ZKW SUPPLIER QUALITY GUIDELINES

BRIGHT MINDS,
BRIGHT LIGHTS.

About ZKW

ZKW Group is the specialist for innovative premium lighting systems and electronics. As a system supplier, ZKW is a global partner to the automotive industry. The group develops and produces products based on our motto of "Bright Minds. Bright Lights." combining bright minds with modern production technologies to produce complex premium lighting and electronic modules for international automotive manufacturers.

Our top products include powerful and cost-efficient complete LED systems. The ZKW Group has a total of twelve locations worldwide, with intelligently networked development and production. In 2020, the Group employed around 10,000 workers and generated total revenues of 1.03 billion euros.
In accordance with the corporate vision "Ground-breaking premium lighting and electronic systems from ZKW for all mobility concepts of the global automotive industry", the company's primary goal is to produce top-quality high-tech products and to promote the development of innovative holistic lighting systems.

With our discoveries and inventions, the ZKW corporate group makes vehicles more desirable, more unique, safer, and more energy efficient.

Our 360-degree product portfolio includes headlamps and fog lamps, rear lamps, flashers, interior and license plate lamps as well as electronic modules. Major automotive manufacturers trust their brands to innovative products from ZKW. We are proud of our customers like BMW (BMW, Rolls Royce), DAIMLER (MERCEDES-BENZ Cars and Trucks), FORD (Lincoln, Ford), GEELY (Volvo, Polestar, Lynk & Co, Geely), GENERAL MOTORS (Buick, Chevrolet, Cadillac), JLR (Jaguar, Land Rover), PSA (Opel, Citroen), RENAULT/NISSAN (Infiniti, Alpine), VGTT (Volvo Trucks, MACK) and VW (Audi, Porsche, Skoda, Lamborghini, MAN, VW, Seat).

With intelligent lighting systems and innovative styling, ZKW is shaping the look and character of vehicles worldwide.

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Table of Content

0.0 Introduction

0.1 Purpose

0.1.1. The purpose of this document is to describe the main requirements required by ZKW to the organizations delivering products to ZKW (hereinafter referred to as "supplier")

0.1.2. The ZKW quality guidelines described in this document are generic requirement, designed to highlight details that are important to ZKW from the ISO 9001, IATF 16949

0.1.3. ZKW requirement concerning a specific project are those described in the contractual documents agreed and signed by ZKW and the supplier. The supplier shall comply with requirements described in this quality guidelines as well as those in the contractual documents.

0.1.4. Requirements described in this Supplier Quality Guidelines shall be considered as ZKW customer requirements. Supplier shall analyze and implement all requirements described in this ZKW supplier Quality guidelines and ensure that the relative department at the supplier are aware of ZKW customer requirements.

0.2 Scope

0.2.1 This document is valid for all suppliers delivering products & services to all ZKW sites and plants.

0.2.2 This document is valid since the release date of the document and is valid for new suppliers as well as existing suppliers.

0.2.3 Supplier shall provide ZKW with a signed copy of this document not more than 15 days after receiving this document from ZKW. Any proposed addendum to this document shall be added to page 33 of this document, agreed and signed by ZKW and the supplier

0.2.4 ZKW holds the right to audit the supplier, based on the requirements described in this document in addition to requirements described in VDA 6.3 and/or IATF 16949.

0.2.5 ZKW Quality guidelines doesn't include requirements specific to logistics, financial agreements and purchasing conditions. Supplier shall refer to ZKW logistics guidelines and ZKW purchasing conditions for such requirements.

0.3 Responsibilities

0.3.1 Suppliers shall receive the ZKW Supplier Quality Guidelines and share the signed copy with ZKW according to the following table

Task	Time	Responsible
Receiving ZKW Supplier Quality Guidelines while Registration through ARIBA	1. Before nomination (for new projects) 2. When Invited by ZKW to register on ARIBA	All suppliers Including Current Suppliers
Upload Signed Quality Guidelines to ARIBA	Mandatory to close the registration	

0.4 Supplier selection, development and approval

0.4.1 Registration at the supplier portal

For the initial approval and contracting of a supplier, a registration at ARIBA is required. Further descriptions and information are available in the registration invitation sent by ZKW. A pre-selection takes place based on the information given during registration.

0.4.2 Evaluation of the quality performance

a) QM-Assessment: The evaluation criteria reflect the contents of this quality guideline, the automotive-specific QM requirements "MAQMSR" and relevant focus points in regard to the technology being evaluated.
b) Goal: Evaluation to which extent the supplier fulfills the ZKW quality guideline. If positive (green or yellow), the potential supplier is admitted to ZKW supplier pool as a potential supplier for the evaluated technology.
c) Note: in case more than one technology are available at the supplier, each technology shall be evaluated separately

0.4.3 Based on the results, the supplier is classified as follows:

a) Approved supplier (Green Result)
Supplier fulfills the ZKW requirements.
b) Controlled supplier (Yellow Result)
The supplier partially fulfills the ZKW requirements, but improvement measures are to be realized before contracting or within a defined deadline after contracting.
c) Blocked supplier (Red Result)
The supplier does not fulfill the ZKW requirements and/or considerable development activities are required prior to possible contracting.
d) ZKW reserves the right to conduct additional QM analyses, possibly with its customers. The supplier herewith confirms access to the administration and production areas (at least in those areas in which the ZKW components are to be manufactured).

0.5 Supplier Nomination

0.5.1 Prior to the contracting, every improvement potential which is identified (resulting from the evaluations stated in section 0.4 must be planned in the form of an improvement program. Before finalizing the nomination letter, ZKW SQE are authorized to discuss the steps required for closing the improvement program actions plan during the lifetime of the project and to agree on possible deviations to this quality guideline in a "side letter".

0.6 Re-evaluation of suppliers

0.6.1. If a supplier has not been contracted for an extended period, the supplier may be subjected to a new re-evaluation.

1.0 General Requirements

1.1 Certification

1.1.1. The supplier certification according to IATF 16949 by a recognizable certification body by the IATF is a required condition before any business with ZKW.
If the supplier is not IATF 16949 certified, the supplier shall follow the below described roadmap in the following order (See diagram 1 in Appendix): -

a) Certification of ISO 9001 through 3rd party audits (Minimum Requirement)
b) According to the risk assessment and the strategic importance of the supplier to ZKW, ZKW will initiate the following development milestones: -
   i. Compliance with MAQMSR through 2nd party audits, refer to CO_ZKW_MAQMSR_lead UP01.
   ii. Certification of IATF 16949 through 3rd party audits

1.1.2. As applicable as per 1.1.1.b, ZKW will provide support through 2nd party audits and development to support the supplier to ultimately get IATF 16949 certified.
1.1.3. The supplier is required to ensure that the sub-suppliers are also bound by this requirement (When applicable)
1.1.4. The supplier shall provide evidence of their certification by uploading a valid certificate to ARIBA. If the supplier failed to provide evidence of certification, ZKW holds the right to place the supplier "ON HOLD" from doing business with all ZKW sites and plants.
1.1.5. The supplier shall communicate to ZKW immediately when there is a change in their certification status, such as but not limited to: Revoked, on hold, withdrawn, ...etc.
1.1.6. Any deviation from this requirement shall be agreed with ZKW in writing in advance.

1.2 QMS

1.2.1 The supplier shall ensure that all processes in their QMS have been defined, also their inputs, outputs, KPIs and interfaces.
1.2.2 The supplier shall assess risks for each process, actions for prevention or mitigation of risks are defined.
1.2.3 Reviews of these risks and their actions shall be done regularly.
1.2.4 The supplier shall ensure that all resources required are available to perform the defined processes
1.2.5 In case of OEM customer specific requirement, the supplier shall provide evidence that these requirements are fulfilled and implemented.
1.2.6 The supplier shall ensure that ZKW is entitled to check the proof that the supplier has checked and is satisfied by the sub-supplier's QMS upon request
1.2.7 The supplier shall have Quality and Safety policies in their QMS
1.2.8 Supplier shall adhere to and pass down all applicable statutory and regulatory requirements to their sub-suppliers.
1.2.9 Supplier shall apply the legal requirements of the production location and of the country of use, when communicated by ZKW during development and/or production.

1.3 Confidentiality

1.3.1 Each contracting partner (ZKW & the Supplier) shall use the documents and knowledge received during the supplier-customer relationship in progress or already existing with the same level of care and confidentiality with respect to third parties that they would apply to their own documents and knowledge.

1.3.2 Specific projects related confidentiality requirements shall be agreed by non-disclosure agreements (NDA) between ZKW and the supplier

1.3.3 See ZKW general terms and conditions for purchase 23. Confidentiality

1.4 Audits

1.4.1 The supplier shall allow ZKW as well as ZKW's customers to conduct audits in order to validate whether the quality management system of the supplier meets ZKW's requirement. Following prior notification and an appropriate period, ZKW shall be entitled to conduct audits in form of potential analysis, system audits, process audits, supplier technical review and product audits. These audits may also include RUN@RATE and/or process sign off.

a) During potential analysis and process audits, supplier shall fulfil VDA6.3 requirements in addition to requirements described in this quality guidelines.

1.4.2 The supplier shall ensure that ZKW has full access in their premises, warehouse and production area as well as any area related to ZKW project or quality/logistics issues. Appropriate restrictions for safeguarding supplier's KNOW HOW will be considered. However, they must be communicated to ZKW prior to the audit.

1.4.3 Upon request or upon quality issues, supplier shall ensure that ZKW is able to audit the sub supplier premises.

1.4.4 ZKW will notify the Supplier of the result of any audits. Any subsequent measures necessary in ZKW's view were identified, the Supplier shall undertake immediately an action plan, implement this plan without delay, monitor it regarding its effectiveness, and notify ZKW of the results. ZKW holds the right to re-audit to validate the effectiveness of these actions.

