COSWORTH

Supplier Manual

Cosworth LLC

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Cosworth LLC

Since it was formed in 1958 by Mike Costin and Keith Duckworth, Cosworth has become the most successful independent engine manufacturer in history as well as one of the market leaders in performance electronics, with a string of driver and manufacturer titles to its credit in a wide range of formulae with impressive performances in Formula One, IndyCar, Champ Car, WRC, sportscars and MotoGP.

In the beginning

Cosworth began life in a small workshop in London in 1958. However, things quickly grew and a move to larger premises was soon required. The company moved to north London, where it began working on the development of the Ford 105E engine. Cosworth actually achieved its first victory when Jim Clark took a win in the Formula Junior category in his Lotus 18 at Goodwood in 1960.

The classic motorsport era

In 1964, the company moved to Northampton where bigger prospects were around the corner. In 1966, Duckworth signed a contract with Ford to develop a new three-litre Formula One engine, and the legendary DFV was born. It got its first taste of victory in 1967, when Jim Clark again provided the maiden victory at the Dutch Grand Prix.
The DFV, in subsequent development guises, went on to dominate the sport for 15 years and clinched 155 race wins during that time.

A host of famous names benefited from Costin and Duckworth's approach in Formula One. Jackie Stewart, Emerson Fittipaldi, Mario Andretti, James Hunt and Nelson Piquet all took championships using Cosworth engines during the 1970s.

This period of sustained dominance in Formula One played a key part in making Cosworth a major name in motor racing around the world and a favorite with fans.

The 1980s & 1990s

Cosworth's success continued through the 1980's and 1990's in a range of championships around the world. The Ford Sierra RS500 Cosworth and XG V6 powered Mondeo both won the World Touring Car Championship and the Zetec-V8 F1 engine powered Michael Schumacher to his first world championship title.

In North America the DFX and XB engines dominated the CART/Indy formula leading to Cosworth receiving the Queen's Award for Export achievement in both 1986 and 1992.

The birth of motorsport electronics

This same period witnessed the spectacular growth of motorsport electronics and the establishment of data recording (or logging) and analysis as a cornerstone of modern high performance motorsport.

In 1987 Cosworth's electronics division was founded by Tony Purnell under the name Pi Research. The company initially focussed on providing electronic instrumentation for race teams and racecar manufacturers wanting to improve the quality of their data from wind tunnel testing. The extension from wind tunnel data gathering instrumentation to on-car data acquisition systems was the natural progression - and the Pi Research "Black Box" was born.
Used extensively in the North American IndyCar Championship, the Pi Research Black Box was the first electronic dash display and combined data logger to be used in professional motor sport. The success of the product in allowing teams to analyse performance parameters of the car, engine and chassis, as well as providing clear, accurate information for the driver marked a turning point in race car technology and defined the future for motorsport.

Following rapid expansion and several relocations, 1998 saw Cosworth's electronic division move to its current home - a purpose-designed facility just north of Cambridge in the UK. At this time Pi Research acquired Pectel Control Systems to complement its data acquisition technologies with world-class engine and chassis controllers.

The Ford years

Cosworth and Pi Research were bought by Ford in 1998 and the companies became works engine and electronics suppliers to the Stewart Grand Prix Formula One team and its successor - Jaguar Racing.

Cosworth and Pi Research also supplied engine and electronics solutions to Ford for its highly successful campaign in the World Rally Championship providing power and performance to legendary names in the sport including Colin McRae and Carlos Sainz.

In North America, 2003 saw the introduction of two new Cosworth engines for open wheel racing.
The Cosworth XG engine for Chevrolet in IRL Indycar, and the Cosworth XF, which was adopted as the specification engine for the Champ Car World Series.
Sister company in Ford's Premier Performance Division, Pi Research supplied the complete set of car electronics to both IRL IndyCar and the Champ Car World Series.

Success also continued in the wider business arena for Cosworth and in 2003 the business was voted the Motorsport Industry Association business of the year.

Today's Cosworth Group is formed

In 2004, Cosworth was purchased by Jerry Forsythe and Kevin Kalkhoven, co-owners of the Champ Car World Series (the successor to CART). Under its new ownership Cosworth embarked on a diversification strategy, applying its expertise in mechanical engineering, performance electronics and precision manufacturing to secure business opportunities in the mainstream automotive, aerospace and defence industries.

In January 2011, the Motorsports Industry Associated (MIA) recognised Cosworth's diversification success with the inaugural New Markets Award. In November of the same year, Cosworth's success in high

value-added manufacturing in the UK was rewarded with the prestigious RBS 2011 Manufacturer Of The Year Award.

In 2013 Cosworth announced plans for a major new factory at its Northampton home to coincide with its 50th anniversary in the town in 2014. The new facility will provide state-of-the-art flexible manufacturing systems to enable Cosworth to supply high-performance engines for premium sports car manufacturers and continue to deliver a "one-stop-shop" for performance products and technologies to the automotive, motorsport and retail aftermarket industries.

COSWORTH Organization Structure

Web Page: Additional information about Cosworth can be found at www.cosworth.com.

1. Quality System Requirements:

Suppliers of products to Cosworth LLC shall maintain a Quality Management System (QMS) which meets the intent of the standard indicated for the plant below. It is preferred the supplier is certified by an accredited third-party certification body to the specification indicated.

