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ADVANCED PRODUCT QUALITY PLANNING
APQP @ KÄRCHER

Guideline for suppliers

APQP – ADVANCED PRODUCT QUALITY PLANNING

APQP IS A 5 PHASE MODEL TO ASSURE QUALITY RIGHT FROM THE BEGINNING

Phase 1	Plan and Define Program
Phase 2	Product Design and Development Verification
Phase 3	Process Design and Development Verification
Phase 4	Product and Process Validation and Production Feedback
Phase 5	Launch, Assessment and Corrective Action

APQP ensures that the Voice of the Customer (VOC) is clearly understood, translated into requirements, technical specifications and special characteristics. The product or process benefits are designed in through prevention.

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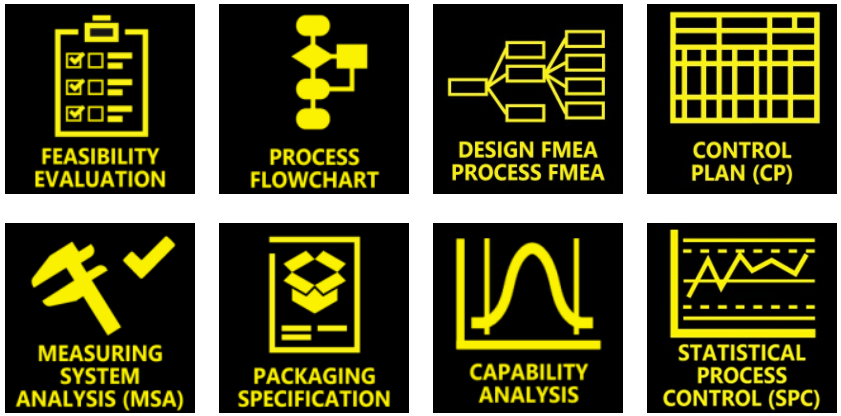
KÄRCHER ADAPTS THE STANDARD APPROACH TO IT‘S SPECIFIC NEEDS

APQP @ KÄRCHER means to focus on the most important, process related tools assuring that purchased materials meet our expectations right from the start.

By this we involve our partners to highlight that for us as the world leading brand in cleaning solutions, quality awareness is the base for sustainable success.

TOOL OVERVIEW



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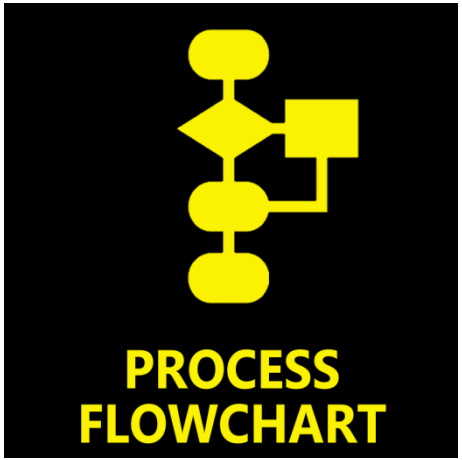
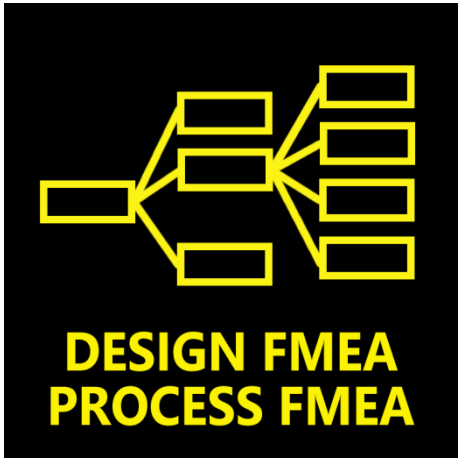
TOOL OBJECTIVES

Our partners confirm via feasibility evaluation that all requirements are clearly understood and the needed prerequisites given to provide the requested goods.



