YRKESHÖGSKOLAN
NOVIA

Creation of a Manual for Revising Marked-Up Drawings

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Bachelor's Thesis

Mechanical and Production Engineering

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EXAMENSARBETE

Författare: Simon Johansson

Utbildning och ort: Maskin- och produktionsteknik

Inriktning: Maskinkonstruktion

Handledare: Leif Backlund (Yrkeshögskolan Novia), Jukka Sorsa (Neste)

Titel: Skapande av en manual för revidering av markerade ritningar

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Datum: 31.3.2024 Sidantal: 24 Bilagor: 2

Abstrakt

Detta examensarbete är skrivet för Layout and Piping avdelningen vid Neste Oy. Målet med detta examensarbete var att skapa en lättläst handbok för revidering av markerade ritningar av underhållsavdelningen vid Nestes raffinaderi i Borgå.

Examensarbetet förklarar processen bakom skrivande samt teorin som krävdes. Läsarcentrerad skrivning, teknisk kommunikation och identifiering av slutanvändare samt deras krav tas upp i teoridelen. Metodkapitlet berättar om hur problemen behandlas med hjälp av kvalitativ analys. Resultat kapitlet går igenom skrivprocessen samt ger en kort sammanfattning av den färdig produkten.

Den färdiga handboken förklarar från hur arbete tas emot tills arkivering av den färdiga ritningen. Handboken är uppdelad i tre delar, emottagning av arbete, modellering och arkivering. Handboken fungerar som en referensmanual med steg-för-steg anvisningar där det har ansetts nödvändigt.

Språk: engelska
Nyckelord: handbok, revidering, teknisk kommunikation

OPINNÄYTETYÖ

Tekijä: Simon Johansson
Koulutus ja paikkakunta: Kone- ja tuotantotekniikka
Suuntautumisvaihtoehto: Konerakennus
Ohjaaja(t): Leif Backlund (Yrkeshögskolan Novia), Jukka Sorsa (Neste)

Nimike: Käsikirjan luominen merkittyjen piirustusten tarkistamista varten.

Päivämäärä 31.3.2024 Sivumäärä: 24 Liitteet 2

Tiivistelmä

Tämä opinnäytetyö on tehty Neste Oy:n Layout and Piping osastolle. Opinnäytetyön tarkoitus oli luoda helppokäyttöinen opas Nesteen jalostamon kunnossapito-osaston merkattujen piirustusten tarkistamiseen.

Tässä opinnäytetyössä kerrotaan oppaan kirjoittamiseen tarvittavista tiedoista. Teoria osuudessa kerrotaan lukijakeskeisestä kirjoittamisesta, teknisestä kirjoittamisesta ja mahdollisten käyttäjien ja heidän ongelmiensa tunnistamisesta. Menetelmä osuudessa käydään läpi, miten ongelmat tunnistetaan laadullisen analyysin avulla. Tulos luvussa käsitellään prosessia ja annetaan yleiskatsaus valmiista tuotteesta.

Valmiissa oppaassa selitetään merkittyjen piirustusten tarkistamisen vaiheet. Opas on jaettu kolmeen osaan: työn hyväksyminen, mallintaminen ja arkistointi. Opas toimii viiteoppaana, mutta löytyy myös tehtäväkohtaisia ohjeita.

Kieli: englanti
Avainsanat: käsikirja, merkittyjä piirustuksia, tekninen kommunikointi

BACHELOR'S THESIS

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Abstract

This thesis was made for the Layout and Piping department at Neste Oy. The purpose of this thesis was to create an easy-to-follow guide for revising marked-up drawings from the maintenance department at Neste Refinery in Porvoo

This thesis explains the process behind the writing and research needed to write said guide. It explains the theory behind reader-centered writing, technical writing, and identifying possible users and their problems. The method chapter goes through how the problems were identified using qualitative analysis. The result chapter goes through the process and gives an overview of the finished product.

The finished guide explains the steps of revising marked-up drawings from accepting work until the archival of the finalized drawing. It is divided into three parts, accepting work, modelling, and archival. The guide works as a reference guide, with task-based instruction interspersed.

Language: english
Key words: manual, marked-up drawings, technical communication

Table of Contents

1 Introduction

This thesis was made for the Piping and Layout department at Neste in Porvoo. The purpose was to create a reference guide to aid design engineers at the Layout and Piping department at Neste Oy to revise marked-up drawings. The finished guide is both a summary and task-based guide of the whole process.

1.1 Neste

Neste Oy is a Finnish producer of refined oil products, sustainable fuels, and renewable feedstocks. It is a medium-sized company, with around 5000 employees, most of which are situated in Finland. The main points of operations are at the Kilpilahti refinery, where raw oil is refined into various products, such as fuels and lubricating oils. However, in 2010 Neste became a global company when it first opened the doors to the biofuel refinery in Singapore and 2011 in Rotterdam. The latest expansion is a joint venture with Marathon Petroleum in Martinez, California, also a biofuels refinery. (Neste, 2023)

1.2 Purpose

The purpose of this thesis is to create an easy-to-follow guide for revising marked-up drawings from the maintenance department at Neste Refinery in Porvoo. It will be used by experienced design engineers who only need a quick reminder, newly employed engineers to whom the process is completely new, and consultants who may only need a quick summary of how the process works. The guide should take into consideration the most asked questions and challenges that have come up. It should also be based on standards, references, and guides made by Neste, Hexagon or third parties.

1.3 Background and objective

Due to the same questions getting asked frequently and the same mistakes being made time after time, the decision to create a reference guide for revising marked-up drawings was taken. Another contributing factor was the change of modelling program, going from PDS to Smart3D. This change created a load of new problems and bugs that most

employees were unfamiliar with. The modelling part in the created guide aims to solve the most common problems related to 3D modelling when revising marked-up drawings.

The created guide aims to explain all steps in the process in a condensed manner while referring and linking to more in-depth guides and standards if more reading is desired. Only information important to Piping and Layout is brought up.

1.4 Delimitation

The guide created is limited to only include instructions for Piping and Layout design engineers at Neste refinery in Porvoo. It covers the steps of accepting work until the archiving of the finalized drawings. The modelling part is limited to challenges deemed specific to red pen revisions, as more general guides are readily available.

2 Pre-study

The process began by doing a pre-study of topics that may be brought up in the guide. It helps to have a surface-level understanding of the inner workings when writing a guide. This chapter contains information about the final drawing procedure, pipe classes, what a technical drawing is, and how drawing statuses work specifically at Neste.

2.1 Standards

There are a multitude of standards to take into consideration when planning and executing projects of which a few are relevant when doing ASB work. Neste has their own standards, which are mostly based on PSK which are mostly based on ASME, American Society of Mechanical Engineers.

Standards are used to unify and streamline work, leading to fewer mistakes and more predictability on what can be expected from a specific product or process. In piping engineering, they can be classified into three categories, international, European, and national standards. Internationally it is ISO (International Organization for Standardization) who are tasked with creating and upkeeping standards. On a European level it is the CEN (European Committee for Standardization) that maintain the EN standards. In Finland SFS (Suomen Standardisoimisliito Ry) upkeeps the SFS standards.

A co-operation between the industrial corporations in Finland, PSK, upkeeps the standards used in the industry. These standards are based on the above-mentioned standards and are more practical in nature. (Horto, 2020)

Other than general standards, many companies make use of their own, internal standards. These are often based on the standards mentioned above, but more specific for the company. Internal standards are a great way to speed up engineering work by removing repetitive tasks.

2.2 Final drawings of Maintenance procedures

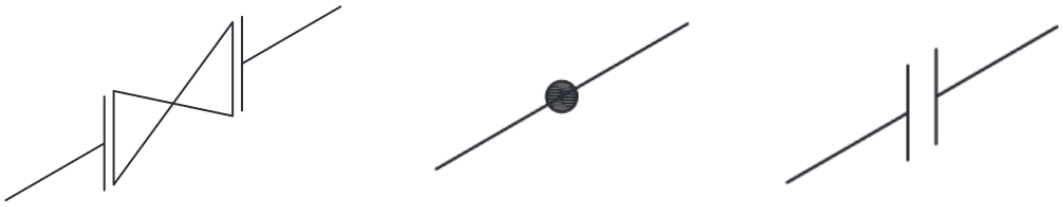
The work procedure of creating finalized drawings for changes implemented by maintenance is standardized internally in the standard *"Final drawing of as-built documents for changes implemented by the Maintenance organization (Work Procedure)".*

Smaller modifications of pipes are often done in-house by the maintenance department and without a design engineer. When maintenance has completed their modifications, the changes are marked on the relevant isometric sheet, by hand or using computer tools. These marked-up isometrics drawings are then added to a folder and the relevant information to a follow-up sheet from where a design engineer can download them and do the relevant modifications to the 3D model or drawing. The sheet is connected to PowerBI, a business intelligence tool, from where managers can track and trace progress.

2.3 Technical drawings

Technical drawings or simply drawings communicate how something is to be constructed using lines, dimensions, and other technical information. There exist several different types of drawings, all depending on which branch of engineering and what information is important for the product. Nonessential information only serves to confuse the user and may even be counterproductive. The most common type of drawing a piping engineer will come upon is the isometric piping drawing. Isometric drawings are a projection of a pipeline in which all three coordinate axes are inclined at the same 30° angle to the projection plane. Piping isometrics differ from other types of drawings by not being proportional.

The straight lines represent a direction in three-dimensional space and its real-world length is communicated with an annotation. Valves, flanges, and other instruments and equipment may be added to the drawing by using the correct symbol. The direction of flow is shown using a flow arrow and welds using filled circles. (Metalliteollisuuden Standardisointiyhdistys ry, 2018)



Picture 1 Examples of isometric symbols, from left: gate-valve, weld seam, flanged connection.

A marked-up or red pen drawing is a drawing that has been modified by hand or computer tools to mark what changes have been made, e.g. changes in geometry, equipment, or materials.

Due to Neste being an old company, drawings have changed in appearance and what they display will change depending on the year it was commissioned. The older drawings, from before 1990 were drafted by hand, while the newer ones are made using CAD programs which will be expanded upon later. Newer drawings contain a lot more information which has been added not only because of changes in standards but also because of accessibility of information, such as Bill of Materials, Design and Operational temperature, ground clamps and painting classes.

2.4 Drawing status

At Neste the drawing can have one of four statuses:

- FC (for comments)

FC drawings are sent to all parties who may want to comment or propose changes to the drawing in the early stages of a project. Usually a rough drawing without all information.

- AFD (Approved for design)

AFD means that the drawing design has been approved and the next step in the design can begin. AFD status can be long and go through many revisions, this is in the middle stages of a project. All information may not be in the drawing yet, such as piping support or temperature values, and info can and will change.

- AFC (Approved for construction)

AFC drawings are used in the field to construct the pipelines. These include all the necessary data for construction, welding, and painting. They have gone through checking and approval and are supposed to be the final revision of the AFD drawing. At this stage, the drawings should not be revised anymore.

- ASB (As built)

As built are the archived drawings. These are updated with any changes that may have been made during construction. The AFC drawings are marked-up and the 3D-model is updated according to the markups and uploaded to the archive as as-builts.

2.5 Pipeclasses

Neste has their own pipe classes based on ASMEs standard B31.2 “Process piping”. Pipe classes are a collection of properties that a pipe, instrument or equipment has. The most common class is A, which is carbon steel. A typical pipe class would be A1NA, where the first letter tells what material the pipe is made of while the number tells the ANSI pressure class. 1 being 150#, 3 = 300# 6 =600# and so forth. The second letter is a “modifier” which

has changed over the years. In the H102 “Piping materials, service specification index list” from 1983 both A1 and A1B standards are shown (Neste Oy , 1983). Here the B means that the pipe is of lower class and only used for transportation of non-corrosive material. The latest change in carbon pipes was in 2011 when the N was added to A1N (Neste Oy, 2011), it meant that the steel now was impact certified for temperatures as low as -29°C, the material was changed from ASTM A106 Grade B to ASME A333-grade 6. While both steels have very similar chemical and physical properties, A333-6 comes certified as a low temperature steel. (Neste Oy, 2002)

The last letter is the inspection class and can be either 0, A or B and is directly taken from the ISO-standard for non-destructive testing of welds (NDT). 0 means that no inspection is needed. A and B both use the same methods, but B is more sensitive and accurate than A. This can be seen in the various tables comparing the accepted values in the standard (Suomen Standardisoimisliitto, 2022)

As ASME is based in America, the imperial system is used as classification values. E.g. Pipes are classed in pounds and inches. But all construction and process data are in metric.

2.6 CAD-programs

CAD (computer aided design) programs are tools used to aid in the creation of designs with computers, instead of traditional hand drafting. This includes 2D vector graphics, 3D-modelling software, plant design software, and simulation software. At Neste there are a few main programs in use.

2.6.1 AutoCAD

AutoCAD is used when working with rasterized versions of older, hand drawn drawings. Rasterized means that everything is represented by pixels, like digital pictures. AutoCAD normally uses vector graphics, which are visual representations of mathematical equations. This in turn means that the rasterized drawings require a different way of working than normal, as you combine both vector and raster graphics.

2.6.2 Smart3D

Smart3D is the main program when designing piping and layout at Neste. Originally developed by Intergraph (now owned by Hexagon) it is the most used plant design software. It is a rule-based database 3D-modelling system. Rule based means that properties will change on pre-defined rules, such as what wall thickness, welding specification, and valve type. It is the successor and a major upgrade from the old program, PDS (Plant design system). PDS was the largest plant design program, but support for it ended in 2023. Due PDS being developed originally in the late 80's, it was filled with legacy code and protocols not used anymore.

PDS models were converted and imported to Neste's own Smart3D database in 2023 with the help of a third party. In S3D the PDS models are called SIO-objects (Smart Interoperability objects). SIO-objects behave differently from native objects and thus require a different way of working. SIO-objects haven't been used to this extent as a working part of the digital twin before, so bugs and problems are prevalent. The SIO-objects are not part of the fully intelligent model and most data allocated to them are not able to be modified such as:

- Pipe class.
- Size and length
- Flowing material
- Insulation (partly)
- Painting specification (partly)

The data migration wasn't 100%, as some relationships between objects weren't implemented correctly, but no data migration will ever be and must simply be worked around (Hexagon, 2020)

Smart3D is also part of Neste PDM system. As it is a database-based modelling system, models are constantly kept up to date between users and BOMs are created automatically. Duplications and discrepancies are almost impossible, as the program is constantly checking for errors, duplicates, and access rights. All of which are key points in a PDM-system.

2.7 Document management systems at Neste

At Neste two different document managers are in use. Found! is a project-specific document management program. Every project has its own folder, and every worker has access rights to all folders. Checking and approving documents is done within Found!. This allows many revisions of the same document to be done during the project, without updating the main document data-vault. The different revisions can be viewed in later stages of development, further speeding up the planning phase. Found! may also contain files and documents that aren't necessary to archive, such as photos and notes, but nonetheless are important to the project.

SmartPlant Foundation (SPF) is the main document data-vault (archive) at Neste. When a document has been marked for handover in Found! it is uploaded to SPF. Only as-built documents are found in SPF and only specific documents deemed important enough are archived. The entered meta-data is used at this point to categorize and create relationships between documents and that is the reason why it is of utmost importance to enter the correct data when uploading documents.

3 Theory

This chapter goes through relevant theory needed to create the reference guide. It contains theory about reader-centered approach, language and how cultural differences need to be taken into consideration when doing technical communication. But begins by going through the theory of what document management and PDM-systems are, to get a better understanding of the document management and 3D-modelling.

