

**QUALITY CONTROL MANUAL**

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This Manual is approved by the Quality Manager and the Metallurgical Engineer as being fully descriptive of the procedures to be followed in controlling the quality of its services.

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Quality Manager

**O&W HEAT TREAT, INC.**  
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**QUALITY CONTROL MANUAL**

**Table of Contents**

1. Mission Statement and Quality Management System Overview ..... 3

2. Quality Control Organization ..... 6

3. Control of Quality Management System ..... 7

4. Procedure Planning and Customer Document Control ..... 9

5. Inspection ..... 10

6. Control of Inspection, Measuring and Testing Equipment ..... 11

7. Equipment & Process Control ..... 13

8. Process & Procedure Approvals ..... 15

9. Control of Purchased, Supplied or Fabricated Materials and Services ..... 16

10. Quality Control Records ..... 18

11. Handling, Storing, Packaging & Delivery ..... 19

12. Employee Training and Safety ..... 20

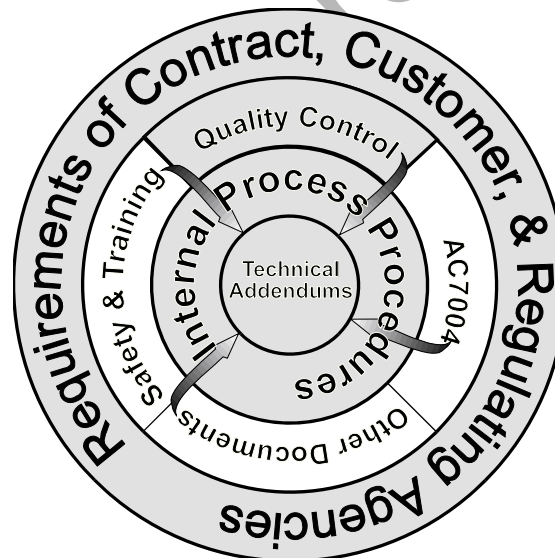
13. Continuous Improvement ..... 21

**QUALITY CONTROL MANUAL**

**1. Mission Statement and Quality System Overview**

**1.1 Mission and Philosophy**

The O&W Quality Management System is a proactive system, the objective of which is to ensure compliance with all customer Quality Management and product requirements for all metallurgical processing and services performed at this facility. It is intended that this Manual, and its referenced documents, serve as a vehicle for compliance with applicable statutory and regulatory requirements and the requirements of AC 7004. The underlying philosophy of this Management System is Continuous Improvement. By making constructive use of feedback and data from our own processing experiences, customer comments and concerns, and safety, health and administrative issues, we are committing to and improving both the quality of the services we provide and the fiscal health of our own business. This means that our Quality System is a dynamic one, ever evolving and changing as we improve and adapt to increasingly stringent industry requirements. It is our goal to ensure that the O&W Quality Management System is designed with sufficient flexibility to meet constantly changing statutory, regulatory, and customer requirements while at the same time maintaining strict compliance to these same requirements. An overview of our Quality Management System is depicted below.



**QUALITY CONTROL MANUAL****1.2 Quality Management System Overview**

As depicted in the preceding diagram, the Quality Control Manual is only one of several documents used to flow down requirements from customers and regulating agencies. All Quality Management System procedures are available at any time to personnel responsible for compliance to requirements defined therein. Quality Management System Procedures are also available to customer and regulatory agency representatives upon request.

- The Quality Control Manual, is the primary vehicle for flow down of requirements related to metallurgical processing. The QC Manual defines control of procedure generation, document control, inspection, measuring and test equipment, heat treating equipment, special processes, critical purchased materials and supplies, quality records, handling, storage, packaging and delivery, employee training and continuous improvement. The QC Manual is available to all employees via network computers located throughout the plant. The QC Manual is also available to customers and regulatory agencies upon request.
- Internal Process Procedures, or IPP's, are internal documents which provide detailed instructions and procedures for performing a variety of tasks and inspections, such as hardness testing, pyrometry, braze joint inspection, purchasing of critical materials, etc. IPP's, as depicted in the diagram, are accessed through the QC Manual, and are referred to frequently throughout the QC Manual. IPP's are available to all employees via network computers located throughout the plant.
- Technical Addendums, or TA's, are supplemental specifications that are directly tied to their parent IPP's. All baseline requirements of the parent IPP are in force for each of its downstream TA's, unless specifically superseded within a given TA to satisfy a customer specific requirement or other reason. TA's contain specific technical data, requirements or specific technical procedures that may or may not be customer specific. Technical Addendums provide a convenient, easily undatable receptacle for storage of technical data or procedures, without requiring the revision and change of documents further upstream. TA's are filed with their respective IPP's in the Main Office; most are

**QUALITY CONTROL MANUAL**

also available to all employees via network computers located throughout the plant.