By visualizing the process, a transparent understanding of each step is given including identification of improvement potentials and maintaining repeatability. It‘s also base for the Process FMEA.



The Failure Mode and Effect Analysis (FMEA) identifies systematically potential risks and therefore prevents unnecessary costs and product liability issues.

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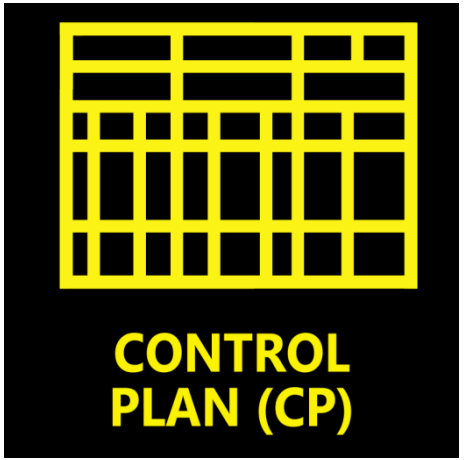
TOOL OBJECTIVES



The control plan is the main document that combines all process steps with the involved capacities, tools and inspections. It provides guidance throughout the whole life cycle of a product.

Inspections along the value stream process identify deviations as early as possible. For reliable results the capability of the involved measuring system has to be approved systematically.

Packaging specifications become more complex as the importance is raising not only by further globalization and transportation needs, but also by trends related to the change in distribution channels.

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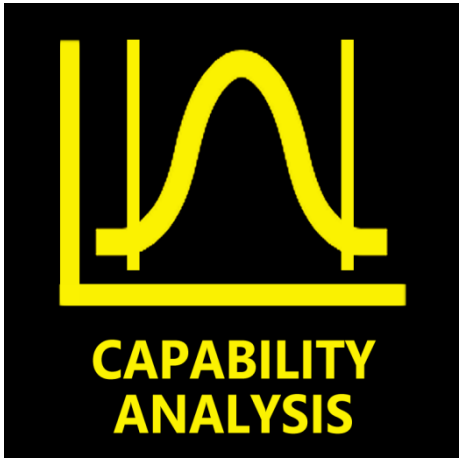
TOOL OBJECTIVES



Capability analysis is the base for reliable machine and process release. It shows whether or not accuracy and repeatability are given throughout the variability of production.

Statistical process control prevents non conform results by showing deviations and negative trends at an earliest possible stage so necessary actions can be taken before corrective actions are needed.

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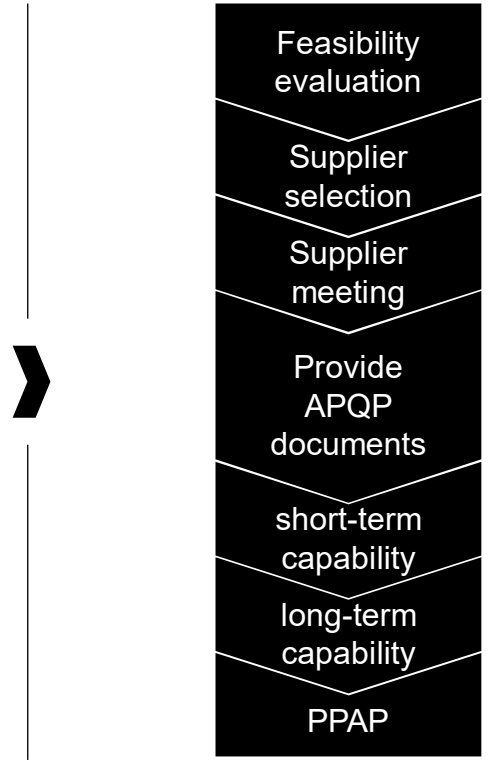
PROCEDURE KÄRCHER APQP

- The Kärcher APQP starts with the feasibility evaluation.
- The document will support supplier selection.
- In a supplier meeting the APQP will planned together.
- At agreed times, the agreed documents will be sent to Kärcher.
- Short-term capability is to be proven with the first part.
- Long-term capability is to be proven immediately after start of production.
- Final approval is given with PPAP.