3.1 Document management

Document management is the process of overseeing and categorizing documents in an organization. Traditionally this was done manually using folders and cabinets, but the digitalization of corporations turned it digital. (Sutton, 1996) Documents are assigned meta-data, which is data about data. Meta-data can be thought of as a traditional folder, except due to it being digital, a document can be in an almost infinite number of “folders”, all depending on how much meta-data is added to it. E.g. a drawing can both be in the “folder” for a specific equipment, but also in the “folder” for a certain piping wall thickness. There are three main types of meta-data (Riley, 2017):

1. Descriptive meta-data is used for discovery and identification, e.g. title, author, keywords.

2. Structural meta-data explains the organization of data and/or its relationship with other data.

3. Administrative meta-data is information that is needed to manage a document. E.g. file-type, how and when it was created and who has access rights.

Drawings contain a bunch of meta-data, mostly for archival purposes. These include but are not limited to:

1. Document Code
2. Sheet Number
3. Pipeline
4. Area
5. Author
6. Revision information
7. Physical Size
8. Connected Equipment

This meta-data can be used to bind together data. If all pipes connected to a certain equipment is wanted, a single search of the meta-data string “Connected Equipment” is enough.

3.2 PDM-system

PDM stands for Product Data Management and one definition of it is:

> *"PDM is the discipline of controlling the evolution of a product and providing other procedures and tools with the accurate product information at the right time in the right format during the entire PLC (Product Life Cycle).* (Ivica Crnkovic, 2003)

In a PDM-system, focus lies on managing and tracking creation, change and archive of technical documents, such as CAD models, drawings, and other documents.

The central use of a PDM-system is the data vaults, where data is stored in different databases. This can be anything from 3D models to documents and can also be either data or meta-data. These data vaults usually provide check-in and check-out systems to prevent duplicates and conflicting changes. (Ivica Crnkovic, 2003)

Workflow management is also a critical part of a PDM-system, ensuring that the right information is available to the right person at the right time. Historical records are also kept, ensuring that users can view and see the changes made at any time. Workflow management also includes the approval process, where usually a user sends the documents to a user for reviewing and approval.

These are only a few examples deemed important for this thesis, but a PDM-system can further include:

- Product structure management
- Classification management
- Program management
- Data transport and translation
- Application Integration

(Ivica Crnkovic, 2003)

3.3 PLM-system

Product Lifecycle Management, or PLM, is not a specific software or method. It is a wide totality, a combination of methods and concepts to steer the process of creating, handling, distributing, and recording product information. In the present day, PLM is carried out with the help of software, but it is not necessary. Agreements and common practices that standardize information handling is the groundwork for a PLM-system that doesn't need specialized software. (Saaksvuori, 2002)

PLM is at its core about connecting technologies. Combining information from different sources in a business and seamlessly transmitting them between different entities provides massive benefits to businesses. (Saaksvuori, 2002)

While a PDM-system is mostly used by engineering and in the creation phase of a product, a PLM-system encompasses the whole lifecycle, from inception until disposal. (Saaksvuori, 2002)

3.4 Technical Writing

Technical writing is the art of expressing a subject to a specific audience in an easy-to-understand manner. Focus lies on the user experience, so the most important part is knowing the audience and their needs and expectations. Technical writing differs from creative writing in that it is directed to a specific audience about a specific product. Not only manuals and guides are part of technical writing but also (Ask, 2012):

- Internet Content
- Research Reports
- Marketing
- Whitepapers

3.4.1 Identifying the user

As with any type of product, the end users should always be first in mind when it comes to creating a written guide. The first step should always be to identify the users' level of competence and their needs. According to James H. Shelton (Shelton, 1994), the reader (users) groups can broadly be classed into three categories.

- Technical Readers
- Managerial Readers
- General readers

Technical readers have the deepest amount of knowledge of the three. If writing for them one must allow them to directly get into the deep end, without explaining general concepts. A common trap many writers fall into according to Shelton is writing verbose and complicated sentences meant to impress, but only serve to hinder the reader and writer. Shelton further splits the technical readers into theorists and technicians. Writing to theorists is usually scientific research and theories and is most often considered the hardest type of writing. It often becomes too hard to understand and boring. Writings aimed at the latter group usually includes manuals and descriptions. Short, step-by-step instructions on how to perform specific tasks are the most common. (Shelton, 1994)

Managerial readers often do not possess the technical knowledge and vocabulary as a technical reader, yet they need to stay informed. An "Executive Summary" has therefore become a popular tool. It's usually a general overview of the subject, without going into detail on how specific parts should be done or how they work. The writer must also remember that in the technical field, the middle managers almost always are experts. Shelton emphasizes that to successfully get your point across with managers is to write short and concise. They are overloaded daily with written information and do not have time for unnecessary prose. (Shelton, 1994)

General readers usually have the least technical knowledge on a particular subject and writing to them usually includes opening subjects and ideas more than for technical or managerial readers. The challenge is doing it without talking down to the reader.

3.4.2 Reader-centered approach.

When the user group has been identified, the following step is figuring out what the readers already know and what they will need to know.

As Paul Anderson says in his book, Technical Communication: A Reader-Centered Approach (Anderson, 2007), a reader only wants to read something that is useful to them. Andersson recommends imagining questions that a possible reader might ask, even if it may seem obvious. The writer should reread his text and ask, “what does this answer?” Andersson also places emphasis on his principle that the writer’s task is to persuade the reader. Any communication has the possibility of changing or reinforcing the reader’s opinion on the company, software or even country! This is a high-level goal and everything from language to layout will affect opinions.

How the reader will look for information is also of importance when writing. Are they going to look for key points, read every page word for word, or look for a certain task? All types of readers may be using the finished product and must all be taken into consideration. The less somebody must think when searching, the better. (Anderson, 2007)

The state-of-mind of the reader will also play a role when writing. A user who is trying to troubleshoot may not be in the mood for extravagant language and graphics, but only needs to find the points to help them.

3.4.3 Language

Written language is the main tool used to express ideas and deliver instructions. It is therefore important to choose a style of language that is suitable for the task at hand. Prose, poetry, and even academic writing will use significantly different language from a reference guide. According to Shelton, many technical writers are still affected by academic writing, where the main objective is to impress and convince the professor that they are learning instead of expressing thoughts clearly and concisely. (Shelton, 1994)

The language of a guide should be concise and only tell exactly what needs to be said, not more or less. Concrete use of language should also be used, avoiding imprecise adjectives such as “very” or “quite” and instead using exact language. This often comes at the cost of using affected language instead. Affected language is the use of complex and impressive

vocabulary, as often found in academia. The challenge lies in using a concrete language that is not trying to impress the reader. (Shelton, 1994)

Furthermore, the use of jargon must be assessed. Jargon is the exclusive language only understood and used by professionals in a specific field. If used correctly it will speed up the reading process but can also hinder the reader if it is misunderstood or not understood at all. Technical vocabulary must be used to ensure that a correct and precise language is used, but jargon can and should often be replaced with a vocabulary understood by the common man. (Shelton, 1994)

3.4.4 Design

Design is the visual aspect of technical communication and an important part of it. A reader will see the design before reading and their attitude to the document be affected. This ties into the persuasiveness (and usability) of the document. A good design helps the reader:

- Understand and locate information.
- Pay attention to important details.
- Feel good about the subject matter and document, hence raising its persuasiveness.

Following a style guide is essential to creating an easily understood technical document. A style guides purpose is to guide the writer and editor. Most companies have their own templates and style guides. A well-chosen style guide will help the reader find what they want and make the reading experience pleasant. (Ask, 2012)

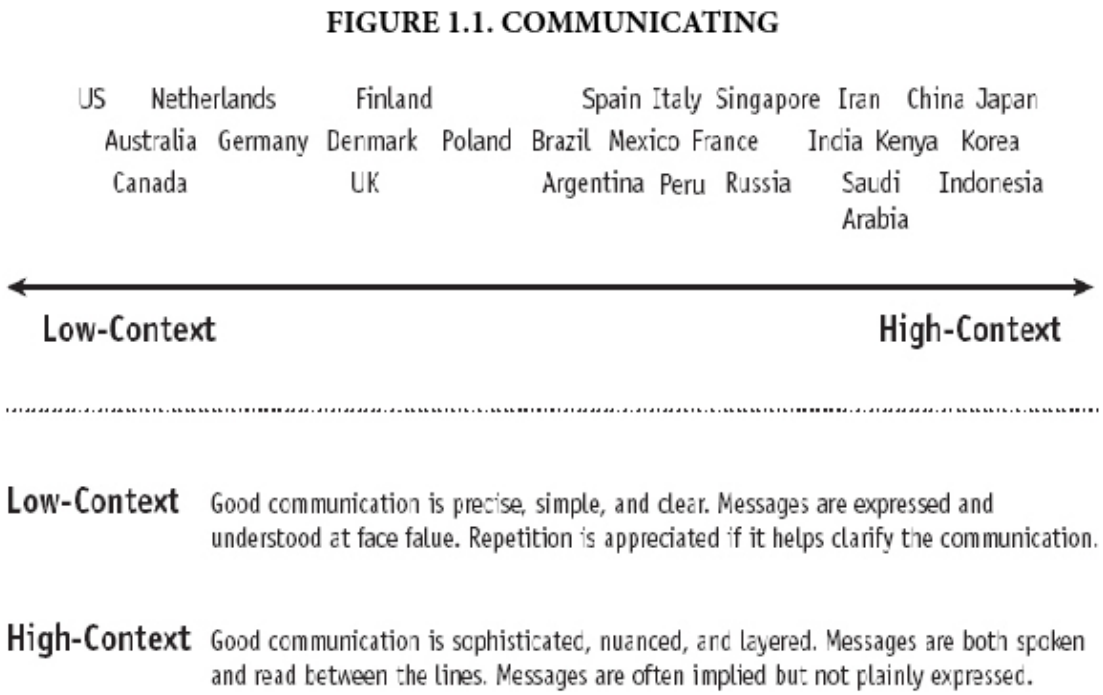
3.5 Cultural differences

What a person expects from a written text also depends on what culture they originate from. There are no set rules, as people are individuals, but having a grasp on what a target groups culture may expect is a step in the right direction (Anderson, 2007). A few example concepts to keep in mind while writing will follow.

3.5.1 Amount of details

Cultures can be placed on a scale from low context to high context cultures. In low context cultures, a good communicator is expected to express themselves literally and as explicitly as possible. The accuracy of the transmission of the message is placed on the deliverer, and they are also responsible for any misunderstanding. Opposed to high context cultures where the intended message hides beneath implications and cultural knowledge. (Meyer, 2014)

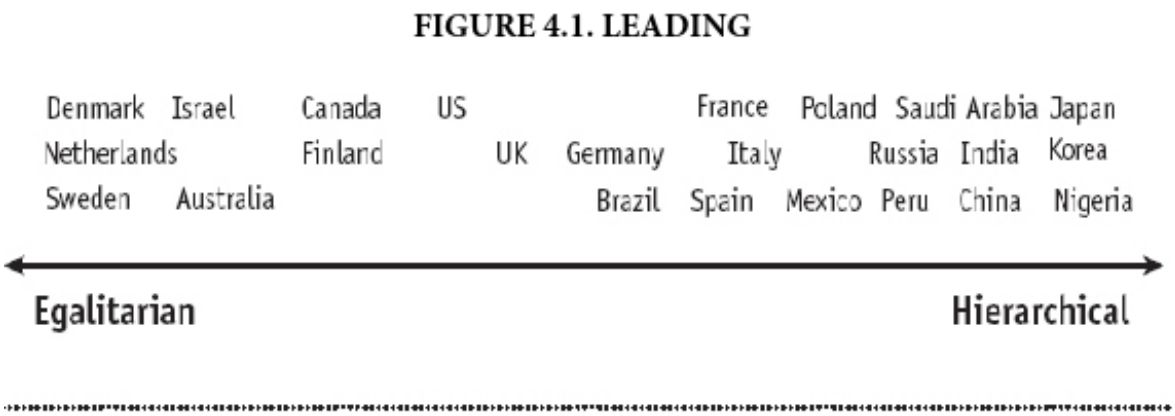
This means that when writing, the amount of detail must be appropriate to the culture the user group belongs to. An Indian might feel that a text written by an American is talking down to them, while the American might feel that the Indians' text is lackluster and unfinished. (Meyer, 2014)



Picture 2 Low vs. High-context culture. (Meyer, 2014)

3.5.2 Importance of hierarchy

The length from top to bottom in a company hierarchy changes depending on culture. Some cultures have rigid hierarchies, while others are more egalitarian. This difference greatly changes the tone of the written text (Anderson, 2007). Generally, the larger the hierarchical distance between the writer and intended reader the more formal the tone of the text is. (Meyer, 2014)



Picture 3 Egalitarian vs. Hierarchial cultures. (Meyer, 2014)

Cultural differences are good to keep in mind when writing for a wide audience. Something that is respectful and great communication in one culture might be seen as rude and condescending in another. (Anderson, 2007)

4 Method

This chapter goes through the process of creating the guide. Qualitative research was used to gather insight into problems, ideas, and techniques. Data collection will mainly consist of analyzing chat-logs and meetings and discussions with co-workers. As the problems gathered are technical and surface level, no deeper analysis is needed.

4.1 Gathering data

Almost anything that includes human experiences can be used as data for research. This can be verified by browsing through research, where everything from interviews to diaries and even photographs have been used as data (Boeije, 2010). The thought of using structured interviews came to mind when planning what to include but was dismissed due to the trove of data already available in the form of chat-logs and meeting memos.

General discussions will be held with CAD admins, co-workers, and managers to get an overview of expectations and material they felt needed to be added.

Written internal resources will also be collected, especially in topics where the way of working is already standardized, and only needs to be collected and edited for use within the guide. As the guide will follow the standard mentioned in Chapter 2.2, finding the corresponding standards, workflows and guides should be straight forward.

As I am familiar with the program and work in question, my own experiences will also play a role in what is and isn't included.

4.2 Filtering data

Filtering data for the modelling section will be done by creating a list of criteria the problems need to fulfill and sorting will be done according to that. The criteria list will be created by the author.

4.3 Testing the finished product

The finished product will be tested by giving it to users and having them use it step-by-step. A discussion will then be held, and necessary changes made according to feedback.

5 Results

This chapter will begin by going through the process of creating the guide and then give a brief walk-through of the guide. The created guide is a reference guide used to create as-built drawings from Maintenance operations and can be viewed in its entirety in appendix 2. The guide is divided into three main parts: accepting work, modelling, and archiving finalized drawings. It contains checklists and an executive summary if only a quick overview is needed.

Table of contents

Picture 4 Table of contents from the finished guide

5.1 First steps

The first step in the process was creating a plan on what should be in the guide and what to leave out. The concept was to create a reference guide that would speed up the red pen revisioning process, but the content was still unclear. After some consideration, a list of guidelines and goals was written down, which can be viewed in Appendix 1.

The guidelines/goals should always be in the back of the mind when writing, so as not to stray too far from the path.

Due to a diverse user group, the guide must both function as a reference guide and a task-based guide.

5.2 Gathering data

As mentioned in Chapter 3.1 the main data for the modelling section would come from chat-logs and meeting memos, while the rest would be gathered from internal documents.

A weekly meeting was organized by the Smart3D admins where users can ask questions on problems they face. These questions were collected in a document and checked for usability later. 10 meetings worth of questions were collected.

Problems that weren't mentioned in meetings still needed to be gathered. Some users don't have time to join these weekly meetings and instead resort to asking questions in a peer support group for Smart3D of around 80 members. Two months of questions were gathered. Two months was chosen as the cut-off point, as major changes were still being made to Smart3D before that.

