



BALLARD POWER SYSTEMS

ACCELERATING FUEL CELL MARKET ADOPTION

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TABLE OF CONTENTS

SECTION A: PREFACE	3
1.0 INTRODUCTION.....	3
2.0 BALLARD’S PHILOSOPHIES.....	ERROR! BOOKMARK NOT DEFINED.
2.1 Vision.....	4
2.2 Mission	4
2.3 Value Set	4
2.4 Communication	4
2.5 Supplier Management.....	5
2.6 Standard Purchase Order Terms and Conditions	5
2.7 Shipping Documentation and Packaging	6
2.8 Press Releases	6
SECTION B: PRODUCTION PART SUPPLIER	7
3.0 BALLARD SUPPLIER MANAGEMENT PROGRAM	7
3.1 Ballard Supplier Management Program	7
3.2 Approval Process	7
3.2.1 Supplier Profile.....	7
3.2.2 Qualification of Suppliers.....	8
3.2.2.1 Probationary Status.....	10
3.2.2.2 Approved Status.....	10
3.2.2.3 Disqualified Status.....	10
3.2.2.4 Preferred Status.....	10
3.3 Supplier Performance Management Process	10
3.3.1 Quality Performance	11
3.3.2 Delivery Performance	11
3.3.3 Response	11
3.3.4 Value Added/Value Engineered (VA/VE)	12
4.0 ADVANCED PRODUCT QUALITY PLANNING AND PART APPROVAL PROCESS.....	12
4.1 Product Development Cycle	12
4.2 Production Part Approval Process (PPAP)	12
4.2.1 Outline of Supplier Production Approval Process.....	13
5.0 SUPPLIER CORRECTIVE ACTION PROCESS.....	16
6.0 DESIGN AND DEVELOPMENT.....	17
7.0 DESIGN AND SPECIFICATION REVIEW	18
8.0 GEOMETRIC DIMENSIONING AND TOLERANCE (GD&T)	18
9.0 SPECIAL CHARACTERISTICS.....	19
10.0 FORMS:	19

SECTION A: Preface

1.0 Introduction

Ballard takes great pride in partnering with those suppliers who are aligned with our philosophy of delivering the highest performance products and best overall value propositions, while also sharing our vision to accelerate fuel cell adoption. Ballard's supplier development program will actively source and develop competitive suppliers that further enhance our leadership position.

Suppliers who partner with Ballard may expect to realize the fiscal and technology development benefits of a long-term relationship. We will remain at the forefront of technology by implementing joint development programs with suppliers who can contribute expertise and enthusiasm in bringing new ideas and methodologies to the design and manufacture of fuel cell products. An attractive supplier to Ballard will be a well-managed, financially sound and technically competent organization.

Consistent with our corporate values, Ballard will treat all its suppliers and their representatives fairly and objectively.

Summary

This Supplier Manual describes Ballard's method of evaluating, approving, rating, and ranking Suppliers. It outlines the process for initially becoming an Approved Supplier, defines the level of quality, and details the Production Part Approval Process (PPAP) submissions Ballard requires of its Suppliers. It is intended to be the primary document that communicates our Supplier Development, Supply Chain and Quality philosophy to our Suppliers and helps align their business objectives with ours.

The following key items are discussed in detail in this manual:

- Ballard's guiding philosophies for Supplier engagement
- Process for becoming an Approved Ballard Supplier
- Performance expectations
- Supplier non-conformance issue resolution methodology
- Change management methodology
- PPAP/FA part submissions.

Scope

This manual covers all Supplier activities that take place out of the Ballard Corporate offices in Burnaby, B.C. The primary focus is for Suppliers who are providing materials, components or services that will be used in Ballard production parts or activities. It will be used as applicable to cover Suppliers who provide other non-production based materials, components or services.

It is not intended for the Supplier Manual to be applied in conflict with any other Ballard process, specification, engineering component definition, or Ballard Purchase order. In such cases the later shall take precedence.

2.0 Ballard's Philosophies

2.1 Vision

Power to Change the World®

2.2 Mission

Accelerating Fuel Cell Commercialization.

2.3 Value Set

Ballard's values play an integral role in everything we do. Our behaviors and decisions are legal, ethical and credible. We are a team that is:

Caring	We believe in Ballard and our vision - Power to Change the World®.
Committed	We work with passion to exceed expectations.
Creative	We are resourceful and seek the best solutions to reach our goals.
Careful	We are proud that our work is first rate and completed to exacting standards.
Courageous	We realize that it takes courage to change the world.
Customer Focused	We take steps to understand customer needs, do whatever it takes to deliver on commitments to customers and aim to exceed all customer expectations

When choosing a supplier among competitors for any goods or service, we will weigh the facts impartially and objectively and choose the supplier who can offer the best-valued product or service in accordance with Ballard's needs. Ballard employees will not do anything that suggests a purchase decision was influenced by irrelevant or improper considerations. In addition, we will not exert any influence to obtain "special treatment" from a particular supplier. We will strive to ensure that suppliers competing for Ballard's business have confidence that Ballard's selection process is ethical.

