NTNU – Trondheim
Norwegian University of
Science and Technology

Development of multiphase sampler

Videreutvikling av prøvetaker

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Industrial Design Engineering (2 year)
Submission date: June 2012
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Abstract

Typhonix is a small independent company based on the west coast of Norway working to optimize oil production processes offshore. As part of optimization Typhonix has developed a sampler, the Typhoon Multi Phase Sampler. It is essential that the samples are representative. The technology differs from conventional samplers by enabling the extraction of samples to do measurements such as oil / water and water / oil concentrations and droplet sizes that are representative to the process.

Based on the Tyhoon multiphase sampler technology I have in my master thesis further developed the Typhoon MultiPhase sampler with regards to product identity, future sample and analysing strategies, functionality and user aspects.
A representative sample is dependent on the right execution of the procedure. The new sampler is therefore developed with a new internal layout and an improved procedure.
Being a small company it is important to be noticed. The sampler has therefore been developed with not only an external layout that complements the internal layout but also that represents the companies identity.

Sammendrag

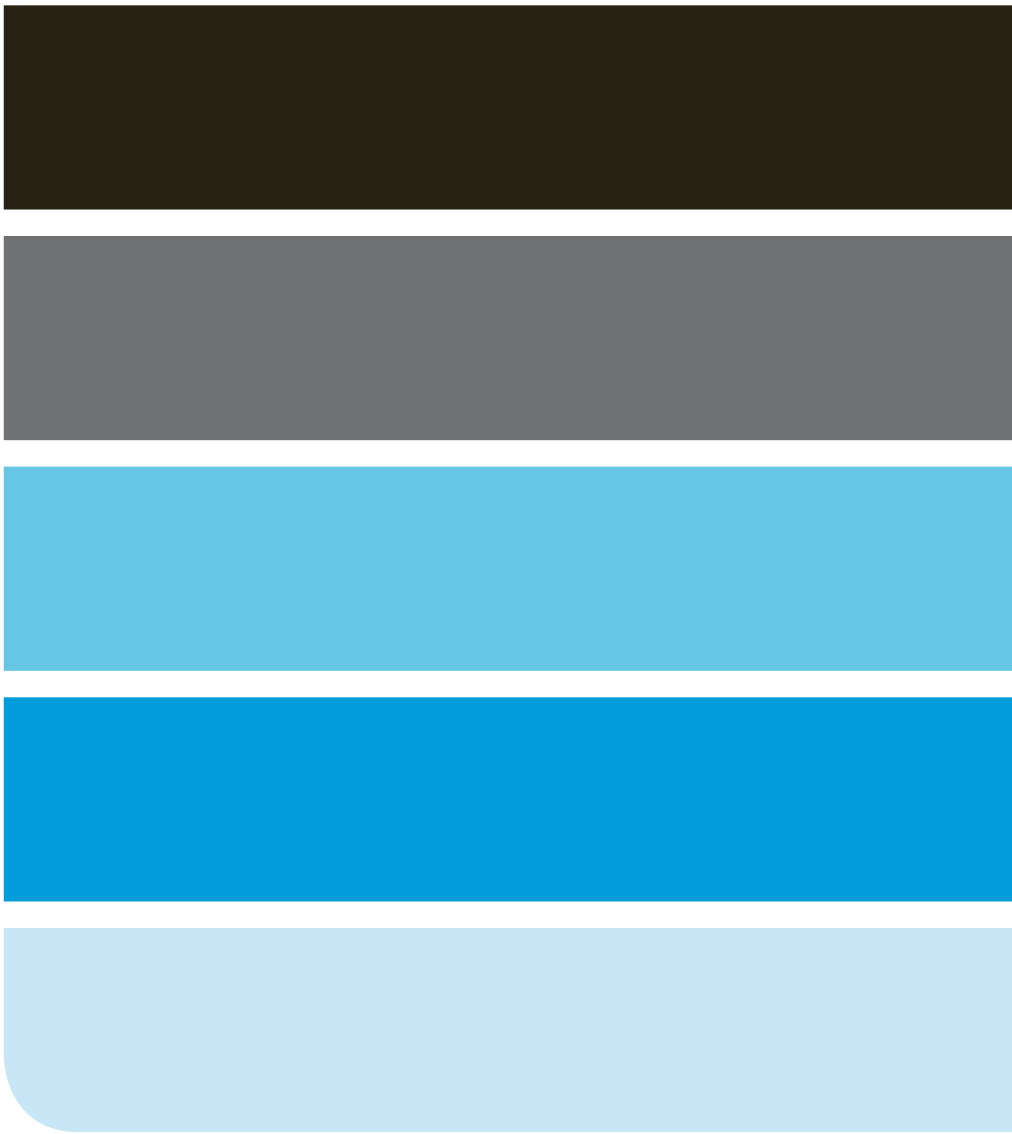
Typhonix er et uavhengig selskap basert på vestkysten av Norge. De arbeider for å optimalisere olje prosesser offshore. Som en del av optimalisering har Typhonix utviklet en prøvetaker, Typhoon Multi Phase Sampler. Det er viktig at prøvene er representative. Teknologien skiller seg fra konvensjonelle prøvetakere ved å muliggjøre utvinning av prøver for å kunne analysere olje / vann og vann / olje konsentrasjonsmålinger og dråpestørrelse målinger som er representative for prosessen.

Basert på prøvetakerteknologien har jeg i min masteroppgave videreutviklet prøvetakeren med hensyn på produkt identitet, fremtidige prøve og analyse strategier, funksjonalitet og brukervennlighet.
Et representativ prøve er avhengig av en sikker gjennomføringen av prosedyren. Den nye prøvetakeren er derfor utviklet med en ny intern layout og en tilhørende prosedyre.
For et lite selskap er det viktig å bli lagt merke til. Prøvetakeren er derfor utviklet med en ytre utforming som ikkje bare er i tråd med den interne layouten, men også som representerer selskapets identitet.

DEVELOPMENT OF THE

Typhoon MultiPhase Sampler

Master thesis 2012
Bård Sondre Dalen
Department of Product Design, NTNU
In collaboration with Typhonix AS



Project Name

Development of the Typhoon
MultiPhase Sampler

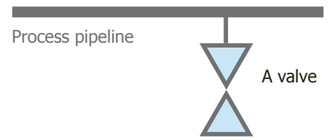
Duration

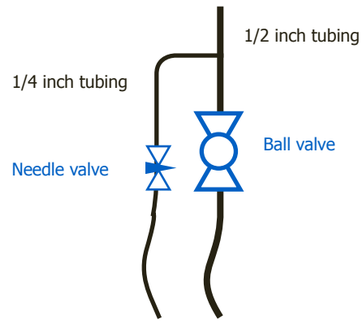
16 Jan - 11 June / 2012

Supervisors

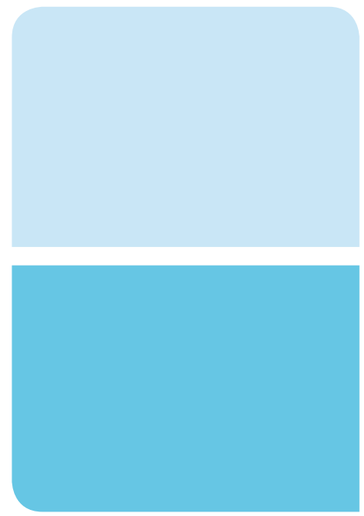
Jon Hermann Rismoen, NTNU
Ole Jørgen Engelsvoll, TYPHONIX

Symbols





Different images that belong together have a graphical layout as shown below. The two different colours represent two different images.



0.1 To the reader

My name is Bård Sondre Dalen and this is my master thesis after having doing a 2 year master in Industrial Design at the department of Product Design at NTNU, Trondheim. The project was done for and in collaboration with Typhonix AS, developing the Typhoon MultiPhase Sampler.

This paper will describe the process I have gone through in this project.

I spent most of the time working at Typhonix AS located at Varhaug, Jæren, on the west coast of Norway.

NTNU
Norges teknisk-naturvitenskapelige universitet

Fakultet for ingeniørvitenskap og teknologi
Institutt for produktdesign

Master thesis for student Bård Sondre Dalen

Development of multiphase sampler
Videreutvikling av prøvetaker

Background: As part of optimization of oil production processes offshore, it is common to take samples of the process using different collection methods, particularly the measurements of oil / water and water / oil concentrations and droplet sizes sampling is often done. When sampling, it is essential that the sample is representative of the real process plant, in relation to this Typhonix has developed a sampler; the Typhoon Multi Phase Sampler.
Assignment: It has been developed a prototype of Typhoon Multi-Phase Sampler that is about to be tested offshore. The assignment will consist of optimize the design of the sampler in terms of functionality and use, production, as well as optimizing the design to serve as a strategic tool in the marketing of TyphoniX.

The thesis will consist of:

- Analysis of: Typhonix
  The Typhoon Multi-Phase Sampler and other samplers
  The Users, usage and area of use
- Idea and concept development
- Evaluation
- Detailing and possibly prototype construction

The assignment is carried out according to the "Guidelines for Master thesis in Industrial Design."

Responsible teacher: Jon Herman Rismoen (NTNU)
Company contact: Ole Jørgen Engelsvoll (Typhonix)

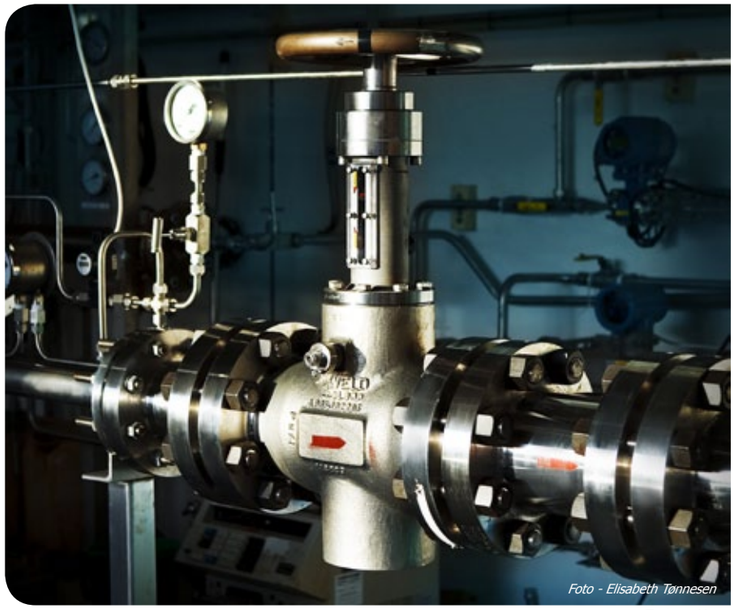
Start: 16. januar 2012
Delivery: 11. juni 2012

Trondheim, NTNU, 16. januar 2012

Supervisor
Jon Herman Rismoen

Head of department
Jon Herman Rismoen

0.2 Company Introduction

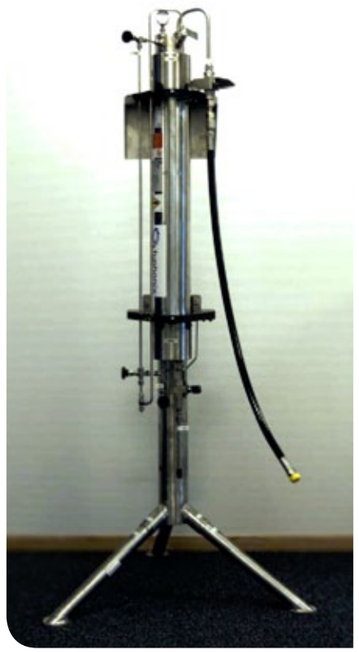


Typhoon Valve

Typhonix is a company is situated on the west coast of Norway. They work to optimize the production process on oil platforms, by developing new technology, methods and solutions within the combined fields of multiphase fluid flow control, transportation, oil/water separation and materials technology. One of the main goals in the production process is to separate petroleum liquid that comes from the well. It consists of crude oil, water and gas, these phases have a natural ability to separate because of the difference in density.

Typhonix work has resulted in products such as the Typhoon Valve (image on the left). A valve is a product that enables control of pressure and flow. The Typhoon Valve threats the liquid in a different way than conventional valves; the technology enhances the further separation process, leading to a cleaner oil phase and cleaner processed water. Processed water describes the water that will be sent back into the ocean.

The name Typhonix and the product name Typhoon is influenced from this technology. Inside the Typhoon valve there is formed a cyclone to better control this turbulent environment.



Typhoon MultiPhase sampler - Version 1

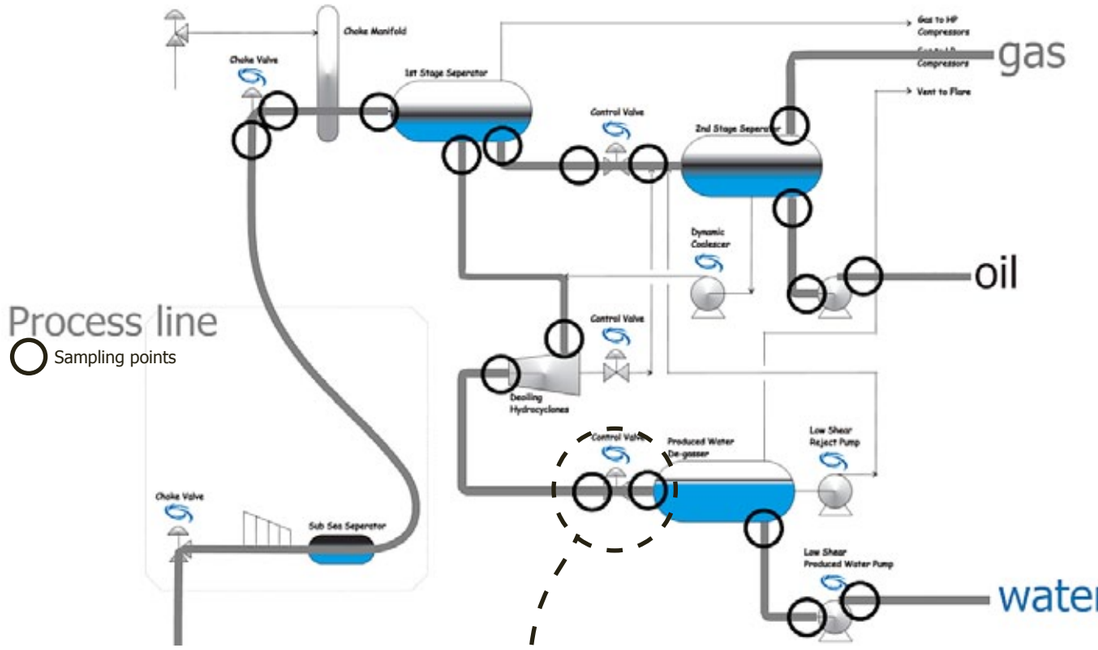


Fig 1 - Process line with sampling points
Base illu. made by Olav Austbø, Typhonix

0.2.1 Sampling

The Typhoon MultiPhase sampler is a bi-product that is derived from the need for a sampler that could extract representative samples (Liquid with equal qualities to the liquid inside the Pipeline) from the process line with any gas rate (image on the left). Typhonix need to measure the quality of oil and water to analyse the affect new or old equipments such as a valve have on the separation process. It is a too/instrument for optimization studies.

Conventional samplers extract samples that are kept mixed/homogenised, for instance in order to make fiscal measurements. Conversely Typhonix need to measure the quality of the different phases thus needs the fluid to separate in order to extract only oil and/or water samples. With their sampler technology they have the opportunity to extract samples (no mather how high the gas level rates are (GLR)) to measure the concentration of oil in water [OiW], water in oil [WiO], water droplet size or oil water droplet sizes. These measurements say something about the liquids ability to separate.
I short; the Typhoon MultiPhase sampler is an instrument that assists Typhonix with optimization studies.

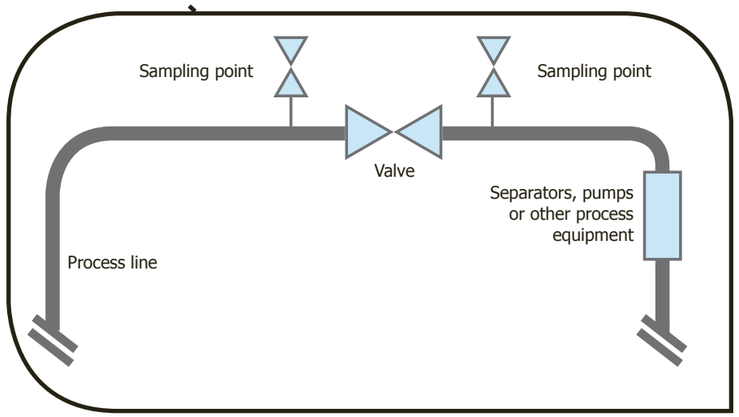


Fig 1 - Process line with sampling points

0.3 Project structure

The Typhoon MultiPhase Sampler technology invented by Typhonix and manufactored by Proserv is center of the research (Sampler version 1).
Meetings with Typhonix before project start gave me an idea of what Typhonix wanted done and also what I found important to research and analyse to improve theire sampler (Appendix, page 115 - 121). The project is therefore devided/separated into 4 areas of research that shall contribute to a new and imporved sampler (Typhoon sampler version 3). I have categorized these into the the 4 areas you see in figure 1.

0.3.1 Goal

In this project I will work to end up with a concept that shall be sufficient detailed *(Retningslinjer for masteroppgaver i i ndustriell design: Master thesis guidlines).*
How deep I will go into the 4 areas will therefore depedend on what I learn about sampling during the reaserach and what I will focus on to accieve this goal.

0.3.1.1 Refinements

Refienements will for the reason described above be found along the process, but a first limitation will be "the basis of development", the Typhhon MultiPhase Sampler of Typhonix, provided by Proserv.

The reason I do not create any bounadries from the beginning is that Typhonix and aspecially me do not know that much about the general world of sampling. So to keep an open mind I found it beneficial to do it like this.

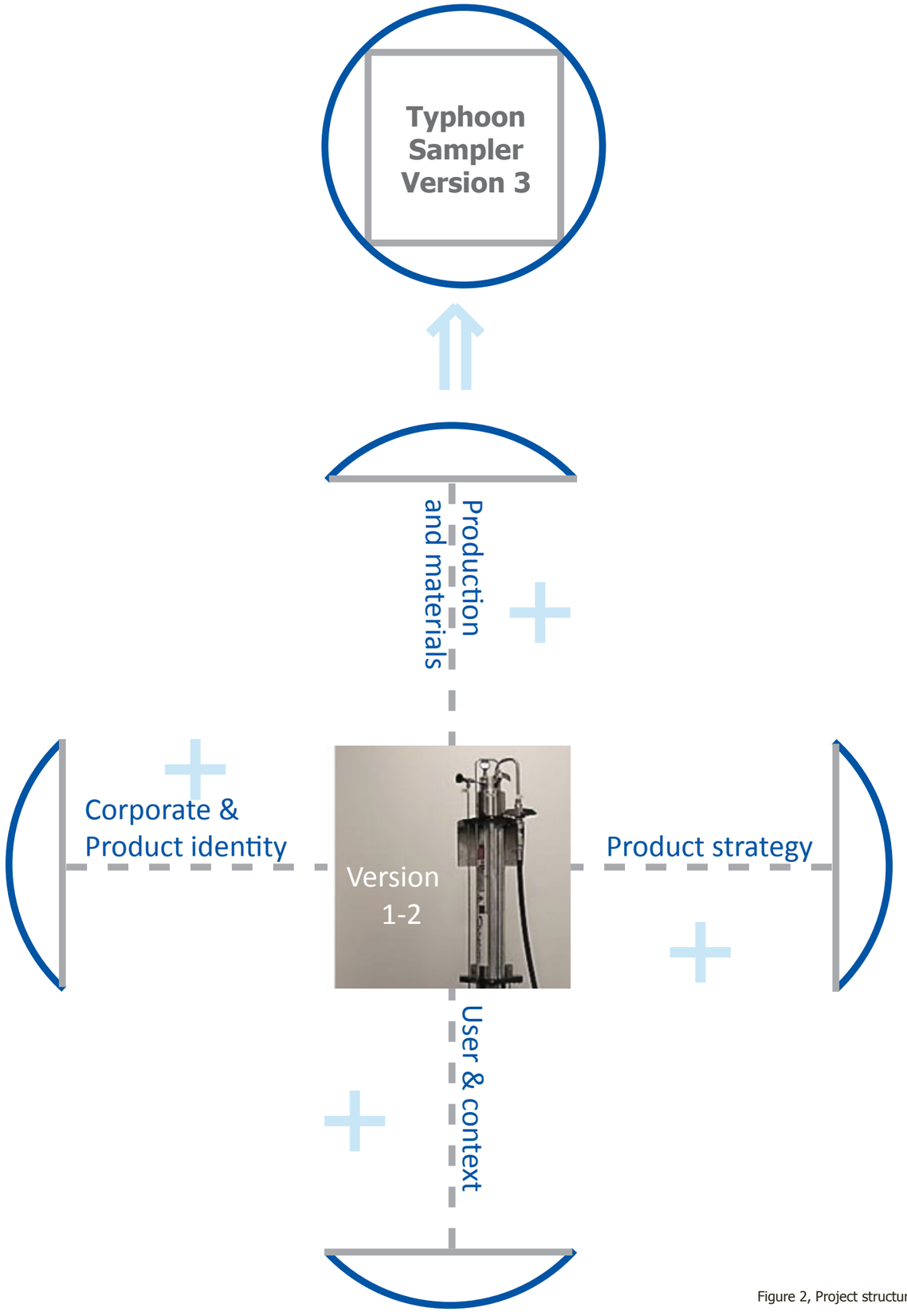


Figure 2, Project structure

ANALYSIS

1 TYPHOON MULTIPHASE SAMPLER - Version 1
Basis for further development

2 USER AND CONTEXT RESEARCH

3 PRODUCT STRATEGY

4 CORPORATE & PRODUCT IDENTITY

0.3.2
Research areas

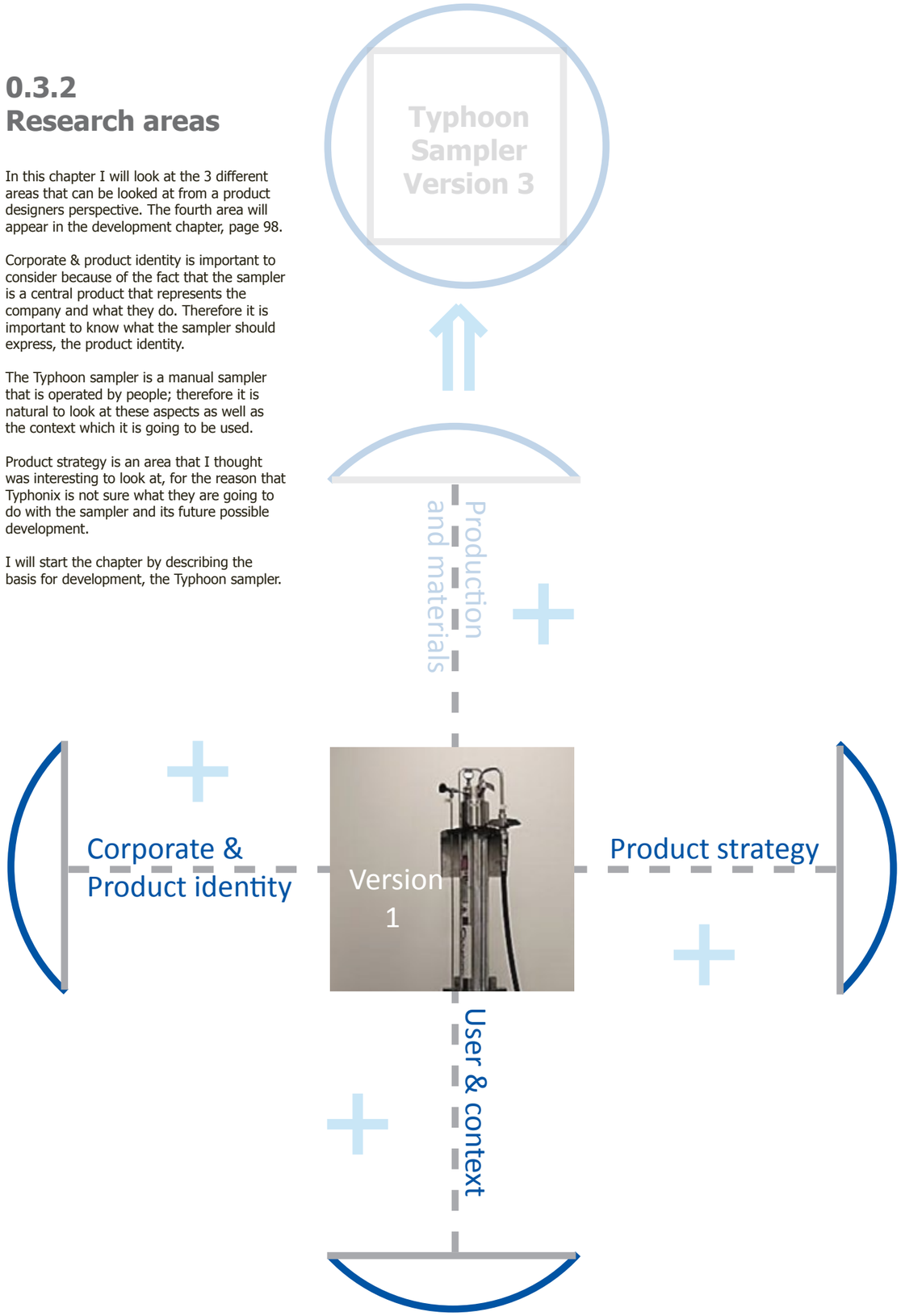
In this chapter I will look at the 3 different areas that can be looked at from a product designers perspective. The fourth area will appear in the development chapter, page 98.

Corporate & product identity is important to consider because of the fact that the sampler is a central product that represents the company and what they do. Therefore it is important to know what the sampler should express, the product identity.

The Typhoon sampler is a manual sampler that is operated by people; therefore it is natural to look at these aspects as well as the context which it is going to be used.

Product strategy is an area that I thought was interesting to look at, for the reason that Typhonix is not sure what they are going to do with the sampler and its future possible development.

I will start the chapter by describing the basis for development, the Typhoon sampler.



1 TYPHOON MULTIPHASE SAMPLER - Version 1
Basis for further development

This chapter will cover the necacerry elements concerning the sampler. The way it is constructed and why and how it is used. This is to get an understanding of what I am working with and what I need to take into consideration for further development.

1.1 TYPHOON MULTIPHASE SAMPLER

This type of sampler is new in the market, and the Typhoon Sampler is patented. Sometimes the qualities of the samples can be affected by poor sampling devices and procedures, leading to non-representative samples.
Problems such as non-isobaric conditions, shear forces, high gas rates and pressure release before sample extraction leads to droplet breakup, mixing, gas flotation effects and trouble with obtaining enough fluid. These are problems which the Typhoon Multiphase Sampler technology solves.

1.1.1 Areas of use

The Typhoon MultiPhase Sampler enables the collection of representative fluid samples from multiphase flows in petroleum production and process systems.
It can be used in process optimization studies, separation efficiency studies, oil and water quality assessments, as well as for the assessment of the efficiency of production chemicals.

For Typhonix the Sampler is like what a hammer is for a carpenter. It assists in the process of creating, in this case in optimization.
It is the tool needed when taking samples at offshore or onshore product process installations.

1.1.2 Basis for further development

The company that currently produce, assembles and realize the principal of the Typhoon Multiphase Sampler technology is Proserv AS. Proserv make sampling cylinders and have used their own pressure cylinders and added the internal tubing and valve layout needed and the support needed to heighten the sampler of the ground. The Typhoon sampler technology will be the base of further development in this project, meaning that the technology will not be put in question. The technology represented in the internal layout of the valves and tubings will make guidelines for other features. The most important aspect for a new sampler is to preserve the samplers ability to take representative multiphase samples.

The pressure container (the cylinder) will not be altered. The material used in the cylinder and the way it is constructed will stay as it is and will not be a focus area in this project. The focus will be on the external, both the aesthetical and functional aspects. By altering the cylinder you also need new certificates.

The sampler in the pictures was created for the purpose of use in a Pilot test of the Typhoon Valve at the Oseberg oilrig, from now called version 1. This test was conducted in the middle of my project. Typhonix has requested a second sampler from Proserv, version 2, by the end of April this will be delivered. This sampler will have an added valve for pressurized water samples, in order to measure the concentration of water in oil and water droplet sizes in oil. The sampler will in version 2 be mounted inside a cage instead of on a tripod. This change is done to better protect the parts and to transport the sampler more easily.
The sampler created in the end of this project will be the 3rd version.

1.1.3 Guidelines

The technology gives guidelines to what, how and where valves should be used. The suppliers of these products also set boundaries with what they can offer of fittings, pressure gauges and valves. These are factors that will affect the sampler internal layout. I will not describe every guideline concerning the patent, but they will never the less be followed.

1.2 Sampler construction

1.2.1 Support

When using the sampler you install it at the sampling point by lifting it onto a rack/tripod. The rack needs to be placed first.
The rack need to be assembled before use by mounting on three legs with a bolt and nut on each leg.

Sampler, without any tubes, valves, etc.

Rack/Tripod

Than you connect the hose to the sampling point and another hose between the outlet point on the sampler and the closed disposal at the oilrig.

After opening the valves on the process pipeline sampling point you can open the inlet valve found on the top at the same time observing the pressure gauge.

There are two ball valves; the one on top is the barrier between the pipeline and the sampler. The one in the bottom is used to extract water and oil samples when the sampler is de-pressurized.
In the image below you can see an empty pin on the right hand side. There is supposed to be a handle mounted on this, but it was temporary broken.

On this version you have three needle valves. The needle valve you see on the top is used to let gas out of the cylinder. The needle valve below that one is used to empty the container for fluid when under pressure. The last needle valve is found on the bottom. This one enables you to extract water samples into a bottle.

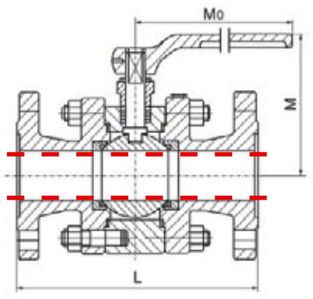
The images below show how exposed and vulnerable the tubes and valves are on the version 1. It also shows that there are now system and nothing that tell you what it is used for, except a number to refer to.

1.3 Sampler parts

The sampler except the tripod is built by the compani Proserv. The pressure container has been tested to 200 bar, and is approved for pressure up to 150 bar, by Proserv. The total weight of both the sampler and the tripod is over 40 kilos.
The sampler without the tripod consists of; valves, tubes, fittings, PRV (pressure release valve/safety valve) a pressure container (the sample container), mounting brackets, a pressure gauge, a level indicator and a handle.

1.3.1 Ball valves

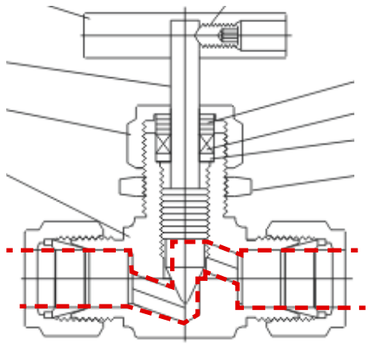
Proserv have on the 1st version of the Typhoon sampler used the brand Parker for ball valves. There is the possibility of using Swagelok, something that was a wish from Typhonix and therefore used on the 2nd version. The picture above illustrates a Parker 1/2" ball valve used for the inlet and outlet on the Sampler version 1. The valve can be mounted in panels. Ball valves are opened and closed by turning a handle in a movement of 90 degrees. When turning the handle a ball with a hole will rotate inside the valve. You can choose ball valves that are "full bore", this means that the diameter of the inside of the valve (the CV) are the same diameter as the tubing leading in to the sampler. This means that there are no restrictions affecting the fluid running through. This is an important element of the Typhoon Sampler technology. This makes the sample fluid not being affected by share forces do to restrictions trough the inlet or outlet.



It is possible to change the handles. The valves have a socket cap screw that unlocks the handle from the valve.

1.3.2 Needle valves

The needle valves are used for extracting pressurized samples, and releasing pressure on this sampler. Because of its construction you have more control over the flow.
To open or close a needle valve you turn the handle formed as a rotating button. Unlike a ball valve the inside of a needle valve are "winding", and gives more restrictions to the fluid and sheare forces may therefore affect the fluid (red line).
When you rotate the handle a stem will work itself downwards or upwards, releasing more or less water through the valve. These stems can vary in material and construction depending on what material should flow through it. Therefore it is beneficial to choose a specific valve for the gas outlet. A stem suited for gas is called by Swagelok a "Soft-seat" stem.



Valves also vary in what pressure range they are suited for and matter running through.