The relevant internal guides and work procedures were gathered for the rest of the process, such as: Accepting work, archiving, isometric extraction, meta-data requirements for archival purposes etc.

5.3 Sorting data and solving problems

To filter the data into what is usable and what is not, a list of criteria was created. The criteria take into consideration if the problems are still relevant in the future, are they especially prevalent during red pen revisioning, and if is it connected to modelling. My own experiences also played a role in what to include in the guide, as I had worked with the systems for a while and possible problems, and their solutions, were familiar.

Finding the solutions was mostly just trial-and-error, though most of them were already, as mentioned above, familiar, and easy to solve.

5.4 Testing the guide

To get an idea of the usability of the guide, it needed to be tested. The test subjects were two design engineers who were new to doing maintenance red-pens. They were given the guide and after a couple of weeks a discussion was held on what could be improved or renewed. Chapter 5.4.4 and 5.4.5 were added in and Chapter 5.2 was revised to be shorter and more coherent.

5.5 Introductions

The guide begins with an introduction “What’s included in this guide?” It delimitates the guide and tells what is included. This was added to give an idea of what might be expected from the document.

The second chapter “Red-pen process” is the executive summary. It gives all the necessary knowledge to know what is happening, but nothing can be produced using it. Main users are planned to be managers and consultants. Links to the follow-up sheet and drive are also given here. The rest of the guide follows the executive summary but in way more detail, so it is also an overview of what’s to come.

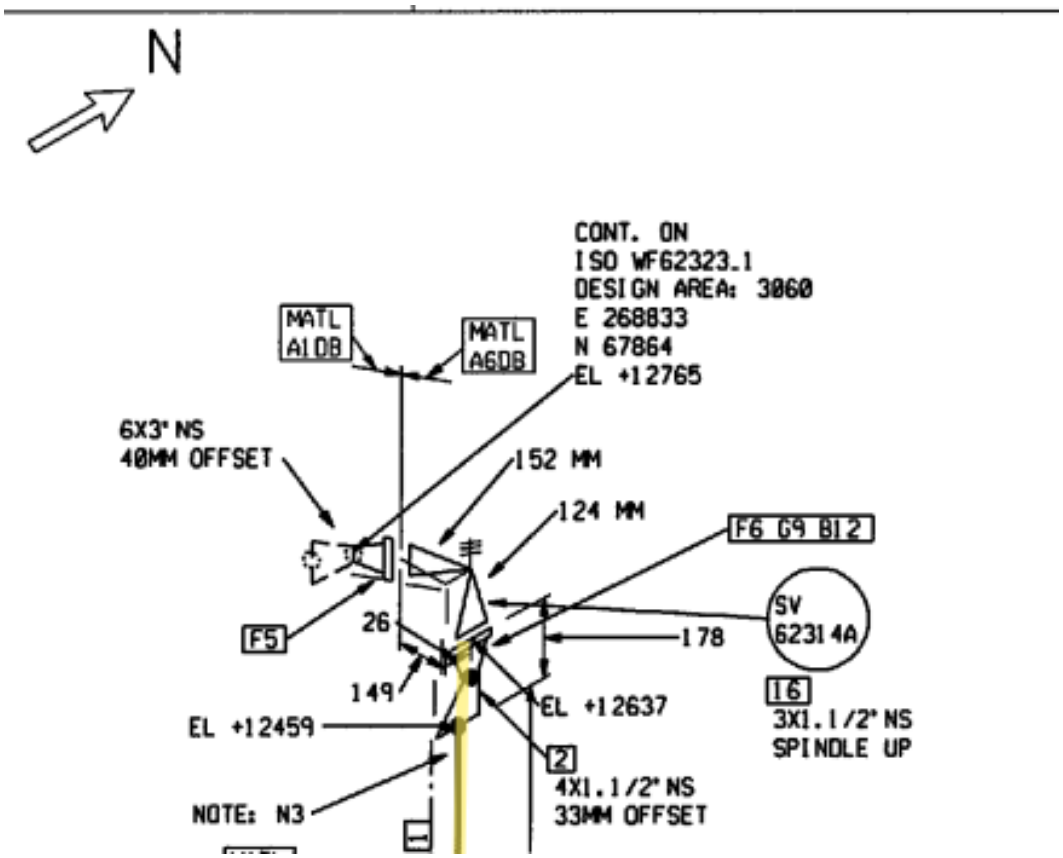
5.6 Accepting work

This chapter goes through step-by-step how to accept work. Translations are also given, as the follow-up sheet is in Finnish and a large part of the employees are foreigners. The next chapter, “Requesting Documents” is a follow-up on this. It goes through the steps and what data is needed for document requests. Document requests are required for hand drafted drawings, which are available as rasterized .dwg files.

5.7 Modelling

The most common modelling problems that were observed are brought up in this section of the guide.

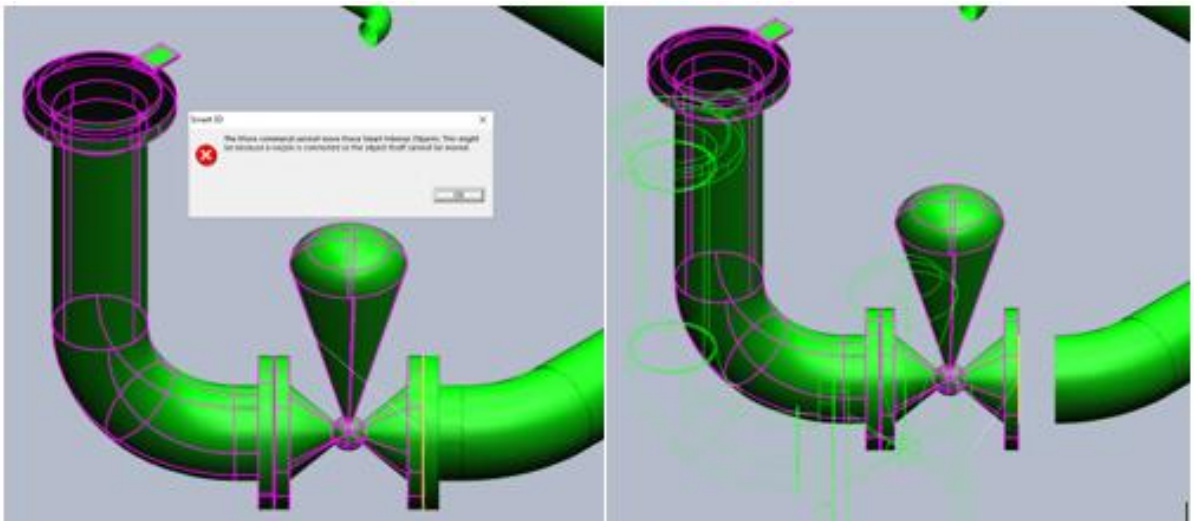
“To remove or not to remove?” goes through whether it is worth the hassle to remove a pipe or component. Specialty components may not yet be implemented in the Smart3D model library and can be hard to remodel.



Picture 5 Example of hard to re-model isometric component.

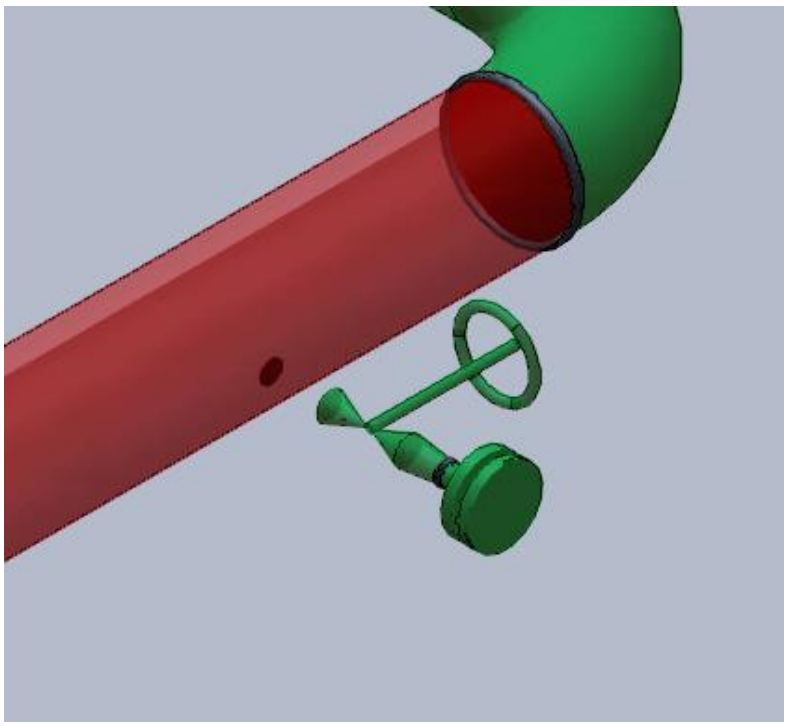
Finding the pipes to be edited seemed to be a problem, with users often loading in whole areas and complaining that the program was slow. The chapter “Finding the correct pipe in the model” goes into detail on how to use the pre-defined volumes and what they mean.

SIO-objects weren’t moveable right after migration, but after some work with Hexagon, the admins managed to get them movable. The problem noticed was that even though SIO-objects were moveable, users either didn’t know this or they didn’t know how it was done, as it required a different way of working than native objects.



Picture 6 Example of when SIO-objects are moveable

The common problems subheading is a collection of smaller modelling specific problems. The decision to not place moving SIOs under “Common Problems” was that while it is used in modelling it is a guide on how to use a tool, not a specific problem. All problems here stem from migration from PDS to S3D, half of them are about missing relationships, e.g. reattaching support and replacing nipolets.



Picture 7 Example of missing nipolet after tuning SIO-pipe (green) into native (red pipe)

Extracting isometrics was the biggest problem in the early days of migration, leading to many errors and bothersome troubleshooting. SIOs do not yet have fully fledged error messages, which leads to frustration when trying to troubleshoot. There already exists good guides on how to fix isometric extractions issues on the intranet, so this chapter mainly links to the guides and brings up solutions to:

- Disconnections
- SIO Disconnections
- Manual Troubleshooting

With these methods, a large chunk of errors leading to failed extraction can be found.

The second part of the isometric extraction chapter deals with stylistic problems and what to do if the drawing does not exist. Stylistic errors could be that columns references show up or that the extraction uses the wrong coordinate system when generating the isometric.

Lastly, a checklist to go through before generating isometrics to ensure that all values are present on the isometrics is there. The extraction process usually takes a few minutes, so

having a list to follow and not having to rerun the same drawing multiple times is a good advantage.

- ☐ Check connectivity.
- ☐ Connection with equipment
- ☐ Correct painting spec, both SIO and Native
- ☐ Insulation, pipe and inspection classes
- ☐ Temperature and pressure values
- ☐ Weld seam construction requirement set to “Shop weld”.
- ☐ Isometrics metadata and revision field
- ☐ Construction requirements set to “Existing”.

5.8 Uploading to FOUND!

The final chapter goes through what procedures are to be followed when uploading the drawing to FOUND! The documents are only to be uploaded using an excel-tool developed by DAS, the document administrator. Meta-data is always added manually and a list of needed meta-data was added. A list of needed meta-data exists but is not in in the same order as the excel-tool, which made it hard to use.

6 Discussion

This thesis gives a good overview of the process and knowledge needed to create a technical manual. Writing with a reader-centered approach is widely different from other styles of writing and the challenges are completely different. For example, figuring out how many details to be included was difficult Too much and the text felt condescending, too little and it felt unfinished and rough. At the same time, the language had to be clear and concrete, but without using affected language. In editing, most of the time went to

changing the tone of the text and vocabulary. The finished guide fulfills all the goals set at the beginning of the process, but this may be due to them being too general.

Gathering the problems went smoothly and the hardest part was figuring out if they were suited for this specific guide, or if they were more appropriate in a more general guide. Gathering the internal standards, work specifications, and other guides took longer than expected. The internal structure of resources at Neste could be better, with much of it being found through links in other documents and discussions with co-workers, instead of through “official routes”.

Even though not inherently relevant, doing a pre-study into Neste-specific theory really helped when writing the guide. As an example, even though only mentioned in passing, understanding what and how pipe classes work really helped concretize what different properties meant in Smart3D.

7 Own reflection and further work

If I were to do this again, I would choose to use a desktop publishing program or a hybrid word processor/desktop publishing program, like InDesign, instead of Microsoft Word. The guide is overall usable, with a lot of links to relevant standards and other guides, which in my opinion is the most valuable part.

The modelling section must be kept up to date as changes are made to Smart3D and will most likely be outdated at some point. There are also a bunch of more problems that could be added if deemed necessary, these are just the most prevalent and chosen to keep the guide within 30 pages (an arbitrary number chosen as goal/limitation to not make it bloated)

I would also like to thank Leif Backlund from Novia University of Applied Sciences for his counseling and constructive criticism, which were of great help when I felt that all hope was lost.

Bibliography

Anderson, P. V. (2007). *Technical communication: a reader-centered approach.* Wadsworth Publishing.

Ask, R. (2012). *Teknikinformatörens Handbok .* Lund: Studentlitteratur.

Boeije, H. (2010). *Analysis in Qualitative Research.* London: SAGE Publications .

Hexagon. (2020). *Interoperability Summary: Leveraging 3D Designs and Data.*

Horto, D. (2020). Standardien vertailu putkistosuunnittelussa. *Bio- ja kemiantekniikka, insinööri*. Metropolia Ammattikorkeakoulu.

Ivica Crnkovic, U. A. (2003). *Implementing and Integrating Product Data Management and Software Configuration Management.* Norwood: ATECH HOUSE INC. .

Metalliteollisuuden Standardisointiyhdistys ry. (2018). *Technical product documentation. Simplified representation of pipelines. Part 2: Isometric projection (ISO 6412-2:2017).* Helsinki: Suomen Standardisoimisliitto SFS ry.

Meyer, E. (2014). *The Culture Map.* New York: PublicAffairs.

Neste. (2023). *About Us*.

Neste Oy . (1983). *H102- Piping materials, service specification index list.*

Neste Oy. (2002). *H102 annex 1 Specification .*

Neste Oy. (2011). *H102 annex 1 Piping class A1N.*

Riley, J. (2017). *Understanding Metadata.* Baltimore: NISO.

Saaksvuori, A. (2002). *Procudct Lifecycle Management.* Springer.

Shelton, J. H. (1994). *Handbook for Technical Writing.* Lincolnwood (Chicago): NTC Business Books.

Suomen Standardisoimisliitto. (2022). *Non-destructive testing of welds. Radiographic testing. Part 1: X- adn gamma-ray techniques with film (ISO 17636-1:2022).*

Sutton, M. J. (1996). *Document Management for the Enterprise.* Hoboken: Wiley.

Appendices

Appendix 1

Who and what are:

- The goals of this guide
    - Give an overview of the redpen process for piping and layout from beginning to end, combining internal standards and workflows into a digestible format.
    - Step-by-step guides on filling in follow-up sheets and FOUND!
    - Step-by-step guides on redpen-specific problems in 3D environment
    - Refer the reader to correct standards, workflows and guides (this has been problematic for me personally)
- The main readers
    - Newly employed design engineers, who are comfortable with the s3d basics.
        - Knows basic jargon and basic commands. Main reader!
    - Old employees looking to refresh their memories.
        - Should know everything in this document already, only used as a reference. Secondary readers
    - Consultants
        - Mainly used as a check of how red-pens are done, may not know the programs. Executive summary most useful. Secondary readers
- Are the reasons it's written?
    - There is no comprehensive guide to doing redpens,

    - When I began this year, I had no idea what to do and no document to turn to!
    - 3D-environment is new to everybody, a reference guide is nice to have.
- Combined reference based and task-based manual. Meaning: A summary of what is to be done, with task-based guides interspersed.

