TOWER
AUTOMOTIVE

Process Approval Sign-Off

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INTRODUCTION / PURPOSE

Tower Automotive requires that a Process Approval Sign-off must be performed on all new parts, unless our Customers require a different process (such as DCX's PSO.)

Applies to all suppliers (internal and external) to Tower Automotive Business Units in the United States and Canada.

REVISION / CHANGE(S)

This Standard was previously released as TA-ST-004. The standard has been re-numbered and transferred to the Standard Template.

DEFINITIONS

1.	TAPAS	Tower Automotive Process Approval Sign-off
2.	SOP	Start of Production
3.	SPC	Statistical Process Control

STANDARD

1. Risk Assessment

   1.1 There are two levels of part risk assessment:

   a. High: Parts must have a Tower Automotive-led TAPAS

   b. Low: Parts must have a Supplier-led TAPAS

   Determinations of part risk will be made by Tower Automotive and provided to the Supplier.

2. TAPAS Elements

   2.1 There are 22 elements in the TAPAS, outlined here and explained in greater detail in the "TAPAS Checklist Requirements" section:

   1. Part number, description and change level
   2. Engineering standards identified
   3. Special product and process characteristics identified
   4. Process flow diagram and manufacturing floor plan
   5. Tooling, equipment and gauges identified
   6. Design FMEA and process FMEA
   7. Pre-launch & Production control plans
   8. Test sample sizes and frequencies
   9. Gauge and test equipment evaluation
   10. Error and mistake proofing
   11. Process monitoring and operating instructions
   12. Incoming and outgoing material qualification / certification plan
   13. Parts packaging and shipping specifications
   14. Parts handling plan
   15. Preventive maintenance plans
   16. Quality planning
   17. Problem solving methods
   18. Evidence of product specifications
   19. Line speed demonstration
   20. Initial process study
   21. BSR / NVH (if applicable)
   22. Production validation testing complete

2.2 In preparing the documentation, if a Supplier believes that a particular element does not apply to the particular part, the element is included with the note "Does Not Apply". Likewise, if data is applicable to more than one element, it will be displayed in the first applicable element and a note referring to that element in the subsequent applicable elements.

3 TAPAS Process

3.1 The TAPAS process is divided into two tracks, depending on the Part Risk Assessment, but results in both cases in a PPAP Warrant submission, Figure 1. In the Tower Automotive-led TAPAS, Tower Automotive will visit at least twice, Figure 2. The first Tower Automotive visit will review the documentation & plans, and recommend any changes. The second Tower Automotive visit will witness the parts being made; review the final documentation; evaluate the Initial Process Study; and review the recovery plans, if necessary. In certain cases it might be necessary for Tower Automotive to revisit the Supplier in order to conclude TAPAS. In the Supplier-led TAPAS, the supplier generates the documentation and maintains it on-file at their facility, Figure 3. After the successful completion of the TAPAS, the supplier will submit the PPAP Warrant (PSW - Part Submission Warrant) to Tower Automotive.

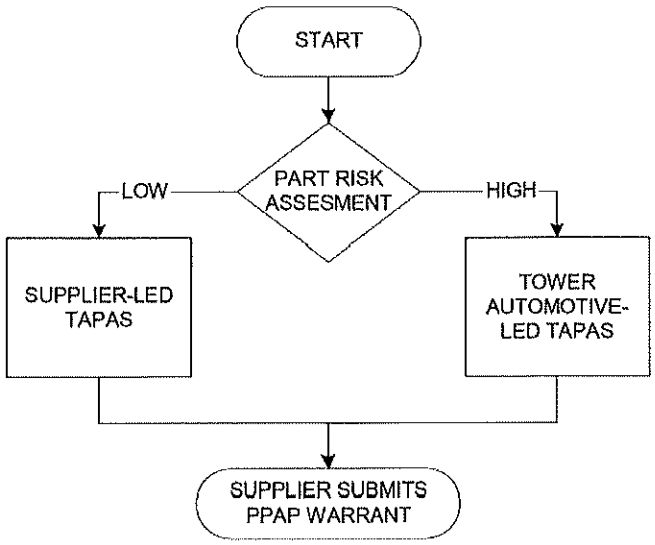

Figure 1. The overall process flow for TAPAS. Detail for the two major elements follows.