1.3.3 Sample container

The sample container is certified to 150 bar. It is constructed for Proserv use and needs. So for instance the hole you see on the side of the cylinder and everything else that goes above the adapters is usually used for having valves sticking out and protects the valves. Cutting these away will not be an option, when this would affect the certification of the pressure container. Even though they serve no purpose on the Typhoon sampler, but add weight and make it longer, the cylinder will for these reasons not be altered.

In the top and bottom of the sample container there are adapters with two NPT holes. You have the opportunity to turn the adapters in steps of 90 degrees because of the adapter bolts holding the adapters in place. This is the only change you can do with the sample container.

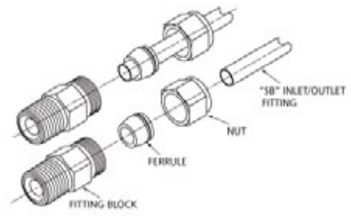
The containers specifications are:

Volume: 4 Litres
Height: 850mm
Diameter: 114mm
Weight: 13 kg (only cylinder)

1.3.4 Tubes

The tubes vary from ¼ inch to ½ inch. The tubes can be bent in different angles. ½ inch tubes are used for in the inlet and outlet in order to make high viscous crude oils flow easier through the system.

1.3.5 Fittings



NPT fittings and tube fittings are the two main fittings used. NPT fittings are tapered threads that are either female or male. In the picture above you can see an NPT in the left corner.
You can see a tube fitting in the right top corner. A tube fitting is used by inserting a tube into the fitting and then tightening a hex nut.
There are many types of fittings. In the picture below you can see a T-fitting, two 1/2" tube fittings with a 1/4" female NPT connection going out, with a tube and NPT adapter going into it. The white stuff is thread tape creating a sealed fit.

1.3.6 Safety/release valve - PRV

The safety valve is the valve that opens if the pressure goes above the certified pressure that is 150 bar. The PRV is adjustable. It is important of this valve has the capability of releasing the same amount of fluid that enters the container. This means it has to have a CV up to and over 1/2".
These valves are often big and heavy the size is shown on the second image below. The PRV used on version 1 (Image below) did not meet these requirements. This is smaller, lighter and more than half the size of the needed PRVs.

Version 1 - PRV

Version 2 and 3 - Full bore PRV

1.3.7 Hoses

Two hoses, one will connect to the pipeline and the other to the disposal equipment. The valve fittings will vary from place to place, so there will be a need for different connectors.

The use of containers made of non-linear polyethylene may lead to sample contamination and/or sample container failure (5.5, ISO 3170:2004(E)) That is why the tube is made as short as possible. That is also why the sampler is stationed close to the product line sampling points.

1.3.8 Pressure gauge

The pressure gauge currently used on version 1 is an analogue gauge. According to the procedure for the use of the sampler it is important to be aware of pressure-variations when operating the sampler. In the 2nd version of the sampler a digital pressure gauge will be mounted. The picture above show the digital test gauge XP2 used on version 2.

1.3.9 Level indicator

The level indicator is not mounted on version 1, but will be mounted onto the second version. The principal solution is to use a floater inside a tube connected to a magnet. The magnet will interact with another magnet in a tube that will show the level inside the container. But in the 2nd version they had trouble with the floater because of the high pressure. The two magnets had trouble interacting. So this was solved by using an EX approved magnetic pen (Ecom: Magnet-Ex 12). This pen lights up when close to a magnet.

1.3.10 Mounting brackets

Two brackets, one on the top and one on the bottom are used to mount tubes and rack/tripod onto. The brackets orignial function is as legs when on the ground and to hold a cylinder that works as a handle. The brackets are made of plastic, POM, Polyoxymethylene. The material has mechanical properties that make it suitable for machining.

1.4 New procedure

The procedure described here is based on the procedure that was created for the Oseberg version, sampler 1. The procedure on the right is a version based on that one, but it has been altered to fit a sampler with a level indicator and an extra valve. The valves have also been given names and different stages of the procedure have been sorted into categories/sequences.
This was done in collaboration with Typhonix to define a proper procedure.

1.4.1 Sampling procedure and principle

This is the procedure that explains how to use the sampler; version 1 + an added valve.

Sequence A - Preparation

Step 1
You connect the main Inlet Cable to the pipeline and the Outlet Cable to the disposal equipment. You cannot dispose gas into the atmosphere because of regulations concerning hydrocarbons.

Step 2
Open the valves at the pipeline. These valves can vary from place to place, so you may need different valve fittings depedending on the place.

Sequence B - Pressurizing

Step 3
To pressurize the container open the Inlet/Pressure Valve slowly to avoid rapid rise in pressure. The Release Valve will activate if pressure exceeds the containers pressure-limit at 150 bar.

Sequens C - Flushing

Step 4
When the Pressure Gauge has stabilized one can start to flush the non-isobaric fluid inside the container. You have to watch the pressure gauge to prevent pressure loss. You do this by opening the Flush Valve. When the level indicator has dropped to the bottom the container is empty for fluids, only containing gas.

Step 5
Close the Flush Valve, the sampler is now ready to extract the sample fluid.

Sequence D - Isobaric filling

You do now have a pressurized container, ready to extract a sample from the pipeline.

Step 6
Open the Filling valve to start the filling process. It is now critical that the pressure do not drop more than ca 0.2 bar. The reason for this is that Typhonix have estimated how much the drop in pressure can be before the sample gets affected, and therefore not being representative.

Step 7
When the Level Indicator have reached the top; close the Fill/Depressurizing Valve.
Close the Inlet valve.

Sequence E - Separating

You now have to wait for the phases to separate.

Sequence F - Pressurized sampling

To extract representative WiO (water in oil) and OiW (oil in water) samples the container is pressurized. The pipes are thinner and the valves are needle valves. The pipes and the needles make up an physical restriction so that the user do not open the valve to much and the pressure limit go above 0.2 bar. If the container was not pre pressurized there would occur gas flotation that would bring oil and water droplets to the surface ruining the representative concentration of oil in water.

Step 8
First extract the oil sample by turning on the Pressurized Oil Sample Valve. You start by extracting this sample first, because the ratio between water and oil can be 90 to 10. This means that only a few cm of the top part will contain oil. That is why the inner tube from the pressurized [WiO] valve is going to the top to make shore that you get an sample. And because if you extracted the [OiW] sample first the level of fluid would be below the inner [WiO] tube.

Step 9
Secondly extract the water sample by turning on the Pressurized Water Sample Valve. This valve is connected to the tube belonging to the Depressurized Water & Oil Sample/Disposal Valve. The reason you cannot use the Depressurized Water & Oil Sample/Disposal Valve in this stage is because the pressure is now to high.

Sequence G - Depressurized sampling

Step 10
Open the Filling/Depressurizing Valve to depressurize the container.

Step 11
Take the water sample by opening the Depressurized Water & Oil Sample/Disposal Valve. Let the remaining WATER flow into the disposal bucket.

Step 12
When oil begin to appear one can start to extract the oil sample. The water and the oil sample are collected to further analyze the quality and to compare the results you got from the pressurised samples. By doing this you will get to know the if the droplet meassurements are represetable. You do not now this because the droplets may have been affected through the needle valves and pressure drop.

Sequence H - Disposal

Step 13
Open if not open the Depressurized Water & Oil Sample/Disposal Valve and let the remaining fluids flow into a disposal bucket. You can do this because the gas has already been collected in the disposal equipment.

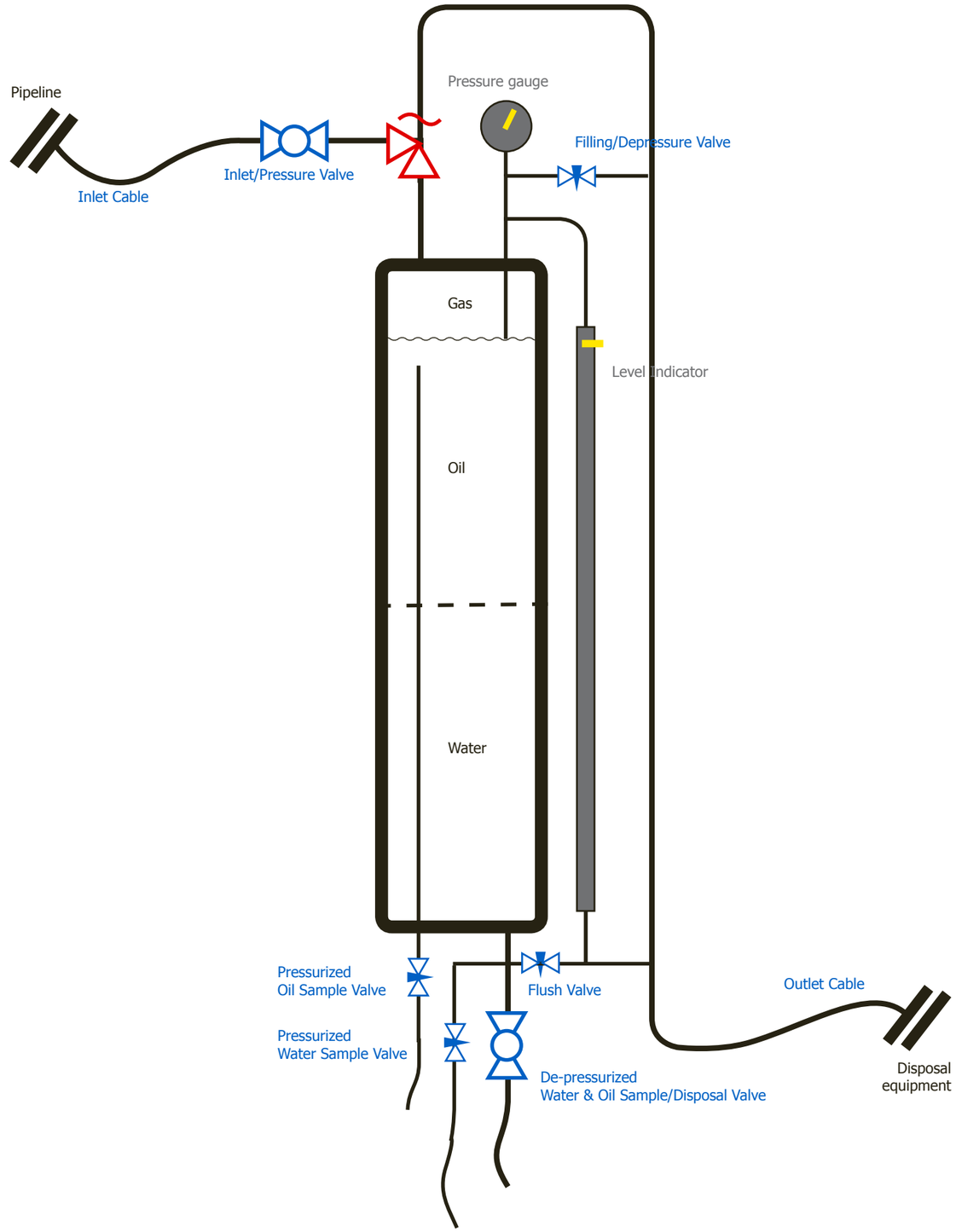


Fig 3, Valve layout

1.5 ISO standards

The manual sampling standard and the automatic sampling standard does not explicit apply to the multiphase sampler, but never the less, they may give ideas to what is important to consider in the making of this project sampler.
I will not focus on regulations that already are implemented in the sampler.

1.5.1 Regulations concerning procedure

This section will investigate important factors in the ISO standard: ISO 3170 Petroleum liquids - Manual Sampling

There are automatic sampling and manual sampling, and two basic manual sampling methods are available according to the ISO standard:

- Tank Sampling
  (Static sampling)
- Pipeline Sampling
  (Dynamic sampling)

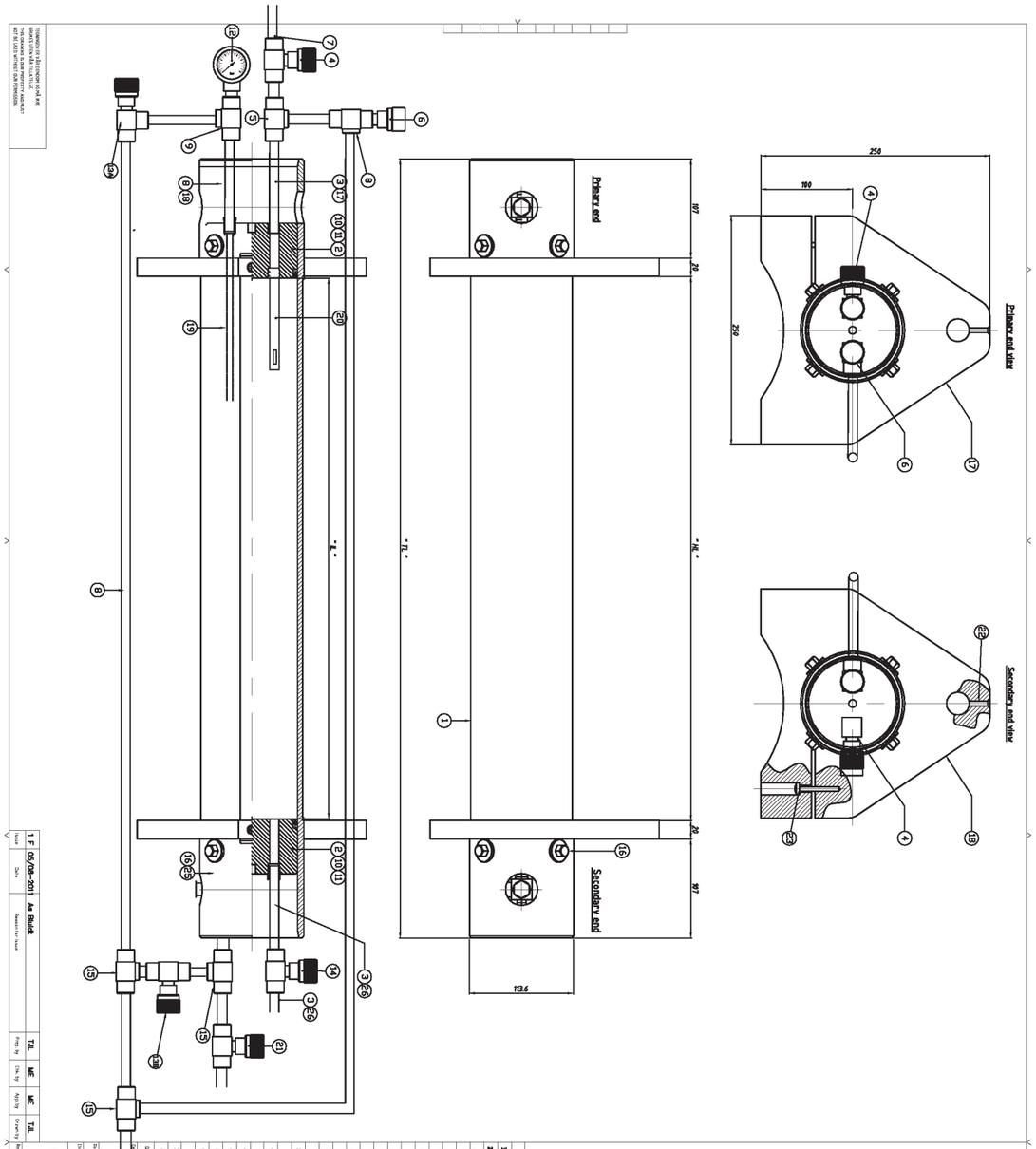
If there would be any regulations concerning the Typhoon Multiphase Sampler they should be found under this standard.

5.1
"They shall be of sufficient strength and externally protected to withstand normal internal pressures likely to be generated, and sufficiently robust to withstand any handling that may be encountered. Their cleanliness shall be confirmed before use."
The last sentence meaning that the sampler needs to be cleaned and flushed before a new sampling session in order to avoid contamination.

7.4.3.1.5
"The pressure difference between the sample and inert gas buffer sides of the piston should not exceed 100kPa (1 bar) at any time during sampling."
With the Typhoon sampler the limit is set to approximately 0.2 bar when filling.

7.2.1.1
"A sample shall not include any product other than that to be sampled and, if it is necessary to transfer a sample from a primary sampler to a secondary sample container, appropriate precautions shall be taken to preserve the integrity of the sample. Thus, steps shall be taken to avoid sample contamination (e.g. by rainwater or perspiration) ..."
This means that functions as for example protection between bottle and sample outlet should be provided (around sample extracting area) to eliminate the risk of contamination.

7.2.1.2
"Sampling personnel shall be fully instructed in the relevant procedures for particular sampling application. Specific precautions are necessary when draining samples for certain tests and the correct sampling procedures shall be closely followed to ensure that the test results are meaningful. These additional precautions do not form part of this International Standard, but should be set out in the test method or product specification concerned."
This emphasizes the importance of creating an user friendly and understandable product to achieve a high level of situation awareness of the user and to ensure a representative sample. It also enlighten the importance of an understandable procedure that the user can transfer to the product itself; meaning that after reading/watching or hearing the procedure the user should be able to use the information when using the sampler (For example by being consistent in name using and calling).



2 USER AND CONTEXT

In contrast to the Typhoon valve there is the perspective of user interaction when it comes to the Typhoon MultiPhase sampler.
This chapter will go through the information collected concerning the user and the context in which the sampler are to be used.

2 User & Context

The users can be divided into two groups. First there are the Research and Developing (FOU) companies such as Typhonix and their specialists travelling to offshore installations to extract and analyse samples.
Than there are the laboratory technician and process operators stationed on the various offshore installations. I will divide these groups into consultants and operators.

The multiphase sampler serves a purpose that makes it likely that it will not be used as frequent opposed to conventional samplers.

The sampler is a new sampling method and its procedures have not been used by anybody except Typhonix pluss an external consultant. These are my sources concerning the prior use of the multiphase sampler.
When it comes to the context, my sources are the specialists, Proserv that build samplers, and the observations experienced by a Typhonix employee after he had done a trip offshore doing a Pilot test of the new Typhoon Valve. Him and the specialist used the Typhoon Sampler version 1 at this test.
In addition to these sources I got a visual experience of the context by watching the NRK series "Oljeriket", following process operators and others at their daily work at an oilrig (Appendix, page 124 -127).

2.1 Consultants

Consultants are workers that are stationed on land but travels offshore doing tasks such as sampling and analysing for different companies, such as Typhonix, that need data from the production process systems offshore.

2.1.1 Onshore

Before the consultant makes the journey offshore the person gets information about the sampling areas. He gets information about where the sample points are placed and the distances between them, and other measurements. There are meetings about how the job should be done, procedures, regulations, safety and what equipment that is needed, this results in a working permission and a work order. It also holds information about the tools that is going to be used, for instance the sampler.

2.1.2 Offshore transportation

When going offshore there are two options for the transportation of cargo. The first option is by a supply vessel. A supply vessel does "not care" if the sampler is big or small. The sampler is usually shipped inside a transport case to protect it from salt water and physical impacts. A transport case is also used because it is easier to stack and easier to lift. So this means that a sampler would even how tough it where it would be shipped in a transportation case. A vessel is unpredictable in the way that the weather is unpredictable. If the significant wave height is over 5 meter the vessel cant unload to the offshore installation. And in worst case there can go weeks. This speaks for creating a "helicopter friendly sampler" but the fact that a consultant needs to transport analysing equipment by vessel anyways weighs the other way again, but the sampler still need to be created as small as possible for on-platform transportation, manoeuvrability and to reduce transport costs.

If the consultant wants to check in the cargo on a helicopter, he has the opportunity to do this. But there are restrictions concerning size, weight and manoeuvrability of the cargo. Helicopters used are the Superpuma and the S92.

Super Puma: 39 kg or 49cm in diameter
S92: 60 kg or 1m in diameter

He also has got with him other equipment such as analysing equipment and a toolbox with fittings, thread tape wrenches and other tools needed in addition to papers, computer and clothes.

The size criteria's are difficult to meet with the construction the sampler needs to have, but the new sampler will be worked on to achieve a lighter, more compact and practical version for other perspectivs such as transportation and manoeuvrability.

2.2 Operateurs

The TV-series "Oljeriket" that went on NRK a while ago, found on NRK web-TV, is about people working at Gullfaks in the North Sea, among the people that are followed is a experienced and a new process operator. By watching this I got an impression of how the life and work life are on oilrigs. And also a visual look at the working environment.

Lab and process workers work in the production process. They work on maintenance, monitoring that everything works and extracting samples that are needed.

Laboratory technician take samples themselves or analyse samples being taken by process operators. This means that operators doesn't necessarily analyse the samples other then extracting them. The reason I mention this is in regards to the future scenario where analyse equipment could be combined with the sampler.

2.2.1 Transportation around the platform

Anybody no matter whom, operators or consultants need to move the equipment around the platform. Both have the opportunity to use transportation devices from place to place.
There are always elevators that will lead you from one place to another. The surfaces you walk on are not slippery, according to rules given by NORSOK.
When equipment weigh more than 25 kg, you are not allowed to carry the equipment and you are therefore required to use forms of transportation devices such as trolleys and lifting devices.

5.2.1.1.0-1
Transportation ways where trolleys and carts are used shall not contain steps and thresholds.
(NORSOK-S-002 Rev. 4, August 2004)

5.2.1.1.0-3
For equipment/objects of mass 25 kg to 200 kg, space for use of adequate lifting and transportation devices (permanent or temporary, e.g. elephant cranes, A-frames, beam clamps, etc.) shall be provided.
(NORSOK-S-002 Rev. 4, August 2004)

5.2.1.0-1 Workplaces shall be designed such that the personnel are not exposed to excessive workloads with risks of musculoskeletal injury.

5.2.1.0-2 For determination of maximum workload and force limits, see EN 1005-2, EN 1005-3 and EN 894-3.
The requirements above entail that efforts should be made to avoid
- monotonous muscular load,
- excessive muscular load,
- work in fixed or static position,
- work with joints in extreme position,
- work requiring high precision and which at the same time requires substantial use of force,
- work in kneeling, squatting and lying positions,
- work of long duration and of repetitive nature with hand above shoulders or below knees,
- continuous asymmetric load on the body.

2.2.2 Storage

There are many different storage locations varying from shelving's to containers. It may also occur that sampler will be stationed outside.

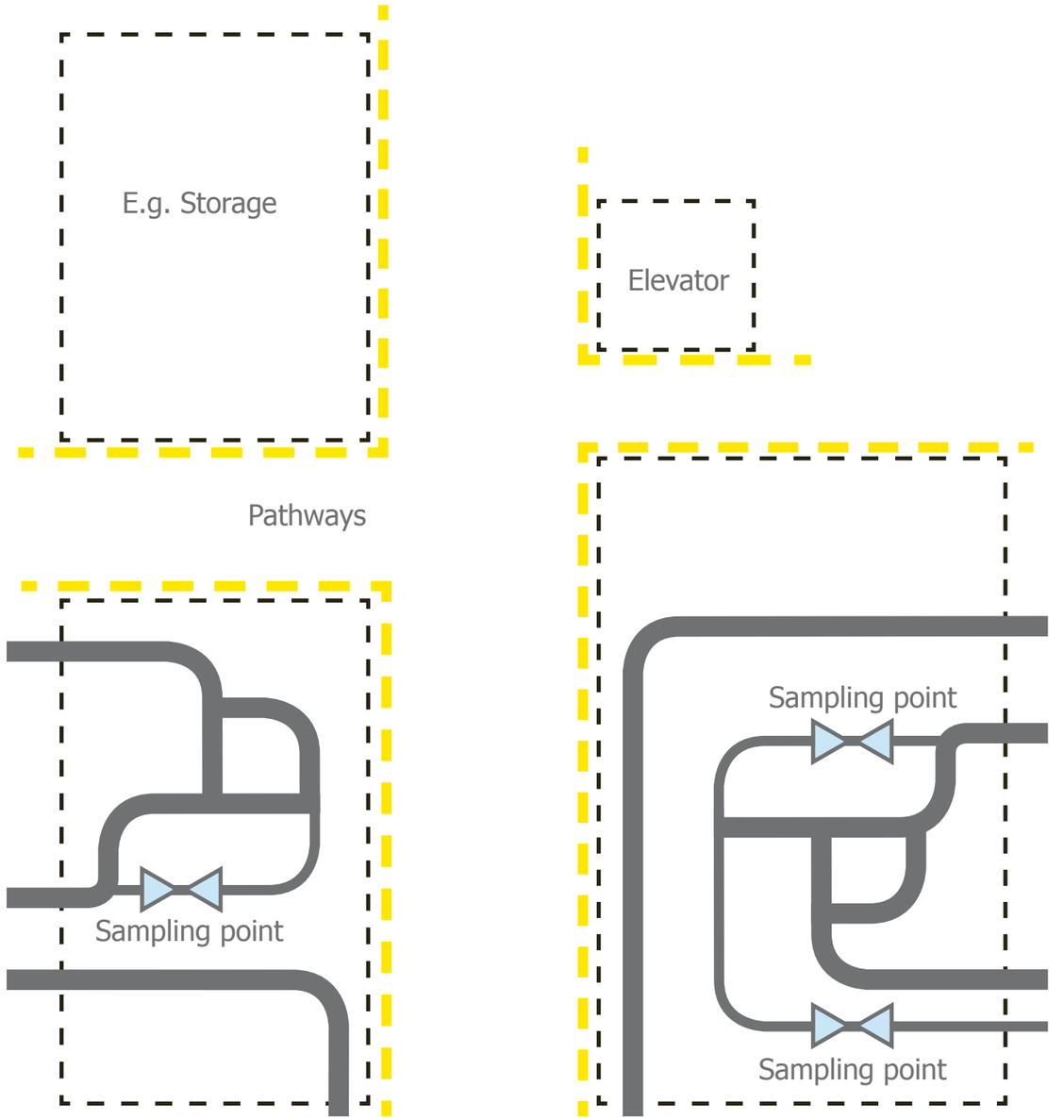


Fig 5, Sampling area - schematic

2.2.3 Sampling point

In the image above you can see the sampler being used on the pilot test of the Typhoon Valve. As the image show the area around can be small, narrow and tricky. In the image below you can see a grey pathway on the right. These pathways, to the different sampling location, are often clear and easy to move around on. It is beneficial to come close to the sampling point because of the short hose (see fig 6).

You need to connect the sampler to two points. To a valve point (the sampling point) and the sampler to a closed drain. A closed drain is a disposal for high vapour petroleum fluids that is not supposed be left out in the atmosphere (hydrocarbons), because of the risk of explosion and the pollution of the environment. The locations where you find the two different points of connection can vary in height and distance. An open drain is where you dispose the fluid after pressure release and after closing the inlet valve. Before you extract samples from the sampler you first let some flow into the bucket. This bucket is emptied in the open drain.
The danger for explosions in the zones where the sampler is used restricts the use of electrical equipment. That is why any electrical components need to be ex-approved.

2.2.4 Working environment

Clothes that are used can be seen in the picture below. Protective gloves, a jacket, pants, helmet, ear protectors and glasses shall be used.
The gloves used will not be a big obstacle when operating the different valves on the sampler. Maximum operating temperatures in the North sea is 90 degrees Celsius.

An oilrig is kept surprisingly clean, but things get dirty and exposed to different fluids. As well as the equipment get handled rough and need to be protected. Especially in narrow spaced areas things can be subjected to collisions. Things might fall or get hit by trolleys or other things. I was told about tree S`s, these apply to products being used on installations. They stood for "sleggefast, spylefast og syrefast" (In norwegian). Products need to withstand rough physical treatment, chemicals and corrosion.

2.2.5 Analysing

Analysing is done in the lab. The workers carry the samples in bottles from the sampler to the laboratory. Often there are different sampling points during sampling.
During the Pilot test there were 3 different sampling points where the sampler where moved between to see the effect of the different valves. There where one point before and one after the valve. The third point where located after a test separator in order to measure the separation affects. This means that the sampler will be moved around to different location, making it important that the sampler is mobile.

2.2.6 User feedback on version 1

The first comments I got about the sampler version 1 was that it was heavy and difficult to move around.
The valves and tubes are exposed and vulnerable.
A Parker valve handle had been broken off, and likewise had a bolt that was used to hold one of the legs.

When it comes to the procedure, I was told that there had been a misunderstanding about when to use what valve. An incident that occurred was that the needle valve was used when the container was not under pressure. In this situation the ball valve should have been used. This information did not reach the user. This resulted in that the fluid was hard to get out and this became a moment of irritation.

2.2.7 Context - Content for use

As shown in the illustration on the right hand side, you can see all the different elements the sampling context consists of. The light blue elements are parts of the context that are fixed, locations you might say. The other elements are objects that are a part of the sampling process.

The analysing equipment will be not being considered as mentioned in the strategic chapter.

Sample containers are standard sized bottles that are found on any oilrig. They are carried from the sampler to the laboratory in a carrying device.

The disposal bucket is also standard sized buckets (10 litres) that are found on any oilrig.

The transport case is a case that the sampler was sent in along with other equipment such as fittings and documentations (Appendix, page 131).

Other equipment that often are found can be toolboxes with e.g. wrenches for changing fittings, adjusting the PRV or placing hoses for inlet and closed drain.
In an toolbox you may also find thread tape, batteries, procedures for operating the sampler and working permissions and plans.

In the list below you can see things that where needed when sampling and testing at Oseberg C. (Pilot test Oseberg C rev)

2.5 Equipment required on board
- Access to 1.5 meters worktop space for laboratory instruments.
- Karl Fisher "titrator"(adequate amounts "titreringsvæske" / additional set of electrodes)
- 20 liters. Pentane for OIW fluorescence
- Noise Level Meter
- Lubrication of bolts in the vortex breaker
- EX-approved camera

2.6 Equipment to be brought to the Oseberg of Mator / TyphoniX.
- Malvern - droplet size and distribution (on the OSC today)
- TD500 - OIW (fluorescence-based) - chemicals
- Mator test cylinder
- TyphoniX test cylinder (on the OSC today)
- SKF vibration meter
- An additional vortex breaker (included valve out)

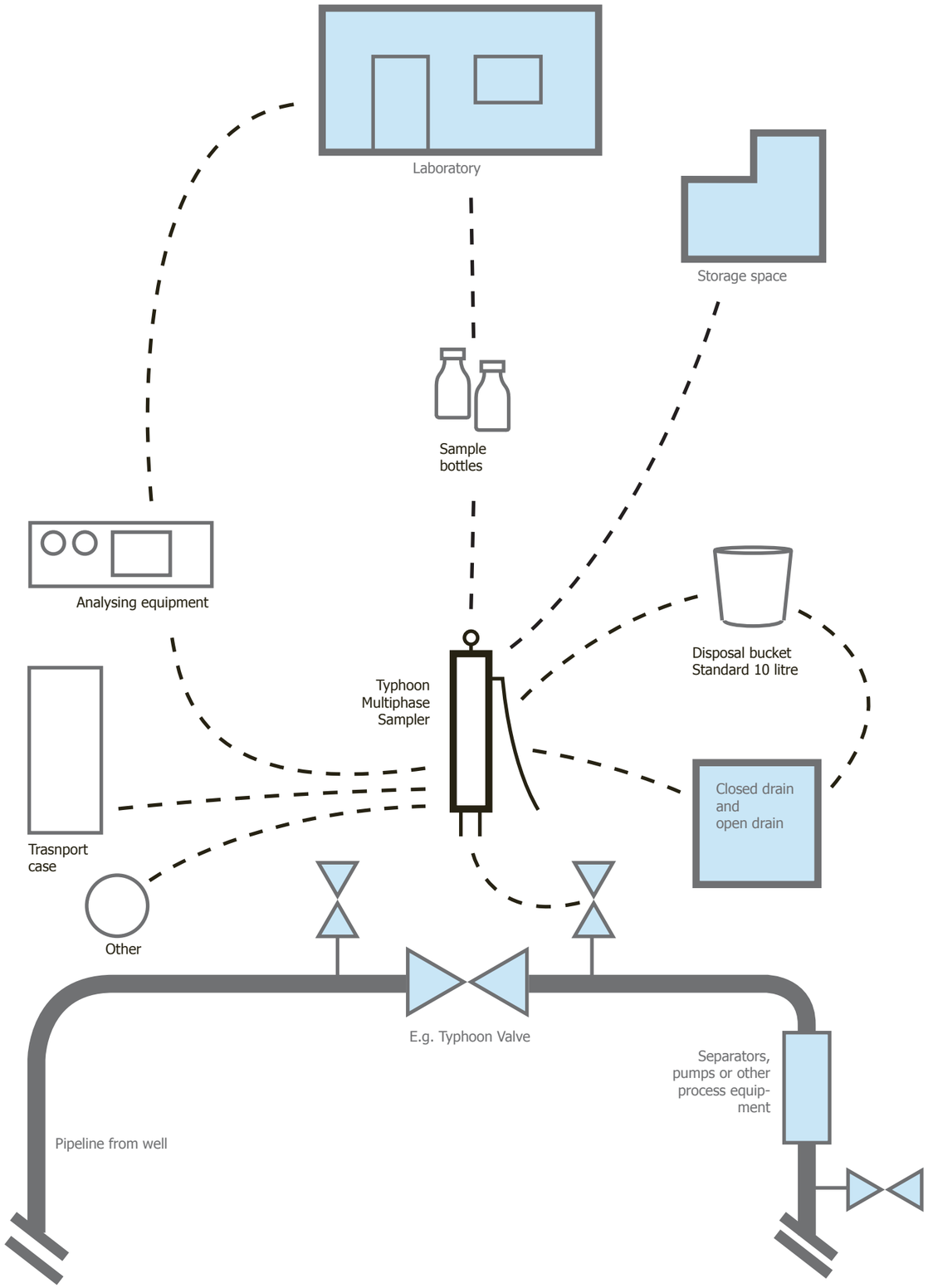


Fig 6 - Context - schematic

3 SAMLER STRATEGY
Future scenarios

This chapter describe the possibilities that exceed the boundaries given by the sampler container delivered by Proserv. I will take a look at the analysing equipment used today. And I will try to create an overall image of manual sampling for so to look at what the future within sampling and analysing may lead to in relation to Typhonix.