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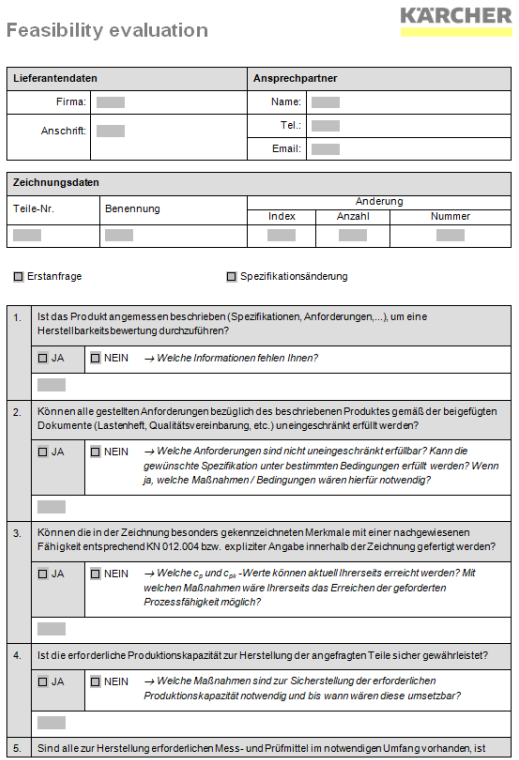
THE KÄRCHER DOCUMENT REQUIREMENTS

FEASIBILITY EVALUATION

- At an early stage the supplier has to assess the feasibility of the planned product and give an opinion whether the requested specification is complete and meaningful & the component can be manufactured and tested under serial conditions.
- The supplier must be convinced that the product is suitable for the intended application and can be produced in adequate quantities, in the required quality, on time and can be tested, packed and delivered to Kärcher.
- Even if Kärcher is responsible for the design, the supplier must determine the feasibility of the product.



Feasibility evaluation

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Lieferantendaten		Ansprechpartner	
Firma:		Name:	
Anschrift:		Tel.:	
		Email:	

Zeichnungsdaten				
Teile-Nr.	Benennung	Änderung		
		Index	Anzahl	Nummer

☐ Erstanfrage ☐ Spezifikationsänderung

1.	Ist das Produkt angemessen beschrieben (Spezifikationen, Anforderungen,...), um eine Herstellbarkeitsbewertung durchzuführen?		
	☐ JA	☐ NEIN	→ *Welche Informationen fehlen Ihnen?*
2.	Können alle gestellten Anforderungen bezüglich des beschriebenen Produktes gemäß der beigefügten Dokumente (Lastenheft, Qualitätsvereinbarung, etc.) uneingeschränkt erfüllt werden?		
	☐ JA	☐ NEIN	→ *Welche Anforderungen sind nicht uneingeschränkt erfüllbar? Kann die gewünschte Spezifikation unter bestimmten Bedingungen erfüllt werden? Wenn ja, welche Maßnahmen / Bedingungen wären hierfür notwendig?*
3.	Können die in der Zeichnung besonders gekennzeichneten Merkmale mit einer nachgewiesenen Fähigkeit entsprechend KN 012.004 bzw. expliziter Angabe innerhalb der Zeichnung gefertigt werden?		
	☐ JA	☐ NEIN	→ *Welche c_p und c_{pk} -Werte können aktuell Ihrerseits erreicht werden? Mit welchen Maßnahmen wäre Ihrerseits das Erreichen der geforderten Prozessfähigkeit möglich?*
4.	Ist die erforderliche Produktionskapazität zur Herstellung der angefragten Teile sicher gewährleistet?		
	☐ JA	☐ NEIN	→ *Welche Maßnahmen sind zur Sicherstellung der erforderlichen Produktionskapazität notwendig und bis wann wären diese umsetzbar?*
5.	Sind alle zur Herstellung erforderlichen Mess- und Prüfmittel im notwendigen Umfang vorhanden, ist		