The Technical Addendum numbering system is tied to the IPP numbering system, e.g., the Technical Addendums for IPP 006, "Pyrometry" are designated TA006-1, -2 etc.

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**QUALITY CONTROL MANUAL****2. Quality Control Organization**

Every employee at O&W Heat Treat has a critical role to play in ensuring that all product that leaves this facility is of the highest quality, and the satisfaction of every customer is only guaranteed by meeting all of their stated and known requirements. Each employee is considered to be a critical link in the total quality program. It is management's responsibility to determine and provide the resources needed to implement and maintain the quality management system, to continually improve its effectiveness and to ensure that each employee understands and performs their own critical role in that system. For this reason, our quality organization is, in fact, the company organization and a complete description has been detailed in the "Function & Organization Document". That document is available upon request. O&W Heat Treat has specifically charged two individuals with the responsibility to coordinate and direct, when necessary, the policies and directives of this manual and its related documents:

**2.1 Quality Control Manager**

The Quality Control Manager is responsible for the establishment and the maintenance of a cost effective Quality Control System.. The Quality Control Manager is also responsible for ensuring that the policies outlined in this manual become an integral part of day to day operations. The Quality Control Manager has the authority, responsibility and organizational freedom to initiate action to prevent the occurrence of any nonconformance relating to product, process or quality system; to identify and record any problems relating to the product, process and quality system; to initiate, recommend or provide solutions through designated channels; to verify the implementation of solutions, and to control further processing or delivery of nonconforming product, as required, until the deficiency or unsatisfactory condition has been corrected.

**2.2 Assistant Quality Manager**

The Assistant Quality Manager is responsible for ensuring that those procedures and policies that directly affect our customer's parts are completely integrated in day to day operations. The Assistant Quality Manager is also charged with assisting the Quality Manager and the company Metallurgical Engineer in evaluating and analyzing specimens and samples as required.

**QUALITY CONTROL MANUAL****3. Control of Quality Management System****3.1 Management Review**

The Quality Management System shall be subject to an annual review by management with executive responsibility to ensure its continuing suitability and effectiveness in satisfying the stated quality policy and objectives. This review shall include a review of the QC Manual and the IPP Manual. An annual sign-off sheet shall appear as an addendum to the QC Manual, and shall be signed-off by the President to indicate that the annual review has been performed. Any changes implemented as a result of this meeting will be documented. On a semi-annual basis, the management team, with representatives of the various work departments as required, shall meet to discuss, review, and plan changes to the overall Quality Management System, to ensure it continues to be dynamic and effective in maintaining customer satisfaction, and services our customers with the highest quality possible.

**3.2 Self - Audit**

The Quality Management System shall be subjected to a Self-Audit, conducted in accordance with IPP 016 by the QC Manager or his designee on an annual basis, or at an increased frequency if necessitated by historical evidence. The auditor(s) may not audit his/her own work. The scope of the Self-Audit shall be at the discretion of the QC Manager, but shall include portions of all facets of the Quality Management System; all Nadcap elements within the current scope of accreditation shall be properly addressed. Nonconformances discovered during the audit will be handled via the NMR system defined in IPP 025. Results of the Self -Audit shall be formally reviewed and initialed by the President on an annual basis, indicating concurrence with both the scope and any corrective actions generated by the Audit. The QC Manager will see that responsible personnel take timely corrective action regarding any deficiencies found during the Self-Audit. The President shall utilize the results of Self-Audits in the planning process as he sees fit to improve the overall Quality Management System. The Self-Audit is an internal document only. However, a summary can be made available upon request.

**3.3 QC Manual Control**

3.3.1 The QC Manual is under the control of, and shall be maintained by, the QC Manager. The QC Manual, and all new revisions thereof, shall be formally reviewed and released by the QC Manager. Additionally, the President shall review and sign-off the QC Manual

**QUALITY CONTROL MANUAL**

after any revisions to the Manual. This review shall be indicated by utilization of a review/release stamp designated for that purpose.

3.3.2 The QC Manual shall be reviewed and signed by all employees. Any significant technical revisions to the QC Manual shall be flowed down to employees via the specification database system. The QC Manual is available to all employees at all times for review or consultation on the Specification Database. The QC Manual and Quality Management System procedures shall be made available to customer/regulatory agencies upon request per IPP 023.