1.4.5 In the following cases, ZKW holds the right to audit the supplier within a short notice period (case by case basis)

a) Major quality issue in serial production caused by the supplier
b) Warranty issues caused by the supplier
c) The supplier is not able to determine the root cause and/or effective countermeasure to a defect caused by the supplier and detected by ZKW and/or its customer.
d) Escalation by a ZKW site
e) ZKW's customer is requesting the audit

1.5 Complaints

1.5.1 In case ZKW (or its customer) detects a defect to a product delivered by the supplier, the supplier will be notified by the responsible ZKW plant according to normal business practice. 8D process shall be followed: -

Task	Timing	Responsible
Notify the supplier with the complaint (Test report). ZKW will ensure that the report includes all available information to support the supplier with the complaint investigation	As soon as a defect is detected	ZKW Plant
immediate identification of the required competent resources to handle the complaint	1 calendar day	Supplier
Implementation of immediate containment actions where the supplier ensures that their stock, the pipelines and ZKW's stock (when necessary, in this case the supplier shall identify sorting criteria and inform ZKW plant with them) are free of the defect and that defected part has been identified and quarantined. Supplier shall also include ZKW's customer during 0km complaints and warranty, or if the supplier sees a necessity. Supplier shall inform ZKW with the date of the first clean shipment and ensure it is marked for clear identification.	1 calendar day (3D report is required to be sent to ZKW	Supplier
Apply root cause analysis tools to identify the real root cause of occurrence and non-detection of the concern. Tools such as but not limited to (Ishikawa, 5-Whys, ...etc.) shall be used and included in the 8D report. In addition, Supplier can use other tools they see will benefit the investigation of the root cause. "Human error" shall be avoided as a root cause.	10 calendar days after receipt of parts (5D report is required to be sent to ZKW) MUST include liability decision	Supplier
Identify robust corrective actions that tackles the occurrence root cause and the non-detection root cause. Actions shall be directed to the system and/or process.		
Conduct PFMEA & Control plan review to include the identified corrective actions into them.		
Ensure the implementation and effectiveness of the corrective actions. This could be done by 100% inspection for a defined period and by running a rabbit to ensure the effectiveness of the corrective actions. Effectiveness is assessed for 30 calendar days after the implementation date of the main corrective action	15 calendar days after receipt of parts (8D report is required by ZKW) 30 Calendar days	Supplier
Ensure that effective corrective actions are implemented in similar production lines for different ZKW project/product (when applicable)	15 calendar days after receipt of parts (included in the 8D report)	Supplier

1.5.2 The deadlines mentioned in the above table can only be extended depending on case by case basis and only at the consent of ZKW.

1.5.3 The deadlines mentioned in the above table may be reduced to a reasonable period at ZKW request depending on the urgency of the complaint to ZKW and/or ZKW's customer.

1.5.4 Supplier shall inform ZKW plant with the appropriate action to be taken with the defected parts.

1.5.5 Return: ZKW plant will return the defected parts to the supplier at the supplier's costs

1.5.6 Scrap: ZKW will scrap the defected parts at the supplier's costs

1.5.7 Rework: the supplier shall provide clear rework instruction for the defected parts. The supplier shall bear the cost of the rework whether it is done by ZKW or an external provider (approved by ZKW). Supplier shall agree with ZKW in advance in case supplier's resources are used for the rework.

1.5.8 The supplier shall bear all costs arising from the complaint which includes but not limited to: (containment actions. Sorting, rework, scrap, logistic costs, laboratory costs, administrative costs, costs at ZKW customer, … etc.).

1.5.9 The Supplier shall have a defined process to handle warranty complaints which shall be according to VDA volume "Joint Quality management in the supply chain – Marketing and service – Field Failure Analysis", shall consider specific customer requirements and shall be approved by the ZKW. It is recommended that the person in charge of warranty complaints at the supplier is VDA FFA certified.

1.5.10 For detailed ZKW 8D report requirement supplier shall refer to: 8D Report Requirements Suppliers LP04

1.6 Information

1.6.1 The supplier shall provide to ZKW the contact details of the responsible persons for quality control, production, supply chain and project management. The supplier shall also describe the escalation path for each department. The supplier shall inform ZKW immediately with any change in these contact details, without further request from ZKW. ZKW holds the right to request the qualification and handover procedure to the new responsible person, also to request justification for the change in the contact person.

1.6.2 The supplier shall inform ZKW and disclose all necessary data and facts using the change request form which is available on ZKW website prior to the following: -

a) Change in production process / process flow
b) Change in materials
c) Change in a sub supplier
d) Change in location of production site and/or production cell location within the same site.
e) Change in inspection procedure
f) Change of tools

1.6.3 The supplier shall maintain a minimum of 3 months period between informing ZKW and implementing the change. Unless otherwise agreed with ZKW.

1.6.4 The supplier shall obtain ZKW approval before implementation of any of the changes mentioned above. ZKW holds the right to request documents, evidence that justify the reason for the change and to verify that the change will not cause a risk to ZKW. Refer 5.0 Change management

1.6.5 The first delivery to each ZKW site after the start of full production following one or more of the above-mentioned changes shall be identified clearly. ZKW holds the right to request a 100% inspection at the supplier's site to the first production batch following the change(s)

1.6.6 Supplier shall inform ZKW immediately should it come to the supplier's attention (after or before shipping products to ZKW) that the agreed requirements such as but not limited to quality aspects, deadlines, lead time, delivery time and supply quantities cannot be fulfilled. Supplier shall agree with ZKW on the temporary solution to this deviation and provide ZKW with an action plan to ensure that this deviation will not reoccur in the future.

1.6.7 Implementation of computer-aided design (CAD) shall be in accordance with the rules required by ZKW and taking into consideration customer-specific CAD specifications.

1.6.8 Provision of CAD data shall be in the respective data format requested by ZKW. If data must be converted

because the supplier uses a different data format, the supplier shall be responsible for the converted data being tested. Possible conversion errors shall be removed by the supplier.

1.6.9 CAD preparation of the required drawings shall be in accordance with ZKW standard and taking into consideration customer-specific drawing specifications.

1.6.10 Supplier shall conduct computer-aided analysis.

1.7 Archiving

1.7.1 Supplier shall follow the below minimum requirements, the minimum requirements set out above do not replace legal requirements. For reasons of product liability (statute of limitations), longer retention periods are recommended.

1.7.2 In case of OEM requirement, the supplier shall follow the requirement relevant to the OEM Archiving requirement

	Type of document	Start of retention period	Retention period
Specification	Documents from the product and process development phase as well as from the production phase of the delivered item e.g. process descriptions, control plans, statement of work, drawings or inspection instructions	after discontinuation of the product and spare parts demand or after modification of the document	15 years
Records	Records of the product and process development phase as well as for the production phase of the delivered product e.g. test charts, control cards, audit reports, reviews, evaluations	with delivery of the product which the records concerning product a referring process belong to	15 years
	Records and documents for process and product release (PPF, PPAP including reference samples	after discontinuation of the product and spare parts demand	15 years

1.8 Document Control

1.8.1 The supplier shall ensure that the procedures, work instructions and test instructions are controlled and traced to their creation date, modification date, creator, modified by and person in charge of releasing the documents into the QMS.

1.8.2 The supplier shall keep archives of outdated documents. **See table in 1.7 Archiving**

1.8.3 When updating live documents such as but not limited to PFMEA and control plans, the supplier shall archive the previous version of the document.

1.8.4 The supplier shall document reasons of updating each document

2.0 Project Management

2.1 Project management process in the QMS

2.1.1 The supplier shall define a process for project management clearly in their QMS

2.1.2 This process shall include at least general project phases, generic timing plans, method of risk assessment through the whole project life cycle, escalation path and generic forms that support the project team fulfill their tasks (example: feasibility study form, risk assessments, timing plan, gates reviews, ... etc.)

2.2 Feasibility Study

2.2.1 The supplier shall conduct a multi-disciplinary feasibility study for the project, ensuring to involve not only the project team members but also support functions team.

2.2.2 Feasibility study shall be conducted during MPP phase 1 (RFQ Phase), the result of the feasibility study shall be communicated to ZKW with justifications and/or action plan if necessary.

2.2.3 The supplier shall provide evidence of conformance in the feasibility study to the following as a minimum: -

a) Regulatory and statuary requirements
b) Quality targets
c) Milestones of timing plan are achievable
d) Availability of required technology
e) Availability of required resources, including but not limited to (competent resources, tools, space, ... etc.)
f) Logistics and packaging requirement
g) Special characteristics
h) Material availability
i) Cleanliness and ESD requirement (when required)
j) Capacity requirement
k) Design for manufacture confirmation
l) Lessons learned
m) OEM Requirements, when required by ZKW

2.3 Risk Assessment

2.3.1 Supplier shall perform risk assessment from the 1st phase, MPP phase 1 of the project through the project's life cycle.

2.3.2 Risk assessment shall be considered as a live document and reviewed during each regular project team meetings and milestones gate reviews and updated if required.

2.3.3 Risk assessment shall be conducted by a multi-disciplinary approach, taking into consideration all team members input.

2.3.4 Supplier shall define actions to eliminate or mitigate the risks defined and assign these actions to the relevant team member.

2.3.5 In case a risk is defined with high impact and high probability of occurrence, that jeopardize the integrity of the project, the supplier shall inform ZKW with the risk, actions in place and discuss alternatives if required.

2.3.6 ZKW holds the right to request the risk assessment from the supplier at any time.

2.3.7 Supplier shall define the form of the risk assessment; however, it shall require the following as a minimum: -

a) Risk identified
b) Risk consequences and severity
c) Probability of occurrence
d) Actions to mitigate
e) Responsible person
f) Actions due dates

2.4 Project leader and Project Team

2.4.1 The supplier shall assign a competent project leader to the project and provide evidence of competence to ZKW (certifications, trainings, experience, etc.) when required. supplier shall also ensure that the project leader assigned to ZKW project is not overloaded, i.e. supplier shall monitor the utilization of the competent project leaders and assign new projects to them accordingly.

2.4.2 Supplier shall also provide evidence that the project leader has become aware of this document (ZKW supplier quality guidelines) and provide evidence to ZKW when required

2.4.3 Supplier shall inform ZKW within 24 hours when the project leader is changed and provide evidence to ZKW of the handover planning and implementation to the new project leader.

2.4.4 Supplier shall define the project team and their deputies to perform the activities of the ZKW project, this definition shall include the interface between different supplier sites (remote locations and/or extension sites and/or outsourced processes, when applicable) and define clearly the role of each member at each site.

