Project Plan -

Smart Solutions Semester

REV’IT!

L.26195 Testing device membrane fabrics for motorcycling



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L.26195 Testing device membrane fabrics for motorcycling

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REV’IT!

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11th of September 2019

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# Preface

This research report for REV’IT! is commissioned by Saxion University of Applied Science as part of the Smart Solutions Semester. The following study fields are involved; Electrical Engineering, Mechanical Engineering and Fashion and Textile Technologies.

  The goal of this research is to provide REV’IT! a breathability testing device for membrane fabrics for motorcycling garments. The purpose of this report is to implement our knowledge and to combine the knowledge of each team member to fulfill the requirements of the company.

The group exists of five team members from different specializations: Harold Kip (MT), Le Van Hoang Minh (EIE), Dimitar Rangelov (EIE), Femke Visser (FFT) and Isabel Wesselink (FFT).

September 12, 2019

Enschede

# Introduction

REV’IT! is a Dutch company, based in Oss, which develops innovative motorcycle clothing since 1995. REV’IT! is a worldwide known company with over a thousand dealers all over the world. After five years REV’IT! introduced the ‘Engineered skin design’ concept, a new method for product development. A groundbreaking method to deliver higher protective motorcycling products. In 2009 REV’IT! made a license agreement with Gore-Tex. By combining Gore-Tex with the Engineered skin, the performance and safety of the products have improved (REV'IT!, 2019).

REV’IT! makes motorcycle clothing for men and women from 18 years and older. The company creates collections which are divided in three different types of motorcycle garment categories: Sport, Adventure and Urban. These categories are based on the level of performance of the motorcyclist. REV’IT! also provides a lifestyle collection for both men and women.

With the lab located in Oss, REV’IT! tests their own fabrics at their own headquarters. Before the garments are produced the fabrics will first be tested in the lab. The fabrics are tested on their safety level to see if the products fulfill to the standards. An example of these tests is the tensile strength test, abrasion resistance, dimensional stability and many more (REV'IT!, 2019).

All information is acknowledged on the 5th of September 2019 by Mr. Memel, the Lab Coordinator at REV’IT! Oss.

## Problem analysis

REV’IT! is currently testing breathability of membranes in combination with different types of fabrics according the ISO 2528-A2 standard. The standard clearly defines the use of a predefined aluminum cup that is filled with 100 grams of distilled water. The fabric is placed on top of the cup with an airtight seal around the corners, so the only way for the water to get out of the cup is through the fabric. The whole setup of the cup and fabric is placed in an oven of 32 to 37 degrees Celsius depending on the type of experiments that are needed. After 120 hours, the cup is removed from the oven for measurements that are evaluating how much water has evaporated through the fabric. This value then gets extrapolated to the international standard of grams per square meter per 24 hours (Huang & Qian, 2008).

REV’IT! is defining the current testing procedure as not efficient and would like to change it. They are not able to monitor the behavior of the environmental data within the test. However, one of the most important things is to be able to monitor and test the behavior of the fabrics in combination with the membranes for breathability in different phases of the test. For example, the well-known Gore-Tex fabric requires a certain amount of time to start functioning in full capability. It is important to know when fabrics in combination with a membrane becomes breathable. This variable is of great importance for REV’IT! as they offer biker wear for different kinds of motorcyclist, each with different requirements. Furthermore, these values and information will result in a more efficient match of fabrics with membranes for the type of bike activities (Sport, Adventure and Urban).

## Research objectives

The most important factor for designing a motorcycling suit is protection. At the same time, the suit must also be comfortable at all times in all weather conditions. Ventilation is therefore key. The vapor permeability of the motorcycling garments must be high so the sweat can be evaporated. Different fabric compositions are required for each type of motorcyclist. For example, an urban motorcyclist who is riding a motorcycle for a short period of time would need a motorcycling suit which evaporates faster than a motorcyclist who is spending a couple of hours. The fabrics for the garments are combined with membranes so it feels comfortable on the skin (de Rome, 2019). The most commonly used membrane is Gore-Tex. Gore-Tex prevents water from penetrating and allows evaporation of sweat, which is known as the wicking-effect. Gore-Tex provides the wearer a thermal protection, reduces heat and allows the wearer to move (Ismal & Paul, 2018).

The fabrics used within the products must meet certain quality standards. One of these standards is the ISO standard. The ISO standard for permeability is the ISO 2528:2017 standard. The fabrics are tested according to the ISO standard and are after determined whether the fabrics can be used for production (ISO, 2017).

## Research question and sub questions

To address the problem, as described in 1.1 Problem Statement, the following main and sub-questions have been composed.