It is our policy that no Ballard employee accepts any gift (other than items with small intrinsic value) or other gratuity from any Supplier or bidder for Ballard's business. This policy applies to all employees whether or not they are directly involved in the purchasing activity.

2.4 Communication

Suppliers are an integral part of the value chain. We therefore promote early engagement in development programs to accelerate insights into the best technologies and materials. We also work with suppliers to optimize manufacturing processes and minimize cost. In most cases Suppliers will be required to sign a confidentiality agreement with Ballard prior to full communications taking place.

Ballard clearly understands that our supply chain forms an extension of our own manufacturing capabilities, and that the expertise for managing that extension lies with the suppliers themselves. Early involvement will undoubtedly lead to more robust product design, optimized manufacturing techniques, lower cost of product, and reduced product development time. This multi-faceted Supplier involvement approach requires communication at various levels within Ballard and also across Ballard and our Suppliers.

Ballard's Supplier Management is broken into 2 key groups:

- Supply Chain Management (Purchasing)
- Supplier Development Engineering and Quality

All commercial communication (including purchase orders, volumes, cost, lead times etc.) should take place between the Supplier and the appropriate **Supply Chain Management contact**.

All information related to manufacturing, process and quality should be communicated directly to the appropriate **Supplier Development Engineers**. Supply Chain (SC) will be able to provide the name of the Supplier Development Engineer (SDE) representative responsible for a particular Supplier.

In cases where the Suppliers need to communicate directly with our engineering and design people, it is recommended that the relevant Supply Chain and SDE representative both be informed. The following general rules should be followed:

- a.) **Email communication** - Copy SC and SDE's on all communication-taking place between the Suppliers and other Ballard employees.
- b.) **Teleconferences** - Invite SC and SDE's to the teleconferences
- c.) **Meetings** - Invite SC and SDE's to any meetings

2.5 Supplier Management

Ballard's Supplier Development Engineers will actively and continuously seek out competitive Suppliers to enhance Ballard's ability to manufacture more effectively in order to maintain its leadership in technical, quality and cost for the fuel cell market.

Ballard will remain at the forefront of technology by implementing new ideas, methodologies and joint development in the design and manufacture fuel cell products. An ideal Supplier to Ballard will be well managed, financially sound, and technically competent.

Ballard's Supply Chain is responsible for all aspects of Purchase orders, volumes, procurement, logistics, warehousing, and delivery. Ballard's Supplier Development Engineer is responsible for the qualification of new Suppliers and re-qualification of existing ones and ensuring program deliverables are meet for PPAP. The choice of Suppliers in any of these areas may be the result of investigation and deliberation amongst various departments within Ballard, but the commitment to purchase rests solely with the appropriate procurement member of Supply Chain. **No other Ballard staff member can make such financial commitments.**

2.6 Standard Purchase Order Terms and Conditions

All Ballard purchase orders shall be subject to Ballard's standard purchase order terms and conditions, as amended from time to time, as posted to Ballard's website at www.ballard.com at www.ballard.com/files/pdf/Global_Terms_of_Purchase.pdf ("Ballard's Standard Global Terms of Purchase").

Unless otherwise agreed to by the parties, when a supplier provides goods or services pursuant to a Ballard purchase order, Ballard's Standard Global Terms of Purchase shall apply.

2.7 Shipping Documentation and Packaging

All products shall be packaged, marked and otherwise prepared for shipment in a manner which is (a) to Ballard's packaging standards or in accordance with good commercial practice; (b) acceptable to common carriers for shipment at the lowest rate for the particular Suppliers; (c) assure that the product performance and characteristics will remain unchanged during packaging, transit and unpacking; (d) In some cases, the packaging may need to be reviewed and agreed upon with Ballard Supplier Development Engineers to ensure the packaging is adequate and compatible with all material handling and assembly equipment.

The Supplier shall clearly mark all containers with:

- necessary lifting, handling and shipping information
- Supplier name
- Ballard Purchase Order number
- complete Ballard Part Number and drawing/ specification revision level
- description and quantity of the material
- lot number (if applicable)
- date of manufacture
- name of the manufacturer

An itemized packing list must accompany each shipment. In addition, Suppliers shall electronically submit a Certificate of Conformance (COC) and/or Certificate of Analysis (COA) with each shipment containing the information as agreed upon with Ballard. As well the supplier may be required to provide any applicable material certifications, plating certifications, measurements, and any required critical specifications as agreed upon with Ballard Supplier Development Engineer, Product Development and Quality. Ballard Quality and/or Supplier Development Engineer's will review the COC to ensure it meets Ballard requirements.

2.8 Press Releases

Except as required by applicable law, a governmental authority or regulatory requirements, Suppliers will not issue a press release, grant an interview to the press, or otherwise make a general public announcement, regarding the subject matter of any relationship, agreement, etc., with Ballard without the prior written consent of Ballard. Consent will be granted only under exceptional circumstances.

SECTION B: Production Part Supplier

3.0 Ballard Supplier Management Program

3.1 Ballard Supplier Management Program

The Supplier Management Program consists of two main components.