Yes = Suppliers are required to be certified by a third party to the standard identified, or their QMS must be audited to insure it meets the standard

Pre = Cosworth prefers to use suppliers which are certified to the standard, and or follows the standard as specified within this manual.

COSWORTH LLC	QMS OPERATING STANDARD	First Article Inspection (FAI)	PPAP	Special Characteristics	Error Proofing	Work Instructions	Control of Monitoring and Measuring Devices	SPC	Preventative Maintenance	Shelf Life	Material Lot Control	Change Control	Nonconforming Material	Containment of NCM	Section 8 Packaging, Delivery	Continual Improvement/Corrective Action	Quality and Delivery Performance	Accounting Requirements	
		4.1	4.2	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	6	7/ 7.1	7.2	8	9	10	11	
	IATF 16949	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
	ISO9001	NO	YES	YES	YES	PRE	PRE	PRE	PRE	YES	YES	YES	YES	YES	YES	YES	YES	YES	

See the following source for a listing of accredited certification bodies:

- The U.S. accreditation body for management systems can be found at ANSI-ASQ National Accreditation Board, http://www.anab.org.
- For ISO/IATF16949, see International Automotive Oversight Bureau at http://www.iaob.org

In the absence of third-party certification, depending on the product, its application, value, and criticality, the Cosworth Quality representative may authorize the acceptance of other evidence of compliance. This may include second-party audit or first-party (self) assessment to the applicable criteria above, or to a set of alternative basic quality requirements.

Once approved, the Supplier shall notify Cosworth Quality of any change to the Quality System. Notification must be made in writing to the Cosworth Division Quality Manager. In addition, Cosworth requires notification of any major audit findings.

1.1 Quality Manual

If a Supplier maintains a Quality Manual, Cosworth may request to review a copy. The quality management system documentation shall include Supplier's statements of a quality policy and quality objectives. Top management shall define quality objectives and measurements which should address customer expectations and be achievable within a defined period of time. The Supplier is required to promptly notify Buyer of any substantive changes to the Supplier's quality management system or personnel.

2. Supplier Approval Process:

Cosworth requires all Suppliers to be approved prior to the issuance of contracts. All Suppliers must be approved by Cosworth, regardless of approvals by customers or other entities.

All suppliers to Cosworth will be classified into one of three groupings: Major, Minor, or Non-Critical.

a. Major Suppliers: Provide a product which regularly impacts Cosworth's ability to meet our mutual customer's requirements, or has a high degree of pass through features.

b. Minor Supplies: Provides product which is less complex, occasionally may impact COSWORTH's ability to meet customer requirements, and has few if any features which are a pass through.

c. Non Critical Suppliers: Provides product which is considered "hardware" or a machined component with few features. Suppliers in this category never impact Cosworth's ability to meet customer's requirements.

Cosworth will have yearly meetings to review Supplier status. If a Suppliers classification has changed, the supplier will be contacted by Cosworth quality. Major Suppliers will require a on-site process audit to be performed. The audit could result in corrective actions which will follow the requirements of section 9.2 of this manual.

2.1 SUPPLIER ASSESSMENT

The Supplier Approval Process may include the following:

a. Supplier Initial Pre-Assessment Cosworth may request the Supplier to provide a copy of its quality management system certificate and/or complete a self-assessment of its business and quality management system and capabilities.

b. Documentation Audit In those cases where a Supplier's quality management system has not been certified by an accredited certification body, Cosworth may request a copy of the Supplier's Quality Manual and supporting procedures to determine if the Supplier's quality management system meets Cosworth requirements.

c. On-Site Assessment (Required for all Major Suppliers to Cosworth) Cosworth and/or its customers, due to product/process complexity or criticality, may elect to conduct on-site assessments of a Supplier's product or process capabilities. As a result, findings may be issued. These assessments could include:

- Quality Management System (QMS) – if necessary, as a result of (or in conjunction with) product or process capability assessments, to determine whether the Supplier's quality management system meets one or more of the applicable standards, and is functioning effectively.
- Business and Manufacturing Operations – to determine whether the Supplier has the financial resources, production capacity, and other business resources needed to fulfill COSWORTH volume production needs and continuity of supply.

- Technology Assessment - to determine whether the Supplier has the needed technical resources, including production and inspection equipment, facilities, engineering resources, etc.
- Sub-Tier Supplier Control – to evaluate the effectiveness of the Suppliers sub-tier management processes and ensure that products or services procured from sub-tier sources and delivered to Coswoth conform to all applicable Cosworth requirements.

3. General Requirements:

The following set of general quality requirements applies to all Suppliers.

3.1 COMPLIANCE TO CONTRACTUAL REQUIREMENTS

Upon accepting a Cosworth contract, the Supplier is responsible for compliance to all contract (e.g., engineering drawing, specification, purchase order) requirements. All documents, drawings and specifications, regardless of origin, are applicable to the Supplier when specified in the contract or documents referenced in the contract, and are required to be used at all levels of the supply chain. Unless otherwise specified in the contract, the document revision in effect on the date of issue of the contract applies to the contract. Neither audit, surveillance, inspection or tests made by COSWORTH, representatives of COSWORTH or its customer(s), at Supplier's facilities, at any sub-tier facilities, or upon receipt at COSWORTH, relieves the Supplier of the responsibility to furnish acceptable products or services that conform to all contract requirements; nor does it preclude subsequent rejection by COSWORTH or its customers.