3.1 Implimentation of analysing equipment

As mentioned before, there are different instruments and methods used to analyse different parts of a sample. Some instruments are harder to implement/add as a part of a sampler.
Typhonix do not produce their own analysing equipment, so they would need to collaborate with different suppliers to develop a product that could do both (sample and analyse).

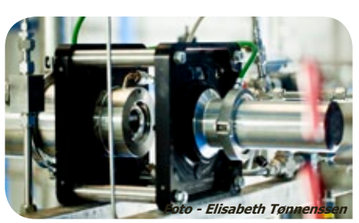
There is not any analyzing equipment that is integrated into the Typhoon Sampler. This section will therefore investigate the different analysing equipment used for the different purposes, this to better get insight on possibilities of integration.

3.1 Analysing equipment

There are a number of reasons for extracting samples. Typhonix is interested in the impacts different elements of the process have on the crude oils ability to separate, the quality. This is why Typhonix is interested in knowing the concentration of water in oil [WiO], concentration of oil in water [OiW], and the oil and water droplet size. There are different ways of doing these analyses.

Malvern is a company that produce analysing equipments. They have categorized different analysing equipment into In-line, On-line and At-line. With On-line or In-line samplers you can get continuous data from the pipeline. In-line analysers can be seen as analysers that have sensors placed inside the process line. Online sampler's leads fluid out of the process stream into an analyser (can be associated with slip stream samplers). At-line equipment is used by first extracting samples from the process line for so to analyse them in an external analyser.
It is At-line analysers that Typhonix use today at offshore installations.

Below is an example of an On-line sampler that at the moment Typhonix use in their in house test-rig. It is big and heavy and therefore puts a sudden stop when considering making it an integrated part of the mobile sampler. Another problem with implementing analysing equipment to the sampler is that areas or zones where the sampler is being used you cannot use electrical equipment or need approval for using such equipment in these areas. The analysers also demand a lot of power and computer hardware.



3.1.1 [WiO]

The process of analysing the concentration of water in oil is a chemical process. This is a process that "needs its space and environment". The process was invented by Karl Fischer.

3.1.2 [OiW]

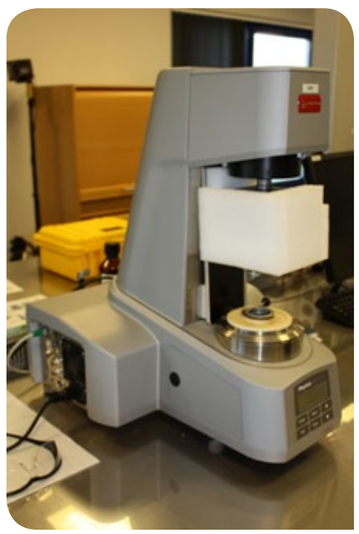
The devices for measuring the concentration of oil in water are available in smaller sizes, and can be used at-site.

3.1.3 Oil droplet size

One of the most important analysing equipment for Typhonix is the droplet size analyser. This is a device created by Malvern, it measures the size of oil droplets. It does this by measuring the refractory light from a laser. This is an at-line version of the on-line version you can see in the first image.

3.1.4 Viscosity

This analyser is not that commonly used, but it measures the viscosity of the oil.



3.2 Strategy - analysing equipment

"Manual spot samples may not be representative for the bulk"
(4.3, ISO 3170:2004)

"It is often necessary to obtain manual dynamic pipeline samples, e.g. for instrumental verifications and quality control purpose. These are spot samples and may not be representative for the bulk."
(7.4, ISO 3170:2004)

These regulations tell us that the spot samples do not necessarily represent the whole process line, because you only get a smaller "picture" of the whole process. With an inline or on line analyser you get continuous "pictures" of the liquid inside the pipelines.
The regulations above do not directly apply to the multiphase sampler and its purpose (Another reason for having its own ISO standard, see next page).
Because you are not trying to get a total image of the entire production process, you only need to know what occurs before and after the product you are trying to optimize. It would be beneficial to implement an inline or an on-line analyser in the sense that you could get more data and more easily get a picture of the process directly into your computer without having to take samples into bottles and then run to a laboratory.

If I were to suggest a future vision or a future goal it would be to aim for a more automatic form of sampling and analysing. For example creating a sampler with an in-line oil in water analyser. Even though it is not realistically a part of a near future solution on a manual portable sampler it is still worth having in mind with other more stationary solution.

All tests done in the Typhonix laboratory is done with the help of a Malvern in-line analyser, seen in the image on the bottom left corner on the previous page.

In the coming work in this project I will not be doing any attempts of trying to implement any analysing equipment.

3.3 Manual Petroleum Sampling

3.3 Multiphase ISO standard

The illustration below was made to better understand the context in which we can find and define the Typhoon Multiphase sampler. The visualisation was based on the ISO standard 3170:2004. The ISO standard is based on the fact that the different sample receivers have different areas of use depending on the petroleum liquid and where the sample is extracted from; pipeline or tank, dynamic or static sampling. The upper categorization level may not be suitable for the Multiphase sampler because the Typhoon use another technology and have a different purpose then the samplers found under these categories. Therefore I have added a category with the name Multiphase receivers.

By having your product standardized you create guidelines for every other sampler that is going to be built for the same purpose as the Typhoon.
If the Typhoon sampler is put in the same category as any other sampler, this would not benefit the Typhoon sampler since the Typhoon sampler is bigger and heavier than other samplers and off course serves a different purpose then the others. By creating a different category or a totally new standard you express that this is the sampler you need to use for this purpose; Multiphase sampling.

This is a common fixed volume sample receiver called "bombå". It has got one needle valve in each end.

Representative sampling has also a different meaning between multiphase sampling and conventional sampling. A representative sample taken by a conventional sampler may not be a representative multiphase sample.

Typhonix has discussed starting projects and JIPs concerning the Typhoon Sampler Technology. This is to further validate the technology. This can also be a part and start of the standardization of the technology.

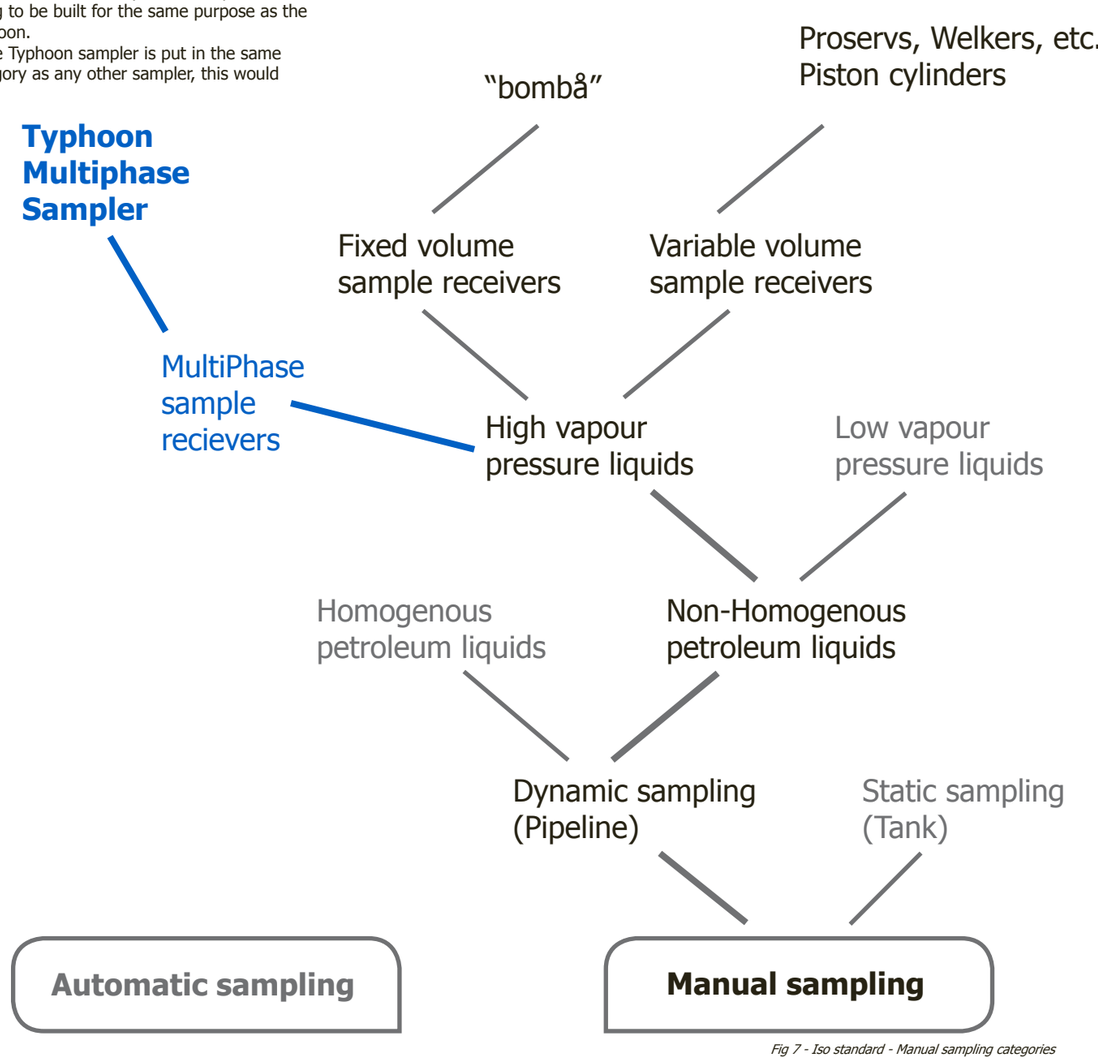


Fig 7 - Iso standard - Manual sampling categories

3.4 Variable volume receivers

(8.2.2.1 ISO 3170:2004)
"If it is necessary to take manual spot samples from pipelines, the procedure will be dependent on whether a fixed volume or variable volume sampler receiver is to be used, and on the pressure within the object you extract the sample from."

3.4.1 Constant pressure sample receivers, also called Single-piston variable volume sample receivers

(7.4.3.1.1, ISO 3170:2004)
"The liquid is sampled at line pressure and maintained at pressure during transportation and subsequent sub sampling. The sample is accumulated against one side of the floating piston by carefully reducing the pressure of an insert gas buffer on the opposite side of the piston."

3.4.2 Its own category, its own reciever

The way Welker and Proserv create their sample cylinders is not necessary beneficial for the Typhoon Sampler since there are different thoughts behind the engineering of these sampler designs. The reason I mention Welker is because they make a sample cylinder in aluminium that weigh less than the one from Proserv. In a future sampler Typhonix should ask them selves if it would be beneficial to start from scratch and engineer a sample cylinder made for the purpose of the Typhoon Sampler. This could lead to a shorter, lighter and a higher pressure class sampler.

3.5 Strategy - Pressure containers

In the future the pressure cylinder might be the one thing that will have an impact on the rest of the design.
Proserv delivers different cylinders. What makes it difficult is that the Typhoon sampler needs two holes in the adapters located in the top and bottom, respectively one 1/2 inch hole and one 1/4 inch hole.
This feature alters the adapters and certifications Proserv has on their pressure containers, especially the cylinders which is approved for around 600 bar.

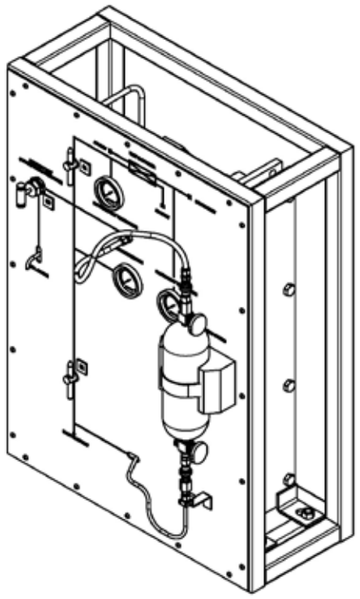
In the developing stage, possible changes concerning pressure containers should be taken into account.

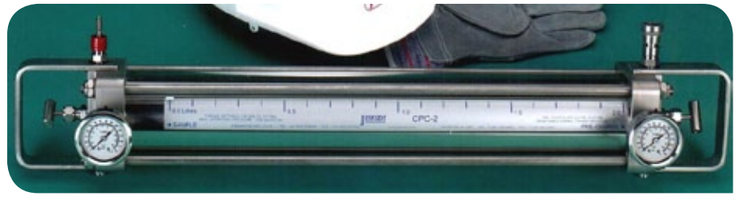
3.6 Other samplers

The samplers below are either portable or fixed. The samplers cannot directly be compared with the Typhoon sampler because of different technical principals. But they can give you an idea of the aesthetics and functions that are applied to the different variations.

Welker light liquid hydrocarbon sampler.

In the image below you can see a sampler being mounted outside a cage, with tubes and other equipment being inside. This is more of a fixed solution.





Jiskoot constant pressure reciever

3.7 Typhonix scenarios

Cleaner production; the vision of Typhonix
This is the future vision of achieving a complete optimal process of oil and water separation. They work towards the vision by developing technology to optimize the production process. This is core of the Typhonix business. The Typhoon Multiphase Sampler was a bi-product, a result of a need for an improved sampler to achieve their strategies. A sampler that could extract representative samples, to be analysed, in order to measure the affect new and old process products had/have on separation.
A question that arises is to what degree the Typhoon Multiphase Sampler is going to be a part of the Typhonix business. One of the future scenarios of Typhonix is to sell the technology in order to focus on their core business.

If Typhonix figure out that they want to employ their own consultant to use offshore they would in addition to get first hand information on the product process also get firsthand information about sampling. Typhonix should think of all the inside information about sampling that would come when having their own offshore consultants working with these products all the time. Sampling and development goes hand in hand. In the same way offshore consultant (internal or external) are important for Typhonix to learn about the production process, it is as important for the development of future samplers to be aware of what happens in the context through these consultants.
What I am trying to say is that by having internal consultants you get free and easy access to information concerning the use of multiphase samplers and other information concerning analysing and sampling.
This is said from a product developing perspective. I have not considered the fact that it would lead to increase of staff in marketing, sales or/and R&D.

The sampler is a tool that serves the Typhonix core business and therefore in some sense represents what Typhonix do. The products such as the valve are sold as internal components to other valve manufactures with their own design aesthetics/expression (If they even have it at all). The Typhoon Multiphase Sampler is a clear and apparent visual symbol that could represent the company. Different technology and products will come and go in Typhonix but the sampler could be a continuous pillar/symbol/anchor-point/representation of/for Typhonix. This is also a point to consider, knowing that if Typhonix sell the Typhoon sampler technology they will probably no longer have that as a visual symbol either or as a common symbol.

Regardless of what the future might lead in this project the product will serve as marketing tool as much as a tool for process improvement. For this project this means that I will focus on the present and the sampler as it is today, focusing less on the different future possible implementation of analysing equipment and possible expanded areas of use. In short; make the product represent Typhonix.

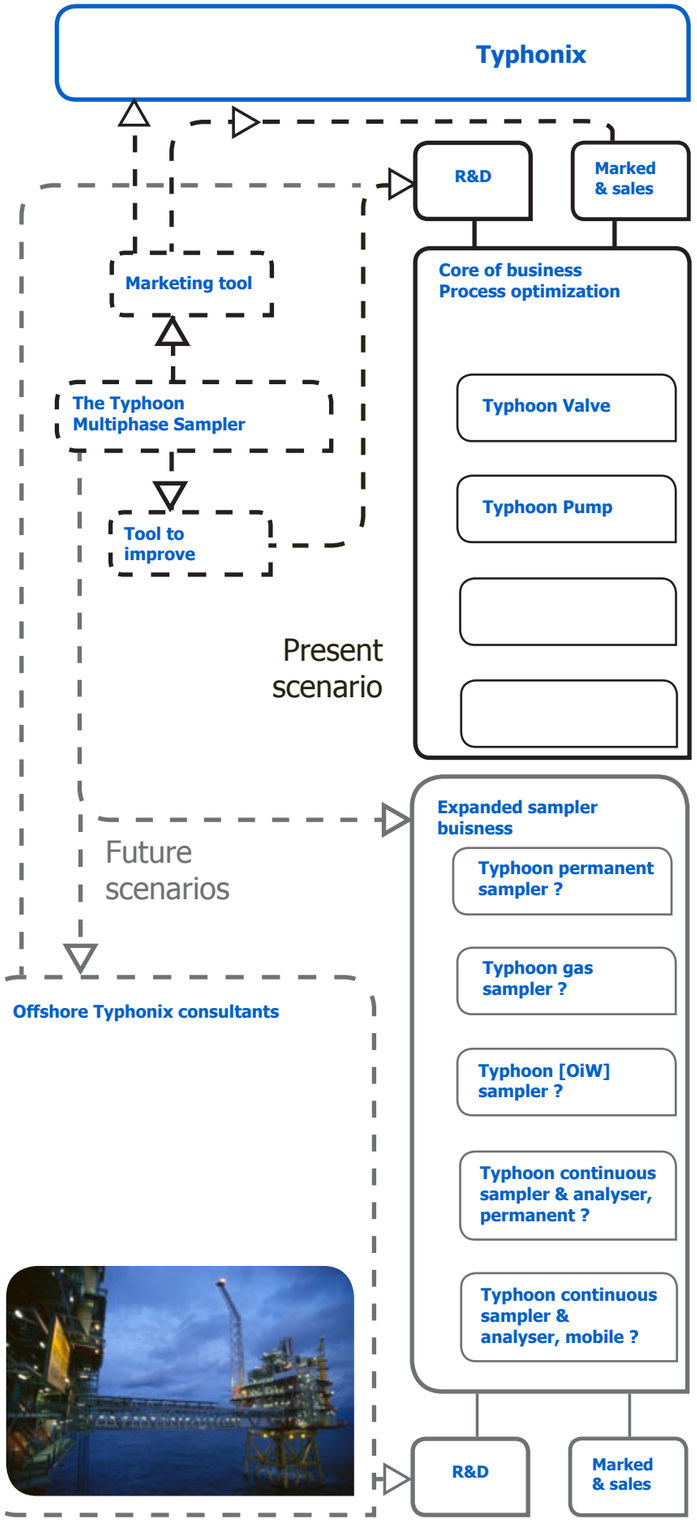
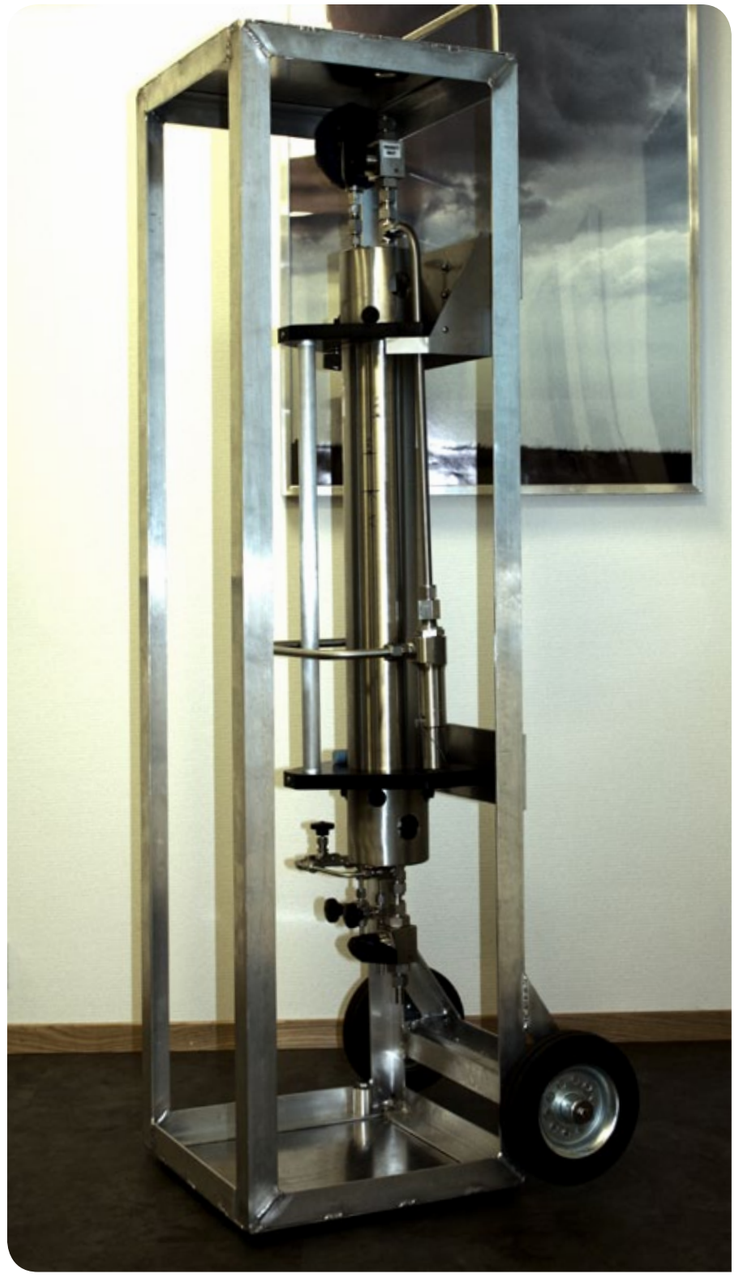


Fig 8 - Business strategy

3.8 Typhoon sampler version 2

Alongside the master project there was made a second sampler (version 2). This differed from the 1st version by having an extra needle valve, a digital gauge fitted, bigger safety valve and being mounted inside a cage. The cage was also mounted on two wheels with a handle on the top as you can see on the image on the right.

The valves were more organized than in version 1, they have the same valve locations as the layout I choose. The two upper needle valves are placed on the left hand side on version 2 making it a bit trickier for right handed users.
From left to right you find the Flushing needle valve, pressurized water needle valve, pressurized oil needle valve, depressurized water and oil ball valve. On the next image you see the filling needle valve; alongside this you can see a vertical tube that contains the floater. Behind this tube you can see the magnet pen that lights up when holding it into the tube wherever the floater with the magnet is located.



4 CORPORATE & PRODUCT IDENTITY

This chapter is about understanding the company identity, and use this information to establish a product identity to base a new design upon.

Typhonix core business is the optimization of products found in the process line, such as valves and pumps. Their Typhoon sampler technology is the provider of representative data from the process line on offshore installations. The sampler is located in another, being a work tool that helps in the work of product optimization. It is a product that interacts with people and should be a symbol that represents Typhonix.

4.1 Staff of Typhonix

Typhonix is a group of 5 people. A continuous similarity within the group is that they have practical and theoretical backgrounds. The distance between theory and practice is short, and vice versa. They are not afraid of testing new solutions and ideas. The distance between the drawing board, test rig and laboratory is short.
Their different backgrounds complement each other and this makes them a strong group, with different perspectives, this also categorize them as versatile. Being such a small group contraire to bigger oil companies make them versatile and flexible.

Working, eating lunch and participating in meetings with them gave me a view that a continuous similarity in the group is that they have a drive, a whiling for success. They have an underling mental attitude that is forward looking, reflected in their vision; cleaner production.

The two words I will highlight are "Reliable" and "Fearless". The product should be reliable. A reliable product is a product that not function as a hindrance, but another team player in any level.
The product should be "fearless". The product should not be afraid of being different; it should represent change and innovation. At the same time the product should not be "fearless - borderline stupid", this means that products should do its purpose without causing or show any risk of not being able to collect and preserve representative samples, thus reliable.

4.1.1 Keywords

Reliable
- Welcoming
- Professional
- Competent

Fearless
- Analytical and Practical
- Drive
- Forward-looking
- Versatile

Foto - Elisabeth Tønnessen

4.2 GRAPHIC PROFILE

Typhonix has developed a graphical profile that consists of fonts, company colours, logo, picture editing guidelines and graphical elements.

The logo and graphical elements play on the characteristics of the typhoon/cyclone, with its circular and dynamic forms.
The colours used are based on blue and varies in strength with its main colour being a slight dark blue. The blue colour can be said to represent water, clean water.

The image editing is done by adding a "moonshine" effect by giving the image a pastel blue, slightly green, look. At the same time the contrast and gamma in the image is raised giving the image contrast. The image/product get a cold and hard/sharp feeling, therefore also the sense of precision (cold precision) that distances itself from "warm" humans that have flaws and are unpredictable.

On the other side the Typhoon sampler are in contrast to Typhonix main products in direct physicall and visual contact with the user and others, this gives a possibility of bringing the human or user perspective back into the equation. So here is a possibility to look at implemention of more warm colours.
It will be a task to fit human aspects in a new Typhoon Multiphase Sampler. The best way to do this is creating a product that at least with its functions considers the human aspect, but can at the same time keep the cold and precise expressions along with the guidelines given by the graphical profile and other following considerations.

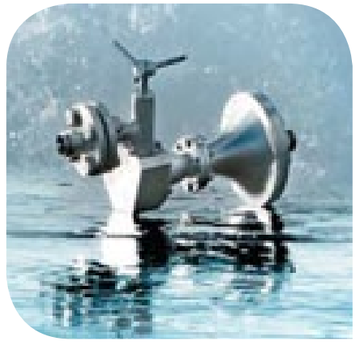


Foto - Elisabeth Tønnessen

4.3 VISION

The vision of Typhonix is:

Cleaner production.

A cleaner production is achieved by optimizing the separation and reducing the content of oil in the produced water, this can be done by developing separation friendly products to reduce the need for separation enhancive chemicals.

Cleaner production is a "green" vision. Typhonix use a blue colour in all their work. One might say the Typhonix blue colour is their answer to the commercial eco symbolic green colour. Green onshore - Blue offshore.

The blue colour represents the positive. AWhen using the product you interact with the "blue", the "good".
The blue can also give information about what is inside the valves, namely the Typhoon.
Many use the colour blue to colour the whole valve or pump. Only colouring the human interactive parts could help Typhoon products distinguish themselves from these products. These are just suggestions, but with the Typhoon sampler blue will be the main colour.

4.3.1 Keyword

Eco green =
Typhonix blue

Produced water

Cleaner production

Typhoon valve

Conventional valve

Fig 9 - Produced water

4.4 The TYPHOON

Typhonix use the name Typhoon in front of their products, such as the Typhoon Valve or the Typhoon Pump. The name tells us actually something about the technology found in these products. Simplified the technology is about trying to control turbulences that occur when valves lower the pressure or a pump increase the pressure. When one is able to control these turbulences it is possible to reduce the droplet breakup and mixing, thus improve separation.

4.4.1 Logo

Typhonix logo represents a Typhoon seen from above, with the characteristic "eye" in the centre of the storm.

To get philosophical the centre of the eye represents the centre of development, Typhonix being in the centre. The core business strategy of Typhonix is to improve process products. Subordinate they work to change conservative thoughts in the oil industry. A typhoon is a result of a symphony of many storms that work together and creates a great force. In the same way the composition of employees in Typhonix create a force that enables change. Typhonix is the place where change happens. The metaphor can be further drawn to talk about how Typhonix is cleaning up the mess, force to be recon with, etc.

4.4.2 Product

A product of Typhonix should represent a symphony; to translate into product design language it should give a sense of "gestalt", a holistic product. The objective will therefore be to bring the different components together creating a product that can emit this feeling.
A Typhoon not only gathers forces but focus them as well. This force and focus is expressed through the dynamic form and the gradual flow into the middle. The form should follow these meanings.

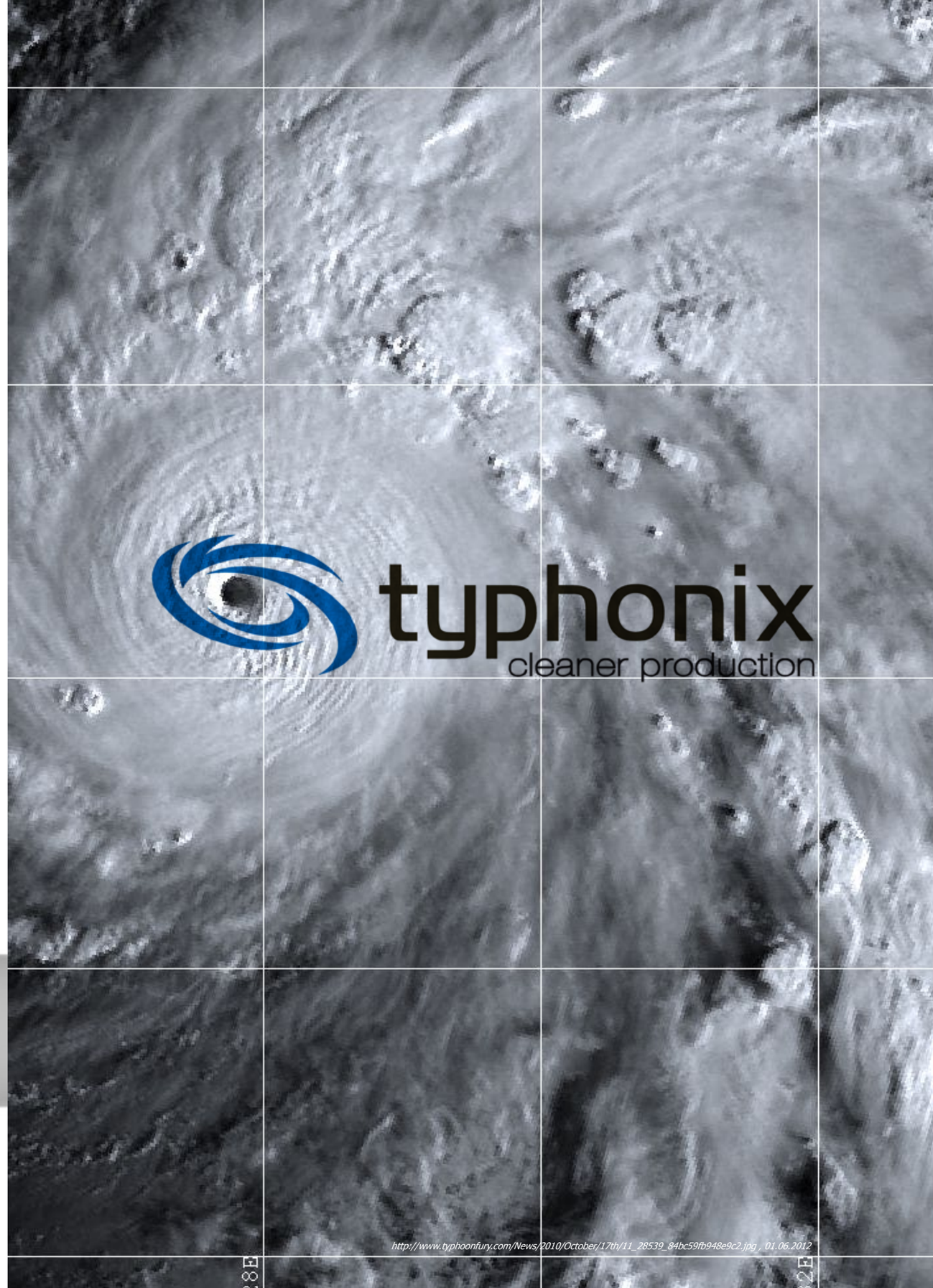
4.4.3 Keywords

Symphony

Strength

Focus

Change



4.5 DROPLET SIZE

The bigger the droplets of oil, the easier the oil will separate from the water. Therefore Typhonix is interested in measuring droplets. In the illustration you can see the affect on oil of a conventional and the Typhoon technology.