3.4 Due Date Schedule Variance

3.4.1 This Quality Manual requires calibration and testing of virtually every aspect of O&W's business, including pyrometry testing of furnaces, dewpoint testing, microstructural testing, braze alloy testing and calibration of test equipment such as hardness testers, micrometers, etc. Calibration frequencies, which reflect AMS 2750 and prime requirements when applicable, and O&W required frequencies where no other requirement exists, are established in TA002-5, the Measurement Management System. Allowable schedule variance from calibration and testing due dates shall be as follows. Overdue equipment shall not be used for production work.

Required Frequency

Daily  
Weekly  
Biweekly  
Monthly  
Bimonthly  
Quarterly  
Semi-annually  
Annually

Allowable Extension

None  
One day  
Two days  
Three days  
Three days  
Four days  
Six days  
Twelve days

**QUALITY CONTROL MANUAL****4. Procedure Planning and Customer Document Control**

The distribution and control of customer and prime contractor specifications as well as all Military, AMS, AS and other specifications, shall be controlled as outlined below. Requirements for Shop Traveler planning and generation for heat treating and brazing processes are also outlined below. All internal, external and procedural documents are available for review to all employees via network computers located throughout the plant.

**4.1 Document Control**

All internal and external specifications, procedures and Shop Travelers shall be subject to a formal review/release procedure. Review/release of internal procedures and specifications shall be conducted by the custodian for the document in question (see TA 023-1). Satisfactory review/release shall be indicated by the use of the review/release stamp (electronic or manual) designated for that purpose, or by initialing and dating the cover page of the document. Shop Travelers shall be approved (electronically or manually) in the block designated for this purpose by both the Engineering and Quality departments. Procedures for maintenance and revision control of documents shall be in accordance with IPP 023, "Maintenance of Specifications and Quality Records".

**4.2 Procedure Planning**

Planning, generation and documentation of specific processing procedures for use in the processing of production parts, including frozen processes, and personnel authorized to plan and change production processes, shall be accomplished in accordance with IPP 001. Any changes to production processes shall be assessed to verify that the desired effect has been achieved with no impact on product conformity.

**QUALITY CONTROL MANUAL****5. Inspection**

Receiving, in-process, and final inspection procedures for production parts to be processed at this facility, including identification, traceability and inspection and test status, shall be conducted in accordance with IPP 002.

**5.1 Receiving Inspection**

All parts received for processing at O&W Heat Treat, Inc. will be subject to a Receiving Inspection per IPP 002. This inspection includes a purchase order/contract review, spot-check of count, cross-check of purchase order vs blueprint, hidden mechanical damage, processability, cleanliness, and in the case of braze assemblies, dimensional inspection of braze joint clearances. These procedures are detailed in IPP 002.

**5.2 In-Process Inspection**

In-Process Inspection may consist of a visual, peel or shear test examination per IPP 008, "Braze Joint Inspection" and/or Hardness Inspection per IPP 003, "Hardness Testing". Control of in-process inspection shall be in accordance with IPP 002.

**5.3 Final Inspection**

All processed parts shall be subject to a Final Inspection to verify that processing performed is in compliance with purchase order and/or contract requirements. This inspection may be at 100% frequency or may involve sampling. Those documents referenced in 5.2 are applicable to Final Inspection as well; IPP 002 is the controlling document for Final Inspection.

**5.4 Non-Conforming Material**

Nonconforming Material Reports and Corrective Action analysis, when required, shall be generated in accordance with IPP 025, "Nonconforming Material and Corrective Action", and may arise from a finding at Receiving, In-Process or Final Inspection. Final disposition of nonconformances shall be in accordance with IPP 025.

**QUALITY CONTROL MANUAL****6. Control of Inspection, Measuring and Testing Equipment****6.1 Calibration Requirements**

Inspection, measuring and test equipment shall conform to the calibration systems control program defined by TA002-5, the O&W Measurement Management System. Calibrations and calibration verifications shall be traceable to internationally or nationally traceable standards. If no such standards exist, the basis or standard used for calibration shall be documented. All calibration of inspection, measuring and testing equipment performed by outside certifying agencies is controlled by IPP 012, "Purchasing of Critical Materials and Services" (See Section 9). Calibration reports shall be reviewed in accordance with IPP 012 and shall contain quantitative data obtained from calibration.