**Main question**

To what extent can a device be developed which can gather the data of the evaporation time, humidity and temperature in the oven, weight of the six cups and breathability of the membrane out of the permeability test to enable the company to understand the behavior of different fabrics?

**Sub-questions**

Sub question 1: What is the permeability test?

Sub question 2: What is the effect of the humidity within and outside the cups?

Sub question 3: What is the effect of the temperature difference within and outside the cups?

Sub question 4: What kind of equipment is required to develop and design the test?

Sub question 5: What is the effect of testing a membrane on breathability with different fabrics?

# Methods

This chapter describes the methods used within the research for REV’IT!

## 2.1 Literature research

A qualitative literature research has been carried out to answer all sub questions to obtain general information about the subjects.

## 2.2 Interviews

Semi-structured interviews were conducted to answers sub question one and four. Interview schemes have been made before the interviews and there were possibilities for extra questions during the interviews. Jorrit Memel was the only person who has an understanding about the testing method at REV’IT! Therefore, the population and the sample of the interviews are one. The interviewees were approached for the interview by email and the interviews were held at Saxion Enschede via Skype.

## 2.3 Measurement

To answer sub questions six and seven a measurement has been carried out to obtain information about the subjects. These measurements have been carried out in a laboratory at the Epy Drost building of Saxion Enschede.

To answer sub questions two, three and five a previous measurement has already been carried out by Jorrit Memel in the lab at REV’IT! By researching these measurements different options for the testing devices can be thought of.

## 2.4 Simulation

To answer sub questions two, five and seven virtual simulations were used to test the effect of the membrane and the humidity inside and outside of the cups. By using virtual simulations, it is able to make the testing device.

# Role & Responsibility

Every person that is part of this project has a specific role and responsibility which corresponds to his or her specialty and interests. In this way everyone can use their full potential, and this will affect the end result.

See table 1 for the roles and responsibilities for everybody within the group.

Table 1

Roles & Responsibilities

|  |  |  |
| --- | --- | --- |
| *Role* | *Identity* | *Responsibility* |
| Chairman and Quality Manager | Femke Visser | Establishing a connection with the client and playing a role as contact person. Testing and evaluating the behavior and characteristics of fabrics and membranes. Also writing detailed quality reports. |
| Quality Manager | Isabel Wesselink | Testing and evaluating the behavior and characteristics of fabrics and membranes. Also writing detailed quality reports |
| Mechatronic Engineer | Harold Kip | Testing and developing the mechanical system of the device. Also forming mechanical electronics of the sensors in the final product. |
| Embedded Engineer and Software Developer | Dimitar Rangelov | Developing hardware and embedded software meeting the criteria and characteristic of the project. Also adapting or creating a firmware for representing the data of the tests. |
| Embedded Engineer | Mk Lê | Developing hardware and embedded software meeting the criteria and characteristic of the project. |

# Planning

See table 2 for the planning for all weeks during the project including facilities (working place (e.g. working space).

Table 2

*Planning*

|  |  |  |
| --- | --- | --- |
| *Week* | *Outcome* | *Facilities* |
| 1.1 | - First group meeting  - Kick-Off Smart Solutions Semester  - Meeting with REV’IT! |  |
| 1.2 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Researching ISO and MVTR standards.  - Send Project Plan to REV’IT! and the tutor  - Buy different types of sensors  - Request cup, membrane, fabrics and standards | OTSWO 3rd Floor - Epy Drost |
| 1.3 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Brainstorm for ideas testing device  - 22th of September Deadline: Final Project Plan  - Interview with Jorrit Memel (sub question 1)  - Literature research | OTSWO 3rd Floor - Epy Drost |
| 1.4 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Testing the cups with fabrics  - Literature research | OTSWO 3rd Floor - Epy Drost  Chemical lab - Epy Drost |
| 1.5 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Testing fabrics | OTSWO 3rd Floor - Epy Drost  Chemical lab - Epy Drost |
| 1.6 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Testing fabrics | OTSWO 3rd Floor - Epy Drost  Chemical lab - Epy Drost |
| 1.7 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping  - Testing fabrics  - 20th of October Deadline: First version personal portfolio | OTSWO 3rd Floor - Epy Drost  Chemical lab - Epy Drost  Hardware lab - Wolvecamp |
| 1.8 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 1.9 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 1.10 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 2.1 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 2.2 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 2.3 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping  - 8th of December Deadline: Second version personal portfolio | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 2.4 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 2.5 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Prototyping  - Preparations presentation Smart Solutions Festival | OTSWO 3rd Floor - Epy Drost  Hardware lab - Wolvecamp |
| 2.6 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - Finalize presentation Smart Solutions Festival | OTSWO 3rd Floor - Epy Drost |
| 2.7 | - Group meeting: Monday, Wednesday and Thursday  - Meeting with Jenny (tutor)  - Literature research  - 17th of January Deadline: Smart Solutions Festival | OTSWO 3rd Floor - Epy Drost |
| 2.8 | - 26th of January Deadline: Final version personal portfolio  - 26th of January Deadline: Final group products |  |