The natural behaviour of oil, water and gas is to separate, this is also the purpose of the production process. It is only natural to develop products that treat them this way, such as the Typhoon valve. The Typhoon technology creates order and cares for the different phases. The technology use force to create order and thus takes "care" of the droplets. "Order in the chaos"


Foto - Elisabeth Tønnessen

4.5.1 Keywords

Care

Controlled turbulence

Order

Feel & flow

Small / LARGE

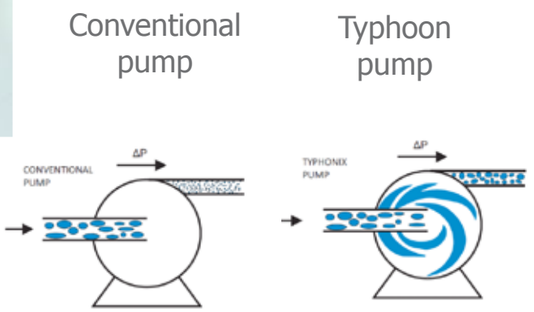


Fig 10 - Droplet size

Foto - Elisabeth Tønnessen

4.6 SEPARATION

Separation is the natural process which occurs between mixed water, oil and gas. Because oil is lighter than water, oil will float on top of water, whilst gas will naturally rise to the top being the lightest (called “light ends” in e.g. ISO3170:2004). In the oil industry this different fluids are called phases, also gas, hence the name MultiPhase. Water, oil and gas, is the 3 main ingredients we want to separate from each other.

In the illustration on the right you can see a natural separating process with oil on the top and water in the bottom.

4.6.1 Keywords

3

Separate

Divide

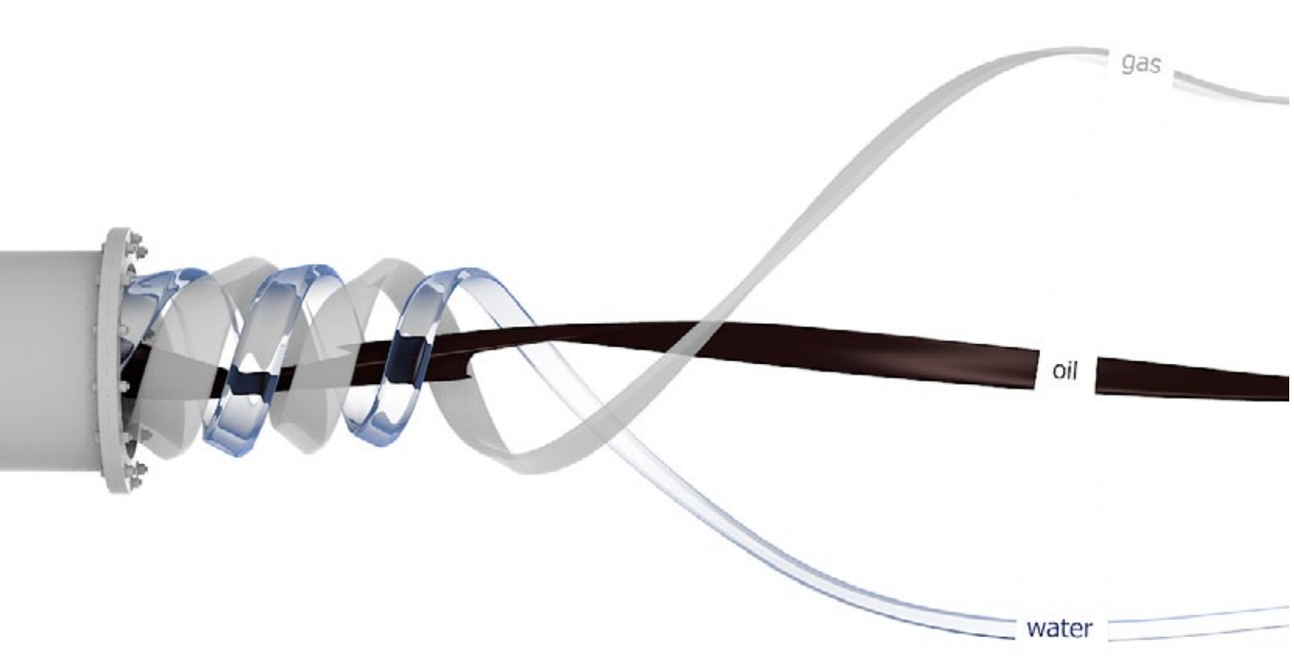


Fig 11 - Separation

4.7 Working environment

A big part of the development process at Typhonix is testing in the lab. The lab consists of tanks to hold salt water and steel constructions to hold pipes, valves and so forth. This is where they test ideas and products.

The frame construction is a practical way of holding everything together and gives easy access to the different components. This is a commonly used way of mounting valves, tubes and equipment together. For an outsider or an aesthetician it might make the appearance of total chaos, and the same visuals you would get on offshore installations.
For people who are used to work in these environments it will probably be an "order in the chaos". Creating a product that appears to be chaotic might not stand out in among the other chaos, from a marketing standpoint, but be more accepted by conservatives as it falls right in with the rest of the environment. Then it could be argued that this is not what Typhonix stands for, representing change, being a company that works to implement new products in a conservative oil industry.
The product could therefore be used as a differentiating tool, a visual subliminal tool to start associations of change in people seeing the product in this environment.
Use the sampler as a visual marketing tool, sending the message through the contrast between product and surroundings.

http://www.flickr.com/photos/22437367@N00/999816, 01.05.2012

Courtesy of synfuels international, 01.05.2012

4.7.1 Keywords

Contrast

Clean & clear

5 & 6
DEVELOPMENT

5 & 6
Program of requirements

Sample container

The developing stage will be based on the Proserv container construction.

Not possible

Alter the Proserv container (e.g. make holes)
Re engineer any parts of the sample container (cylinder and adapter)

Possible

Rotate the two adapters in steps of 90 degrees.
Use other fittings, valves and connections as long as they are suited for their use (over 200 bar, corrosion resistant, etc).

Valves and fittings layout

The fluid that enters the container should not meet any restrictions on the way in. This means that the fluid should in the optimal situation flow straight into the container and without going past to much flexible tubing, as the material in the flexible tube may affect the sample fluid.

Tube fittings are preferred in ½ inch depressured inlet and outlet.

Swagelok is the preferred supplier of valves and fittings.

Use Tube fittings in ½ inch Main intake and ½ inch outtake to not affect the sample.

Tubing will be 1/2 inch or 1/4 inch.

User & Context

The sampler should be mobile, And possible to handle in narrow areas.

It should be developed on the bases of the three S`s:
- Salgfast (Withstand physical impact)
- Spylefast (Withstand cleaning chemicals)
- Syrefast (Non-corrosive)

Non-electrical components,
except EX-approved pressure gauge and magnet pen.

The layout of inputs and valves should be easy to understand and compliment the procedure.

Use NORSOK S-002 (Working environment) as guidelines, to consider ergonomically aspects to avoid injuries.

Product strategy

The implementation of for instance analysing equipment will not be tried implemented, because of the complexity this would lead to and the duration of the project.

The design should have in mind that future sample cylinders may change in size and weight.

Production

The amount that is going to be produced is between 1 - 40 depending on the demand.

Low production costs.

Possible to assemble.

Product Identity

The identity of the product should represent the identity of Typhonix. The keywords will be used as bases for the sampler idea generation.
Some keywords are more important or easier to express, but they will at least give me a mental mindset that will help when working with ideas and concepts. These words is what I have perceived as central in the corporate identity of Typhonix, after analysing and been experienced working with Typhonix.

Typhonix blue

Symphony
Strength
Focus
Change

Care
Controlled turbulence
Order
Feel & flow
small / LARGE

3
Separate
Divide

Contrast
Clean & clear

Version 3 (system design)

=

Internal parts (Multiphase sample container layout)

+

External parts (Functions such as protection, aesthetic features, etc.)

Fig 12 - System design

The new sampler will consist of internal parts and external parts. The cylinder with its fitting, tubes and the fact that the cylinder needs to be vertical makes it unable to work alone. Therefore external parts are need to

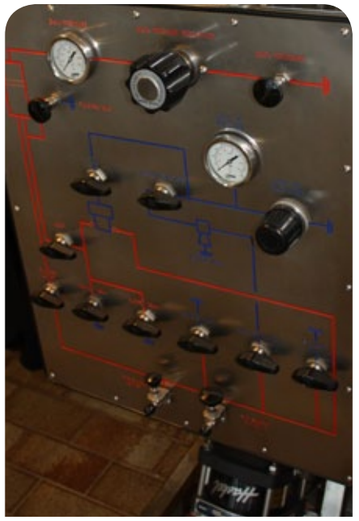
Support, protect and project.

5 System design: Sampler internal layout

5.1 Procedure: Valves and fittings layout

The procedure gives us an order in which actions needs to be followed. It is important to follow the procedure in order to avoid user errors and thus non representative samples.

Every valve has their own purpose, and can therefore for instance get their own name that complements the procedure. In the image below you can see how valves can be put together to create a holistic and a better understanding of a system.



5.1.1 User operated components

When it comes to the positioning of the different valves it will be favourable to put them in a system. The system is going to organize the valves in relation to their purpose and the procedure. If we consider the procedure the valves should be in a chronological order, but if we look at the valves in relation to their purpose this can change.

The sample container consists of the following interactive elements:

There are two hose connections
- Main inlet; is the valve that pressurize the container and fills it with non representative fluid.

- Disposal/outlet, is the fluid and gas disposal outlet.
You have to reach these fittings
with a wrench

There are two ball valves:

- Main inlet; is the valve that pressurize the container and fills it with non representative fluid.
- Depressurized samples is the valve used for extracting de-pressure samples and emptying the container for fluid.

There are four needle valves:

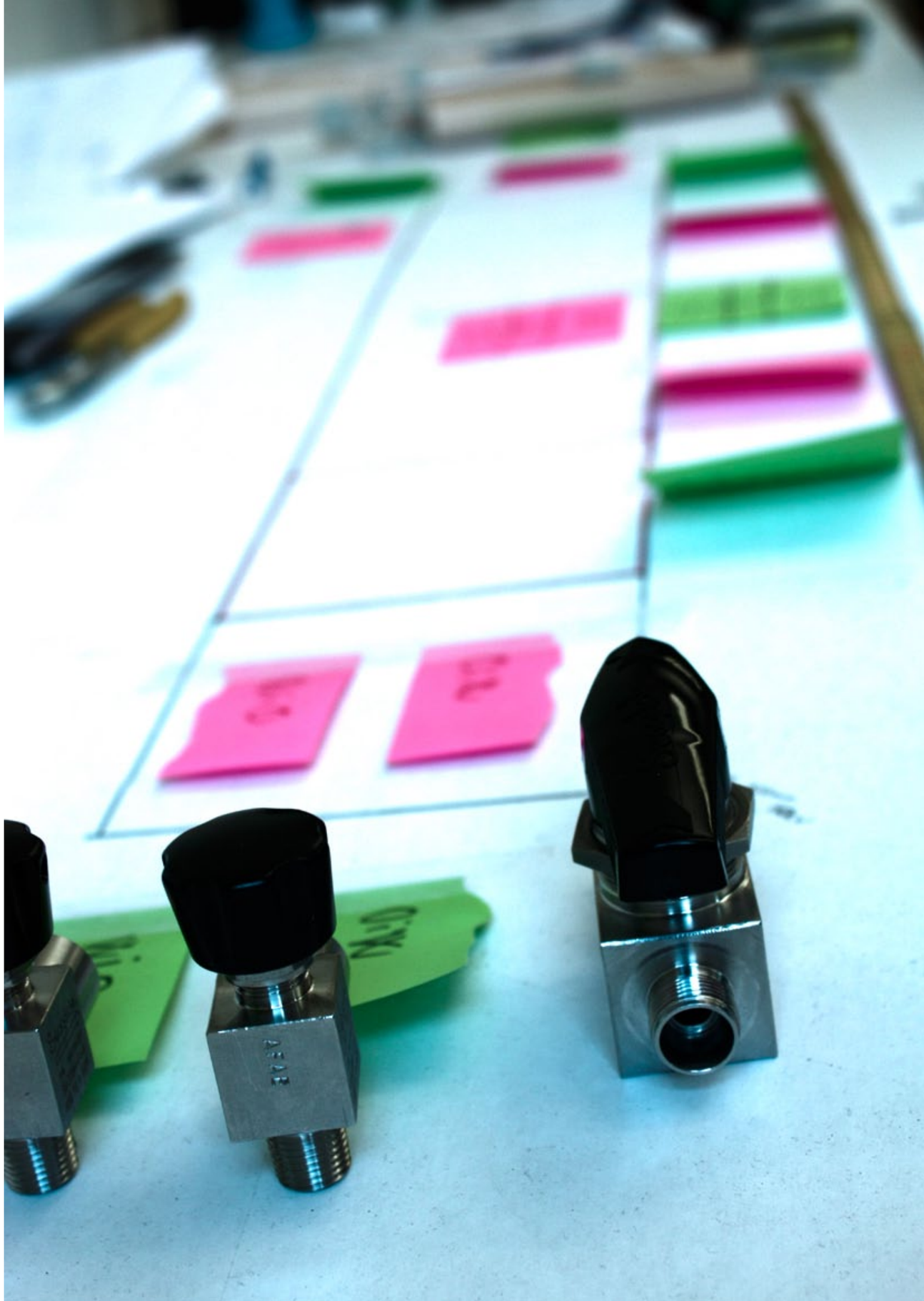
- Valve for flushing the container (emptying the container for non representative fluid, when under pressure)

- Valve for filling the container (Filling the container with representative fluid after flushing, under pressure)
This valve is also used to de-pressure the container. This valve lets gas out through the disposal outlet.

- Two valves for Pressurized samples: One enters the oil phase and the other enters the water phase.

There is one pressure gauge to control the pressure.

There is one PRV (Pressure release valve) to release pressure if it rises above the limit.



5.2 Preferred layout

To look at placement of the valves I drew up the sampler on a cardboard and placed the different elements as shown in the image below. The red posters are equal to the green posters, but are used in accordance with a smaller sample container. The drawing is actual size. I placed the cardboard upwards and tried to simulate using the different components, following the procedure. By moving the posters and going through the procedure I got an idea of what would be a good solution in terms of the placement of the different components.

It was also important that the placement of the valves symbolised its purpose. If you look at step 3 and 2 you notice that they are in the wrong chronological order (from top to bottom) when considering only the procedure. But if we look at the placement of the fill and flush valve we can see that it is a natural placement to have the fill valve above the flush valve. The placement of the valve represents its function.

An important factor concerning the procedure is the continuous observation of the pressure during filling, flushing and pressurized sampling. It is very important to have control over the pressure when using the valves to obtain a representative sample. Therefore the pressure gauge should have a central position.

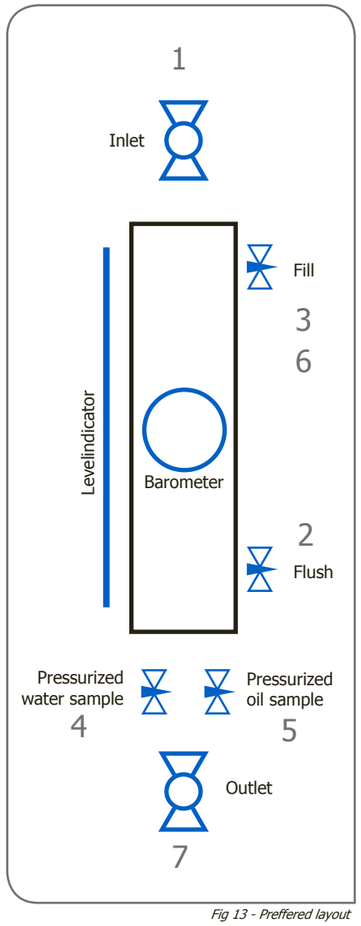


Fig 13 - Preffered layout

5.3 Feasible layout

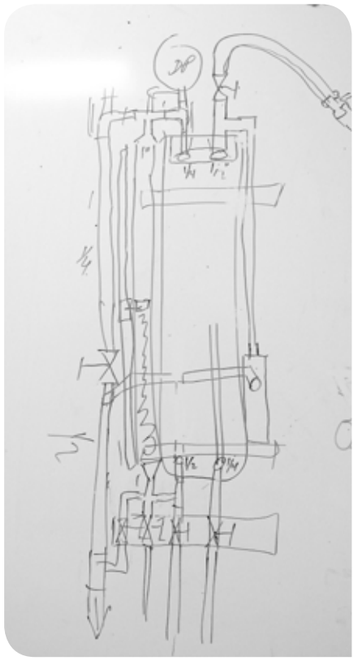
Trying to realize the preferred layout to was a "nut to crack". Trying to make all elements fit together, and at the same time try to make things more compact was not easy. After working with the layout in 2D I went over to 3D and shortly after to creating physical mock-ups of different solutions.

5.3.1 2D VS 3D VS Mock-ups

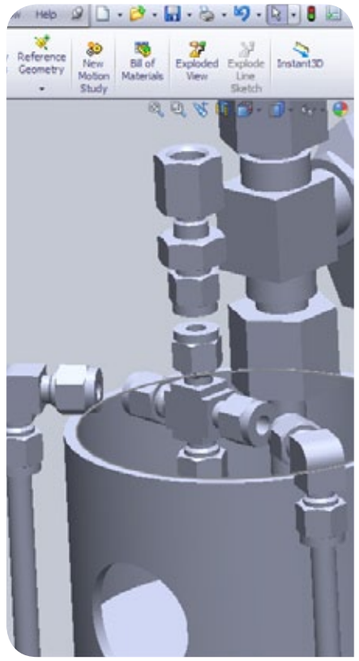
When working in 2D you get a very limited view of how to place and fit different components together, a method that need a lot of visualisation capacity. It is hard to draw a layout that for instance has one tube in front of another. You only have one perspective.

When working in 3D I could download parts from Swagelok and then get actual sizes of the different components. For example: when working in 2D I got an idea of what I wanted the sampler to look like, but after checking it with 3D I had to discard it.

Although I had an advantage when using 3D I felt that I lacked a freedom that was restricted by the tools in the 3D software. To avoid this I started building mock-ups. When working with live models I could more easily see the whole picture and get every perspective I needed. Instead of spending time on visualizing the layout (as in 2D) I had the model to "visualize it for me." And I could focus on changes and possibilities.



2D layout



3D layout

Mock-up layouts

5.4 The chosen layout

The modelling led to a layout that made the sampler more compact than before. The layout formed now tree branches; this also complements the product identity keyword; "3" and "separate".

This layout was chosen because:

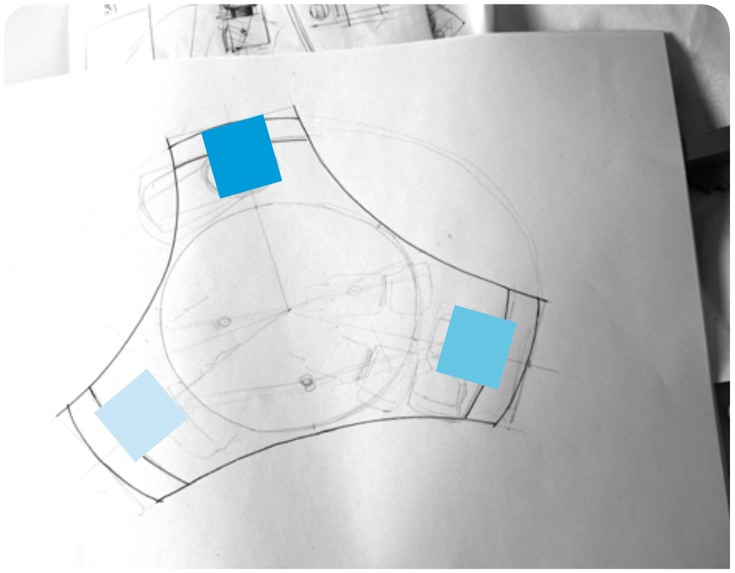
There are totally 3 tubes that need to make connections between the top and the bottom of the sampler.

This layout was the closest to the preferred layout.

The pressurized needle valves became a part of the same branch; with the De-Pressurized ball valve on its own branch and with the outtakes and main intake on the third branch.

The PRV was now bigger and heavier than on version 1. The PRV has one intake and one outtake that are perpendicular to each other. It was therefore difficult to find a place where it would fit that also would match with the rest of the layout. The solution was to put the PRV in the bottom "valve hole" of the Proserv cylinder. This also lowers the point of gravity.

Another problem was the two needle valves that make up the pressurized outtakes. One of these needed to come out of the 1/2" tubing. The problem was to make these two be together. This was solved by using an NPT adapter that went out of a T-fitting (2x1/2" too 1/4" out). The two valves became then angled in the same direction, on line with the other pressurized valves (the Flush and the Fill valve) found on the right branch.



5.4.1 Representative Samples

The layout is in accordance to the guidelines given by the Typhoon Multiphase Sampler Technology.

The fluid will enter straight in from the top and go straight out when leaving the sampler. Because NTP fittings have restrictions that can alter the sample they are not used at certain areas.

Needle valves that are used have a soft stem that is suited also for gas.

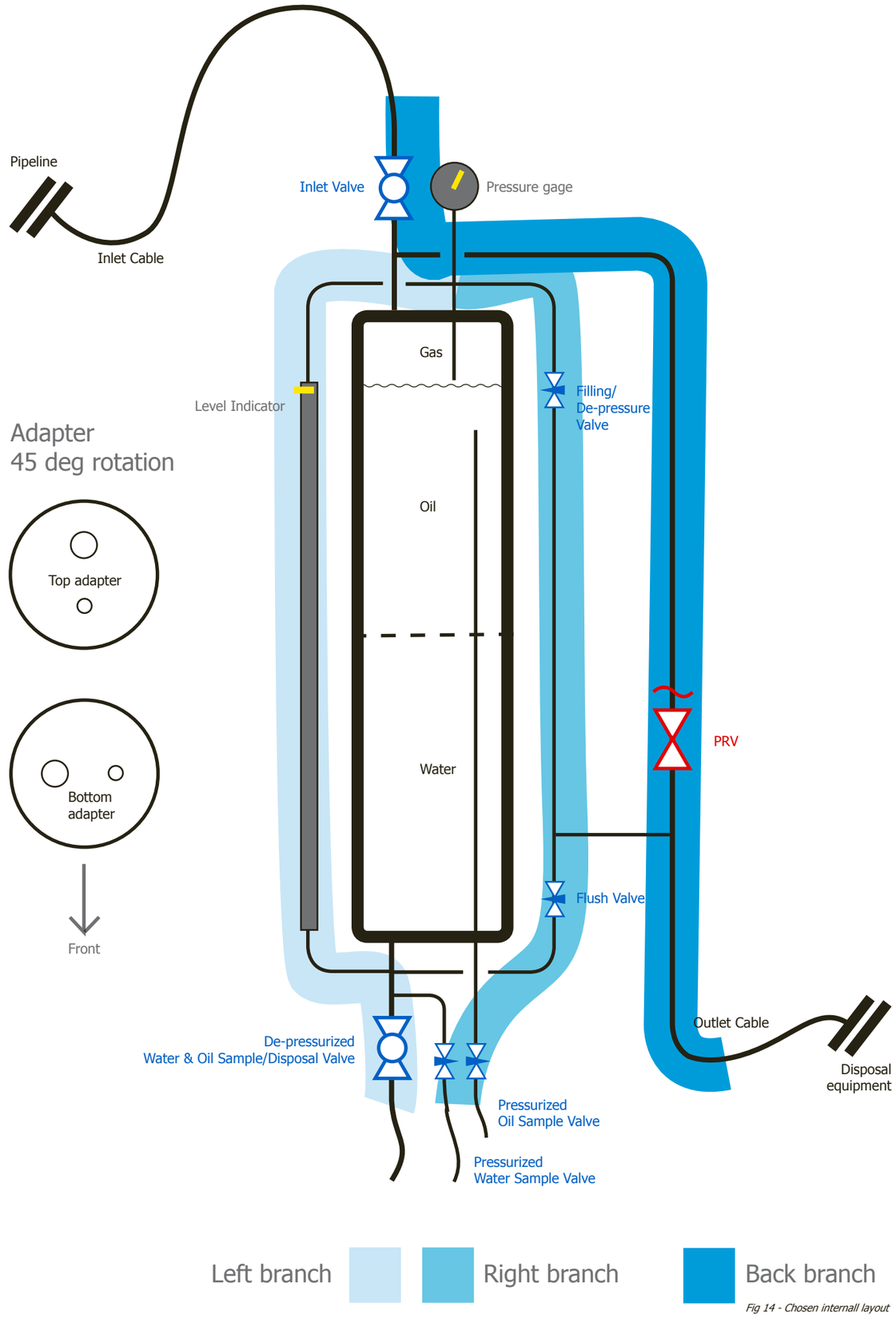
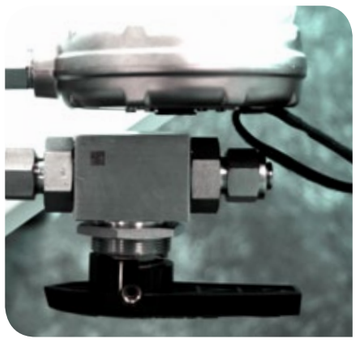


Fig 14 - Chosen internall layout

5.5
Version 3 - Internal

The pressure gauge is placed in top in front of the main inlet valve. The level indicator is placed on the opposite side of the Flush and Fill valve that controls the level. At the bottom you will find the different sampling valves, with the pressurized valves on the same side as the other to valves used under pressure. The outlet and PRV is placed in the back.



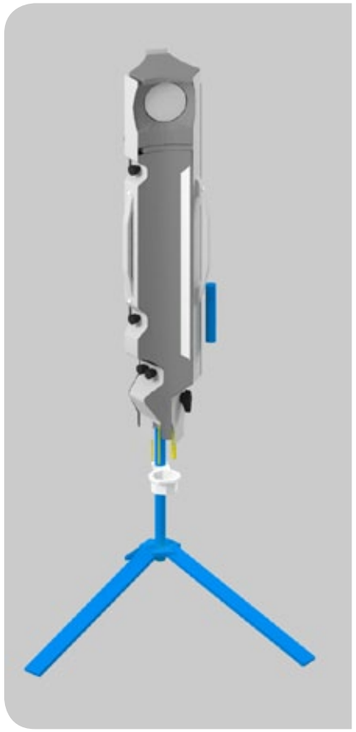
6 System design: Sampler external construction

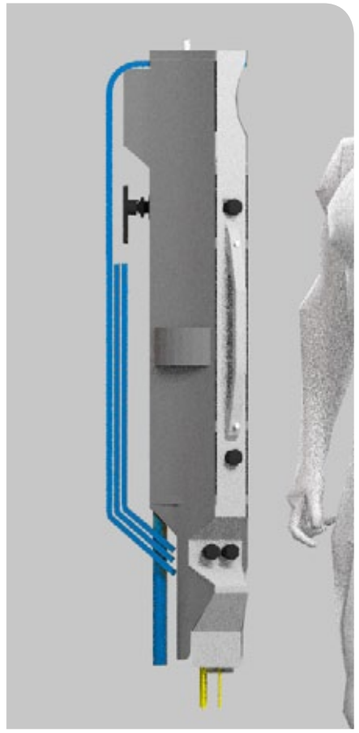
After looking at different ways of constructing the sampler (Appendix, page 132 -135) the selection fell on the concept you see to the left on the image below. This concept is based on the chosen internal layout. The internal and the external concept chosen gave the combination that matched the most of the criteria's given by the program of requirements. In what way it matched and how the concept developed will be explained more throughout the following pages and in the chapter: Prototype.

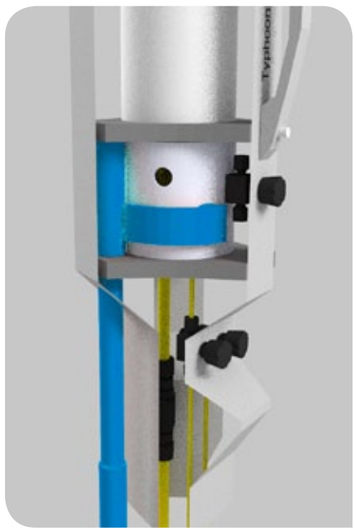
6.1 Concept (idea) principle

The idea behind the concept is that you create 3 structural supports where the three internal branches go, protecting the pieces of the internal layout.
The pressure gauge is central in order to give the user a situation awareness that is critical to get a representative sample.
The sampler is as compact as the internal layout allows.
It has a characteristic aesthetic with no tubes and fittings showing, just the objects that are to be used.
The legs was ment to be foldable and are stored by putting them on the back of the sampler to make it as compact as possible.

In the beginning it was uncertain how much the sampler would weigh, therefore the sampler where though to be carried, in the hope of using a smaller container. The cylinder showing on the image is drawn with a 2 litre container instead of the 4 litre container you find on version 1.
A 2 litre container was also a wish from one of the consultants; he ment that this was enough.
Later you will see that it was decided to use the same 4 litre as in version 1.







6.2 Concept development: Elevation and transportation

6.2.1 Legs

In order to fit sample bottles and disposal buckets underneath the sampler it needed to be elevated up of the ground. To achieve this there had to be some functions that made this possible.
In order for the sampler to be an "independent product" the sampler should not be dependent on using lifting equipment that is found on platforms. The sampler can as well be used on shore where such equipment may not be found. The equipment may also vary from installation to installation.

The conventional tripod is something that is commonly used. It is stable because it is supported by three points. I thought it was favourable to make a tripod that where foldable and to make it obtain as little space as possible.
I found two ways to create the legs: To make them an integrated part of the sampler or to make them individual. This would mean that the user would have to install the leg support at the place he/her wanted the sampler to be, and then lift the sampler on top of the support much like in the same way as on the sampler version 1. With version 1 you could not move both the sampler and the leg support at the same time, unless you used a trolley of some kind.
So an optimal solution would be to have some legs that where a part of the sampler, obtaining little space and easy to mount and demount.

In the image below you can see the leg concept that was chosen for the sampler concept.
When lifting the sampler the legs and a locking ring will fall down by gravity. When lowering the sampler the ring will lock the legs and stop the sampler from collapsing.

6.2.2 Wheels

Because of the sampler weight the sampler cannot longer be carried over long distances therefore need to be transported in some other way. The sampler was therefore fitted with wheels in order to make it easier to move around.

6.2.3 External feel

I made a cardboard model of the ouside to see how it would look and also get a sense of the sizes.

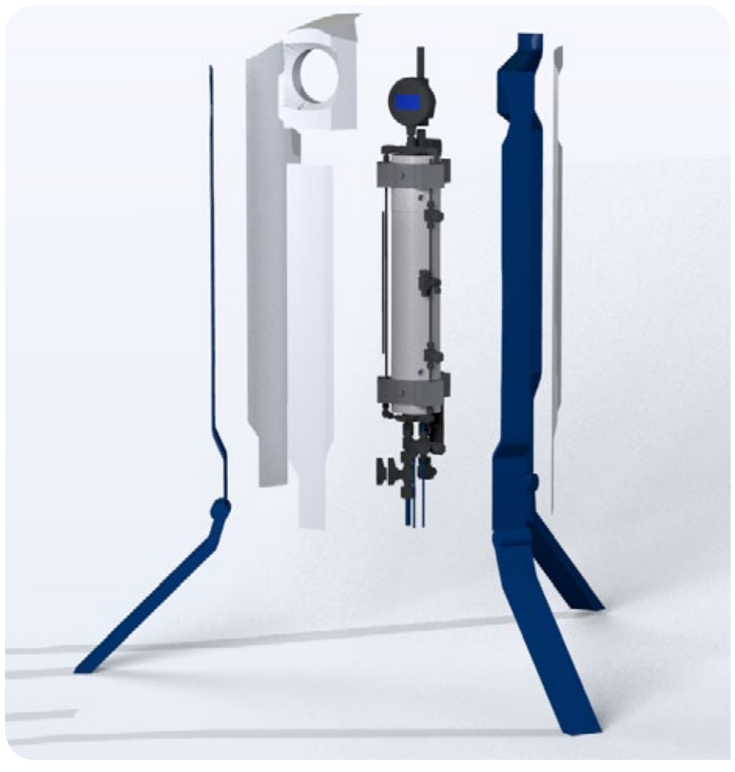
6.3 Concept update: Concept (portable)

The concept was further developed and ended up with some changes regarding the legs and some changes to the structural profiles because of the internal layout. The inward going bumps where the Fill and Flush valve are where taken away because of production.

The construction consists of two brackets holding 3 structural profiles, 3 foldable legs connected to the 3 profiles, 3 covers in between and one Plastic cover on the top over the pressure gauge.

I added wheels to the concept to make the sampler more transport friendly.

In this stage of the concept the legs works now as followed (row of pictures on the right):
First you let the legs fall down to the ground.
Secondly you lift the sampler up from the ground. For example a locking ring will fall down.
Thirdly you put the sampler down and the locking ring should prevent the sampler from collapsing.