**6.2 Selection and Calibration of Inspection, Measuring and Test Equipment.**

Inspection, measuring and test equipment in use at O&W shall be selected after a review of the measurements to be made and the accuracy required - equipment capable of meeting the required criteria shall be selected. Inspection, measuring and test equipment which can affect product quality are identified in TA002-5 of IPP 002, and shall be calibrated/verified and adjusted as required, and at the intervals prescribed in that specification, in accordance with paragraph 6.1, above. The calibration intervals specified in TA002-5 are defined by the QC Manager, and are based on purpose, stability, frequency of usage and historical data, unless otherwise frequency is otherwise dictated by customer requirements. The QC Manager may, at his discretion, alter the calibration schedule based on the results of previous calibrations.

**6.3 Inspection, Measuring and Test Equipment from Outside Sources**

All inspection, measuring and test equipment borrowed, on loan or supplied by customers or other sources are subject to all the requirements of Section 6 of this manual, and shall be reviewed for up-to-date calibration stickers prior to use at this facility. All such equipment shall be made available for use by the customer as required to determine contract conformance.

**QUALITY CONTROL MANUAL****6.4 Handling, preservation and storage of inspection, measuring and test equipment**

The handling, preservation and storage of all inspection, measuring and test equipment shall be such that the accuracy and “fitness for use” of the equipment is maintained. All measurement standards shall be traceable and shall have accuracy, stability, range and resolution as required for the intended use. Unless otherwise specified, the collective uncertainty of measurement standards shall not exceed 25% of the characteristic being calibrated.

Inspection, measuring and test equipment shall be utilized in an environment which has been controlled to the extent necessary to assure continued measurements of the required accuracy. Factors such as temperature, humidity, vibration, cleanliness, etc. shall be controlled to the extent possible and necessary, giving due consideration to the operating location of the equipment in question.

Inspection, measuring and test facilities, including test hardware, shall be safeguarded from adjustments which would invalidate the calibration setting.

**6.5 Identification and Restrictions**

All calibrated inspection, measuring and testing equipment shall be properly identified (e.g., stickered) and dated by the certifying agency, with a specific due date clearly defined. See IPP 012, "Purchasing of Critical Materials and Services". Section 10 of this manual addresses the maintenance of calibration records for inspection, measuring and test equipment. Any inspection, measuring and test equipment which has calibration restrictions, i.e., certain capabilities of the equipment are not being utilized for some reason, shall be clearly identified regarding said restrictions, to preclude its use for improper acceptance of production parts.

**6.6 Recall System**

TA002-5 of IPP 002 defines a recall system to ensure the timely recall of inspection, test and measurement equipment to assure timely recalibration. TA002-5 also addresses the subject of out-of tolerance equipment.

**QUALITY CONTROL MANUAL****7. Equipment & Process Control**

The following tests shall be performed to ensure that all heat treating equipment (furnaces and freezers) conform to AMS 2750 and all customer pyrometry requirements. IPP 006, "Pyrometry", is the primary document for pyrometric procedures and guidelines. Furnace operation and maintenance procedures, including thermocouple replacement schedules, shall be in accordance with IPP 004, "Furnace Operation and Maintenance". Changes to production or pyrometric equipment which could affect production processes shall be documented and addressed as specified in IPP 004 and IPP 006. Equipment in storage shall be carefully preserved and periodically checked for condition and suitability for its intended purpose.

**7.1 Instrument Calibration**

Pyrometric instrument calibration shall conform to AMS 2750 and shall be in accordance with IPP 006.

**7.2 Systems Accuracy Check (SAT)**

Also referred to as a Probe Check, this test shall be performed in accordance with IPP 006.

**7.3 Temperature Uniformity Surveys (TUS)**

All TUS frequencies, frequency reductions and procedures shall be in accordance with IPP 006, Pyrometry.

**7.4 Thermocouples**

Thermocouples for controllers, recorders, overtemperature instruments, SAT, load monitoring and TUS shall conform to the requirements of AMS 2750, and shall be in accordance with IPP 006.

**7.5 Metallography & Process Control Testing Program**

Metallography and metallographic controls shall be in accordance with IPP 011, "Metallography".

IPP 014, Process Control Testing, serves to break down each customer specification, analyzing each for the required testing, and frequency of testing, for parts processed at O&W. IPP 001, Process and Procedure Planning, will generate procedures based on a review of each customer specification, as well as a review of the process control testing

**QUALITY CONTROL MANUAL**

as outlined by IPP 014. Routine testing may be incorporated in the procedure being generated, while less frequent testing may be identified during a Receiving Inspection review of IPP 014 and the PCT database, and will be so noted on the specific traveler. The intent of this methodology is to validate all verifiable processing via routine monitoring and measuring, e.g., hardness testing, visual examination, microstructural examination, X-Ray, ultrasound, peel testing, load testing, etc.