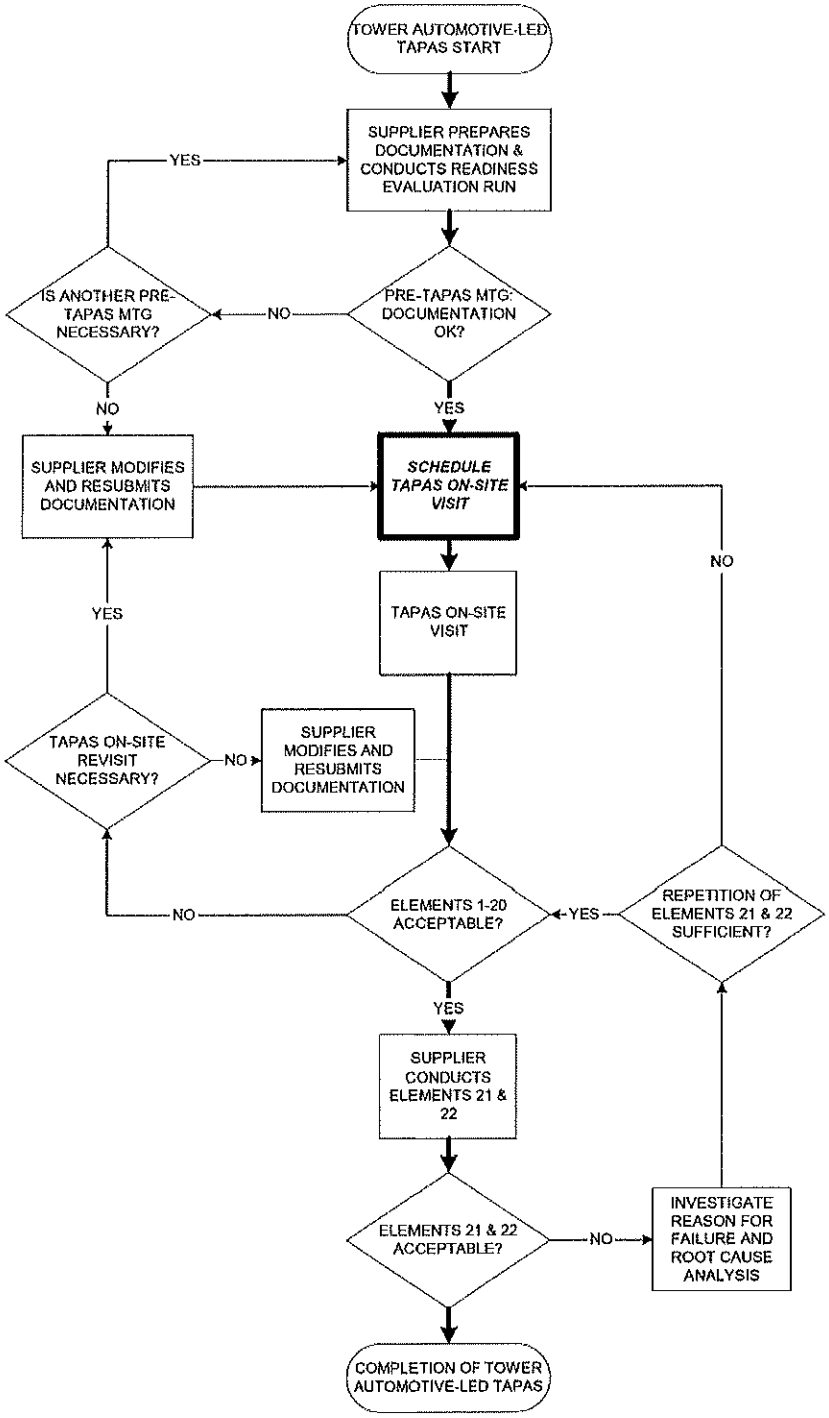

Figure 2. The process flow for Tower Automotive-led TAPAS

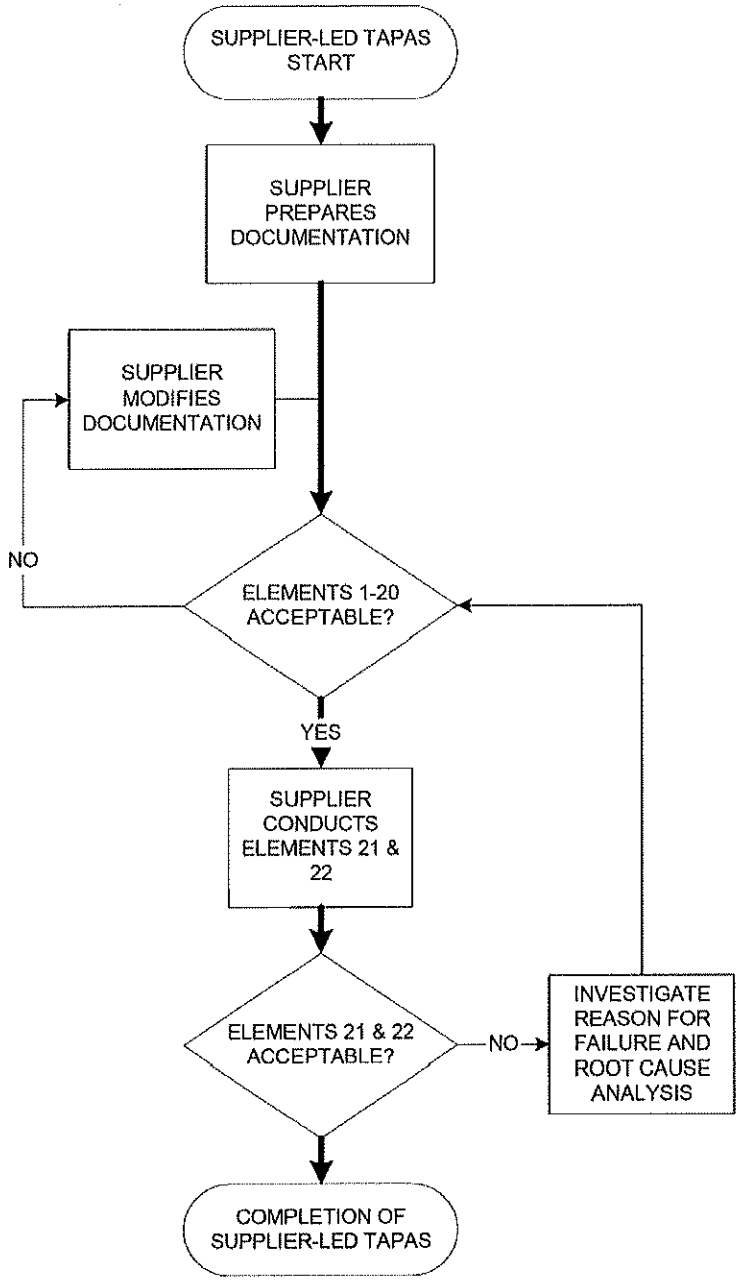

Figure 3. The process flow for Supplier-led TAPAS

4 TAPAS Time-line

4.1 The TAPAS will be completed prior to 16 weeks before the stated Start of Production (SOP – 16 Weeks), Figure 4. If the Supplier cannot finish the elements of the TAPAS and complete all visits successfully prior to SOP - 16 Weeks, an Interim Process Approval (Type I) must be sought from Tower Automotive and must include an approved recovery plan. If at SOP – 8 Weeks the TAPAS has not been completed, an additional Interim Process Approval (Type II) must be sought from Tower Automotive and must include an approved recovery plan. The difference between the Type I & II Interim Process Approvals is the level of approval required from within Tower Automotive and also from within the Supplier. An Interim Process Approval does not relieve the Supplier of the requirements of completing the TAPAS, and it will lead to greater scrutiny of the Supplier by Tower Automotive.

