

Forward

Fiberglass Reinforced Plastic (FRP) manufacturing is a process whereby liquid resins and fiber reinforcements are combined to produce products and structures. The resins are thermosetting and the resulting laminates are rigid and permanent. Once combined and cured, the laminates cannot be altered and the materials cannot be recovered.

The application of a Quality Assurance Program (QAP) to FRP manufacturing must recognize that there is no “second chance”. The quality of the product is determined at the beginning of fabrication and no degree of subsequent inspection will improve the laminate integrity.

Quality Statement

Edwards Fiberglass, Inc. is committed to providing a high quality, composite constructed product, which meet, or exceed, the needs of our customers and complies with the requirements of EFI. We pride ourselves on excellence in manufacturing the development of designs and processes to ASME RTP-1, ASTM D3299, and ASTM D4097 standards.

The Company will manage systems and processes, which are designed to deliver value and to prevent deficiencies in quality. Quality means:

1. Compliance with Company policies, procedures, and standards of ASME RTP-1, ASTM D3299, and ASTM D4097
2. Compliance with applicable laws and regulations
3. Conformance to agreed customer requirements

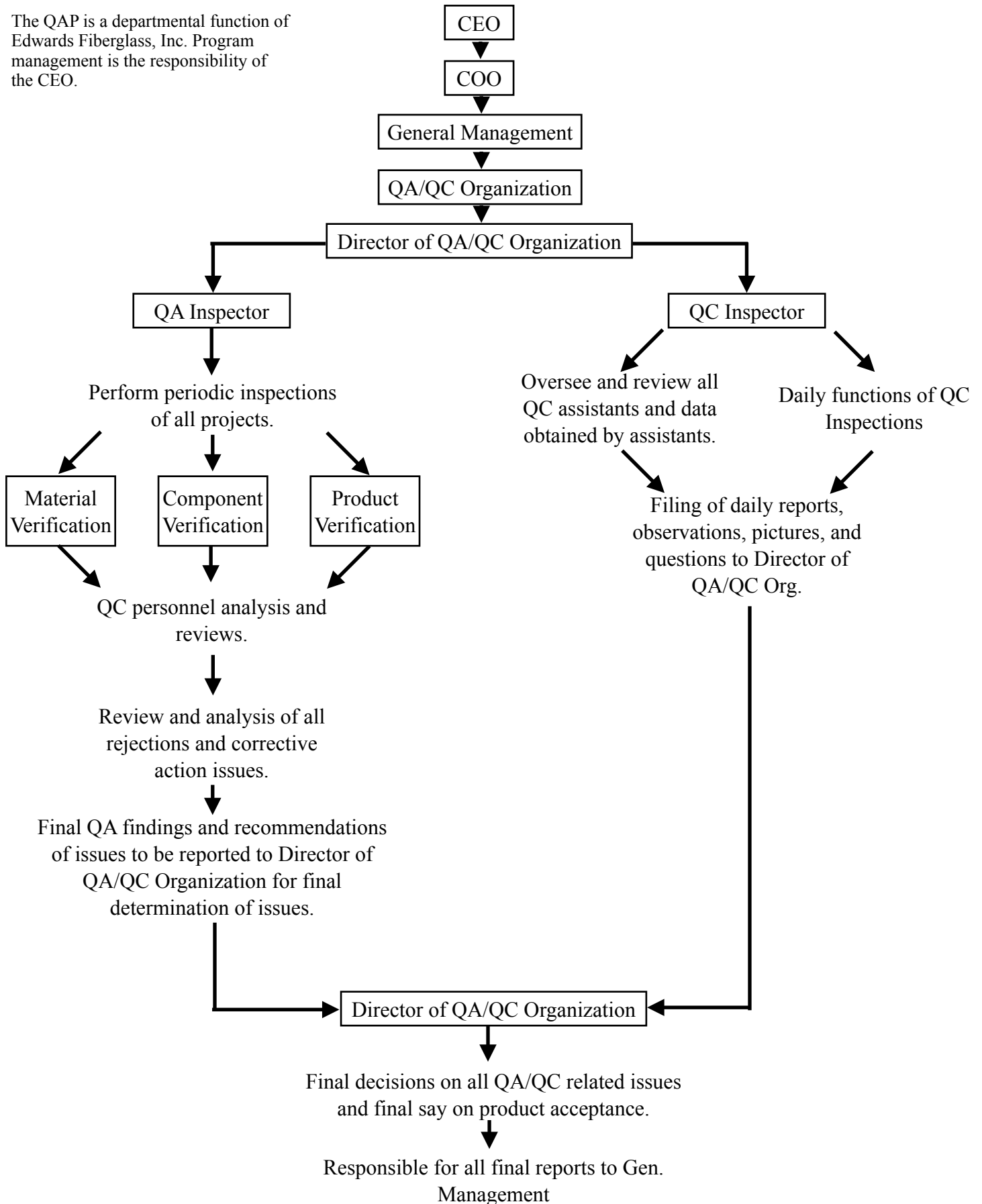
The quality assurance plan promotes and maintains the quality of manufactured products and makes possible continuous improvement within all business processes. The program has the full support of management and is woven throughout all levels of the organization.