Appendix 2

AsBuilt revisions of maintenance work for Piping and Layout at Neste Porvoo refinery

Table of contents

1 What is included in this guide?

This Quick-Start/reference guide will go through the process and the basics of correcting marked-up drawings, “red pens”, from the maintenance department at Neste. It is based on standards, references, and guides made both by Neste, Hexagon and third parties. Links will be given to the corresponding standard, if further reading is desired. This guide is loosely made to be used in a chronological working order, based on the red-pen process (Chapter 2), but each chapter can be used separately from the rest as a guide. The modelling part will go through red pens specific problems, as for normal modelling there already exists a good number of guides and help on the intranet.

Links can only be accessed if the computer is connected to the OILINFRA-vpn

2 Red-pen process

The red-pen process is standardized in the NMS page "Final drawing of as-built documents for changes implemented by the Maintenance organization (Work Procedure) " It can be recapped for Piping and Layout as:

- A Maintenance supervisor uploads the red pen drawing to the correct disciplines drive folder and enters basic data into the follow-up table.
- A design engineer is assigned to handle red pens, picks a drawing from the follow-up table, and marks his name in the correct column and change the status of the drawing.
- Checks if additional info is needed.
- Work can begin when all the needed info has been acquired.
- When the isometric has been extracted, it gets sent for review, approval and handover.
- The design engineer continuously updates the status of the drawing in the follow-up table, depending on what stage in the process it is.
- When handover is done, the design engineer copies the FOUND! link to the table, sends the link to the Maintenance supervisor and enters the finalization date.

Modelling is done exactly as it says in the red pen, this has been decided upon to save time and resources.

Marked-up drawings can be found at:

- Punakynäpaketit, Putkisto

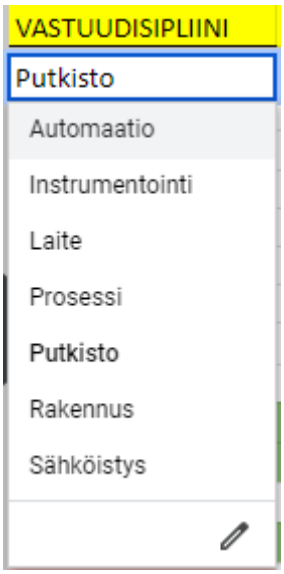
Follow-up sheet can be found at:

- Follow-up sheet

3 Accepting work as a design engineer

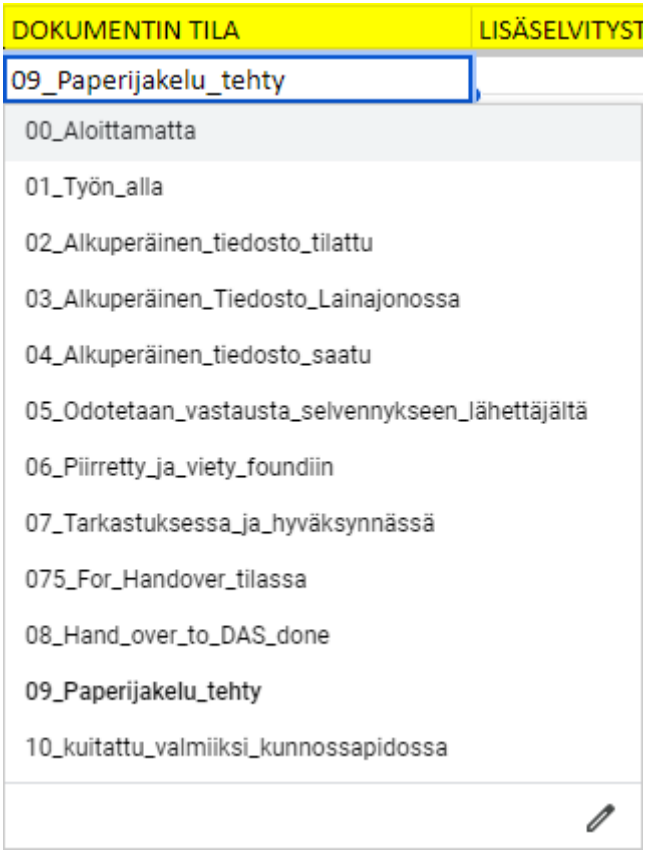
After getting assigned to do red-pen work by their manager, the design engineer picks a red-pen from the follow-up table and corresponding drive and enters the following info:

1. Vastuudisipliini, (eng. responsible discipline)



Finnish	English
Automaatio	Automation
Instrumentointi	Instrumentation
Laite	Equipment
Prosessi	Process
Putkisto	Piping
Rakennus	Civil
Sähköistys	Electrical

2. Dokumentin tila, (eng. Document status) to ”01_työn_alla”

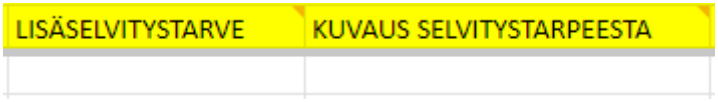


Finnish	English
00_Aloittamatta	Not yet started
01_työn_alla	Work in progress
02_Alkuperäinen_tiedosto_tilattu	Native file ordered
03_Alkuperäinen_tiedosto_Lainajonossa	In queue for native file
04_Alkuperäinen_tiedosto_saatu	Native file received
05_Odotetaan_vastausta_selvennyksen_lähettäjältä	Waiting on additional information
06_Piiretty_ja_viety_foundiin	Drawn and uploaded to FOUND!
07_Tarkastuksessa_ja_hyväksynnässä	For review and approval
075_For_Handover_tilassa	In Handover
08_Handover_to_DAS_done	
09_Paperijakelu_tehty	Document distribution done*
10_kuitattu_valmiiksi_kunnossapidossa	Given OK from maintenance

* Document distribution practically means that the link to the FOUND! card is added to the Follow-up table and sent to the person who ordered the work.

3. Tekijä (eng. Authors name)

4. (Optional) Lisäselvitystarve and kuvaus selvitystarpeesta. (eng. Need for clarification and description of needed clarification)

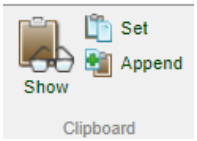


When all documents have been ordered, needed clarification gotten, and all info has been entered, work can begin.

If new line number and valve tags are needed, contact the process engineering department, they are responsible for taking care of such matters.

4 Requesting documents

Document request are done according to the internal standard "Document Administration Service User Instruction" Chapter 8 Requesting a native file for updating. Requests are always done by creating FOUND! card(s) and sending the FOUND clipboard to DAS



If the red-penned drawing is based on a hand drafted drawing, the native .dwg file must be ordered from DAS. All files except 3D-models (as they are a part of the DMS system) are ordered from DAS. The step-by-step guide for requesting documents is comprehensive (found at the link above), so there is no need for repetition.

Data needed for document request is:

- Neste Project Code
- Site Location
- Client document code (with sheet number)
- Author company
- Author Email

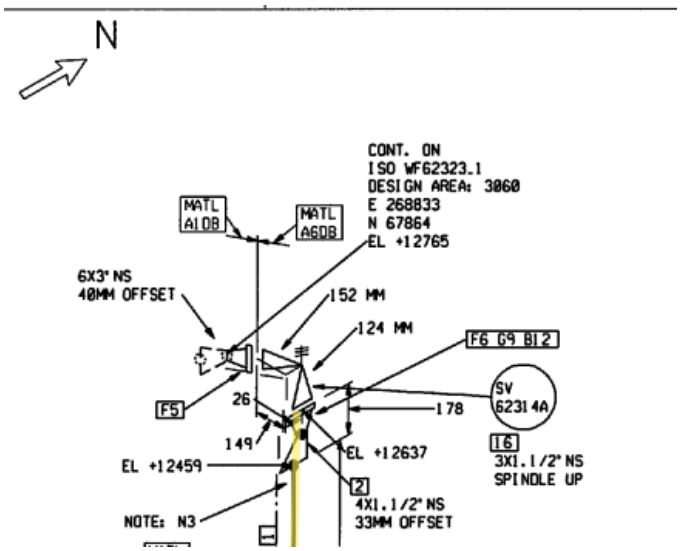
5 Modelling

This chapter goes through some practicalities when doing changes to the 3D-model, such as: when to and not to remove SIO-parts, how to connect a native flange to SIO bend and equipment at the same time and some tips on how to save time when modelling.

5.1 To remove or not to remove?

It is a necessity to convert and sometimes remove SIOs when editing the model, but generally, as many parts should remain as SIO-parts as possible due to:

- Components may be hard to remodel. In particular specialty items (special valves, hoses, RO-plates and nozzles to name a few.)



Picture 1 Example of hard to remodel component.

  - Safety valve would be time consuming to remodel, due to it not being a standardized part.

- Relationship between headers and branches gets removed. (Nipolets and weldolets get removed when converting header to native, see Chapter 6.4.1)

- If old, the piping class may not exist in the database, leading to wrong data in the B.O.M.

- Converting always runs the risk of data loss. Values such as temperature, pressure, and insulation may have to be looked up from piping schedules, leading to longer modelling time.

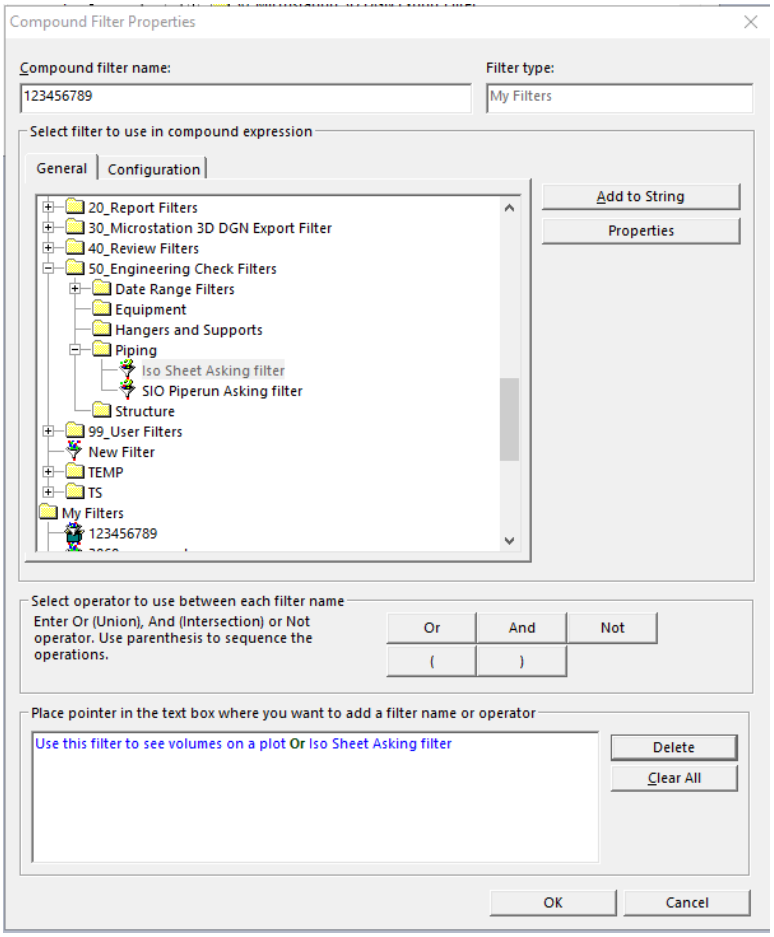
5.2 Finding the correct pipe in the model

For a more comprehensive guide on how to use different filters and what properties are filterable, place go to the document "Filter what I see"

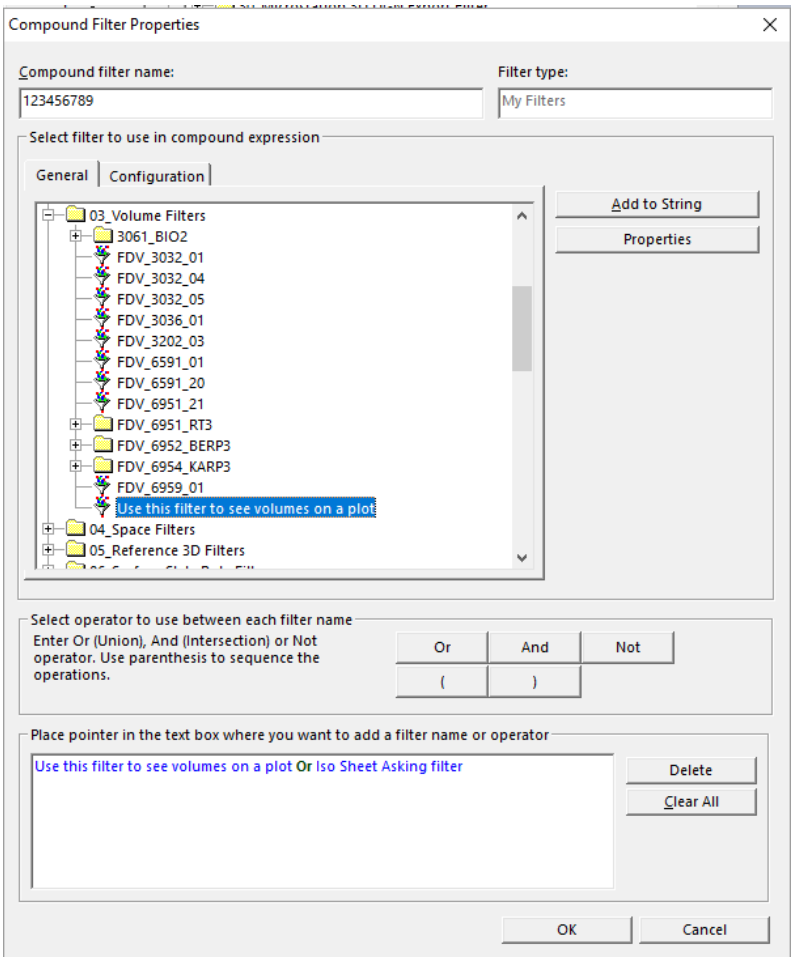
5.2.1 By Volume

Volumes are the best way to work with red pens if there are connections to be made to equipment or other pipes, due to how it loads in everything in a pre-defined volume.

1. Open up S3D and select the correct database, i.e. plant.
2. Create a new "Compound Filter".
3. Under the "50_engineering_filter" select ISO sheet selection filter and combine it with "Use this filter to see volumes on a plot" under "03_Volumes" using OR to combine them. Remember to name the filter.



