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Conceptual Design of Process Water Treatment Container Modules

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Abstract

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This thesis was done for Metso Outotec. Metso Outotec is one of the world's leading suppliers of ore processing technology. The goal of the thesis was to produce a conceptual 3D model and a piping and instrumentation diagram for a modular water treatment container.

Water plays significant role in ore processing, as the rock material extracted from the ground is mixed with water in comminution processes. After water has been introduced to the process, the mixture of water and solids is called slurry.

The water used in ore processing plants does not need to be purified, but it still needs to be treated to a certain standard. This is required to prevent a decrease in separation process efficiency due to contaminated water.

The thesis was conducted as an investigation and modeling project. The modelling was done with MicroStation software. Reference projects which had same kind of equipment were used as help in the modeling project.

As a result of the project, a conceptual 3D model and piping and instrumentation diagram were created. It can be used in future projects to reduce the required design time, which makes it possible to streamline the design process in forthcoming projects, thereby reducing the amount of time needed for design development.

Keywords: chemical process engineering, ore refining, water treatment, modular, recirculation, 3D design, piping and instrumentation diagram

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Tämä insinöörityö tehtiin Metso Outotecille. Metso Outotec on yksi maailman johtavista malminrikastusteknologian toimittajista sekä suunnittelutyötä tekevistä yhtiöistä. Työn tavoitteena oli tuottaa konseptuaalinen 3D-malli sekä putkistoinstrumentointikaavio modulaarisesta vedenkäsittelykontista.

Vesi on tärkeässä roolissa malminrikastuksessa, sillä maasta louhittu kiviaines sekoitetaan veteen murskausprosesseissa, sillä malminrikastusprosessit tapahtuva vesi kiviaines sumpussa.

Malminrikastamoissa käytettävän veden ei tarvitse olla puhdasta, mutta vesi pitää silti käsitellä tiettyjen standardien tasolle, jotta erotusprosessit eivät kärsisi tehokkuuden laskusta likaisesta vedestä johtuen.

Työn tuloksena luotiin konseptuaalinen 3D-malli ja putki- ja instrumentointikaavio, joita voidaan käyttää tulevissa projekteissa vähentämään tarvittavaa suunnitteluaikaa. Tämä mahdollistaa suunnitteluprosessin virtaviivaistamisen tulevissa projekteissa.

Avainsanat:	kemian prosessiteollisuus, malminrikastus, vedenkäsittely, modulaarinen, kierrätys, 3D suunnittelu, putkisto instrumentointi diagrammi

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List of Abbreviations

PID: Piping & instrument diagram

1 Introduction

Water plays a crucial role in ore refining processes, by assisting in the refining process itself, serving as a cooling agent or supressing dust. However, remote locations where ore refining takes place can present several water-related challenges. These can include scarcity of water, poor water quality, lack of infrastructure, strict environmental regulations and high cost associated with accessing and treating water. To overcome these challenges ore refining operations in remote locations must consider investing in water treatment to minimize costs and cause no harm to the environment and local water sources.

The purpose of this thesis was to meet the requirement for contaminated water treatment and water reutilization in remote location plants by developing conceptual containerized water treatment unit. Main tasks during the thesis were to determine the requirements for different water treatment units and developing conceptual layout models of the units as well as to create PID: s (Piping & instrument diagram) for the unit.

2 Water usage in concentrator plant

The majority of metals in earth's crust or in sea-bed deposits are not found in their metallic form but as reacted compound with usually oxygen, sulphur, or carbon dioxide. These minerals are naturally occurring inorganic substances with specific chemical compositions and atomic structures [1, p.1]. Thus, not all minerals have metals in them. When valuable minerals occur in sufficient enough quantity to permit profitable extraction, they are called ore [2]. These ores are made of gangue minerals and precious minerals, in this case metals [1, p. 1].

2.1 Comminution

Mining is followed by comminution of the ore to desired size, which prepares the ore for the separation of the valuable metal minerals from the gangue minerals. Comminution is done in many steps of crushing and grinding of the mined material. Initial addition of water is done in the grinding part of comminution.

2.2 Separation

After the minerals have been crushed and ground to desirable size, the gangue material needs to be separated from the valuable minerals. This is typically achieved using froth flotation, which involves adding chemicals and water to the material to assist with separation. The process results in two streams of material: an enriched portion and a gangue portion. [3, p. 4;1, p. 5]

2.3 Dewatering

To maximize water and cost efficiency in the concentrator plant, the enriched portion of material must be dewatered through sedimentation and filtration. This thesis focuses on developing more affordable solutions to improve the water

efficiency of dewatering processes. For further details on the working principles of these processes, please refer to sections 3.2 and 3.4.

The gangue stream, which comprises both dissolved and suspended solids resulting from separation and dewatering processes, poses a challenge to industrial plant operations. To mitigate this issue, it is necessary to implement an effective water treatment strategy, which includes the utilization of a containerized water treatment unit. The containerized water treatment unit is meant to assists in the removal of dissolved and suspended solids.

2.4 Tailings dam

During the concentration process, gangue material is commonly directed to a tailings dam. These dams are typically constructed using earthen materials, such as soil and rock, and are designed to confine large volumes of tailings in a specific area. They are typically situated in low-lying areas or valleys and lined with a waterproof barrier to prevent seepage and contamination of groundwater. Most of the water loss in concentrator plants occurs in the tailings dam, making it a critical area for management and optimization. Same dewatering equipment which are used in dewatering processes are typically used to reduce water that goes to tailings dam.

3 Water treatment

Water treatment in context of process water is a process in which harmful compounds are removed from water to increase the effectiveness of process or to prevent damage done to the equipment. Physical water treatment is based on physical phenomena such as sedimentation, filtration, and aeration. Biological water treatment is based on the use of living microorganisms that break down organic substances in water. Chemical water treatment uses chemical reactions to remove impurities from water. In this thesis we are mostly concentrating on physical treatment of water. [4; 5; 6]

The quality of water used in flotation circuits has a significant impact on the effectiveness of the process. In fact, research has shown that improving water quality can lead to better flotation performance, including increased recovery rates and improved concentrate grades. [7]

3.1 Water quality parameters

Water quality parameters are measurements that assess the physical, chemical, and biological characteristics of water. There are many parameters which can be monitored, but in following paragraphs the most important ones to the thesis are explained.

3.1.1 Particle size distribution

Processes usually produce different sized and shaped particles. This difference of particles is called particle size distribution [8, p.14-15, 28-29]. Particle size distribution is often represented graphically with a figure. An example of particle size distribution curve of filter cake is presented in Figure 1.

