# **Introduction/ General**

### Note: Nothing in this standard SHALL supersede applicable laws and regulations. In the event of a conflict between English and a domestic language, the English language SHALL take precedence. GM issued drawings and Math supersede any conflicts created by this specification. ANY conflict in SOR documentation SHALL be brought the attention of the GM Commodity SQE and DRE for resolution.

### **Purpose**: It is the responsibility of the supplier to ensure that the manufacturing process is state of the art. The expectation is for GM to receive parts that meet 100% of the specifications as defined by GM. It is the responsibility of the Supplier to ensure that the process **meets or exceeds** all requirements and able to show compliance through the associated Commodity Specific Audit (self-audit and/or through onsite audit by GM personnel) by the time of the APQP Kickoff review and verified according to CRV process requirements.

## **Applicability**: These requirements are in addition to any requirements as outlined in CG4338 GM 1927 03 SQ SOR. “SHALL” in this document is mandatory. “Should” is highly recommended.

## These requirements SHALL be valid for any components or assemblies manufactured at the sub-supplier (Tier 1 or Tier 2… Tier x.). The Tier 1 supplier SHALL be responsible to validate and audit to these requirements at sub-tiers and provide evidence to GM upon request.

## All deviations requested for “SHALL” items are to be documented and submitted using CG3404 M7 Technical Issues List for review and approval by General Motors Supplier Quality prior to sourcing.

### It is understood that advances in technology may require modifications to the following requirements in order to ensure that state of the art processing and testing are being utilized. Alternative solutions that achieve the intended requirement SHALL be documented and approved by the GM SQE.

# **References**

## Note: Only the latest approved standards are applicable unless otherwise specified.

## **External Standards/Specifications-**

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## **External Audits**

* **Intentionally Left Blank**

## **GM Standards/Specifications**

GM Standards/Specifications: Part Specific and Process Specific Audtis and Statements of Requirements are located in GM SupplyPower.

* GM1738NA GM Packaging & Identification Requirements for Production Parts
* GMW16037 Test Method to Quantify Cleanliness of Powertrain Components
* GM 1927 33 Early Production Containment
* CG3404 M7 Tehnical Issues Report

## **GM Specific Audits**

* GM 1927 16b Process Specific Audit

# **Planning**

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## **Audits and Action Plans**

### An assessment using GM 1927 03b Contamination Control Audit SHALL be conducted initially and as needed to confirm continued compliance due annually at a minimum unless otherwise requested.

### All findings classified as “Fail”, or “Needs Immediate Action”, or “Not Satisfactory” should be included in a continuous improvement plan and could, at the discretion of the SQE, impact Full PPAP status.

### Analysis of the failures SHALL be done to identify potential process improvements.

### For any non-compliances, a regular audit SHALL be developed to control areas of risk for each non-compliance.

# **PRODUCT Design & Development**

## **Manufacturing Equipment Development Activity -**The supplier manufacturing location SHALL incorporate the following Lessons Learned and Best Practices into the manufacturing process / equipment development activity:

## Equipment suppliers SHALL provide a machine FMEA. They should refer and comply to AIAG FMEA VDA Handbook or AIAG PFMEA 4th Edition and CG4338 GM 1927 03 SQ SOR to develop a preventative maintenance plan and schedule to determine spare part requirements. For Critical Characteristics, test equipment/EP SHALL reject part automatically and place part into a locked scrap bin without operator involvement. (i.e., exits system on the other side of the equipment.)

## No Silicones, grease or sealants are allowed in the manufacture of any AUTOMATIC transmission component.

# **PROCESS Design & Development**

## **Control Plan -**The supplier manufacturing location SHALL incorporate the following Lessons Learned and Best Practices into the manufacturing process control plan.

## Cleanliness: Operators SHALL clean workstation / equipment defined by the PM schedule (minimum-start of each shift and break). Example: Follow 5S principles.

## **Contamination Control**: CG5404 applies, must be accepted,and followed. High severity items SHALL be mitigated by vacuum, air, magnetic means, brush, or a combination. This operation SHALL be automated and not operator dependent.

## **Containerization -** The supplier manufacturing location SHALL incorporate the following Lessons Learned and Best Practices into the Containerization activity:

## Supplier is responsible for maintenance and cleanliness of container per GM 1738NA.

# **Product & Process Validation**

## **Compliance/ Regulatory Documentation -**The supplier manufacturing location SHALL incorporate the following Lessons Learned and Best practices into the Compliance Documentation activity:

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# **Production**

## **Cleanliness and contamination**

## Supplier Plant Floor SHALL be safe, clean and organized. Example: Following 5S principles.

## Equipment used to Manufacture for GM SHALL be safe, clean and in proper working order per the local PM’s and SOP’s.

## Tools used to Manufacture for GM SHALL be cleaned and maintained per written procedure with pre-defined frequencies/standards.

