

Item Interchangeability Rules

Scope

This paper contains guidelines to support the decision if an altered part is interchangeable with the old one or not and if a new part number has to be assigned. It is based on [1], [2] and [3].

1. General

Each new part (having a unique part number) causes a lot of costs for the enterprise because of maintaining database records and BOM's, administrating drawings and other related documents, separate handling in purchasing, supply chain, stock keeping, inventory control etc. Change administration and implementation costs are about few hundreds of dollar higher if a new part/part number is created than without part number changing.

Therefore minimizing the number of parts must be a fundamental goal of good engineering practice. The best way of course is to reuse existing parts whenever possible.

In the change process the rule for minimizing the number of parts is:

Assign to each unique part only one unique part number. A part is unique if it is not interchangeable with another one. Interchangeable parts always should have the same part number.

These rules mean that the part number may be changed - better saying: a new part number may be assigned - only at non-interchangeable changes.

Note: There are some cases where non-interchangeable changes should not require a new part number, and there are some cases where interchangeable changes can require a new part number, see clause 3.

Form, fit and function may be used as interchangeability criteria, if they are well defined. It is very important to note, that form and function are related to product specification, and that fit is related to drawing dimensions and tolerances (see [1], p. 78).

It is also very important to note, that the decision on interchangeability is not the same as the decision on assigning a new part number. These are two different steps in the decision-making process for assigning a new part number.

First check interchangeability. Then check the need of a new part number. These two steps are described in clause 2 and 3.

2. Item interchangeability criteria

The decision tree shown in Fig. 1 reflects the interchangeability definition given in [1], p. 78.

Principles on using Fig. 1:

1. **Product Specification** is the specification of the end-item (final product).
2. **Functional requirements** of Product Specification also include performance, safety, EMC, reliability requirements etc.
3. Interchangeable **"with no special measures"** means that parts are interchangeable with no special adjustments, modifications or alterations to the item or related items, and that repair and test procedures remain the same.
4. Interchangeable **"in all applications"** means that they are interchangeable in all different parent assemblies, for all applications, for all customers. Have in mind that there may be future assemblies too.
5. **"Form & Function** statements refer to the Product Specification. In other words, the criteria is not what the engineer or anyone else think, but rather what the Product Specifications say" ([1], p. 82). If the criteria isn't covered in the product specifications, or isn't added as part of the change, then it cannot be used as reason for form or function non-interchangeability. Or in other words: If the form & function criteria are not in the product spec the change is interchangeable (see [1], p. 85).
6. **"Costs"** are not an interchangeability criterion and are not covered by the decision on a new part number.

When two items are interchangeable?