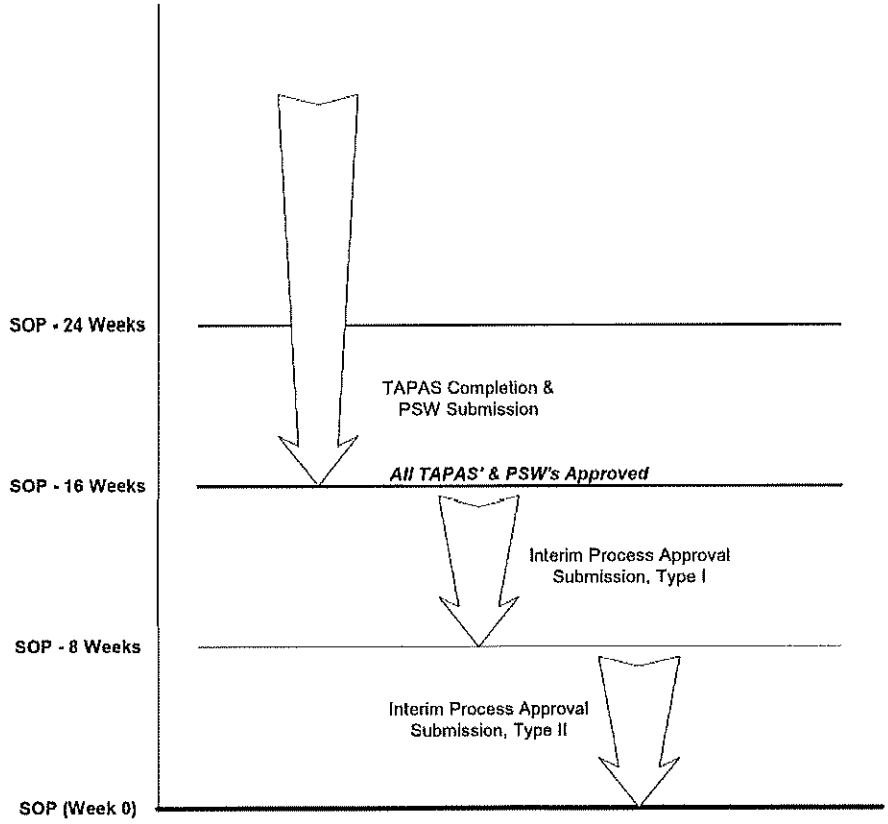

Figure 4. TAPAS completion timeline. All TAPAS' and PSW's should be submitted and approved before SOP - 16 Weeks

5 Instructions

5.1 The Tower Automotive Quality Team colleague will initiate the TAPAS dialogue with the Product Team, schedule and coordinate the Pre-TAPAS Meetings and the TAPAS On-Site Visits. The Tower Automotive Quality Team colleague will also advise the Supplier of the documentation the team will want to review.

5.2 The method for presenting documentation to the Tower Automotive Product Team is in a binder with dividers that correspond to each Checklist element. Documentation required for each element would be places in that section. If the element pertains to more than one section, only one copy is required in the binder. Other sections will refer to the section containing the document copy.

5.3 Pre-TAPAS Meeting

5.3.1 Review Program Status

5.3.2 To reduce the time spent at the Supplier's facility, the Product Team must review and approve all TAPAS Checklist elements and available documentation with the Supplier prior to the TAPAS On-Site Visit.

a. It is important that the Supplier Readiness Evaluation Run results for Element 18 and Product Demonstration Run plans for Elements 19 and 20 are reviewed.

b. Element 18 – the Supplier is required to present the performance results obtained from a (usually 30 pieces) Supplier Readiness Evaluation Run. The Supplier with the concurrence of the Tower Automotive Quality Team colleague will determine the exact quantity. This run shows that the process is set-up, debugged, and ready for the Production Demonstration Run during the TAPAS On-Site Visit.

c. Element 19 – the Product Team must review the plan for required production rates, data to be recorded, recording method, measurement method, and calculations to be performed for each station, the overall production line, multiple production lines, and multiple tools.

d. Element 20 – the Product Team must review the Initial Process Study plan for each characteristic and tolerance designated as a "Special" characteristic, as well as those additional characteristics and operations selected by the Team for initial process studies. The Team should review the inspection methods, gauge calibration and R&R results, the data to be recorded, the data recording methods, the quantity to be inspected and the calculations to be performed.

e. These reviews must be completed before the TAPAS On-Site visit is scheduled.

f. Emphasize that this is a team effort to verify production readiness and process capability.