Edwards Fiberglass recognizes the importance of a Quality Assurance Plan. All employees are responsible for quality of production and service to internal and external customers. All employees shall be familiar with and apply the policies and procedures to EFI. Implementation of this program is assigned to a Quality Assurance Director who will oversee and direct all necessary functions and documentation of the Quality Assurance Plan.

Shane Edwards
President

Chain of Command and Duties Chart

The QAP is a departmental function of Edwards Fiberglass, Inc. Program management is the responsibility of the CEO.



Production Employee Qualifications

Quality Control Inspector:

- Familiar with ASME RTP-1, ASTM D3299, and ASTM D4097 standards and processes.
- Well versed in all aspects of hand lay up or vacuum infusion process. (when applicable)
- Cannot be involved “hands on” in the production of composite tanks or parts.
- Reports directly to the company’s President.

Production Manager:

- Familiar with ASME RTP-1, ASTM D3299, and ASTM D4097 standards and processes.
- Experienced in the fabrication of composite tank or parts.
- Well versed in all aspects of the hand lay up or vacuum infusion process. (when applicable)
- Completely familiar with, and responsible for, implementation of shop drawings, special provisions, standard operating procedures and associated forms.
- Schedules production and organizes material purchasing and shipping for finished products.

Production Lead:

- Oversees the manufacturing of an assigned project.
- Familiar with ASME RTP-1, ASTM D3299, and ASTM D4097 standards and processes.
- Well versed in all aspects of hand lay up or vacuum infusion process. (when applicable)
- Will be required to assure that completed work complies with desired specifications.
- Keeps the project moving forward on-time.
- Manages Composite Technicians assigned to their particular project.
- Maintains a clean and organized working environment.
- Maintains quality control for their project.
- Documents the necessary information relating to their project.
- Reports to Production Manager.

Composites Technician:

- Familiar with, and has proven competence in, the fabrication of composite parts, including the following:
 - o Cutting of fiberglass cloth to size, following template, drawings, or laminate schedule using scissors, or knife.
 - o Laying-up of mold/tool with fiberglass, as to avoid any bridging/wrinkles causing potentially resin rich areas, and in accordance with specifications.
 - o Promotion of resin, according to specified measurements, using proper procedure.
 - o Lay up parts using hand layup methods.
 - o Infuse parts using vacuum infusion process. (when applicable)
 - o As required, trim, drill, grind, sand, and finish cured parts to specifications, using templates, fixtures, hand tools, and power tools.
 - o Drilling of close tolerance holes, as required.
 - o Responsible to keep scrap at minimum levels.
- Follows all OSHA, safety, and environmental regulations.
- Reports to Project Lead.

Drawing Revision Standard Operating Procedure (SOP)

- 1) Revisions to shop drawings, work orders, ship lists, and any job related documents that are issued to Production and Quality Control Department can be handled in one of two ways: (for this procedure we will refer to shop drawings, work orders, shop lists, and related documents as: documents)
 - a) Re-issue of revised documents
 - b) Pencil revision of revised documents
- 2) Re-issue of revised documents require the engineer, project manager, or designated person to do the following:
 - a) Make the changes or additions to the original
 - b) Cloud the changes on the document and note revision # with description on lower right of document
 - c) Record revision number with issue date in document log
 - d) Retrieve and destroy all previous issues and replace with new. (Note: previous distribution and revision number is already recorded in document log)

- 3) Pencil revisions are for less involved changes and simply required the designated individual to do the following:
 - a) Make the changes or additions to the original
 - b) Cloud and note the change on the document
 - c) Record the revision and issue in the document log
 - d) Pencil the revision on all copies previously issued. These should be in red and initialed.
- 4) If additional dimensioning or information is given to production for ease of fabrication, but is not essential to build the piece, then it is not necessary to revise the document.
- 5) Any changes that occur in the fabrication process that alter the product from the document requirements will be recorded by the production department and submitted to engineering, who will then revise the original document accordingly.
- 6) All working shop documents will be kept in the production office work order file unless they are currently in use on the floor. All in use shop documents will be returned to the work order file at the end of each shift. This will help facilitate the revision process and insure that no multiple copies or out of date copies are on the floor.