Picture 2 Iso Sheet asking filter



Picture 3 See Volumes Filter

4. Load your created filter and enter the line and sheet number in the popup, e.g. P1234_6. The most used operators are the following:

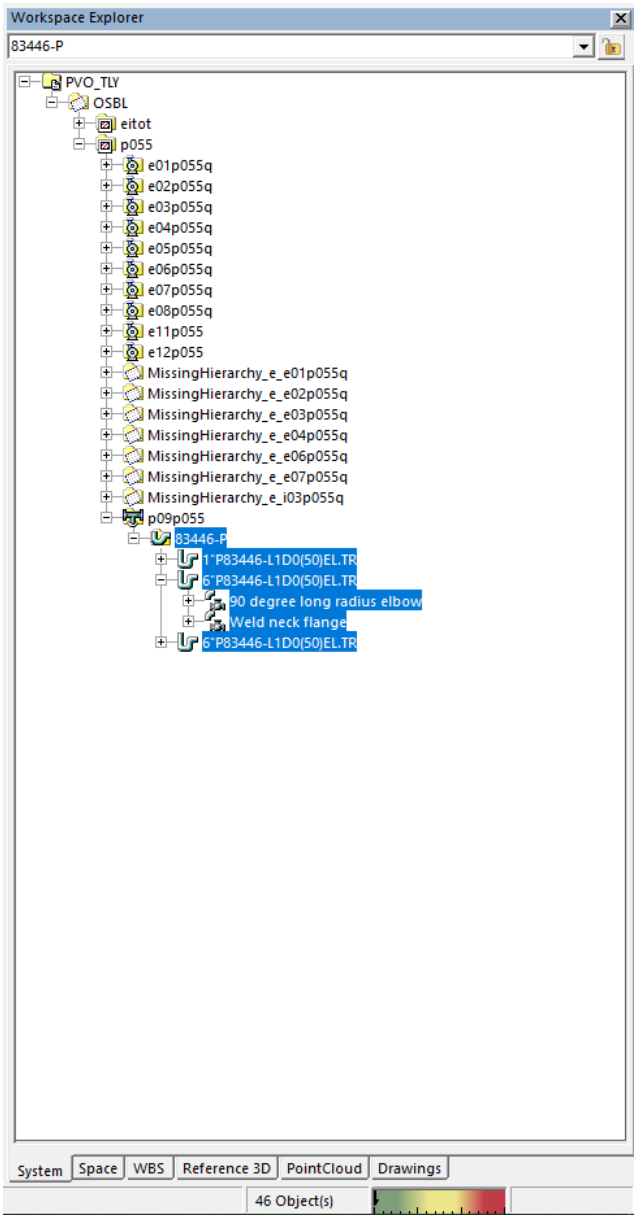
    a. Contains, loads all lines whose corresponding isometric sheet contains the entered text string. This is useful for loading in entire lines.

        i. P1234 would load the whole line

    b. Equals, loads only the lines that correspond exactly to the string entered. Useful if only one specific isometric sheet is in interest.

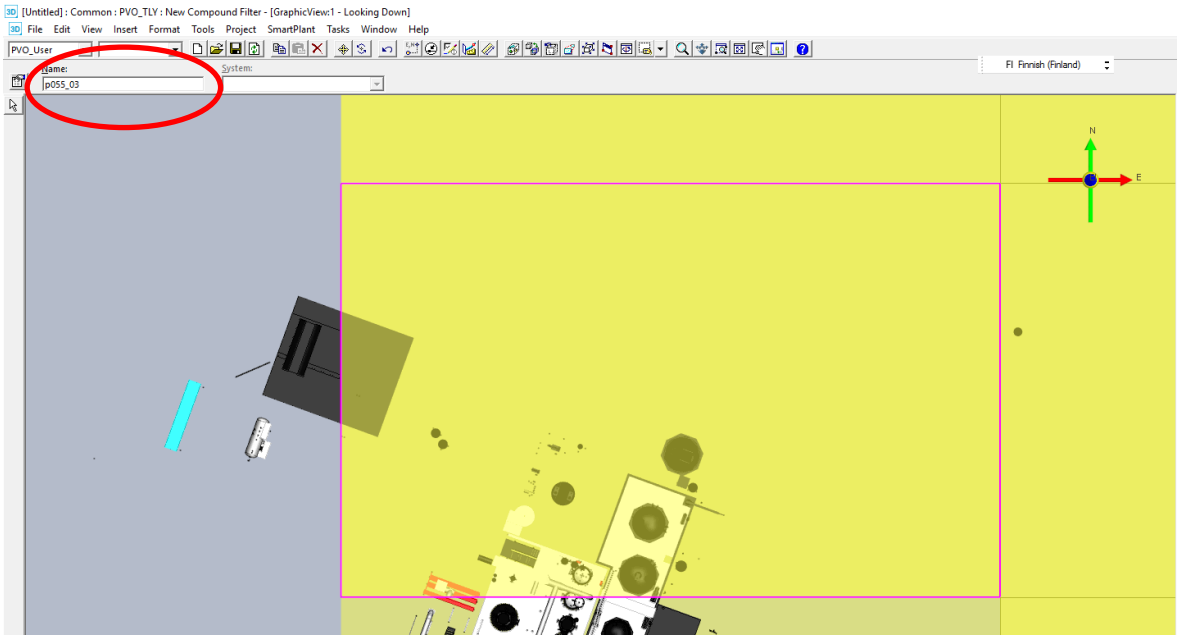
        i. P1234_6 will load only that specific isometric sheet

5. When everything is loaded, **left click** on the pipeline in the "System" tab in the "Workspace Explorer" window and then **right click** | select nested | fit to screen.



Picture 4 Workspace Explorer with a complete pipeline selected.

6. The piperun should be contained within a yellow box, select the yellow box (with the “All” selection filter), and write down the number in the upper left (circled in red). If it is not in a yellow box, go to point 10.



Picture 5 Volume with volume name highlighted.

7. Create a compound filter that includes both the volume (the number just written down) and “All WBS projects”

8. The loaded workspace now contains everything (such as pipes, equipment, coordinate systems) within the volume.

9. Under “Tools” use “Select by Filter” and use the same ISO sheet asking filter as in point 3 and fit to screen and/or “Clip by Object”. Work can now begin.

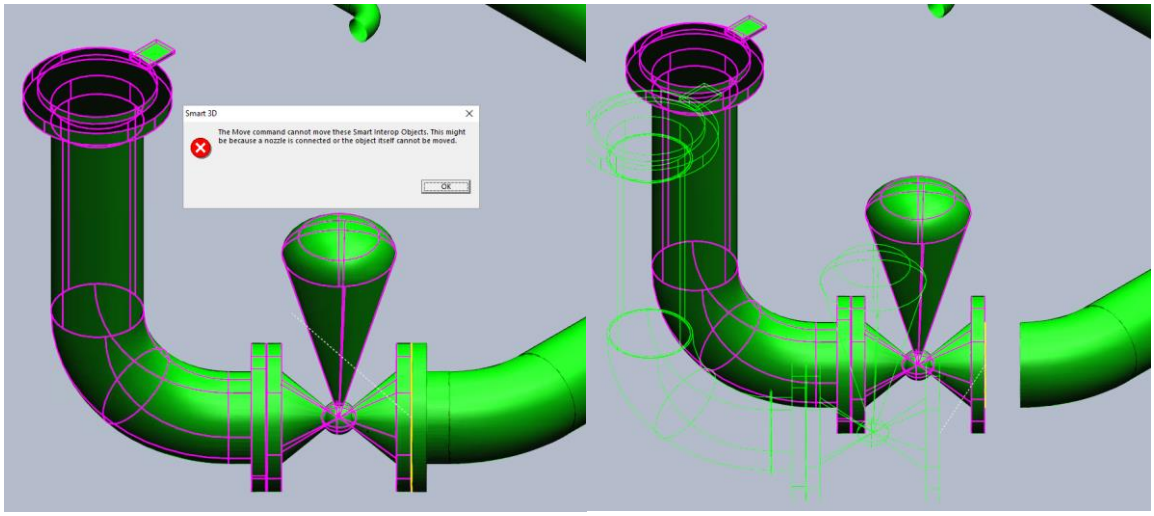
10. If the pipe is not in volume, or one is not available, the whole area needs to be loaded, which is doable but not advisable due to the size of some of the areas, expect some slowdown. Simply select the correct area filter in “Define Workspace” and load it in.

5.3 Moving SIO and Native objects

Both SIO and Native objects can be moved, but there is a difference between what can be moved and how.

5.3.1 Moving SIO

Think of SIO-objects as stiff, they cannot bend, lengthen or change any geometry. To move an object, it must be free in space, meaning it can't be connected to other objects. Moved SIO-objects won't automatically create relationships between components and must be added manually like "6.2 Replacing Nipolets" Remember to use "Piping Part" selection filter (SIOs are not features!)



Picture 6 SIOs only being able to be moved when free in space.

As can be seen in the pictures above, the parts must be separated, in this case by removing the flange, to be movable.

5.3.2 Moving Native

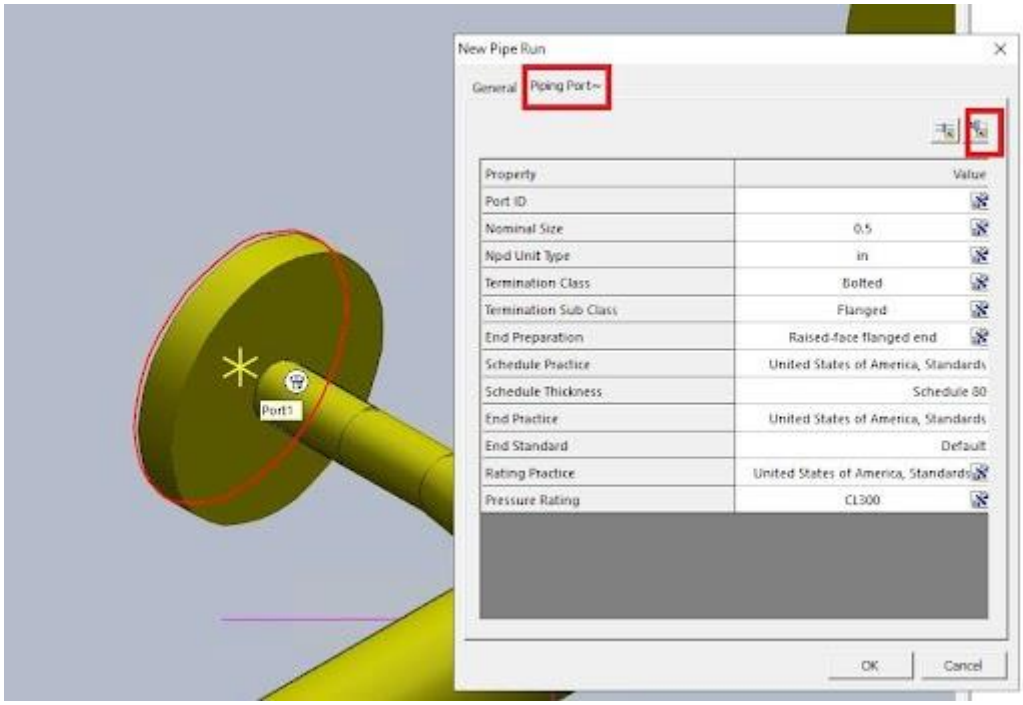
Native objects can easily be moved, rotated and modified, just remember to use the "Piping Feature" filter when trying to move native objects. Smart3D will automatically try to create relationships and bends according to the pipespec in question. E.g. <1" pipes will be bent instead of welded.

5.4 Common problems

Working with SIO-objects requires a different approach than with purely native S3D modelling. This chapter will go through a few common issues and present solutions.

5.4.1 Importing correct port data

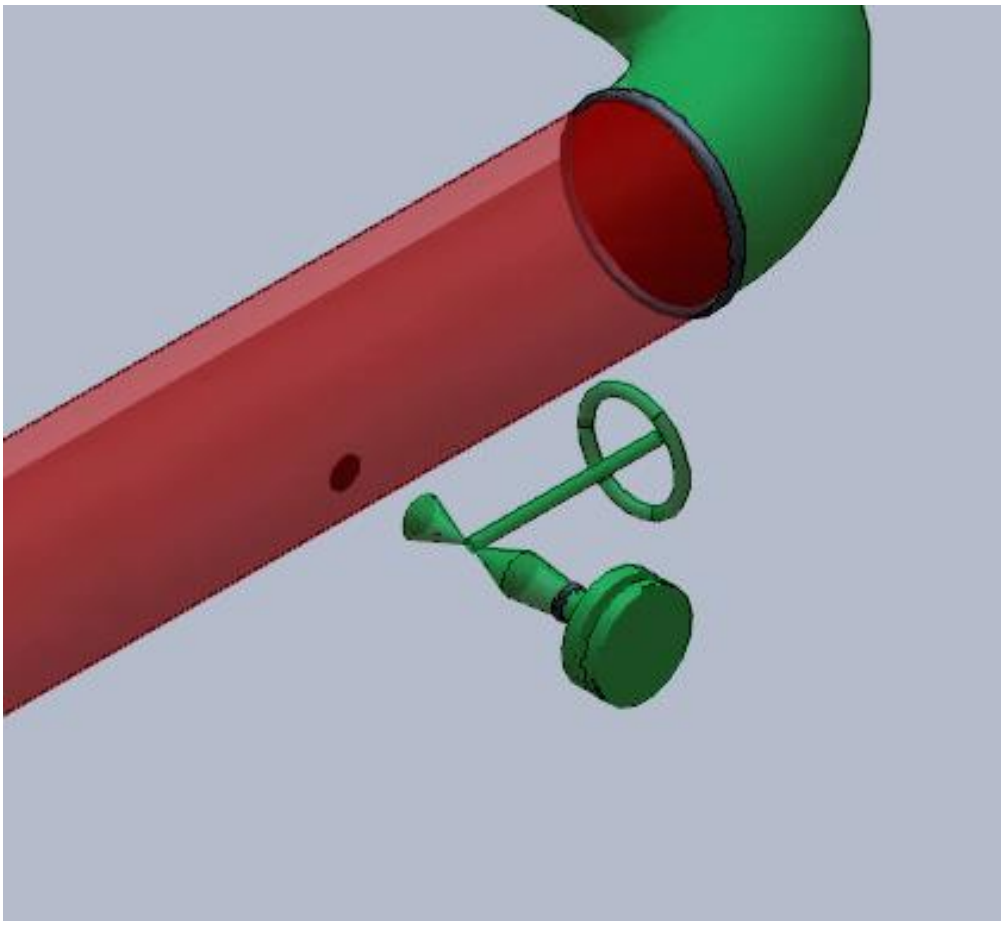
This is not exactly a problem but needs to be done anytime a pipe is routed to or from a SIO-port. If it is a welded connection, choose the weld symbol, if it is a flanged connection, choose the flange symbol. All this does is imports the correct connection according to the pipe spec.



Picture 7 Importing correct port data flanged connection.