2.4.5 The supplier shall define the responsibilities and authorities of each project team member and define a clear escalation path.

2.4.6 ZKW holds the right to request evidence of qualification of project team members at the supplier at any time and supplier shall provide this evidence upon request without delay.

2.5 Resource planning

2.5.1 Supplier shall ensure that resources required to perform the activities along the project life cycle are planned and available with respect to the ZKW requirement, timing plan and contract agreed with ZKW.

2.5.2 Resources includes – but not limited to – technologies, facilities, human resources, logistic resources, machinery, tools, measuring equipment, ...etc.

2.5.3 Supplier shall review resource planning (such as but not limited to: equipment tracking, budget allocation, facility preparation, etc.) along the project phases and adjust whenever necessary, taking into consideration ZKW timing and quality requirements. Any adjustment that will affect the timing milestones provided by ZKW has to be agreed with ZKW in advance.

2.5.4 Supplier shall also review resource planning against the critical path in the project timing plan and include it in the critical path if necessary.

2.5.5 Supplier shall also include tools provided by ZKW in their resource planning, when applicable.

2.6 Project plan

2.6.1 Supplier shall implement detailed project timing plan with all activities of the project highlighted and progress can be monitored. Each activity shall be assigned to the relevant responsible person in the project team.

2.6.2 The supplier shall document KICK OFF meeting (internal and or with ZKW). The Kickoff meetings shall be carried out before the project starts with the objective that all requirements are available and understood by relevant project team members.

2.6.3 This project timing plan shall take into consideration ZKW requirements and project milestones mentioned in the nomination letter

2.6.4 The supplier shall implement a regular review to the project timing plan, this review shall include core team members, status of relevant activities are discussed, issues are highlighted, action plans are put in place and by the end of each phase, a milestone review shall be done and escalations are made when necessary. A status report shall be the output of each review, including closed actions, in progress actions, delayed actions with justifications and action plans, risk assessments, escalations, etc.

2.6.5 It is advised that the supplier uses a software program for the project timing plan such as Microsoft projects.

2.6.6 When changes are made to the project timing plan that may affect the ZKW provided milestones, the supplier shall inform ZKW with the change, reason for the change and discuss alternatives with ZKW and obtain ZKW approval for the change and highlight the changes in timing plan to be easily identified.

2.6.7 Supplier shall clearly highlight in the project timing plan the activities that form the critical path in the project timing plan. Any changes in the activities that are in the critical path of the timing plan shall be communicated to ZKW. Also, if a change integrates an activity that wasn't originally in the critical path, shall also be communicated to ZKW.

2.6.8 Supplier shall plan and confirm in the project timing plan that lesson learnt from previous projects will be taken into consideration in planning the project.

2.6.9 Supplier shall include the quality planning in the project timing plan for example but not limited to: PFMEA, Control Plan and process validation.

2.7 Advanced Product Quality Planning

2.7.1 Supplier shall follow the ZKW Monitoring Purchased Parts along with ZKW responsible team.

2.7.2 Depending on the result of the risk assessment, ZKW has performed to classify the supplier, the supplier shall provide/document evidence of completeness of each activity in the MPP. The status of each activity shall be highlighted with traffic light, green: Done, yellow: in progress, Red: delayed or open.

2.7.3 Supplier shall perform milestones reviews after each MPP phase and plan and implement an action plan to close any open issues, if any.

2.7.4 For ZKW projects, the supplier shall use traffic light view (green: Closed, Yellow: in progress, Red: blocked) to identify the status of each activity in each project phase

2.7.5 In case of open issues and respectively a not approved phase, an action plan shall be issued which includes at least:

a) Reason for non- completion
b) Action to be taken
c) Responsibility
d) Due date

2.8 Lesson Learnt

2.8.1 Supplier shall document lesson learnt after each phase of the project. This activity shall consider inputs from all project team members

2.8.2 For example: this documentation can include lesson learnt from dealing with a specific sub supplier of component or tool. It can also include lesson learnt in the product and/or process development.

2.8.3 Supplier shall review lesson learnt from previous project when starting a new project to ensure that all actions (lesson learnt) from previous projects are included and considered in this project.

3.0 Product Development

3.1 Manufacture Feasibility Study

3.1.1 Supplier shall conduct multidisciplinary manufacture feasibility study to ensure that the supplier is capable to consistently meet ZKW product, process requirement and capacity requirement

3.1.2 Supplier shall include the Design for Manufacturing in the manufacture feasibility study where the following shall be considered as a minimum: -

a) 100% Dimensional checks and tolerances
b) Performance requirement
c) Process adjustment
d) Material handling
e) Design sensitivity to manufacturing variations

3.1.3 Supplier shall apply this feasibility study to new products and processes as well as during changes to the existing ones, regardless of the cause. For example: this feasibility study is required during every design change

3.1.4 Supplier shall communicate this manufacture feasibility study to ZKW as a confirmation that the supplier agrees and confirm that they are capable of developing and producing the product according to ZKW requirements.

3.1.5 Supplier shall ensure that the selection of the measuring equipment and inspection method is relevant to the requirements and tolerances.

a) The selection of measuring equipment shall be according to VDA 5

3.1.6 ZKW ownership of design doesn't waive the supplier obligation to assess the manufacture feasibility.

3.2 DFMEA

3.2.1 Supplier shall conduct Design failure mode and effects analysis in accordance to AIAG FMEA 13 or VDA 4

a) Supplier may consider applying AIAG & VDA FMEA handbook when conducting the DFMEA

3.2.2 Supplier shall ensure that the DFMEA is conduct in a multidisciplinary approach including team members that are relevant to the DFMEA (example: Designers, process engineering, production, quality, product safety officers etc.). Supplier shall also consider ZKW's input in the DFMEA. ZKW holds the right to request attendance in the DFMEA meetings.

3.2.3 Supplier shall ensure that previous warranty complaints as well as lesson learnt from previous product development has been considered in the DFMEA

3.2.4 ZKW doesn't recommend a target for RPN, however actions must be put in the DFMEA in order to reduce the RPN, in the following cases: -

a) Severity is equal to or more than 9

iii. This shall be considered as special characteristics and a critical characteristic, and a design change shall be considered to eliminate the high severity. If a design change is not applicable, special controls shall be considered in the process development to prevent its occurrence during production.
iv. Such characteristics shall be highlighted in the DFMEA and drawing (when applicable) with ▽ when the special characteristics is relevant to function and OEM requirements, such as but not limited to leakage and fit for assembly.
v. Special characteristics that are related to legal requirements and product safety shall be highlighted with ⍒ In the DFMEA and drawing when applicable
vi. Supplier can use an equivalent symbol; however, it shall be communicated to ZKW.

b) Severity equals 5 - 8 AND occurrence equals to or more than 4
c) ZKW complaints (root cause was determined as a design issue)

3.2.5 Supplier shall ensure the implementation and effectiveness of actions taken in the DFMEA before the start of serial production and that the ratings in the DFMEA have been reviewed and updated

3.2.6 DFMEA shall be considered as a live document, supplier shall review the DFMEA and update it if necessary, in the minimum following cases: -

a) Design change
b) ZKW complaint (root cause was determined as a design issue)
c) Internal concerns detected by the supplier
d) It is advised that DFMEA is reviewed every 6 months to include further inputs from team members and update ratings if applicable.

3.2.7 Supplier shall document all changes that occurred on the DFMEA and keep a record of these changes and reasons.

3.2.8 DFMEA may identify new equipment/tools/facilities for the supplier to be able to meet ZKW's requirements, accordingly, the supplier shall review and update the project's timing plan in a manner that fulfills ZKW's timing requirement. If the timing plan will be affected in such a way that a ZKW milestone will not be achieved, the supplier shall agree with ZKW responsible team and obtain a written agreement from ZKW.

3.3 Design Verification and Validation

3.3.1 In case supplier is responsible for design, the supplier shall confirm that the design meets ZKW requirement

3.3.2 In case supplier is responsible for design, Supplier shall track design verification progress using Design Verification Plan & Report (DVP&R)

3.3.3 In case supplier is responsible for design, Supplier shall take into consideration gaps between their DVP&R and ZKW's and apply appropriate design changes that closes these gaps.

3.3.4 Supplier shall have a prototype program, where samples are prepared and functional and/or measurement reports are available and both samples and reports are provided to ZKW, according to ZKW project requirements: -

a) Supplier shall provide ZKW with deviation report in case of deviations and implement action plans to tackle these deviations.
b) ZKW may request changes to the design reference to the prototype samples ZKW receives from the supplier
c) Suppliers that are not responsible for the product development are still required to fulfil this point 3.3.4.

3.3.5 Supplier shall implement prototype PFMEA and control plan to the production area producing these samples.

3.3.6 After all changes derived from the verification and validation process, supplier shall update the design, DFMEA, the feasibility study and prepare a list of special characteristics. Supplier shall obtain ZKW approval when required.

4.0 Process Development

4.1 Requirements

4.1.1 Supplier shall consider the outputs, process requirement and actions defined during the project and product development during process development. For example: actions from DFMEA & PFMEA, special controls and/or measuring devices required in the production process.

4.1.2 Supplier shall take into consideration the capacity planning of the production process in order to ensure the fulfillment of ZKW demands/orders at the right time.

4.1.3 The supplier shall ensure that the cleanness and ESD requirement of the components and packaging are met and implemented in the PFMEA. Possible specifications by ZKW regarding technical cleanliness/surface cleanness such as but not limited to VDA 19 and ESD (such as but not limited to DIN IEC 61340) in drawings or supplementary agreements shall be met and guaranteed in the long-term by appropriate packaging.

4.2 Process Flow chart

4.2.1 Supplier shall illustrate all process required to produce the ZKW product in a process flow chart that starts with incoming of material from sub suppliers and ends with dispatch of finished goods to ZKW plant(s).

4.2.2 Supplier shall ensure that the process flow chart takes into consideration the output of the manufacturing feasibility, DFMEA, special characteristics and risk assessment. i.e. supply shall implement processes technologies and/or testing/inspection points in the process flow that are relevant to potential issues in the process defined in the above-mentioned documents.