1. The first component is the Approval Process in each of the required functions (Business, Quality, Technical and Environmental). This process is intended to quantify the strength of a Supplier and its ability to keep Ballard competitive.
2. The second component will be the Supplier Performance Management Process (Quality, Delivery, Response, Value/Cost). This process will allow us to monitor the effectiveness of a Supplier's management systems and identify continual improvement opportunities.

3.2 Approval Process

A Supplier is considered under evaluation during a period of initial business, quality, technical and environmental review or after a period of lengthy inactivity between Supplier and Ballard. Typically, purchase orders are not issued during this time, however the Supplier may be asked to deliver engineering samples for evaluation and testing.

3.2.1 Supplier Profile

A Supplier Profile (FRM5100105) is the minimum information required for the assessment of a Supplier. This form can either be accessed on-line at www.ballard.com or provided by Supply Chain or Supplier Development.

It is Ballard's intention to work with Suppliers who excel in quality, competitive cost and on-time delivery that continues to keep Ballard competitive. We incorporate an open process that combines customer, partners, internal and supplier insights to identify innovations that address the product development, part production, manufacturing and customer needs.

A commercial review will be completed in the Supplier Profile to ensure the potential Supplier is a viable company and has the financial capability to perform as desired by Ballard. It is Ballard's expectation that Suppliers will provide full financial disclosure during the business assessment.

Ballard expects that all Ballard Suppliers shall be registered to ISO 9001 or have plans to register to ISO 9001. For suppliers that will supply products into the automotive products ISO/TS 16949 will be a final goal for Quality System requirements. Suppliers that do not have ISO 9001 certifications are expected to work towards their registration with an approved plan. If there is no plan to being certified in the future a full audit/review will be completed by Ballard and the Supplier. Ballard's Supplier Development Engineer will monitor this plan and provide guidance to the supplier if needed.

Note: Suppliers that are currently ISO/TS 16949-registered may not require an on-site audit by Ballard. Ballard may simply request that specific quality documents be forwarded (i.e. Quality Manual, FMEA's, control plans, and PPAP) as required.

Ballard requires that all of its Suppliers and Service Providers comply with all applicable Governmental, Federal State/Provincial and local environmental regulations. Suppliers must

also ensure compliance of their products and services to all applicable laws and regulations. This includes compliance to all environment, health and safety, requirements on restricted toxic and hazardous substances. Compliance must be completed prior to shipment of any products or delivery of any services, to and from Ballard, that fall into this category.

For products that are to be used in our Europe markets the Supplier will need to ensure that electrical and electronic components do not contain any of the six banned substances in order to be RoHS compliant: lead, mercury, cadmium, hexavalent chromium, poly-brominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE), in quantities exceeding maximum concentration values.

In addition, Ballard requires its Suppliers to be active in the implementation and management of environmental best practices. Evidence of compliance to these requirements will be a formal documented system, and by performing internal or external audits to demonstrate total compliance. ISO 14001 registration is strongly recommended.

3.2.2 Qualification of Suppliers

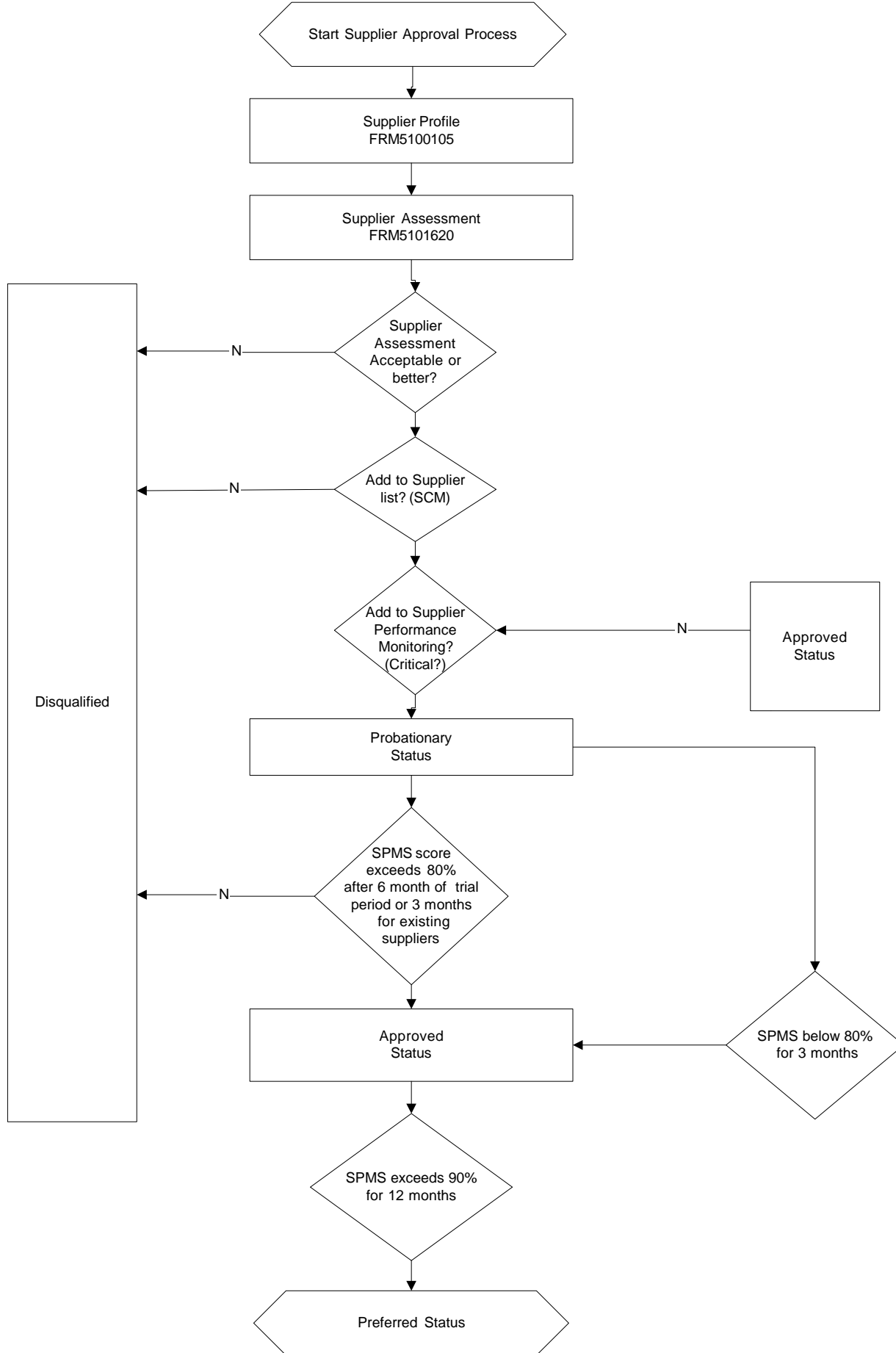
All suppliers will have a review of their technical, commercial, management approach and environmental capabilities by Ballard prior to supplying parts or services to Ballard. Ballard will use the Supplier Assessment form FRM5101620 to assess capabilities. Ballard will periodically review the capabilities as initially determined in the capability assessment.