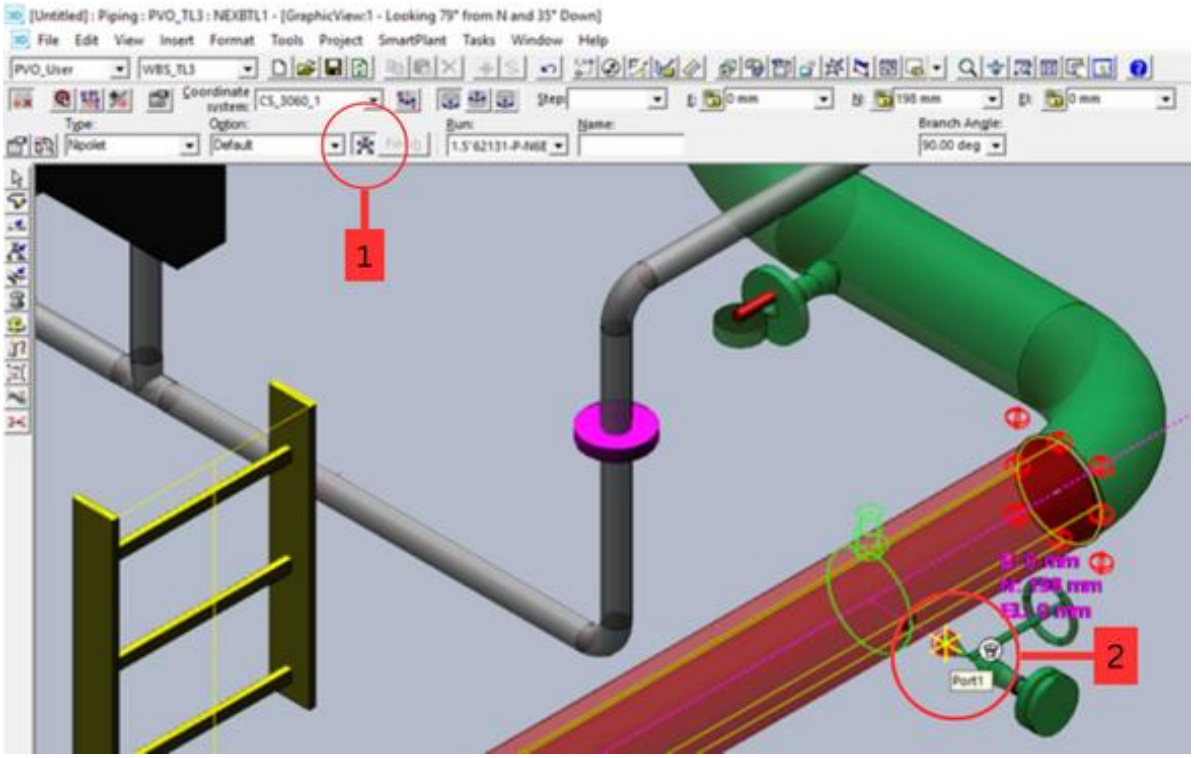
5.4.2 Replacing nipolets

As stated above, nipolets will disappear when converting SIO-pipes to Native format and must thus be replaced. The best way to replace nipolets is the following:



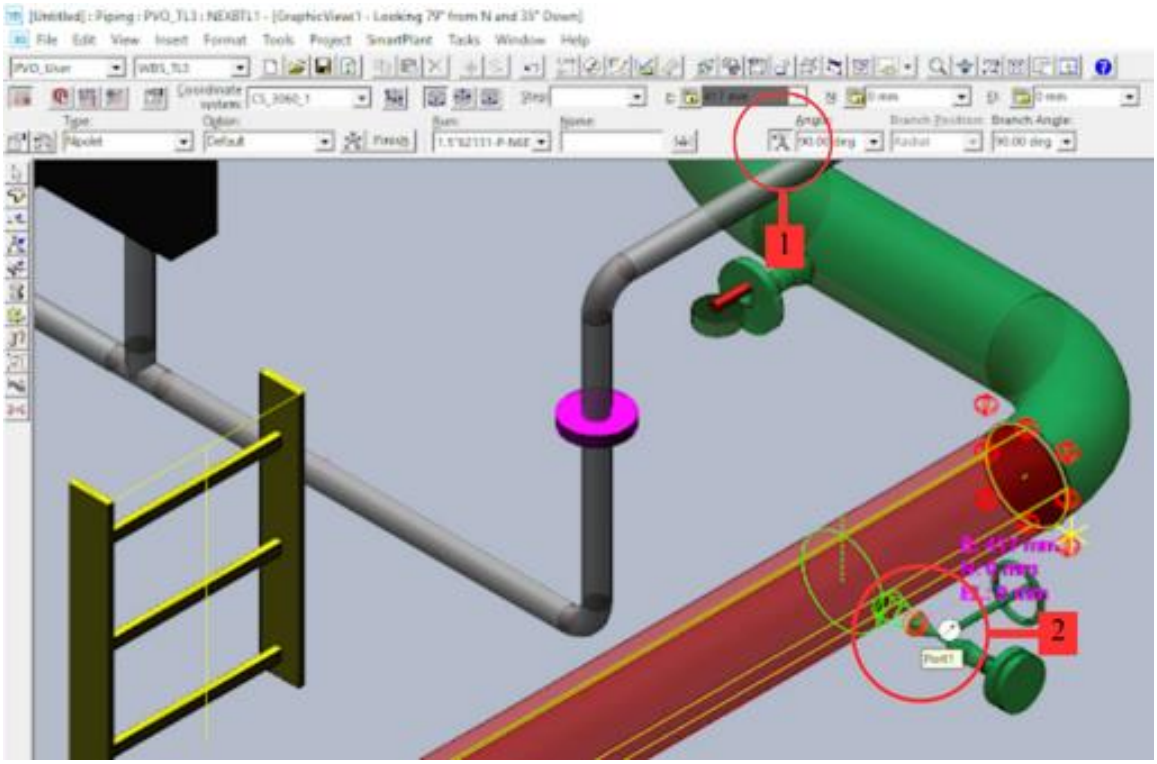
Picture 8 Disappearing Nipolets

- In the picture above, the nipolet has disappeared when the header was converted into native.



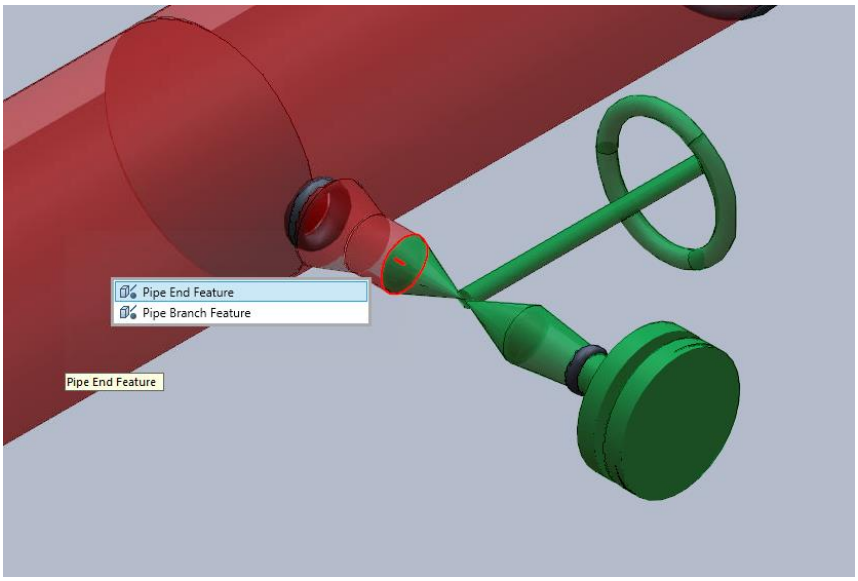
Picture 9 Placement of Nipolets

- Begin by placing nipolet using “Place Component” tool and selecting the native pipe.
    - Remember to create a new run with the same pipe size and class as the branch you want to connect to! In this case 1.5”
- Use the “Move” command, while in the “Place Component” tool (1 in the picture) and hover over the port until SmartSketch highlights the port (2 in the picture)
    - This ensures that the nipolet will be exactly in the right position on the header



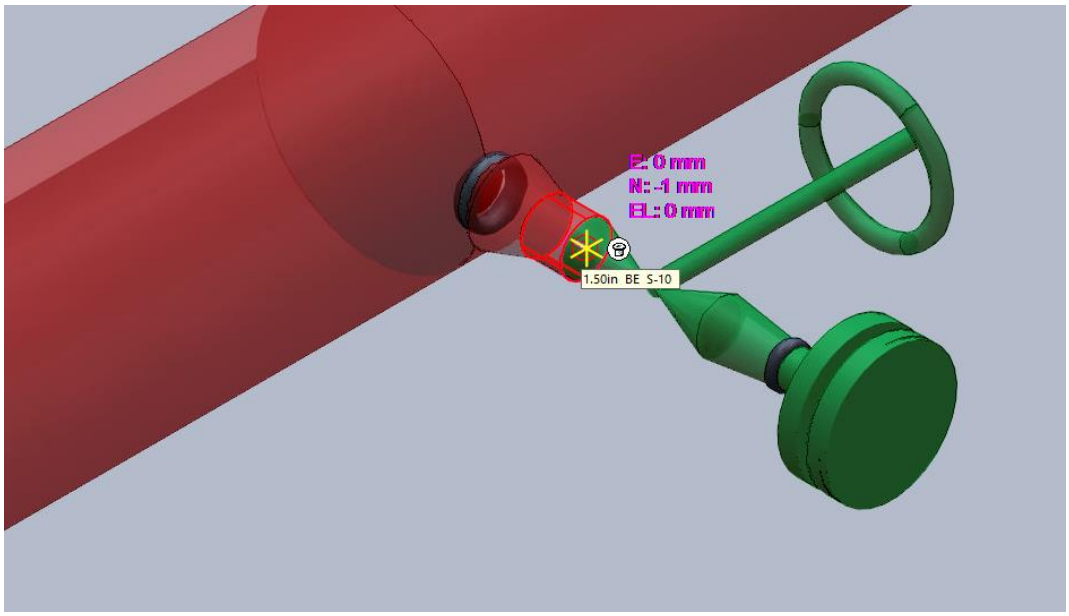
Picture 10 Placements of Nipolets pt.2

- Use the “Rotate” tool, still in the “Place Component” command (number 1),
- Find the port of the valve/pipe you are connecting to.
    - Now the nipolet is in the same place as the old one!
- Even though it is placed in the same place, a connection between the components hasn’t yet been created.



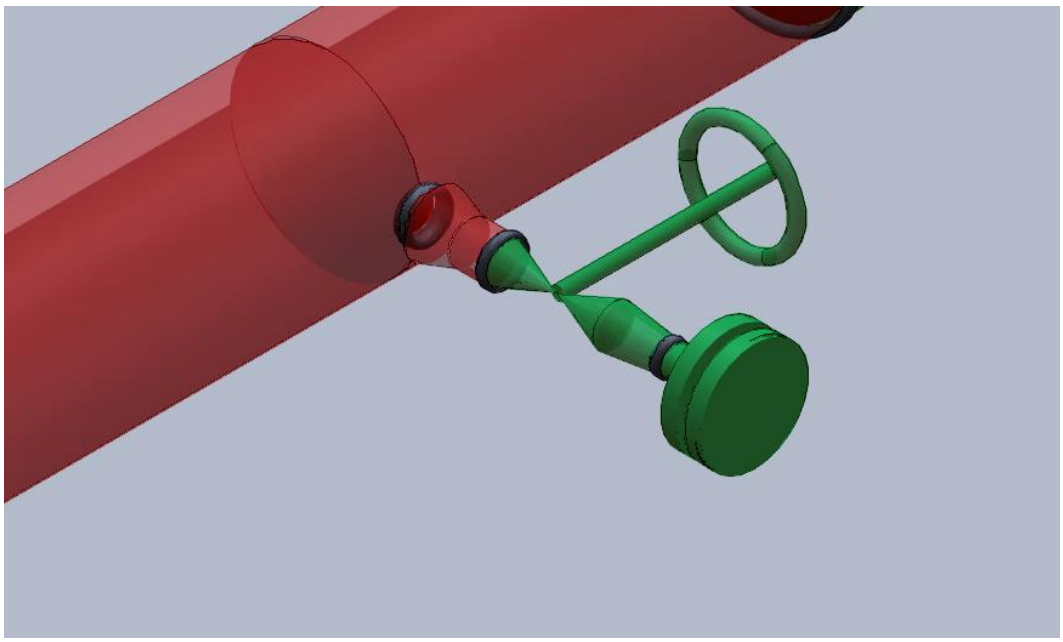
Picture 11 Placement of Nipolets pt.3

- Hover over the native nipolet (with the "Piping Feature" selection filter active) and select the "Pipe End Feature" as depicted above
- Use the "Move" command found in the top ribbon.
- Once again, select the "Pipe End Feature" as the starting point as in picture the above.



Picture 12 Creating Relationship between Nipolets and SIO port

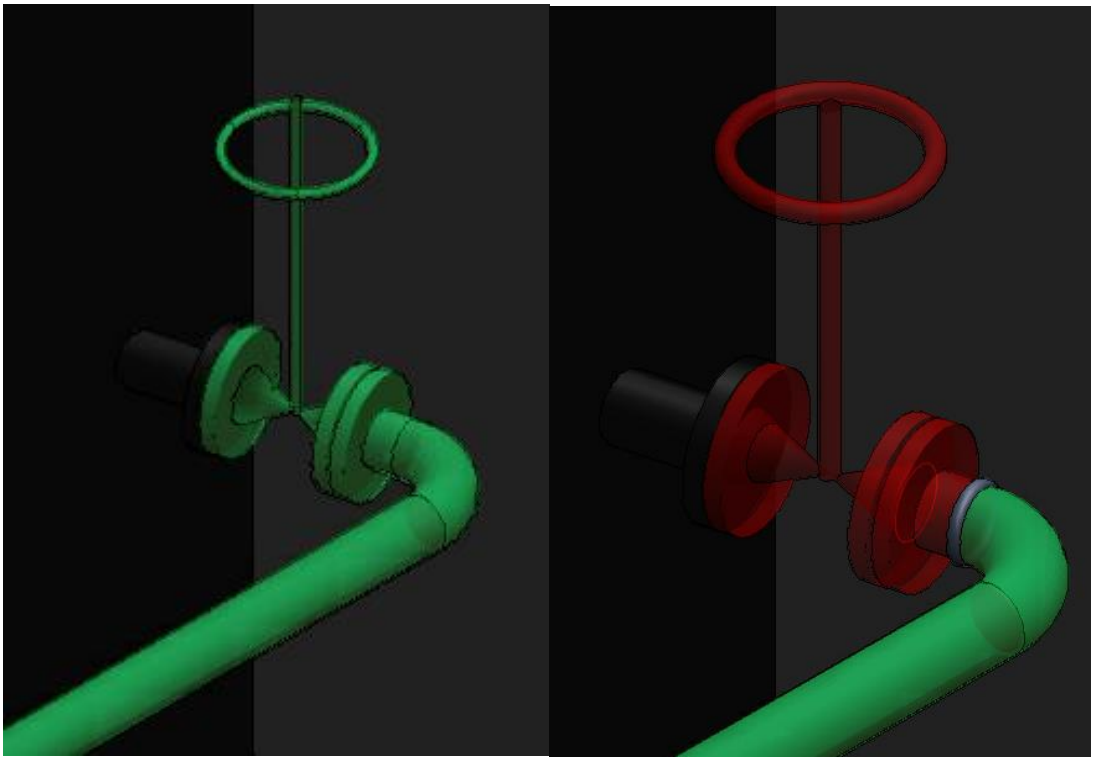
- Select the valve port or the nipolets port as destination and a weld seam will appear confirming that a connection has been made



Picture 13 Completed Nipolet.

5.4.3 Bend+Flange

The relationship between equipment nozzles and flanges was lost during the conversion from PDS to S3D. This means that flanges and equipment that connect to nozzles must be remodeled!

