

Supplier Manual



BALLARD®

Smarter Solutions for a Clean Energy Future

■ A Clean Energy Growth Company | WWW.BALLARD.COM | **TSX: BLD** **NASDAQ: BLDP**

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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 latter shall take precedence.

2.0 Ballard's Philosophies

2.1 Vision

Smarter solutions for a clean energy future

2.2 Mission

Putting fuel cells to work

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 - Smarter Solutions for a Clean Energy Future.
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 identify creative and innovative solutions to continuously improve Ballard's procedures, processes and products.
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 met for PPAP (Production Part Approval Process). 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 on Ballard's website at http://www.ballard.com/files/PDF/Suppliers/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 send a Certificate of Conformance (COC) and/or Certificate of Analysis (COA) containing the information as agreed upon with Ballard for each shipment to gcballard@ballard.com. As well, the supplier may be required to provide 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

In pursuit of our mission to accelerate fuel cell product adoption, we seek to work with Suppliers who also share Ballard's passion and commitment to succeed in the fuel cell industry. As such, we have developed a strategic supplier management plan to address our needs. 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 is the Supplier Performance Management Process which is designed to monitor four key Supplier performance characteristics (Quality, Delivery, Responsiveness, and Value/Cost). This process will allow us to monitor the effectiveness of the Supplier's quality management system, identify continual improvement opportunities, and determine the preferred suppliers with which to build long term strategic relationships.

3.2 Approval Process

A Supplier is considered to be under evaluation during a period of initial business, or after a period of lengthy inactivity between Supplier and Ballard. The flowchart in Figure 1 outlines the Supplier Approval and Performance Management Process.

3.2.1 Supplier Profile

The Supplier Profile (FRM5100105) should be the minimum amount of information required for the assessment of a Supplier. This form can be obtained from Supply Chain or Supplier Development.

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

The Supplier Profile will enable a commercial review to ensure that the potential Supplier is a viable company with strong quality management systems. It is Ballard's expectation that Suppliers will provide full financial disclosure for the business assessment.

Ballard prefers that all Ballard Suppliers be registered to ISO 9001, or have plans to register to ISO 9001. Suppliers that do not have ISO 9001 certification are recommended to work towards registration with an approved plan. Ballard's Supplier Development Engineer will monitor this plan and provide guidance to the supplier if needed. If there is no plan to being certified in the future, a full audit/review may be conducted by Ballard. An on-site audit by Ballard may not be required for Suppliers that are currently ISO/TS 16949-registered. Ballard may simply request that specific quality documents be forwarded (i.e. Quality Manual, FMEA's, control plans, and PPAP).