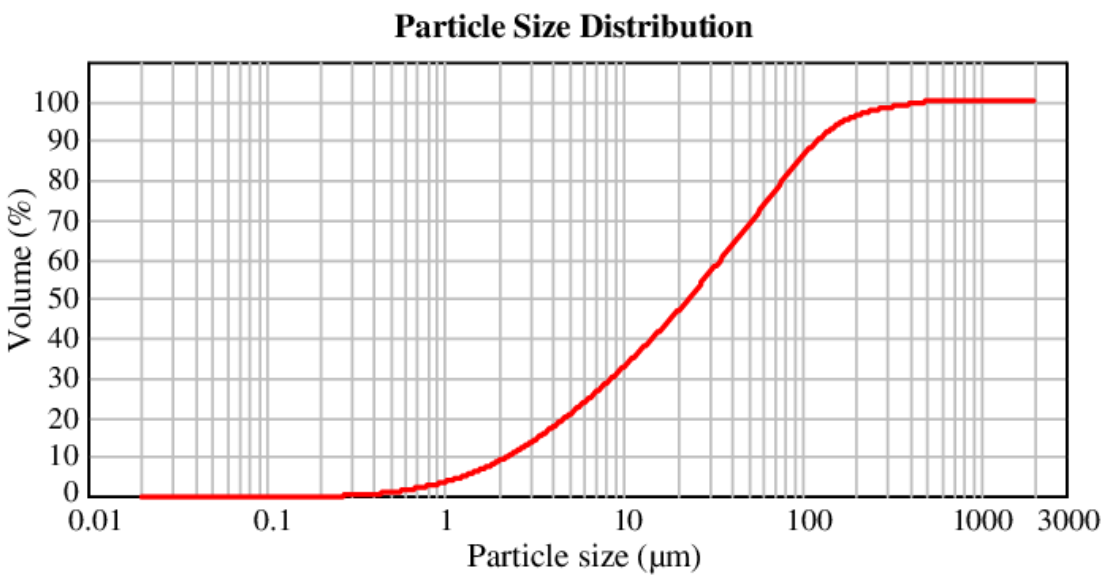


Figure 1. Particle size distribution of filter cake [9]

The size of particles in process water is an important factor that influences the performance of dewatering systems. Larger particles can be removed easily through processes such as sedimentation, but smaller particles require filtration or use of hydrocyclones.

3.1.2 Specific gravity [SG]

Many separation processes rely on the density difference between the carrying medium and the material being separated. This difference is known as specific gravity, which determines how effectively the separated objects settle. Specific gravity of a substance is calculated using Equation 1. [10; 11]

$$SG = \frac{\rho_{substance} \frac{kg}{m^3}}{\rho_{reference\ substance} \frac{kg}{m^3}} \quad (1.)$$

SG = Specific gravity
$\rho_{substance}$ = Density of substance ($kg*m^{-3}$)
$\rho_{reference\ substance}$ = Density of reference substance ($kg*m^{-3}$)

The specific gravity defines whether a particle can be separated from processable stream or not.

3.1.3 Total suspended solids

Total suspended solids are particles larger than 2 microns that float or drift in the water, including sediment, silt, sand, plankton, algae, and organic particles from decomposing materials. Chemical precipitates are also considered a form of suspended solids. Total suspended solids affects water clarity, and the more solids present in the water, the less clear the water will be. Some suspended solids can settle into sediment at the bottom of a body of water over time, while others remain suspended, known as colloidal or non-settleable solids. Heavier

particles like gravel and sand often settle on the bottom, but the remaining particles are either too small or too light to do so. [12]

3.1.4 Total dissolved solids

Total dissolved solids are particles smaller than 2 microns. There are many types of dissolved solids, but they can be broadly categorized into four categories: minerals, salts, dissolved metals and organic matter. [13, p. 17;14]

In the water treatment module, the aim is not to eliminate dissolved solids. Typically, chemical precipitation or ultrafine filtration, reverse osmosis, and evaporation techniques are utilized to remove such impurities. However, it is generally not necessary to remove these impurities from process water because it is neither technically nor economically justifiable. [15]

3.1.5 Turbidity

Turbidity indicates how clear water is, and it is measured by optical means. Water with high turbidity will look discoloured, murky, or cloudy, which alters its physical appearance. The presence of suspended solids and dissolved coloured substances reduces water clarity, creating a muddy, opaque, or hazy appearance. Turbidity measurements are commonly employed to assess water quality based on clarity and estimated total suspended solids in the water. [12]

3.1.6 pH control

Controlling the pH level of treatable water is important because it affects many chemical processes, such as precipitation of heavy metal hydroxides and coagulation of dissolved particles and solids. pH level also affects corrosion caused by cooling water systems and the effects amount of scale deposition. The

most used reagents for pH adjustment are sulfuric and hydrochloric acids, calcium hydroxide, sodium hydroxide, and sodium carbonate. [16, p.81]

3.2 Filtration

Filtration is a commonly employed technique for removing suspended solids from process streams. Filtration involves using a permeable material to separate solid particles from liquid substances, with the material trapping the solids while allowing the liquids to flow through. Typically filter media is cloth but various materials can be used as filter media, and the specifics of the filtration process can vary greatly, with equipment selection depending on a multitude of factors. A filter press is the typically used for liquid/solids separation. A conceptual picture of the filter press is portrayed in Figure 2 [3, p. 390-391]

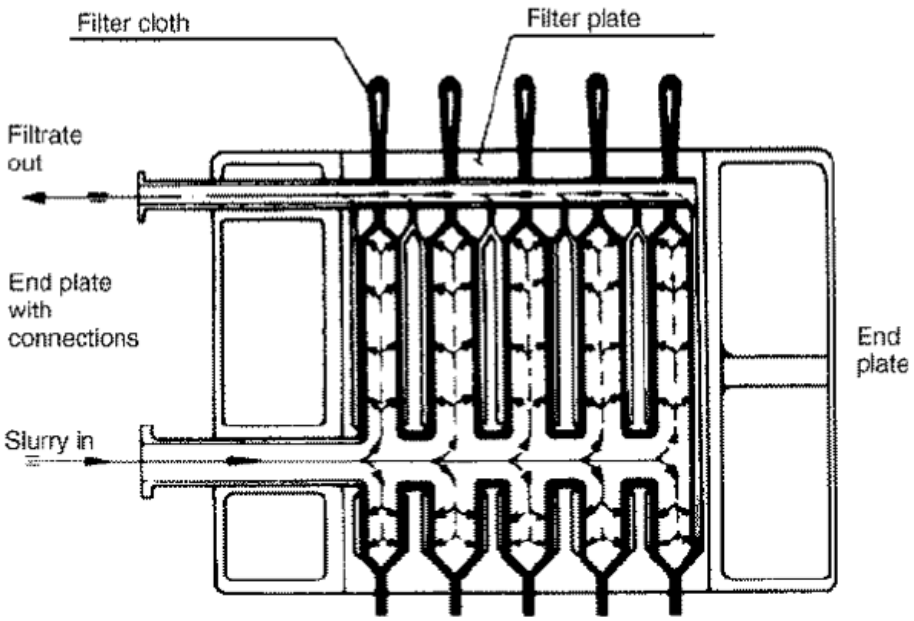


Figure 2. Conceptual picture of filter press [3]

The filtering process produces two material streams: a filtrate which has water and fine solids in it and a filter cake. To increase water efficiency of the process the filtrate stream should be treated and reused in the process.

