IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

0 General

Document "LQP - Supplier Quality Planning Procedures" outlines the requirements of IMS Connector Systems as regards its supplier quality planning (LQP).

Attention! The requirement of IMS Connector Systems regarding LQP is not binding. The LQP 1-3 point are equivalent to PPAP 1-3. According to the preference and applied practice at the suppler, PPAP 1-3 is allowed to be used instead of LQP 1-3. The levels of the procedures are comparable – e.g. you may use PPAP 2 instead of LQP 2. Application of VDA 2.4 for sampling is acceptable.

Those suppliers who do not use either PPAP or VDA 2.4 should apply below procedure for piecepart sampling.

All forms and templates referred to in this document (see appendix) are available as Excel files and can be downloaded at www http://www.imscs.com/supplierinformation.html.

IMS-CS applies 3 different methods of assessment:

LQP-1:
Standard procedure for all parts, with the exception of parts that must fulfil special requirements (to be assessed according to LQP-2 or LQP-3).

LQP-2:

Procedure for all parts that must fulfil special requirements. Such requirements might relate to the number of parts, their complexity, application, etc.

The LQP-2 procedure applies to all parts where the request/order is accompanied by form LQP-2. In the respective drawing, all critical dimensions are marked with ◆.

LQP-3:

Procedure for all parts that must fulfil special requirements and that are designed for the automotive industry.

The LQP-3 procedure applies to all parts where the following text is included in the drawing: "Special Approval procedure according LQP-3". In the respective drawing, all critical dimensions are marked with ◆. Dimensions that are subject to in-process monitoring are marked with SPC.

The supplier may not make any modifications regarding
- the production process
- materials
- geometries
- galvanisation

without the prior written approval by IMS-CS.

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

The properties of series parts (e.g. visible properties, mechanical properties, etc.) must correspond to those of the reference samples. Series parts must be inspected accordingly by the supplier prior to delivery.

By accepting the IMS-CS order, the supplier undertakes to comply with the specifications.

1 Overview - Requirements re. LQP 1, 2 and 3

Step	Requirement	LQP-1	LQP-2	LQP-3
1	Feasibility study Form-CS-172-Feasibility Statement Submission: together with offer	*	*	X
2	Estimated capacity Submission: together with offer	X	X	X
3	Process FMEA Submission together with initial sample test report		*	*
4	Control plan Submission: together with initial sample test report		X	X
5	Test equipment capability (gauge R & R) c_g , c_{gk} values for critical dimensions in control plant (SPC, ◆) Submission: together with initial sample test report		X	X
6	Capability of machine/tool (short-term capability) c_m , c_{mk} values for critical dimensions marked with SPC or ◆; min. 50 parts; (for tool-formed parts: characteristics of soft tool and hard tool) Submission: together with initial sample test report		X	X
7	Initial sample test report with 5 parts, or 1 part per cavity (for tool-formed parts: characteristics of soft tool and hard tool) Submission: together with first parts and in the event of changes in the drawing	X	X	X
8	Material certificate according to ISO 10474 or DIN EN 10204: 3.1B Submission: together with initial sample test report	X	X	X
9	Material declaration in IMDS Submission: together with initial sample test report	*	*	X
10	For coated parts: coating thickness measuring report Submission: together with initial sample test report	X	X	X
11	Reference samples Submission: together with EMPB, 5 parts to be stored by supplier			X
12	Preliminary process capability p_p , p_{pk} values for dimensions marked with◆; min. 10 random samples (n = 5) / minimum interval 0.5h (for tool-formed parts: characteristics of soft tool and hard tool) Submission: together with initial sample test report		X	X
13	Proof of process capability c_p , c_{pk} values for dimensions marked with ◆ 50 random samples (n = 5) / min. 50h Submission in consultation with supplier		X	X
14	SPC monitoring / long-term capability analysis Submission: upon request by IMS-CS, within one working day		X	X

X required in all cases

***** required depending on specifications/arrangements

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

Instead of the LQP procedures, suppliers may complete Level 3 of the PPAP Procedure (Production Part Approval Process) laid down in the QS 9000 quality standard.

All documents must be submitted in English or German!

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

1 Approval LQP

If the initial sample test report shows that all dimensions are within the specified limits and requirements no. 1 to 12 of the LQP are fulfilled, the supplier receives a ***preliminary approval***. The preliminary approval is included in the initial sample test report form issued by IMS-CS.

When all requirements of the LQP are fulfilled, the supplier is granted a ***series approval***. This approval is issued by IMS-CS on the LQP-2 or LQP-3 form respectively (see sample form on page 4).