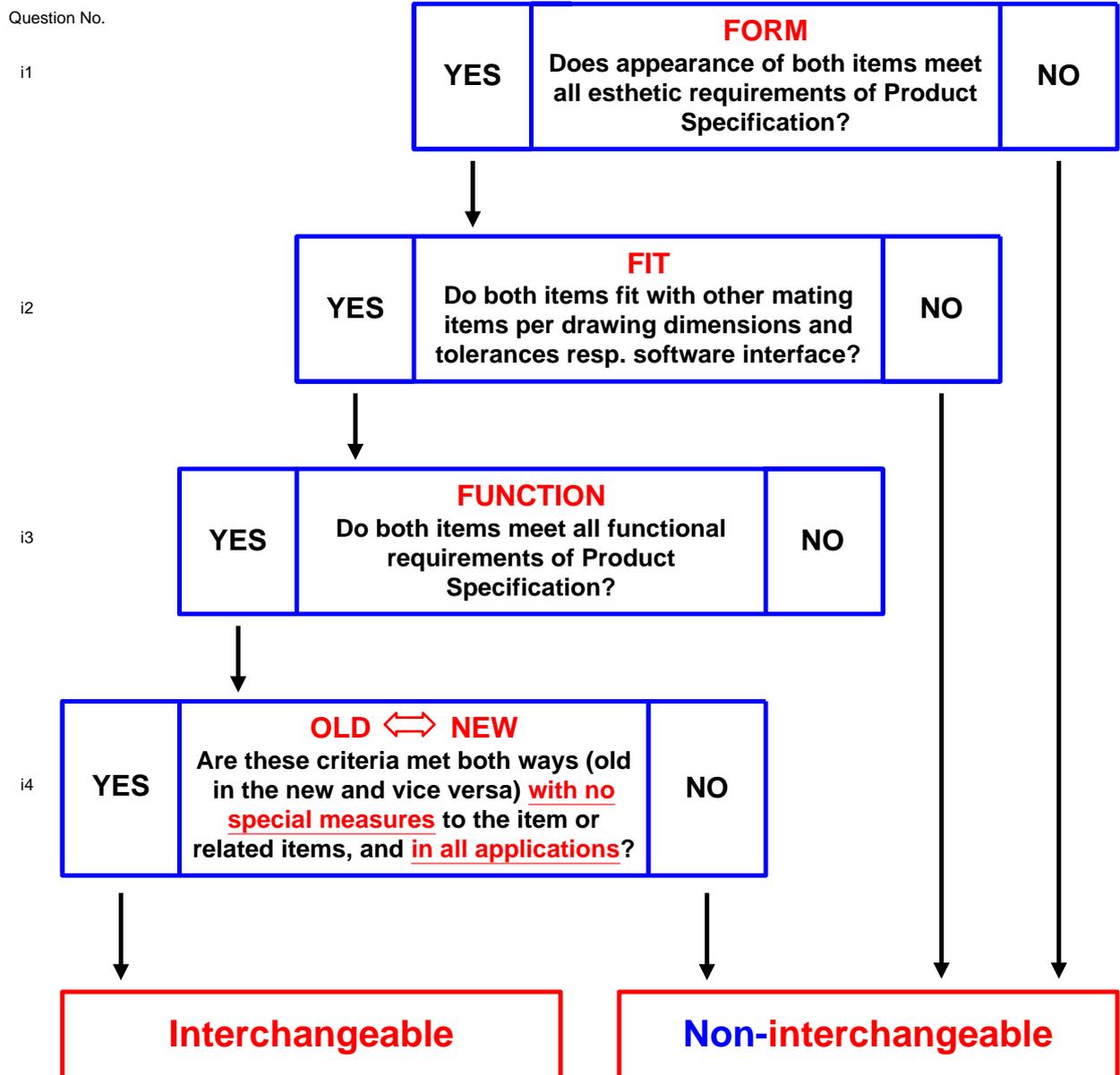


Figure 1: Interchangeability decision tree
(See [1], p. 78.)

Conclusions:

“Thus, any change required to meet the form or functional requirements found in the product specifications is a non-interchangeable change. Any change to exceed those requirements (wherein the product has been meeting the product specification) is an interchangeable change. If the criteria isn’t covered in the product specifications, or isn’t added as part of the change, then the change is interchangeable. Therefore some form and function changes can be interchangeable.” ([1], p. 79)

“If physical fit interchangeability is not obvious from analysis of the drawing dimensions and tolerances, added and/or changed dimensions are required ... Fit criteria must be on the drawings, not in someone’s head.” ([1], p. 89)