The accumulating filter cake mostly contains filttered solids and water. The cake needs to be removed because it impedes with the flow rate of the liquid being filtered. [3, p. 391-392]

Self-cleaning filters have been developed to allow for continuous flow filtration without the need for interruptions. While the specific mechanisms of operation may differ among models from different manufacturers, the fundamental principle of these filters remains constant. Through automated self-cleaning, these filters can provide consistent performance and reduce the need for manual maintenance. The working principle of a self-cleaning filter is portrayed in Figure 3**.** [17;18]

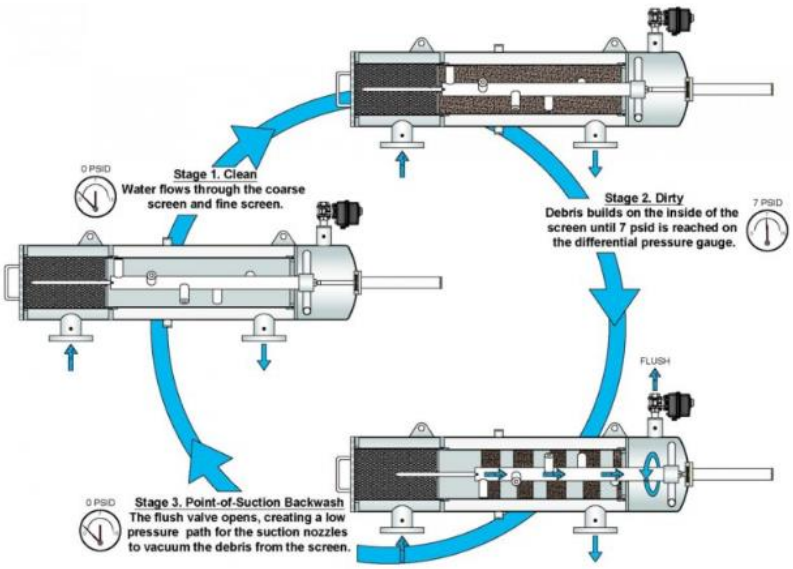


Figure 3. Working principle of Forsta self-cleaning filter [17]

3.3 Coagulation-flocculation

The process of coagulation-flocculation plays a crucial role in water treatment and can be utilized either on its own or in combination with sedimentation and filtration as demonstrated in Figure 4.

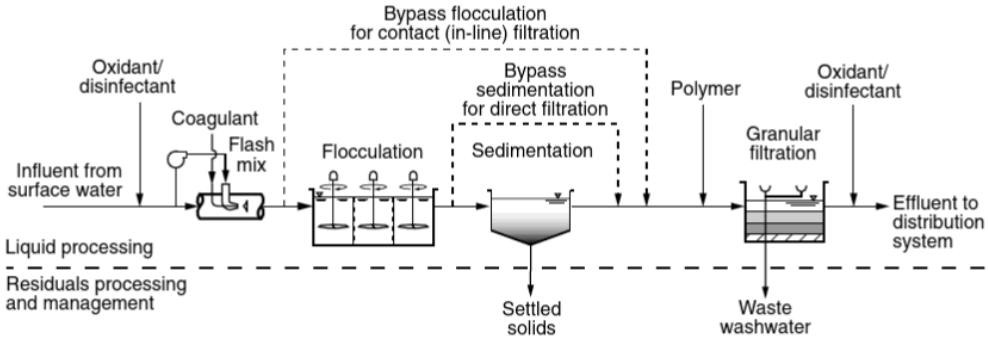


Figure 4. Typical water treatment process [19, p. 140]

In the coagulation process, chemicals are added to treatable water. These chemicals neutralize the charge of the suspended and colloidal particles. This neutralization destabilizes the particles and causes them to aggregate into larger, heavier particles called flocs. [19, p. 141;19, p. 293]

Coagulants are generally classified into three groups: aluminium-based, iron-based, and polymers. Each of these chemicals has a specific pH range within which they operate effectively in the water feed. Consequently, adjusting the pH is crucial. The ideal pH range varies depending on the type of coagulant employed, necessitating a case-by-case assessment of pH control. [20, p. 33, 90, 248]

To ensure the coagulation-flocculation process is as effective as possible, coagulation is typically performed in a rapid-mixing tank. This rapid-mixing stage is arguably the most critical step in the process, as the initial flocs are created during this phase. [20, p. 293]

In the flocculation part of coagulation-flocculation process, flocs are brought together with agitation and allowed to combine into larger particles. Sometimes flocculant chemicals are used. These larger particles can then be removed from the water through methods such as gravity separation or filtration. The process often occurs in several different stages, because as the flocs grow, they cannot withstand high mixing forces and may break into smaller flocs. Therefore,

flocculation often occurs in multiple stages, where the mixing intensity is gradually reduced to maintain its effectiveness. [21;18, p. 6, 162, 174]

3.4 Sedimentation

Sedimentation is a gravity-based process that separates liquid and solid matter from each other. Its efficiency is primarily influenced by the difference in density and size between the carrying medium and the solids that settle. [wills e7, p. 378]. The sedimentation is classified into two subcategories: if the process is used to clarify used process water, it is called a clarifier, and if the process is used to concentrate slurry, it is called a thickener. The process usually takes place in sedimentation tank or basin [19, p. 81; 1, p. 378]. Mechanically thickener and clarifier have some minor differences [22]. The working principle of a sedimentation tank is portrayed in Figure 5.

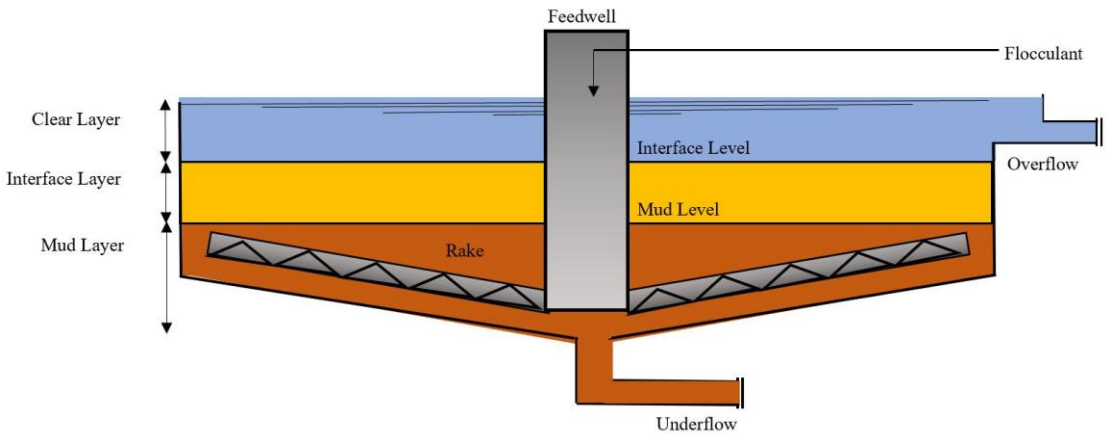


Figure 5. Working principle of thickener and clarifier [22]

Sedimentation facilitates the settling of solid particles or flocs present in the process water. The solid particles or flocs accumulate at the bottom of the tank and form a sludge bed, which is pumped out of the tank via underflow. At the same time, the lighter water rises to the surface and is removed through overflow.