# Budget

To find the best solution a few prototypes need to be built, this so different tests can be run to see the effect of different sensors, the placement of the sensors and the ability to modify the cups for sensor usage. See table 3 and 4 for the budget which is needed for building the prototype. All products above are without VAT and shipping + handling

Table 3

*Electronic devices budget*

|  |  |  |  |
| --- | --- | --- | --- |
| *Electronic device* | *Amount* | *Costs per piece* | *Source* |
| SHT85 Humidity, Temperature Sensor | 1 | €25 | Mouser |
| ADA 2857 Humidity, Temperature Sensor | 1 | €15 | Mouser |
| FlexiForce A301 Sensor 1lb | 1 | €15 | Antratek |
| MINI LOAD CELL - 500G, STRAIGHT | 1 | €10 | Antratek |
| LOAD CELL AMPLIFIER - HX711 | 2 | €10 | Antratek |
| Controller | 1 | €20 | Antratek |

Table 4

*Mechanical devices budget*

|  |  |  |  |
| --- | --- | --- | --- |
| *Mechanical device* | *Amount* | *Costs per piece* | *Source* |
| Cups | 2 | €150 | Solidworks Cost Analisys |
| Oven Memmert UN30 | 1 | €1000 | Dijkstra Vereenigde |

# Risk analysis

To address the risks that can impact the research during the project a table has been made on how to manage the risks. See table 3 for the risk analysis and table 4 for the comparation of the maximum score and the actual score.

Table 5

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Category* | *Risk* | *Value\** | *Risk Chance* | *Risk Impact* | *Risk Tot* | | |
| Time factor |  |  |  |  |  | | |
| 1 | Estimated duration of the project | 2 quarters | 1 | 4 | 4 | | |
| 2 | Does the project have a deadline? | Yes | 0 | 4 | 0 | | |
| 3 | Does the project team have enough time to finish the project? | Yes | 2 | 5 | 0 | | |
| Complexity of the project |  | |  | |  |  |  |
| 4 | Is it an adjustment or a new project? | | New project | | 2 | 2 | 4 |
| 5 | Are there other projects dependent on this project? | | No | | 0 | 5 | 0 |
| 6 | Is the project divided by parts? And is the Project dependent on the connection between them? | | Yes | | 3 | 4 | 12 |
| The project group |  | |  | |  |  |  |
| 7 | Who are the project members? | | Students | | 3 | 4 | 12 |
| 8 | Will the project members feel responsible for the result? | | Yes | | 1 | 5 | 5 |
| 9 | Can the project members help each other? | | Yes | | 0 | 5 | 0 |
| 10 | Are there any users of the end result in the project group? | | Yes | | 0 | 3 | 0 |
| The Scrum master |  | |  | |  |  |  |
| 11 | Have the Scrum master any experience being scrum | | No | | 2 | 2 | 4 |
| 12 | Does the Scrum master feel responsible for the result? | | Yes | | 1 | 5 | 5 |
| 13 | Can the Scrum master help the project members with starting to work? | | Yes | | 2 | 4 | 8 |
| The tools |  | |  | |  |  |  |
| 14 | Can the hardware crash? | | Yes | | 4 | 5 | 20 |
| 15 | Can we lose all code when lap top crashes? | | No | | 0 | 5 | 0 |
| 16 | Do we have backup hardware? | | No | | 1 | 5 | 5 |
| 17 | Does every project member have experience with hardware | | No | | 3 | 4 | 12 |
| 18 | Does every project member have experience with the programing languages? | | No | | 3 | 4 | 12 |
|  | | | | | Total Points | | 113 |
| Total risk  percentage\*\* | | 25.1% |

*Risk Analysis*

\*Value chosen by leader

\*\*Total risk percentage is the total amount of points divided by 450 (max score) multiplied by 100

Table 6

*Maximum score vs actual score*

|  |  |  |  |
| --- | --- | --- | --- |
| *Category (with maximum score vs actual score)* | | *Maximum* | *Score* |
| Time factor |  | 75 | 14 |
| Complexity of the project |  | 75 | 16 |
| The project group |  | 100 | 17 |
| The Scrum master |  | 75 | 17 |
| The tools |  | 125 | 49 |

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# Appendices