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Fastener Data Analysis

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The objective of this Bachelor's thesis was to analyze the current condition of Ensto Industrial Solutions' fastener data and to provide suggestions how to improve the current situation. Ensto Industrial Solutions is a part of Ensto and specializes in enclosing solutions and industrial components.

In the beginning of this thesis Ensto and Ensto Industrial Solutions are introduced. Then the basic product data and part numbering systems are explained. Chapter 4 is an analysis of the current situation of Ensto's fastener product data.

Suggestions and future developments are covered in chapters 5 and 6. In chapter 7 conclusions are made and solutions are suggested on how to continue with developing Ensto's fastener data.

This thesis lead to major changes in Ensto's fastener product data and gave instructions on how to name the products.

Keywords	Product Data, Part Numbering, Fasteners

Contents

List of Abbreviations

PDM	Product data management
PLM	Product lifecycle management
PPM	Project portfolio management
BOM	Bill of materials
ERP	Enterprise resource planning
IFS	Enterprise resource planning software used by Ensto
MEO21	Ensto's current instruction for part numbering

1 Introduction

1.1 Background

This thesis was commissioned by Ensto Industrial Solutions. The product data of fasteners and other purchase parts is in critical condition. A noticeable problem arises when searching items from their database IFS Applications. It is almost harder to find old, still usable items, than create new items for the purpose. This problem creates extra workloads for designers and project managers in Ensto. The goal of this thesis is to analyze the situation and create feasible solutions for managing items better.

Ensto Oy is a family business and international company specializing in the development, manufacturing and marketing of electrical systems and supplies. Ensto Oy was established by Ensio Miettinen in 1958 and now has over 1600 employees around the globe. Ensto's turnover exceeded 280 million euros in 2013. Ensto has three key business units: Ensto Utility Networks, Ensto Building Technology and Ensto Industrial Solutions.

Ensto Industrial Solutions is an expert in enclosing solutions and industrial components which includes:

- Standard enclosures, plastics and metals
- Customized enclosures based on standard products.
- Tailor-made enclosures based on customers' products.
- Total enclosing solutions based on integrated enclosures and industrial components.
- Industrial terminals and switches.

Products are manufactured in production facilities located in Finland and Estonia.

1.2 Goals

The goal of this thesis is to improve part numbering and part descriptions to reduce search time and improve the accuracy of search results. In addition, it will lessen the possibility of creating doubles of existing items.

2 Product Data

Different types of product data are necessary when developing, manufacturing or supporting products in their lifecycle. That data includes all information necessary to recreate the product's lifecycle from design to disposal.

Typical product data includes information such as part number, part description, cost, drawings, applicable standards, material, supplier and unit of measure. (Stark 2009: 115)

2.1 Applications

Product data is used in many applications of PLM. Data is created and managed via different software and then transferred to other sites, tools and applications. This introduces a problem in keeping all data up to date and not creating duplicate items in different applications. (Stark 2009: 117)

2.2 Access

Access is to be provided for all users who need it. Product data usage still needs controlling so that only authorized people can access and modify it.

Access may change during a product's lifecycle. A single user may have access on different points in the product lifecycle and not have access at all at certain points. A single user can also have access to different products and projects.

Access to data can be complicated by introducing new applications and data management systems. New systems might not be able to use data produced for old products in older systems or applications. Users still might require access to old data and use it with newer data. (Stark 2009: 117)

2.2.1 Users

There are many users of different types of product data. They may be working as a designer, as a purchaser, for a supplier, for a partner or they might even be the final customer. Product data has to be available to all these people. Product data must also be protected from unauthorized access. (Stark 2009: 133)

2.2.2 Locations

Product data can exist in various locations. It can be in a database, in headquarters in a file cabinet, on a desk in a sales office in a different country or even only in an email. Accessing information is necessary for many, and therefore data should be gathered, stored and allowed access by those in need.

2.3 Incorrect and Inconsistent Data

When data is transferred to another application or location constant updating is required. When transferred data is not updated automatically, or it is taken out of its system, incorrect and inconsistent data will be created. Some data may only be incorrect until it is manually updated, but the risk of using old or wrong data exists.