IMS has to verify the results of the supplier´s FAI. The minimum requirements are:

- **Measuring of all functional and SPC dimensions.**
- **Measuring of all customer specific and internal specified characteristics**
- **Attributive evaluation of dirt, damages, burrs, and visual discrepancies**

Approval by IMS-CS does not release the supplier from his responsibility as regards the quality of the products. The supplier must at all times adhere to all specifications (e.g. drawings, specifications of materials, forbidden substances, etc.).

During series production, the SPC dimensions must be continuously monitored and the relevant measured data must be made available to IMS-CS upon request. The respective data must be filed for 5 years and must be accessible to IMS-CS. If SPC dimensions are not continuously monitored during production, the series approval is automatically revoked.

IMS-CS reserves the right to carry out process audits, even if series approval has been granted. The series approval might be revoked, if new requirements arising from the process audit are not complied with.

If **no approval** is granted, new samples must be forwarded for the non-compliant dimensions and/or any missing documents must be submitted. In the event of a reinspection of samples ordered on the grounds of deviating dimensions, a new initial sample test report must be compiled, where the non-compliant dimensions are reassessed.

2. When is an LQP required?

A complete or partial LQP procedure must be carried out in the following situations:

- New revision index of IMS-CS drawing: Steps 7 to 11 (in certain circumstances: steps 4, 5, 12, 13) for the changed dimension(s) or parameter(s). If the revision index is incremented, new samples must be submitted. If the changes in the drawing don't require a change in the production procedure of the supplier, a simplified procedure applies whereby only the cover page of the initial sample test report form is replaced and completed with the following details:
  - New revision index
  - Reason for simplified sampling procedure (e.g. no changes in dimensions, does not concern supplier, packaging instructions are complied with).
- New part: complete LQP must be carried out
- Planned process change: complete LQP must be carried out
- Planned change of material: complete LQP must be carried out

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

- In the event of manufacture of an additional tool for formed parts, steps 6 to 14 must be completed
- If a tool is replaced by a new one or if a tool is revised, steps 6 to 14 must be completed
- At the change of the machine type, steps 6, 7, 12, 13 and 14 must be completed.

➔ **Series parts will not be accepted without prior approval by IMS-CS!**

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

IMS drawing no.	Date of issue	Rev.	IMS purchasing dep. – KLE	Phone	Fax
Supplier			IMS quality – TQT	Phone	Fax
Supplier sales department			Phone	Fax	
Supplier quality department			Phone	Fax	

No.	Measure	☒ required	Comments	Checked
1	**Feasibility study**	with offer	**Use attached form CS-172**	
2	**Estimated capacity**	with offer		
3	**Process FMEA**	☐		
4	**Control plan**	☒		
5	**Test equipment capability (gauge R&R)**	☐		
6	**Capability of machine / tool (short-term capability):** c_m, c_{mk} values: dimensions with ◆; 50pcs	☐		
7	**Initial sample test report:** All dimensions and specifications including material c… reference samples … by suppl…	☒		
8	**Material certificate a… IS 10474 or DIN EN 10204:3.1B**	☐		
9	**Material declaration - IMD**	☒		
10	**Coating-thickness measuring report**	☒		
11	**Reference sample**	☒		
12	**Preliminary process capability:** p_p, p_{pk} values: dimensions with ◆ min. 10 random samples (n=5) / min. interval 0.5h (other intervals after consultation with IMS)	☐		
13	**Proof of process capability:** • c_p, c_{pk} values: Dimensions with ◆ 50 random samples (n=5) / min 50h • Capacity and frequency of defects	☐		
14	**SPC monitoring:** Dimensions marked with SPC **Reference sample** comp. with series	☐		

All measures must be completed according to the IMS specifications and requirements.

Signature quality manager of supplier	Date

Series approval for product

Signature IMS-TQT	Date

Comments:

Double border = to be completed by supplier

Documents regarding items 1 and 2 must be forwarded by the supplier together with the offer to the purchasing department of IMS Connector Systems. Steps 3 to 14 become only relevant in the event of an order by IMS-CS. Send the completed form together with the order confirmation to the purchasing department of IMS-CS.

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

3 The 14 LQP steps

3.1 Feasibility study

Definition

Feasibility study: Examination of the product design in order to establish whether it is suitable for large-scale series production.

Purpose

- Critical analysis of the suitability of the design for series production
- Systematic communication between supplier and IMS-CS
- Inclusion of requirements and capabilities of the supplier by ensuring a constructive dialogue between IMS-CS and the supplier
- Support of IMS-CS in finding a design that is cost-effective and suitable for its manufacturing processes
- Ensuring that the series products delivered by the supplier conform to the IMS-CS specifications

Requirements

The feasibility study must be documented on form ***Form-CS-172-Feasibility Statement*** and forwarded to IMS-CS.