3.2 CONTROL OF SUB-TIER SUPPLIERS

The Supplier, as the recipient of the contract, is responsible for meeting all requirements, including work performed by the Supplier's sub-tier (or special processing) Suppliers. In addition, the Supplier shall insure the sub-tiered supplier is qualified and/or approved to perform the work being subcontracted. (COSWORTH recommends all sub-tiered suppliers be identified and provided to the buyer at time of quote). When the Supplier uses sub-tier sources to perform work on products and/or services scheduled for delivery to COSWORTH, the Supplier shall include (flow-down) on contracts, to its sub-tier sources, all of the applicable technical and quality requirements contained in the COSWORTH contract, including quality system requirements, product traceability, regulatory requirements, and the requirement to document and control 'key characteristics' and/or 'key processes,' and to furnish certifications and test reports as required. COSWORTH and its customers reserve the right-of- entry to sub-tier facilities, subject to proprietary considerations. Changes in the process, including changes in the use of Sub-Tier suppliers require PCN submittal and approval.

3.3 CONTROL AND RELEASE OF COSWORTH FURNISHED DOCUMENTS

Documents furnished by COSWORTH to the Supplier are furnished solely for the purpose of doing business with COSWORTH. Proprietary documents may be furnished to the Supplier in

hard copy, electronic or other media. The Supplier is responsible for controlling and maintaining such documents to preclude improper use, loss, damage, alteration and/or deterioration. Unless authorized by the COSWORTH in writing, the Supplier may not transmit or furnish any COSWORTH furnished documents, or copies of such documents, to anyone outside the Supplier's business organization except to a sub-tier source used by the Supplier for performance of work on the COSWORTH contract. The Supplier shall return to COSWORTH, or purge electronic copies of, all proprietary documents with the last delivery of products or services on the contract. COSWORTH may request the Supplier to furnish objective evidence or certification that proprietary documents have been purged. The Supplier shall flow down this requirement to all sub-tier sources, when such sources will be in receipt of COSWORTH proprietary documents during performance of work for the Supplier.

3.4 BUSINESS CONTINUITY

The Supplier should have a business continuity plan which would allow for the safeguarding, storage and recovery of engineering drawings, electronic media, and production tooling in the event of damage or loss. This plan should also contain contingency plans to satisfy COSWORTH requirements in the event of significant utility interruptions, labor shortages, equipment failure and field returns.

4. Product Qualification

This section defines the generic requirements for production part qualification and approval. The purpose is to determine if all COSWORTH design and specification requirements are properly understood by the Supplier and that the manufacturing processes have the capability to consistently meet these requirements. In all instances where a product is manufactured for the first time, to a new design, for a new system, or for a new application, it is important that Supplier and COSWORTH allocate responsibility for assuring that all performance, endurance, maintenance, safety and warning requirements are met. It is preferred that this allocation of responsibility be in writing.

4.1 FIRST ARTICLE INSPECTION (FAI)

Unless the PPAP process (below) is used, a First Article Inspection (FAI) is required to initially qualify a part/process for Supplier production approval. Furthermore, a new FAI may be requested if there is an extended gap of time since last production. The FAI requires that all features and characteristics on the design specification and control plan be inspected and verified prior to production. Actual measured values shall be recorded as opposed to general statements of conformance or other notations simply indicating acceptance. For First Article Inspection guidance, see AIAG PPAP Manual (Appendix C, D, & E) – Production Part Approval Process (available from www.aiag.org). In addition to an FAI, Suppliers shall, as a minimum, develop a Control Plan by identifying special product and process characteristics that are key to achieving quality. The Supplier shall also include those special characteristics designated by COSWORTH in the drawing, specification, or contract.

4.2 PRODUCTION PART APPROVAL PROCESS (PPAP)

When required by AIAG standards, the Supplier shall submit a more comprehensive Production Part Approval Process (PPAP) qualification package. The Supplier is responsible for obtaining the latest revision of the applicable AIAG core tool reference manuals and forms.

The AIAG Core Tools Manuals are:

- Advanced Product Quality Planning (APQP) and Control Plan
- Production Part Approval Process (PPAP)
- Potential Failure Mode and Effects Analysis (FMEA)
- Measurement Systems Analysis (MSA)
- Statistical Process Control (SPC)

Unless otherwise notified by COSWORTH Quality, when PPAP is required due to first production run of part, the Supplier shall submit at minimum “Level 3” PPAP package to COSWORTH. See AIAG PPAP Manual, Table 4.2, for complete list of submission requirements for each level of PPAP. Also, see AIAG APQP Manual for related guidance on associated product and process design and development methodology and techniques.

A) Design Record, Change Documents, and Customer Approval

The Supplier shall follow the standards as specified in the AIAG PPAP Manual regarding the documented design records for the saleable product/part and components, including any authorized engineering change documents for changes not yet recorded in the design record but incorporated in the product, part or tooling.

B) Process Flow Diagram

The Supplier shall have a visual diagram of the proposed or current process as described in the AIAG PPAP Manual.

C) Failure Mode and Effects Analysis

Suppliers with product design responsibility shall develop a Design FMEA. A single Design FMEA may be applied to a family of similar parts or materials. Suppliers shall develop a Process FMEA in accordance with, the AIAG FMEA Manual.