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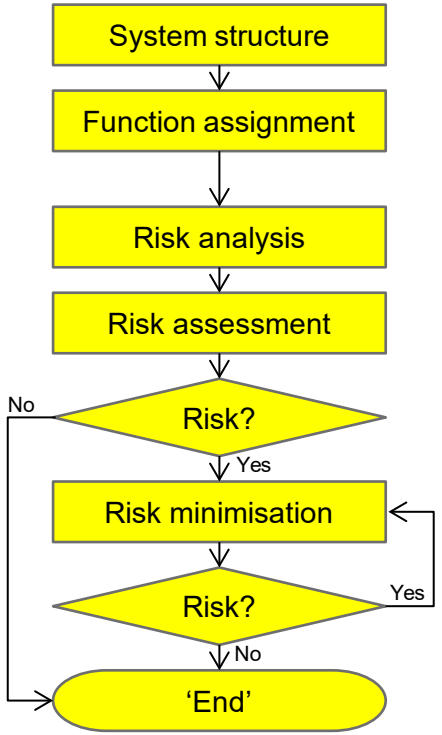
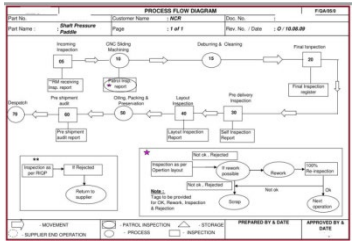
DESIGN FMEA

- Only a supplier that is responsible for development (design) needs to draw up a Design FMEA.
- The D-FMEA has to be prepared according to the scheme on the right.
- The supplier has to provide a document that shows the final risk of the product and the effectivity of the Design FMEA.
- The supplier must grant Kärcher access to the document and allow to review the D-FMEA at any time.



PROCESS FLOW & PROCESS DESIGN

- A process flow/ design illustrates the sequence of production and test stations in a simple and graphical way.
- It contains the same production and test stations like the control plan & describes all movements of a product, also the marking and testing of reworked products.
- Basis for the process flow chart is the Process FMEA.



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Product Program: Cleaner
Issue Date: 01.01.2020
Supplier Name: SampleSupplier
Part Name: Button
Supplier Location: Winnenden/Germany
Part Number: x.xxx-xxx.x

Legend: Event | Activities | Decisions | Connections | Subprocess

Operation or Event	Description of Operation or Event	Evaluation and Analysis Methods
	Step 0: Delivery of goods.	
	Step 1: Incoming goods inspection of the following parts: - part-no. 1 - part-no. 2 - ...	checking: - ident / quantity by order papers - weight / dimensions by drawing
	Step 2: Good parts → production line. Bad parts → complaints process.	
	Step 3: Transport to production line.	
	Step 4: Installing pushbutton wheel pin (part-no.), pushbutton wheel (part-no.), spring (part-no.), button (part-no.) and circuit board pushbutton left (part-no.) onto housing (part-no.). Screwing.	Attention: - screw torque
	Step 5: Pressing magnet (part-no.) into slide. Installing slide, spring (part-no.) and slide retainer onto housing.	
	Step 6: Function test.	checking: - movement with hand
	Step 7: Good parts → Step 8. Bad parts → rework process.	
	Step 8: Connecting cable harnesses (part-no.) to pushbutton left & right.	checking by: - testing unit
	Step 8: Function test of pushbutton.	
	Step 9: Test ok → Transport into stock. Test not ok → scrap.	scrap = red boxes

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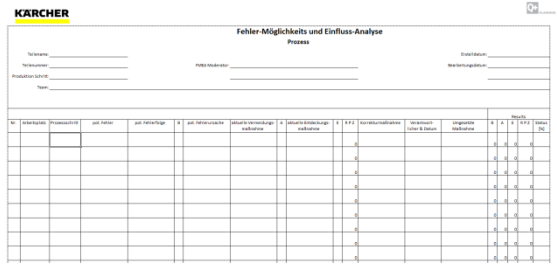
PROCESS FMEA