5.3.3 Review all of the elements and requirements from the TAPAS Checklist with special emphasis on the following items:

a. Review applicable engineering standards, product material, process methods and inspection procedures, preliminary process performance studies and drawings to confirm test frequencies and procedures to be used in compliance with APQP and Purchase Order requirements.

b. Review Error and Mistake Proofing methods and implementation.

c. Review product and process characteristics and identify the characteristics that will be measured during the TAPAS On-Site Visit. These are not limited to special characteristics such as "MP's". The Product Team may select any characteristics of interest in addition to special characteristics.

d. Review the Packaging Plan including back-up expendable packaging.

e. Review the Pre-Launch and Production Control Plans.

f. Set the TAPAS On-Site Visit date and agenda.

g. Verify the planned line speed for the TAPAS Product Demonstration build.

h. Review requirements of Tower Automotive Launch Containment Certification (TALCC) with the Supplier. When complete, indicate on the TAPAS Checklist that the review has been done and the date reviewed.

i. Discuss the Quoted Lines Speed, Quoted Tooling Capacity, Quoted Net Operating Time for Tower Automotive Parts, and rejects with the Supplier and Buyer during the Pre-TAPAS Meeting. The Product Team should know the line speed the Supplier will be required to demonstrate before the TAPAS On-Site Visit is scheduled.

5.3.4 TAPAS must be completely approved prior to a full PPAP submission.

5.4 TAPAS On-Site Visit

5.4.1 Begin and end the TAPAS On-Site Visit by meeting with the appropriate plant management personnel to discuss the purpose of the visit and the results of the on-floor assessment. The majority of the time should be spend on the plant floor observing the manufacturing process and reviewing the plant's production readiness.

5.4.2 Verify that all process instructions and Control Plan checks are being effectively implemented.

5.4.3 Review opportunities for Error and Mistake Proofing and process improvement during the on-floor assessment.

5.4.4 Review the process performance studies:

a. Gauge R&R studies must be completed on all measurement systems prior to capability evaluation

b. Pp and Ppk > 1.67 must be achieved for each special characteristic.

c. Unacceptable preliminary performance results require a written recovery plan.

5.5 Reinforce to Supplier plant personnel that they cannot change the approved process without prior notification and written approval by Tower Automotive Engineering, Purchasing, and Quality Teams. This includes sub-source changes, and sub-source process changes.

5.6 Each product must have a Launch Containment Certification (TALCC) program. This program should be reviewed again in detail with the Supplier's plant personnel. Following this review, the Product Team should indicate that the review took place and enter the appropriate date on the TAPAS Checklist form.

5.7 Each Process Approval Sign-off must have a Compliance Report included with the TAPAS Checklist. This is an audit of compliance to specification requirements and is required for element 18 of the TAPAS Checklist. The parts and features checked will be determined by the Product Team during the TAPAS On-Site Visit and may include, but are not limited to, work in progress, piece parts from workstations bins and stock, or final products from the Production Demonstration Run.

5.8 Each Process Approval Sign-off must have a Product Demonstration Results form included with the TAPAS Checklist. For multiple production lines or multiple tools, a separate form must be included for each one. This form is used to document the quantity of units built during the Production Demonstration Run, the demonstrated line speed, element 19, and the Initial Process Study and First Time Capability results from element 20.

6. Forms / Data Retention

6.1 The TAPAS Checklist shall be used to document the Process Approval Sign-off information. The form in this manual may be duplicated as needed. The Supplier must retain all TAPAS information for a minimum of one year following SOP. The Tower Automotive Advanced Quality colleague will retain the original copy of the signed-off TAPAPS Checklist, Comments/Follow-up Sheet, and Compliance Report and will provide a copy to the Supplier and the Product Team.