The study must include the following information:
- IMS-CS drawing number
- Revision index of IMS-CS drawing
- Supplier details
- Discussion of feasibility according to Form-CS-172

The supplier will inform IMS-CS of any design features that might make the production of the parts difficult, costly or even impossible. In particular, the supplier must examine the specified dimensions and tolerances.

Examples of common problems to be discussed in a feasibility study:
- Requirements regarding the galvanised coatings (e.g. solderability, etc.)
- Thickness of galvanised coatings (blind holes, etc.)
- Requirements re. material
- Requirement regarding dimensions of part after hardening
- Requirements regarding measuring
- S dimensions and processing requirements

Submission of feasibility study:

- The feasibility study must be sent to the purchasing department of IMS-CS together with the offer.
- The feasibility study must be completed in English.
- Under point 6 of the Feasability Statement (Form-CS-172), (A) must be marked with a cross. If there is a cross at (B), (C) or (D), IMS-CS has to be contacted. If drawings have changed or in case of other relevant modifications, the feasability analysis has to be performed again until the result corresponds to the analysis point 6. (A) or it is decided that the product cannot be produced.

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

3.2 Estimated capacity

Definition

Estimated capacity: Estimation of the secured maximum capacity (number of parts) achievable by the supplier

Purpose

- Basis for series planning by IMS-CS

Requirements

The estimated capacity must be entered in form ***Form-CS-166-Capacity*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

The declaration of capacity must include the following information:

- IMS-CS drawing number
- Revision index of IMS-CS drawing
- Supplier details
- Secured maximum capacity per week
- Number of shifts per week
- Earliest date at which capacity is available

Notes

- Standstill times including maintenance periods must be taken into account.
- If the capacity fluctuates, include a respective schedule.

Submission of estimated capacity declaration

- The declaration must be sent to the purchasing dep. of IMS-CS together with the offer.
- The estimated capacity declaration must be completed in English.

3.3. Process FMEA (P-FMEA)

Definition

Process FMEA: Risk evaluation and analysis for the entire production process including a schedule of measures for the elimination of the main risks

Purpose

- Detection and elimination of risk arising in the course of processing
- Preventive modification of the process in order to eliminate faults and defects in the series production

Requirements

The P-FMEA results must be entered in form ***Form-CS-166-P-FMEA*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

The P-FMEA must include the following information:

- IMS-CS drawing number
- Revision index of IMS-CS drawing
- Supplier details
- Date and revision status of P-FMEA

for each individual process:

- Potential errors

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

- Potential consequences of error
- Potential causes of errors
- Risk priority number (RPN)
- For RPN ≥ 125: recommended measures for the elimination of the risk including details of person responsible and deadlines
  - Measures taken to eliminate risk
  - Description of improvements

Notes

- It is often useful to compile the P-FMEA in co-operation with subcontractors or with IMS-CS.
- The P-FMEA must also refer to risks arising during transport and intermediate storage.

Submission of process FMEA

- The P-FMEA must be submitted after the process planning is completed (sequence and description of individual production processes) and prior to the implementation of the process. The respective form must be sent to the responsible TQT officer of IMS-CS
- The process FMEA must be completed in English.

3.4. Control plan

Definition

Control plan: Sequence of all production processes, including testing, from the roll-in of the raw materials to the dispatch of the goods

Purpose

- Overview of all control and regulation mechanisms governing the process
- Compliance of production process

Requirements

The control plan must be entered in form ***Form-CS-166-Control Plan*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

The control plan must include the following information:

- IMS-CS drawing number
- Revision index of IMS-CS drawing
- Supplier details
- Date and revision status of control plan
- Dimensions and parameters to be used for the assessment of the process capability

for each individual process:

- Description of individual processing steps
- Measured parameter/property
- Specifications / requirements
- Measuring instruments
- Measuring instructions (if applicable)
- Test method (random sampling, 100% testing, SPC testing: type of control card)
- Test frequency (frequency and scope of test procedures)
- Corrective actions, if measured values are outside the specified limits

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

Notes

- The control plan must be regularly updated to reflect the applicable requirements. Modifications to the control plan are often required after the results of the process capability analysis (steps 6 and 13) have been obtained.
- Where possible, quality should be controlled rather than inspected.

Submission of control plan

- The control plan must be sent together with the initial sample test report (step 7) to the responsible TQT officer of IMS-CS.
- The control plan must be completed in English.