D) Measurement Systems Analysis

The Supplier must develop or obtain gages and standards to control their processes and to determine product conformance to specifications. Variable gages and measurements are preferred. Alternative methods, gages or standards may be used at COSWORTH to verify the Supplier’s inspection results. COSWORTH may request the Supplier to participate in a correlation study to compare Supplier measurement results against results obtained by COSWORTH gages and methods. The Supplier shall perform Measurement Systems Analysis (MSA) studies. See AIAG MSA Manual.

E) Control Plan

The Supplier shall have a Control Plan that takes into account the output from the FMEA and defines all methods used for process monitoring and control of special product/process characteristics. The control plan covers three distinct phases: prototype, pre-launch, and production. A single control plan may apply to a group or family of products that are produced by the same process at the same source. See AIAG APQP Manual

F) Process Capability Study

Process Capability Index (Cpk) is a comparison of the inherent variability of a process output to specification limits under statistically stable conditions. Most methods for estimating capability require that the characteristic being evaluated is approximately normally distributed, and in statistical control. The distribution should be determined prior to estimating capability. If the process is not in statistical control, all assignable causes must first be identified and removed. Special techniques are available for calculating capability when inherent assignable causes, such as tool wear, are present. Definitions and calculations for Cpk and Ppk indices are found in AIAG PPAP and SPC Manuals.
Suppliers are requested to notify the assigned COSWORTH quality engineer of any process capabilities falling below the blue print or process specifications at defined levels. Specific inspection plans may be required by COSWORTH plant quality to insure delivered product quality meets COSWORTH's expectations.

G) Certification and Test Reports

The Supplier shall provide evidence that the following verifications required by the design record and control plan have been completed and that results indicate compliance with specified requirements:

- Dimensional Results – for each unique manufacturing process, e.g., cells, lines, molds, patterns, a record of actual results of all characteristics.
- Material and Performance Test Results – for all parts and product materials with chemical, physical, metallurgical, and functional performance requirements.
- Qualified Laboratory Documentation – documentation showing laboratory results of the qualifications for the type of measurements or tests conducted and the standards used.
- Sample Product – actual samples as required by the applicable specification or COSWORTH contract.
- Master Sample – retain a master sample, when required by the Buyer, and make available upon request.
- Checking Aids – if requested by the Buyer, submit part-specific assembly or component checking aids.
- Records of Compliance – copies of records showing compliance to all applicable COSWORTH-specific requirements.

See AIAG PPAP Manual for applicable forms and instructions.

H) Part Submission Warrant

Upon completion of all PPAP requirements, the Supplier shall complete the Part Submission Warrant (PSW). A separate PSW shall be completed for each COSWORTH part number. Upon receipt, COSWORTH will review and either approve, reject, or provide interim approval. See AIAG PPAP Manual for forms and instructions.

5. Process Control

This section defines the basic necessities for Suppliers to control their manufacturing processes.

5.1 SPECIAL CHARACTERISTICS (SC)

The Supplier shall demonstrate conformity to those special characteristics designated by COSWORTH through means of documentation and appropriate control methods. In addition to any special characteristics identified by COSWORTH, the Supplier shall also review, identify, document, and control other product and process characteristics that are key to achieving quality. Features designated as SC require actual inspection data to be available for review upon request.

5.2 ERROR-PROOFING

The Supplier should use error-proofing devices and techniques as a form of process control; especially for repetitive functions, difficult tasks prone to mistakes, or where the cost of error is high.

5.3 WORK INSTRUCTIONS

The Supplier shall prepare documented work instructions, as necessary, for all employees having responsibilities for the operation of processes that impact product quality. These instructions shall be maintained current and accessible for use at the work station.

5.4 CONTROL OF MONITORING AND MEASURING DEVICES

The Supplier shall determine the monitoring and measurement to be undertaken and the monitoring and measuring devices needed to provide evidence of conformity of product to requirements. As a minimum, where necessary to ensure valid results, measuring equipment shall:

- be calibrated or verified at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification shall be recorded; and be identified to enable the calibration status to be determined.

-Insure the suitability of the inspection method/equipment for its intended purposes and is capable of producing valid results. Suitability includes limits for accuracy, precision and repeatability.

5.5 STATISTICAL PROCESS CONTROL

Where specified in the Control Plan, the Supplier is required to apply effective statistical process controls. Suppliers should consult the Statistical Process Control (SPC) manual published by AIAG for guidance, methods, examples, and related reference information.

5.6 PREVENTIVE MAINTENANCE

The Supplier should identify key process equipment and provide resources for machine/equipment maintenance activities and develop an effective planned total preventive maintenance system.

5.7 SHELF-LIFE CONTROL

With each delivery of materials or products that have a limited or specified shelf life, the Supplier shall furnish data that shows (a) the cure or manufacture date, (b) expiration date or shelf life, (c) lot or batch number, and when applicable any special handling or storage requirements. Unless otherwise specified by contract, for all shelf life limited materials or products delivered to COSWORTH, the remaining shelf life shall be a minimum of 75% of the total shelf life for the material.