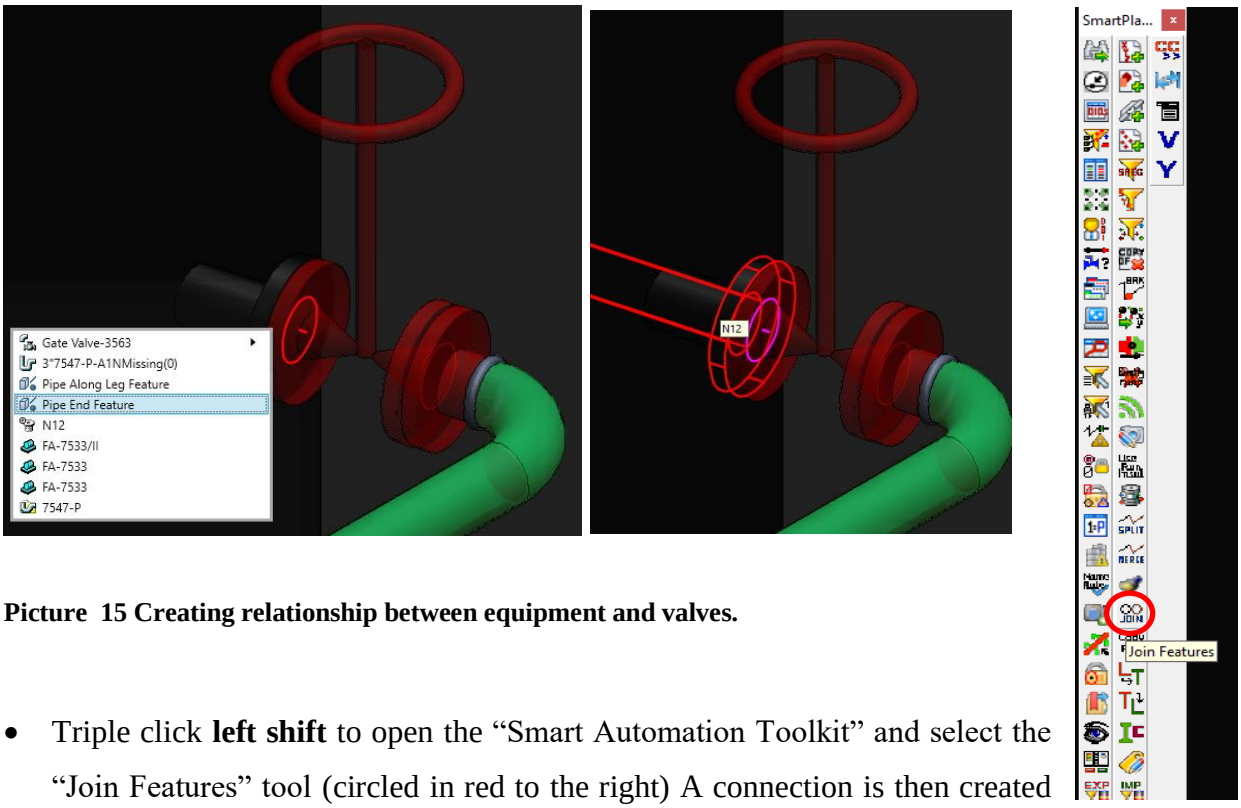


Picture 14 Placing native valve in place of SIO

- The valve in the left picture must be replaced to establish a relationship with the equipment.
- Delete the valve and place a new one beginning from the bend. As has been done in the right picture.

Funfact: red, translucent color indicates that the “Construction Requirement” is “New”

- With “All” selection filter selected, hover over the end of the flange you want connected to the nozzle and when a question mark appears, **left click**. This will open the “QuickPick” menu. Select “Pipe End Feature” in the menu, (left picture), hold down **Left CTRL** on keyboard and select the nozzle. Both nozzle and end feature should be highlighted, as can be seen in the middle picture.



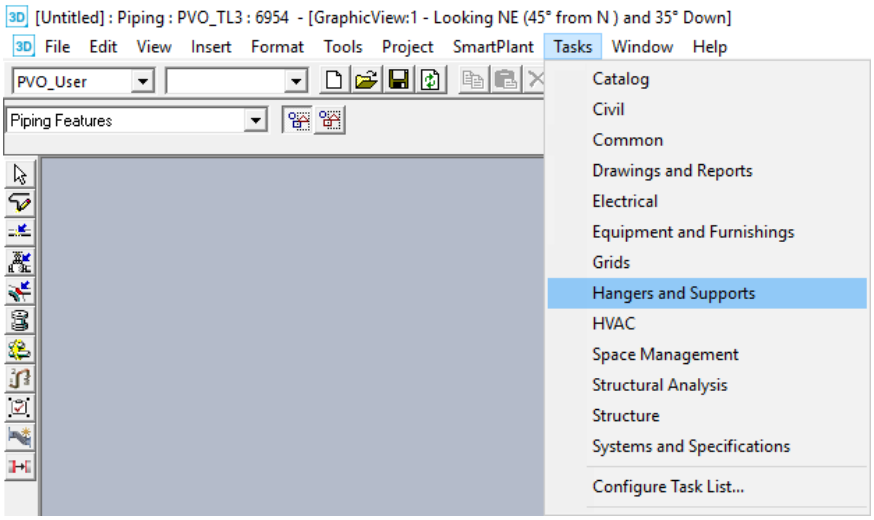
Picture 15 Creating relationship between equipment and valves.

- Triple click **left shift** to open the “Smart Automation Toolkit” and select the “Join Features” tool (circled in red to the right) A connection is then created between the two, and the equipment will now show up in isometrics.

- If the connection has a blind, it should be placed before the join feature.

5.4.4 Reattaching Supports

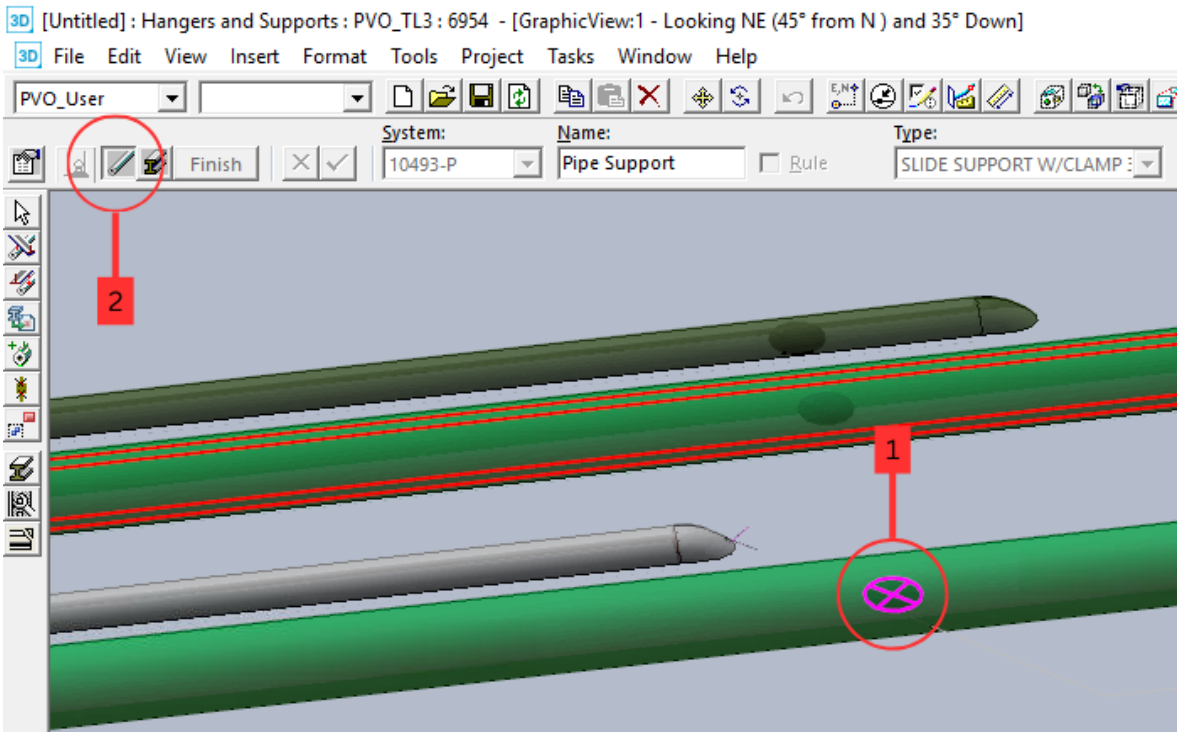
The relationship between some supports and pipes were lost in the conversion. To reapply this relationship, begin by going into the “Hanger and Supports” task.



Picture 16 Hangers and Support task

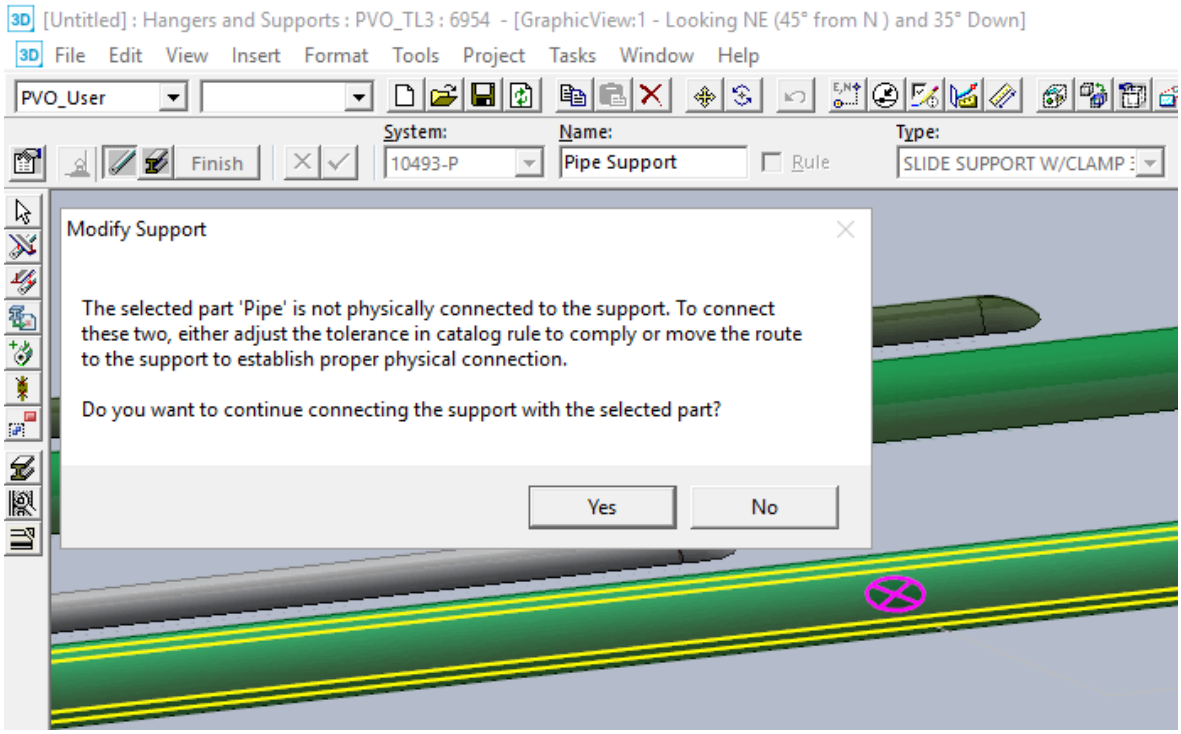
1. Find the missing support by hovering over the pipes until it is found and select it. (1 in picture below)

2. Select the “Feature” tool (2 in the picture below)



Picture 17 Attaching supports

- If a message pops up, asking if it is ok that the support is not physically connected to the part, select yes. When that is done, the support will show up in the drawing.

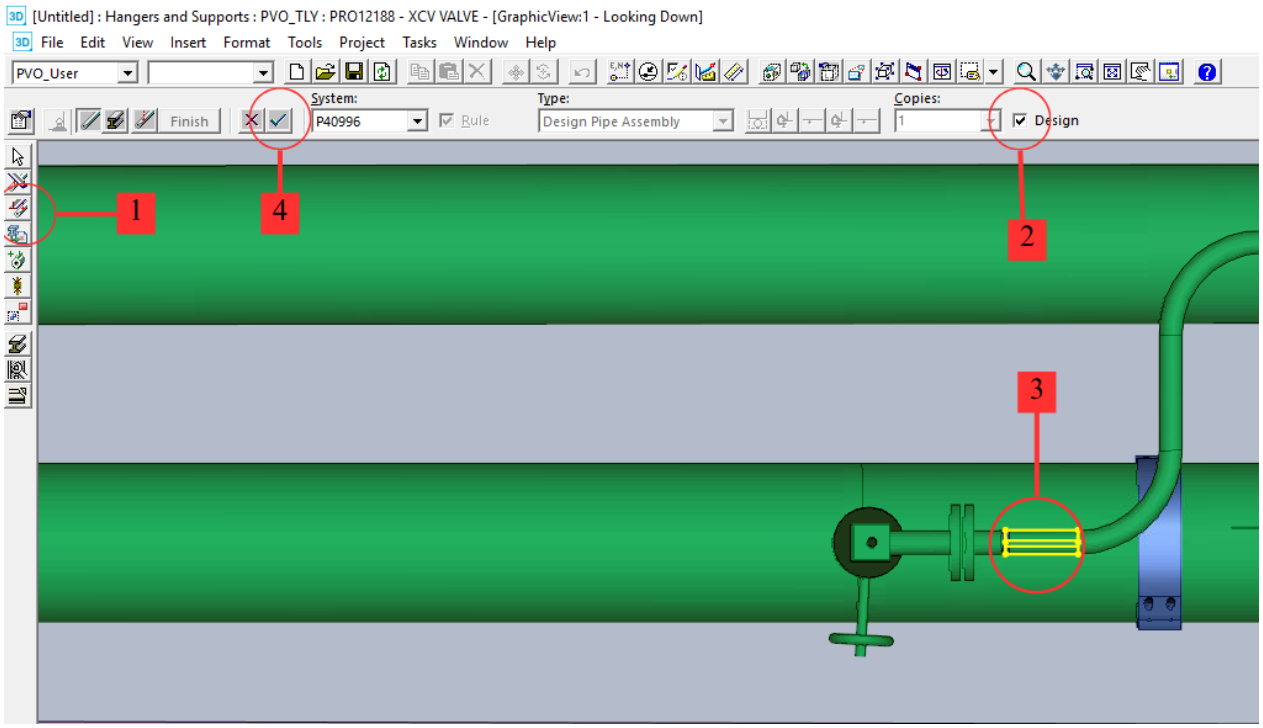


Picture 18 Warnings

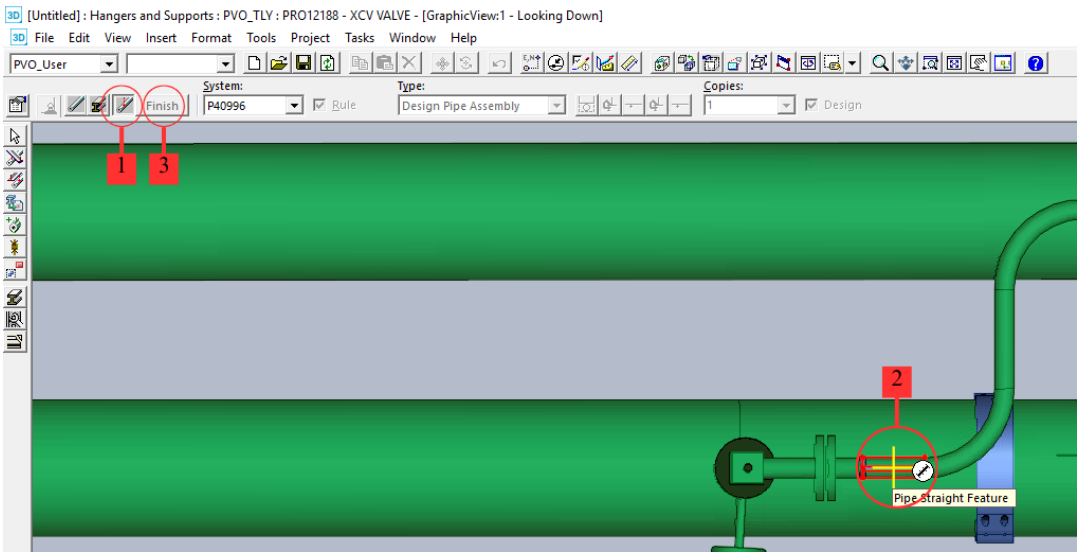
5.4.5 Design Supports

Sometimes the support mentioned in the red pen isn't available in the red pens, such as the commonly used PS-xx. They must be added as a "Design Support". Design supports are only logical supports, with no graphical interpretations, unlike NOS204X which when placed in S3D have graphics.