## **Begin contamination specific criteria**

## Air Quality checks shall be conducted in supplier manufacturing facilities a minimum of annually.

## The supplier shall monitor and perform PM’s on HVAC system(s) including filters being required to be changed at a minimum of quarterly.

## The supplier shall have replacement filters in stock.

## The supplier shall forbid food and drink in the manufacturing/assembly room (bottled water may be permitted) along with other potential items that may contribute to contamination.

## There shall be a defined and enforced policy to keep exterior doors and windows closed.

## Any touch-pointing of parts/assemblies during sorts and confirmation checks shall follow as prescribed and be reviewed and approved by Commodity SQE, DRE and receiving GM facility, unless otherwise approved by your Commodity SQE, DRE and GM receiving facility;

### No paint pens shall be used on a part or assembly internal to the engine or transmission.

### Paint pens can be used on the external. No white shall be used as the color is achieved with the use of titanium dioxide (TiO2) which can contribute to contamination.

### If marking on internal surfaces are required to be permanent, supplier shall use Dykem ACTION MARKER (registered trademark) 44. No white shall be used as the color is achieved with the use of titanium dioxide (TiO2) which can contribute to contamination.

## Supplier shall have a documented and enforced Shutdown procedure, this would entail clear standardized work for extended shutdown periods of greater than 3 days, to reduce contamination on parts.

## The supplier shall have visual aids supporting contamination awareness and control stored / posted at line side. This shall be trained including resulting transmission damage and types of contamination to be aware of.

## The supplier shall have robust a 5S system in place with visual aids supporting contamination awareness and control.

## The supplier shall have an incoming inspection process for all purchased fluids (media) to check for contamination.

## The supplier shall have an incoming inspection process for Key components to check for contamination.

## The supplier shall ensure all machined parts are subject to a cleaning operation prior to assembly.

## The supplier shall keep components sealed / covered until just prior to assembly.

## The supplier shall keep tools, such as abrasives discs, cutting discs, etc., that can introduce contamination out of the assembly area.

## If the supplier uses hammers and or mallets in assembly, only plastic and rubber types shall be used and they shall be changed out on a specified frequency /PM schedule.

## The supplier shall have scheduled PM’s on vacuum /blow off systems which include filter changes, etc.

## The supplier shall have periodic verification of vacuum / blow off effectiveness (in-line gauges that assure adequate suction/air PSI power).

## The supplier shall perform periodic analysis of sediment collected by vacuum / blow off systems and evaluate for trends.

## A washer/high pressure deburr operation shall be used to ensure cleanliness, IF this operation is performed by a Tier 2 or 3rd party, they shall conform to this specification and audit.

## Clean parts shall be identified clearly after washing operation.

## All parts shall be covered/sealed after washing.

## Chemical titration shall be used to monitor washing solution.

## Wash solution shall be analyzed on an on-going basis for PPM, Conductivity, hard particles, soft particles, particle size, …

## The supplier shall have a list of approved wash supplies such as filters, chemicals, wipers, …

## There shall be a reaction plan for any discrepancies that are identified for above parameters, which include how far back to contain product, how to identify product that requires re-washing, etc.

## There shall be a complete documented Wash System PM.

## The washer process controls shall be documented in the control plan.

## There shall be a post wash drying process with filtered air, heated drying recommended to facilitate faster drying.

## The supplier shall ensure that pressure and temperatures are verified each shift, with a documented procedure and reaction plan for values out of limits.

## The supplier shall monitor differential pressure to determine frequency of filter change.

## The supplier shall have a PM schedule in place and adhered to for washer deep cleaning, flow by nozzle, nozzle alignment and overall effectiveness.

## Supplier shall establish detailed pass/fail criteria in standardized work and include Dykem checks.

## Established pass/fail criteria shall include inspections for burrs, flash, chips, lamination, other items as determined. Inspection shall use bore scope at a frequency determined in the control plan for critical passages.

## Supplier shall have 5S in place for contamination sources.

## The supplier should have an on-site washer for cleaning dunnage.

## The supplier shall have PM/5S instructions for Pallet and work bench cleaning.

## The supplier shall have PM/Cleaning schedules on all fixtures and tooling that come in contact with parts after wash.

## The supplier shall have PM/Cleaning schedules for gages in addition to Calibrations.

## The supplier shall have PM/Cleaning schedules for conveyors that come in contact with parts and conveyors that may run overhead of parts.

## The supplier shall monitor returnable dunnage for cleanliness and internal dunnage shall be on a cleaning schedule.

## The Supplier shall train operators on the correct procedure for opening and presentation of stock to their assembly line(s).

## The supplier shall keep scrap cardboard, garbage and excess waste out of the production areas.

## The supplier shall protect incoming stock to production by not over-stacking material on delivery carts/systems.

## The supplier shall enforce/adhere to FIFO for all stock.

## The supplier shall take care to load finished parts rack in a manner conducive to reduced sediment/cross-contamination levels.