- The P-FMEA is carried out in the production planning phase
- Testing for suitability and safety of the manufacturing and assembly process, quality capability and process stability as well as risk assessment
- Breakdown of the complete process into single sub-processes / work steps / work stations
- Detection and early avoidance of possible risks and errors in a production process (caused by the 5Ms – man, machine, material, mission, management) through appropriate measures
- The supplier has to provide a document that shows the final risk of the process and the effectivity of the Process FMEA.
- The supplier must grant Kärcher access to the document and allow to review the Process FMEA at any time.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Fehler-Möglichkeits und Einfluss-Analyse
Prozess

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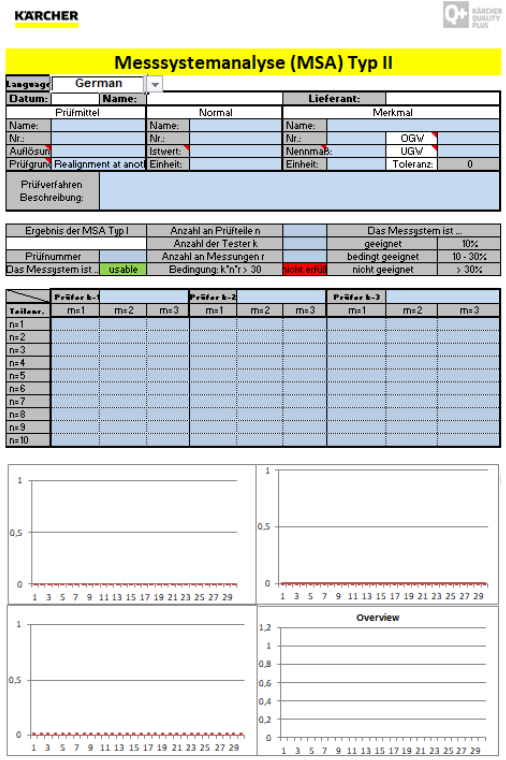
MEASUREMENT SYSTEM ANALYSIS

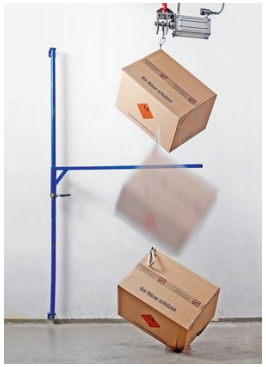
- For all measurements, documented in the control plan, there must be an documented measurement system analysis.
- Kärcher is expecting the value Cg/Cgk (Type I) and the Gage R&R (Type II), preferred analyzed with ANOVA method.
- The measuring system variance has identified by repeat measurements of several parts (typ. 10), several persons (typ.3) and repeat measurements of each part of each person (typ. 2x).
- To perform an analysis there are a lot of suitable software solutions. If not available, on our Supplier Information Portal you'll find a suitable template.



PACKAGING

Kärcher expects evidence for

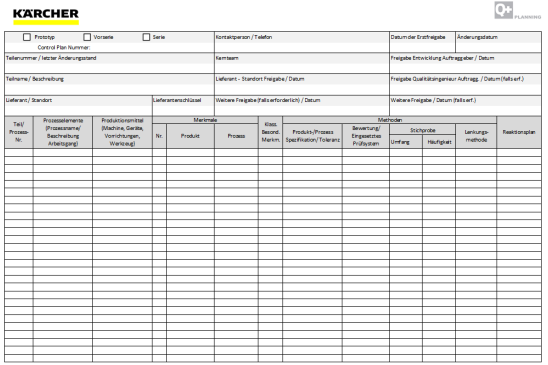
- defined and tested packaging for transport from or to sub-suppliers, internal transport and storage and for shipping to Kärcher.
- created packaging specifications.
- compliance with applicable packaging regulations.
- product quality is not impacted during packaging, shipping, storage and removal.
- an adequate amount of packaging to meet the delivery units.