Unverifiable processes will be validated via ongoing processing and testing in accordance with IPP 004, Furnace Operation and Maintenance; IPP 005, Process Gas Purity and Dewpoint Check Procedure; IPP 006, Pyrometry; IPP 014, Process Control Testing (routine microstructural testing) and IPP 022, Training and Training Records.

#### 7.6 Heat Treat/Braze Fixtures, Baskets, Tooling etc.

Care shall be taken to safeguard baskets, tooling, fixturing, graphite plates from damage, wear, deterioration, contamination and any other detrimental condition which could effect the fit/function of the tool or fixture, or which might negatively impact a production part. Any suspect basket, tool, fixture or plate shall be reviewed by QC prior to returning to production use. See section 9 regarding additional controls for fixturing and tooling.

**QUALITY CONTROL MANUAL****8. Process & Procedure Approvals**

Specific customer or prime contractor approval or certification is required prior to processing of virtually all production parts. This requirement may constitute an annual audit certification, pre-approval of a part-specific procedure, government source control, etc..

**8.1 Certification/Approval**

Where government source, prime contractor or customer approvals and/or certifications of processes, procedures, equipment or personnel is required by purchase order or contract, such approvals and/or certifications will be verified prior to the planning and processing of production work, in accordance with IPP 001 and IPP 002. Evidence of such approval or certification will be submitted upon request to any duly authorized agent of the customer.

**8.2 Sub-contractor Processing**

When processing is performed by a subcontractor, O&W Heat Treat, Inc. will verify that the source has the necessary certifications and/or approvals on file prior to processing production work. Critical sub-contractor processing shall be procured in accordance with IPP 012, "Purchasing of Critical Materials and Services" (See Section 9). IPP 012 defines those processing services deemed critical, as well as the procedures for selection and control of suppliers.

**QUALITY CONTROL MANUAL****9. Control of Purchased, Supplied or Fabricated Materials and Services**

Purchased materials and services which are to become part of the finished product or effect the processing performed on the finished product are deemed critical and shall be procured in accordance with IPP 012, "Purchasing of Critical Materials" and Services. Critical Materials and Services include, but are not limited to: thermocouples, braze alloys, pyrometric instrument calibrations, process gases, micrometers, shear gages, hardness testers and sub-contracted processing (e.g., plating, welding, NDT, etc.).

**9.1 Control of Materials and Tooling/Fixturing**

Customer supplied critical materials such as braze alloy or tooling/fixturing shall be reviewed in accordance with IPP 012 by the Quality Manager, or his designee, prior to release for production work to ensure that: a.) braze materials are accompanied by proper material certifications and b.) calibration controlled tooling/fixturing (i.e., tooling or fixturing with calibration stickers) has up-to-date calibration stickers. Customer supplied tooling/fixturing must be properly identified with part number, prime and owner, as applicable. Out of calibration tooling/fixturing shall be returned to the customer for re-calibration prior to use on production hardware. Tooling/fixturing calibration that goes out-of-date while in O&W possession need not be immediately returned for calibration, but must be re-calibrated prior to production use. No customer supplied fixture or tool may be modified, repaired or adjusted by O&W personnel without specific purchase order or other written instructions.

A tooling/fixturing log will be maintained in the braze room, which will be used to facilitate tracking, status, and ownership of tooling, including O&W fabricated tooling. Part number specific induction coils and fixturing shall be stored in clearly labeled boxes in the induction area. Care shall be taken to safeguard all tooling/fixturing and coils from damage, wear deterioration, contamination and any other detrimental condition which could effect the fit/function of the tool or fixture, or which might negatively impact a production part. Tooling/fixturing in storage shall be periodically checked as required to verify condition and suitability.

Braze material which arrives pre-assembled by the customer must be so noted on the purchase order, including braze specification and lot number. A material certification for the braze alloy is not required in such an instance, but do not process purchase orders which are missing the braze specification and lot number.

**QUALITY CONTROL MANUAL**

Unassembled, supplied braze materials shall be stored and maintained as would O&W braze materials, in accordance with IPP 018.

Supplied materials / tooling which are damaged, lost or otherwise unsuitable for use will be addressed via IPP 025, Nonconforming Materials and Corrective Action and reported to the customer.