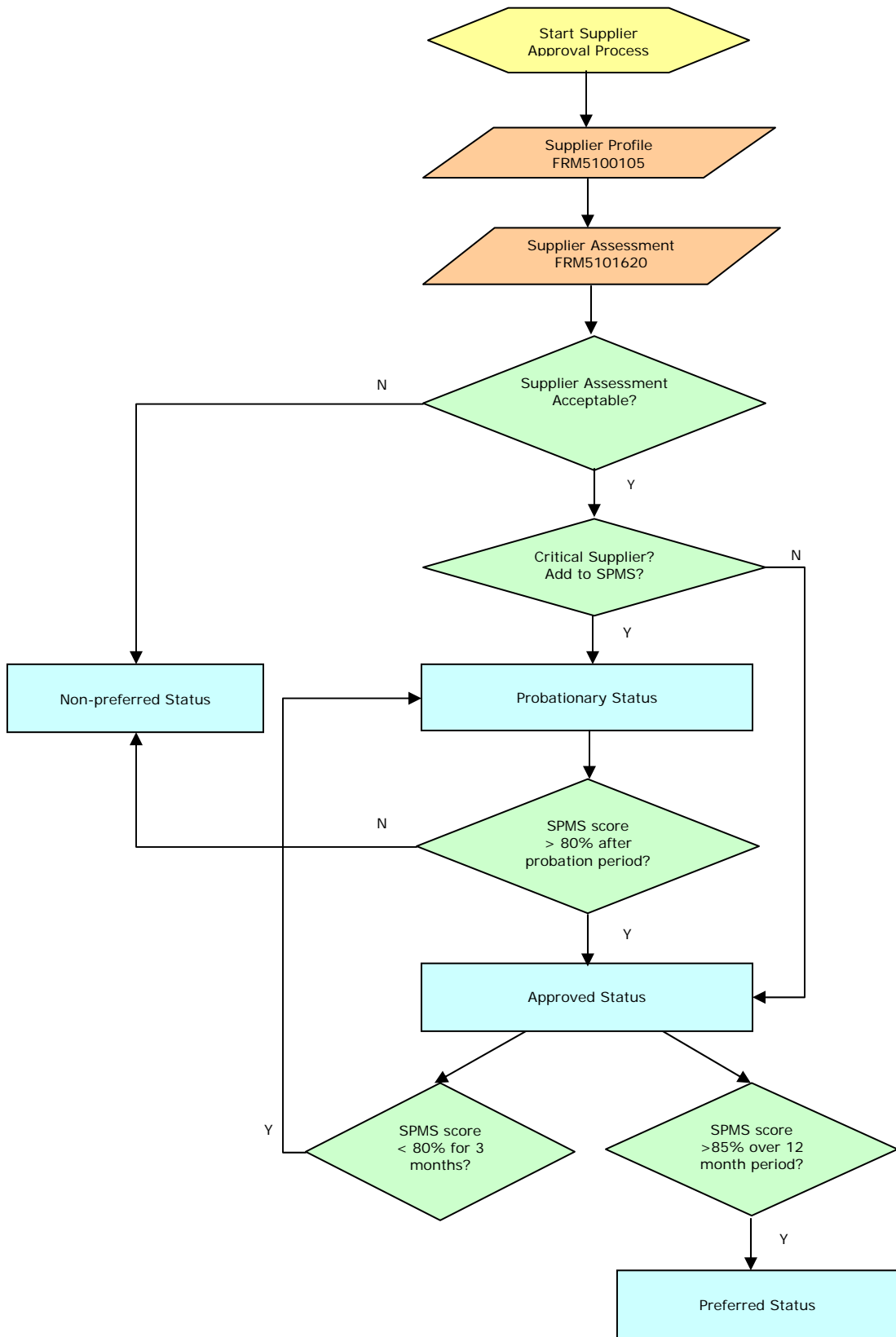


Figure 1: Supplier Approval and Performance Measurement Process

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.

Some of the products that Ballard sells may need to be RoHS compliant. Suppliers of materials, parts and assemblies for such products will be required to provide statements of compliance. Full details of the EU Directive 2002/95 on the restriction of the use of certain hazardous substances in electrical and electronic equipment can be obtained from the website: www.rohs.gov.uk.

In addition, Ballard requires its Suppliers to be active in the implementation and management of environmental best practices. ISO 14001 registration is strongly recommended.

3.2.2 Qualification of Suppliers

Typically, Ballard will review the technical, commercial, management approach and environmental capabilities of new Suppliers before placing any orders for parts or services from new Suppliers. Ballard will use the Supplier Assessment form FRM5101620 to assess capabilities. Ballard may also periodically re-evaluate the Supplier's capabilities.

Besides the capability assessment, Ballard may require additional actions to qualify a supplier, depending on the criticality of the Supplier's part in our products. A cross-functional team will meet annually to assess the criticality of the component through Ballard's DFMEA process and criticality assessment. The main criteria that will be reviewed to determine criticality include, but are not limited to:

- component impact on Product performance,
- component impact on product reliability,
- component cost,
- whether alternate sources are available for this component (i.e. not sole sourced), and
- whether a new plant, new technology and/or new process is being used to produce the component.