Upon satisfactory assessment Ballard will determine the criticality of the suppliers based on the products they are intending on supplying to Ballard or if the Supplier is critical to Ballard's requirements. A cross-functional team will assess the criticality of the component through Ballard's DFMEA process and criticality assessment. The main criteria reviewed in determining the criticality consists of, but is not limited to: the components impact on Product performance, the components impact on product reliability, components cost, whether alternate sources are available for this component (i.e. not sole sourced), and if the supplier has a new plant, new technology or a new process for producing the components.

Depending on the criticality level, Ballard's SDE determines the actions required to qualify/determine a Supplier. These may include:

- ISO 9001 registration
- ISO/TS 16949 registration/ implementation plan
- On-site Ballard Supplier Assessment
- Process/documentation review
- Production Part Approval Process (PPAP).
- Design and Specification Review
- Advanced Product Quality Planning (APQP) Audit

Please refer to flowchart for Supplier Approval Process



For Suppliers that meet Ballard requirements for capability assessment, Ballard will determine if the Supplier will be added to Ballard's Supplier Performance Management System (SPMS - section 3.3). Any Suppliers that are deemed critical will be added to the Supplier Performance Management System. Those suppliers that meet capability requirements and Ballard has decided to add to the SPMS will achieve Probationary status; the remainder will achieve Approved status.

3.2.2.1 Probationary Status

A Supplier will be determined to achieve probationary status when supplier is new and meets criteria above or an existing approved supplier that has some performance concerns as measured by the SPMS. Suppliers at probationary status will be under review to assess their performance. The following criteria will determine movement to and from Probationary status:

Move from Probationary to Approved Status

1. New supplier and SPMS score exceeds 80% for six consecutive months
2. Existing supplier and SPMS score exceeds 80% for three consecutive months

Move from Probationary to Disqualified Status

1. New supplier and SPMS score does not exceed 80% for six consecutive months during 12 month trial period
2. Existing supplier and SPMS score does not exceed 80% for three consecutive months during 9 month period

3.2.2.2 Approved Status

A supplier that is approved will be considered part of Ballard's on-going supply base. Suppliers that have been added to the SPMS are expected to maintain an overall average score in excess of 80% in any calendar year. All approved suppliers may have capability re-assessments complete based on schedule determined by Ballard SDE.

3.2.2.3 Disqualified Status

A supplier that has been deemed disqualified will not be asked to quote on future products. Existing suppliers that provide product to Ballard will be phased out or alternate sourced as soon as Ballard is able. A supplier that has been disqualified and wishes to join the Ballard supply base will need to state intentions and corrective action evidence to Ballard Supply Chain Management.

3.2.2.4 Preferred Status

A Supplier can be elevated to a Preferred Status if it has successfully exceeded a 90% SPMS rating for a period of 12 months.

3.3 Supplier Performance Management Process

The Supplier Performance Management Process will evaluate Suppliers in four basic performance areas: Quality, Delivery, Response, and Cost/Value. The first three parameters (Quality, Delivery and Response) are the main metrics used in the calculation of monthly Supplier Performance Index and will be important in developing a continuously improving supply base. Ballard Supplier Development will monitor this. Supply Chain and the Supplier Development Engineer will give suppliers feedback on their performance on a regular basis.