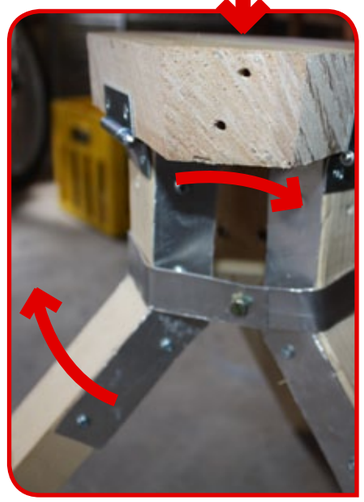


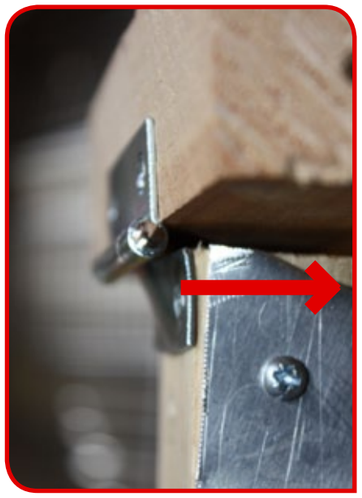
6.4 Concept development: Legs and wheels

By creating a provisional model of the sampler legs I experienced how the forces would work on the hinges.
The images on right shows the locking ring and the weight of the sampler creating a torque that forces the hinges inwards.

On the first model I placed the hinges vertically. In the image below you see what happened to the hinge. The hinges where weak to sideway movement and buckled easily when I sat on the construction (80kg).There was also a rotation of the legs and hinges when I moved in sideways movements.

It should be mentioned that the hinges where not high quality, the leaf thickness was 1.5 mm, the height was 40 mm and they where extremely loose.



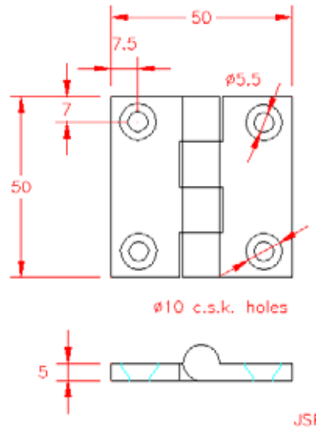


Because of how the forces worked I placed the hinges in a horizontal position instead. This meant that the hinges would depend on their tensile strength. This time the hinge where not deformed, only when I moved a lot the screws that held the hinges in place where drawn out of the wood and the legs collapsed.

Critical aspects are the looseness of the hinges and the strength of the hinges. Having loose hinges will make the torque work on different weak areas and make the legs buckle. It will also make the sampler unstable and give the impression of being unsteady.

6.4.1 Hinges

Butt Hinge - 50mm x 50mm
Part No: JSPB03
Grade: 316



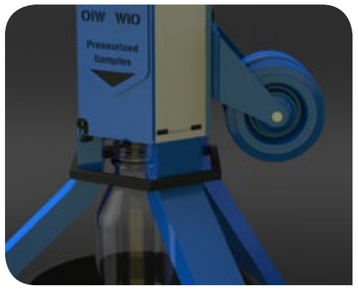
The hinges that were chosen for the prototype where bought from juststainless.co.uk
The reason they were chosen was because of the price and measurements.
They are 50x50x5 mm. Heavy duty hinges are hinges above 3mm.
The only drawback with these hinges is that they are not made exactly after these measurements. They are actually 3.4mm thick and 48-49 mm in width and height.

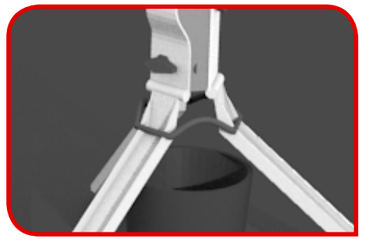
If these hinges are not found to be optimal there will be other alternatives, such as the heavy duty railway hinges 72-7-4187 from Pinet. They are actually 50x50x5mm. These hinges are sold by http://www.torp-fasteners.no

6.4.2 Wheels

Two wheels are positioned in the back and lower part of the sampler. These replace the two small wheels from the earlier concept. This is because they were not suited for ruff surfaces.

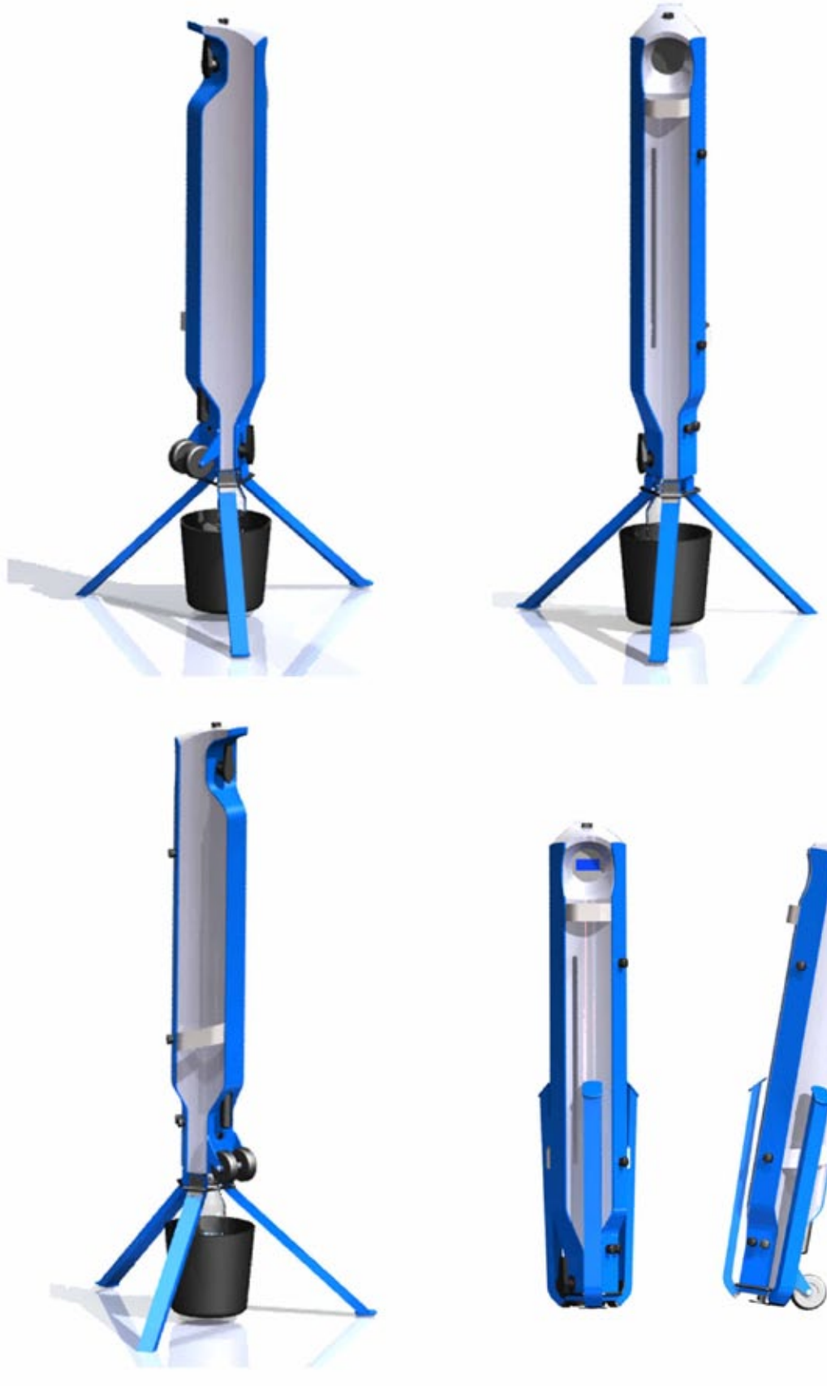
I had to move the legs from coming out of the end of the profiles to the end of the covers. I had to do this in order to create strong enough legs that also could be rotated upwards lying inside the sampler, making it compact. The legs were also moved because of the fact that the sample bottle and disposal bucket had to fit under the sampler. By rotating the legs I got easier access underneath and a more compact sampler.

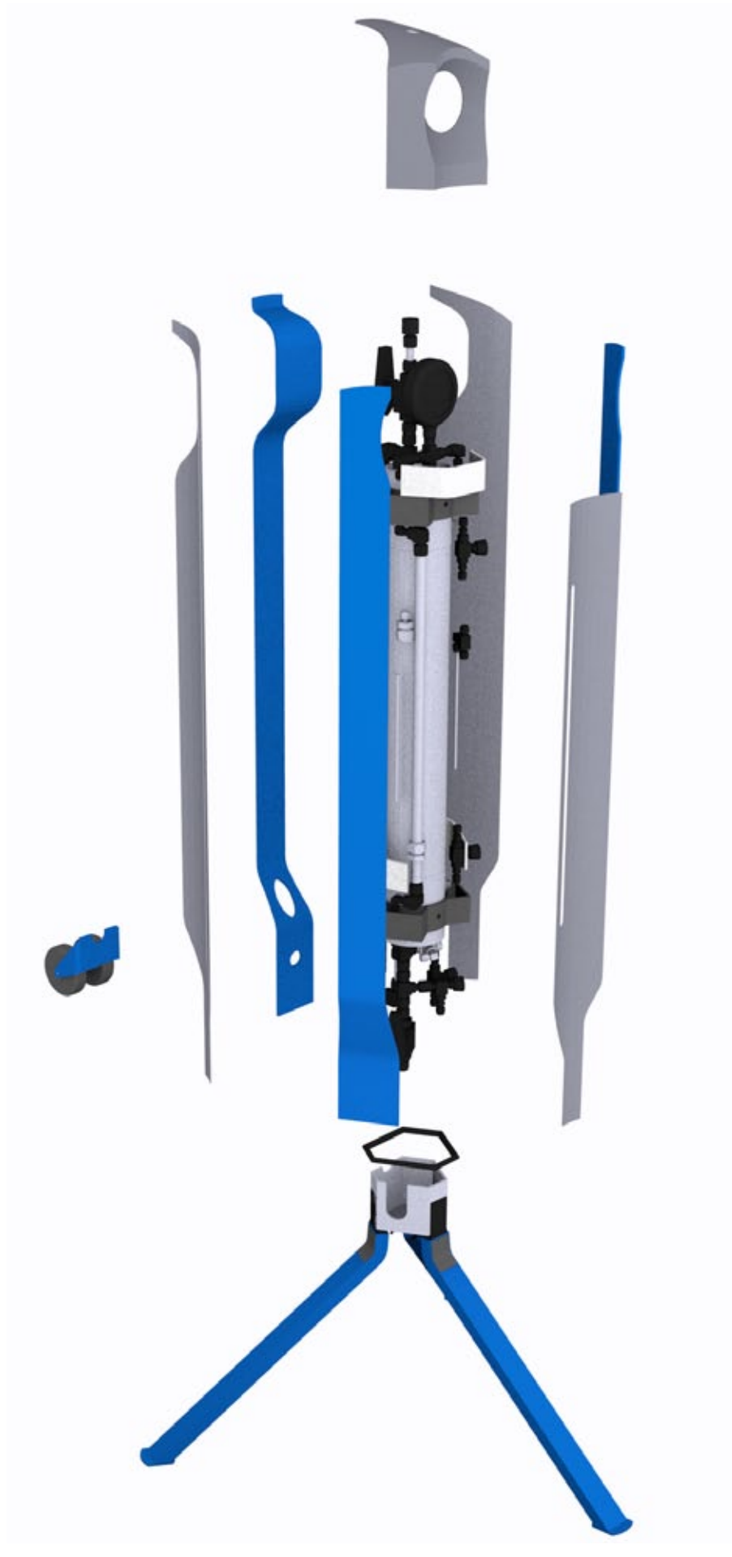




6.5 Concept update: Concept (need verification)

The concept where now starting to come together, but I had questions that I needed answered concerning production.





6.6 Concept development: Manufacturing

A goal with the project was to make something realistic, something that was possible to produce, at a fear cost. At this point in the process I had not consulted with any manufacturers, but I had in mind that I wanted the structural elements to be aluminium and the side and top covers to plastic or metal as well. Uncertain with other aspects of the sampler concept as well I therefore wanted to consult with somebody about production possibilities and solution concerning the concept.
With the help from Typhonix I got a meeting with IKM Haaland. In the meeting we got to talk about the sampler technology and present the concept to them (Appendix, page 142 - 143).
IKM Haaland work with sheet metal and has a large production facility located in Vigrestad on the west coast of Norway.
A lot of feedback where given on changes and possibilities on how to make it more suited for production.
The meeting also lead to that IKM offered to help out with the production of a prototype.

6.6.1 Profile bends

In the concept I have used a radius of 50mm on the profile bends. The tools needed to achieve these bends put restriction on how short the distance could be between a bend and the end of the material. And it also put restrictions on how close bends could be to each other. This resulted in the change of the back profile where I got rid of the two top bends (see images on the left).

6.6.2 Side covers

The bow in the side covers was hard to manufacture especially because of the cuts that are done to the covers. Cutting after roll forming could make the material change in shape, because of the tension in the material after roll forming.
And also it would make the assembly easier if the covers where bent instead. So that was what I decided to do after looking how the changes would affect the aesthetics.
I tried with different amounts of bends but ended up with 3, this number matched with the keyword 3 and more than three bends looked strange and feigned.

6.6.3 Brackets

The brackets where made by creating a "puzzle" of different pieces. The puzzle easily fit together and is easier to weld and assembly together to the specific measurements.

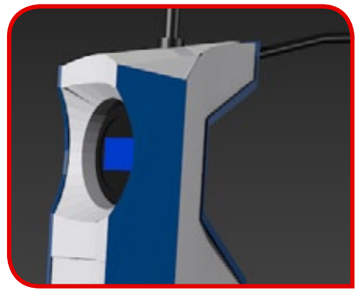
6.6.4 Labels

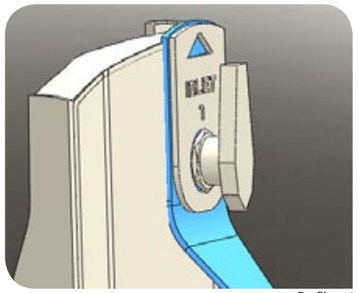
When operating the sampler it is important to follow the procedure. So to emphasize the functions of the different valves in addition to their placement, there was added labels for every valve.
This would give the user an added trust in the product and the procedure, telling the user which valve he/her should operate and when.

I was told that a good way to produce labels where to make the holes go directly through the material instead of engraving. In that way when the sampler is repainted by somebody with a brush the message will still be visible.

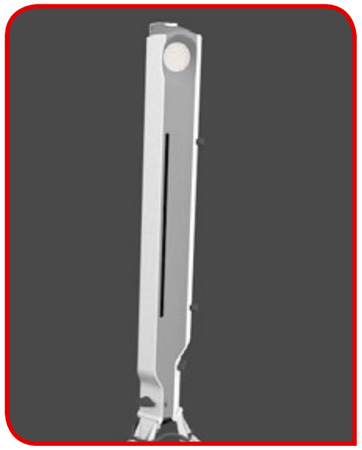
Since I could not do this to the structural supports, the labels where created as own parts so they could be disassembled from the sampler and repainted or replaced.

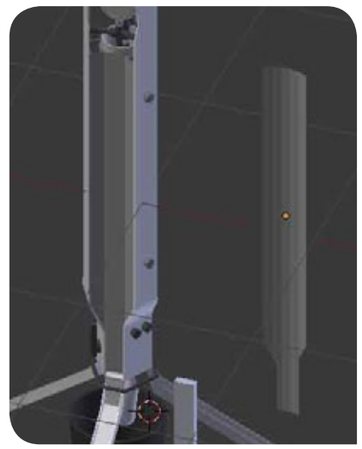
The black colour filling the text is tape or folio that lies in between the profiles and the labels.
Since oil and dirt are dark colours also, this will not affect the visibility of the information.

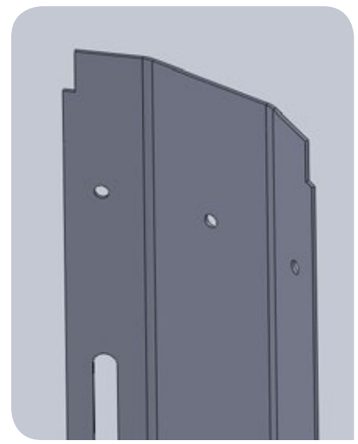




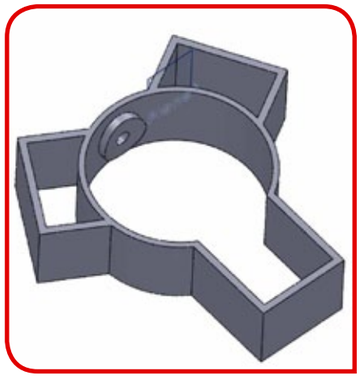
Profile cut

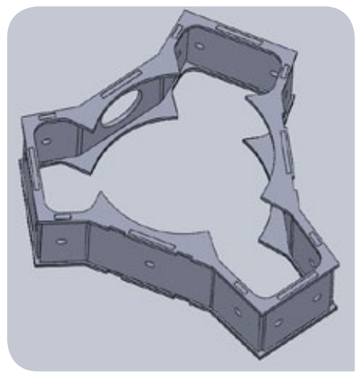


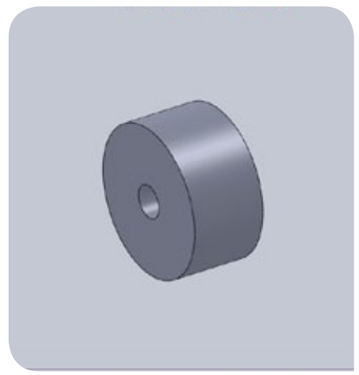




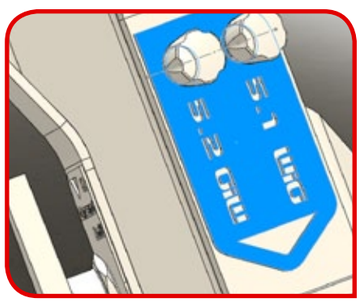
Cover bends







Brackets and positioning cylinder



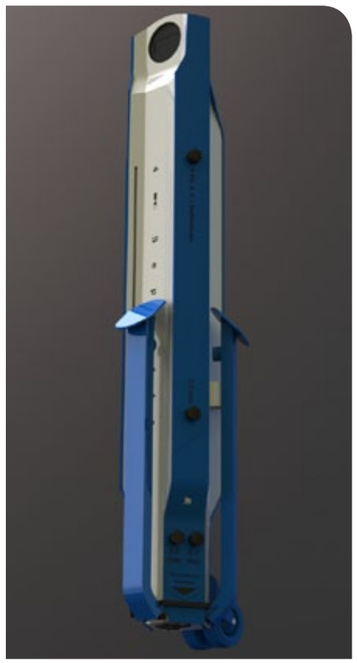
Informative labels

6.7 Concept update: Concept (almost there)

Even though the curves in the side covers where replaced by two bends the aesthetic expression was not lost I thought. On the contraire the expression became more strict and fearless. The keyword “fearless” can be understood as opposite to “care” and “feel & flow”. But having a product express “care” may also become a sense of brittleness, and we would not have that either. The right sense should be that the product expresses a sense of ability to take care of the sample by being fearless and solid, so more tough-care than nervous-care.

The light reflections given by curved surfaces get elongated, in contrast to flat surfaces that get cleaner and non deformed reflections.

The top plastic cover is changed by letting the lines go straight upwards. By doing this the look got even more clean and simpler. Knowing that the fluid enters in the top it also helps when this “restriction” is gone. The functional aspect by removing the top of the plastic top is that if you would change the pressure gauge you could just make a different sized and located hole on the flat surface.



6.8 Concept development: Final detailing

6.8.1 Leg magnets

In order for the legs to be held in place when disassembled there shall be placed a magnet in both the side handles, the bottom front handle as well as on the three legs.

6.8.2 Leg ends

When the sampler is lowered to install the sampler the legs need to glide outwards for the legs go into position. Therefore the leg ends were changed to have a bend on the end just like a ski tip to better glide over restrictions in the surface.

6.8.3 Leg bends

The legs had originally a bend, but because of easier production the bend was replaced by straight profiles.

6.8.4 Handles

The handles should serve three purposes. There need to be two handles, one on each side to lift the sampler when installing the sampler.
There should be a handle in the top to roll the sampler around.
And finally a handle below the top handle in case two persons shall lift the sampler.

6.8.5 Locking mechanism

When you are finnished sampling and want to rig up another place you need to "unlock" the locking ring. When lifting the sampler the locking ring should go up in order to release the legs. An solution to this is to preload the locking ring with springs. The forces given by the loaded spring should lift the locking ring while lifting the sampler, thus relieve the weight from the legs, and the pressure on to the locking ring.

I bought two pairs of springs seen in the list below.

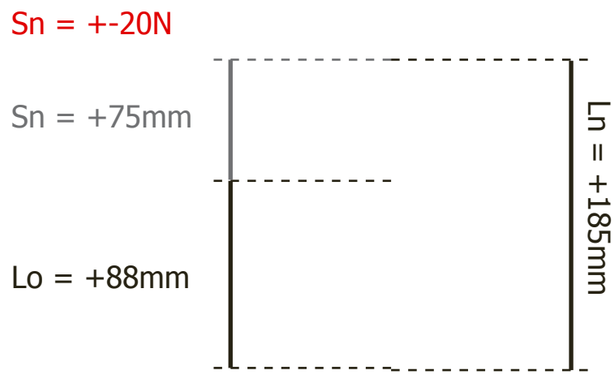


Fig 15 - Locking mechanism

Terminologi:
d = Tråddiameter i mm
De = Utvendig diameter i mm (D+d)
D = Middeldiameter i mm (De minus d)
Lk = Ubelastet lengde på fjærkropp i mm
Lo = Ubelastet lengde innvendig i øyne
L1 = Belastet lengde innvendig i øyne ved F1
L2 = Belastet lengde innvendig i øyne ved F2
Ln = Belastet lengde (maks.) innvendig i øyne ved Fn
Fo = Initialkraft (forspenning) i N (Newton) ved ubelastet fjær
F1 = Delvis belastning i N (Newton) ved L1
F2 = Ytterligere belastning i N (Newton) ved L2
Fn = Maksimal belastning i N (Newton) ved Ln (bør ikke anvendes)
sn = Maksimal vandring (uttrekking) i mm ved Fn (bør ikke anvendes)
R = Fjærkonstant i N/mm
m = Åpning (luft) ved øye i mm
Lk = Ubelastet innvendige lengde i mm

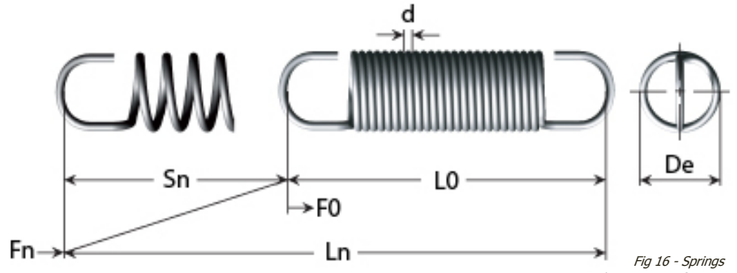


Fig 16 - Springs
Sodemann www.fjaer.net

d	De	L0	Ln	Sn	Fn	F0	R	Lager Nr.
0,94	**9,14**	**88,90**	**220,22**	**131,32**	**21,86**	**1,85**	**0,15**	**E03600373500S**
0,74	6,10	88,90	190,75	101,85	16,68	1,48	0,15	E02400293500S
0,99	**9,14**	**76,20**	**173,23**	**97,03**	**26,02**	**2,33**	**0,25**	**E03600393000S**
0,94	9,14	76,20	186,69	110,49	21,86	1,85	0,19	E03600373000S
0,94	9,14	76,20	186,69	110,49	21,86	1,85	0,19	E03600373000S

6.9 Concept update: Concept (prototype build)

6.9.1 Final steps before production

CAD

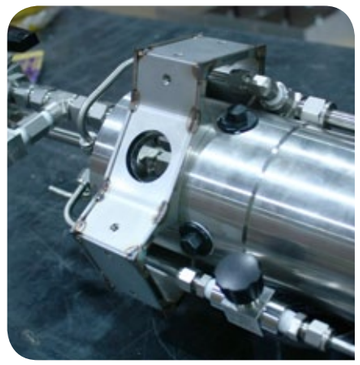
I was asked by IKM to help make the CAD files ready for production.
This process consisted of putting in k-values for bending, putting on material, paint, material treatment before paint, etc.
I learned a lot from this experience. The cad files I had provided needed a bit of work, and I had built the models in a way that I thought was for the best, but actually made the process more difficult. A lot of final adjustments where done during this process. In the end the files and drawings got ready and were sent to production. And two days before I needed to be finished I got the parts you can see below.

6.9.2 Assemble of version 3

I also got to assemble the sampler at IKM Haaland.
The process of assemble will show how all the parts fit together and what needs to be changed.

6.9.3 Brackets

The brackets where the first parts that where mounted and these fitted perfectly.



6.9.4 Covers

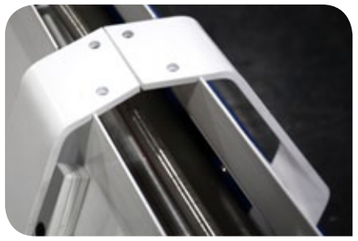
All the covers fitted as intended.
But they do not fit perfectly in relation to the profiles, there are some gaps, these can be removed by adjusting the cad files.

6.9.5 Locking mechanism

Before putting on the side covers I needed to insert the two sliding elements that go between the brackets and the side covers. After the side covers where mounted I could assemble the rest of the locking mechanism. The two sliding elements where painted and was for this reason a bit tight in the beginning, but they loosened up eventually when the paint were scraped of.
The springs chosen was E03600373500S (www.fjaer.net), these had enough force.

6.9.6 Handles

Handles were mounted without problems.



6.9.7 Legs

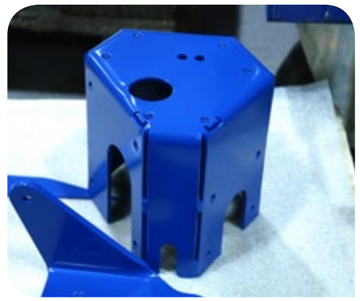
The hinges used on the legs do not match in the hole distance aither so we had to drill bigger holes in the bottom cover to make the legs fit.
In the image below you can see that one of the pieces to the front leg was velded to close to the leg itself. So the leg would not go back far enough, so we had to grind of a bit to make it work.

6.9.8 Wheels

Wheels were mounted without problems.

6.9.9 Bottom cover

The hole for the outlet is a bit out of position. This needs to be adjusted in the cad files.
The Tracks where the bottom part of the locking mechanism enters is also a bit out of position and need to be adjusted. The temporary solution was to grind these tracks larger in order to make the locking mechanism go all the way down.



6.9.10 Profiles

After the covers and handles were mounted there was no problem with mounting the profiles, except that the holes where just slightly a bit off. The hole for the PRV was a bit too small and needed grinding. Some valves were only 1 or 2 mm off some places, nothing critical.
They feel strong and work well as structural supports.

6.9.11 Plastic cover

The cover was made after the report was finnished, but there are no issues expected from the plastic cover.

7 PROTOTYPE

7 TYPHOON MULTIPHASE SAMPLER version 3

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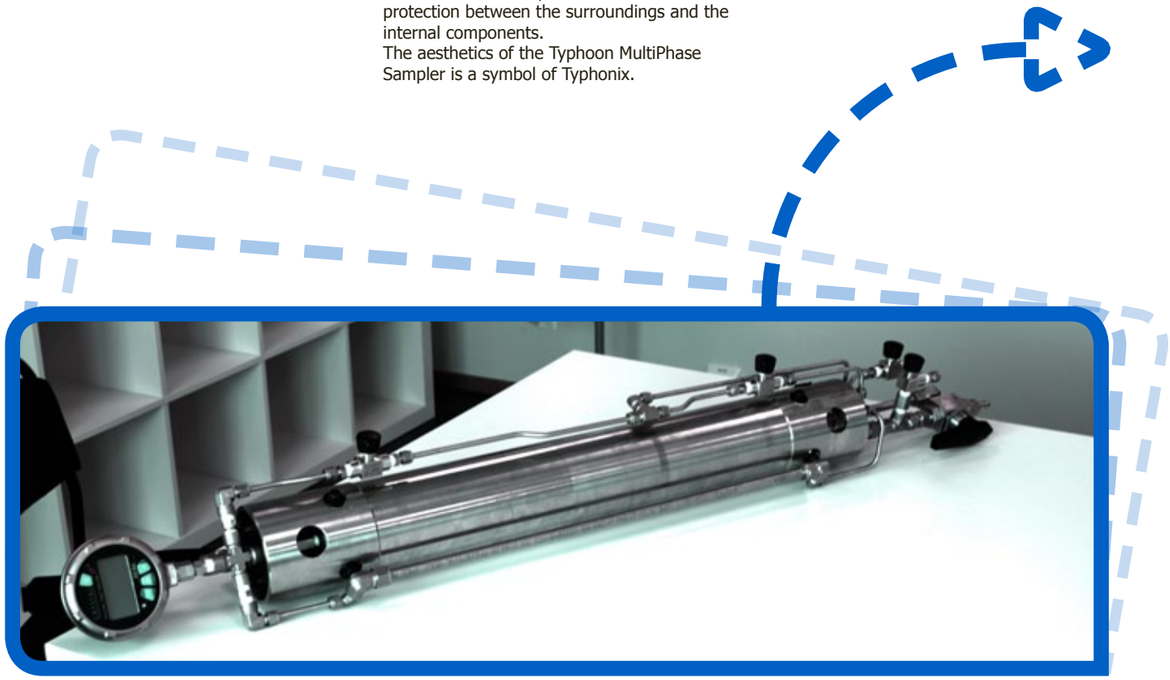
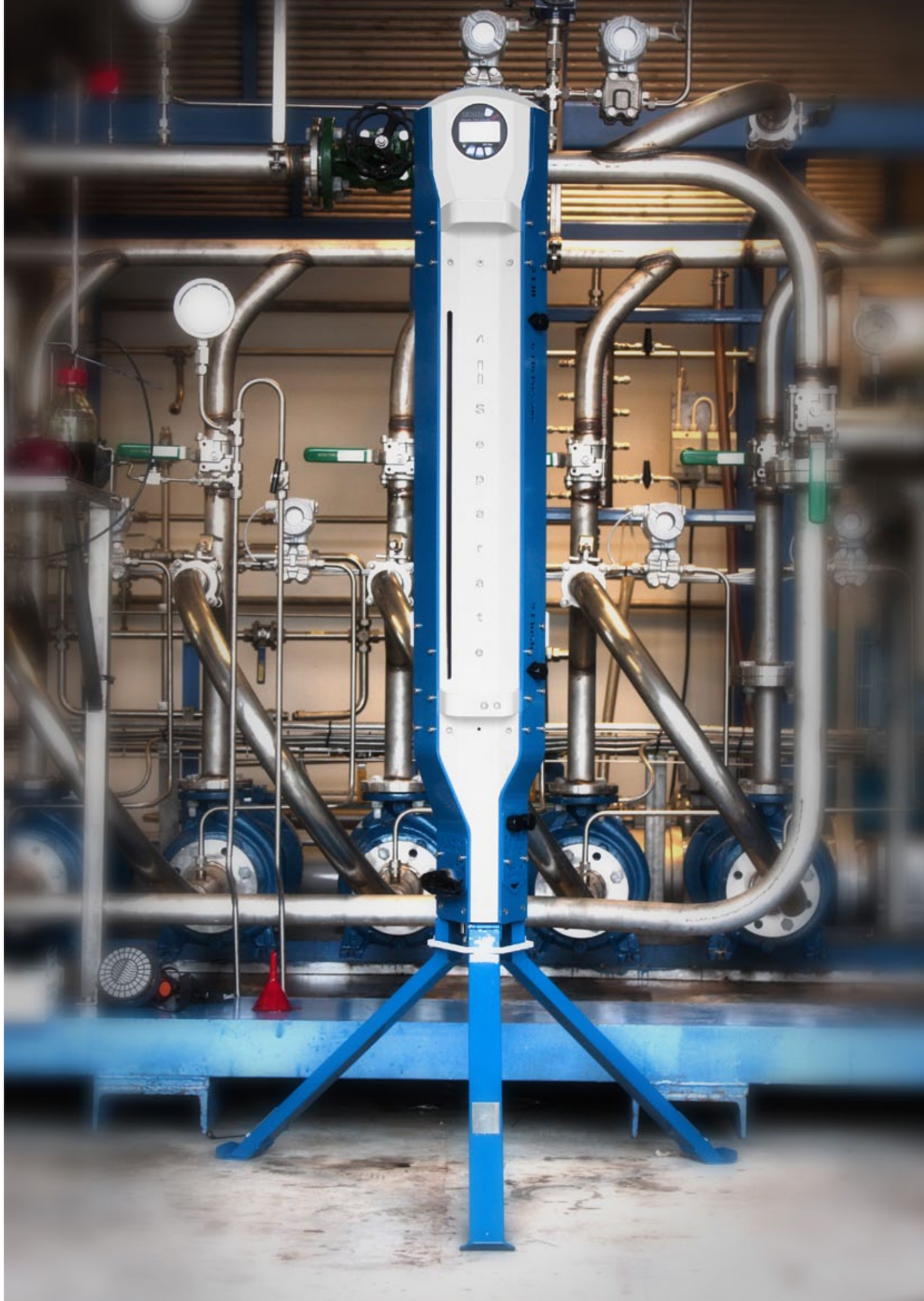
The new Typhoon MultiPhase Sampler, version 3, consists now of internal components that is laid out after specifications given by the Typhoon MultiPhase Sampler Technology and therefore allows representative multiphase sampling. In addition, the internal components are laid out in a system that makes the Typhoon MultiPhase Sampler compact and gives the user a better understanding of the relations between the product and the procedure to ensure the proper execution of the procedure and thus lead to optimal sampling.