Depending on the criticality of the component, the Ballard SDE will determine the appropriate actions that are required to qualify the Supplier. These may include:

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

Only qualified Suppliers that are deemed critical will be added to the Supplier Performance Management System (SPMS - section 3.3). The objective of the SPMS is to ensure Ballard works with preferred suppliers of critical parts to continuously improve performance standards, so as to promote a best-in-class Supply Chain, and to assure that the purchased parts meet specifications and requirements. New qualified Suppliers of critical parts will initially be given Probationary Status, while new qualified suppliers of non-critical parts will be given Approved Status immediately.

3.2.2.1 Probationary Status

Besides new Suppliers of critical parts, the existing Suppliers that demonstrate performance issues as identified by the SPMS will also be classified as Probationary. Suppliers at Probationary Status will be closely monitored to assess their performance. If needed, Ballard Supplier Development will work with the Supplier to address the performance concerns during this period.

The following criteria will determine movement from Probationary Status:

Move from Probationary to Approved Status

1. New supplier's average SPMS score exceeds 80% following a 12 month probationary period.
2. Existing supplier's SPMS score exceeds 80% for three consecutive months.

Move from Probationary to Non-preferred Status

1. New supplier's average SPMS score does not exceed 80% during the 12 month probationary period.
2. Existing supplier's SPMS score does not exceed 80% for three consecutive months.

3.2.2.2 Approved Status

A supplier that is Approved will be considered part of Ballard's 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. Suppliers with an average SPMS score below 80% will be moved back to Probationary Status.

3.2.2.3 Non-preferred Status

A supplier that has been deemed Non-preferred will not be asked to quote on future products. Existing suppliers that provide product to Ballard may be phased out or alternate sourced as soon as Ballard is able. Ballard encourages suppliers in this category to strive to meet Approved Status.

3.2.2.4 Preferred Status

A Supplier will be elevated to Preferred Status if its average SPMS score exceeds 85% in a calendar year. Preferred Suppliers will receive consideration for new and follow-on business.

3.2.2.5 Elite Supplier Award

To recognize Suppliers that consistently demonstrate exemplary performance, Suppliers that achieve near 100% SPMS scores are awarded an Elite Supplier Award. This award is reserved for Suppliers who perform at the highest level, demonstrate technological leadership in developing fuel cell technology, and/or worked with Ballard to resolve a significant engineering hurdle. The award will be presented to the Supplier in the form of a trophy or plaque, as applicable, together with a congratulatory letter from the CEO of Ballard.

3.3 Supplier Performance Management System

The Supplier Performance Management System (SPMS) will evaluate Suppliers of critical parts in four key performance areas: Quality, Delivery, Responsiveness, and Cost/Value. The first three parameters (Quality, Delivery and Responsiveness) are the main metrics used in the calculation of the monthly Supplier Performance Index (SPI) and will be important in developing a continuously improving supply base. Ballard Supplier Development will maintain this database. Supply Chain and the Supplier Development Engineer will provide suppliers with feedback on their performance on a regular basis using the Supplier Performance Management report (FRM5100712).

The SPI score will be calculated as follows:

$$SPI = 50\% \text{ Quality} + 25\% \text{ Delivery} + 25\% \text{ Responsiveness}$$

Because the prices of parts are not expected to change on a regular basis, Cost performance will be measured on a quarterly basis. Cost is a very important parameter as Ballard strives to commercialize fuel cell products. Therefore, Ballard must work closely with Suppliers on cost reduction initiatives for all parts to produce a cost competitive clean energy alternative. Given the emphasis on cost, Cost performance will account for 30% of the overall SPMS score.

$$\begin{aligned} SPMS \text{ score} &= 70\% \text{ SPI} + 30\% \text{ Cost} \\ &= 35\% \text{ Quality} + 17.5\% \text{ Delivery} + 17.5\% \text{ Responsiveness} + 30\% \text{ Cost} \end{aligned}$$

As Suppliers will be monitored on an on-going basis, the occurrence of major issues/non-conformances or unsatisfactory performance will highlight the need to re-evaluate the Supplier. Under such circumstances, Ballard Quality may require that a re-qualification or on-site Supplier Assessment be conducted.