4.2.3 Supplier shall include inspection in the process flow, whether it is done visually, using a gauge or automatically. Supplier shall also include rework in the process flow chart and clearly show the path of non-conforming products when identified till the decision is taken whether to rework or scrap them.

a) ZKW generally doesn't allow rework unless it is specifically agreed with ZKW
b) ZKW however doesn't allow repair to any product/component unless an approval was provided to the supplier in writing in certain cases. This approval shall be only temporary till the underlying root cause is resolved.

4.2.4 Supplier may use a generic PROCESS FLOW CHART for a family of products that have the same processes

4.2.5 Supplier shall highlight in the PROCESS FLOW CHART where special characteristics exists.

4.2.6 Supplier shall consider PROCESS FLOW CHART as a controlled document and document changes occurred on the PROCESS FLOW CHART with reasons.

4.2.7 The process flow shall be designed and implemented in a way that ensures that each process step can only be started only when the previous step has been successfully completed.

4.3 Process FMEA

4.3.1 Supplier shall conduct Process failure mode and effects analysis in accordance to AIAG FMEA 13 or VDA 4
- a) Supplier may consider applying AIAG & VDA FMEA handbook when conducting the PFMEA

4.3.2 Supplier shall ensure that the PFMEA is conduct in a multidisciplinary approach including team members that are relevant to the PFMEA (example: process engineering, production, quality, product safety officers etc.). Supplier shall also consider DFMEA and special characteristics identified in the DFMEA when conducting the PFMEA.

4.3.3 Supplier shall ensure that previous warranty complaints as well as lesson learnt from previous process development has been considered in the PFMEA

4.3.4 ZKW doesn't recommend a target for RPN, however actions must be put in the PFMEA in order to reduce the RPN, in the following cases: -
- a) Severity is equal to or more than 9
  - i. This shall be considered as special characteristics and a critical characteristic, and special controls shall be considered in the process development to prevent its occurrence during production.
  - ii. Such characteristics shall be highlighted in the PFMEA, Control plan and work instructions with ▽ when the special characteristics is relevant to function and OEM requirements, such as but not limited to leakage and fit for assembly.
  - iii. Special characteristics that are related to legal requirements and product safety shall be highlighted with ⓥ in the PFMEA, Control plan and work instructions
  - iv. supplier can use an equivalent symbol; however, it shall be communicated to ZKW.
  - v. Supplier shall communicate a list of special characteristics to ZKW
- b) Severity equals 5 - 8 AND occurrence equals to or more than 4
- c) ZKW complaints

4.3.5 PFMEA shall be conducted before the start of production during MPP Phase 3

4.3.6 PFMEA shall be considered as a live document, supplier shall review the PFMEA and update it if necessary, in the minimum following cases: -
- a) Design change
- b) Process change
- c) ZKW complaint
- d) Internal concerns detected by the supplier
- e) PFMEA shall be reviewed every 6 months, unless otherwise agreed with ZKW, to include further inputs from team members and update ratings if applicable.

4.3.7 Supplier shall document all changes that occurred on the PFMEA and keep a record of these changes and reasons.

4.4 Control Plan

4.4.1 Supplier shall implement the control plan as per the Advanced Product Quality planning and control plan second edition

4.4.2 Pre-Launch control plan
- a) Supplier shall implement a pre-launch control plan where the dimensional measurement, material and functional test that will occur after the prototype but before the full series production are described. The pre-launch control plan shall include additional controls that will

be implemented until the process in validated. This is to control potential non-conformities that might occur during or prior to initial production run. For example: This could be achieved by implementing more frequent inspection.

4.4.3 Series Control plan

a) Supplier shall implement a series control plan that systematically provide a structured approach of value-added controls for the production process.
b) Supplier shall consider the DFMEA, PFMEA, special characteristics and PROCESS FLOW CHART when implementing the control plan.
c) Supplier shall include all tools, machines and measuring equipment used in each process step in the series control plan.
   i. Supplier shall ensure that the selection of the measuring equipment and inspection method is relevant to the actions defined in the PFMEA and relevant to the tolerance and specifications of the underlying characteristic.
d) Supplier shall ensure the alignment between PROCESS FLOW CHART, PFMEA and control plan in terms of process steps and controls. PROCESS FLOW CHART, PFMEA and control plan shall include all processes starting from the incoming of materials till the dispatch of products to ZKW. A cross reference numbering shall be assigned to all these applicable documents.
e) Supplier shall ensure that special characteristics defined in the DFMEA and PFMEA are highlighted in the cross-ponding characteristic in the control plan using the same symbol. See 4.3.4
f) Supplier shall consider process and product characteristics as well as process characteristics in the control plan.
g) Supplier shall include a reaction plan in the control plan. This reaction plan shall clearly define the immediate action to be taken when the process produces a non-conforming product and clearly characterize which failures can be reworked and which shall be scrapped.

4.4.4 Supplier shall consider the control plan as a live document where it is reviewed and updated if necessary, in the minimum following cases: -

a) Design change
b) Process change
c) Inspection method change
d) ZKW complaint
e) Internal concerns detected by the supplier
f) Control plan shall be reviewed every 6 months, unless otherwise agreed with ZKW, to include further inputs from team members and it is advisable that is reviewed and updated with the PFMEA

4.4.5 Supplier shall consider product audit and requalification in the control plan

4.4.6 Supplier shall document all changes that occurred on the control plan and keep a record of these changes and reasons.

4.5 Process instructions

4.5.1 The supplier shall ensure that the process instruction provide clear sufficient understanding and details for all personnel with direct responsibility to the process, the process instruction shall take into consideration the characteristics, failures and acceptance and rejection criteria defined in the following sources as a minimum: -

a) DFMEA
b) PFMEA
c) Control plan
d) Drawings, Material specifications
e) PROCESS FLOW CHART
f) Process parameters
g) Packing standards
h) Supplier's experience and knowledge of the process
i) Handling requirement

4.5.2 The process instruction shall include – but not limited to – operating procedures, set-up parameters, 1st off procedures, machine speeds, feeds, cycle times and machine and tools to be used in the process

4.5.3 The process instruction shall be available in a designated area in the production area where operators and supervisors have easy access to them.

4.6 Process Validation

4.6.1 Supplier shall ensure that the monitoring, measuring devices, measuring methods and operator training to use these devices are checked using measuring system analysis.

a) Supplier shall ensure that the resolution of the measuring device is less than or equal 5% of the tolerance range intended to be measured
b) For variable characteristics:
Study 1 C_g and C_{gk} ≥ 1.33
Study 2 %GRR ≤ 10% is required, in case 10 % ≤ %GRR ≤ 30% is conditionally approved depending on the application and shall be agreed with ZKW.
c) For attribute characteristics: Kappa ≥ 0.8
d) Supplier shall ensure that all characteristics mentioned in the control plan had been checked using MSA before the significant production run.

4.6.2 Supplier shall perform process capability studies on characteristics identified in the control plan with classification of special characteristics whether identified by ZKW or internally by the supplier. And for other characteristics when required.

a) ZKW requires Machine capability index, short-term analysis Cmk ≥ 1.67, Preliminary process capability index P_{pk} ≥ 1.67 and Process capability index, long-term analysis capability index C_{pk} ≥ 1.33
b) If the above-mentioned minimum capability studies requirement cannot be fulfilled, the supplier shall implement a 100% testing/inspection for this characteristic and study the applicability of improving the process to be able to meet the minimum capability process requirement.

4.6.3 Supplier shall perform Production process approval (PPA)to ensure that the results of the actual production process complies with ZKW requirements with regards to stable quality and corresponds with the actual tooling, equipment, capacity and personnel trainings i.e. PPA will ensure that the actual production process was developed as planned.

a) Supplier shall perform PPA in the following minimum cases: -
i. Introduction of new products whether in a new production line or a current one
ii. Introduction of new technologies, new machines and/or equipment
iii. Introduction and/or transfer to a new production plant/site

iv. After re-start of production following an emergency in the production
v. After restart of production following a one-year pause.

b) Supplier shall apply PPA under series conditions
c) Supplier shall include the following evidences in the PPA as a minimum: -
   i. Production line can produce the correct quantities with no defects with the available personnel and machine capability
   ii. Evaluation of packaging, storage racks/containers and transportation methods that they are suitable for the product and protect it from damage, handling and environmental factors
d) Supplier shall document the PPA process and keep records for the following as a minimum: -
   i. PROCESS FLOW CHART
   ii. Result of production capacity (R@R)
   iii. 100% testing/inspection reports of produced parts
   iv. Results of implementing Cleanness requirement (if applicable). This could be illustrated by laboratory reports and/or 5S audit results. ZKW holds the right to request cleanness report as applicable for the part produced by the supplier.
e) Supplier shall evaluate the PPA process as OK, open or NOK.
   i. OK: PPA results are OK reference to PPA and ZKW requirements, no further action needed
   ii. Open: minor deviations were found in the production process such as but not limited to despite 0 defects, but it was found that production equipment didn't fulfill the required capacity, or incomplete or missing work instruction was detected in the production area. In this case, corrective actions are defined with responsible person and due dates.
   iii. NOK: PPA showed major deviation such as but not limited to Cpk values less than 1.33 or 100% testing/inspection detected quality defects, the whole process development process needs to be considered. Supplier shall implement corrective actions to resolve these deviations in a timely manner. In this case, the verification of these action is done by a new PPA process.
   iv. In case of open or NOK result of PPA, supplier shall review and update PFMEA and series control plan with the corrective actions defined in the PPA.

4.6.4 Supplier shall validate the production testing used to ensure that the products produced from the production process are according to the specification. This validation may be done using OK & NOK master samples.

4.6.5 Supplier shall perform a significant production run for the whole production line, using the production tools, machine, equipment, measuring devices, facility and production operators (the same operators who will run the mass production). This significant production run shall be from 1 hour to eight hours of production, and with the specific production quantity of a total of minimum of 300 consecutive parts unless otherwise agreed with ZKW, the supplier shall prepare a dimensional/functional report for at least 5 samples per tool and/or production line produced during this significant production run. This dimensional/functional report shall be part of the PPAP that will be submitted to ZKW. The supplier shall keep a master sample produced from this production run.