+

The external layout serves as structural support and protection for the internal components. The external match the internal with its three branches, these profiles serve as the structural support of the sampler. Three covers between the profiles serve as added protection between the surroundings and the internal components.
The aesthetics of the Typhoon MultiPhase Sampler is a symbol of Typhonix.





7.2 TMPS Features

7.2.1 Support

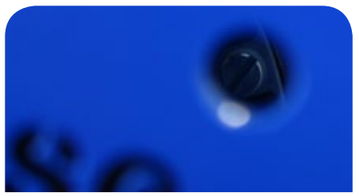
The most important part of the sampler is that the sampler is vertical and above the ground. 3 structural profiles, 3 legs and 2 brackets make shore that the sampler is supported.

7.2.2 Protection

The 3 profiles can withstand physical impacts that likely will occur. And 3 covers will further protect the samplers internal components from its surroundings.

7.2.3 Changing batteries

To change the batteries for the pressure gauge you need to loosen three screws. To reach them with a srew driver there are 4 holes going through the back profile.
After you have loosened the srews, pull the borreås to take of the batterie cover.. The srews are attached to this cover, so they wont fall out.



7.2.4 Situation awareness

The pressure gauge is located in a central position, being the most important instrument in the procedure.
The pressure gauge is placed in front and on the same level as the inlet valve. Monitoring the pressure gauge is important especially when opening the inlet valve an Filling.

The level indicator works by moving a magnet pen up and down the slot created on the front cover. The level indicator tells the user if the sampler is full or not.

The different valves have strategic positions and a label that explain their purpose. These labes can be replaced.

7.2.5 Symbols

The sampler is not going to be used by trained and dedicated personnel. In the image below you can see a droplet that points towards the top of the level indicator. The same element you can find on the flush valve.
There is also the hour glass that illustrates the time needed for the sample containers content to separate.

7.2.6 Magnets

There are magnets on the three handles and a metal plate on each leg in order to hold te legs folded.

7.2.7 Static electricity

According to ISO 3170:2004 A.4 precautions should be taken to avoid danger from static electricity. This is why there is a bolt on two of the three legs to connect wires onto.

7.2.8 Leg pads

The leg pads are formed as a ski tip to make the legs slide more easaly.

7.2.9 Plastic cover

The plastic cover enables the changes of different pressure gauges because the hole can be placed and sized after needs.

7.2.10 Portable

By having a sampler that is easy installed, easy to taken down and fitted with wheels, it demands little effort to move the sampler from sampling point to sampling point.
The sampler is compact and therefore easy to store and transport.

7.2.11 Install

The legs are a part of the sampler and makes it fast to install. You install by lifting the sampler, a locking ring will fall down, and when lowering the sampler the locking ring will stop the sampler from collapsing.
To take down the sampler you slide up and hold a handle on both sides while you lift the sampler by its two side handles. The locking ring should pop up and make the legs be push upwards when you lower then sampler.

The inlet and outlet hose fittings are found in the on top and bottom of the sampler.
The outlet is placed on the "dirty" side the back side.

According to NORSOK regulations nobody should carry over 25 kilos so the sampler is provided with handles enabling two persons to lift the sampler. The handles are positioned so they will enable proper lifting for one person (back straight).

7.2.12 Uninstall

To uninstaal the sampler you need to unlock the legs. You do this by sliding up the release handle on each side, continue the oppward motion lifting the sampler by its handles. This will put of the pressure onto the legs and make the locking ring pop up. You will heare a clear sound of this happening. After hearing this sound; lower the sampler. Now you can lift up the legs and lay it down or take it with you.

7.3 Procedure

Every future user will have to learn and know about the procedure described below. Therefore it is organized to better understand the sampler in relation to the sampler and its purpose.

Where it says - 0.2 bar, this means that the pressure should not drop more than 0.2 bar from the pressure of the cylinder, the same pressure found in the process line.

0 Preparing

Connect Inlet and Outlet hoses.

a - Make shore every valve is closed on the sampler.
b - Follow correct procedure for opening of valves at sampling point.

1 Pressurizing

Open INELT valve.

a - Monitor pressure gauge.
b - Wait for the pressure to stabilize.

2 Flushing

Open the FLUSH valve.

a - Monitor pressure gauge (- 0.2 bar).
b - Close valve when the level indicator show empty.

3 Filling

Open the FILL valve.

a - Monitor pressure gauge (- 0.2 bar).
b - Close when level indicator show full.

4 Separation

Wait for the sample with the different phases to separate.

4.1

Close Inlet valve

5 Pressurized sampling

5.1

Use the Pressurized Oil valve.

a - Monitor Pressure gauge (- 0.2 bar).
b - Close valve.

5.2

Use Pressurized sample Water valve

a - Monitor pressure gauge (- 0.2 bar)
b - Close valve.

Tips to presserve needle valves:

You do not need to tighten the needle valves when the valve handle naturily stops.
(ref swagelok)

6 De-Pressurized Sampling

6.1

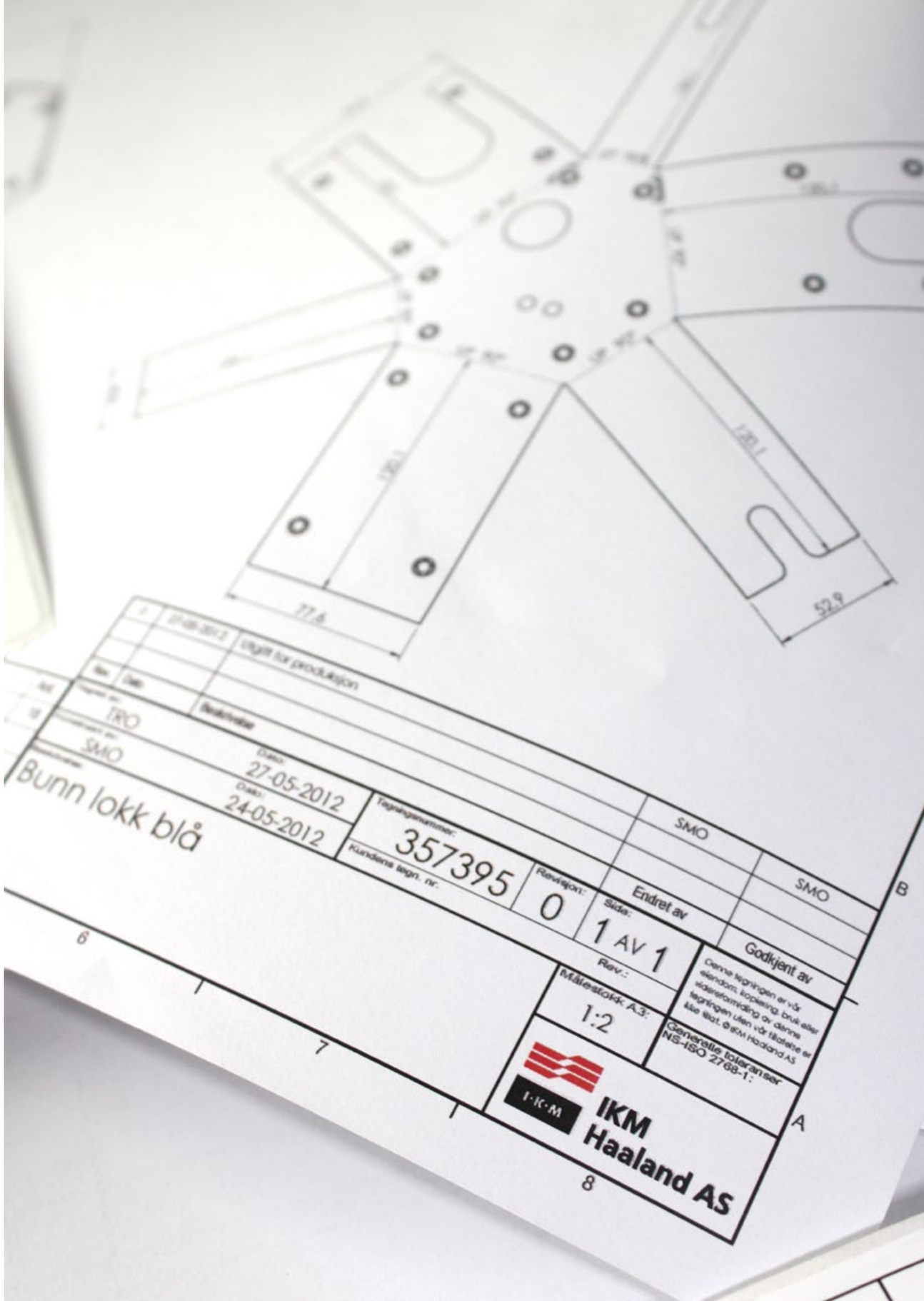
Open the De-Pressure/Fill valve to release pressure.

6.2

Use De-Pressurized Oil and Water valve

a - 1st Water
b - 2nd Oil

8 Production



8.1 Parts and prices

8.1.1 Internal parts

Prices include VAT at 25%

Pressure container - Proserv

4 liter used in version 1, 2 and 3	70 000,-
ProLight Ti-690-200 FT -	*69 656,-*
ProLight Ti-690-250 FT -	*70 205,-*

Valves, tubes and fittings Swagelok

Cross			
	SS-4-CS	1	311,-
Elbow			
	SS-400-8-4	2	322,-
	SS-400-2-4	3	341,-
	SS-810-8-8	2	607,-
	SS-810-2-8	1	252,-
Tee			
	SS-810-8-4	1	213,-
	SS-810-3-8TTM	1	290,-
	SS-4-ST	1	227,-
	SS-400-3-4TTF	1	275,-
	SS-810-3-4TTF	3	1282,-
	SS-400-3-4TMT	1	234,-
Nippel			
	SS-4-HN	2	110,-
Long Nippel			
	SS-4-HLN-2.00	1	77,-
Outage Tubes			
	SS-DTM4-F4-104	2	607,-
Adapter			
	SS-400-1-4	8	480,-
	SS-810-1-8	1	277,-
	SS-4-A	1	79,-
Ball Valves			
	SS-AFSS8	2	4995,-
Needle Valves			
	SS-20KF4	3	2479,-
	SS-20KM4-F4-A	1	1019,-
TOTAL			14340,-

PRV

8000,-

Pressure gauge

XP2 7000,-

8.1.2 External parts

IKM Haaland

External metal costruction	*10000
** protoype*	

Forus Industrier

Plast trekk	15500,-
Form	*14500,-*
Per trekk	*1000,-*

Just Stainless

3 x JSPB03 Butt-hinges	200,-

Blickle

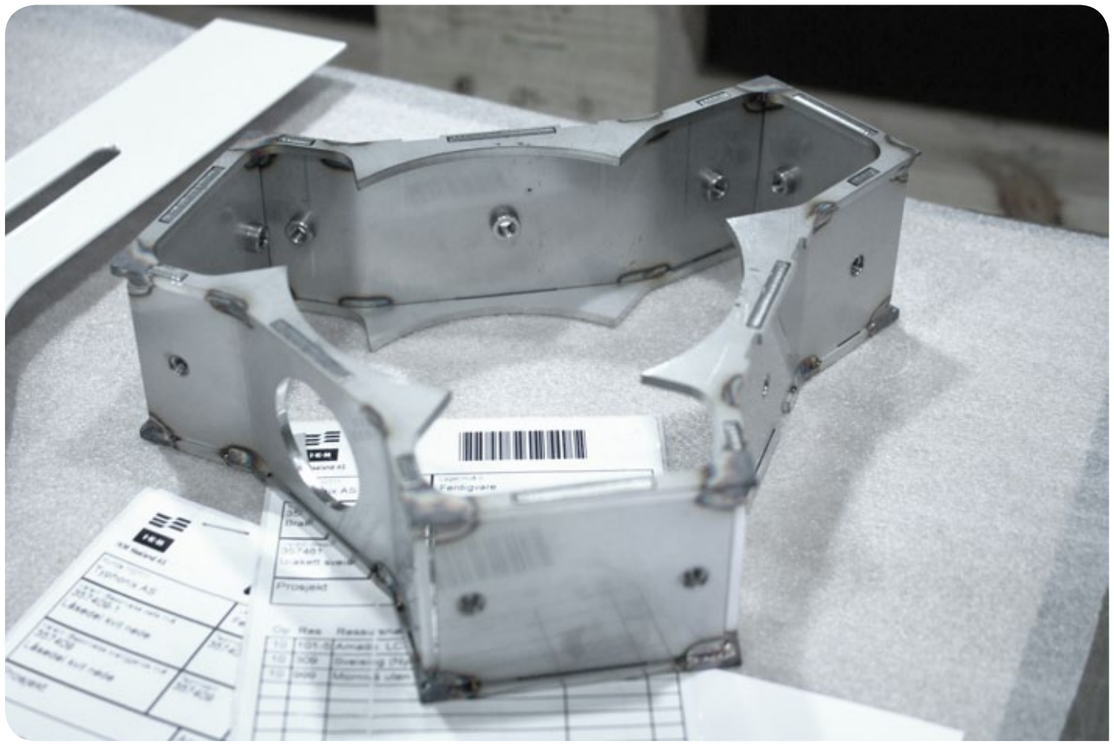
Wheels	466,-

Incl. VAT

125 506,-

Minus plastic form cost

111 006,-



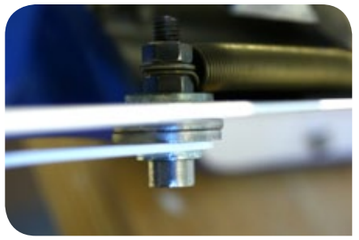
8.2 Further Detailing

After two days using the sampler there have been discovered things that should be improved. The suggestions described below may change.

8.2.1 Locking the locking ring

The locking mechanism works fine, but there are some adjustments needed. The locking ring is the wrong size, it is to wide.
The hinges need to be replaced for two main reasons. The hinges were not accurate in what sizes and measurements they were supposed to be so they were not mounted perfectly in position.
The hinges should be changed in order to make the system you see in the figure on the right work. A hinge that can do this is the Pinet hinges. They are also stronger.

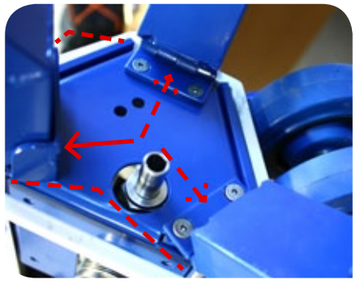
If you where to hit the locking ring or push the sampler hard sideways the locking ring will begin to or just pop up making the sampler crooked or collapse. This is why it is necessary to create a function where the locking ring is locked when the sampler is stationary. This can be done like you see in the illustration to the right.



It would help to make a bush that could guide the spring bolt in the white side cover slots.

8.2.2 Temporary position

In the temporary position the sampler can be steadier. Instead of using the one support (you can see the arrow pointing to in the image below) it have this on every leg or to continue the two blue front profiles in an arrow shape. This will add to the balance. If the sampler became to steady in this position, people could be tempted to live it in the temporary position.



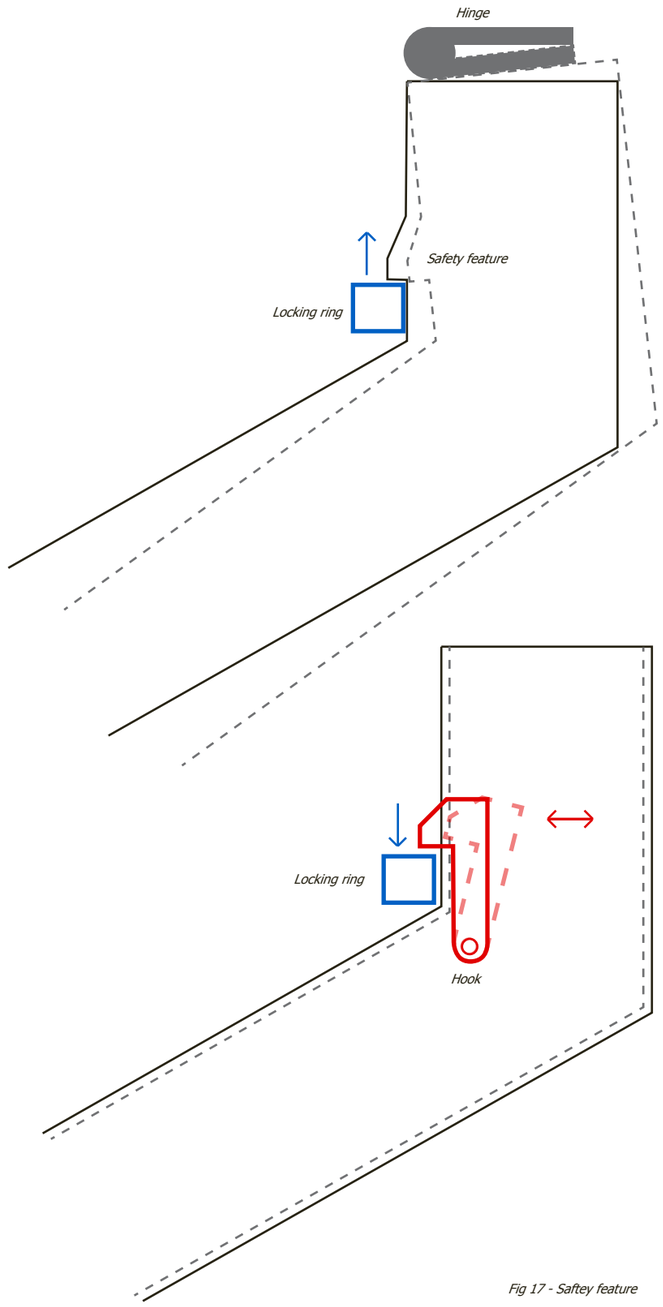
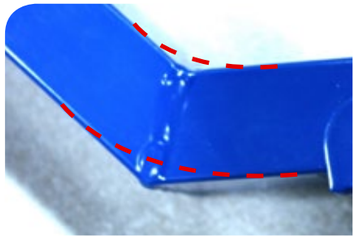


Fig 17 - Saftey feature

8.2.3 Legs

The legs was originally made with a bend (image below), but as a last minute decision to make the production easier these where made by cutting the material into two parts for so to weld them together.



The reason why the bucket did not fit underneath the tripod was because I got the dimensions wrong when I updated the production data.

The solution to this problem is to increase the angle of the legs. On the prototype it is possible to add some pads underneath the leg pads to heighten the sampler.

8.2.4 Magnets

The magnets that hold the legs in place while unfolded are to week. If the wheels hit a bump the legs tend to fall of the magnets.

The magnets will be replaced by stronger magnets.

8.2.5 Sounds

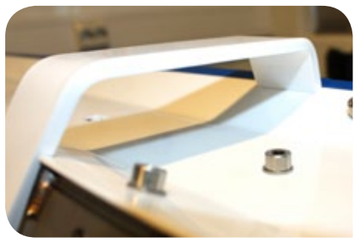
A loud noise comes when the sampler is lifted from the temporary position shown in the mage below. The legs will hit the ground.

This noise could be reduced with rubber padding underneath the legs.

8.2.6 Handles

The unlocking handle can be thinner and the handles to lift the sampler onto its legs can be wider. They are now not that pleasant to hold on to even though it is for a short while. They make the sampler feel heavier.

The handle you use when wheeling transporting the sampler should have something soft underneath to make it more comfortable.



8.2.7 Measurements

When assemblying the sampler some measurements where a bit off. And need adjsutments. The bottom "lid" had some holes that didnt match up with the rest.
The hole in backprodfile was to small to let the PRV through.
The white side cover do not math 100% with the blue proffiles. When the two brackets where mounted to the blue profiles the two holes did not align properly with the the holes in the cylinder. Therefore only the top-bracket is connected to the cylinder thorugh the holes.
The bottom of the white covers and some corners of the blueprofiles hit the legs when the legs where turned upwards.

These issues will be solved by updating the CAD files with new and more precise measurements.

8.3 Plausible changes

This is a prototype so the next step will be to see how functions work and how the aestetichs will be precieved.
The aestetich expressions and functions need to be validated.
Functions need to be further tested.
Typhonix will probably use the product them self in the beginning, in this way they can discover areas that need to be changed or further developed, and also experience how people will react to the aestetichs. Using the product on stands they will obtain more responses.

8.3.1 Length of the sampler

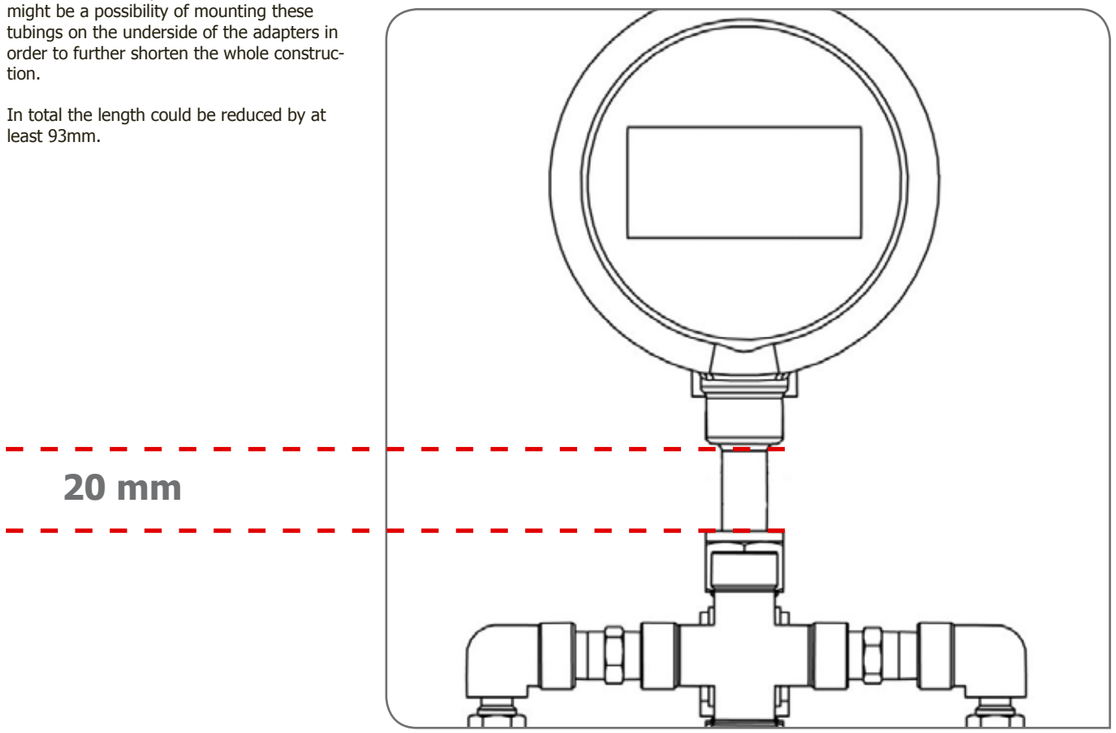
The length of the prototype can be shorter.

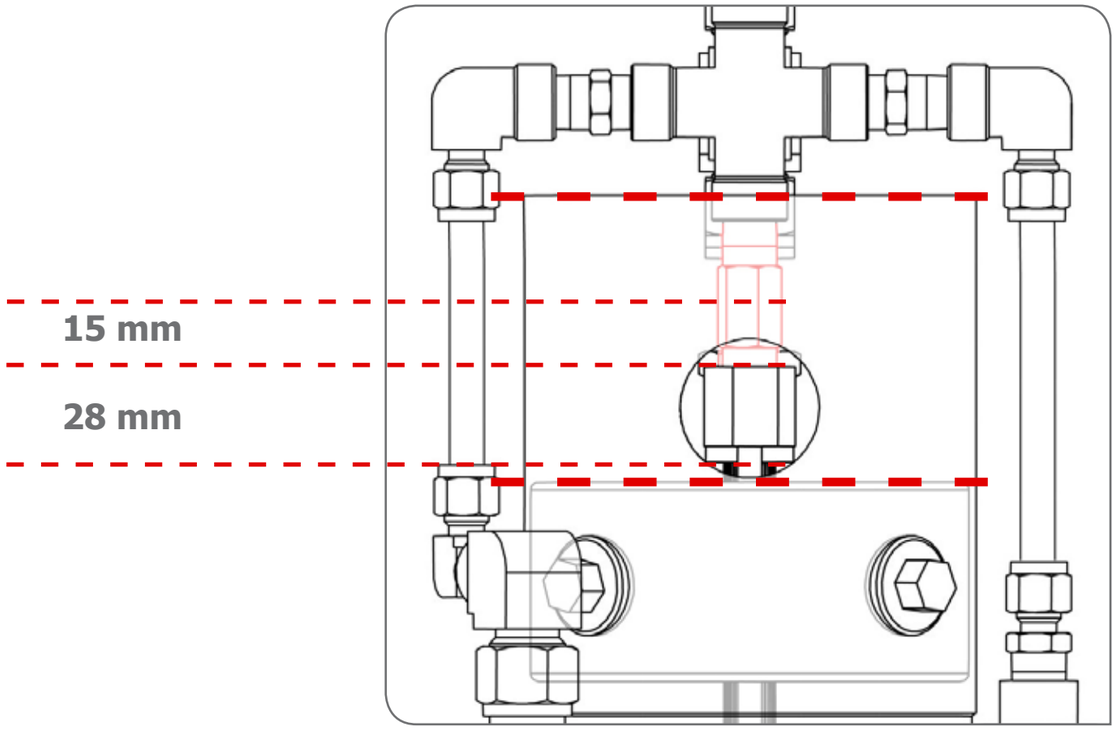
The XP2 pressure gauge used today do not have a 1/4 inch fitting that is normally used. This means that there need to be a fitting between the pressure gauge and the cross fitting, meaning that the pressure gauge gets higher, about 25 mm.

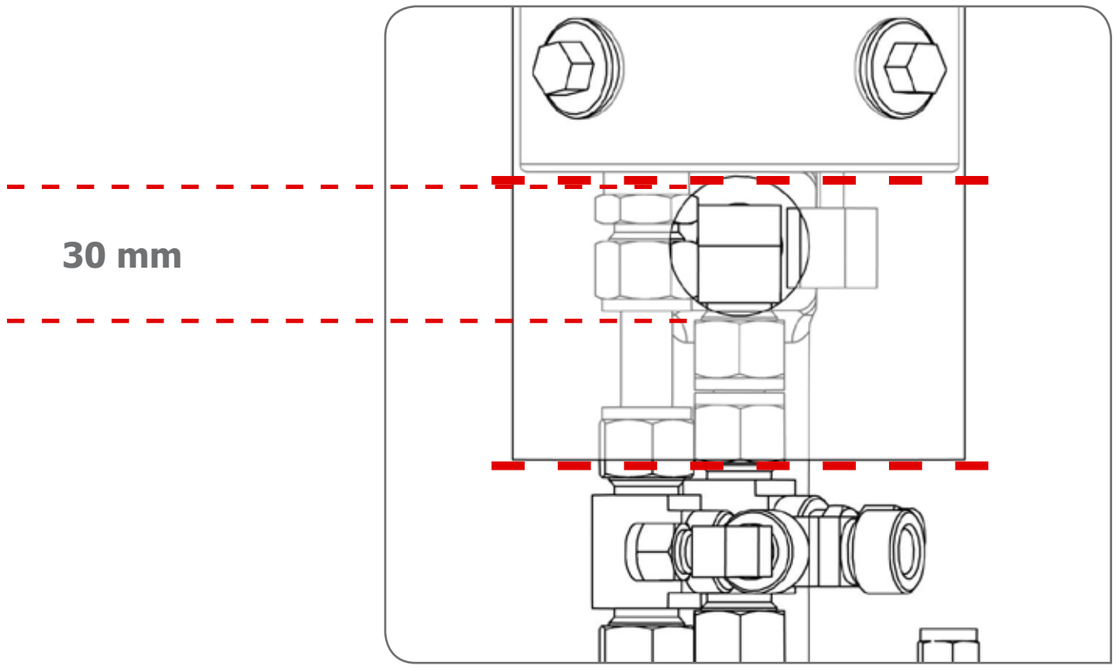
In a future engineered sample container the protection caps found on the top and bottom of the Proserv cylinders are more or less redundant. If these where cut of you could use different fittings and shorten the construction.

Instead of using the Outage tubes that are mounted on the top and builds 30mm there might be a possibility of mounting these tubings on the underside of the adapters in order to further shorten the whole construction.

In total the length could be reduced by at least 93mm.







8.3.2 Level indicator

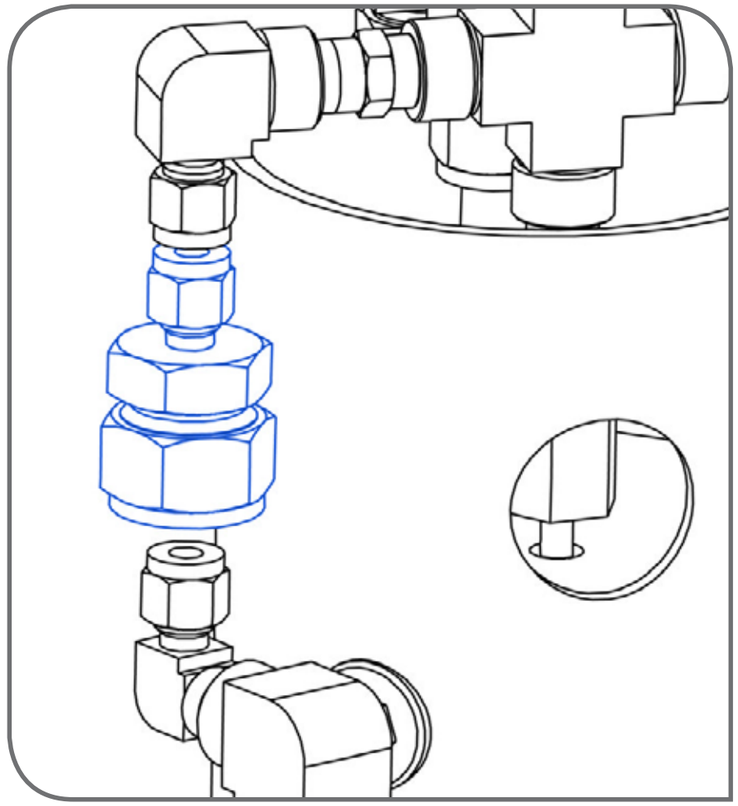
The levelindicator including the floater is an area that Proserv found to be a difficult to solve. The floaters had trouble moving when the magnet of the idicator tube interacted with the magnet in the floater.
The high pressure affected the floater.