## The supplier shall ensure any loading and unloading of parts to/from fixtures does not generate chips.

## The supplier shall shield parts from foreign material in any over/under conveyor situations.

## The supplier shall ensure that racks, minomis, pallets are not painted as paint has a potential to chip and contaminate parts.

## The supplier shall ensure that operations/duties are separated thus that “dirty” operations are not performed in clean areas or dirty parts handled by someone performing a clean operation.

## The supplier shall cover or mask open parts from inadvertent contamination (dropped clips or bolts).

## The supplier shall have covers for assembly part bins.

## The shall provide a documented method to ensure only clean gloves are used by team members to contact clean parts in machining areas.

## The Supplier shall design dunnage to eliminate shaving of the containers by the parts.

## Finished parts shall not be stored in any in-process or incoming dunnage.

## Parts shall not be left in washer during any down periods (greater than 8 hours).

## Parts shall be covered/protected during down periods (greater than 8 hours).

## There shall be no rubber bands or ties on parts in packaging delivered to the assembly line.

## There shall be a documented agreement that is Customer approved that defines the acceptable level of contamination.

## The sediment particle size/weight shall be developed off the agreed upon Customer approved specification.

## The supplier shall identify contaminates back to their point of origination and reduced/eliminated.

## Contamination shall be addressed adequately in the PFMEA and linked to DFMEA. Refer and comply to AIAG FMEA VDA Handbook or AIAG PFMEA 4th Edition and CG4338 GM 1927 03 SQ SOR.

## All contamination related failures shall be in the PFMEA as part of continuous improvement activity.

## The suppliers process control plan shall address contamination, correlated to the PFMEA.

## The supplier shall have standardized work for operations that contribute to or introduce contamination.

## The supplier shall ensure standard work is being followed.

## The supplier shall properly train all operators.

## The supplier shall protect for contamination control at any tear down / rework operations.

## The supplier shall analyze sediment/debris collected through the process.

## The supplier shall apply Customer focused problem solving for contamination reduction from customer data such as repairs, PPM, warranty…to drive contamination reduction.

## The supplier shall utilize and drive improvement to contamination/sediment via the internal audit process.

## The supplier shall graph sediment/contaminate data and set alarm limits.

## The supplier analysis of sediment/contamination shall be identified as “introduced from outside” or “created within/at the assembly line”.

## The supplier shall properly investigate with root-cause/corrective action completed on cases of contamination discovered on the line.

## **Sediment Lab Requirements – applies to internal GM plants and sub tiers that supply fully assembled engines and transmissions to GM vehicle assembly plants**

## The supplier shall perform full transmission checks where Transmission fluid is captured during the teardown process and filtered. The weight of sediment from this fluid is included in the total transmission sediment. The transmission filter is opened and inspected for any unusual / abnormal sediment to determine source. Instead of testing a transmission with oil it should be tested dry so that a pareto can be created of the subsets that have the most contamination and then a game plan can be established to reduce. The oil moves the debris into the valve body so it is impossible to figure out where the debris originated. To make sure the oil is clean daily checks of oil contamination after it has been filtered through reclaim will ensure that the oil going into the transmission is clean.

## The supplier shall perform full transmission checks where a sediment check torque convertor is used for all full transmission checks. This torque convertor is then flushed and included in the total transmission sediment value.

## The supplier shall perform full engine/transmission checks at an increased frequency during launch and new model introduction.

## The supplier shall perform subassembly and machined component part checks with sediment analysis completed for high risk parts as defined by the plant and the product team.

## The supplier shall perform sediment analysis where sediment will not only be monitored for weight but also for particle size. There should be continuing efforts to reduce both the weight and size of contamination throughout the lifecycle of the part.

## The supplier shall perform incoming material checks on high risk parts as defined by the plant and product team. Also, parts that are highest on the pareto during whole transmission checks should be monitored and the supplier notified so that they can figure out root cause and correct the problem.

## **Clean room – this applies to GM subassembly plants and sub tiers that have and maintain clean rooms for assembly**

## There shall be a neutral zone before entry doors to the clean room.

## The air quality of the clean room shall be monitored at a defined frequency (which shall be adjusted based on actual findings).

## There shall be a PM for changing of air filters in the clean room.

## There shall be monitoring or control of the cleanliness of the components introduced into the clean room.

## There shall be monitoring or control of the bins/washed containers that are introduced into the clean room.

## There shall be a neutral zone entry for part entry and exit points, like that for personnel entry and exits.

## There shall be temperature and humidity control that is monitored and maintained.

## There shall be a parts handling policy which includes drop parts policy, bare hands, part transfer from/to operations.