Suppliers may be re-evaluated depending upon the criticality of their products, occurrence of major issues/non-conformances or unsatisfactory performance. In this case, the Supplier's criticality rating shall be re-assessed and Supplier Quality Assurance may conduct a re-qualification or may perform an on-site Supplier Assessment.

3.3.1 Quality Performance

The Quality of supplied part or service will be evaluated as:

$$\% \text{ Yield} = (\text{Qty of Good Parts or Service} / \text{Total Qty}) \times 100$$

Parts are considered good if:

1. They meet the print or
2. If the Supplier has requested a deviation that has been approved by Ballard or
3. If an internal deviation is needed/approved for the parts due to a Ballard issue (i.e. Tolerances, material certifications, required documents, etc.).

It is preferred to have all issues be caught in the Supplier Design and Specification Review (FRM5100574) during the initial kick off.

3.3.2 Delivery Performance

Delivery Performance is a measure of on-time delivery, delivery quantities, and documentation of parts/services to Ballard as indicated in the specific Purchase Order. Ballard will monitor the following performance indicators to assess the delivery performance of all Suppliers.

1. **On-time delivery:** Number of shipments that are received on time (on time meaning 0 days late or 5 days early) as per agreed upon delivery date in our purchase order. If a part is going to be late a new delivery date must be communicated to Ballard Supply Chain prior to the original agreed upon date to update our internal systems. Supplier delivery performance will be penalized 10% per day late.
2. **Delivery Quantities:** Number of shipments with quantities under or over the terms mentioned in the Ballard Purchase Order. A Supplier Corrective Action Request (SCAR) may be issued if the shipments do not conform to the right quantities.
3. **Documentation:** Includes packing slips, invoices, Certificate of Conformance /Certificate of Analysis, etc. These must be present with each shipment as required by the purchase order. A Supplier Corrective Action Request may be issued if appropriate documents are missing with any shipment of parts.

3.3.3 Response

Response is a measure of a Supplier's support to Ballard operations, including its promptness in resolving Supplier Corrective Action Requests (SCAR's), complaints, issues and non-conformances.

1. **Number of Supplier Corrective Action Requests (SCAR's) per month:** The number of new/unresolved SCAR's will be monitored. More than 3 SCAR's per month, and up to 9 per year, will result in the Probation of the Supplier's Approved Status.
2. **Number of Stop-Shipment Caused by Non-Conformance:** The number of stop shipments caused by non-conformance will be monitored. More than 3 stop shipments per month, and up to 9 per year, will result in the Revocation or Probation of a Supplier's Approved Status.
3. **Customer Support:** This refers to the Supplier's willingness to help Ballard in part design, tolerances, manufacturing & provide prompt and efficient support.

In order to resolve issues in a timely manner a lack of response from the supplier will result in a deduction at 5% per day late. This is a subjective score determined by Ballard Supplier Development Engineer, Quality and Supply Chain so it is in the best interest of the Supplier to keep an open communication to ensure no delays in resolving issues.

3.3.4 Value Added/Value Engineered (VA/VE)

Suppliers are encouraged to suggest changes over the course of the product development and in production to further reduce costs (this may include revising specifications/drawings, manufacturing/assembly process, and inspection criteria, open tolerances.). Yearly cost reduction goals may be applicable on certain products as agreed upon with Ballard supply chain.

In order to have a change submitted to improve the product/process costs the Engineering Change Request form (FRM5100416) will need to be completed and show the cost savings/improvements for the requested change. Early supplier involvement will ensure that the product is designed to the lowest costs and best processes.

4.0 Advanced Product Quality Planning and Part Approval Process

Note: The following applies to Suppliers with Critical Components. Ballard may ask other Suppliers to comply with these requirements on a case-by-case basis.

4.1 Product Development Cycle

It is Ballard's intent to involve Suppliers in the product planning cycle as early as possible. There may, however, be unique requirements related to the confidential and competitive stage of our business, which will require a confidentiality agreement to be signed. It will be the intent of Ballard to clearly identify product specifications and product development cycle milestones from early prototype stages through to Job 1 dates for each program. To fulfill the requirements for supporting Ballard's critical program components the Supplier Assessment FRM5101620 needs to be completed with all issues being noted and resolutions for potential problems. The Ballard APQP process is based on the Automotive Industry Action Groups (AIAG) Advanced Product Quality Planning (APQP) guidelines. More details on this process are available from the AIAG website (www.aiag.org). Upon receiving an order for a product the supplier must send back a signed Purchase Order and the completed Supplier Design and Specification Review (FRM5100574). The Supplier Timing Chart (FRM5101625), or the suppliers' equivalent Microsoft Project timeline, may also be required as determined by the Supplier Development Engineer and should be forwarded in the early stages of the program to track. This will be used to track the component progress and should be forwarded to the Supplier Development Engineer in the early stages of the program.

Where possible, it is preferred that Suppliers have quality and rapid prototyping capabilities that are representative of the intended production processes. Ballard will choose to work with Suppliers who are capable of supporting a comprehensive prototype plan throughout the development cycle and to the ultimate supply of production volumes.