7. TAPAS Checklist

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
1) **Part Number, Description, And Revision Level** Verify that the paper drawing is in fact the revision being produced and is also the revision that is on the latest released BOM (that an engineering change has not superceded the drawing).	• Latest revision of paper drawing • Latest version of the released bill of materials
2) **Engineering Standards Identified** All applicable engineering standards with the latest change level must be available, including Tower Automotive Standards, Customer Standards, and other standards called out on the part drawing.	• Copies of latest engineering standards.
3) **Special Product and Process Characteristics Identified** Special Characteristics identified on the part drawing (including any SPC points) must be noted on the Control Plan, set-up sheets, and operator instruction sheets.	• Special Characteristics list.
4) **Process Flow Diagram and Manufacturing Floor Plan** The process flow must represent the entire manufacturing process from receiving through shipping and should include the following points: • Process sequence, method, and equipment used at each station including inspection and repair stations • Number of operators needed per station including inspection and repair stations. • It should include both main-line assembly processes and all off-line processes that supply it. The manufacturing floor plan should show the layout of the facility and illustrate station-by-station the overall flow of the manufacturing process.	• Process flow diagram • Manufacturing floor plan

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
5) **Tooling, Equipment, and Gauges Identified** All tooling, gauges, fixtures, and capital equipment required to produce a product must be identified, tagged, and appear on a tooling list. All Tower Automotive-owned and Customer-owned tooling or equipment must be identified on the supplier tooling records, and be identified as "Property of <the appropriate party>" wherever practical.	• Tooling list • Supplier tooling records
6) **Design FMEA and Process FMEA** Design and process FMEA's must be completed for each unique product or process and must be approved by the Product Team. All FMEA concerns must have descriptions of current controls and recommended actions. The FMEA are living documents and must be traceable to the engineering change levels and processing changes. The PFMEA must reflect the entire manufacturing process from receiving through shipping. **Note:** In instances when the DFMEA is the responsibility of Tower Automotive or of the Customer, a separate sheet stating who on the Product Team at Tower Automotive is responsible for the DFMEA can be used in lieu of the actual DFMEA itself.	• DFMEA (see Note) • PFMEA
7) **Pre-Launch & Production Control Plans** Separate Control Plans that cover production before launch and after launch must describe each step of the manufacturing process including: receiving, material handling and storage, in-process operations, testing, inspections, rework/repair, and shipping. A higher degree of inspection, checking, and scrutiny is expected for the Pre-Launch Control Plan than for the Production Control Plan.	• Pre-Launch Control Plan • Production Control Plan

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
The Pre-Launch Control Plan will consist of additional controls, inspection audits, and testing to identify non-conformances. Depending on the production process, additional controls shall include: • Off-line, separate and independent checking form the normal production process whenever possible • Mandatory 100% inspection for all pre-production parts shipped • Increased frequency/sample size of receiving, process, and or shipping inspections. • Increased verification of label accuracy The Pre-Launch Control Plan will also serve to validate the Production Control Plan. All process and product control parameters should be documented. Sample sizes, frequency of inspection, acceptance criteria, and reaction plans must be included. The Pre-Launch and Production Control Plans are living documents and must be updated to reflect any changes in the manufacturing process. Any temporary or interim off-standard operation must be identified.	
8) **Test Sample Sizes and Frequencies** Products that require on-going testing must have the test sample sizes and frequencies included in the testing plan. For products which performance testing is not required, a separate sheet stating "Performance testing is not required for this part." will satisfy the requirements of this element.	• Testing plan • Applicable performance process and material engineering standards
9) **Gauge and Test Equipment Evaluation** All gauges and test equipment shall be calibrated, reflect the last calibration date, and expiration date. Calibrations must be traceable to a known source or standard. All gauges must have acceptable R&R studies prior to the Pre-TAPAS Meeting.	• Gauge R&R records • Gauge and test equipment calibration records