Inconsistent data can also exist in a system. Product data gathered from different sources can lead to contradicting data in similar items or products. (Stark 2009: 122)

2.4 Unused Data

Maintaining data that is not used costs money. Ensto has estimated that the maintenance of a single item may cost 100€/year. Data should have a lifetime, and after it is not used for a certain period, it should be removed or archived.

2.5 Relationships

There are various relationships in product data. Relationships could be between a product and a part, between two items, between a bill of material and its parts, parts and drawings. There can be relationships between different cycles of design, for example designing a certain part can be started only after another part has been designed and tested. Linking between a source and its derived data must also exist.

Complications usually arise when an item which has many relationships is changed. All drawings and other linked data need to be updated also.

Losing relationship links may lead to the creation of identical "duplicate" data. (Stark 2009: 126-127)

2.6 Categorization

Categorizing of items is made due to:

- Categorizing a bigger group to subset groups with similar information makes access of information faster and easier
- Possibility of assigning limited access and managerial privileges for a limited group
- Behavior control of objects in the category

2.7 Attributes

Attributes are referred as common properties and characteristics of an item. Attributes for fasteners could be, for example:

- Applicable standard
- Property class
- Material
- Surface treatment

- Size
- Screw drive

Attributes can be used in a PDM environment to describe items and also to search items matching the wanted attribute criteria.

3 Part Identification

3.1 Part numbering systems

Part numbering system identifies all items so that each item has its unique part number and one part number only. It allows clear distinguishing between parts when they differ from each other in any way. Accurate and unambiguous identification is important for all phases of the item's lifecycle. (Part Numbering System Design 2005)

3.1.1 Intelligent

Intelligent is also referred to as "significant" .The part number describes detailed information about the part, possibly even uniquely identifies the part. For example, a part number may be PUM 6, where "P" stands for semi-fabricated product, "U" stands for nuts, washers and etc. and "M" is a group for nuts. "6" is a serialized suffix. (Part Numbering Schemes, Intelligent vs. Non-Intelligent. 2002)

3.1.2 Non-intelligent

Non-intelligent is also referred to as “non-significant”. The part number does not describe the product in any way. Non-intelligent part numbers are usually pulled in a numerical order. Non-intelligent part number for a nut could be 000285633. (Part Numbering Schemes, Intelligent vs. Non-Intelligent. 2002)

3.1.3 Part numbering in Ensto

Ensto uses an intelligent numbering system. In Figure 1 the first two letters are required and the first one refers to the main group it belongs to. The second one details

the subgroup it belongs to and the third and fourth letters are voluntary. Serialized numbers are required in the suffix but the index and the numbers after it are optional.

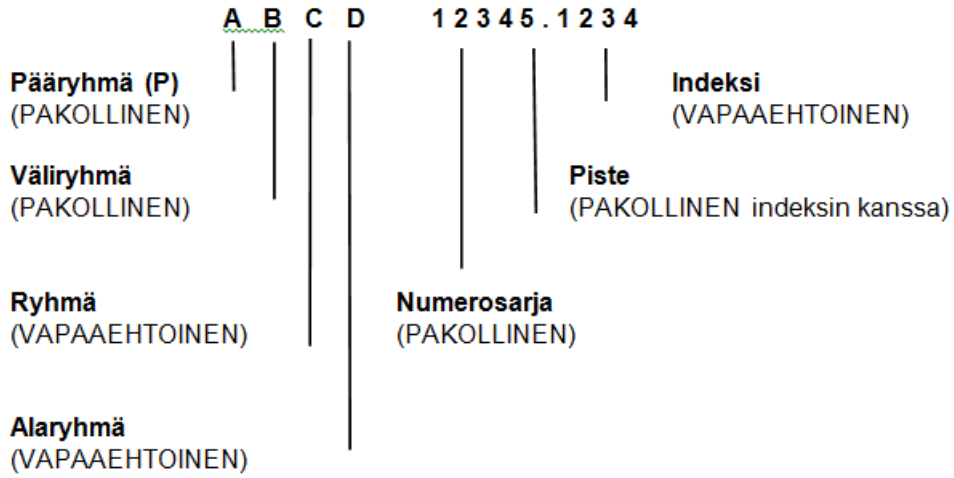


Figure 1 Part numbering in Ensto according to MEO21

Figure 1 is taken from the part numbering instruction MEO21 and explains the basic structure of the part numbering system used. The system is flexible and able to detail products, but the group definitions in MEO21 are contradictory.