4.2 Production Part Approval Process (PPAP)

To ensure quality launches of production products and to verify manufacturability of part designs prior to release into production, Suppliers may be required to adhere to the AIAG Production Part Approval Process (PPAP) guidelines (PPAP manuals are available for purchase through the AIAG).

Production parts are those produced to a Level 3 design as defined in Ballard's design control process. Parts are to be manufactured at the production site using production tooling & gauging, processes, materials, trained operators, environment and process controls where the PPAP was completed. In the Ballard product development cycle, Suppliers will be required to submit a Prototype and Interim Approval (FRM5101622) for prototype validation builds. Further submission requirements are identified in Section II of the PPAP manual.

Unless otherwise stated on the Ballard Purchase Order, the default PSW submission requirement will be Level 3 for all programs. No product or process changes are to be completed without written approval from Ballard via a Supplier Request - Engineering Change Request Form (FRM5100416). Unless otherwise agreed upon with Ballard, the test and dimensional samples included in the PSW should be chosen at random from a significant production run. The run size for PPAP will be agreed upon with Ballard and the supplier to show process capability.

Specifications that are identified as 'critical', 'safety', 'key', or 'significant' and can be evaluated using variable data must meet a 1.67 Ppk. This data should be included with the initial PSW. The ongoing requirement for these specifications is to maintain a Cpk of 1.33. Ballard may audit recent control charts and process capability to ensure ongoing process capability.

If a Supplier cannot meet the PPAP requirements by the required date the Prototype and Interim approval form (FRM5101622) will be required outlining the issues with new promise dates. If Ballard agrees to the action plan submitted, the interim approval will be signed off and issued to authorize the use of parts prior to PPAP completion. All parts built under the interim PPAP must be accompanied by a Ballard deviation number to ship the parts under. All parts sent to Ballard must be clearly identified with the deviation number in a manner agreed upon with Ballard.

PPAP submissions should be submitted electronically in an organized folder that includes the following subfolders:

1. PSW (Part submission Warrant) or Interim Approval
2. Design Records/Drawings
3. Engineering change documents if applicable
4. DFMEA (if applicable)
5. Process Flow Diagrams
6. PFMEA
7. Control Plan
8. Dimensional Results/Process Capability
9. Material/Performance test results
10. Measurement System Analysis studies
11. Qualified Laboratory Documents
12. Supplier and Sub-supplier Certification (ISO, QS, Rohs...)
13. Sub Supplier PPAP

Any section that is not applicable must be included in the PPAP submission with a placeholder showing that this section is not applicable. This is to ensure no sections have been missed.

Ballard Quality will review the supplier PPAP submission using the PPAP submission checklist (FRM5101623) with any deficiencies being sent back to the supplier for resubmission.

4.2.1 Outline of Supplier Production Approval Process

Product Design

- Defines part/component requirements.
- Defines critical components in DFMEA along with SDE and SC
- Provides preliminary drawings and specifications.
- Uses approved vendors list for product design.

Steps for Supplier Approval and Quoting

Supplier Development Engineer (SDE) and Supply Chain (SC) will review drawings and pick the appropriate supplier from the Approved Vendors List (AVL) or a new supplier if required

For new suppliers the following documents need to be completed for the supplier to be included on the AVL per section 3.0:

1. FRM5100105: Supplier Profile.
2. FRM5101620: Supplier Assessment
3. Copy of ISO/TS registration. If the vendor is not currently registered a timeline or plan is required for the certification. If there is not plan in place an onsite Supplier Assessment (FRM5101620) will need to be completed by the supplier and Ballard. Should the supplier without the appropriate certification be awarded the business the supplier will have a probation status until they show 6 months of 80% and above as measured with Ballard's Supplier Performance Management System.

Supply Chain forwards the appropriate Drawings, specifications, CAD files, volumes and cost targets (if available) to the vendor to review, comment and supply a quote. Quotes should be in the format (or equivalent) as shown on the Supplier Quote Breakdown (FRM5101626). This form is used to understand the main drivers for the costs of the products and identify any areas/opportunities to reduce the product costs.

Quotes are sent back to Ballard to be reviewed by SDE and SC to ensure they meet the requirements. If any changes are needed a re-quote will be required from the supplier

Preference for the award of business will be given to those suppliers who supply the Supplier Quote breakdown FRM5101626, feedback on the design, tolerances, manufacturability, and any cost savings suggestions.

Steps for Production Part Requirements

Our part selection process is based on a balanced evaluation of technical merits, strategic implications as well as quality and cost. Approved and Preferred suppliers will have advantage in the decision making tools used. Ballard makes every attempt to be transparent in the part selection and will share the part selection matrix that will be used in the selection process.

PO is issued to the supplier. Please see Purchasing terms and agreement as posted on our website www.ballard.com.

Supplier provides confirmation of acceptance of the PO and completes the Supplier Design and Specification Review form (FRM5100574), all documents are returned to Ballard SC. This form is the supplier's opportunity to identify any areas of concern that need to be further reviewed, changed or may be an issue in production. The Ballard PO will reference the Supplier manual and signing off on the PO also signifies that you have read and agreed to the terms and conditions included in this manual.