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**QUALITY CONTROL MANUAL****10. Quality Control Records**

All information recorded on internally generated Quality Control Records shall be recorded neatly, precisely, legibly, accurately, completely and in ink, and shall include identification of the person recording the information and the date the information was recorded. Corrections (cross-outs), when necessary, shall be made with a single line, leaving the original information legible. Refer to IPP 020, "Signature and Stamp Control and Authorization Matrix" and IPP 023, "Maintenance of Specifications, Documents and Quality Records" for additional details and requirements. When applicable, Quality Control Records shall be traceable to the production job involved.

**10.1 Internal Quality Control Records**

Internal Quality Control Records include, but are not limited to: Furnace Charts, Certifications, Processing Travelers, Customer-Approved Processes and Procedures, Personnel Approved for Special Processes, Nonconforming Material Reports and Corrective Action Reports, Log Book entries, Test Reports, Temperature Uniformity Surveys, System Accuracy Checks, Dewpoint and Leak-Up Rate Logs, Customer Satisfaction Surveys, Calibration Verifications and Reports, Management Review Records, Self-Audits, Supplier Audits, Evaluations and Verifications and this Quality Manual.

**10.2 External Quality Control Records**

External Quality Control Records include, but are not limited to: Process Gas Certifications, Braze Alloy Certifications, all Calibration Certifications, X-Ray reports, etc.

**10.3 Quality Record Maintenance**

All Quality Control Records shall be maintained in accordance with IPP 023, "Maintenance of Specifications and Quality Control Records". See IPP 023 for Special Record Retention requirements (e.g., Flight Safety parts, etc.)

**QUALITY CONTROL MANUAL**

**11. Handling, Storing, Packaging & Delivery**

Handling, packaging, storage and delivery of all parts shall be in accordance with IPP 009, "Packaging and Shipping".

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**QUALITY CONTROL MANUAL****12. Employee Training and Safety**

A formal on-going training program has been established for all employees. This program shall be administered in accordance with IPP 022, "Training and Training Records". The program is designed to ensure that all employees involved in work relating to the conformance to all customer, product and regulatory requirements, are competent and aware of the relevance and importance of their activities, and of how they contribute to the achievement of the Quality Management System objectives. Additional training requirements are detailed in various IPP's (e.g., IPP 003, Hardness Testing). Technical Training Topics, as administered via IPP 022, constitute a part of our overall plant procedures unless superseded by Shop Traveler, purchase order, B/P or specification requirement.

IPP 013, Safety and Communications is applicable to all employees, for activities performed on the grounds, or while performing duties for O&W off-site, without exception. IPP 013 details a variety of safety programs for many activities throughout the shop, including, but not limited to, compressed gas cylinder safety, electrical safety and lock out/tag out (LOTO) procedures, forklift safety, solvent and chemical safety, hot work safety, furnace operation safety and manual brazer safety. All employees are required to comply with all safety programs flowed down via IPP 013 as well as detailed safety information that may be included in IPP's, Safety Manuals, TA's, TTT's and general safety pamphlets, signs and notifications throughout the shop. Employees are further required to immediately cease work in the affected area and to notify a supervisor should they detect or suspect an unsafe working condition of any kind.

**QUALITY CONTROL MANUAL****13. Continuous Improvement**

The Continuous Improvement program shall be administered in accordance with IPP 016, "Continuous Improvement". The intent of this program is to gather insight and data from all areas of the company's operations. This information is then evaluated, with a goal of continuously improving the Quality Management System and overall efficiency, as well as the effectiveness of the business, and take positive action where appropriate to implement necessary or desirable changes. The resources available to the company will be used for the upgrade or acquisition of improved systems and processing equipment and/or the manpower necessary to achieve those goals or changes. Areas which contribute data to Continuous Improvement evaluations include, but are not limited to:

- Nonconforming material reports generated at Final, In-Process or Receiving Inspection.
- Performance and maintenance logs and reports.
- Customer feedback, including rejections, suggestions, surveys, or other commentary.
- Customer satisfaction as a function of conformance to requirements, scheduling, quality, pricing, and technical support.
- Self-audits and customer audit.
- Pyrometric observations related to Heat Treating Equipment Control.
- Purchased materials and supplies where they affect quality of process, cost of process, etc..
- Health and Safety issues including ergonomic issues.
- Production hardness or other processing-related data.
- Specifications and Supplier Quality Requirements from prime contractors and customers.
- Statutory and regulatory requirement from all sources.
- Quality Management Reviews and Management Meetings.