3.2 Part Descriptions

Part descriptions are used for describing the product more accurately. Currently fasteners do not contain much data. There are not any documents or attributes describing them. Therefore the only accurate method of recognizing the fastener is by its description, for example:

PLG41 DIN933 8.8 M12x40 A2K kuusioruuvi

Figure 2. Part number and part description

Figure 2 illustrates a DIN933 standard bolt. The part number only partially describes the product, so in this example, you can see from the part description that the bolt's standard is DIN933, its property class is 8.8, size and thread is M12x40mm, surface treatment is A2K and additional info is included after all the required info.

4 Analysis

4.1 Current naming instructions

Naming instructions are used to keep naming of items similar to each other and recognizable by all. Items not named accordingly are hard to find and can lead to double items. Naming instructions are held in Ensto's intra web where they can be found by all users who have access.

Currently the naming instruction MEO21 is contradictory and out of date. MEO21 has been used loosely and use of MEO21 needs supervision and user familiarization.

PL Ruuvit

Ryhmä (Kolmas kirjain):

PLA	Lieriökanta St, M3
PLB	Lieriökantaiset St, M4
PLC	Lieriökantaiset St, muut koot
PLD	Lieriökantaiset, muut aineet
PLE	Erikoisruuvit
PLF	Kuusiokoloruuvit
PLG	Kuusioruuvit, sähkösinkityt
PLH	Kuusioruuvit, kuumasinkityt
PLI	Kuusioruuvit, muut aineet
PLJ	Al-ruuvit
PLP	Pelti- ja muovikierreruuvit
PLR	Ristiuraruuvit

Alaryhmä (Neljäs kirjain):

PLRA	Itsekierteytyvät
PLS	Jousiruuvi

Figure 3. Screw and bolt section of MEO21

Contradictions in naming can be seen in figure 6. The basis of grouping is not clearly defined. The grouping should be defined so that one item cannot belong to several groups. Current groups are divided by different information such as material, shape, screw drive and end use application. Currently one screw can belong to several groups.

Figure 4 Example of contradictions

Figure 4 is an example where an item can belong to two naming groups. It could be named "PLC" due to its shape and it also could be named "PLF" due to its socket type.

This creates confusion and makes the part numbering groups insignificant since the item is not recognizable.

Documented instructions for naming part descriptions were not found. Since part description is the main tool used for searching fastener items, naming instructions should also be documented and made available for all users who need them.

4.2 Actions taken so far

Only major deviation from naming instruction MEO21 was made by Ensto's manufacturing plant in Mikkeli. The use of V-prefix in almost all items was started and it has not been defined in MEO21. The production plant in Mikkeli has also been using MEO21 very loosely in items including V-prefix.

Several new part number groups have been created, but not updated to MEO21.

4.3 Target items

Target items of this thesis were standard components classified as fasteners. Fasteners are devices that mechanically join two or more objects together, for example:

- Bolts
- Screws
- Nuts
- Rivets
- Washers

Fasteners were filtered so that only items listed above remained. Items like cable ties, grommets, latches, nails and staples were left out to target the most used and biggest groups in fasteners.

4.4 Data filtering

Ensto does not use any libraries for standard components like fasteners, so the data had to be filtered manually from IFS. It was started by listing all the suppliers that delivered fasteners for Ensto.

Then all the products they deliver for Ensto were exported to an Excel datasheet from IFS. That datasheet did not contain only fasteners, but there were all the products they deliver for Ensto, so all the fasteners had to be manually separated from that datasheet.

If an item has been exported to a different IFS site, for example a manufacturing site or sales site, the item appeared in the list as two items, one for each site. This is as it should be, but for this analysis, the double items were to be removed.

The separation was started by removing all items that have the same part number by using Excel's remove duplicates tool.

From 3816 items, 2186 was extracted. Then the manual filtration of fasteners was begun. Items that were not fasteners were removed from the list manually. There were 1002 fastener items left, named under 64 different part number groups.