5.8 RAW MATERIAL LOT CONTROL

In those cases where the Supplier elects to use more than one lot of raw material, the Supplier shall ensure, document and furnish positive traceability of each individual product to the raw material certification/test report that represents the raw material from which each of the products was manufactured. Traceability shall be provided by identifying the raw material heat, lot, batch or melt number from the certification/test report on the product and/or on packaging (when used), or the products segregated and identified.

5.9 COSWORTH Furnished Material

Supplier shall insure procedures are in place to properly identify and control all COSWORTH supplied materials. Tooling/fixtures owned and supplied by COSWORTH must be tagged or otherwise identified as being COSWORTH owned property. Material supplied by COSWORTH must be controlled, identified and segregated from other Supplier material. Unless otherwise specified by the COSWORTH buyer, Suppliers must account for 100% of consigned material.

5.10 Automated Processes

If computers, software, or other automated methods are used as part of the production or verification process, the supplier shall validate the computer software for its intended use. The validation process shall create a validation protocol (describing the planned activities) and a validation report (documenting the outcome of the planned activities). All software changes shall be similarly validated prior to use.

The Supplier shall keep records of these activities and make them available to COSWORTH upon Request.

6. Change Control

Suppliers shall not make changes to their processes, location, facilities, equipment, material, product design (or any change which may affect product design or function) without written approval from the COSWORTH Buyer for:

- Correction of a discrepancy on a previously submitted part;
- Product modified by an engineering change to design records, specifications, or materials; or
- Any planned changes by the Supplier to the design, process, or manufacturing location, such as:

  a) Use of other material than was used in previously approved part or product

  b) Production from new, additional, replacement or modified tools, dies, molds, patterns, etc.

  c) Production following upgrade or rearrangement of existing tooling or equipment

  d) Production from tooling and equipment transferred to a different plant site or from an additional plant

  e) Change of sub-tier Supplier for parts, nonequivalent materials, or services (e.g. heat treating, plating, etc.)

  f) Product produced after tooling has been inactive for production for 12 months or more

g) Change to test/inspection method – new technique (no effect on acceptance criteria)

h) For bulk materials: new source of raw material from new or existing Supplier, or change in product appearance attributes, etc.

i) Use of any non-conventional manufacturing methods such as electro-discharge machining (EDM), electro-chemical machining (ECM), laser or abrasive water jet metal cutting, flame spray coatings, etc.

Before submitting to COSWORTH a request for a permanent change to a Supplier-controlled design, the Supplier shall review the FMEA and Control Plan, as applicable, to ensure that all process-related issues have been addressed and resolved. COSWORTH may require the Supplier to submit an updated FMEA and Control Plan prior to approval of such permanent changes. COSWORTH may also require other portions, or all, of the related qualification process to be repeated. In some cases, COSWORTH may elect to review Supplier proposed permanent changes at the Supplier's facility.

Emergency deviation requests must be made to the COSWORTH Division Quality lead, and must be approved in writing prior to shipment.

7. Control of Nonconforming Material

Suppliers shall maintain a documented process which specifies how NCM material is to be identified, quarantined, and monitored.

For nonconforming products supplied to COSWORTH, including those that reach a COSWORTH's customer, the Supplier must cover all costs to correct the nonconformance.

7.1 SUPPLIER REQUEST FOR NONCONFORMANCE DEVIATION

A Supplier shall not knowingly ship product that deviates from the drawing, specification limits, or design intent without prior written authorization from COSWORTH. If such a condition exists, the Supplier may petition the COSWORTH plant Quality Manager, in writing, to allow shipment of the product under a written nonconformance deviation. Contact the COSWORTH division Quality lead for appropriate forms and submittal process. The cost of shipping, inspection, and testing to determine the potential acceptability of such product will be charged to the Supplier. COSWORTH's approval of a deviation is specific to the products for which it has been submitted and approved and shall not to be construed as a permanent engineering change. The Supplier must begin work immediately on corrective action. In all cases, the Supplier shall fully contain all product suspected of being nonconforming. In addition, nonconforming product may be returned to the Supplier at Supplier expense, or the Supplier may be required to sort any suspect product already shipped to COSWORTH or be charged back for the cost of sorting by COSWORTH. Any parts shipped to COSWORTH that have been approved for deviation shall be clearly identified as such externally on the box, container, or other packaging and on shipping documentation. Inside of each box shall contain a copy of the approved deviation document.

7.2 CONTROL OF REWORKED PRODUCT

Rework or repair is defined as additional operations that are not part of the PPAP or FAI approved production process flow, which will bring product in full compliance with applicable drawings and specifications. Instructions for rework, including re-inspection requirements, shall be approved by COSWORTH's Quality personnel prior to Supplier performing the rework. All rework shall be documented and must be accepted by COSWORTH quality.

7.3 SUPPLIER CONTAINMENT

For product quality problems reported by COSWORTH to the Supplier, until formal corrective action has been taken and approved, the Supplier shall provide documented evidence with subsequent shipments that such product has been inspected for the identified nonconformances and meets all applicable requirements.

8. Packaging, Labeling, Delivery & Record Retention

Preservation, packaging, labeling, and shipping methods must comply with common industry practices and COSWORTH requirements specified on the contract.

8.1 PRESERVATION

In order to detect deterioration, the condition of product in stock should be assessed at appropriate planned intervals. The Supplier should use an inventory management system to optimize inventory turns over time and should assure stock rotation, such as "first-in-first-out" (FIFO).