If the part being supplied is deemed critical or if the supplier is not ISO/TS registered a full on site Supplier Assessment (FRM5101620) will need to be completed by the supplier and Ballard Supplier Development.

The supplier, Supplier Development Engineer and appropriate Ballard engineers will determine the PPAP requirements, which may include the required measurements from the drawing, testing, measurements for production, characteristics that affect or control the results for meeting the specification and Certificate of Conformance (CofC) or Certificate of Analysis (CofA) requirements.

If requested by the Supplier Development Engineer the supplier will create a timeline using the suggested Timeline (FRM5101625) or suppliers MS Project equivalent and should include the

timing for all testing and measurements agreed upon above to complete PPAP requirements, as well as ramp up and production. It is suggested that the supplier give the SDE updates for progress and highlight any areas that may be an issue.

The supplier, Supplier Development Engineer and appropriate Ballard engineers will also determine the ongoing inspection requirements and frequency during the life of production

Steps for PPAP Submission.

All suppliers will submit a PPAP package to the agreed upon level (default is level 3) in the format specified in section 4.2 of this manual, as well as a completed PPAP checklist and sample parts that are numbered per the inspection completed on them.

Off the shelf components do not require a PPAP submission only a Certificate of Conformance from the supplier may be required if available.

PPAP submissions are submitted electronically to the SDE and the Quality department. These packages are reviewed and will require resubmission should the PPAP be inadequate.

Upon approval of the submission, the Supplier will assure that future production continues to meet all customer requirements.

Approved indicates that the part or material, including sub-components, meets all customer requirements. The supplier is authorized to ship production quantities of the product, subject to releases from the Ballard Supply Chain

Interim Approval permits shipment of material for prototype requirements. This is also to be used for production requirements on a limited time or piece quantity basis. Interim approval will be granted when the Supplier has clearly defined the non-compliances preventing approval and has prepared an action plan agreed to by Ballard Supplier Development Engineer's. PPAP re-submission is required to obtain a status of approved.

Material covered by an interim approval that fails to meet the agreed upon action plans by the expiration date or quantity will be rejected. No additional shipments are to be made unless an extension of the interim approval is granted.

Rejected Means the PPAP submission does not meet Ballard's requirements based on the production lot from which it was taken and/or accompanying documentation. In such cases the submission and/or process shall be corrected to meet Ballard requirements. The submission must be approved before production quantities may be shipped.

(Refer to section 4.2 for further details).

During production the Ballard SDE will provide a monthly Supplier Performance Management report (FRM5100712).

If the supplier needs to change any part of the production process after PPAP an updated PPAP may be required. Changes cannot be made without informing Ballard SDE.

4.3 Product Verification

The supplier will establish inspection plans to document product measurement requirements. The inspection plans may be part of the production documentation, but shall include the following:

- Criteria for acceptance and/or rejection
- Where in the process measurement and testing operations are performed
- A record of the measurement (and approval of the record)
- Type of measurement instruments required and any specific work instructions for their use.
- For areas deemed critical or significant on the drawing or specification the actual measurement/inspection results shall be recorded.

The supplier will monitor and measure the characteristics related to the manufactured products to verify that the component requirements have been met for all products supplied. After PPAP a reduced inspection plan will be used to verify the products on an ongoing basis. The supplier, with Ballard's approval, shall establish the characteristics to check, method and frequency of the sample measurements and shall be documented in the control plan. Where the implementation of reduced inspection levels has resulted in non-conforming product, 100% inspection shall be re-introduced until the inspection method is verified to be in control.

This process is not applicable to propriety or catalogue parts and standard parts.

5.0 Supplier Corrective Action Process

If any parts supplied to Ballard do not conform to the drawings and specifications the supplier must request a deviation prior to sending the parts. Once the deviation is completed and signed the parts can be shipped into Ballard. All parts shipped to Ballard under a deviation must be clearly identified with the deviation number in a manner agreed upon with Ballard.

Should non-conforming parts be sent into Ballard without notifying Ballard of the issue and/or without requesting a deviation, a Supplier Corrective Action Request (SCAR) will be issued. Each Supplier must provide Ballard with primary and backup contact information, including E-mail address and/or fax number for receiving SCAR's. The SCAR will include an email cover page outlining the issue with required dates as well as the Corrective Action Request Form (FRM5000017). All SCAR related communication should take place between Ballard's Supplier Development Engineer, Quality and the Suppliers' quality representatives.

Upon receipt of a SCAR for a non-conforming material/ service, a Supplier is required to react immediately with the following:

1. Verify concern on-site and initiate immediate containment/quarantine of all suspect material/ service.
2. Review all quality and/or manufacturing records related to the production of the suspect material/service
3. Respond to Ballard's Supplier Development Engineer within a reasonable time, as agreed upon with the Supplier Development Engineer, of receiving notification with preliminary investigation results. This response will be provided on the completed SCAR form (FRM5000017) and may include any supporting documents.

Questions related to the SCAR requirements and structured problem solving may be directed to Ballard's Supplier Development Engineer/Quality as identified on the SCAR.