4.5 Data analysis

To know the condition of existing items, an analysis of the current fastener data was made. Data was assigned 5 color grades which represent the quality of the data. Table 1 shows the criteria for grading data.

Colors red and orange were assigned based on the condition of the part numbering. If the part number grouping is correct, grades yellow, light green and green were given based on the condition of part descriptions.

Color	Stands for
Green	Description includes standard, property class, size and material
Light Green	Description includes standard and size. Material or property class missing
Yellow	Description does not include standard or size
Red	Wrong part number group, belongs to another group.
Orange	Part number group does not exist in MEO21

Table 1 Data grading

PLG41 DIN933 8.8 M12x40 A2K kuusioruuvi

Figure 5. Item labeled green

Figure 5 is labeled green and includes information describing standard, property class, size and surface treatment.

PLG45 DIN933 M6x12 A2K kuusiokantaruuvi

Figure 6. Item labeled light green

Figure 6 is labeled light green because it is missing information about property class.

PUM6 Kuusiomutteri m8

Figure 7. Item labeled yellow

Figure 7 is labeled yellow and it is missing all necessary information except size.

Color	pcs	%
Green	119	11,88 %
Light Green	301	30,04 %
Yellow	297	29,64 %
Red	185	18,46 %
Orange	100	9,98 %

Table 2 Data condition analysis

From Table 2 can be seen, that 28.44% (grades orange and red) of products could not be correctly identified based on part number grouping. It means that when part number grouping is used for searching products, almost 30% of the items would not be found.

The main tool for searching fastener items currently is part descriptions. And as seen in Table 2, only 11.88% of fastener products have part descriptions that fully detail the product. Of the current fastener items 30.04% are somewhat recognizable and 29.64% are not recognizable at all.

5 Strategy

5.1 Updating MEO21

As a result of this analysis, it was decided not to update MEO21 as a part of this project. Even updating only the section including fasteners would create too much workload because a single fastener has been used in several hundreds of products and all drawings attached to them would require updating.

Figure 8 PUM4 is used in 462 products

For example PUM4 is used in 462 products and would require drawing and bill of material (BOM) updates.

Ensto is planning to update the current enterprise resource planning software, or the so-called ERP, and as a part of that project they are considering updates on MEO21. Updating it as a part of this thesis could create unnecessary workload if MEO21 is totally rewritten.

Ensto is also currently working on a project developing project portfolio management, or the so-called PPM, and standard components are a part of that project. A shorter version of this thesis was released as an analysis for that project.

Fastener section of MEO21 is contradictory and needs updating in future if the use of intelligent part numbering system is continued.

5.2 Correcting existing data

It was decided that based on this analysis all fastener part descriptions are to be corrected and documents to be added. Correcting part descriptions will not change the product or its part number, so immediate updates on BOM lists or drawings are not required.

5.2.1 Cost of correcting existing data

Costs are generated mainly from work hours used for manually checking and changing the part descriptions of fasteners. That requires comparing Ensto's data and suppliers' data.

From table 3 can be seen an estimate of time required from one person to execute this task.

1002	Quantity of descriptions to check and correct
25	Corrected descriptions per day
8	Weeks to complete
16000€	Estimate of total costs (50€/h)

Table 3 Estimate of work required (Mustonen, 2015)

5.2.2 Estimated savings

Multiple costs are created by incorrect and inconsistent product data. By correcting all part descriptions of fasteners and removing duplicate items, savings could be made due to:

- Faster product development
    - Less time consumed on finding fastener items
    - Example: In Ensto Industrial Solutions, the average lead time of customized projects is 4h, and by fixing part descriptions on all fastener parts, 5% time saving is expected. With an average of 100projects/month, this adds up to 240 saved work hours/year. If calculated with average 50€/hour the total estimated yearly savings are 12000€.

- Reduced item maintain costs
    - Removing the estimated 50 duplicates would reduce the annual item maintenance costs by 5000€. Estimated 100€/year/item.
- Discounts due larger order volumes
    - Removing duplicate items and ordering bigger quantities of single item
- Fewer design flaws due to the use of incorrect fasteners
    - Designers would less likely use wrong fasteners when recognition is easier. That leads to better quality products and fewer production stops.