4.6.6 Supplier shall ensure that the packaging of the products is evaluated regarding the protection from damage of the product and dirt during normal transportation and environmental factors. Even if ZKW specify the packaging, the supplier is still obligated to evaluate the packaging. Supplier shall report to ZKW the use of harmful material with potential impact to the planned application and obtain ZKW's approval.

4.6.7 Suppler shall take into consideration outputs and results of the process validation and update the series control plan and all relevant documents. Supplier shall ensure that the set-up parameters, tool setting, machines and relevant characteristics are checked during normal production by performing 1st off samples

that are assessed before the production starts. Triggers for performing these 1st off sampling includes but not limited to: start of production, change over, maintenance or repair of machine/tool and material change. The frequency and sample size shall be defined by the supplier where middle and last off samples may also be required.

4.6.8 Supplier shall have a documented process to sign off the production process and give the "OK to start". ZKW holds the right to audit the process sign off before the start of series production or afterwards.

4.6.9 Supplier shall implement and monitor 5S in the production area

4.6.10 The supplier shall provide ZKW with evidences (product and process) that the customer requirements are fulfilled. Sampling shall be in accordance with VDA volume 2 PPA or AIAG PPAP level 3. Unless otherwise required by ZKW SQA

4.6.11 The supplier shall include IMDS number for each part supplied to ZKW within its PPAP or PPA in the following cases: -

a) During the initial sampling
b) After every change
c) During requalification
d) If requested by ZKW at any time

4.6.12 Supplier shall submit PPAP and/or PPA in English language

4.7 Production Scheduling

4.7.1 The supplier shall have a process of scheduling the production in order to meet ZKW demands/orders and deliver the right quantity at the right time to ZKW plant. Supplier shall take into consideration while scheduling the production the following as a minimum: -

a) ZKW orders
b) Sub suppliers' deliveries and lead times
c) Production capacity
d) Material inventory

5.0 Change Management

5.1.1 The supplier shall have a documented process to control changes occurring in the production and/or product whether initiated by ZKW or by the supplier or by a sub supplier.

5.1.2 In case of ZKW requesting the change, the supplier shall review and respond to ZKW with the feasibility study of this change within a period agreed with ZKW from receiving the change request from ZKW. In urgent cases, ZKW holds the right to request a response in a short timeframe

5.1.3 The supplier shall implement feasibility study requirement defined in 2.2 Feasibility Study for every change.

5.1.4 The supplier shall also perform a risk assessment for the change, especially for the product, process and deliveries to ZKW

5.1.5 The supplier shall define the verification and validation activities to ensure that the change will be implemented effectively.

5.1.6 The supplier shall validate each change before implementation

5.1.7 The supplier shall obtain ZKW approval prior to implementing the change

5.1.8 The supplier shall plan the implementation activities to ensure that the change is implemented effectively according to the timeframe required by ZKW

a) In some cases when the change is massive and requires many activities or big ones, the supplier shall plan the activities of the change in a project plan.

5.1.9 After implementing the change, the supplier shall ensure that verification and validation activities were performed and that all ZKW requirement are met such as production trial run and new production validation

5.1.10 When required by ZKW, the supplier shall perform a new PPAP and PPA

5.1.11 The supplier shall inform ZKW with the first delivery where the change is implemented (LOT number, quantity) and highlight the first batch of the production where the change was implemented with change triangle to ensure easier identification at ZKW site.

6.0 Verifying external provided products and services

6.1.1 The supplier shall have a defined procedure defining criteria according to the control plan for incoming inspection of products received from sub supplier

6.1.2 Incoming inspection shall be performed based on defined sample size and frequency identified in the control plan, using of skip lot procedure is allowed, ideally according to ISO DIN 2859. It shall be performed by trained inspectors using appropriate tools and measuring equipment verified to be capable of inspecting the products. See 4.6 Process Validation

6.1.3 All incoming inspection results shall be documented and the recorded shall include all measurements of all samples inspected. The records shall include as a minimum the following: -

a) Inspector performed the inspection
b) Quantity and date of the shipment and shipment number (delivery note) inspected
c) Sub supplier name and code
d) Number of samples taken
e) Results of inspection for both attribute and variable characteristics
f) Evidence of COC if available
g) The parts inspected shall be stamped or marked in a way to show that they have passed the inspection process as OK parts and shall include data about the inspector. The supplier shall also implement preventive actions to prevent uninspected parts from bypassing the inspection process and entering the production process.

6.1.4 In case the supplier depends on the results and/or control of the sub supplier, the supplier shall receive a COC with every shipment from the sub supplier which includes the results of the characteristics inspected and controlled by the sub supplier. The supplier shall ensure that the sub supplier is capable to perform such inspections, this could be done by ensuring that the PPAP of the sub supplier contains the controls the sub supplier is performing. In addition, the supplier shall verify the results of the sub supplier at least once annually whether internally at the supplier if the technologies are available or by an accredited third party.

6.1.5 The supplier shall also have defined criteria for evaluating the processes done by a service provider in case of outsourced process and shall ensure that the service provider is implementing ZKW requirements. The supplier shall verify the outsourced processes for compliance with ZKW requirements.

6.2 Approval of sub supplier

6.2.1 The supplier shall ensure that the personnel in charge of approving the sub supplier PPAP are competent and understand the PPAP requirements according to VDA 2 and AIAG. Supplier shall be able to provide ZKW with training evidence upon request

6.2.2 Unless otherwise specified by ZKW, the supplier shall define for their sub suppliers the PPAP level required

6.2.3 The supplier shall request requalification from their sub supplier at least once annually. This requalification shall include at a minimum the following in addition to OEM And project requirements: -

a) Dimensional report
b) Material performance test

6.2.4 ZKW holds the right to request the PPAP and/or the requalification of a component received by the supplier from their sub suppliers

7.0 Controlling sub supplier's

7.1 Sub supplier selections

7.1.1 The supplier shall select their sub suppliers based on the following criteria as a minimum: -

a) The sub supplier is at least ISO9001 certified, it is recommended to select sub suppliers that are IATF 16949 certified
b) The supplier shall access the sub suppliers prior to nomination. Ideally, potential analysis based on VDA 6.3 is recommended.
c) The decision to select a sub supplier shall be made in a multi-disciplinary risk assessment approach taking into consideration other relevant aspects such as but not limited to business volume, price, financial stability, availability of resources, availability of technologies, logistic routes and manufacturing capabilities.
d) The supplier shall only use the sub suppliers directed by ZKW, when applicable.

7.1.2 Sub supplier Monitoring

a) The supplier shall have a clearly defined process on how to monitor the sub supplier.
b) The supplier shall agree with each sub suppliers on the targets and KPIs they will be scored upon and evaluate the sub supplier based on these targets. Different targets to different sub suppliers are possible according to volume, technology, history, etc.
c) At a minimum, sub suppliers shall be evaluated every 6 months.
d) The sub supplier evaluation shall be based on criteria and scoring system to determine the performance of the sub supplier. These criteria shall include at minimum the following: -
   i. Quality performance (PPM & number of complaints), different scoring assigned to different quality issues based on where it was detected. For example, At ZKW site is scored higher than at incoming inspection at the supplier.
   ii. Delivery performance could be measured by OTIF, on time in full, number of bottleneck notifications from sub supplier, incidents of production stoppage at the supplier and/or at ZKW.
e) Based on the evaluation of each sub supplier, the supplier shall take necessary actions in terms of developing the sub supplier to improve their performance in the next evaluation. Official action plans shall be put in place and monitored regularly for implementation and effectiveness.
f) The supplier shall also consider the output of the sub supplier monitoring in the planning of the sub suppliers' audits.
g) The supplier shall have in place a detailed escalation process when a sub supplier evaluation is

below the criteria and/or when the sub supplier's performance is not improving after implementing corrective actions. Escalation to ZKW shall be considered when the sub supplier was directed by ZKW.

h) The supplier shall include service suppliers, such as calibration services, logistics service suppliers, sorting and rework services in this requirement

8.0 Preservation

8.1.1 The supplier shall ensure that all incoming parts are identified. This identification shall include at least the following: -

a) Part number
b) Supplier name and code
c) Quantity
d) Receiving date
e) Inspection status (inspected, waiting inspection, not required, etc.)
f) Current status (OK, NOK, suspected, etc.)
g) Expiry date (if applicable)

8.1.2 The supplier shall ensure the implementation of FIFO (First In First Out) in their warehouses and production lines. This is to ensure that parts received first from the sub supplier are introduced first to the production. The same principle shall be implemented in the finished parts warehouse with outgoing parts being sent to ZKW sites. Ideally, an automatic method using an ERP system is recommended.

8.1.3 The supplier shall ensure that the parts are stored according to their storage conditions defined by the sub-supplier and/or customer. In all cases, parts shall be at all time protected from damage, contamination and dust. The supplier shall ensure the availability of calibrated equipment that monitor the conditions where parts are being stored. For example: temperature and humidity measurement devices. Also, the supplier shall define in the control plan the frequency where the storage conditions are checked. Supplier shall keep records of these checks.

8.1.4 The supplier shall ensure that warehouse personnel are aware of different material storage conditions and include the storage conditions in the work instructions in different warehouses.

8.1.5 The supplier shall implement a process for monitoring and handling of parts that have an expiry date (shelf life). The supplier shall ensure that the shelf life stated in the material data sheet are respected and monitored

8.1.6 The supplier shall implement 5S and ensure that personnel are trained on 5S and a process is in place to monitor the compliance with 5S and its effectiveness. The supplier shall ensure that the cleanness of parts, workplace and warehouses, etc. Also, the supplier shall implement specific ZKW cleanness requirement mentioned in the project documents, nomination letter and/or drawings.

8.1.7 The supplier shall implement a traceability system that is able to trace back a component from the final goods to the batch number received from the sub-supplier.

8.1.8 The supplier shall ensure the availability of safety stock for incoming material that will secure their production and ensure continuous flow of parts to ZKW. Also, the supplier shall have a safety stock of 2 weeks for finished parts delivered to ZKW sites, unless otherwise agreed with ZKW.