8.2 PACKAGING

The Supplier must adequately plan for packaging designed to prevent product contamination, deterioration or loss and to eliminate shipping damage. Suppliers should provide expendable packaging or returnable containers, where appropriate, that provide for sufficient density and protection from any likely damage that may occur. Expendable materials and packaging must meet local and national standards for safe disposal and/or recycling. Packaging specifications should be submitted with PPAP or FAI.

8.3 LABELING

Labeling and bar code requirements may vary among COSWORTH's divisions. At a minimum, the label shall contain the COSWORTH part number, revision, and lot control number. COSWORTH's division may provide the Supplier with additional labeling specifications.

8.4 DELIVERY

The Supplier should systematically inform COSWORTH of any delay in delivering product and provide a new shipment date. The Supplier is responsible for additional transport costs due to delays.

8.5 RECORD RETENTION

The Supplier shall retain quality records for a time period specified by the AIAG standards or for Medical Devises as specified by 21 CFR 820.181. Upon request, the Supplier shall be capable of retrieving and delivering required records to COSWORTH within forty-eight hours from time of request.

8.6 SHIPPING DOCUMENTS

Shipments to COSWORTH require the following documents:

- Packing slip with a unique number, COSWORTH's part number, quantity shipped, purchase order number and line item of the purchase order. **(Must have a three way match with Purchase Order).**
- Certification of Conformance to the purchase order, part number revision and lot control number.
- Material certification indicating name of producing mill, actual chemical, physical, and metallurgical results. Specification to which material is certified, including heat lot or traceability number.
- Special processing certification must state the specification parts were processed to.
- Suppliers of Medical components must also provide all inspection results with each shipment.

8.7 ROUTING INSTRUCTIONS

COSWORTH shipping terms of freight prepaid and charge back or freight collect:

Packages up to 200 total pounds (30 pound packages).
- Ship UPS collect COSWORTH Account. (Contact COSWORTH Buyer for Account information).

Packages over 200 total pounds and LTL
- COSWORTH plant will designate a carrier, refer to the Purchase Order

Insurance option for freight is NOT to be selected unless otherwise specified by the COSWORTH Buyer.

9 Continual Improvement.

Continual improvement of the organization's overall performance should be a permanent objective of the supplier's organization. ISO 9000 offers guidelines and a process for continuous improvement. COSWORTH prefers to utilize suppliers which operate by ISO 9000 standards.

9.1 PROBLEM SOLVING PROCESS

Suppliers should use a closed-loop corrective action process whenever a problem is encountered internally or upon notification from COSWORTH. For additional guidance on problem solving methods, tools, training, and related references, refer to AIAG document CQI-10.

9.2 CORRECTIVE ACTION REPORT

COSWORTH may issue a request for a Corrective Action Report (CAR) to the Supplier when nonconforming material, components, or assemblies are found. When documenting the root cause, the Supplier shall include the underlying reasons:

a) why the specific nonconforming condition or incident occurred,
b) why it was not detected by the Suppliers quality controls, and
c) why the related process, from a systemic viewpoint, allowed the nonconformance (and potentially others like it) to occur.

The Supplier should apply the following criteria to determine whether the underlying root cause has been identified:

a) It initiates and causes the event you are seeking to explain.
b) It is directly controllable.
c) The elimination of that root cause will result in the elimination or reduction of the problem.

Unless otherwise requested by COSWORTH when notified, the Supplier shall respond to a request for corrective action as follows:

9.3 Supplier's timeline for Corrective Action Reports

- Emergency Response Activity (ERA) where the supplier Acknowledges receipt of notification and communicates containment actions (if needed) — Within 24 hours
- Interim Containment Actions (ICA) Containment plan provided, which includes confirmation all suspect material is identified and contained. — Within 72 hours
- Permanente Corrective Action (PCA) Report with permanent actions taken, or to be taken, to prevent recurrence of the same or like problems. — Within 30 days

10. Supplier Quality and Delivery Performance

$$PPM = \left(\frac{\text{Number of parts Rejected/Returned}}{\text{Number of parts Received}} \right) \text{X } 1{,}000{,}000$$

COSWORTH PLANT	MINIMUM ACCEPTABLE PPM LEVEL	MARGINAL PPM PERFORMANCE	PPM'S GREATER THAN LISTED MAY REQUIRE CORRECTIVE ACTION/IMPROVEMENT PLAN
AMC II	50	51 – 150	➢ 150

10.1 Minimum acceptable Quality Performance

Suppliers which have PPM's exceeding the levels listed in section 10, may require a corrective action to the suppliers quality management system. It will be at the discretion of COSWORTH's Plant Quality as to the specific area's the corrective action will address.

10.2 Delivery Performance

Suppliers shall have a system that supports 100% on time shipments to COSWORTH's requirements. The system shall be capable of tracking and measuring delivery performance so that necessary corrective actions are taken when the performance level drops below 100%. Poor delivery performance will require corrective action by the supplier.

Suppliers are expected to take proactive approach and communicate all potential delivery problems prior to COSWORTH being affected.

This metric defines the delivery performance rating using the following criteria:

- Each COSWORTH plant will document line interruptions or potential line interruptions during regular scheduled plant metric meetings.
- Two or more line interruptions within a 12 month period will result in unacceptable rating for delivery.
- Unacceptable delivery rating will require a corrective action from the supplier.