3.5 Test equipment capability (gauge R&R)

Definition

Test equipment capability: Evaluation of test equipment in order to establish whether the equipment is suitable for a specific measuring task under industrial conditions whereby accuracy and repeatability are assessed

Purpose

- Assessment of accuracy of measuring results
- Method to ensure that the results of the process capability assessment are correct, providing a suitable basis for all further actions

Requirements

The results of the test equipment capability assessment must be entered in forms ***Form-CS-166-Test equipment capability P.I - P.III*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

All test equipment used for the measuring of SPC dimensions or the assessment of the process capability of the respective part must be individually evaluated.

The assessment must fulfil the following minimum requirements:

- All characteristics must be defined
- The resolution of the measuring instrument must be minimum 5% of the tolerance for the respective characteristic. The recommended value is 2% of the tolerance for the characteristic.
- For each measuring instrument, complete first procedure 1 followed by procedure 2. For automated testing systems, complete first procedure 1 followed by procedure 3. Only testing systems where the parts are automatically fed are considered automated systems.
- Note: Procedure 1 may be completed by the manufacturer of the test equipment (this is generally the case for standard testing devices).
- Procedure 2 must be completed with the respective measuring instrument at least once for all dimensions marked with ◆. After consultation with IMS-CS, the supplier might be permitted to examine the equipment using parts and/or dimensions that are similar to that of the respective product.
- It is however in the interest of the supplier to complete all measurements as laid down in procedure 2.
- **Procedure 1:** The reference value is 20% of the tolerance for the respective characteristic and reference $4*s_g$. The capability indices c_g and c_{gk} must be greater than 1.33. c_g and c_{gk} must be calculated on the basis of 25 repeat measurements (recommended). In certain

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

circumstances (and after consultation with IMS-CS), it might be sufficient to complete less than 25 repeat measurements. The minimum number of measurements is however 20.

- The true value of the calibration master must be within the magnitude of the dimensions of the part to be measured.
- For procedure 1, the following data must be submitted (see form ***Form-CS-166-Test equipment capability P.I***):
  – Supplier details
  – Date of assessment
  – Details of measuring equipment (description, model, manufacturer, serial number, resolution)
  – Details of applied references (description, number, actual value)
  – Measured values
  – Tolerances for characteristics
  – c_g and c_{gk}
- **Procedure 2:** Procedure 2 is based on the average range method (ARM). For this purpose, 10 parts are selected and numbered. The parts are measured twice by one tester in the same sequence. This procedure is repeated by two other testers. Subsequently, repeatability, reproducibility and the measuring system parameters are calculated (R&R) The tolerance is used as reference.
- For procedure 2, the following data must be submitted (see form ***Form-CS-166-Test equipment capability P.II***):
  – Supplier details
  – Date of assessment
  – Details of measuring equipment (description, model, manufacturer, serial number, resolution)
  – Details of applied references (description, number, actual value)
  – Measured values
  – Tolerance for characteristics (reference)
  – Repeatability (%EV), %Reproducibility (%AV) and measuring system (%R&R)
- **Procedure 3:** In procedure 3, the total %R&R is assessed across the entire range. 25 parts are measured twice in the same sequence, using an automated measuring system. Subsequently, the repeatability (EV) is calculated. In this case, %EV=%R&R applies, as the influence of the operator is negligible. The tolerance is used as reference.
- For procedure 3, the following data must be submitted (see form ***Form-CS-166-Test equipment capability P.III***):
  – Supplier details
  – Date of assessment
  – Details of measuring equipment (description, model, manufacturer, serial number, resolution)
  – Details of applied references (description, number, actual value)
  – Measured values
  – Tolerance for characteristics (reference)
  – Repeatability (%EV) = measuring system (%R&R)

Notes

- For more detailed information on procedures 1, 2 and 3, please refer to the literature (see [1], chapter 6).

Submission of test equipment capability (gauge R&R) report

- The report must be sent to the responsible TQT-3 officer of IMS-CS together with the initial sample test report.
- The capability report must be completed in English.

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

3.6 Capability of machine / tool (short-term capability)

Definition

Short-term capability: Method for the assessment of the processing position and variation

Purpose

- Assessment of suitability of the processes and tools applied by the supplier for the relevant specifications and requirements
- Basis for subsequent process improvements at the hard tool

Requirements

The short-term capacity must be entered in form ***Form-CS-166-Short-term capability*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

The analysis of the short-term capability must fulfil the following minimum requirements:

- All specifications and dimensions marked with ◆ in the drawing must be included in the analysis.
- The dimensions/specifications must be measured/assessed at 50 parts per cavity. The parts must be individually sampled from the process.
- The head data of the analysis must include the following details:
  – IMS-CS drawing number
  – Revision index of IMS-CS drawing
  – Supplier details
  – Date
  – Location of production
- **Variable characteristics:** For each dimension/specification, the following information must be included in the analysis:

– c_m	Histogram
– c_{mk}	Nominal value
– Average	Upper tolerance limit
– Standard deviation	Lower tolerance limit
– Minimum value	Measured values
– Maximum value	Details of measuring equipment used

- Calculation (normal distribution):

$$\bar{x} = \frac{1}{n} \bullet \sum_{i=1}^{n} x_i \quad \text{(mean)}$$

$$s = \sqrt{\frac{1}{n-1} \bullet \sum_{i=1}^{n} (x_i - \bar{x})^2} \quad \text{(standard deviation)}$$

$$\mathrm{T} = \text{tolerance} = \mathrm{UTL} - \mathrm{LTL} = \text{upper tolerance level} - \text{lower tolerance level}$$

$$c_m = \frac{T}{6 \bullet s} \quad \text{(short-term potential)}$$

$$c_{mko} = \frac{UTL - \bar{x}}{3 \bullet s}$$

$$c_{mku} = \frac{\bar{x} - LTL}{3 \bullet s}$$

$$c_{mk} = Minimum\{c_{mko}, c_{mku}\} \quad \text{(short-term capability)}$$

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

- In general, the calculation of the short-term potential (c_m) and capability (c_{mk}) must be based on the normal distribution, as the number of measured values is not sufficient for any other type of distribution. For position tolerances and certain processes, other distribution types might be available. In these cases, the normal distribution is not suitable and indices c_m and c_{mk} should therefore be calculated with a different distribution. The indices must be calculated by means of the percentile method. If another distribution type is used, please state the reasons.
- **Attributive characteristics:** The analysis must include the following information (per attributive characteristic):
  – Number of parts within the range of specification
  – Number of parts outside the range of specification
  – Reasons for deviation from specification
  – Method of analysis used
- For the short-term capability analysis of hard tools, the relevant dimensions/specifications must be measured/assessed at 50 parts per cavity. The parts must be individually sampled from the process.

Notes

- If required, additional dimensions and specifications may be marked with ◆. This can be done at the start or during production. These dimensions are then also subject to the above requirements.
- A separate short-term capability analysis must be completed for each soft tool and hard tool.
- In the event of modifications to the hard tool, the respective dimensions and specifications must be reassessed.

Submission of short-term capability analysis

- The short-term capability analysis must be sent to the responsible TQT officer of IMS-CS together with the first parts.
- The short-term capability analysis must be completed in English.

3.7 Initial sample test report (EMPB)

Definition

Soft tool initial sample test report: Report including all measured dimensions (with samples) of the pre-series tool (soft tool)

Hard tool initial sample test report: Report including all measured dimensions (with samples) of the series tool (hard tool)

Initial sample test report: Report including all measured dimensions (with samples) produced under serial production conditions

Purpose

- Provision of evidence for the IMS-CS engineer that the supplier is capable of producing the part according to the specifications of IMS-CS
- The soft tool initial sample inspection report provides the basis for the requirements regarding the production of series tools (hard tools)
- The soft tool initial sample test report can be used as a reference for possible improvements to the series tool (hard tool)
- The initial sample test report can be analysed in order to detect systemic errors

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

Requirements

The initial sample test report must be entered in forms ***Form-CS-166-EMPB*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

The report must fulfil the following minimum requirements:

- **Cover page including the following data (*Form-CS-166-EMPB-Result*):**
  – Address details of supplier
  – Type of report
  – IMS drawing number, revision index, description of part
  – Date of compilation of report
  – Number of samples
  – Reason for report
  – Location of production
  – Name and telephone number of person responsible for the report (supplier)
  – Signature
  – Approval section for IMS-CS
- **IMS drawing:**
  – All dimensions and other specifications (e.g. spring resistance, material specifications, hardness, optical features, etc.) must be numbered All dimensions/specifications must be measured/assessed
- **Test report including the following data (*Form-CS-166-EMPB-Test Results*):**
  – The required dimensions/specifications including tolerances must be listed according to the numbering in the drawing
  – For each dimension, all measured values or at least the lowest and highest measured value must be listed
  – Results that are outside the tolerance range must be assessed in co-operation with the respective engineer. Nonconforming dimensions must be marked accordingly (e.g. with asterisk, underlined or in bold print) in the initial sample test report and accompanied by a reference to the discussion with the engineer. After the design engineer has modified the drawing accordingly, a simplified sampling procedure must be completed.

  Deviations from this procedure have a negative effect on the evaluation of the initial sample test report and thus on the supplier evaluation.
- **Number of parts:**
  – For tool-formed parts, at least one part per cavity must be measured. The parts must be clearly identified as to their cavity. All measured parts must be labelled and submitted together with the test report.