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
10) **Error and Mistake Proofing** "Error Proofing" and "Mistake Proofing" approaches used to improve the production process must be reviewed during the Pre-TAPAS Meeting and verified during the TAPAS On-Site Visit. Error proofing eliminates by design the possibility of producing a specific defect. Mistake proofing identifies errors and prevents them from becoming non-conformances	• List of error and mistake proofing implemented by operation number. • Error and mistake proofing studies
11) **Process Monitoring and Operating Instructions** Operator, set-up, and inspection instructions must be approved, signed, dated, traceable to the revision level of the parts being produced, and must include documented sample sizes and frequencies. The instructions must be located adjacent to the process, visible to the operator and legible. Visual displays and diagrams should be used whenever possible. Process control charts (attribute or variable) must be available and be reviewed by the TAPAS Team.	• Operator instructions • Set-up sheets • Inspection instructions • Visual displays • Control charts
12) **Incoming and outgoing Material Qualification/ Certification Plan** Review the Incoming and Outgoing Material Qualification/Certification Plan plus associated documents and records. • The plan must describe operations and procedure used by incoming and outgoing inspection to qualify and certify incoming material and outgoing material. • The plan must include incoming and outgoing acceptance sampling plans, both attribute and variable. One or more of the methods described in element 4.10 of QS9000 shall be used; otherwise, the minimum requirements found in the Lot Acceptance Sampling Table apply. • Some parts require lot control and traceability that must be described in detail and verified.	• Incoming and outgoing inspection procedures • Sampling plans • Receiving and shipping reports • Routing cards/sheets • Material standards • Inspection/test reports • Copies of sub-tier supplier certifications for each specific part in the assembly, including a copy of the PSW

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
• A lot is not to exceed one shift or one day's production, whichever is smaller. • Special controls are required for reworked or repaired material to provide traceability to the rework or repair process. • The plan must address containment of non-conforming material. • The plan shall identify processes performed by sub-suppliers or any outside processor and must include records indicating inspection/test results that relate to the appropriate lot code. • The lot acceptance date (or date the lot was inspected) must be identified by the year, the month, the day, and the numeric sequence.	
13) **Parts Packaging and Shipping Specifications** The parts packaging and shipping plan must include the types of containers (expendable or returnable) that will be used to ship product to Tower Automotive plants. The plan must include: • Specific container information (returnable and/or expendable, container dimensions, container material, # of pieces per container, weight of full/empty container, # of containers per pallet, etc.) • Shipping and labeling instructions, and packaging requirements. If returnable containers are to be used a returnable Container Management Plan must be developed which includes: • Inventory control to track the number of containers on hand and in transit. • Documented procedure for the mandatory transmittal of container/part number information during ASN submissions from the Supplier's facility. • Maintenance plan, which identifies damaged or contaminated containers for removal from service and provisions for repair and cleaning. • Expendable backup plan must cover a shortage of returnables. The backup plan must define the expendable packaging and the implementation of this packaging until returnables are available.	• Parts packaging and shipping plan • Shipping instructions • Returnable Container Management Plan, including: • Maintenance and cleaning • Back-up expendable plan, where applicable • Bar coded labeling instructions • Bar code label (actual)

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
• Expendable backup packaging must be available at all times, in the event of a shortage. • Backup packaging must maintain the same footprint (dimensions) as the returnable container, and when possible, hold the same number of pieces. • Bar coded labels must reflect the latest revision level, must include the sequence code, and must include the manufacturing date	
14) **Parts Handling Plan** The Parts Handling Plan must include the following: • Documented procedures that detail the internal material handling operations. • The types of containers used throughout the manufacturing process including any external processing. • The method by which material is tracked and transferred from one point to another, such as routing cards. • Where production operators must use special handling methods, appropriate instructions should be included in the Operating Instructions.	• Material handling procedures • Packaging Instructions
15) **Preventative Maintenance Plans** A Preventative Maintenance (PM) plan must exist for all equipment and tooling. As a minimum, the PM plan must include: • Set-up and approval procedures for the installation, set-up, and adjustment for machines, tools, and other equipment. • Plans, schedules, frequencies, and instructions for the periodic maintenance of equipment or machinery, tools, dies, fixtures, etc. for each item of process equipment and tooling. • Perishable tools and supplies, etc., shall have life expectancy and utilization parameters identified, including maintenance frequency and responsibility.	• PM Plan