11. Accounting Requirements

All shipments to COSWORTH plants must comply with the following:

- The packing slip must have a unique number, clearly identifying the COSWORTH purchase order number, line number, COSWORTH part number, revision level, and quantity (using the unit of measure from purchase order) being shipped. The quantity must match the quantity ordered on the purchase order. It is COSWORTH's policy to only receive and approve for payment the quantity on the purchase order.
- Unless otherwise requested, Suppliers shall submit one invoice per packing slip, and for each Purchase Order product was shipped against. The supplier's invoice must clearly identify the purchase order number, match the Purchase Order price and quantity. Any difference may create delays in the payment process, and/or result in a short payment to the invoice.
- Invoices must be sent to accounting1@Cosworth-1.com, or the "Bill To" as identified on the face of the Purchase Order

11.1 Automated Clearing House (ACH) Payments

Suppliers are requested to sign up for Automated Clearing House (ACH) payment processing. The use of ACH process will improve accuracy and speed of payments. All ACH information should be submitted to ACHSupplier@COSWORTH-1.Com

- ACH payment processing requires the following information to be forwarded to the email address referenced above:
  - Bank Routing Number
  - Bank Account Number

  - Email address for remittance
- COSWORTH requires a completed W-9 Taxpayer identification number to be on file prior to any payment being made. Blank W-9 forms can be provided upon request.

COSWORTH's Glossary

Advanced Product Quality Planning (APQP) – A structured method of defining and establishing the steps necessary to assure that a product satisfies the customers specified needs. The APQP process mitigates and reduces risk.

Bill of Material (BOM) - A list of parts, sub-assemblies and raw materials used to make a product. Defines type, number, quantity, and relationships of parts and assemblies.

Buffer Stock – Finished goods available within the value stream to meet Takt time due to variations in customer demand.

Cell – The location of processing steps for a product immediately adjacent to each other so that parts and documents can be processed in a nearly continuous flow, either one at a time or in small-batch sizes that are maintained through the complete sequence of processing steps.

Complaint – A written, electronic, or oral communication that alleges deficiencies related to the identity, quality, durability, reliability, safety, effectiveness, or performance of a device after it is released for distribution.

Corrective Action – Action to eliminate the cause of a detected nonconformity or other undesirable situation.

Continuous Improvement (CI) – Continuous improvement of an entire value stream or an individual process to create more value with less waste. Value-stream mapping is an excellent tool for determining where a process improvement event may be beneficial.

Critical Path – The series of consecutive activities that represents the longest time path through the process.

Cycle Time – How often a part or product is completed by a process, as timed by observation. This time includes operating time plus the time required to prepare, load and unload. Different cycle times can include machine cycle time, operator cycle time, order-to-cash time, processing time and production lead time.

Demand – Usage of an item over a period of time. Also includes an understanding of the customer's requirements for quality, lead time and price.

Efficiency – Meeting exact customer requirements with the minimum amount of resources.

8 wastes – The major wastes typically found in mass production: untapped creativity, overproduction, waiting, motion, processing, inventory, transportation and rework.

Enterprise Resource Planning (ERP) – Business management system that integrates all facets of the business, including planning, manufacturing, sales and marketing. As ERP methodology has become more popular, software applications have emerged to help business managers implement ERP in business activities such as inventory control. Order tracking, customer service, finance and human resources.

Error-Proofing – Method that help operators avoid mistakes such as choosing the wrong part, leaving out a part or installing a part backwards. Commonly referred to as poky-yoke.

First in, First Out (FIFO) – Principle and practice of maintaining precise production and conveyance sequence by ensuring that the first part to enter a process or storage location is also the first part to exit. Ensures stored parts do on become obsolete and that quality problems are not buried in inventory. FIFO is a necessary condition for pull-system implementation.

5S – Five related terms, beginning with an S sound, describing workplace practices conducive to visual control and lean production. The five S's are: sort, straighten, shine, standardize and sustain.

Five Whys – The so-called five W's and One H (who, what, where, why and how) as used in problem solving. "Why" is asked a minimum of five times when trying to find the root cause of a problem.

IM&TE- Inspection, measuring, and test equipment

Inventory Turns – How quickly materials move through a facility or an entire value stream, calculated by dividing a measure of cost of goods by the amount of inventory on hand.

ISO 9001: 2015 – A collection of formal international standards, technical specifications, technical reports, handbooks and web-based documents on quality management and quality assurance. There are approximately 25 documents in the collection, with new or revised documents developed on and ongoing basis.

Just-in-Time (JIT) Production – Production system that makes and delivers what is needed, when it is needed, in the amount needed. Relies on production leveling as a foundation and comprises three operating elements: the pull system, Takt time and continuous flow.

Kanban – Signaling device that gives authorization and instructions for production or withdrawal (conveyance) of items in a pull system. The term is Japanese for "sign" or "signboard". Kanban cards are the best-known and most common example of these signals.

Lead Time (LT) – Total time from the beginning of the supply chain to the time something needs to ship. The amount of value-added time and non-value-added time for a product to move through the entire value chain.

6 sigma Lean – business system for organizing and managing product development, operations, suppliers and customer relations that requires less human effort, less space, less capital, less material and less time to make products with fewer defects to precise customer desires when compared with the previous system of mass production.