3.3.1 Quality Performance

Suppliers are expected to provide a stable supply stream, free from defects and disruptions. (i.e., capable of producing reliable product consistently). Suppliers are encouraged to provide continuous improvement on products and services offered (e.g., improvements in product performance, more efficient product development cycles, etc.). The Quality performance of a Supplier will be measured based on:

1. **Incoming Quality Control (IQC) part reject rates:** Parts rejected as a percentage of total quantity of parts received.
2. **Production reject rates:** Parts identified as rejects during Production use as a percentage of total quantity used.
3. **Incomplete / incorrect documentation:** Number of shipments with incomplete or incorrect packing slips, invoices, Certificate of Conformance /Certificate of Analysis, etc. as specified by the purchase order or specification.
4. **Deviations:** Number of deviations initiated to accept parts that do not conform to specifications, drawings and/or purchase order.
5. **Supplier Corrective Action Requests (SCARs):** Number of new and unresolved SCARs requiring supplier action to resolve issues and implement corrective and preventative actions.

The Quality score will be calculated as follows:

$$\begin{aligned} \% \text{ Quality} &= 100\% \\ &\quad - \% \text{ IQC reject rate} \\ &\quad - \% \text{ Production reject rate} \\ &\quad - 10\% \times \# \text{ shipments incomplete / incorrect documentation} \\ &\quad - 10\% \times \# \text{ deviations initiated} \\ &\quad - 25\% \times \# \text{ SCARs initiated} \\ &\quad - 10\% \times \# \text{ of SCARs unresolved} \end{aligned}$$

Parts are considered good if:

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

It is preferred to have all potential issues related to the production and supply of the part to be negotiated and agreed upon between the Supplier and Ballard in the Supplier Design and Specification Review (FRM5100574) during the initial part evaluation and selection process.

3.3.2 Delivery Performance

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

1. **On-time delivery:** Number of shipments that are received on time (0 days late) as per the original agreed upon delivery date between the Supplier and Ballard. If a shipment is ready to be delivered early, the Supplier must communicate and obtain approval from Ballard Supply Chain for early delivery. 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. However, Supplier delivery performance will be penalized 10% per day late from the original agreed upon delivery date.
2. **Delivery Quantities:** Number of shipments with quantities over or under the terms mentioned in the Ballard Purchase Order. Supplier delivery performance will be penalized 10% for each shipment of incorrect quantities, including partial deliveries.

The Delivery score will be calculated as follows:

$$\begin{aligned} \% \text{ Delivery} &= 100\% \\ &- 10\%/\text{day late vs. original promised delivery date} \\ &- 10\% \times \text{number shipments of incorrect quantities} \end{aligned}$$

Occasionally, Ballard will place rush orders for parts and/or services to meet customer delivery schedules. Ballard recognizes the support and effort of Suppliers to fill rush orders, and as such, rush orders are exempt from penalties for late and/or partial delivery.

3.3.3 Responsiveness Performance

Responsiveness is a measure of a Supplier's support to Ballard operations, including its promptness in responses to inquiries, resolving Supplier Corrective Action Requests (SCAR's), issues, and non-conformances. As Ballard strives to deliver outstanding service and support to our customers, we expect our Suppliers to provide a similar level of service and support to Ballard. Examples of Supplier Responsiveness include: responding promptly to inquiries, supporting changes in Ballard's demands or requirements, proactively seeking guidance to prioritize actions if multiple issues exist, notifying Ballard of delivery or quality non-conformances before shipping against orders, and taking appropriate measures to ensure problems or issues do not recur.

The Responsiveness score is a subjective score, calculated as the average of the Responsiveness scores provided by the Supplier Development Engineer, Buyer, and PD/R&D supplier contact (if applicable).