Clarifiers are often assisted with a coagulation-flocculation process to improve the sedimentation process and removal efficiency of suspended solids. Thickener tanks are designed to handle a higher concentration of solids and are used for the purpose of sludge thickening, which results in a higher percentage of solids in the underflow. Sedimentation is not always assisted with the coagulation-flocculation process to function effectively, but in concentrator plants, thickeners are typically assisted with addition of flocculation chemicals. [1, p. 382; 23]

3.5 Centrifugal separator

A centrifugal separator or hydrocyclone functions by separating solid particles based on their settling rate relative to one another. This is achieved through the centrifugal force created within the cyclone's body. When the material is introduced into the cyclone tangentially, the solid particles are propelled towards the cyclone's walls. The force within the hydrocyclone is strongest on the larger particles, which are pushed against the cyclone's wall. The smaller, finer particles, on the other hand, are drawn towards the center of the cyclone. These particles are caught in the vortex and carried upwards through the overflow, while the coarser particles continue to fall and exit through the underflow. The working principle of a hydrocyclone is portrayed in Figure 6. [24]

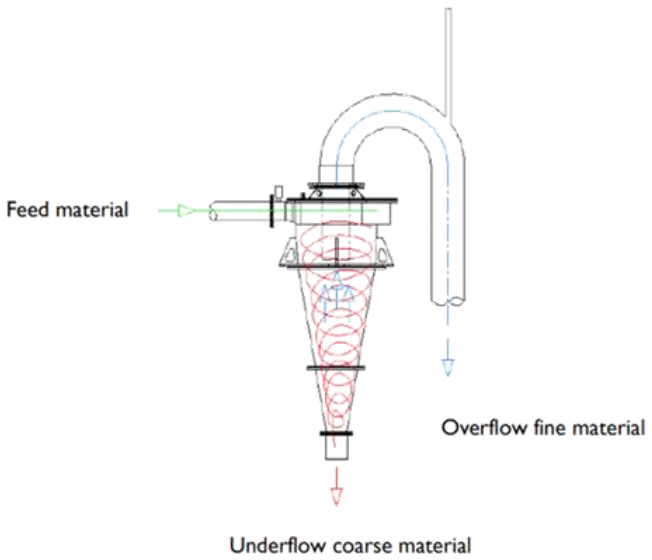


Figure 6. Working principle of an hydrocyclone [25]

Hydrocyclones are widely used in many industries, and it is often used for separation, classification, dewatering or in water treatment. In water treatment they are particularly useful for removing suspended solids from water. [26]

4 Container

The vessel in which the conceptual container module was designed is standard 20-foot container for the water treatment module. 20-foot container frame has dimensions of 5.90 metres in length, 2.35 metres in width, and 2.39 metres in height. The door width of 2.34 metres and door height of 2.28 metres enable easy loading and unloading of cargo. Despite its compact size, the 20-foot container can carry a maximum payload of 28,200 kg, making it suitable for transporting heavy machinery and raw materials. [26]

5 Stream specifications

The module was designed to physically treat the concentrator plant's internal water circuits by treating them from solids. The streams are mainly coming from thickener overflows and concentrate and tailings filters' filtrates and other process

water streams. The streams are treated by using a centrifugal separator or a filter or a combination of the two. The affected streams are categorized into three different categories: process water, treated process water and clean water. The streams and their uses are listed in Table 1.

Table 1. Specifications of the treatable streams

Category	**Clean water**	**Treated Process water**	**Process water**
	+50 micron	+100 micron	+100 micron
Particle	particles	particles	particles
size	removed	removed	removed
Solids	<50 ppm of	<50 ppm of	<50 ppm of
	solids	solids	solids
	Cooling water,	Flocculant post-	
Use	Sealing water,	dilition water,	Process water
	Flocculant make-	Filter wash	
	up water	water	

In the context of this thesis, the stream categories are not as important as the flow rate of the equipment because the increase of flow rate increases the dimensions of the equipment. The flowrates are listed in Table 2.

Table 2. List of flowrates

Flow rate	
7-10	m3/h
31-51	m3/h
65-120	m3/h
102-187	m3/h
265-490	m3/h

During the initial planning phase, there were concerns regarding whether the two largest flow volumes could be accommodated within a standard 20-foot

container. However, after the models were received from vendor, it was concluded that even the largest equipment can fit inside the container if placed alone.

6 Equipment

To achieve the desired water quality, two different kinds of equipment are utilized:a centrifugal separator which is produced by Lakos and a self-cleaning filter produced by Lenzing. Table 3 lists some of the important specifications of the Selected equipment.

Table 3. Specifications of equipment.

	Lakos JPX-0028	**Lenzing**	
Dimension	938 x 276 x 276	2002 x 712 x 610	mm (H x W x L)
Dry weight	24	90	kg
Feed pipeline	1¼" BSP or NPT male	50	DN
Feed pressure	1-10	16	Bar
Output pipeline	1¼" BSP or NPT male	50	DN
Output pressure	1-10	16	Bar
Reject pipeline	1½" BSP or NPT male	25	DN
Flowrate measurement	None	None	Instrument type
Pressure measurement	2pcs gauge	Differential pressure	Instrument type
Power requirement	None	0,1	kW
Pressurized air	None	min 6	Bar
Filtration size	40	1	µm
Filtration efficiency	98	100	%

The centrifugal separator is used to remove most of the suspended solids, but it is not guaranteed to remove all solids; therefore, the Lenzing filter must be placed after to guarantee a certain level of stream quality. Using only a self-cleaning filter is not a feasible solution because the filter’s capacity is not enough to be used as stand-alone solution.

6.1 Lakos JPX-00028

Lakos JPX-0028 is simple equipment since it does not require any auxiliaries to operate, and it should not require any maintenance if used in optimal conditions. It can separate in recirculation process up to 98% to as fine as 40 microns of solids, which have a specific gravity of 2.6. An outline drawing of Lakos JPX-0028 can be found in Appendix 1, and a picture of the equipment produced in Navisworks 3D modelling software is shown in Figure 7.