## The supplier shall store washed parts and protect them in the clean room.

## **Control of Non-Conforming Material/Rework**

## “Rework of parts or date codes SHALL not include abrasive material such as Scotch Brite. Residual abrasive material from these products may contain Aluminum Oxide which has proven to be a serious problem in the past. This residual material can embed in engine components and lead to premature engine failure.

# **Feedback Assessment & Corrective Action** The supplier manufacturing location SHALL incorporate the following Lessons Learned and Best Practices into the GM 1927 28 EPC activity:

### For new product launches, the EPC exit criteria SHALL include the following:

## There SHALL be no supplier responsible warranty returns at 2 Months in Service (MIS) for 30 production days.

## The suppler SHALL formally request to the GM Product Development Team (DRE, SQE, and CVE) to exit from or to modify the EPC exit criteria.

## All AIAG PFMEA VDA Handbook, or AIAG PFMEA 4th Edition within CG4338 GM 1927 03 SQ SOR failure modes identified as high severity or safety critical, SHALL be clearly documented in the control plan and visible throughout the EPC inspection process.

## An off-line EPC station SHALL be required whenever there is a need for additional level of inspection (i.e., new product launch, CS1/CS2 or certain SPPS type, Start Up/Shut down, etc.). EPC process SHALL fulfill requirements of GM 1927 28 EPC Procedure, the duration of EPC control implemented SHALL be agreed with GM.

## Supplier is responsible for the uninterrupted supply of high-quality level components as approved during PPAP for the entire lifetime of the product, including aftersales requirements.

## Supplier is required to implement Quality System aligned with IATF 16949 standard. A new facility SHALL be IATF 16949 Certified prior to start of MVBs build on customer side.

## Supplier SHALL ensure timely execution of each SPPS (Supplier Practical Problem Solving) issued.

## The PFMEA and Control Plan SHALL include labeling and label error-proofing SHALL implemented where feasible. For any critical characteristics where event error-proofing is not in place, redundant inspection SHALL be implemented. Refer and comply to AIAG FMEA VDA Handbook or AIAG PFMEA 4th Edition and CG4338 GM 1927 03 SQ SOR.

# **Quality Information at Global APQP Technical Review**

## Gather the above information in a binder or envelope marked “Quality” and submit it with your bid package. If you have any questions relative to the required information, please contact your GM Supplier Quality Engineer for clarification. All information SHALL relate to the manufacturing site that the product will be manufactured and SHALL reference the RFQ number and part numbers. All listed information is required in your Quote Package. Be prepared to answer questions during the Technical Review Meeting.

Acronyms, Abbreviations, Definitions and Symbols

5S Sort, Straighten, Sweep, Standardize, Sustain

APQP Advanced Product Quality Planning

CC/SC Critical/Significant Characteristic

CCT Continuous Compliance Testing

CG GM General Form/Template identifiers

CN Change Notice

CVE Component Validation Engineer

CRV Component Readiness Valve

DRE Design Release Engineer

EP Error Proofing

EPC Early Production Containment

FIFO First In, First Out

Gate Product Development Checkpoints

GPS GM Global Propulsion Systems

GMW GM Worldwide Engineering Standards

HVAC Heating, Ventilation, Air Conditioning

LAT Lot Acceptance Testing

NOK Not Ok

PM Preventative Maintenance

PPM Parts per Million

SOP Standard Operating Procedure

SOR Statement of Requirements

SPC Statistical Process Control

SPCR Supplier Process Change Request

SPPS Supplier Practical Problem Solving

Acknowledgement

Please sign, date, provide evidence (current and/or empirical) and return this document as a record of your understanding of these requirements

Authorized Supplier Management:

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| **Change History** | | | | |
| **Date** | **Version** | **Change Summary** | **Approver** | **Approving Department** |
| 4/20/2016 | Initial Template | Restructured Global Propulsion Appendix F format for a baseline template | Brian Davis | GPS Global Process |
| 4/23/2018 | 1.0 | Created Statement of Requirements based on Contamination Audit and Part Marking Bulletin | Brian Davis | GPS Global Process |
| 4/30/2018 | 1.1 | Corrected title from 03b to 03a | Brian Davis | GPS Global Process |
| 5/14/2018 | 1.2 | Grammar corrections 7.17, 7.19, 7.22, 7.26, 7.44, 7.56 & 7.61 | Brian Davis | GPS Global Process |
| 4/23/2019 | 1.3 | Update name to remove date and GM Conf | Brian Davis | GPS Global Process |
| 3/28/2022 | 2.0 | Changed SRV with CRV; GP12 with EPC; GM1925 with GM 1927 10 Fixture Standards; Updated header; GP9 with GM 1927 35 R&R; added new FMEA VDA requirements, removed GM 1927 03 16b audit link, change naming convention, changed author and owner | Craig Kirbitz | GPS Global Process |