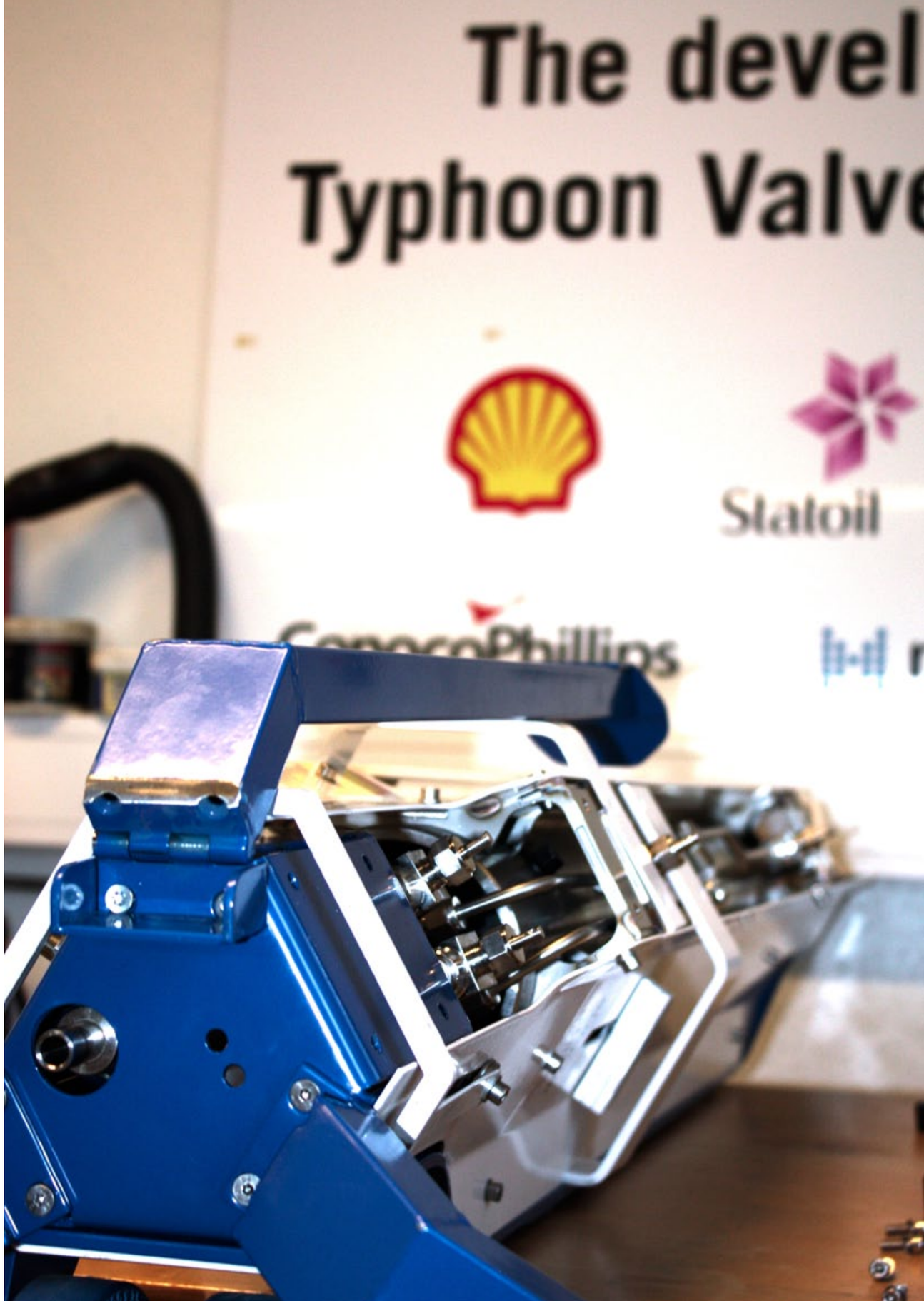
Therefore the size of the tube has been a bit uncertain. Therefore the samper is made in such a way that changing the tube size wont be problm. On the illustration you can see in blue a 3/4 inch tube adatper that can replace the 1/2 inch tube fitting used on the prototype.

The reason for the angeled fitting you see below the blue was to get closer to the front cover. Instead of using the two elbow bends it is possible to have a tube from the fitting above directly down into a fitting as the blue fitting only 1/2 inch tubing.

There may also be a possebility of replacing the whole cross on the top from a female cross to a tubing cross.

Non of these changes would affect the over-all design, only production and assembly.





9 APPENDIX

9 Appendix

110 - 145

9.1 Refrences

9.1.1 web-pages

Typhonix.com
swagelok.com
proserv.com
welkereng.com
mpm-no.com
crystalengineering.net
malvern.com
juststainless.co.uk
fjaer.net
torp-fasteners.no

9.1.2 Documents

"Pilottest av Typhoonventil på Oseberg C"

"Profile manual Typhonix"

"NORSOK S-002 N, Arbeidsmiljø,
Rev. 4, august 2004"

"ISO 3171:1998 (E), Petroleum liquids -
Automatic pipeline sampling
Second Edition 1988-12-01"

"ISO 3170:2004 (E), Petroleum liquids -
Manual sampling"
Third edition 2004-02-01"

9.2 Starting document

Innleiing

Utgangspunktet for dette dokumentet er for å skape en forståelse mellom partane i prosjektet. Det er meint å gje meg og Typhonix ein oversikt og forståing av prosjektet. Dokumentet er særskilt dynamisk og kan endras.
Viss dokumentet visar seg nyttig i den forbindelse, kan det nyttas og oppdateras viare i prosjektet.

Dei tri fysste sidane beskriv korleis eg tolkar det som bør gjerast med utgangspunkt i forespørselen via mail og møte med Typhonix før jul.
Formålet med dette er at begge partar skal forstå kvarandre nok til å utarbeida ein god oppgåvetekst og eit godt utgangspunkt for prosjektet.

Dei to siste sidene beskriv er blant anna kva som er nyttig å vite i forhold til brukaren og konteksten. Dei inneheld og ei liste med ting som kan vera nyttig å ta bilete av og vite om.

Fristar

6. januar 2012 Valg av oppgavetema og veileder skal meldes til koordinator(Johannes)
16. januar 2012 Uttak av oppgavetekst ved instituttkontoret IPD.
30. januar 2012 Plan for gjennomføring av oppgaven leveres til veileder og koordinator
11. juni. 2012 Innlevering av oppgave til instituttkontoret IPD
18-19 juni 2012 Presentasjon

00 - Prosjektforespørsel

Mail om forespørsel:

"Jeg representerer et firma som arbeider med å optimalisere prosessutstyr til oljeindustrien. For tiden arbeider vi med en ventil, en såkalt strupeventil som tar ned trykket på brønnstrømmen før det går inn i prosessutstyret på plattformen. I forbindelse med testing av ventilen har vi utviklet en ny type prøvetaker for å måle innholdet av olje, vann og gass i brønnstrømmen som vist i vedlegg. Vi hadde satt stor pris på om en av studentene ved institutt for produktdesign hadde funnet det motiverende og interessant å forbedre prøvetakeren estetisk og funksjonelt. Vi har god kontroll på det tekniske rundt selve prøvetakingen (type ventiler, slanger og koplinger) men har behov for innspill på form, materialvalg (må være i henhold til regelverk) og brukervennlighet."

I møte med Thyponix den 17 desember fekk eg intrykk av at det som skulle gjeras var følgjande:

1 - Å utvikle estetiske og funksjonelle idear til den patenterte prøvetakeren.
2 - Prøvetakeren skal representere Typhonix som eit element i markedsføring.
3 - Prøvetaking vil i framtida utvikle seg mot online prøvetaking.
4 - Ynskje om eit ferdig produkt i juni.
5 - Bruksanvisning (video)

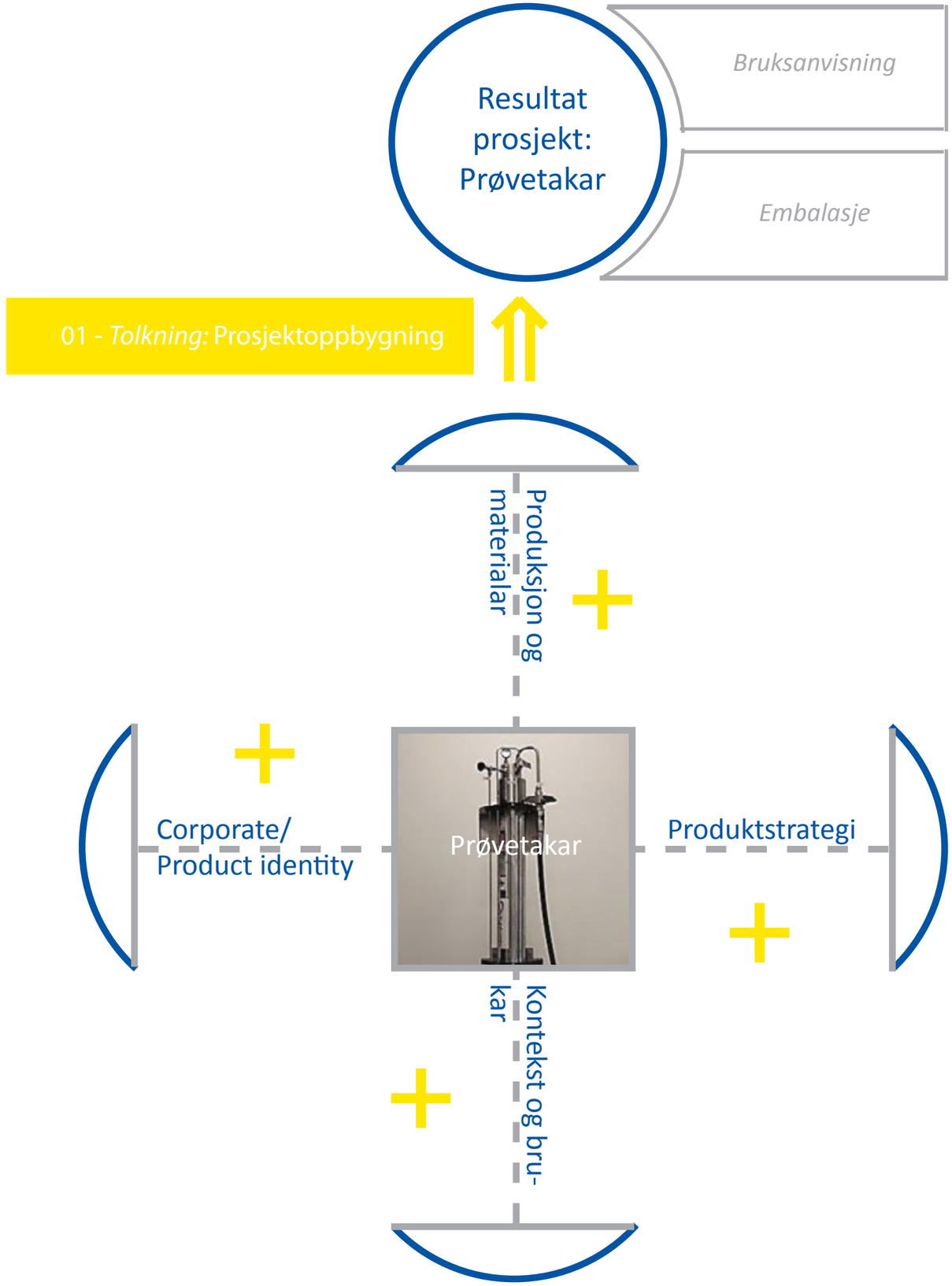
01 - Tolkning: *Prosjektoppbygning*

Tolkning av kva som då kan arbeidas med i prosjektet:

Punkt 1 - produktdesign
Punkt 2 - corporate/product identity
Punkt 3 - produktstrategi
Punkt 4 - produktkommersialisering, embalasje, beholder, container...
Punkt 5 - grafisk design, 3d visualisering

Punkt 4 og 5 kan verta i det meste laget for det gitte tidsskjemaet.

Neste side visar korleis prosjektet kan leggas opp og kva hovudelement som bør jobbas med for å skapa eit forbetra produkt, med utganspunkt i den patenterte løysninga.



Prøvetakar

Forstå formålet med flerfase prøvetakeren.
- Kva behov dekker prøvetakaren. (scenario)
- Bruksprosess
- Andre liknande produkt
- Bestandeler
- Patent
- Materiale
- Lovar og reglar
- Sikkerhet
- online
- Logginutstyr

Produktstrategi

Korleis er den framtidige utviklinga i bransjen
- online
- subsea
- c

Konkurentar
- Liknande produkt
- Liknande bedriftar
-

Produksjon og materialar

Materiale:
- Miljøpåvirkning: Salt, kjemikalier, olje, trykkrefter, slitasje bruk (KONTEKST)
- Plast, stål, titan
- Krav i det såkalte trykkdirektivet (PED) må innfries – typiske materialer som kan tenkes brukt er austenittiske rustfrie stål (type 316), Titan, duplex, glassfiber/kompositter (GRP).

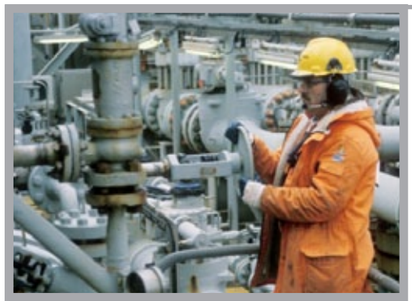
Produksjon:
- Moglege leverandørar: Bryne plast,
- Kvanta: Litt usikkert ennå men si at hver offshoreinstallasjon kjøper to stk pluss alle som driver med prøvetaking - i norsk sammenheng kanskje 20- 30 stk (optimistisk anslag)
- Produksjonsmetodar
-

Corporate/Product identity

Typhonix: Type bedrift
Corporate identity: Verdier, visjoner, mål, økoperspektiv (grønt)
Product identity: Produktet skal representere bedriften utad.
- Fargar, form, logoar, språk,
- var det dei som kom på Typhoonen? Representerar denne dei.

Kontekst og brukar

Transport til installasjon



Brukaren

Bruksprosessen ved installasjon

Bruksområde ved installasjon

Oppbevaring ved installasjon

Transport ved installasjon

Observasjon ved installasjon

Dette er og ein oversikt over kva du kan sjå etter og ha i bakhovudet når du er ved installasjona med hensyn til prøvetakaren.
I **blått** har eg markera kva som er mogleg og er interessant å ha bilete av ved installasjona.

Transport:

1 - Korleis vert prøvetakeren frakta til og frå installasjonar (Skip, hellikopter, lastebil, bæring, kontainer...) ?
2 - Foretrukket max vekt og størrelse (med hensyn på fraktkost og bruk) ?

Brukaren:

3 - Arbeidstittel, arbeidsmentalitet og arbeidsoppgåver?
4 - Kva bekledning nyttas (jobber med hansker..)?
5 - ***Erfaringar og tankar*** *(*ved tidlegare prøvetakere, ved ny prøvetakar, generelt)?

Bruksprosessen:

6 - Korleis er bruksprosessen (prøvetakinga og analyseringa)?
7 - Når vert prøvetakaren nytta og kor ofte?
8 - Kor langvarig er prosessen?
9 - Skal utstyret reingjeras?
10 - Skal det følgjas ein streng prosedyre ved bruk (sikkerhetstiltak...)?
11 - Er det ein kritisk prosess som krev høge krav til prøvetakaren? Evt kva?

Bruksområde der prøvetakaren vert nytta:

12 - Vert prøvetakeren nytta fleire stader på plattforma, evt er desse like (Labratorie, prøveuttak...)?
13 - Størrelse og utsjånad på bruksareal?
14 - Inntak og uttak?
15 - Korleis er arbeidsforholda? Mykje lyd? Er det mykje søl?
16 - Kva vert prøvetakaren utsett for av kjemikalier...?
17 - Evt kvar foregår reinhald av utstyr? (inne i vask eller ute med høgtrykkspylar?).

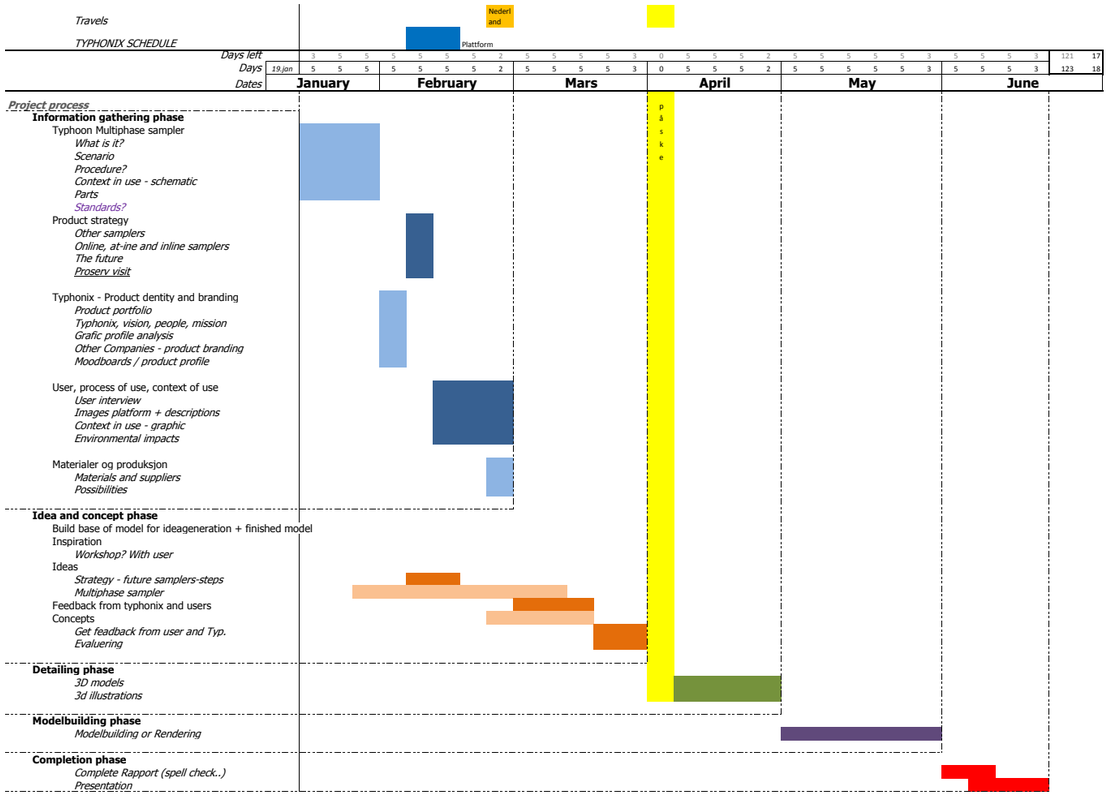
Oppbevaring ved installasjon:

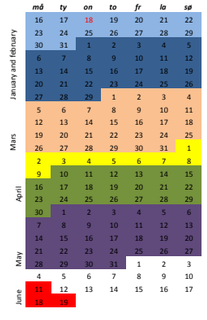
18 - Kvar oppbevaras prøvetakaren; skal den stå ved ein plass heile tida eller skal den fraktas til og frå “lager”?
19 - Oppbevares prøvetakeren ute, inne, på ei hylle...? Bør/skal den pakkes ned?

Transport ved installasjon:

20 - Korleis vert prøvetakaren transportert ved installasjonen (bæres...)?
21 - Veg til/frå oppbevaring og bruksområde (trapper, ganger...)?
23 - Kva slags underlag som ein går på?

9.3 Schedule


Travels
Nederl and
TYPHONIX SCHEDULE
Plattform
Days left
Days
Dates
19.jan
January
February
Mars
April
May
June
påske
Project process
Information gathering phase
Typhoon Multiphase sampler
What is it?
Scenario
Procedure?
Context in use - schematic
Parts
Standards?
Product strategy
Other samplers
Online, at-ine and inline samplers
The future
Proserv visit
Typhonix - Product dentity and branding
Product portfolio
Typhonix, vision, people, mission
Grafic profile analysis
Other Companies - product branding
Moodboards / product profile
User, process of use, context of use
User interview
Images platform + descriptions
Context in use - graphic
Environmental impacts
Materialer og produksjon
Materials and suppliers
Possibilities
Idea and concept phase
Build base of model for ideageneration + finished model
Inspiration
Workshop? With user
Ideas
Strategy - future samplers-steps
Multiphase sampler
Feedback from typhonix and users
Concepts
Get feadback from user and Typ.
Evaluering
Detailing phase
3D models
3d illustrations
Modelbuilding phase
Modelbuilding or Rendering
Completion phase
Complete Rapport (spell check..)
Presentation


må ty on to fr la sø
January and february
Mars
April
May
June

9.4 Research

9.4.1 Still frames from
the tv-program “Oljeriket”
- NRK


















9.4.2 Interview/workshop - Consultant

The source is well known with sampling and procedures for sampling and process of sampling. He has worked a long time as a consultant, traveling too platforms conducting sampling and analysis.

The approach to my interview was to have a session where we went through a illustration of how I saw the context in which the sampler was used, at the same time gothrough a series of questions that went along. A couple of images of offsore instalations where shown with the intention of evoking memories concerning sampling and offshore instalations. If this helped or not is a question unanswered, but the question intended to be
answered where, and some.

A Brukaren:

1 - Arbeidstittel, "skala" og type arbeid?
Kva prøvetaking utførar du? Og kor ofte?
Av kven lærer du om prøvetaking?
3 – Brukargruppa: Kva skil prosessingeniøren(deg?) og prosessoppertøren?
Beskriv ein dag for å sjå om det er i overenstemmelse med det eg har illustrert.

A Transport:

3.2 Har du med deg din eigen prøvetakar?
Ser du for deg den muligheten? (snikker med verktøy)
3 - Korleis vert prøvetakeren frakta til og frå installasjonar (Skip, hellikopter, lastebil, bæring, kontainer...) ?
3.1 – kva har du med deg av utstyr? Analyseutstyr? Prøveglass? Generelt? Kvifor ikkje?
4 - Foretrukket max vekt og størrelse (med hensyn på fraktkost og bruk) ?
Vert den løfta opp av ei kran IEIN KOnteiner? Eller ikkje?

B Oppbevaring ved installasjon:

18 - Kvar oppbevaras prøvetakaren; skal den stå ved ein plass heile tida eller skal den fraktas til og frå "lager"? Størrelse på lager?
19 - Oppbevares prøvetakeren ute, inne, på ei hylle...? Bør/skal den pakkes ned?
20 Utsatt for vær og vind?/ kjemikalier? Utsatt for folk? Behandles godt eller dårleg? Heises? Europalle?
B Transport ved installasjon:
20 - Korleis vert prøvetakaren transportert ved installasjonen (bæres...)?
Eller pleier prøvetakaren å berre stå der ute?
23 kilos regel, 2 stk? Andre HMS regler?
21 - Veg til/frå oppbevaring og bruksområde (trapper, stiger, ganger...)? trangt?
23 - Kva slags underlag som ein går på? Som på bilde fx? Magnetbein?
Korleis orienterar du deg ved ei platform?

B Lab

Viss du ikkje treng å ta med deg prøvetakeren kan må du då tilbake for å hente den etter prøvetakinga? Etter analysa lixm?
B Vasking og vedlikehald
Vaskar du prøvetakaren nokon gong?
9 - Skal utstyret reingjeras?
Er det deler som ofte må byttast?
Korleis vert dette gjort?

C Bruksområde der prøvetakaren vert nytta: context

12 - Vert prøvetakeren nytta fleire stader på plattforma, evt er desse like (Labratorie, prøveuttak...)? Teikne forskjellige scenario
Dei plassane kor Typhoonen skal nyttas, er dei like eller ser du for deg en ver bruka over alt.
13 - Størrelse og utsjånad på bruksareal? Trangt? Må du ha tilgang til prøvetakeren frå alle sider?
Kan det hende du må kile fast prøvetakeren mellom to røyr?
14 - Inntak og uttak? Høgde? Avstand mellom disposal og inntak?
15 - Korleis er arbeidsforholda? Mykje lyd? Er det mykje søl?
16 - Kva vert prøvetakaren utsett for av kjemikalier...?
17 - Evt kvar foregår reinhald av utstyr? (inne i vask eller ute med høgtrykkspylar?).
24 - Er det problem knytta til vær eller anna som kan forureine prøva under prøvetapping?
33 – Trykktestet det på prosessrøyret før prøvetakeren kobles på?
36 – Er det mykje ytre påkjenningar?
37 – vert den stående mykje ute?

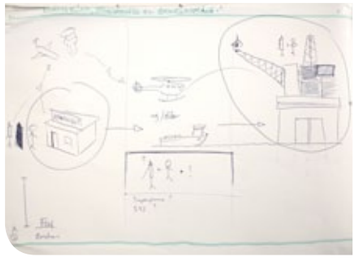
C Bruksprosessen:

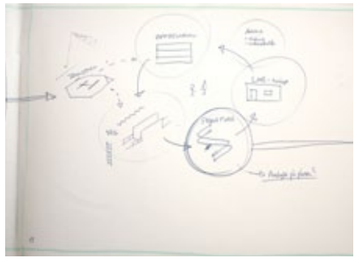
Gå igjennom ein prøvetaking.(oppkobling, bøtter og glass, og anna utstyr.
Jobbar du åleine? 23 kilo regel, kjenner du til andre hms/norsok regler?
Nyttar du forskjellig p.t.?
Nyttar du ein prosedyre eller kan du det utanat?
27 – Må du/Hender det du sette inn prober sjølv? Eller anna utstyr, koblingar?
Kva utstyr er med (verktøy, koblingar,bøtt, miniseperator ? og kven er med?
30 kven leverer provebeholdarane, disposal(avfalls)bøtta og glassa(metalcasing annex a) og analyseutstyret?
Disposal bøtta?
24 - Kva bekledning nyttas (jobber med hansker..)? Er ein skitten på hanskane?
29 – Utførar ein sikkerhetstiltak?
8 - Kor langvarig er prosessen?
26 - Høg temperatur på prøveflasker? Kva gjer du?
7 - Når vert prøvetakaren nytta og kor ofte? Og kva prøvetakar er best til kva?
2 – Kva analysar tek du og kva tek du mest av? Og kva prøvetakar er best til kva?
Analyserar du av og til på staden? Eller er det andre som gjer det?
Merking av prøver?
Korleis kjenner du igjen ventilar? Står det lapp?
11 - Er det ein kritisk prosess som krev høge krav til prøvetakaren? Evt kva? HMS TRYKKKLASSE
Stressa under prøvetaking?

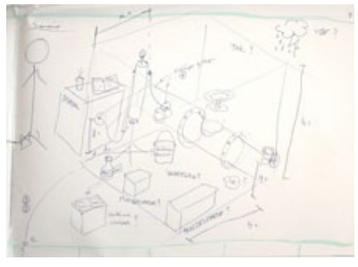
PRØVETAKEREN OG ANDRE PRØVETAKERE

Vile scenario endras med denne prøvetakeren?
5 - Erfaringar og tankar (ved tidlegare prøvetakere, ved ny prøvetakar, generelt)?
Kva slag prøvetagere har du brukt og vert brukt?
Kva må til for at prøvetakaren skal kunn erstatte eksisterande prøvetakere? Kan den det?
3.2 Har du med deg din eigen prøvetakar?
Ser du for deg den muligheten?
Kva ser du på som det viktigste aspektet ved ein fremtidig prøvetaker?
Du kan ha det me har snakka om bakhovudet på turen?
Aspekter som eg ikkje har tenkt på?
Kjenner du noko prosessoperatører?

z







9.4.3 Questions to Proserv

1 – Må den trykktestet nokon gong på platform og korleis vert dette gjort? (iso manual sampling 7.4.3.1.2)
3 – kva brukar hensyn har dykk tatt?

Reguleringar

4 – HMS hensyn tatt?
5- kor kjem den regelen med to som bærer frå? (annex A i ISO manual- Sampling personell should be provided with carriers for their equipment in order that at least one hand may be free.)
17 er det nokon veg utanom den 23 kg regelen?
16 Vill neste generasjon prøvetakere mest sansynlig komme under denne grensa. Kva "side" skal eg forholde meg til?
11 Vill Multiphase sampleren verta ein del av den allereie eksisterande ISOen?
Eller er det kanskje ikkje slik det fungerar?
6 – er det nokre spesielle reglar på bruk av plast generelt? Og legge det rundt sylinderen for eksempel?
21 Er det regler på eventuelle bevegelige deler/deksel?
22 Low til å bytte ut handtaka, med eigen produserte?

OM PRØVETAKING
7 kva veit dykk om prøvetaking? Fleifase variable, constant KATEGORISERING
- Kvifor vert prøvetakarane trykksatt? Piston?
+ Kva er forskjellen på psiton og typhoonen?
Kva katergori ville prøvetakaren komt under?
Variable volume sample reciever eller fixed volume reciever?
8 kva ser dere på som spesielt med typhoonen? Kva har den som ingen andre har?
Framtida: Implimentering av analyseverktøy?
9 repair kit?
10 er det hurtigkobling på dei slangane+
11 kva utstyr følgjer med? Koblinger? Ser ut?
12 må den ligge i ei kasse?

KONSTRUKSJON

10 Volum/mengde indikatoren? Muligheter kor fri er eg der?
Finns det manometer som sender signala til ein støøre skjerm? Ledning frå målaren til skjermen lixm

12 Er det nokre usikkerhetsmoment rundt prøvetakeren? Problemområder?
14 Må dei lokka vær med?
Den pinnen i midten kva gjer den? Kva gjer heile greia egentlig?
Hola i botn og topp er dei flexible?
13 mogleg med ein dobbel ventil?? I botn lik
18 korleis vil plasseringa av ventilane på botn verta?
19 Kor nærme kvarandre kan røyra være?
Er det fleksibelt med tanke på bøying? Kor mykje kan dei bøyast og kor mange bøyar?
Kva type røyrskøyter finns ?
20 tåler ventilene mykje? Eller Må dei tildekkas? Kva er kritiske område som må verta dekka?
21 Kor satt er type delene: ventilar, trykkmålaren, konstruksjonen, level indicatoren? Kan andre nyttas?

Produksjon

22 Welker 7075 – T6 alu , få med 7000 legering? Skrive ut.
Er det mogleeg å bruke andre materialer?
Som kevelar foreksempel
Korleis vert den produsert?
Kan eg spør om å få låne ventilar og barometer til modell?
Bygge beskyttelse rundt og over (holder det)
Bygge inne i ei kasse

Kan det være ein kort stubb på prøveuttaket, og eller kan det være hurtigkobling?
Vinkel, tri kobling? er det mulig?
Kvifor må ein ha den svære sikkerhetsventilen?
Kan du alltid ha pten ved "vegen" berre slangen er lang nok?

½ ½ inn ¼ ut (tee) er det mogleg å få med NPT alle veger?
ELLER er det mogleg å få ½ NTP linært og Tube ¼ ut?
Vri topp adapteret 45 grader?
Kan ein bøye ¼ røyret prøverøyret nere utover?
Overgangane frå adaptera?
Kan ein ha ein elbow directe inn i sikkerhetsventilen?
Port connector ?

Spørsmål til IKM Haaland

Filtype vannskjærer/laser… ?
Hengsler?
Materiale?
Tykkelse?
Konstruksjon?
Trekantrør?
Gummi mellom? Nødvendig?
Radiuser i knekka?

9.4.4 Transportation sampler ver 1

The sampler came back after testing in a aluminum trasnportation container. It was filled with bobble wrapping and cardboard. In the case there was also different fittings, legs, equipment documentation, and sother things that belonged to the Malvern analyser.

The transportation case had a layer of salt covering it. Probably from the trip on the supply vessel.

Around the valves there where oil residues.
One of the Parker ballvalves handles had been broken.
One of the bolts that held one of the three legs where broken in half.
The sampler came back in the end of april. this was the first time I got to see the sampler in real life.

9.5 Other external construction concepts

9.5.1 Various sampler concepts

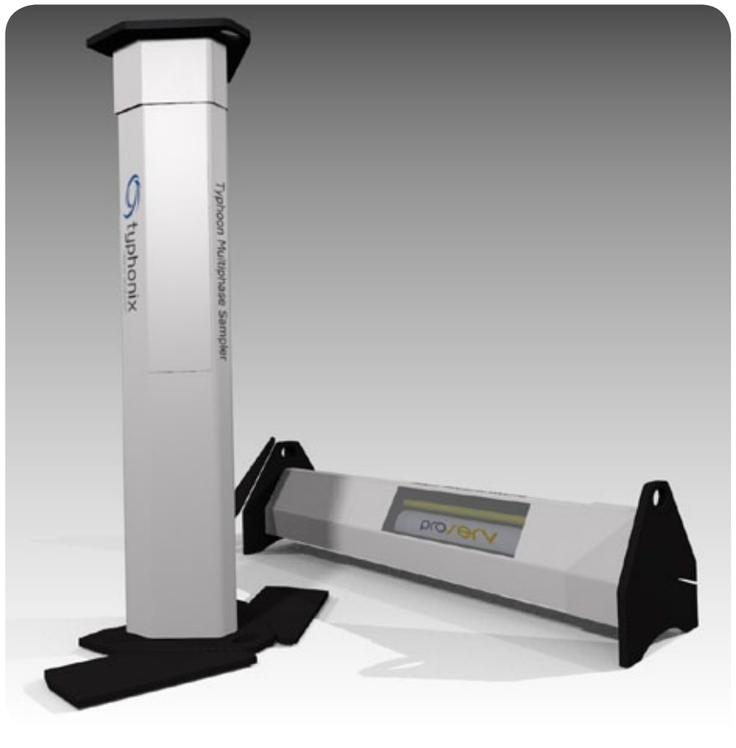
Here are some concepts that differs from the choosen concept. This is to show that I have thought on other solutions.