6.0 Design and Development

The design and development process requirements apply to suppliers who are authorized by Ballard to create design definitions using: The Suppliers design rules and standards; within the constraints defined in this document; Ballard's requirements; government regulations and Ballard's customer requirements. The requirements also apply to other product development activities such as design analysis and testing.

Design and development suppliers shall ensure that they and their supply chain comply with the technical requirements, and any additional contract specific process' and design requirements as outlined by Ballard.

The technical requirements are the product requirements produced by Ballard through engagement with Ballard customers and the Supplier. The technical requirements may be presented by a Technical requirements document (i.e. component requirements, envelope drawing, request for proposal, standards document etc.). Technical Requirements may include

- o Functional and performance requirements.
- o Reliability, unit cost, integrity and life requirements
- o Environmental requirements (space, thermal, vibration, etc)
- o Applicable statutory and regulatory requirements.
- o Applicable Ballard design procedures.

Outputs by design responsible activity will be specified in Ballard's requirements and could be:

- o An overview of the interface between the supplier and Ballard.
- o Develop product concept.
- o Define contract specific requirements.
- o Timelines for the product development including milestones and gate reviews.
- o Create DFMEA's - Complete standard product development as outlined in the AIAG APQP Reference Manual. A template is available for the DFMEA however the supplier may use an alternative format as agreed upon with Ballard.
- o Design for Manufacturability and Assembly
- o Design Verification
- o Design reviews
- o Prototype builds
- o Engineering drawings including CAD files, assign part numbers and/or drawing numbers with rev levels.
- o Engineering Specifications
- o Material Specifications
- o Drawing and Specification changes - tracked throughout the design process and life of the product, proper authorization must be obtained from Ballard for those changes that directly affect the end customer.
- o Identify Key characteristics - A key characteristic or physical attribute of a product whose variation has a significant influence on the product fit, performance, service life, manufacturability etc.

During the design stage it is encouraged to use bench marking which will provide input to establishing product and process performance targets. Research and development may also provide benchmarks and concept ideas. Successful benchmarking will: A) Identify the appropriate benchmarks; B) Understand the reason for the gap between your current status and the benchmark; C) Develop a plan to close the gap, match the benchmark or exceed the benchmark.

Where possible products should be designed to reduce the environmental impact. This should not be limited to recycling the product but should be such that at the end of the products life cycle the components can be broken down and reused to produce the same component and be used in the product without affecting the design integrity.

The submission of the completed technical package will be reviewed and approved by Ballard and will establish the baseline configuration of this product. To assure that any further changes to the product design still results in a product that satisfies all technical requirements, the supplier shall obtain Ballard approval for the updates.

7.0 Design and Specification Review

Before accepting an order on new parts/ components (including revision updates), the Supplier will be required to submit a completed Supplier and Design Specification review (FRM5100574). The objective of this process is to involve Suppliers in a formal design review of the part drawings/ specifications/specifications. The Supplier is required to assess the parts and drawings for manufacturability and signing off this form will signify acceptance or the list of required changes to make it acceptable. The completed form will be reviewed by Ballard's Supplier Development Engineer to review the issues and ensure they can be resolved in a timely manner to meet program-required dates.

8.0 Geometric Dimensioning and Tolerance (GD&T)

Ballard's drawing standard is ASME Y14.5M-1994 [Geometric Dimensioning and Tolerance (GD&T)].

In relation to this, Suppliers of Ballard Production parts and services (if applicable) are preferred to have the knowledge and understanding on how to use GD&T in the manufacture and inspection of parts/ service. Initiating early supplier involvement to develop the parts and drawings will ensure that the parts can be manufactured within the tolerances of the specified manufacturing process.

9.0 Special Characteristics

Ballard identifies special characteristics (significant or critical) on its documentation (e.g. on drawings, specifications, control plans, etc.). Significant characteristics are identified with a symbol, while critical characteristics are identified with a symbol.

Table 1: Definition of Special Characteristics

	FMEA	Source	Definition
Significant Characteristic	Severity 5 to 8 and occurrence ≥ 4	AIAG	Product characteristics that are important to the customer and that must be included in the control plan
Critical Characteristic	Severity >8	AIAG	Product requirements (dimensions, performance tests) or process parameters that can affect compliance with government regulations or safe vehicle/product function and which require specific supplier, assembly, shipping or monitoring and inclusion on control plans

For Ballard documents with significant/critical characteristics symbols (on drawings, specification, control plans, etc.), Suppliers are required to manage these characteristics by reporting product/process capability and submitting dimensions/test results for each shipment. A control plan should also be in place to ensure that such special characteristics are met. This requirement does not affect a Supplier's responsibility to ensure that other product/ process characteristics are satisfied.

10.0 FORMS:

- FRM5100105: Supplier Profile
- FRM5101620: Supplier Assessment
- FRM5100574: Supplier Design and Specification Review
- FRM5101626: Supplier Quote Breakdown
- FRM5100416: Engineering Change Request
- FRM5101625: Timeline
- FRM5101624: Part Submission Warrant
- FRM5101622: Prototype and Interim Approval
- FRM5101623: PPAP Submission checklist
- FRM5000017: Supplier Corrective Action Request