3.3.4 Cost / Value Performance

With Cost becoming the greatest barrier to the commercialization of our fuel cell products, Ballard must place a strong emphasis on all elements of cost, starting from the cost of raw materials to the cost of processing and assembly for our stack products. Therefore, Ballard tries to work closely with Suppliers on cost reduction initiatives for all parts and services to offer a cost competitive clean energy product to the market.

Ballard believes that early Supplier involvement in the product development cycle will ensure that the product is designed to the lowest costs and best processes. Suppliers are encouraged to suggest changes over the course of the fuel cell stack product development cycle to further reduce part costs (e.g., revising part specifications/drawings, opening tolerances, and improving Supplier manufacturing/assembly processes and inspection criteria, etc.). 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 it must show the cost savings/improvements for the requested change.

The Supplier's Cost performance is a subjective assessment. The cost competitiveness of a part and/or service, and the Supplier's willingness to provide an open cost structure for their products and/or services are taken into consideration. The flexibility of the Supplier as demonstrated in the Terms and Conditions of Purchase Orders and Supply Agreements will also be considered in the assessment of Cost performance. Examples of flexibility include payment terms, taking back excess inventory, holding inventory, reducing lead times, including shipping costs, etc.)

4.0 Technology and Product Portfolio Management and Part Approval Process

Note: The following applies to Suppliers of 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. Ballard's Technology and Product Portfolio Management (TPPM) process is based on the Advanced Product Quality Planning (APQP) process developed by the Automotive Industry Action Group (AIAG). More details on this process are available from the AIAG website (www.aiag.org).

Ballard's Product Development Engineers and Supplier Development Engineers will work with Suppliers to create a specification and/or drawing which must be approved by the Supplier using the Supplier Design and Specification Review form (FRM5100574). 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 ensure that the issues can be resolved in a timely manner to meet program-required dates. After receiving the Review form, Ballard may place orders for the material/part.

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.

During the Ballard product development cycle, Suppliers may be required to submit a Prototype and Interim Approval (FRM5101622) for prototype validation builds. Prior to the release of a part to Production, as defined by Ballard's TPPM process, a PPAP submission from the Supplier is required. Off-the-shelf components do not require a PPAP submission; a Certificate of Conformance from the Supplier, if available, will suffice. Parts that are released to Production are to be manufactured at the Supplier's production site using the production tooling & gauging, processes, materials, trained operators, environment and process controls where the PPAP was completed.

No product or process changes to Production parts are to be implemented without written approval from Ballard via a Supplier Request - Engineering Change Request Form (FRM5100416). A minimum of 3 months notification by the Supplier is required for change requests. Product or process changes may require qualification testing at Ballard and a re-submission of PPAP documentation.

4.2.1 Steps for PPAP Submission

Suppliers will be required to submit a PPAP package to the agreed upon level (default is level 3) in the format specified below, together with the sample parts that are numbered per the inspection completed on them.

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 requirements on the Certificate of Conformance (CofC) or Certificate of Analysis (CofA). Furthermore, the test and dimensional samples included in the Part Submission Warrant (PSW) should be chosen at random from a significant production run. The run size to show process capability for PPAP will be agreed upon with Ballard and the supplier.

Specifications that can be measured and are identified as 'critical', 'safety', 'key', or 'significant' should meet a 1.67 Cpk. This data should be included with the initial process study. 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.

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

1. Design Records (Drawings/Specifications)
2. Engineering Change Documents (FRM5100416)
3. Customer Engineering Approval
4. Design FMEA (if applicable)
5. Process Flow Diagrams
6. Process FMEA
7. Control Plan
8. Measurement System Analysis Studies (Gage R&R, bias, linearity, stability)
9. Dimensional Results
10. Material, Performance Test Results
11. Initial Process Study (Process Capability)

12. Qualified Laboratory Documentation
13. Appearance Approval Report, AAR (if applicable)
14. Records of Compliance (TS or ISO Certificate, RoHS)
15. PSW (Part submission Warrant) or Interim Approval

PPAP submissions are to be submitted electronically to the SDE and the Quality department. Any section that is not applicable must still be included in the PPAP submission, with a placeholder folder indicating that the section is not applicable. This is to ensure that no sections have been missed.