5.3 Instructions for naming part descriptions

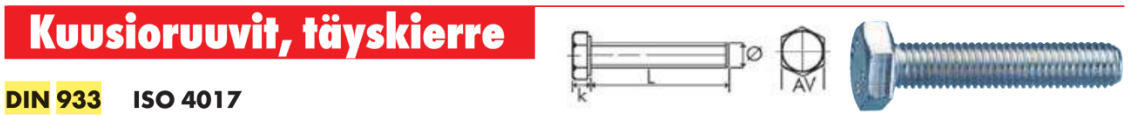
Naming instructions for part descriptions were created as a part of this thesis. It is taken into Ensto wide use for naming new items and to help correct older and flawed descriptions. The whole naming instruction is attached as Appendix 1 in this thesis.

Figure 9 Example part description taken from the created instructions

The instructions are example based as seen in figure 9. It was made example-based due to the various different types of fastener products and it is easily applicable for other sorts of fasteners that are not taken as examples in the document.

5.4 Adding documents

It was decided that documents are to be added to fastener items in IFS. This document should describe the fastener and other fastener sizes following the same standard. The document which can be found on all the fasteners following the same standard reduces unnecessary time used on searching detailed drawings. Figure 10 is an example document which could be added to all bolts following DIN933 or ISO4017 standards.



d Ø	M6	M8	M10	M12	M16	M20	M24	M27	M30	M36
AV	10	13	17	19	24	30	36	41	46	55
Kierrenousu	1	1,25	1,5	1,75	2	2,5	3	3	3,5	4
Kanta korkeus	4	5,3	6,4	7,5	10	12,5	15	17	18,7	22,5

Figure 10 Example document for DIN933 bolts

Ensto has special screws modified for Ensto's use and they are called Ensto Special fasteners. Their part descriptions start with ES rather than a standard. All Ensto Special fasteners require a fully detailed drawing where changes can be seen. The drawing is to be added uniquely to the item it is applied on.

6 Implementation

6.1 Test series

DIN934 nuts were chosen as a test subject for replacing old descriptions with updated versions. The process is done with a special excel sheet where the old data is replaced with new corrected data. The excel sheet is then emailed to IFS main user who is responsible for mass moving items into IFS.

DIN934 nuts were chosen because they are widely used and include bad and unusable data. The group was also of the right size (28 items) for a test run. Test series of mass

correcting part descriptions will be conducted in first half of 2015. Test items will be DIN934 nuts and will be done with information acquired from suppliers.

The excel sheet can be modified in many ways to accomplish the required results. In this case, corrected part descriptions will replace the old ones and then be updated to all Ensto sites that use them.