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
16) **Quality Planning** The plan must identify major milestone events, required product or process tasks, responsible organizations, and scheduled and actual timing dates. Refer to the AIAG Advanced Product Quality Plan (APQP) manual. A diagram or indented list of the "supply chain" Supplier/Sub-supplier hierarchy is required. The list must identify down to the production material level each Sub-supplier by name, part or material produced, manufacturing plant location, and PPAP status of the parts supplied.	• Product Assurance Plan or APQP documents • Sub-supplier source diagram or list, with PPAP status of the parts supplied.
17) **Problem Solving Methods** Evidence of problem solving techniques must be provided describing how these techniques were used in developing the production process. Identify the individuals who participated in the problem solving process by name, title, and location.	*Examples of Problem Solving Methods:* • Design of Experiments • 8-D's • Root-Cause Analysis • Charting
18) Evidence of Product Specifications The Supplier is required to present the performance results obtained from a Supplier Readiness Evaluation Run for each production line/tool. The Supplier with the concurrence of the Tower Automotive Product Team will determine the exact quantity (usually 30 pieces). This run shows that the process is set-up, debugged, and ready for a Production Demonstration Run during the TAPAS On-Site Visit. Prior to the TAPAS On-Site Visit, process performance calculations (Pp and Ppk) are required for each machine and operation as well as the overall process. In the case of multiple production lines/tools, process performance calculations are required for each line. These performance values will be used as an indication of beginning performance. During the TAPAS On-Site Visit, Product Team colleagues are required to randomly select and measure, or witness the measurement of, specific product or process characteristics (other than those of the final audit) using the "Compliance Report" form.	• Supplier Readiness Evaluation Run results • Laboratory reports • Material certifications • Compliance Reports

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
19) **Line Speed Demonstration** During the TAPAS On-Site Visit, the Supplier must demonstrate that they are capable of producing quality parts at the quoted rates. The Production Demonstration Run must be on the production lines, using production tools, processes, and trained operators. The Production Demonstration Run consists of 300 pieces or two hours of production whichever is more stringent. Any deviation from the minimum quantity of 300 pieces or two hours of production must be approved in writing by the Product Team and documented on the Production Demonstration Results form. Process constraints which may impact quality or production schedules must be documented on the Comments/Follow-up sheet, and contingency plans established.	• Line speed calculation • Process constraints and contingency plans
20) **Initial Process Study** Process performance studies (Pp and Ppk) must be performed for all special characteristics and other dimensions selected by the Product Team using part data from the Production Demonstration Run. The selected characteristic, tolerance, type (attribute of variable), quantity processed, quantity accepted, and calculated performance values must be recorded on the Production Demonstration Results form. It is intended that 100% of the parts from the Production Validation Run be included in the study. Where this is not practical, the Product Team can deviate from the 100% requirement. However, at least 100 parts in 25 subgroups must be checked from each production line/tool/cavity to satisfy PPAP requirements. Other calculations such as First Time Capability, station process quantities, rates, and accepted quantities must be included in the study and recorded on the Production Demonstration Results form. First Time Capability is measured as the total number of items correctly processed, divided by the total number	• Initial Process Study plan and results • First Time Capability • Station process rates • Reject rates • End item part layout reports

TAPAS CHECKLIST REQUIREMENTS	
Checklist Element & Instructions	**Documentation**
attempted. These calculations must be completed for each production line/tool. Correctly processed means no repairs are required or allowed. Repaired parts are not to be used in the First Time Capability calculation. A recovery plan is required for all items on the Production Demonstration Results form that do not have a Ppk of at least 1.67. Any deviation from the Ppk requirement must be improved in writing by the Product Team and noted on the "Comment/Follow-up Sheet". If Process Capability is less than the required Ppk > 1.67, then 100% verification of shipped parts is acceptable if TAPAS On-Site Visit team agrees.	
21) **BSR/NVH** Buzz, Squeak, and Rattle (BSR) and Noise, Vibration, and Harshness (NVH) issues must be addresses, with potential causes evaluated and documented. Analyses should include evaluations of interactions with mating parts. To reduce/eliminate and/or monitor any objectionable BSR/NVH characteristics, potential causes must be addresses in the DFMEA, PFMEA, and Control Plan.	• Documentation that indicates BSR/NVH considerations.
22) **Production Validation Testing Complete** Supplier responsible for on-going test plan and test results must be reviewed and approved by the Product Team.	• Test plan and test results • Test procedures • Applicable standards

8 Lot Acceptance Sampling Table

Lot Size or Shipment Size	Sample Size Per Characteristic Classification Acceptance Number = 0
0-15	100% Inspection
16-25	100% Inspection
26-50	100% Inspection
51-75	50
76-125	65
126-225	75
226-425	85
426-1300	90
1301 and up	90