Notes

- The measured parts must be handed over to IMS-CS as samples. **Parts that have been cut open to measure an internal dimension must also be submitted.**
- In the case of changes to the soft tool or hard tool, or if the process has been modified, the respective dimensions/specifications must be reassessed with new samples.
- A separate initial sample test report must be completed for each soft tool/hard tool.
- If several parallel machines (processes) are involved in the production, a separate initial sample test report must be completed for each machine.
- **For each measured dimension the used equipment, test procedure and personnel has to be clearly retraceable.**
- In the event of a change to the drawing (new revision index of IMS-CS drawing), the modified dimension or parameters must be assessed by means of an initial sample test report. In certain cases, the simplified sampling procedure might be sufficient (see section 2.2).

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

- When presenting the Initial Sample Test Report, point 6 (A) of the Feasability Statement must be marked with a cross (compare paragraph 3.1).

Submission of initial sample test report

- The initial sample test report must be sent to the TQT-department of IMS-CS together with the initial samples. The initial sample test report should reach IMS-CS before the first series parts.
- The initial sample test report must be completed in English.

3.8 Material certificate

Requirements

- Material certificate according to ISO 10474 or DIN EN 10204: 3.1B

Submission of material certificate

- The material certificate must be submitted together with the initial sample test report.

3.9 Material declaration - IMDS

Requirements

The supllier shall follow and confirm the Guidelines RoHS 2002/95/EG and RoHS 2002/96/EG and REACH (EG) Nr. 1097/2006.

All relevant data regarding the material of the purchased parts must be recorded in the International Material Date System (IMDS). For more information, please refer to website www.mdsystem.com.

Other material declaration formats are only permitted after consultation with IMS-CS. The declaration of must include the following information (***Form-CS-166-EMPB-Material Declaration*).**
- Weight (in grams, rounded to 4 decimals) of purchased parts, including tolerance
- Declaration of materials and their composition
- Information regarding the content of hazardous substances according to German Chemicals Act / Hazardous Substances Act; CAS code and identification according to German Hazardous Substances Act, if applicable
- Information regarding the risk of emission of hazardous substances when the material is handled properly.
- Declaration regarding water-pollutants contained in the material with reference to the relevant water protection acts

Submission of material declaration

Registration in the IMDS, or declaration in any other agreed format must be made upon submission of the initial sample test report.

3.10 Galvanised parts

For galvanised, the following samples must be submitted with the initial sample test report:
- 5 raw parts (exception: pre-galvanised strips) and
- 5 galvanised parts

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

The samples must be accompanied by the following information:
- Name of electroplating plant (IMS-CS reserves the right to carry out an audit of the company)
- Structure and composition of galvanised layers [%]
- **Galvanised layer thickness report**
- Evidence that all requirements of RL-CS-o6-Definition Surfaces - Supplier are fulfilled

If the supplier changes galvanising subcontractor, he must inform the strategic purchasing department of IMS-CS and resubmit an initial sample test report.
All surfaces must be reinspected.

3.11 Reference samples

For tool-formed LQP-3 parts, the supplier must submit a set of parts (i.e. one part per cavity), while another set of parts remains at the supplier's premises as reference samples.
For other LQP-3 parts, 5 additional parts must be submitted, while another 5 parts are to be stored by the supplier as reference samples.

3.12 Preliminary process capability

The preliminary process capability assessment is completed as described in 3.13. The relevant requirements differ however slightly and are as follows:

- Random samples of n=5 parts must be taken from the process. The minimum interval between the sampling procedures is 30 minutes (other intervals might be chosen after consultation with IMS-CS). The minimum number of random samples is 10.
- Assessment of P_p instead of c_p
  Assessment of p_{pk} instead of c_{pk}

3.13 Proof of process capability

Definition

Proof of process capability: Analysis of the stability, capabilities and capacities of the supplier processes. The analysis must cover a minimum production period of 50 hours.

Purpose

- Provision of evidence that the processes of the supplier are stable for a prolonged period of time and that meet the specifications and capacity requirements.
- Basis of further process improvements

Requirements

The proof of process capability must be entered in forms ***Form-CS-166-Process capability I + II*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format.

- The process capability must be proven under series conditions.
- All specifications and dimensions marked with ◆ in the drawing must be included in the assessment
- Random samples of n=5 parts must be taken from the process over a period of minimum 50 hours. The minimum number of random samples is 50 (for tool-formed part: take random samples for all cavities).