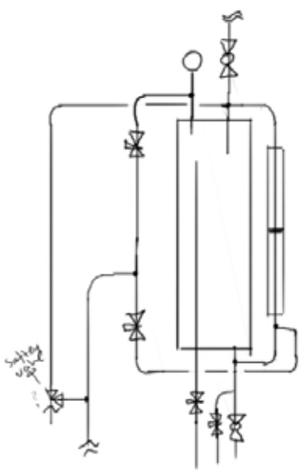
A concept that is not shown is a concept

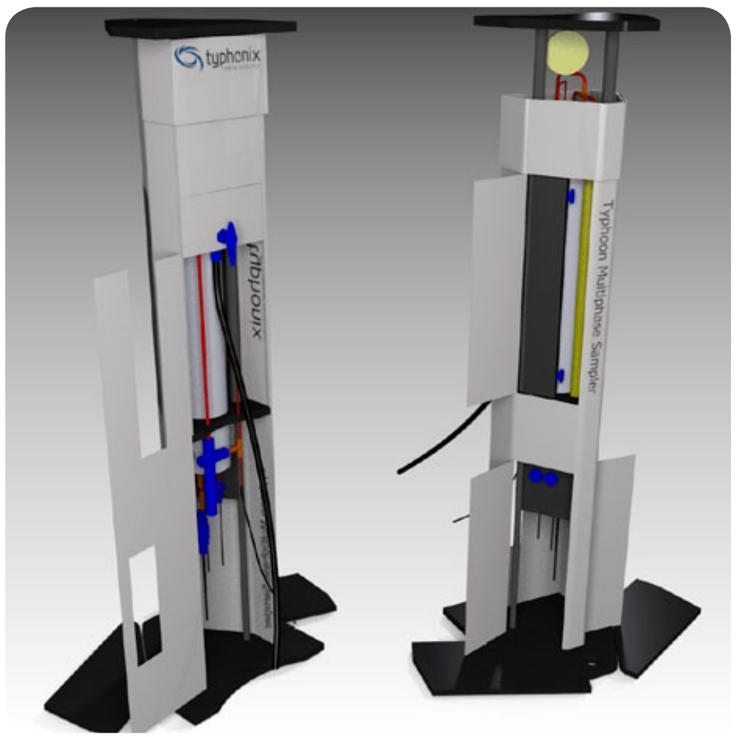
9.5.1.1 Early concept

This was a sugestion I made while Proserv was working on the 2nd version. It colaboration with Typhonix it was decided that it was to early n the process to go further with this design. As it was early in the process I was not finnished with the analysis stage and there where still areas to envestigate/ analyse. I was given the choise to aither work closley with Proserv with this concept or let them continue theire process whilst I continued on my own. The decission fell on the last one.

The design is based on the the parts used by Proserv Except the sheet metal and tubes holding it together.

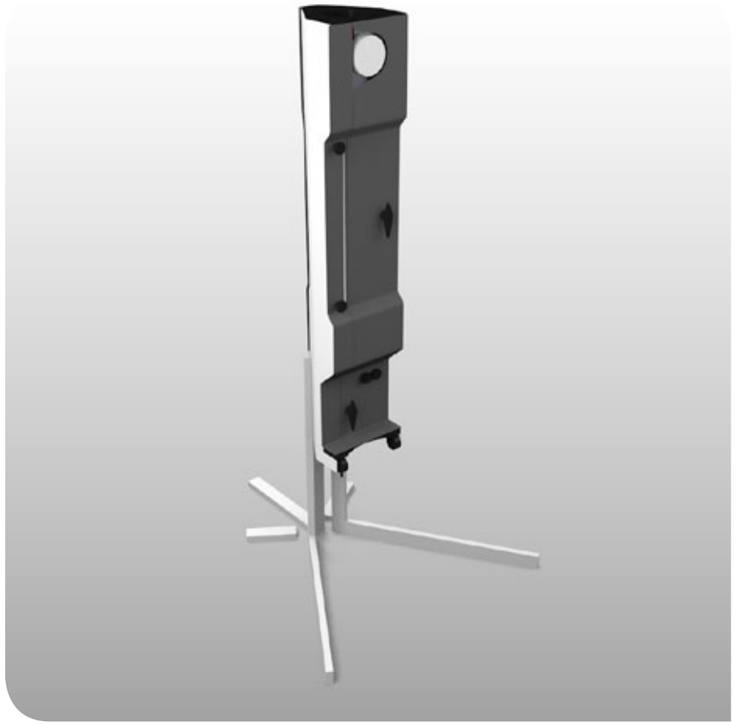






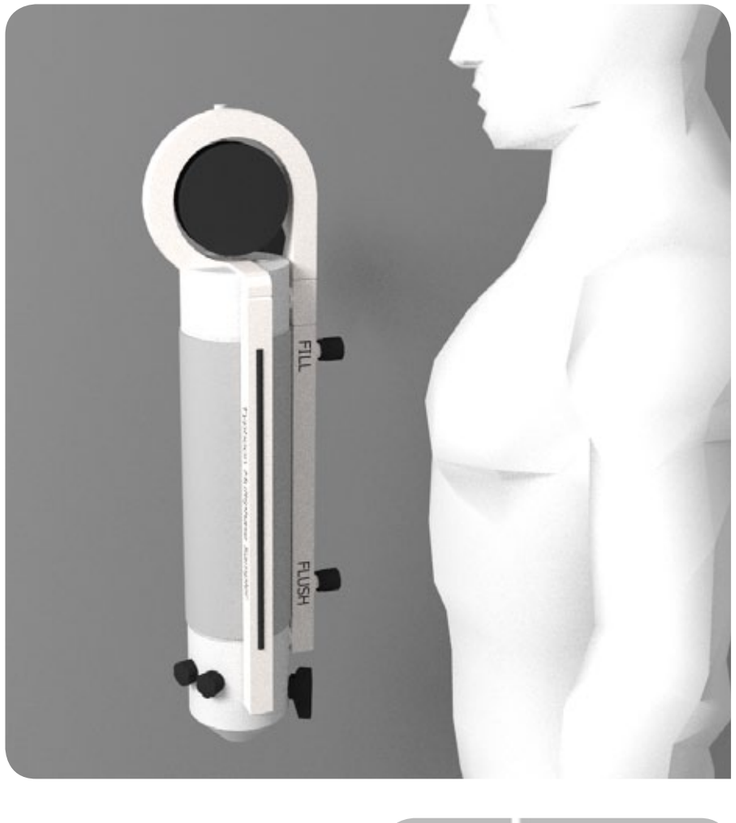
9.5.1.2 Concept 2

This concepts was based on the early concept, but with a diferent internal layout. It was also ment to be more protable and with all the valves sticking out i the front. The form of the product is based on the POM brackets that Proserv use.



9.5.1.3 "Manifold" sampler

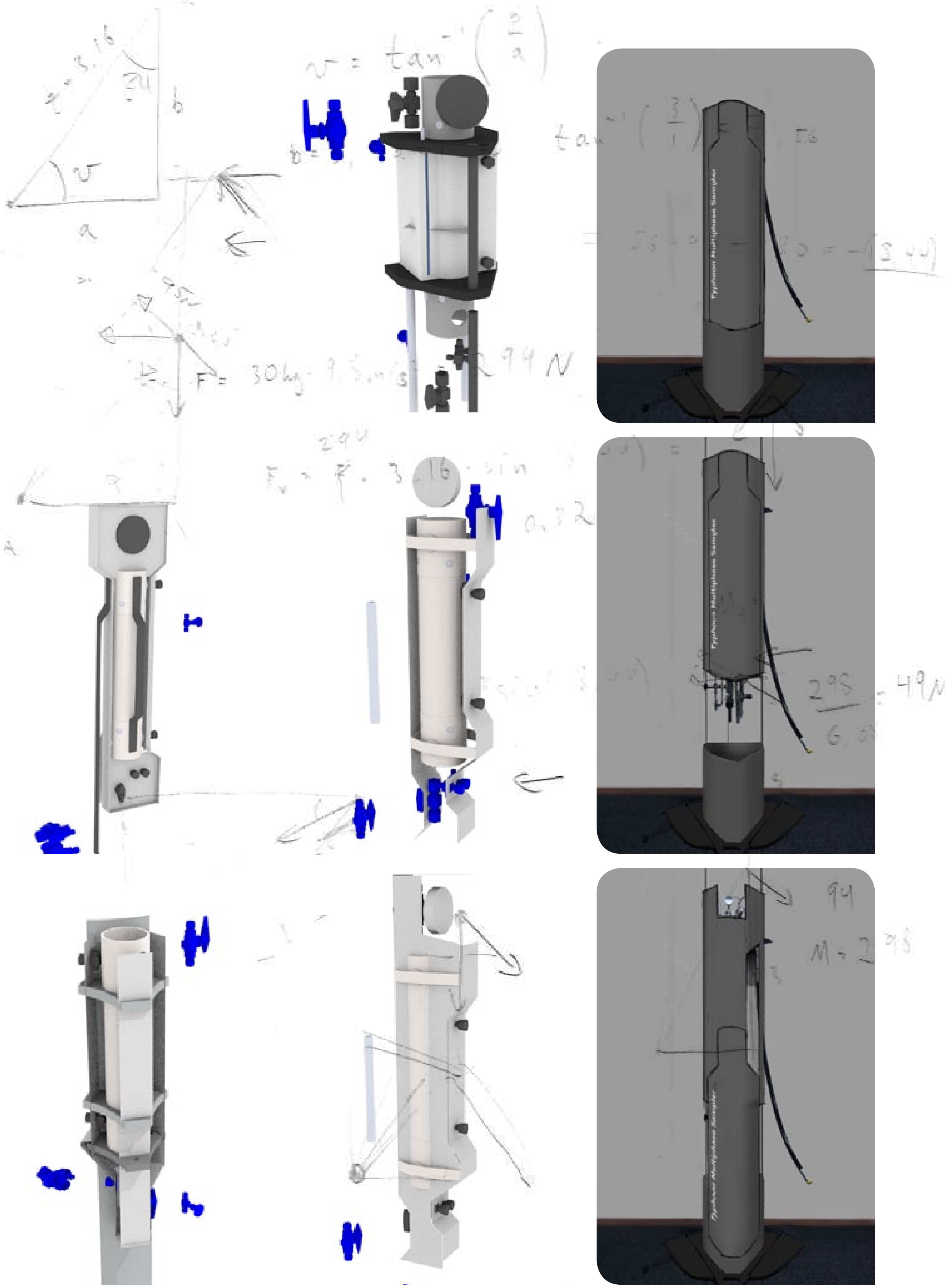
The Typhoon sampler technology demands a lot of tubing and fittings. Manifolds are bits of metal with internal channels that different valves are connected to. This is a more compact way of creating a layout of flows.
The concept is based on such a way of constructing.
It differs from the excisting way of constructing but it was a concept created to think a little bit outside of the box. If it is possible or benefitial is another question.

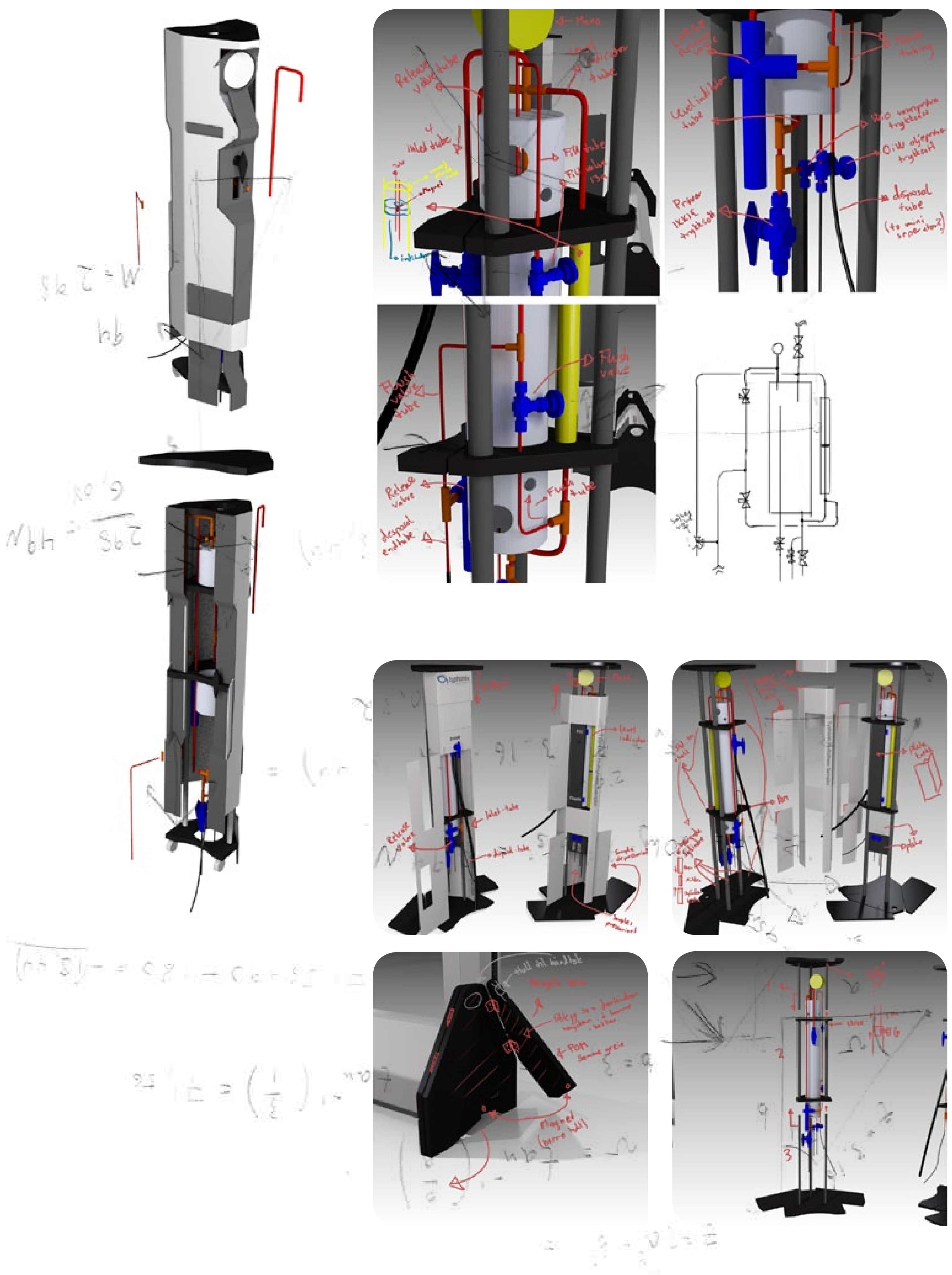


9.5.1.4 Combined sampler & transport case

A sampler is always transported inside a container, not just for protection but also in order to make it easier to store and stack. This concept consist of a transportcase where the sampler is constructed inside. On top of the sampler there is a vacuum pressed plastic cover that make it all more clean and clear. In the same casing you have the opportunity to store different components that follows the trasnport, such as fittings and documentations (See Appendix, page 131).

9.6 Ideas

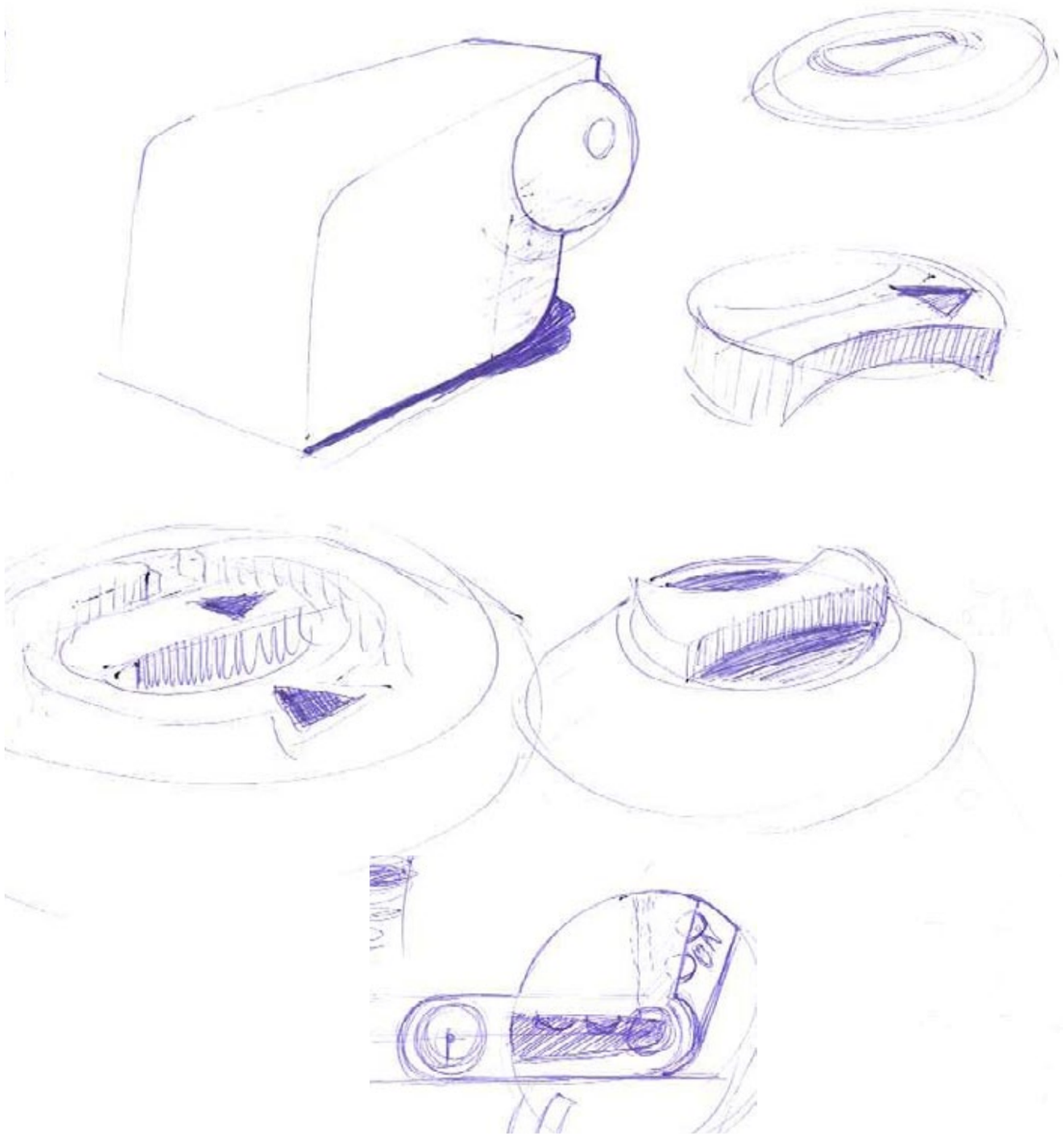




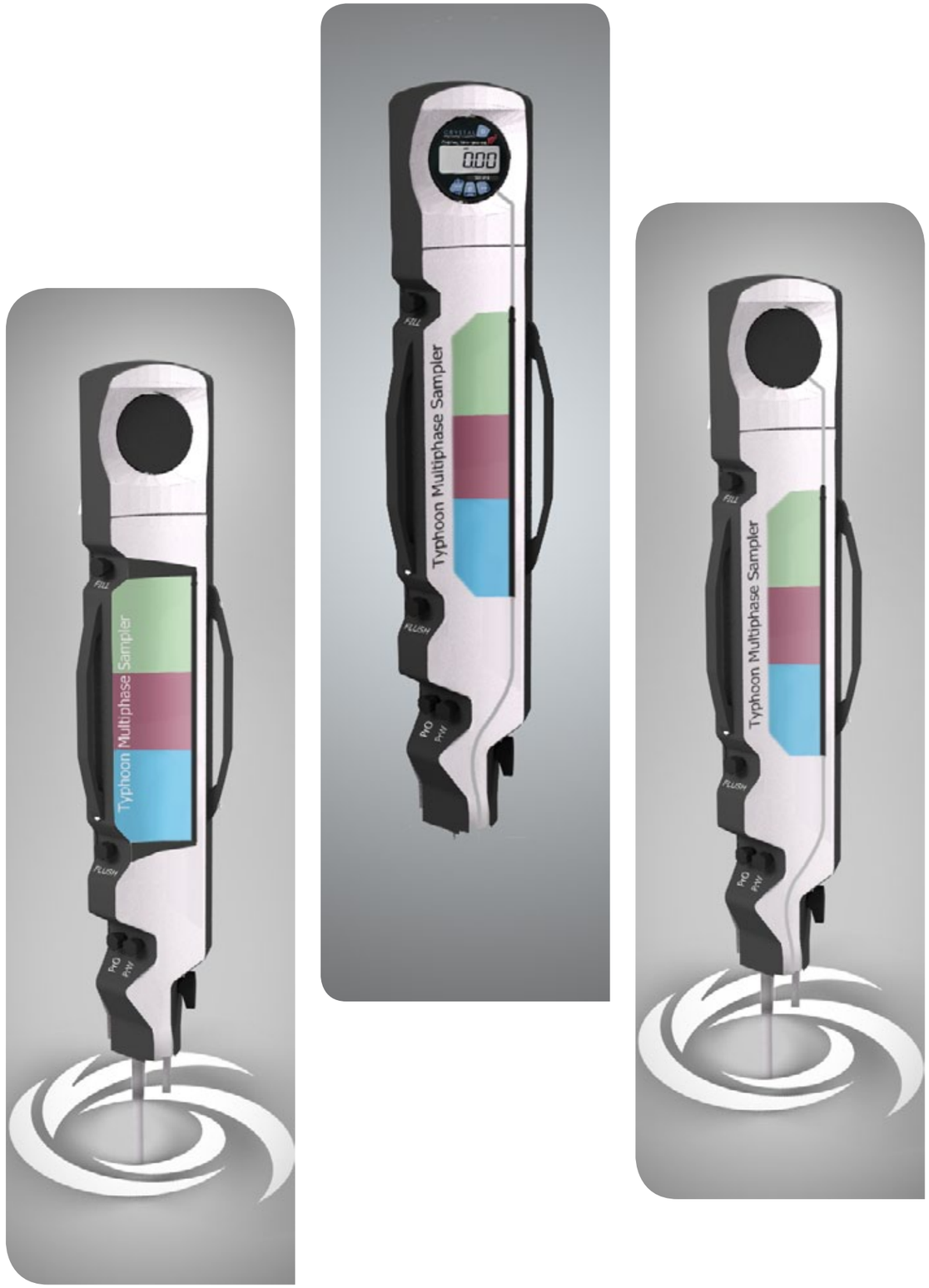
9.6.1 Valve handles

I looked on the possebility of creating own Typhonix valve handles, knowing that the handles on valves can be changed.

I decided to not working on devloping new handles because of the extra cost and time this would use. The inovative leap where big enough as is.



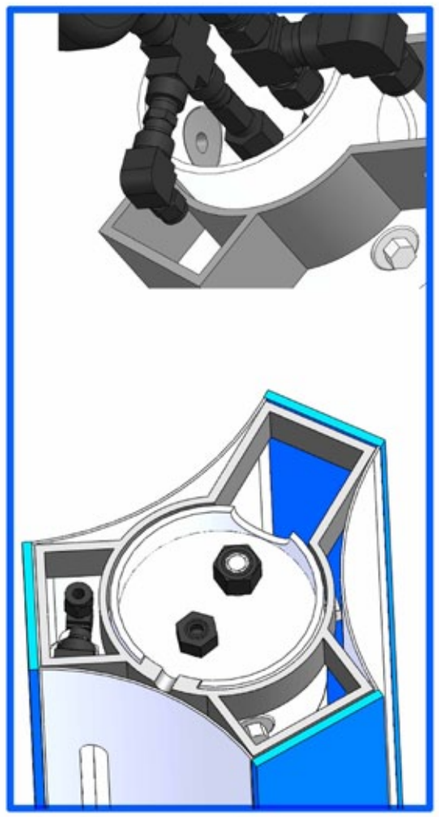
9.6.2 Graphic ideas



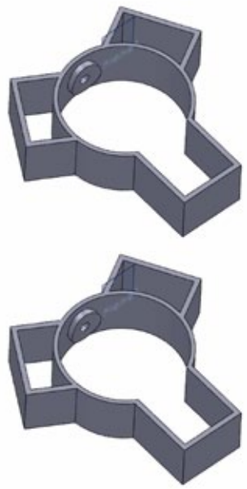
Meeting with IKM

Here are some illustrations that where used when showing IKM Haaland the concept. The illustrations shown on these two pages show the different elements I needed created. By looking at the differnt elemetns you can see that I had velding and cutting in the back of my head. Not neceserally the optimal production method. Especially not after the meeting with IKM Haaland.

In addition to these illustrations, a video was shown, showing the principels behind the concept. As weel as detailed pictures of the model.



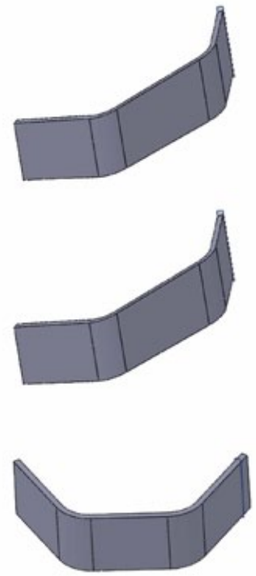
Braketter

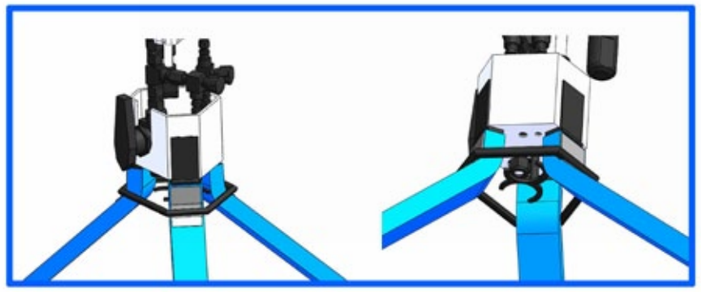


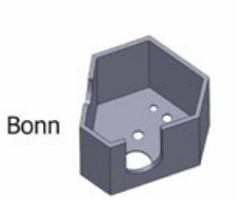
Dekseler

Ramme profiler

Håndtak







Bonn

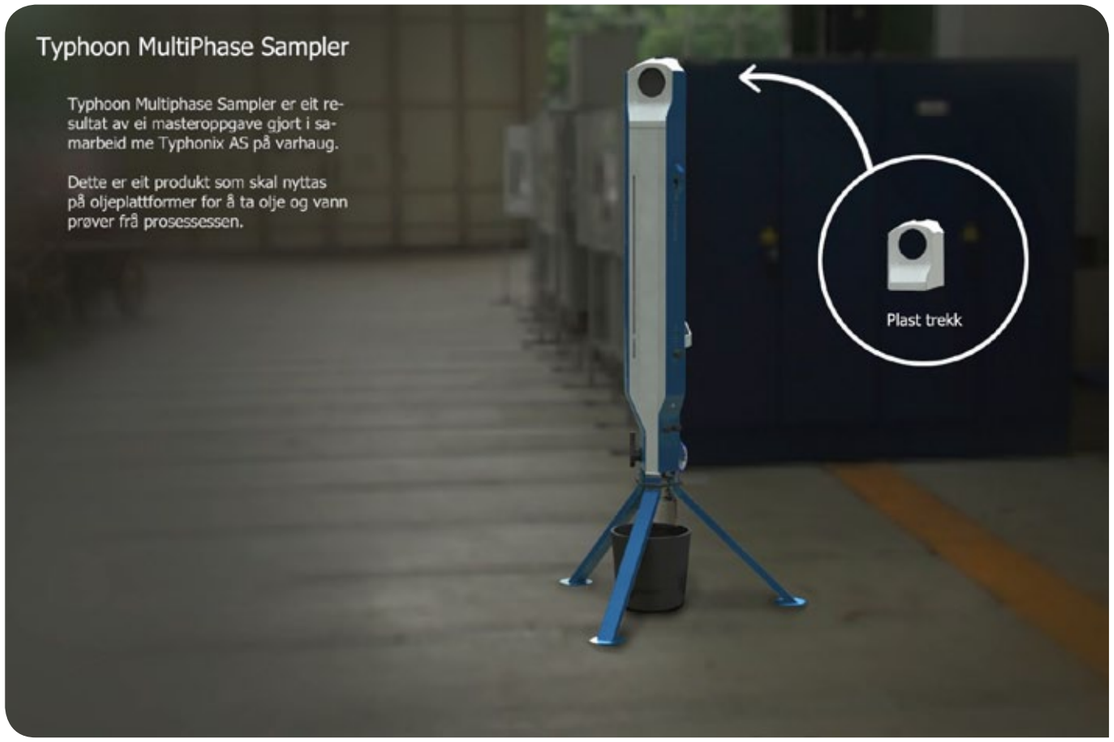
Bein

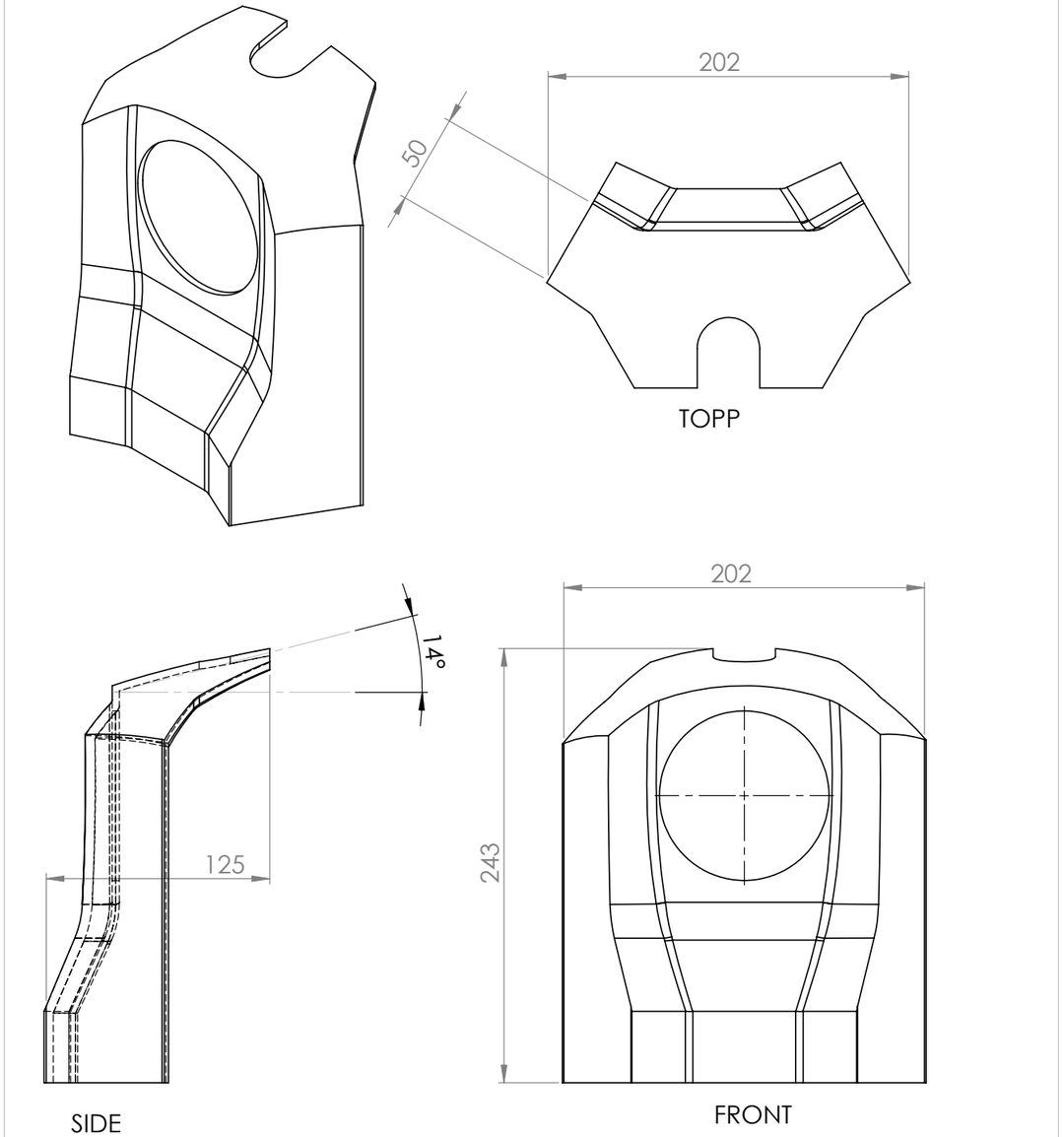
Hengsler

Låsring

Hjulholder

Production request





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PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF Bård Sondre Dalen.

Material-egenskaper:
3-6mm tykkelse (er brukt 5mm på modellen)
Må tåle Råolje og andre kjemikalier
som ein finn på oljeplattformer og grader rundt 80
Må tåle ein støyt
Overflate: Glatt/blank kvit

SIZE	DWG. NO.	REV.
	Plast trekk	
SCALE:1:1	WEIGHT:	SHEET 1 OF 1