frame is not yet sufficiently ready for deployment and needs further development work. Despite this, the work done gave the company a lot of information about the direction in which to move forward with this project.