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

- The head data of the analysis must include the following details:
  – IMS-CS drawing number
  – Revision index of IMS-CS drawing
  – Supplier details
  – Date
  – Location of production
- **Variable characteristics:** For each dimension/specification, the following information must be included in the analysis:

– c_p	Histogram
– c_{pk}	Nominal value
– Average	Upper tolerance limit
– Standard deviation	Lower tolerance limit
– Minimum value	Measured values
– Maximum value	Measuring equipment used

  – Shewart control card with intervention limits for the assessment of the process stability

- Calculation (normal distribution):
  (a) Calculate average and standard deviation of every fifth sample

$$\bar{x} = \frac{1}{5} \bullet \sum_{i=1}^{5} x_i \quad \text{(mean)}$$

$$s = \sqrt{\frac{1}{5-1} \bullet \sum_{i=1}^{5} (x_i - \bar{x})^2} \quad \text{(standard deviation)}$$

  (b) Calculate overall average and standard deviation (k = number of samples):

$$\hat{\mu} = \bar{\bar{x}} = \frac{\sum_{i=1}^{k} \bar{x}_i}{k}$$

$$\hat{\sigma} = s_{ges} = \frac{\sum_{i=1}^{k} s_i}{k} \bullet \frac{1}{a_n}$$

$$a_5 = 0.940$$

  (c) Assessment of stability: Record averages and standard deviations on a quality control card. On the average value card, calculate the upper and lower intervention limits. On the standard deviation card, calculate the upper intervention limit. (Values for 99% intervention limits, constants for fifth samples)

$$UIL_{\bar{x}} = \bar{\bar{x}} + A_E \bullet \bar{s}$$

$$LIL_{\bar{x}} = \bar{\bar{x}} - A_E \bullet \bar{s}$$

$$UIL_s = B_{Eob} \bullet \bar{s}$$

$$A_{E5} = 1.152$$

$$B_{Eob5} = 1.927$$

  Criteria for a stable process:
  – The values may not be outside the tolerance range
  – The total of the values outside the intervention tolerance range (number of values outside the limits) may not exceed the limits of the spread of the binomial distribution (99% bilateral)

  With 25 random samples, maximum 2 values may be outside the intervention limit (QRK with intervention limit 99%).

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

(d) Calculation of process potential and process capability:

$$T = \text{Tolerance} = UTL - LTL = \text{upper tolerance limit} - \text{lower tolerance limit}$$

$$c_p = \frac{T}{6 \bullet s_{ges}} \text{ (potential)}$$

$$c_{pko} = \frac{UTL - \bar{\bar{x}}}{3 \bullet s_{ges}}; \quad c_{pku} = \frac{\bar{\bar{x}} - LTL}{3 \bullet s_{ges}}$$

$$c_{pk} = Minimum\{c_{pko}, c_{pku}\} \text{ (capability)}$$

- In general, the calculation of the potential (c_p) and capability (c_{pk}) must be based on the normal distribution, as the number of measured values and the relatively short period are not sufficient for any other type of distribution. For position tolerances and certain processes, other distribution types might be available. In these cases, the normal distribution is not suitable and indices c_p and c_{pk} should therefore be calculated with a different distribution. The indices must be calculated by means of the percentile method. If other distribution types are used, please state the reasons. DIN 55219 must be adhered to!
- **Attributive characteristics:** The analysis must include the following information (per attributive characteristic):
  – Number of parts within the range of specification
  – Number of parts outside the range of specification
  – Reasons for deviation from specification
  – Method of analysis used
- **Capacity:** The declaration of capacity must include the following information:
  – IMS-CS drawing number
  – Revision index of IMS-CS drawing
  – Supplier details
  – Secured maximum capacity per week
  – Number of shifts per week
  – Earliest date at which the capacity is available
  – Standstill times including maintenance periods must be taken into account
  – If the capacity fluctuates, include a respective schedule

Notes

- A separate process capability analysis must be compiled for each machine type/tool. Exceptions are only permitted if approved by IMS-CS.
- If required, additional dimensions and specifications may be marked with ◆. This can be done at the start or during production. These dimensions are then also subject to the above requirements.

Submission of proof of process capability

- The proof of process capability must be sent to the responsible TQT officer of IMS-CS together with the initial sample test report.
- The proof of process capability must be completed in English.

3.14 SPC monitoring - long-term capability - reference samples

Definition

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

SPC monitoring: Continuous monitoring of the production by means of quality control cards. For LQP-3 parts, the series must be inspected on a regular basis by comparing the produced parts with the reference samples. This is necessary to detect whether the product properties have changed.