Part no.	Old Part Description	New Part Description
MU16	Mutter m20.8,din934	DIN934 8 M20 Hex Nut
MU18	Mutter m24.8, must,din934	DIN934 8 M24 Hex Nut
PLH15	Mutter m8, din934	DIN933 8.8 M8X25 HDG Hex bolt
PUM10	Kuusiomutteri m14 d934-8 znk	DIN934 8 M14 HDG Hex Nut
PUM121	Mutteri Haponk. DIN 934 A4-80 M6	DIN934 A4-70 M6 Hex Nut
PUM144	Hexagon nut M8 DIN934 Brass	DIN934 Ms M8 Hex Nut
PUM146	Vastamutteri M3 A2 DIN934	DIN934 A2-70 M3 Hex Nut
PUM151	Hexagon nut M8 DIN934 A2	DIN934 A2-70 M8 Hex Nut
PUM18	Hexagon nut M12 DIN934 g8 hdg	DIN934 8 M12 HDG Hex Nut
PUM19	DIN 934/8 M4 Zn mutteri	DIN934 Fe-8 M4 A2K Hex Nut
PUM22	Hexagon nut M20 DIN934 A2	DIN934 A4-70 M20 Hex Nut
PUM25	Kuusiomutteri m6 din934 a2	DIN934 A2-70 M6 Hex Nut
PUM26	DIN934/8 Zn M3 kuusiomutteri	DIN934 8 M3 A2K Hex Nut
PUM3	Kuusiomutteri m5 din934-a2	DIN934 A2-70 M5 Hex Nut
PUM31	Hexagon nut M30 DIN934 A2	DIN934 A2-70 M30x1.5 Hex Nut
PUM41	DIN934 M10 A4 Hexagon nut	DIN934 A4-70 M10 Hex Nut
PUM47	DIN934 A4-70 M4 kuusiomutteri	DIN934 A2-70 M4 Hex Nut
PUM48	DIN 934 A4-70 M5 kuusiom.	DIN934 A4-70 M5 Hex Nut
PUM51	Hexagon nut M12 DIN934 A2	DIN934 A2-70 M12 Hex Nut
PUM9	Hexagon nut M10 DIN934 g8 hdg	DIN934 8 M10 HDG Hex Nut
PUM90	Hex Nut M10 Brass DIN 934	DIN934 Ms M10 Hex Nut
VPRR8A2	DIN934 M8 A2 mutteri	DIN934 A2-70 M8 Hex Nut
VPRR8A4	DIN934 M8 A4 mutteri	DIN934 A4-70 M8 Hex Nut
PUM16	M12 kuusiomutteri	DIN934 8 M12 A2K Hex Nut
PUM4	Kuusiomutteri m5	DIN934 8 M5 A2K Hex Nut
PUM5	Kuusiomutteri m6	DIN934 8 M6 A2K Hex Nut
PUM6	Kuusiomutteri m8	DIN934 8 M8 A2K Hex Nut
PUM7	M10 kuusiomutteri	DIN934 8 M10 A2K Hex Nut

Table 4 Test series with DIN934 nuts

In table 4 can be seen the old and the new part descriptions that are to be updated. PLH15 is a good example of false data. It was described as a DIN934 nut, but actually was a DIN933 bolt.

6.2 Schedule

The process of correcting fastener data is to be made in second half of 2015. A summer trainee will be familiarized with Ensto's fastener data and IFS and then carry out the work done in the excel sheet.

Introduction of 2 weeks and the implementation of the project is estimated to take 8 weeks adding up to 10 weeks in total.

7 Conclusions

Data condition analysis yielded good results and is a real indicator of the critical condition of fastener data. Calculations based on this analysis indicate that after the first year savings are estimated to be 17000 €/year.

Based on this analysis, it is recommended to update MEO21 in future. MEO21 should be rewritten so that an item can only belong to one part numbering group. It follows the idea behind the intelligent naming system. Part numbers should provide detailed and accurate information about the item and the level of detail given by part number should be carefully considered. The length of the part number should be memorable and detailed enough to actually give information to the user. If these conditions are not met or seen necessary, Ensto should consider choosing a non-intelligent part numbering system.

The created instructions on naming part descriptions (Appendix 1) were immediately taken into use for new fastener items. Those instructions are to be properly shared amongst users, so that everyone in need should be informed and have access. The creation of instructions, user familiarization of instructions and supervising use of instructions will prevent future problems of unrecognizable items or double items.

Adding documents to all fastener items will reduce the time used on finding proper usable data when in need of more accurate data or drawings.

After conducting the test series of mass correcting parts in IFS, the consequences need to be inspected, tested and documented. This prevents mistakes when correcting bigger quantities of data.

This analysis should be used as a basis for considering changes in other purchase parts also. The logic is applicable in other purchase parts and they should also be named uniformly and so that they are recognizable.

8 References

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Instructions for naming fasteners

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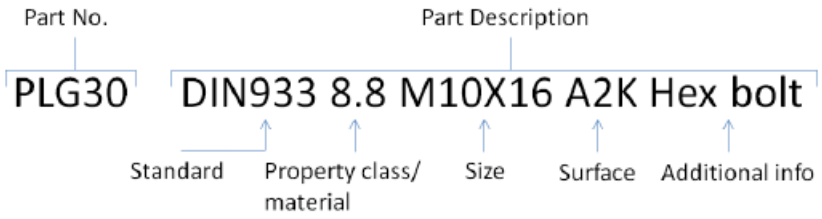
INSTRUCTIONS FOR NAMING FASTENERS