8.1.9 For logistic requirements, supplier shall comply with ZKW logistics guidelines.

9.0 Environment and safety

9.1.1 The supplier shall ensure that statuary regulation reference to all countries the supplier is operational regarding protection of health, safety and environmental aspects. The supplier shall have an HSE policy where it is communicated and understood by all employee of the supplier.

9.1.2 The supplier shall have safety targets such as but not limited to number of incidents. Action plan shall be implemented for each incident and communicated for all levels of employee at the supplier.

9.1.3 The risk assessment which is to be carried out in the course of the RFI phase of new projects shall consider the following as a minimum relevant to environment and safety: -

a) A description of the risk
b) The severity of the risk
c) The probability of occurrence
d) The impact on environment and safety
e) The respective action to mitigate
f) The respective costs
g) A responsible person for the actions' implementation
h) The respective due date of the action to be implemented

9.1.4 The supplier shall be guided by ISO 14001 and ISO 45001 when dealing with safety and environmental issues. Ideally, the supplier should be certified ISO 14001 and ISO 45001

9.1.5 Upon ZKW's request, supplier shall submit recycling and disposal concepts appropriate for their products.

9.1.6 Supplier shall submit safety data sheets for materials and mixtures as per the united nation's globally harmonized system (GHS) of classification and labelling of chemicals and the European classification, labelling and packaging (CLP) regulation

9.1.7 Supplier shall implement improvement actions to lower their CO_2 emissions

9.1.8 Supplier may issue a sustainability report to communicate their performance and impact on environmental, social and governance matters.

10.0 Emergency Plan

10.1.1 The supplier shall have an emergency plan based on assessed risks that might affect the continuous production output and/or ZKW's requirement.

10.1.2 The emergency plan shall include as minimum the following aspects: -

a) natural disaster
b) failure of key equipment
c) failures at sub suppliers
d) Energy failures
e) Environmental issues
f) IT systems failure
g) Labor shortage
h) Infrastructure disruptions

10.1.3 The supplier shall define actions with responsible person for each aspect in the emergency plan depending on the risk evaluation of each aspect.

10.1.4 The supplier shall have a frequent testing of actions mentioned in the emergency plan, examples (fire drills, Cyber-attacks, simulation of emergency when applicable etc.)

10.1.5 The supplier shall review the emergency plan in a multi-disciplinary approach including top management.

10.1.6 The emergency plan shall be reviewed at least once annually and shall be reviewed during the management review

10.1.7 The supplier shall have in place a notification procedure to ZKW when an emergency occurs that might disturb the supply of products to ZKW and/or affects their conforming to requirements.

10.1.8 The supplier shall have a validation process in place when returning back to normal operation after the emergency is cleared.

11.0 Competence

11.1.1 The supplier shall ensure that their personnel are competent according to each cross-ponding job profile.

11.1.2 The supplier shall ensure that each personnel receives the required training to qualify them to be able to perform their tasks according to the job profile and process model effectively and efficient.

11.1.3 The supplier shall determine key processes that require frequent training and evaluation

11.1.4 The supplier shall define criteria for the frequency and content for retraining and evaluation of personnel.

11.1.5 Test personnel and inspector shall be aware of the latest quality issues and customer concerns and are trained on how to differentiate between OK and NOK parts. See 4.6 Process Validation

11.1.6 Reworkers shall be evaluated at least every 6 months by a practical evaluation

11.1.7 The supplier shall define tasks, responsibilities and authority for each personnel.

a) The supplier shall ensure that personnel who has the authority to stop the production line in case of a failure is available at every shift.

11.1.8 The supplier shall evaluate the training provided for each personnel to monitor how effective it was and if retraining is required. This applies to internal and external trainings provided.

11.1.9 Supplier shall ensure the following with regards to their internal auditors (system, process and product auditors)

a) Trained according to ISO 19011
b) 1st party system auditors shall be
   i. trained and qualified according to IATF 16949
   ii. Preferably, has experience in quality management
   iii. has participated in at least 3 audits as an observer before being assigned with system audits
   iv. has performed at least 1 system audit per audit year
   v. has discipline specific knowledge of system requirements and principles
   vi. has knowledge of core tools and risk management principles and understands the interaction between different system process models
c) 1st party process auditors shall be
   i. Trained and qualified according to VDA 6.3
   ii. According to OEM requirements 1st party process auditors may be required to be certified VDA 6.3 auditors
   iii. Preferably, has experience in quality management
   iv. has participated in at least 3 audits as an observer before being assigned with process audits
   v. has at least performed 1 process audit per audit year
   vi. has discipline specific knowledge of process requirements and principles
   vii. has experience in the production processes being audited
   viii. has knowledge of core tools and risk management principles
d) Product auditors
   i. Trained according to VDA 6.5

ii. has participated in at least 3 audits as an observer before being assigned with product audits
iii. has performed at least 1 product audit per audit year
iv. has discipline specific knowledge of process requirements and principles
v. Trained to use different measurement equipment
vi. Has knowledge of customer specific requirements and special characteristics
vii. has knowledge of core tools and risk management principles

e) 2nd party process auditors shall be
i. Trained and qualified according to VDA 6.3
ii. According to OEM requirements 2nd party process auditors may be required to be certified VDA 6.3 auditors
iii. Preferably, has experience in quality management
iv. has participated in at least 3 audits as an observer before being assigned with supplier process audits
v. has performed at least 1 supplier process audit per audit year
vi. has discipline specific knowledge of process requirements and principles
vii. has technical competence in the production processes being audited
viii. has knowledge of core tools and risk management principles

12.0 Product safety

12.1.1 The supplier shall have evidence of qualification of the product safety officer assigned to ZKW products.
a) ZKW holds the right to request certification of the product safety office with PSCR, VDA QMC, depending on the project and ZKW's customer.

12.1.2 The supplier shall ensure that the product safety officer is part of the DFMEA and PFMEA teams and will communicate product safety characteristics to ZKW, when requested.

12.1.3 Product Safety Officer shall be available and announced to ZKW

12.1.4 Product safety activities shall be defined over the entire product lifecycle including interfaces to sub suppliers

12.1.5 Related to concerned commodities (mechatronics, electronics) a clear process based on ISO 26262 shall be implemented as well as a person in charge (functional safety manager) shall be nominated.

12.1.6 In the course of the RFQ phase requirements concerning Product safety shall be evaluated as well as characteristics relevant for product and functional safety shall be determined within the feasibility study.

12.1.7 Based on the results of the feasibility study a safety concept shall be established and shall be integrated into the FMEA either as a part of it or as a separate FMEA.

12.1.8 As a result of the FMEA a product safety test plan shall be derived.

13.0 ZKW Property

13.1.1 In case the supplier uses ZKW and/or OEM property for production such as but not limited to: Mold tools and/or packaging materials, the supplier shall implement the following: -
a) ZKW/OEM property are clearly tagged with the property tag stating that this item is a ZKW/OEM property.
b) ZKW/OEM property are stored and handled in a way that prevent them from getting damaged and/or stolen, hence ZKW/OEM properties shall be stored in a secure location
c) The supplier shall inform ZKW immediately when a ZKW/OEM property is damaged or no longer usable.

d) According to the agreement with ZKW, the supplier shall be responsible for the maintenance of ZKW/OEM property if applicable. ZKW holds the right to request the maintenance records of the ZKW/OEM property at any time.
e) In case ZKW/OEM property is at the sub-supplier premises, the supplier shall ensure that all the above-mentioned requirements in 13.1.1 are implemented at the sub-supplier.

14.0 Calibration

14.1.1 The supplier shall ensure that the all measuring equipment needed to provide compliance with internal and customer requirement are: -

a) Identified by a unique serial number for each equipment
b) Calibrated at a defined frequency against international standards, if applicable
c) Highlighted with status
   i. Ready for use (in calibration)
   ii. Out of calibration
   iii. Damaged
d) Due date for next calibration
e) Safeguarded against manipulation, adjustments that may alter the calibration status

14.1.2 The supplier shall record all readings taken during internal calibration, including readings that are out of specifications that indicates that the device is out of calibration

14.1.3 In case a measuring equipment fails during calibration, the supplier shall perform containment actions for all products that were measured with this device and assess the risk of using these parts at ZKW site. If the supplier suspects that defective parts have already been shipped to ZKW, the supplier shall inform the ZKW site with the information including LOT numbers and quantities suspected.

14.1.4 After calibration, the measuring equipment shall be labelled with the status of the calibration

14.1.5 The supplier shall keep records of all calibration activities and certificates

14.1.6 The supplier shall have a defined scope for calibration activities performed at the supplier which shall include at a minimum: -

a) Services provided
b) Competence of calibration personnel
c) Range of calibration available
d) List of equipment and their Resolution used for calibration
e) Permissible error for each calibration activity

14.1.7 In case the supplier uses a third part for the calibration service, the supplier shall only use certified service providers according to the national accreditation and/or ISO /IEC 17025

14.1.8 The supplier shall implement an alarm system that monitor the status of the calibration of measuring equipment and alerts the user to send the equipment for calibration.

14.1.9 The supplier shall ensure the availability of calibrated spare equipment in case the calibration will take time so that it doesn't disturb the production

15.0 Maintenance

15.1.1 The supplier shall identify all machines and equipment that require maintenance in order to keep producing conforming products. The supplier shall also classify the machines and defined critical machines for production.

The supplier is responsible for defining criteria for this classification.

15.1.2 The supplier shall implement a maintenance plan for all machines and equipment required for production. The maintenance plan shall be defined whether it is daily, weekly, monthly or annually. It is recommended that a software is used for the maintenance plan. This ensures easier planning and availability of analysis and monitoring of maintenance activities.

15.1.3 The supplier can delegate some of the daily maintenance plan to the operator according to work instructions and trainings.

15.1.4 The supplier shall ensure the availability of spare parts and equipment required to perform the maintenance

a) Machines classified as "Critical" their spare parts inventory shall not be less than 1 part at any time.