Major Supplier – Suppliers of product which is implanted, causes significant issues with COSWORTH's customers, or is viewed as a high risk supplier due to past performance.

Material Requirements Planning (MRP) – Information system that determines what assemblies must be built and materials must be procured in order to build a unit of equipment by a certain date. Queries the bill of materials and inventory data- bases t to derive the necessary elements.

Non Value-Added Activity (NVA) – An activity that takes time, resources or space but does not add value to the product itself. The activity may be necessary under current conditions, but does not add value from the customer's perspective.

One-Piece Flow – Making and moving one piece at a time.

One Sided specification – Allows for a range of measurements in one direction to the print specified dimension. Example 50.00 + .25.

Overproduction – Producing something earlier or faster than required by the next process.

Pacemaker Process – Any process along a value stream that sets the pace for the entire stream. Usually near the customer end of the value stream, often the final assembly cell. Not to be confused with bottleneck process, which necessarily constrains downstream processes because of a lack of capacity.

Pass Through (feature) – A feature on a part which is shipped to the ultimate customer without modification by the receiving plant.
Plan, do, check, Act (PDCA) – Improvement cycle based on the scientific method of proposing a change in a process, implementing the change, measuring the results and taking the appropriate action.
Plan for Every Part (PFEP) – Detailed plan for each part used in a production processes, showing everything relevant to managing the process with no errors or waste.
Planned Inventory – amount of inventory needed prior to each step in a process in order to keep processing moving smoothly.
Point-of-Use Storage (POU) – Storing production parts and materials as close as possible to the operations that require them.
Process Owner – Responsible for the process methodology along with the related tools, processes, assessment and certification criteria.
Pull Production – Production control in which downstream activities signal their needs to upstream activities. Pull production strives to eliminate overproduction and is one of the three major components of a complete just-in-time production system.
Push Production - A system of manufacturing in which parts are pushed from one step to the next step, without regard for what is really needed. Large batches of items are produced at a maximum rate based on forecasted demand, then moved to the next downstream process or into storage, regardless of the actual pace of work in the next process. Such a system makes it virtually impossible to establish the smooth flow of work from one process to the next that is the hallmark of lean production.
Safety Stock – Inventory held to compensate for variation in demand quality and downtime.
Setup Time – The time required to changeover a process from the last part of the previous product to the first good part for the next product.
Special Processing - Any production or service delivery process that generates outputs that cannot be measured, monitored, or verified until it's too late. It's often too late because deficiencies may not be obvious until after the resulting products have been used or services have been delivered. In order to prevent output deficiencies, these special processes must be validated in order
to prove that they can generate planned results.
Standard Work – Establishing precise procedures for each operator's work in a production process, based on three elements: Takt time, work sequence and Standard Inventory. This enables all team members to identify problems. The best current method for doing a job is written down; this is called standardized work.
Sub-Tier Suppliers – A third party which provides goods or services to the primary Supplier to COSWORTH.
Supermarket – The location where a predetermined standard inventory is kept to supply downstream processes.
Takt Time – The rate at which the product must be produced to satisfy market demand. Determined by dividing available production time by the rate of customer demand.
Total Productive Maintenance (TPM) – A set of techniques to ensure every machine in a production process is always able to perform its required tasks. The approach is termed total in three senses: total participation of all employees (not just maintenance personnel), total productivity of equipment and total life cycle of equipment.

Toyota Production System (TPS) – Production system developed and used by Toyota Motor Company that focuses on the complete elimination of waste in order to consistently improve quality, reduce cost and shorten lead times.

IATF 16949 – An ISO technical specification that aligns previous American (QS-9000), German (VDA6.1), French (EAQF) and Italian (AVSQ) automotive quality systems standards within the global automotive industry. Together with ISO 9001:2015, USO/IATF 16949:2016 specify the quality system requirements for the design / development, production, installation and servicing of automotive related products.

Two Sided Specifications – A specification which allows actual measurements, plus or minus to the print dimension. Example is 50.200 +/- .002

Value – The inherent worth of a product as judged by the customer and reflected in its selling price and market demand.

Value- Added Activity (VA) – Any activity that transforms or shapes material or information or improves quality to meet customer requirements.

Value-Added Time – The time expended in value-added activity to produce a unit. Time for those work elements that transform the product in a way for which the customer is willing to pay.

Value Stream – All of the actions, including value-adding and non-value-adding actions, required to bring a product from concept to launch and from order to delivery. These include actions to process information from the customer and actions to transform the product on its way to the customer.

Value Stream Mapping (VSM) – A simple diagram of every step involved in the material and information flows needed to bring a product from order to delivery. A current-state VSM follows a product's path from order to delivery to determine current conditions. A future-state VSM deploys opportunities for improvement identified in the current-state map to achieve a higher level of performance at some future point.

Visual Workplace – The placement in plain view of all tools, parts, production activities and indicators of production system performance so the status of the system can be understood at a glance by everyone involved. The practice of making all standards, targets

Waste – any activity that consumes resources but creates no value for the customer. Most value-stream activities that actually create value as perceived by the customer are a tiny fraction of the total activities. Eliminating the large number of wasteful activities is the greatest potential source of improvement in corporate performance and customer service.

Work in Process (WIP) – Any inventory between raw material and finished goods.