Verpackung Kabelbaum

CONTROL PLAN

- Kärcher is expecting the control plan for series production.
- The control plan has to be subject to the change management and must have a version number.
- The control plan defines all important process steps, product and process characteristics & describes how parts and products are controlled by the production.
- Definition of test procedures, measuring equipment used, test frequency and tolerances to be adhered to as well as countermeasures in case of deviations
- Basis for the control plan is usually the Process FMEA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☐ Prototyp ☐ Vorserie ☐ Serie Control Plan Nummer:		Kontaktperson / Telefon		Datum der Erstfreigabe	Änderungsdatum
Teilenummer / letzter Änderungsstand		Kernteam		Freigabe Entwicklung Auftraggeber / Datum	
Teilname / Beschreibung		Lieferant - Standort Freigabe / Datum		Freigabe Qualitätsingenieur Auftragg. / Datum (falls erf.)	
Lieferant / Standort	Lieferantenschlüssel	Weitere Freigabe (Falls erforderlich) / Datum		Weitere Freigabe / Datum (falls erf.)	

Teil/ Prozess-Nr.	Prozesselemente (Prozessname/ Beschreibung Arbeitsgang)	Produktionsmittel (Maschine, Geräte, Vorrichtungen, Werkzeug)	Merkmale			Klass. Beeinfl. Merkm.	Methoden				Reaktionsplan
			Nr.	Produkt	Prozess		Produkt-/Prozess Spezifikation/ Toleranz	Bewertung/ Eingesetztes Prüfsystem	Stichprobe Umfang	Stichprobe Häufigkeit	Lenkungs-methode	

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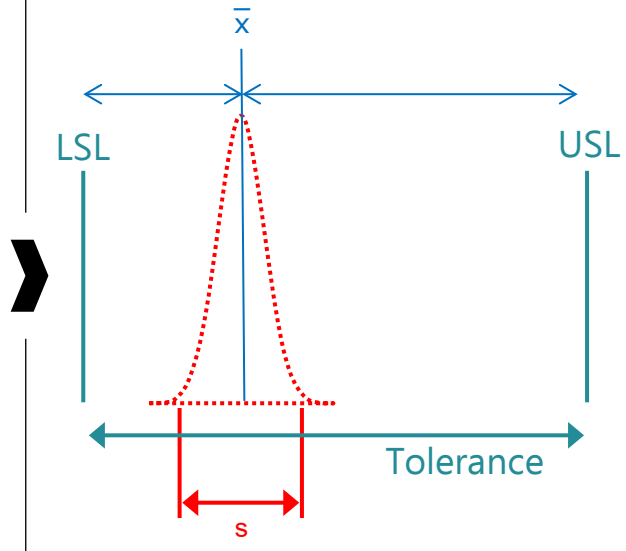
MACHINE CAPABILITY

- Machine capability is an assessment of the machine to check whether it can produce in the context of its normal variations within the given limit values.
- A random sample of at least 30 parts (per nest / cavity) is required. They have to be produced directly one after the other and without changing the machine.
- Kärcher is expecting the values for C_m and $C_{mk.}$
- Formulars:

$$C_m = \frac{USL - LSL}{6s}$$

$$C_{mk} = \min\left(\frac{USL - \bar{x}}{3s}; \frac{\bar{x} + LSL}{3s}\right)$$



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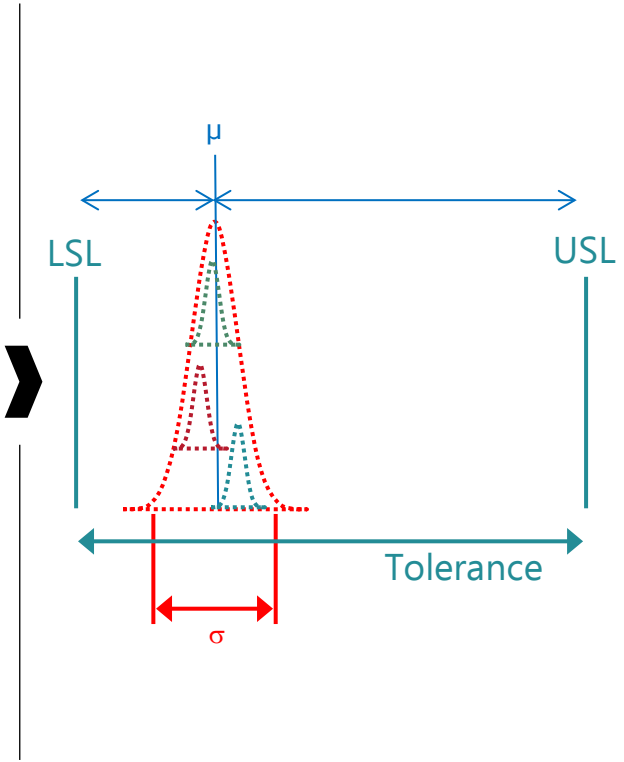
PRELIMINARY PROCESS CAPABILITY

- The preliminary process capability is the assessment of the process to check whether it is capable within the tolerance with few influences and random samples in early phase of production.
- Kärcher has determined/ specified that for the calculation of the preliminary process capability minimum 3 random samples à 5 parts should be available (per nest/ cavity)
- Kärcher is expecting the values for P_p and $P_{pk.}$
- Formulars:

$$P_p = \frac{USL - LSL}{6\sigma}$$

$$P_{pk} = \min\left(\frac{USL - \mu}{3\sigma}; \frac{\mu + LSL}{3\sigma}\right)$$



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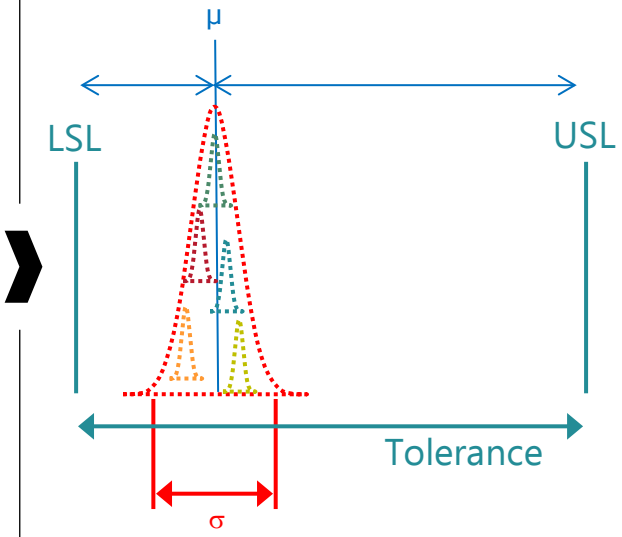
LONG-TERM PROCESS CAPABILITY

- The long-term process capability is the assessment of the process to check whether it is capable within the tolerance in the face of all typical influences and random samples in series production and stable process.
- Kärcher has determined/ specified that for the calculation of the long-term process capability minimum 40 random samples à 5 parts will be measured (per nest/ cavity)
- Kärcher is expecting the values for C_p and $C_{pk.}$
- Formulars:

$$C_p = \frac{USL - LSL}{6\sigma}$$

$$C_{pk} = \min\left(\frac{USL - \mu}{3\sigma}; \frac{\mu + LSL}{3\sigma}\right)$$



CONCLUSION

By the use of APQP @ KÄRCHER we focus on preventive quality management involving our supply chain partners.

We evaluate possible risks of purchased goods. Together we define necessary preventive measures and tools based on this evaluation.

With this frontloading approach we gain more speed and reliability by avoiding unnecessary loops in the product development process in order to satisfy our customers‘ needs right from the beginning and in a sustainable way.

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MAKE A DIFFERENCE