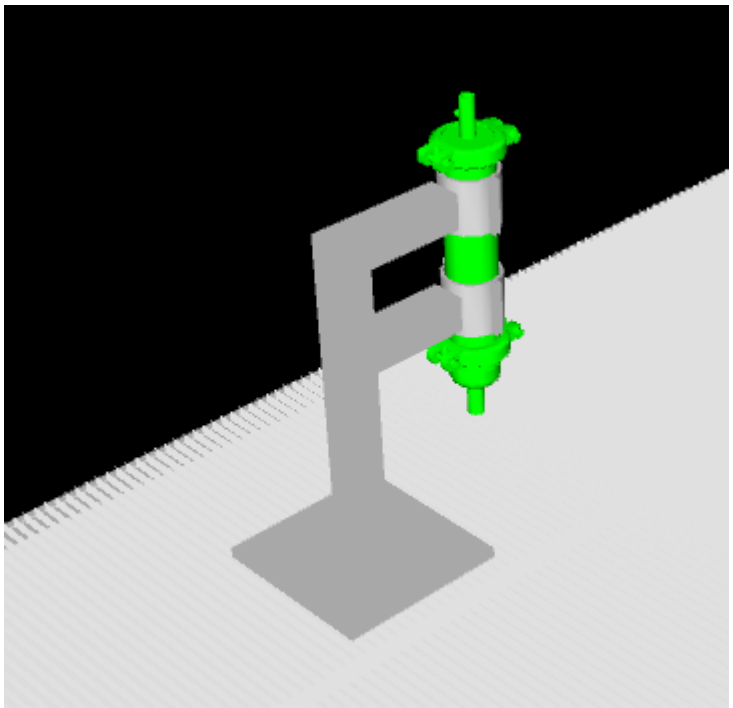


Figure 7. JPX-0028 in its conceptual support stand

Since Lakos has no need for auxiliaries it does not have many requirements for its placement. The only thing that needs to consider in its placement is its height: both inlet and outlet of the equipment requires a valve which need to be reached by operators.

6.2 Lenzing OptiFil®-050-0200

Lenzing OptiFil® filters have a filter fineness down to 1 micron, and it has a self-cleaning cycle of 2 – 3 seconds. Unlike Lakos separator, it requires electricity and pressurised air to function, and a space reservation for maintenance. A datasheet

of OptiFil®-050-0200 Can be found in Appendix 2, and a picture of the equipment is displayed in Figure 8.

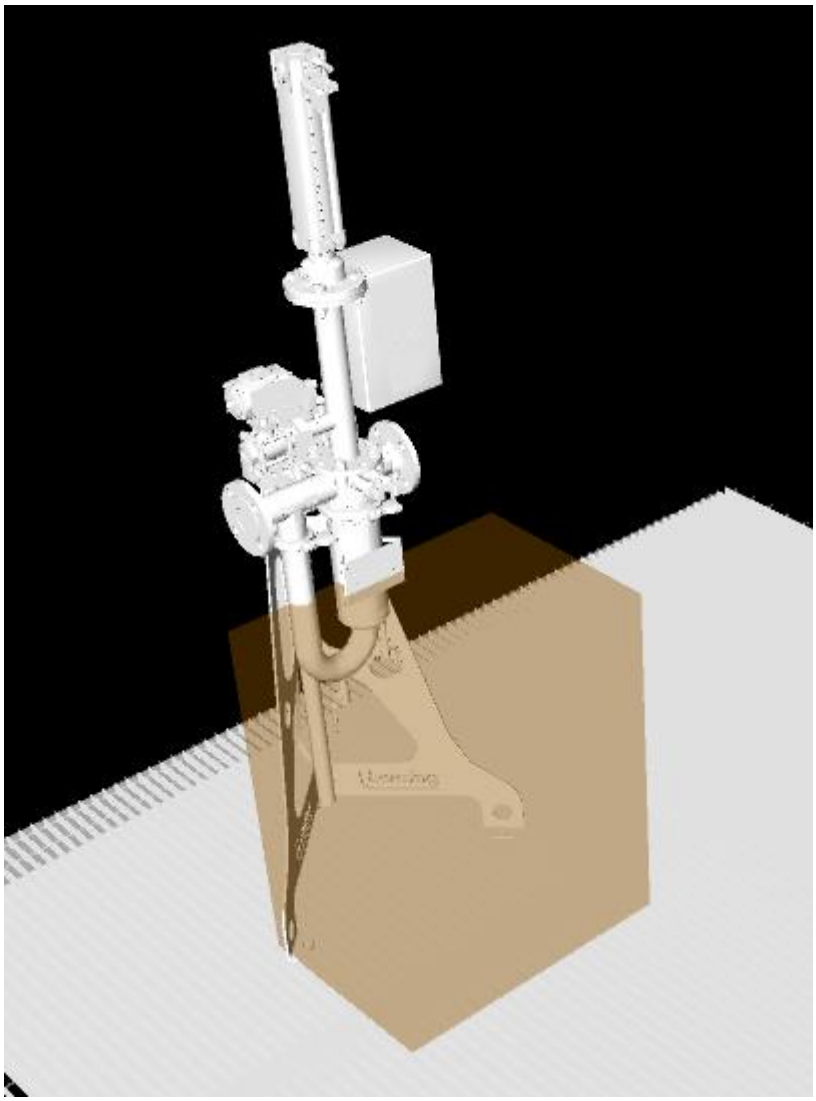


Figure 8. Lenzing OptiFil®-050-0200 and its maintenance space reservation in its stand

Aside from needing electricity, pressurised air, and space for occasional maintenance, the Lenzing does not have requirements for its placement since its inlet and outlets are on a reachable height.

7 Description of conceptual engineering

The development work began by defining the potential process water streams which could be treated. In the beginning also different equipment were evaluated. Since the selected equipment was not part of Metso Outotec proprietary equipment, the vendor of equipment was also considered. Once the vendor was selected, a meeting was arranged where the relevant data about the streams was shared with the vendor. In the initial meeting, the vendor proposed the use of the Lakos eJPX product line and Sofi' self-cleaning-cleaning filters. After the meeting, the supplier properly analysed the stream specifications and offered the equipment with slightly adjusted flow ranges.

Prior to commencing the design process, it was necessary to acquire proficiency in MicroStation OpenPlant Modeler, as this software was required for the piping design of the concept. Additionally, a deeper understanding of PID legends was obtained with the assistance of the PSK and SFS standards.

The conceptual design process began with drafting an initial Piping and Instrumentation Diagram (PID), which received several iterations during the process. To assist with the design, reference was made to earlier projects with similar equipment. The final version of the PID can be found in Appendix 3.

The first version the conceptual container module design was drafted based on the initial PID and reference projects. Bentley MicroStation Connected Edition was used to place the equipment into the container. Piping design for the conceptual container was drafted with MicroStation OpenPlant Modeler.