15.1.5 The supplier shall ensure that the spare part warehouse including warehouses where maintenance tools are stored follow the same requirements in 8.0 Preservation

15.1.6 The supplier shall keep records of all maintenance activities, these records shall include as a minimum the following: -

a) Job order
b) Date
c) Planned or unplanned maintenance
d) Maintenance technician performing the activities
e) Checklist of activities required to complete the maintenance
f) Records of spare parts changed
g) Time taken to perform the maintenance

15.1.7 The supplier shall perform 1st off after the machines are released from maintenance to ensure effectiveness. This shall be defined in the control plan.

15.1.8 The supplier shall monitor the performance of machines and equipment and review the maintenance plan accordingly.

a) This monitoring can be done using the following indicators: -
   i. OEE
   ii. Mean time between failures
   iii. Mean time to repair
   iv. Tool lifetime

15.1.9 In case of unplanned failure of machines, the supplier shall investigate the root cause of the failure and defined corrective actions to prevent the root cause from reoccurring, update the maintenance plan if required and replicate the corrective actions to similar machines when applicable.

15.1.10 The supplier shall also monitor the response time of the maintenance team and define targets for the response time to ensure that production is resumed as soon as possible.

15.1.11 The supplier shall ensure that all maintenance technicians are trained to perform each activity defined for the maintenance

15.1.12 The supplier shall have a personnel plan that ensures the availability of maintenance technicians in all production shifts

16.0 Monitoring & Data Analysis

16.1.1 The supplier shall define KPIs to monitor the performance of all QMS processes for effectiveness and efficiency

16.1.2 The supplier shall set targets for these KPIs and review the targets on annual basis. The supplier shall consider

that fulfilling the KPIs target will also fulfill the customer's target, if any.

16.1.3 The supplier shall monitor the KPIs on a monthly basis and define actions in case a target is not met. These actions shall be verified for implementation by the process owner and verified for effectiveness the following evaluation to ensure that the target is met.

16.1.4 Supplier's top management shall monitor and evaluate the KPIs at least once in the management review

16.1.5 The supplier shall ensure that the quality and process parameters at the production line are recorded against a target value and considered in the QMS processes KPIs

16.1.6 These recorded parameters shall be analyzed, and improvement actions shall be defined.

16.1.7 The following tools can be used for this analysis: -

a) SPC
b) Pareto
c) Cause and Effect diagram
d) QRQC
e) PFMEA
f) Reverse FMEA

16.1.8 Improvement actions shall be reflected in the PROCESS FLOW CHART, PFMEA and control plan when applicable

16.1.9 The supplier shall also set and evaluate KPIs for intracompany transactions and apply the same requirements mentioned above.

16.1.10 The supplier shall monitor ZKW satisfaction by the following: -

i. monitoring and analyzing the performance evaluation letter sent by ZKW (Supplier Rating) In case of supplier evaluated by ZKW is B or C, the supplier shall submit an action plan and ensure its implementation
ii. monitoring and analyzing key project KPIs mentioned in the nomination letter. In case of out of target KPI, the supplier shall implement an action plan to improve the KPI(s)

17.0 Internal Audits

17.1.1 The supplier shall have an annual audit program where system, process and product audits are planned with defined strategy and focus points

17.1.2 The supplier shall perform at least 1 system audit per year covering all processes in the QMS

17.1.3 The supplier shall perform internal process audit based on VDA 6.3 considering relevant process elements evaluated over all shifts.

17.1.4 The supplier shall at least audit ZKW project each audit year. ZKW holds the right to define which project the supplier shall audit internally.

17.1.5 The supplier shall perform product audit based on VDA 6.5. The supplier shall ensure that special characteristics are considered in the product audit.

17.1.6 The product audits shall be planned annually where all ZKW products shall be audited in a single audit year. if, due to large number of ZKW projects at the supplier exist, the supplier can plan the ZKW product audit based on family of products.

17.1.7 The content and frequency of product audits shall be recorded in the respective control plans. ZKW holds the right to define the frequency of product audits in case of - but not limited to: quality concerns and/or after process and/or product changes

17.1.8 Internal audits shall be closed only when root cause analysis is performed, action plan is defined and implemented and rated for effectiveness. The evidence of the effectiveness of the measures derived from the

root cause analysis shall be provided by the person responsible for the process. In case of major nonconformity, the supplier shall inform ZKW immediately with the major nonconformity.

17.1.9 The supplier shall analyze the internal and external audit reports annually and define weaknesses, threats and repeated findings and ensure they are included in next year's internal audit program to verify actions taken for effectiveness

17.1.10 Based on the control plan (it is coordinated with ZKW until the serial production process) the supplier shall conduct requalification inspections. This shall be arranged with ZKW

17.1.11 and conducted at least once per year. In the context of these re-qualification inspections and after requesting by ZKW, the supplier shall e-mail the results in form of a summarizing report to the supplied ZKW plant within 24 hours (one calendar day).

17.1.12 If not otherwise concerted corresponds the scope of the requalification inspection to the scope of the initial part approval. if the re-qualification result is deviating from its specification then this shall be announced to ZKW through the supplier actively.

18.0 Handling non-conforming products

18.1.1 The supplier shall have a clearly defined procedure that regulates the handling of non-conforming products, whether in the warehouse (before production line), during production and at finished goods warehouse.

18.1.2 Suspected and NOK parts shall be quarantined and secured in a quarantine room and labelled as NOK parts. ERP system control is allowed as long as it conforms with the following requirement in **18.1.13**

18.1.3 The quarantine room shall have the following requirement as a minimum: -

a) Secured from unauthorized access
b) Current stock inside the quarantine room is up to date
c) Storage condition are respected inside the quarantine room in case, the suspected parts were evaluated as OK then they have been stored in a suitable storage condition
d) Documentation of reason, quantity and entry date for all parts inside the quarantine room
e) Regular checks are performed on the quarantine area (inventory, 5S, storage condition, labelling, etc.)

18.1.4 The supplier shall define in the control plan a reaction plan for each failure and ensure that the reaction procedures are included in the work instructions

18.1.5 The supplier shall include in the operators training the procedure of handling non-conforming products and reaction plan.

18.1.6 The supplier shall have a defined OK and NOK criteria for each characteristic mentioned in the control plan and ensure that the inspection points, whether automated or done by the operators are capable to defect the NOK from the OK. This checking shall be done by using measuring system analysis GR&R% for variable characteristics and R&R for attribute characteristics. See 4.6 Process Validation

18.1.7 The supplier shall take a decision with a defined timeframe actions to be taken with products in the quarantine area. Actions such as: Scrap, rework, return to sub supplier.

18.1.8 Unless otherwise specified in the drawing or project files, the supplier can perform rework on parts that will be sent to ZKW sites but only when the following criteria are met: -

a) Approval of the scope of rework by a Q-responsible of ZKW
b) Usage of validated tools for rework
c) Rework procedure is validated that it produces OK parts
d) Rework is performed by trained operators, who are evaluated every 6 months at a minimum

e) A dedicated rework area is in place
f) Reworked parts and their packaging are marked and highlighted and can be easily identified by ZKW sites
g) Rework is recorded in detail which allows traceability to the rework procedure and rework operator.
h) Supplier shall have in place risk assessment for rework procedure, preferably in the form of FMEA.

18.1.9 Repair is strictly prohibited

18.1.10 In case the supplier requires to send ZKW sites parts under deviation, the following shall be in place: -

a) The supplier shall obtain a written approval from the ZKW site based on the deviation, the request to ZKW shall include at a minimum the following
   i. Justification, why parts will be sent under deviation
   ii. Root cause for this situation
   iii. Actions to prevent the deviation from occurring
   iv. Risks associated with the deviation
   v. Timeframe and/or number of parts where the deviation approval will be valid
b) The supplier shall issue a special work instruction for operators producing under the deviation approval.
c) The supplier shall ensure that parts produced under the deviation are at least 100% inspected.

19.0 Error Proofing

19.1.1 In order to be able to guarantee error safety, the following shall at least be considered:

a) Defined criteria for error proofing equipment
b) List of error proof processes
c) Alternative process defined in case error proof process is not available
d) Availability of test-the-test procedure and devices for validating error proofing equipment

20.0 Escalation Process: -

20.1.1 The ZKW escalation process has three stages, see diagram 2 in Appendix: -

Stage 1:

a) Escalation criteria:
   i. C-rating from supplier evaluation.
   ii. In case of serious deviations of requirements.
b) Applied methods:
   i. Discussion with the supplier in the respective ZKW plant.
   ii. Structured problem-solving process (control circle).
c) De-escalation criteria:
   i. Improvement to at least B-rating at the end of the next evaluation period (supplier evaluation).
   ii. Evidence of the effectiveness regarding implemented actions.

Stage 2:

a) Escalation criteria:
   i. C-rating from supplier evaluation twice in a row.
   ii. De-escalation criteria of stage 1 not met.
   iii. Delays of issues addressed already in stage 1 but not adequately solved.
b) Applied methods:
   i. Process audit based on ineffective 8D reports and control circuits.
   ii. Continuous progress report concerning improvement program of process audit.
c) De-escalation criteria:
   i. Improvement to at least B-rating at the end of the next evaluation period (supplier evaluation).
   ii. Result audit: "B" classification (>85%). Evidence of the effectiveness regarding implementation actions.

Stage 3:

a) Escalation criteria:
   i. C-rating from supplier evaluation three times in a row.
   ii. De-escalation criteria of stage 2 not met.
b) Applied methods:
   i. New business on hold.
   ii. Clarification of willingness of further cooperation on management level.
   iii. Setting a final time limit for effective implementation of the measures.
   iv. Repeated audit.
c) De-escalation criteria:
   i. Result repeat audit: "quality-capable" ("A" classification) based on the ZKW Supplier Quality Guidelines.
   ii. In case of a negative audit result, a phasing-out process or a part relocation process to alternative supplier are initiated.

21.0 Signature Page

By signing this document, the supplier confirms that this document was read, understood, agreed upon its terms and conditions and can be implemented at all supplier's affiliated companies and sites providing ZKW with products and/or services.
The supplier confirms that the supplier is aware that there may be additional individual quality assurance measures agreed between ZKW and the supplier and/or between individual divisions and/or sites of ZKW with the supplier.