Purpose

- Monitoring of production
- During the entire production process, the supplier must ensure that the achieved and proven process capability is not reduced by rather improved.
- Quick intervention in the event of deviations

Requirements

The proof of SPC monitoring must be submitted upon request by IMS-CS only. The details of the SPC monitoring must be entered in form ***Form-CS-166-SPC monitoring*** in the appendix and sent to IMS-CS. Alternatively, the information can be submitted in any other suitable format. The respective data must be filed for 5 years and must be accessible to IMS-CS.

- The process must be monitored by means of a parallel set of SHEWART quality control cards. As a rule, one standard deviation card should be used. In certain special cases (e.g. manual registration without computer support), the use of a median range card is permitted.
- The sample must include n=5 parts. In exceptional cases (long measuring periods, the sample size might be reduced to n=3 parts.
- The interval between the sampling processes depends on the process capability and stability.
- For all dimensions/specifications that are marked with SPC in the drawing, a separate quality control card must be completed. In other word, for each marked dimension and specification, a separate proof of SPC monitoring must be compiled.
- The head data of the analysis must include the following details:
  – IMS-CS drawing number
  – Revision index of IMS-CS drawing
  – Supplier details
  – Period of SPC monitoring
  – Location of production
  – Measuring equipment used
- **Variable characteristics:** The following data must be recorded:
  – Shewart average card (with intervention limits)
  – Shewart standard deviation card (with intervention limits)
  – cp and cpk values, calculated over the SPC monitoring period
  – Average and standard deviation over the SPC monitoring period
- For the calculation of the intervention limits (normal distribution), total average and total spread, see 3.11

(a) Intervention limits for average card (probability of non-intervention 99%):

$$UIL = \hat{\mu} + A_E \bullet \hat{\sigma};\ LIL = \hat{\mu} - A_E \bullet \hat{\sigma}$$

$$A_{E5} = 1.152\ \ (n = 5)$$

(b) Intervention limits for standard deviation card (probability of non-intervention 99%):

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

$$UIL = B_{E_{ob}} \bullet \hat{\sigma};\quad LIL = B_{E_{un}} \bullet \hat{\sigma}$$

$$B_{E_{ob}5} = 1.927;\quad B_{E_{un}5} = 0.227$$

(c) Assessment of stability: Criteria for a stable process:
– The values may not be outside the tolerance range
– The total of the values outside the intervention tolerance range (number of values outside the limits) may not exceed the limits of the spread of the binomial distribution (99%)

- Calculation of c_p and c_{pk}: see 3.13
- For the calculation of the quality control card and the process capability, a distribution type that adequately describes the process must be selected. In many cases, a distribution other than the normal distribution is chosen. If another distribution type is used, please state the reasons. For all other distribution types, the position must be based on a SHEWART quality control card with extended limits (mixed distribution) or a Pearson quality control card (standard distribution, Rayleigh distribution, Pearson distribution, Johnson transformation, Weibull distribution). Indices cp and c_{pk} must be calculated by means of the percentile method.
- **Attributive characteristics:** The following data must be recorded:
  – Defects card listing all causes of defects and the number of defects per cause
  – Monitoring period
  – Frequency of monitoring

Notes

- Other methods of SPC monitoring are only permitted after consultation with IMS-CS.

Submission of SPC monitoring report

- Upon request by IMS, submission within two hours (in English).

4 Delivery of series products

Prior to the supply of series products, all documents according to the quality instructions of IMS-CS must be completed, signed and filed with IMS-CS. A plating thickness report must be attached to each delivery of plated parts.

5 Complaints

Complaints must be made in writing on form ***Form-CS-166-8D Report***. Alternatively, complaints might be submitted as an 8D report.

6 Literature

[1] Dietrich, Schulze: Statistical Procedures for Machine and Process Qualification; 1st edition; ASQ Quality Press; Milwaukee, Wisconsin; 1999

IMS CONNECTOR SYSTEMS Kft
Ipar Krt. 27.
H-9400 Sopron
Tel +3699-513-528
Fax+3699-513-534

7 Appendix

The appendix consists of a separate document ***Form-CS-166a-Forms-LQP 1 - 3*** containing all forms referred to in this text.

8 List of changes

Rev. 02 from 01.02.2006. replaced by	
Rev. 03 from 17.03.2008.	changed: Section 4 - 32 raw parts cancelled
Rev. 04 from 07.04.2008.	changed: Section 3.10 - 32 raw parts cancelled
Rev. 05 from 29.04.2008.	changed: Section 4 - plating thickness report added
Rev. 06 from 09.12.2009.	changed: Section 1 - Elements prefix changed changed: Section 3.9 – REACH/ROHS added
Rev.07 from 28.10.2015	changed: Section 0: General prescription amended, PPAP 1-3 – VDA 2.4 added