0. Begin by going into Task | Hangers and Support
1. Select "Place Support by Point"
2. Check the "Design" box.
3. Select the pipe which will be supported.
4. Select the checkmark.



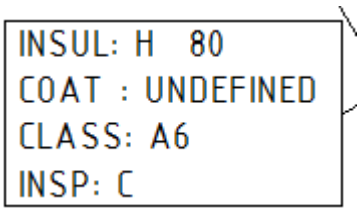
1. Select “Support Position”
2. Place support in correct place
3. Select “Finish” button’
4. To change the name and appearance in the isometric, **right click** the design support and go into its’ properties



5.4.6 Painting specification

Painting specifications are treated differently between SIOs and native objects. In SIOs it is a “part-level property” while with natives it is a “run-level property”. What this means in practice is:

1. SIO: When adding painting specification to SIOs, use “Piping part” selection filter and select all parts, open properties, and change the painting specification. This must always be done, otherwise a break in the painting specs, will be shown in the isometric. See picture



2. Native: When adding painting specification to native, use “Piperun” selection filter and select all native runs, open properties, and change the painting specification.

5.5 Problems with isometric generation

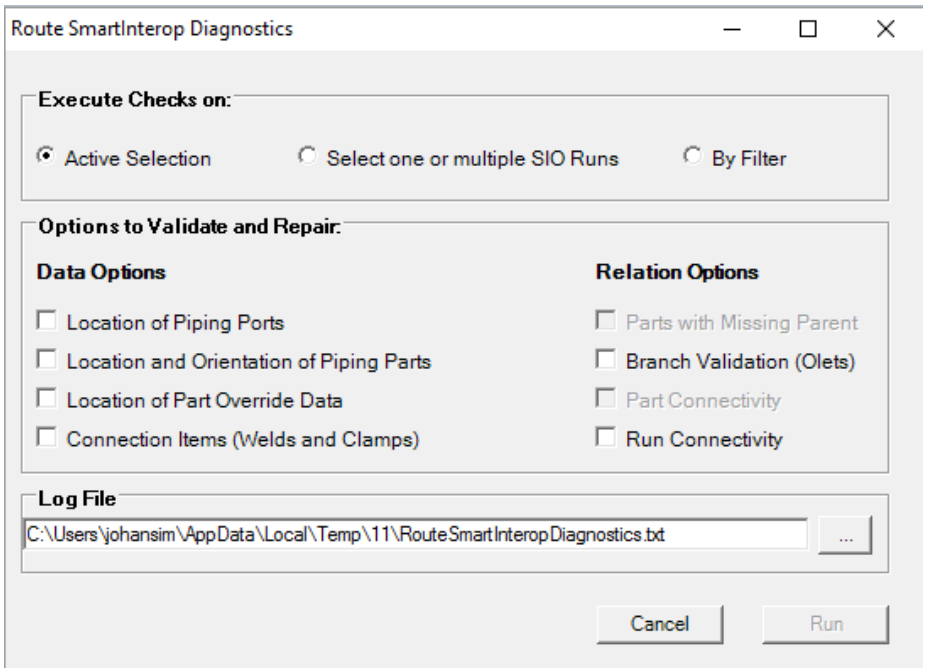
Sometimes the isometric generation will come out with wrong information or simply fail. There is an uncountable number of problems that could cause failure, but there are a couple of steps that can be taken to fix ~90% of failed isometric extraction. More reading can be found at "Analyze Iso. drawing error in Smart3D" where the isometric generation procedure is gone through in detail.

5.5.1 Yellow exclamation point

The yellow exclamation point means that something has gone wring when extracting the isometric. A few pointers will now be given to fix the most common issues

3. Problem with SIOs

    a. First step to fix any problems that may be caused by SIOs is to use the "Route Smart Interop Diagnostics". Can be found under Tools | Utilities.

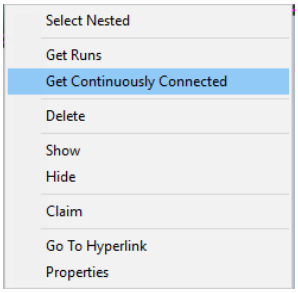


Picture 19 SmartInterop Diagnostics tool

This tool is a catch-all for repairing problems with SIOs. Select the SIO-piperuns and check all the boxes and the tool will repair almost all problems regarding connections between SIO-objects.

4. Disconnection

   a. Find disconnection by using **Right Clicking** a piping part with the "Piping Part" selection filter active and choosing "Get Continuously Connected", all connected pipes should get selected. If they do not, reconnect them.

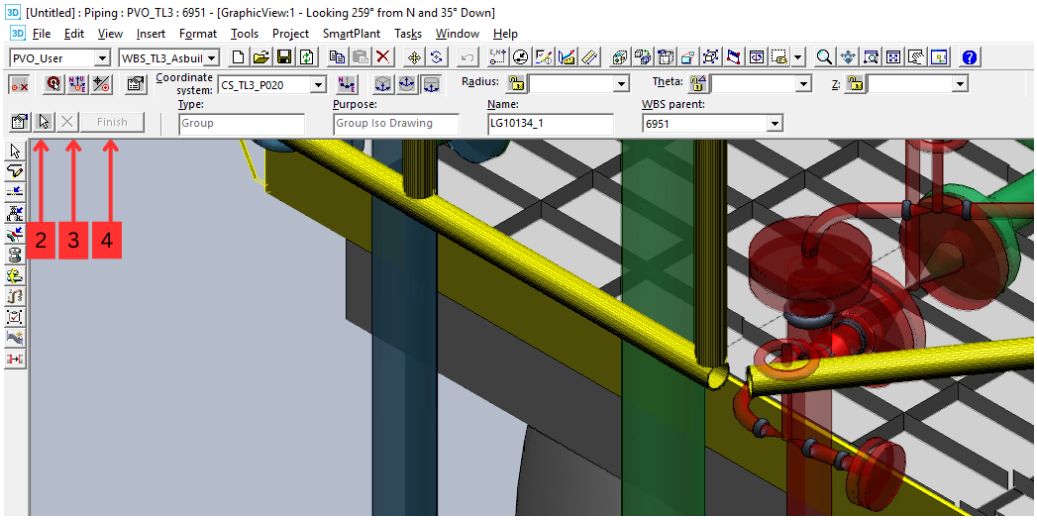


   b. Also if non adjacent parts are assigned to the WBS the isometric will fail

If the guide linked above has been gone through and the quick fixes above have been tried and the isometric is still showing the yellow exclamation sign, the approach is the following.

- Release everything from the WBS

  1. **Left click** the corresponding drawings WBS, with "All" selection filter.
  2. **Left click** the pointer.
  3. **Left click** the x
  4. **Left click** the finish button

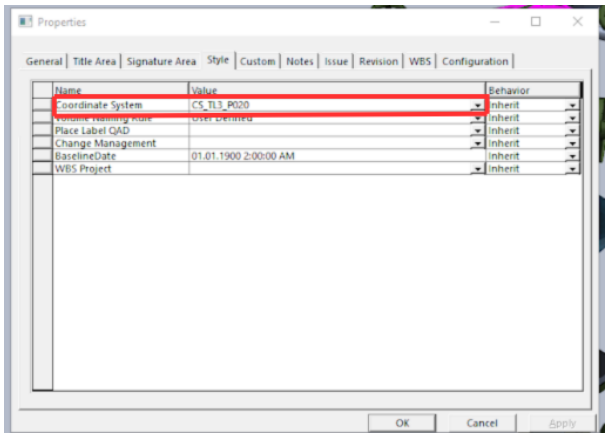


- Add one component at a time to the corresponding WBS and run the isometric. This is time consuming, but due to SIOs not having fully fledged error messages (yet) it is at this moment the best way to catch bugs. When the isometric fails, the latest added component is the bugged one. Replace it.

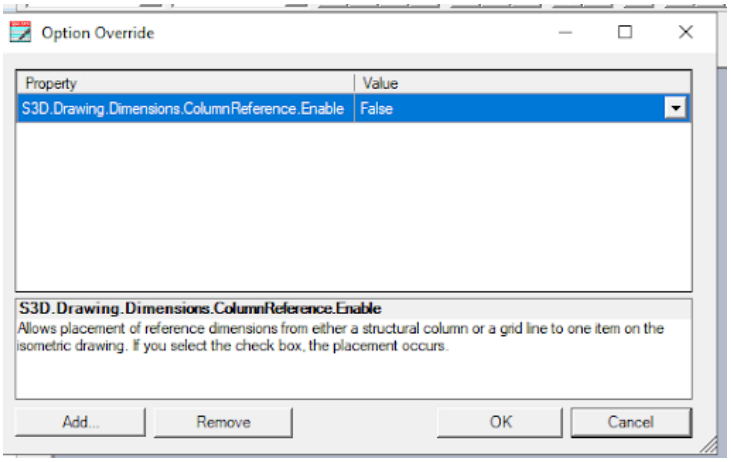
5.5.2 Other Problems

A summary of the most common problems with isometrics not related to failed extraction

- Wrong coordinate system
    - Change the coordinate system, by going to the drawing and selecting: Properties | Style | Coordinate system and choosing the correct one.

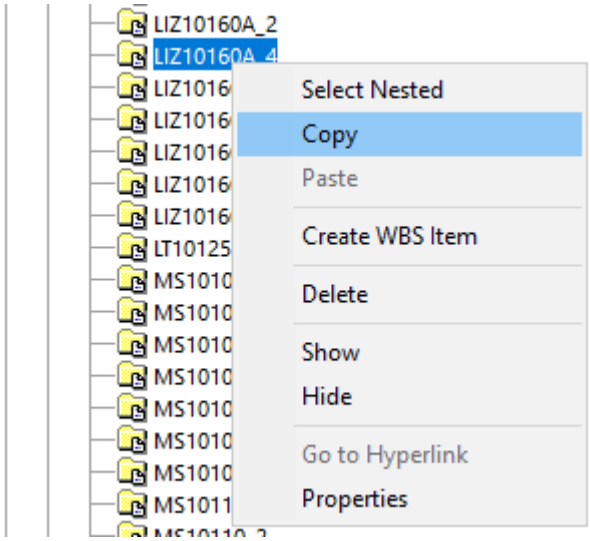


- Column references showing up.
    - Sometimes references to columns will show up. This option can be turned of by right clicking on the drawing and choosing: Option Override | Property | S3D.Drawing.Dimensions.ColumnPreference.Enable. Turn it into “False”

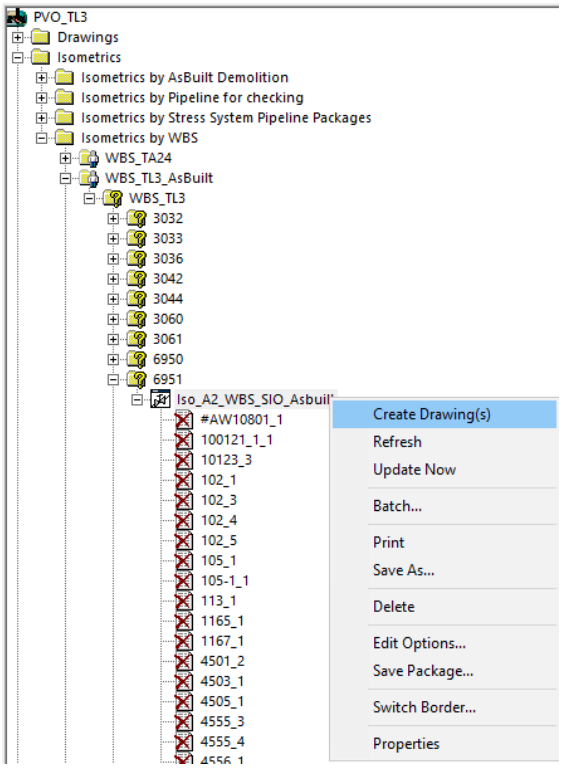


- Drawing not existing

- Sometimes the correct drawing/ WBS project does not exist. A new WBS can easily be created by copying, pasting and renaming an existing project



- DO NOT "CREATE WBS ITEM! Simply Copy and Paste
- To get the drawing to show up, **right click** the isometric symbol and "Create Drawing(s)"



5.6 Checklist before generating isometrics.

This checklist is meant to be used to get the correct data on the isometric from the 3D-model. If all of these are correct the extraction procedure will be quicker, as there is no need to re-run the isometrics.

- ☐ Check connectivity.
- ☐ Connection with equipment
- ☐ Correct painting spec, both SIO and Native
- ☐ Insulation, pipe and inspection classes
- ☐ Temperature and pressure values
- ☐ Weld seam construction requirement set to “Shop weld”
- ☐ Isometrics metadata and revision field
- ☐ Construction requirements set to “Existing”

6 Rasterized drawings

Due to the refinery being in continuous development since the 60s, there is still a good number of lines not yet converted to 3D. These hand drafted drawings have been digitalized to .dwg format and are revised on AutoCAD. Documents are ordered according to Chapter 4

7 Uploading to FOUND!

The info in the chapter is based on DASs own website and further reading can be found there. After modelling and isometric extraction has been done, the following step is to upload the files to the archive, via the FOUND! DMS-system. Documents are only added using ES DMS Excel tool, do not create new document card in FOUND! via create button. Link to guide on how to enable and use the Excel-plugin. Chapter 2.3 goes through how to create document cards.

The following meta-data is needed for isometric uploads, the same data as in the drawing meta-data box should be entered. For more reading go to "Found-fields_Piping". The following list is specifically for red pens.

Field to be filled in	Description	Example
###File Content by##		Project
New version?	If a new major revision should be created	Yes
Discipline	What discipline has done it	Layout and Piping
Task Group	What group your task belongs to, isometrics belong to 3D-modelling	3D-modelling
Task	What task, Isometrics for isometrics	Isometric
Document Class	What class it belongs to, Isometric for Isometrics	Isometrics
Client	What client, choose Neste, as it is the only option	Neste

Project Code	NES project code, the format PRO/SERxxxxx	SER12453
Site Location	Which city	Porvoo
Plant	What plant at location	Porvoo_Tuotantolaitokset
Client document code	Document code, full drawing number including sheet	ISO6954-P445-2
Name	Name of the FOUND card, size and line code	ISOM. 2” P445
Relevance	To whom the documents are relevant	Public All Groups
Production Line	Which production line	TL3
Process Unit	Which unit in the production line	KARP3
Area Code	Which area	6954
Client Equipment Tag	Equipment referenced in drawing	FA-10428
Client Revision Code	Latest revision	6
Revision Author	5+3 name	JOHANSIM
Revision Date	Same as in drawing	20.12.2023
Revision Description	Same as in drawing	ASB
Sheet number	Same as in drawing	4
Author Company	What company author is from (exception, Engineering Solutions adds ES)	ES
Author Organization	Organization in said company	Piping and Layout
Author Email	Email	
Size	Physical Size if printed, isometrics are always A3	A3
Issue Status	What status the drawing is in, red-pens are always always ASB	ASB
In Handover	Does the document go into the archive?	Yes
Work Code	Choose appropriate Work Code	HA
File Owner	Who owns the file (Borealis could also own it)	NO

Information like, Process Unit and Production Line can be found in the follow-up sheet.

This is the minimum amount of data to be filled in for handover to DAS, the only exception being “Process Unit”, as the TLY area only uses area codes, e.g. P020, and does not have units.

When all files have been uploaded to FOUND!, the following step is to send them for review and approval, after which they will be archived if approved.

When handover is done, the FOUND! card link should be added to the correct column in the follow-up sheet and sent to the person who has ordered the as built drawing and the status changed to “09_Paperijakelu_tehty”. Maintenance will then check if everything is ok and change the status to the last “10_kuitattu_valmiiksi_kunnossapidossa”