3. Rules for assigning a new part number

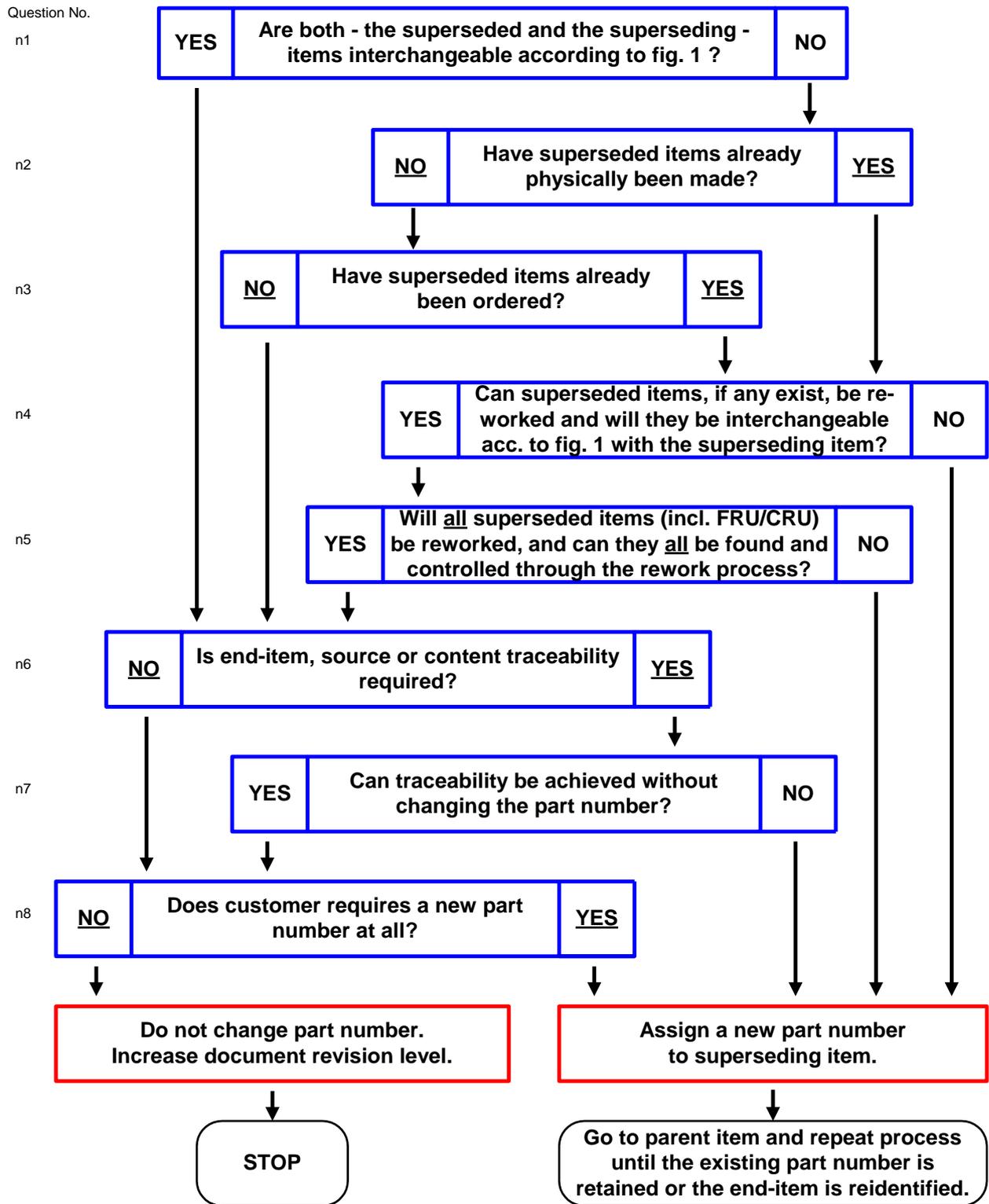


Figure 2: Part number change decision tree

Note:

The figure 2 is a modified version of the item re-identification decision tree taken from the CM2 course materials presented by the Institute of Configuration Management and for which copyrights belong to the CM2 Research Institute, see [2], p. 10. It has been published here by kind permission of the CM2 Research Institute.

Principles on using Fig. 2:

1. **Superseded item:** Item prior change (“old” item)
Superseding item: Item after change (“new” item, changed item)
2. Question n2 and n3: **Physical existence:** If no parts have been physically made or not been ordered they cannot be intermingled, so also non-interchangeable superseding parts do not need a new part number.
Assemblies which are handled in the production line only and are not stored temporarily in the stock, commonly do not need a new part number also when they are non-interchangeable.
3. Question n4 and n5: **Rework:** If all superseded (old) items can and will be reworked in such a manner that they become interchangeable with the new item, then the reworked items and the new item don't need a new part number, they all keep the number of the old item. Reason: The old item does no longer exist.
 In anyway avoid automatic assigning of different part numbers to reworked old and to the new item. Check interchangeability and new part number need according to fig. 1 and 2.
4. Question n6 and n7: **Traceability:** Assign a new part number only then if traceability is really required and if it really cannot be achieved in other way. Some alternatives: “Mod number” in addition to end item part number, reference between made configuration and end item serial number, tracking by FIFO date (First IN – First Out).
5. Question n8: **Customer requirements:** If the customer requires a new part number without of regard for interchangeability or traceability, then assign a new part number.
6. If a new part number is assigned then **both decision trees have to be repeated for all next higher assemblies** containing the superseding part.

Additional rules for assigning a new part number

End items:

Don't change the end item part number unless marketing issues require selling two different products, one with and one without the change. Reason: Changing end item part numbers may confuse customers and may require re-certification by UL or other agencies. It may cause trouble in the ordering and selling cycle from and to customer (see [1], p. 89).
 Identification and traceability of interchangeable and non-interchangeable changes should be achieved by serial numbers, lot numbers, mod numbers etc.

When in doubt ...

... change the part number (see [1], p. 95).

The „Golden Rule“:

Two parts are interchangeable and do not need different part numbers, if they can be stored in a common bin (marked with the part number, not with the drawing revision), and taking a part out of the bin it shouldn't matter, what was the revision level of the document the parts were made from (see [1], p. 86).

4. Further information

For further information on the item interchangeability rules and in general for a better understanding of the Configuration Management the author recommends to visit the CM2 courses and the annual CM2 conferences or workshops.

See more on CM2 (former CMII) at

<https://ipxeu.com/>

<https://ipxhq.com/>

5. References

- [1] **Watts, Frank B.:** Engineering Documentation Control Handbook – Configuration Management for Industry, William Andrew Publishing, LLC; ISBN: 0815514468; 2nd edition; Norwich/New York/USA 2000, page 77ff.
- [2] **CM II – CONFIGURATION MANAGEMENT II, Course III, chapter G: Interchangeability and Re-Identification**, Revision T, 2000-10-23, Institute of Configuration Management (ICM), Phoenix, Arizona, USA
(Today: [Institute for Process Excellence – IpX, https://ipxhq.com](https://ipxhq.com))
- [3] **ATIS TCIF-97-001**, Issue 1, 1997-01-08: Item Interchangeability Guidelines
(Document has been canceled but is still available, e.g. at global.ihs.com.)

6. Revision History

| Rev. | Released on | Author | Modifications |
|------|-------------|------------------|--|
| A | 2004-07-02 | Jörg Eisenträger | Initial revision |
| B | 2012-04-03 | Jörg Eisenträger | Figure 1, criterion "FIT" amended with software interfaces. Minor editorial changes. |
| C | 2013-08-26 | Jörg Eisenträger | Editorially revised. Note to fig. 2 added. Clause 4 added. Clause 5 updated. |
| D | 2019-05-16 | Jörg Eisenträger | Updated links. Some editorial modifications. |