FOR ZKW USE (In case of Addendums)

ZKW Responsible Person: _____

Date: _____/_____/_____

Signature: _____

FOR SUPPLIER USE (Mandatory Fields*)

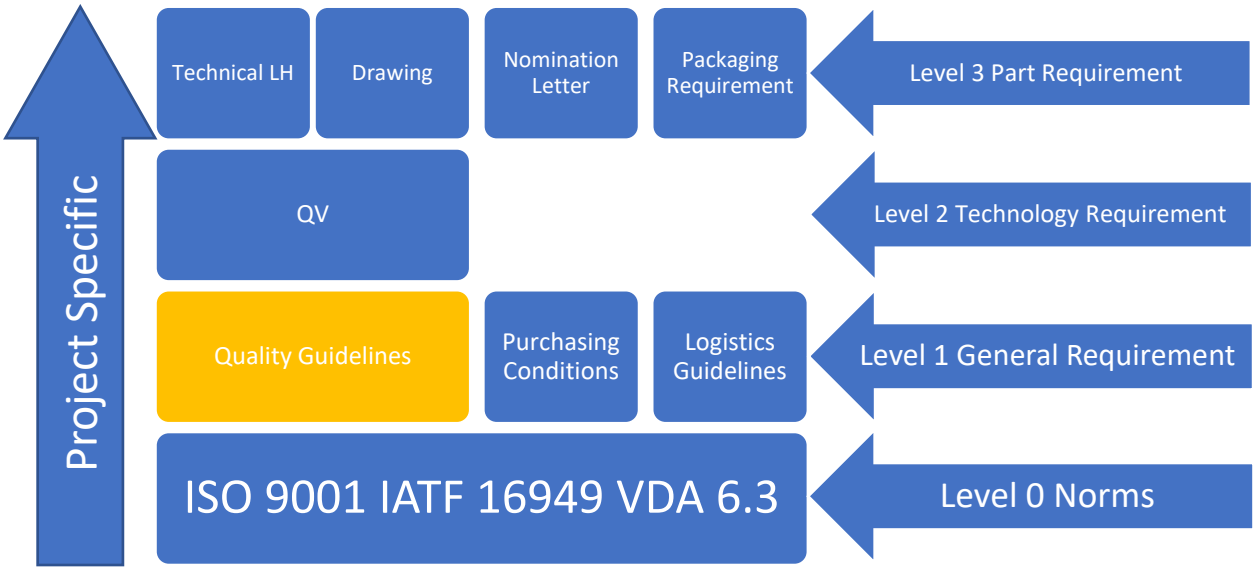
Supplier Name*: _____

Supplier Responsible person /Department*: _____

Date*: _____/_____/_____

Signature*: _____

22.0 Documents Briefing and Hierarchy



This Document

- IATF 16949:2016
  - A standard which is supplemental to ISO 9001:2015 that defines the quality management system requirements for the design, development, production, assembly, installation and services of automotive related products, including products with embedded softwares.
- VDA 6.3
  - A Process standard that contains current questionnaire and evaluation criteria and additionally the requirements for the qualification of process auditors and the preparation and implementation of process audits
- ZKW Supplier Quality Guidelines
  - A ZKW documents that defines generic requirements that highlight the important details for ZKW in IATF 16949 & VDA6.3. it is to be considered as a customer requirement and not an alternative to IATF 16949
- QV
  - A ZKW documents that defines further requirements in addition to those defines in the supplier quality guidelines for a specific technology and/or family of material.
- Technical LH
  - A document that descries specific technical specifications for a certain project such as but not limited to Dimensions, setting parameters, operating temperatures, testing standards, OEM Requirements, ...etc.
- OEM Requirements
  - Requirements that are defined by the OEM (ZKW's customer) and highlighted by ZKW to the supplier through nomination letter and project documentations

Appendix

Diagram 1 Supplier Development process description

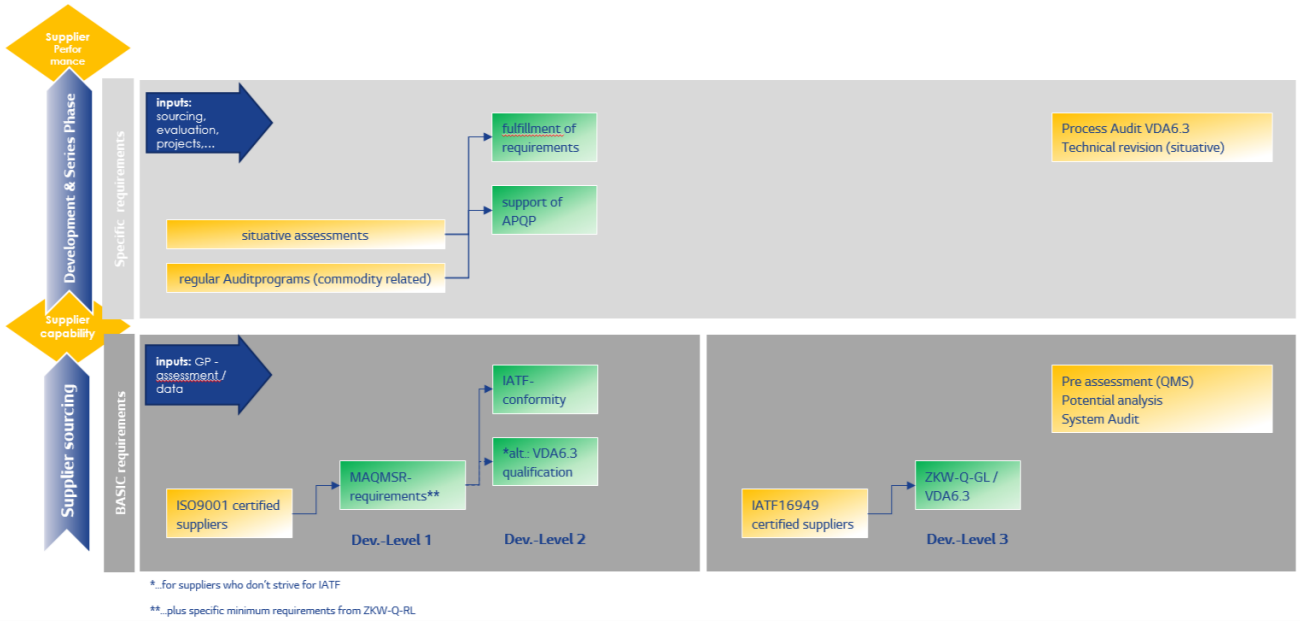


Diagram 2 Escalation Matrix

level	*description*	*activity*	*responsible*	*collaboration*	*consequences*	*de-escalation by*
0	supplier has problems	standard claim management	PQP-plant	GPC-B plant		
escalation level: PQ-plant, RSO-plant						
1	problem solving at supplier is not possible	escalation meeting	PQ-plant	RSO-plant PQP-plant GPC-B plant engineering/LCM plant LG-plant	- development program through supplier - short term regular communication with control circle at ZKW	PQ-plant and RSO-plant
escalation level: SQ-Group, FWS-Group						
2	supplier needs help for assuring delivery capability	escalation meeting	SQ-Group	FS-Group PQ-plant RSO-plant GPCx LG-plant *optional:* *GPM* *E- or O-plant* *SCM-Group* *specialists*	- analysis of situation at supplier by SQE - development program by supplier including definition of target - monitoring by Audits - short term regular communication by TF at ZKW	SQ-Group and FS-Group
		taskforce (TF)	SQ-Group	TF-team		
3	supplier is not suitable for quality within the group	management meeting	GQ-Group	GP-Group SQ-Group FS-Group GPCx Group *optional:* *GPM plant*	- NewBusinessOnHold - respite for optimization - monitoring by Audit - clarification of willingness to continue the business activity	GQ- and GP-Group

Terms definition

Abb.	Definition
5S	A workplace organization method that describes how to organize a workspace for efficiency and effectiveness
CAD	Computer Aid Design
CMK	Machine capability index, short-term analysis
COC	Certificate of conformance
CPK	Process capability index, long-term analysis capability index
CSR	Customer Specific Requirement
CR	Customer Requirement
DFMEA	Design Failure Mode Effect Analysis
DVP&R	Design Verification Plan & Report
ERP	Enterprise resource planning
ESD	Electrostatic Discharge
FFA	field failure analysis
GRR%	gauge repeatability and reproducibility
HSE	Health Safety Environment
Kappa	Kappa Statistics
KPI	Key Performance Indicator
MAQMSR	Minimum Automotive Quality Management System Requirements
MPP	Monitoring Purchased Parts
MSA	Measuring System Analysis
NDA	Non-Disclosure Agreement
OEE	Overall Equipment Effectiveness
OEM	original equipment manufacturer
OTIF	On Time In Full
PFMEA	Process Failure Mode Effect Analysis
PPA	Production Process and Product Approval
PPAP	Production Part Approval Process
PPK	Preliminary process capability index
PSCR	Product Safety & Conformity Representative
QMS	Quality Management System
R&R	repeatability and reproducibility
RFQ	Request for Quotation
RPN	Risk Piriority Number
SQE	Supplier Quality Engineer

Relevant Documents

- ISO 9001
- IATF 16949
- MAQMSR
- ZKW_MAQMSR_lead UP01.
- VDA 2
- VDA 4
- VDA 5
- VDA 6.3
- VDA 6.5
- VDA FFA
- AIAG PPAP
- AIAG APQP & Control Plan
- AIAG SPC
- AIAG VDA FMEA
- ZKW Logistics Guidelines
- ZKW purchasing conditions
- ZKW QV 400s
- ZKW Monitoring Purchased Parts
- ZKW 8D Report Requirements Suppliers LP04
- ZKW QV 500 01 ZKW ESD Technical Guidelines
- ZKW Questions Catalog

Change History

Revision	Date	Description	Editor	Checked	Approved
8	2015	New Edition	Michael Gundacker Franz Hörtler	Wolfgang Riegler	Philipp Tiefenbacher
9	2017	Revision	Wolfgang Riegler	Wolfgang Riegler	Wolfgang Riegler
10	2019	Revision	Thomas Niedermayer	Wolfgang Riegler	Wolfgang Riegler
11	2021	New Update	Akram Hatem Thomas Niedermayer	Wolfgang Riegler	Wolfgang Riegler

In case of deviation between English version and German version, the English version has the preference