During the design process four reviews were conducted with other plant engineers in which the design was greatly improved. The final design prioritized safety and operational efficiency. Inlet and outlets of the container are on same side of the container to accomplish smaller footprinted container. The equipment is placed so that maintenance is possible when needed. In addition, easy access to valves, pressure gauges, and sampling points is ensured. ~~A~~ solution with

grating and inclined plates was implemented to allow for efficient drainage in the event of spillage or maintenance.

During the review process, it was concluded that it was preferable to avoid including cable racks in the design. Instead, instrumentation and power cables were placed in separate, conduit pipes. The final result of the design process can be found in Appendix 4.

8 Summary

Water plays a crucial role in ore refining processes and concentrator plants are often placed in remote locations. This creates a need for internal water treatment system. The purpose of this thesis was to meet the requirement for more efficient water treatment solutions in concentrator plants. This requirement was met by producing a conceptual 3D model and PID of a modular water treatment container.

The thesis was divided into two parts: preparation and study, and actual modeling. Neither of these phases was done alone, as the preliminary planning was done with the process engineer in charge of the project, and the actual modeling was done with several plant engineers.

Since no project is never identical to an another, the result of this this thesis may not be used in future projects without some level engineering, but it offers potential for streamlining the design process in the forthcoming projects, thereby reducing the amount of time needed for design development.

The result of this thesis could appeal to customers who are seeking an easy, affordable, and more controllable solution for handling process water streams, as compared to conventional methods. This is because the use of these results could significantly reduce the demand for fresh water among potential customers.

References

1 Wills’, Barry; Napier-Munn, Tim. 2006. Edition 7. Wills' Mineral Processing Technology: An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery. E-book.

2 Frequently asked questions. Online resources. Government of Meghalaya Department of mining & Geology<https://megdmg.gov.in/faqs.html/>. Read 20.4.2023.

3 Wills’, Barry; Napier-Munn, Tim. 2015. Edition 8. Wills' Mineral Processing Technology: An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery. E-book.

4 Physical and chemical wastewater treatment methods. Online resources. Ngo environment. <http://ngoenvironment.com/en/Wastewater-treatment-tec29-PHYSICAL-AND-CHEMICAL-WASTEWATER-TREATMENT-METHODS-d55.html/>

5 Water treatment. Online resources. Centers of disease control and prevention. <https://www.cdc.gov/healthywater/drinking/public/water_treatment.html>. Read 02.4.2023.

6 What is biological wastewater treatment. Online resources. Flience. <https://www.fluencecorp.com/what-is-biological-wastewater-treatment/>. Read 20.4.2023.

7 Towards minimum impact concentrator – effects of water quality and recycled reagents on flotation performance. Online resources. <https://www.mogroup.com/insights/blog/mining-and-metals/towards-minimum-impact-concentrator---effects-of-water-quality-and-recycled-reagents-on-flotation-performance/>. Read 20.4.2023.

8 Merkus, Henk. 2009. Particle size measurements fundamentals, practice, quality. E-book.

9 Particle size analysis of the top part of the filter cake. Online resources. Researchgate. < https://www.researchgate.net/figure/Particle-size-analysis-of-the-top-part-of-the-filter-cake_fig5_257293430/>. Read 24.4.2023.

10 Specific gravity. Online resources. whatis. <https://www.techtarget.com/whatis/definition/specific-gravity/>. Read 20.4.2023.

11 Mixing 101:The importance of Specific gravity. Online resources. Dynamix. <https://dynamixinc.com/specific-gravity/>. Read 24.4.2023.

12 Turbidity, Total suspended solids & water clarity. Online resources. Fondriest. <https://www.fondriest.com/environmental-measurements/parameters/water-quality/turbidity-total-suspended-solids-water-clarity/>. Read 20.4.2023.

13 What is total suspended solids. Online resources. Wastewater digest. <https://www.wwdmag.com/instrumentation/suspended-solids-monitors/article/10939708/what-is-total-suspended-solids-tss>. Read 20.4.2023.

14 Makarov, Artem. Metso-Outotec, Written statement. 2023

15 Stuetz, Richard. 2009. Edition 1. Principles of water and wastewater treatment processes. E-book.

16 What is a self-cleaning strainer?. Online resources. Forsta filters. <https://www.forstafilters.com/why-forsta/how-it-works/>. Read 20.5.2023.

17 How different types of self-cleaning filters work. Online resources. commercial filtration supply <https://www.commercialfiltrationsupply.com/education/how-self-cleaning-water-filters-work.html/>. Read 20.4.2023.

18 Howe, Kerry; Hand, David; Crittenden, John; Rhodes Trussel, R; Tchobanoglous, George. 2012. Principles of water treatment. E-book.

19 Bratby, John. 2016. Coagulation and flocculation in water and wastewater treatment. E-book.

20 About water treatment.2020 Online resources. Kemira.

21 Difference between clarifier and thickener. Online resource. 911 metallurgist. <https://www.911metallurgist.com/blog/difference-between-clarifier-and-thickener/>. Read 20.4.2023.

22 Control strategies for minerals thickening. Online resources. Process analysers. <https://www.plapl.com.au/control-strategies-for-minerals-thickening/>. Read 20.4.2023.

23 Piispa, Petteri. Metso-Outotec, Spoken statement. 2023

24 Dewatering hydrocyclone | hydrocyclone separator. Online resources. Atlantic pumps < https://atlanticpumps.co.uk/products/hydrocyclones/>. Read 20.4.2023.

25 Andersson, Rasmus. 2010. Evaluation of two hydrocyclone designs for pulp fractioning. Licentiate Thesis. Royal institute of technology Sweden, School of Chemical Sciences and Engineering.

26 20-foot container – Dimensions, Measurements and weight. Online resources. iContainers. < https://www.icontainers.com/help/20-foot-container/>. Read 20.4.2023.