Part Description

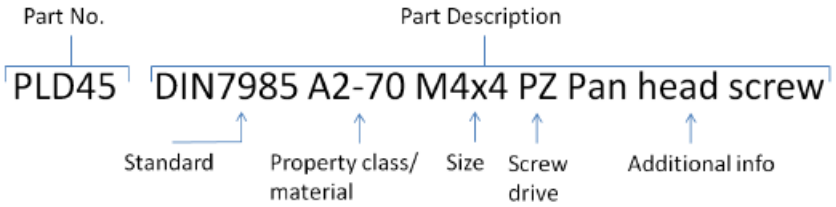
Fasteners are to be named so that all necessary information is shown in part description.
All required info is to be filled accordingly and written in English. This instruction is for fastener part descriptions only.

1 EXAMPLE GALVANIZED HEXAGON BOLT



Standard:	Required
Property class/material:	Required
Size:	Required
Surface:	Required, if no surface treatment, leave empty
Additional info:	Optional

2 EXAMPLE A2 SCREW



Standard:	Required
Property class/material:	Required
Size:	Required
Surface:	Required, if no surface treatment, leave empty
Screw drive:	Required when more than one option according to standard
Additional info:	Optional

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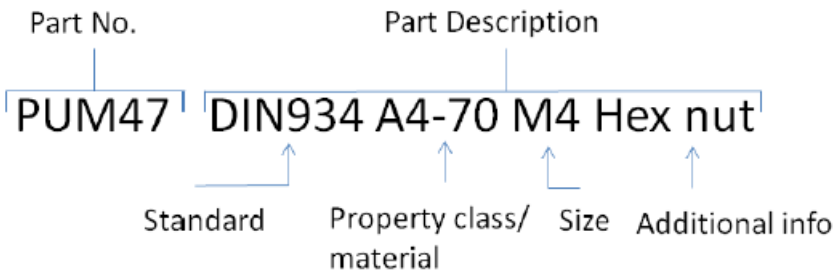
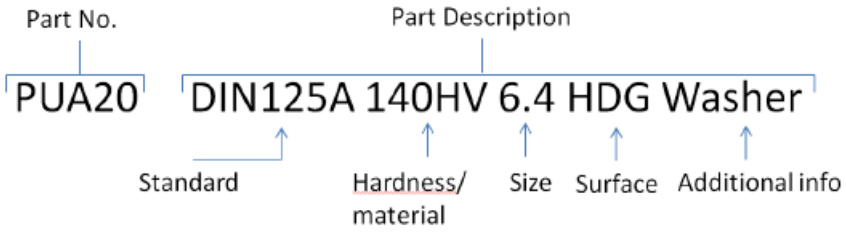
INSTRUCTIONS FOR NAMING FASTENERS

3 EXAMPLE A4 HEXAGON NUT



Standard:	Required
Property class/material:	Required
Size:	Required
Surface:	Required, if no surface treatment, leave empty
Additional info:	Optional

4 EXAMPLE GALVANIZED WASHER



Standard:	Required
Hardness/material:	Required
Size:	Required
Surface:	Required, if no surface treatment, leave empty
Additional info:	Optional

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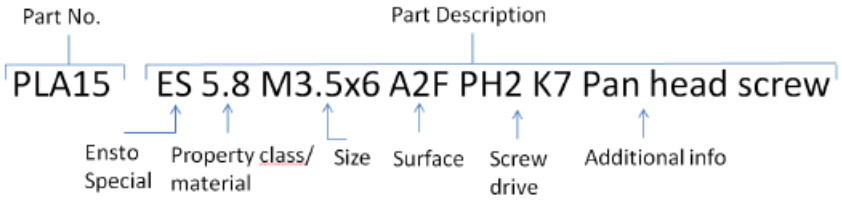
INSTRUCTIONS FOR NAMING FASTENERS

5 EXAMPLE ENSTO SPECIAL SCREW



Ensto Special:	Does not comply standards, Ensto modified
Property class/material:	Required
Size:	Required
Surface:	Required, if no surface treatment, leave empty
Screw drive:	Required
Additional info:	Optional

Detailed drawing document must be added to all Ensto Special fasteners.