Ballard Quality will review the supplier PPAP submission using the PPAP submission checklist (FRM5101623). Deficiencies will be sent back to the supplier for re-submission.

The Supplier must provide written notification to the Ballard SDE if there are intentions to change any part of the production process after the PPAP Submission is approved. An updated PPAP submission may be required from the Supplier.

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. Furthermore, the Supplier will assure that future production continues to meet all customer requirements.

The Supplier, Supplier Development Engineer and appropriate Ballard engineers will work together to determine the ongoing inspection requirements and frequency during the life of production.

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.

4.3 Supplier Selection and Quoting Process

Supplier Development Engineer (SDE) and Supply Chain (SC) will review drawings and specifications to identify the appropriate supplier(s) from the existing supplier base, or source a new supplier if required. New suppliers will be qualified as explained in section 3.0 of this manual.

Ballard's 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 part and Supplier selection process. Ballard makes every attempt to be transparent in part selection and will share the part selection matrix that will be used in the selection process.

Supply Chain will forward the appropriate Drawings, specifications, CAD files, volumes and cost targets (if available) to the Supplier(s) to review, comment and supply a quote. Quotes are reviewed by Ballard's SDE and SC to ensure that the requirements have been met. 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 feedback on the design, tolerances, manufacturability, and cost savings suggestions.

Upon down-selection of a supplier for the part, Ballard will issue a PO to the Supplier. Please refer to section 2.6 of this manual for further information on Ballard's standard purchase order terms and conditions.

4.4 Product Verification (Supplier Quality Assurance)

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:

- o Criteria for acceptance and/or rejection
- o Where in the process measurement and testing operations are performed
- o A record of the measurement (and approval of the record)
- o Type of measurement instruments required and any specific work instructions for their use.
- o 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 may be used to verify the products on an ongoing basis. The supplier, with Ballard's approval, shall establish the characteristics to check, while the method and the frequency of the sample measurements shall be documented in the control plan. Where the implementation of reduced inspection levels has resulted in non-conforming products, 100% inspection shall be re-introduced until the inspection method is verified to be in control.

Note: This process is not applicable to 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 shipping the parts. Once the deviation is approved, the parts can be shipped to Ballard. All parts shipped to Ballard under a deviation must be clearly identified with the deviation number in a manner agreed upon with Ballard.

A Supplier Corrective Action Request (SCAR - FRM5000017) may be issued to the Supplier should non-conforming parts be delivered to Ballard without prior notification of the issue and/or without a deviation request. 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, the 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. The response should be provided on the signed SCAR form (FRM5000017), with appropriate supporting documentation attached.

Questions related to the SCAR requirements and structured problem solving process 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:

- o the Supplier's design rules and standards;
- o the constraints defined in this document;
- o Ballard's requirements;
- o 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

- 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.
- 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 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.

8.0 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	Definition
Critical Characteristic	Severity >8 And Occurance >1 And Detection >1	A product or process characteristic that can affect compliance with government regulation or safe product function, and require special actions or controls that must be listed on a Control Plan.
Significant Characteristic	Severity 5 to 8 and occurrence >=4	A product or process characteristic that is important for customer satisfaction and for which Quality Planning actions must be addressed on a Control Plan.

For Ballard documents (drawings, specifications, control plans, etc.) with significant/critical characteristics symbols, Suppliers are required to manage these characteristics by reporting product/process capability and submitting dimensions/test results. 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.

9.0 Forms

- FRM5100105: Supplier Profile
- FRM5101620: Supplier Assessment
- FRM5100574: Supplier Design and Specification Review
- FRM5100416: Engineering Change Request
- FRM5101624: Part Submission Warrant
- FRM5101622: Prototype and Interim Approval
- FRM5101623: PPAP Submission checklist
- FRM5000017: Supplier Corrective Action Request
- FRM5100712: Supplier Performance Management report