Outline drawing of Lakos JPX-0028

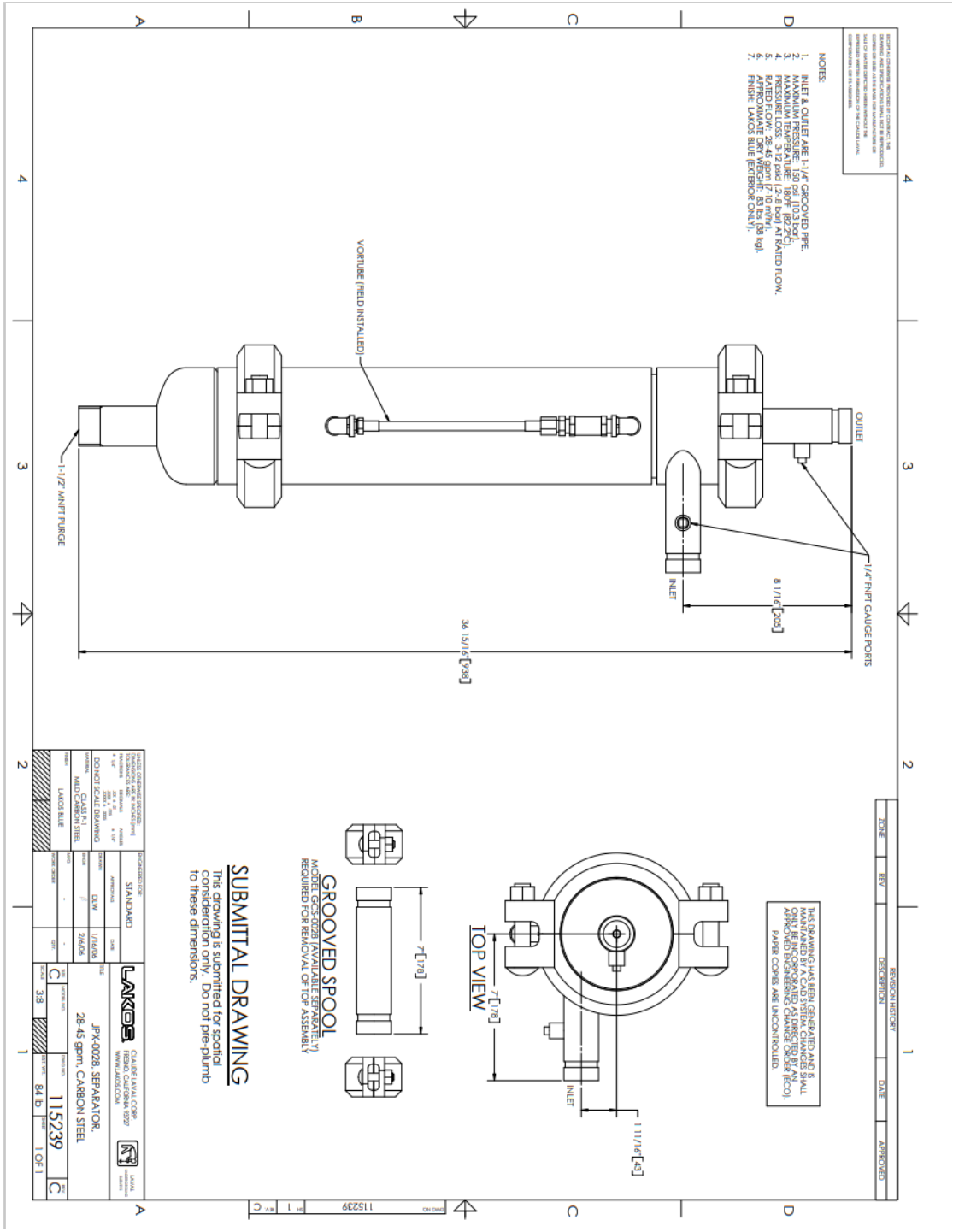


Figure 1.1. Submittal drawing of JPX-0028

Data sheet of OptiFil®-050-0200

Lenzing
Innovative by nature

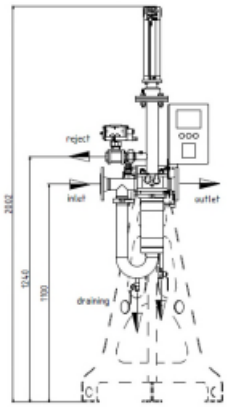
LenzingTechnik
Datenblatt / Data Sheet
Filtration & Separation

Automatischer Rückspülfilter Typ OptiFil®-050-0200
Automatic backwash filter type OptiFil®-050-0200

Allgemeine Daten / General Data

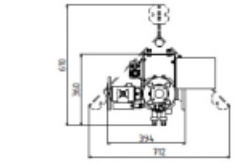
- Empfohlener Durchsatz / Recommended flow rate: max. 20m³/h* / max. 90gal/min*
- Min Betriebsdruck / Min. working pressure: 2 – 4bar* / 29 – 58psi*
- Max. Betriebsdruck / Max. working pressure: 16bar / 232psi
- Max. zul. Betriebstemperatur / Max. working temperature: 120°C / 248°F
- Nettogewicht / Net weight: 90kg
  Volumen / Volume: 9l / 2,4gal

*Auswahl erfolgt durch Lenzing / selection to be qualified by Lenzing



Rückspülung / Backwashing:

- Rückspülmenge / Reject volume: 1l / 0,3gal
- Dauer Rückspülung / Backwash time: ~ 2sec.



OptiFil®-050-0200-QC

OptiFil®-050-0200-QC

Anschlüsse / Connections:

- Einlauf / Inlet: DN50 / 2"
- Auslauf / Outlet: DN50 / 2"
- Reject: DN25 / 1"
- Entleerung / Drain: ¼"
- Druckmessung / Pressure measurement: ½"

Energieversorgung / Energy supply

- Leistung / Power: 0,10kW
- Verbrauch / Consumption: < 30W
- Frequenz / Frequency: 50 / 60Hz
- Spannung / Voltage: 1 x 100 – 240V
- Nennstrom / Rated current: 1,0A
- Druckluft / Pressurized air: min. 6bar / 87psi

Änderungen der technischen Daten und Ausführung vorbehalten! / Technical data and pictures are subject to change without notice!
Lenzing Technik GmbH ▸ Filtration & Separation ▸ A-4860 Lenzing
▸ Tel.: +43 (0) 7672 701-3479 ▸ Fax: +43 (0) 7672 918-3479 ▸ filter-tech@lenzing.com ▸ www.lenzing-filtration.com
10/2018
Rev. Nr: 2.0

Figure 2.1 Datasheet of Lenzing OptiFil®-050-0200

PID

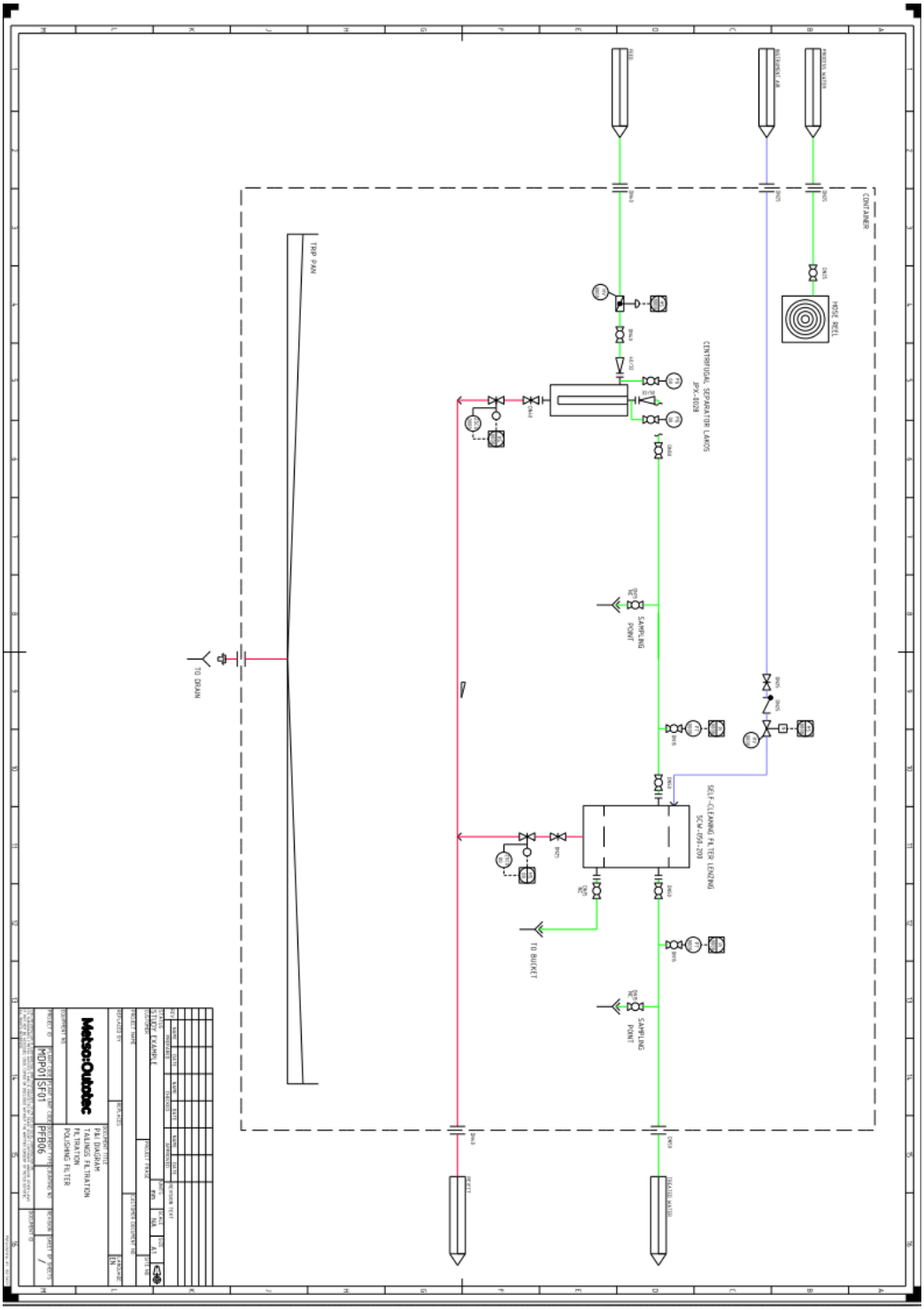


Figure 3.1. Piping and instrumentation diagram

3D design

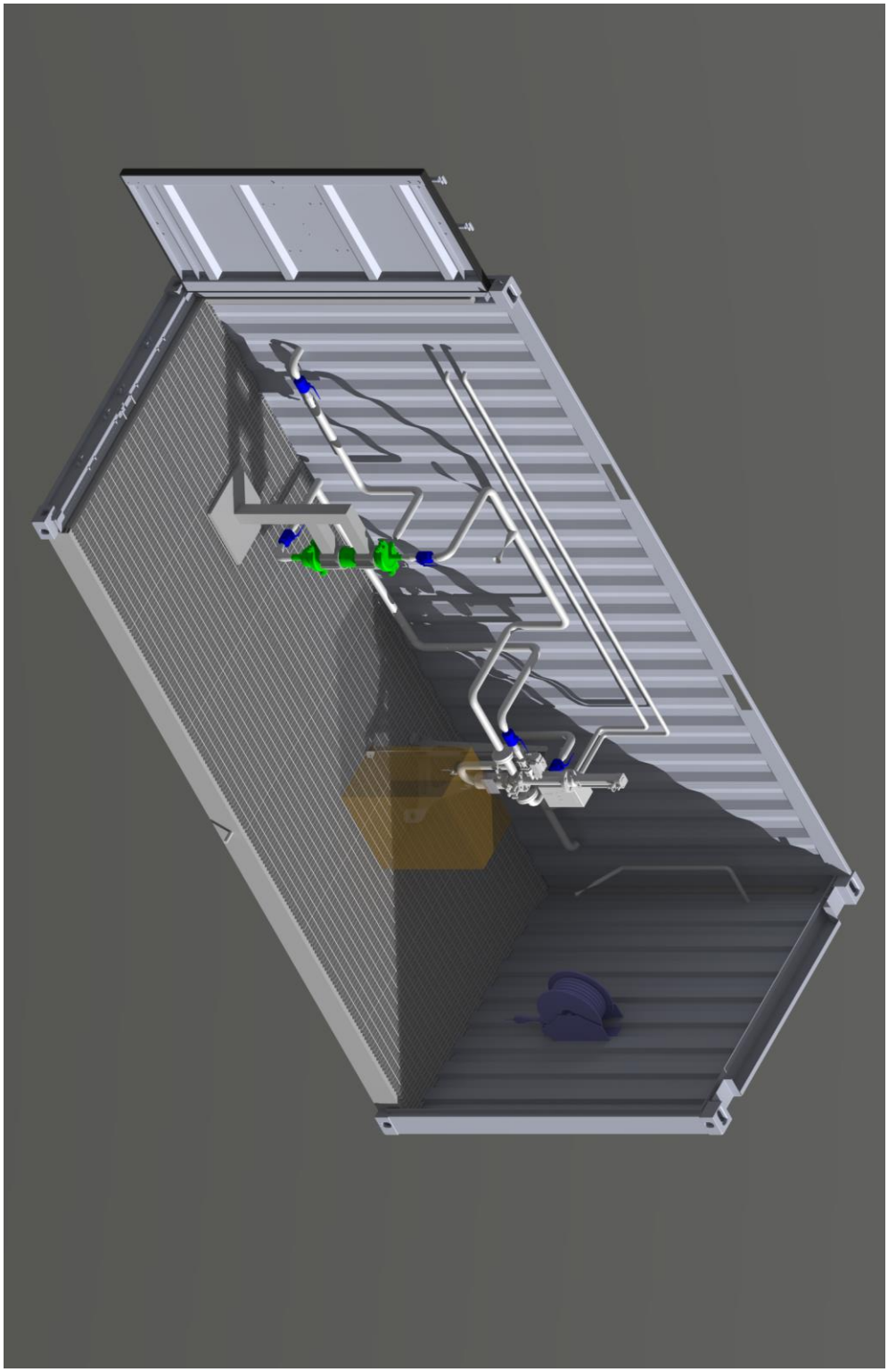


Figure 4.1. 3D-design of the container