Material Ordering SOP

1. The goal of material ordering is to ensure that sufficient material is on hand to meet productions needs, while maintaining the minimal possible inventory.
2. Material ordering is performed per the following routine:
 - Material requirements for the following week are itemized and quantified.
 - Needs are assessed against inventory, an allowance being made for material requirements for the current work week and the minimum inventory level. The result being the order requirement per line item to support the following week's production needs.

- Items with longer lead times, such as glass reinforcement and 2lb density foam are typically ordered per project in advance to ensure timely delivery.
 - Purchasing, in communication with accounting, generates the purchase orders in “Quick Books” and physically places the orders with vendors, either through fax, phone, email, or web page.
 - Purchase orders must include product description, item number, quantity, units, delivery expectation, packaging requirements, and the requirements for certificates of conformance/analysis or mill certificates which includes the following materials: veil, CFM, glass reinforcement, resin, pigment, MEKP, BPO, DMA, and Antimony.
3. Should manufacturing not have sufficient material on hand to support the production schedule, or material is found to be of poor quality, incorrect type or quantity, packaged incorrectly, or delivered either sooner or later than agreed; then a corrective action investigation shall be conducted to generate a course of action.

Incoming Material SOP

1. Upon receiving incoming material, verify the product description, item number, quantity, units, delivery expectation, and packaging requirements are as detailed on the purchase order.
 - Obtain a copy of the purchase order
 - In pen and on the copy of the purchase order acknowledge verification the following:
 - Date of receipt
 - Product description
 - Item number
 - Quantity
 - Check that packaging meets expectations and is undamaged. Record on the copy of the purchase order.
 - Check that all bung and cap seals are intact. Record on the copy of the purchase order.
 - Provide the original of the marked up copy of the purchase order to accounting and place a copy into the job file.

If the above conform to expectations then:

- Remove packaging and label all containers with the date of receipt.
 - Label all incoming materials that have been purchased for specific job, other than general shop supplies, with job's number.
 - Move all job specific materials from the receiving area to a designated area, assigned for such storage. Keep separate, or delineate, from material for other jobs or general in house stock.
 - To the greatest degree possible store all flammables in their designated flammable locker or combustibles room. Ensure that all cardboard packaging has been removed.
2. The following materials require certificates of analysis, or mill certificates. If they are not located with the packing list, then the vendor is to forward them by fax/email.

Antimony	HDPE
Veil	MEKP
CFM	DMA
Glass Reinforcement	BPO
Resin	Gel Coat
Pigment	

3. The following materials require additional inspections upon receipt, each having a dedicated incoming inspection SOP and form.
- Glass reinforcement
 - Steel
 - Foam
 - Resin
4. Any product that has been obviously damaged, or is of an incorrect description or item number, shall be put aside in a specified area, labeled "DO NOT USE". A corrective action investigation will determine a course of action.

Incoming Resin Inspection SOP

Upon completing the Incoming Material SOP, complete the Incoming Resin Inspection Form which requires:

1. Collection of basic information such as supplier and batch number. If the resin's batch number has not been gel tested previously, then a gel test must be performed, per the following procedure to verify that the resin reacts as expected.

2. Verification of gel time through a 16 ounce gel test as follows:
 - Verify surface temperature of drum is between 60 and 85°F
 - Don face shield and latex gloves
 - Verify that both the pour and vent bung seals are unbroken
 - Remove drums pour bung and fit auto-closing valve
 - Position drum cart and tip to horizontal
 - Remove drum's vent bung
 - Pour 16 oz into a plastic beaker
 - Promote according to Promotion SOP and mix, recording all required data on the incoming Resin Inspection Form.
 - Catalyze resin per schedule, adjusting percentage according to ambient temperature
 - If the samples gel in the desire time frame, then the resin is acceptable
 - Correctly store all chemicals, clean up area, and dispose of waste appropriately.
 - File the Incoming Resin Inspection Form in the Incoming Resin Inspection Form Binder.

3. Material that fails the inspection shall be put aside in a specified area and labeled "DO NOT USE". A corrective action investigation will determine a course of action.

Resin Promotion SOP

The following procedure is to be followed to verify resin promotion:

1. Data is to be collected on the "Promotion Form". This includes such data as brand, batch number, date of manufacture and date of receipt, etc for resin, cobalt, DMA, UV-9, pigment, wax, and styrene.

2. Material is weighed out in quantities per the "Promotion Schedule". Quantities will vary depending upon the amount of resin being promoted, the type of resin, and the product to be used with the resin.

3. The required quantity of BPO is measured out into a dedicated plastic container positioned on a digital scale. The measured quantity of BPO is at all times kept removed from other promotion additives.
4. Each of the remaining components are measured out into dedicated containers and collected in a common area.
5. The promotion technician labels the drum side with the following information:
 - “Promoted on:
 - “Promoted by:
 - The job name or number
 - List each promotion ingredient with the amount that is about to be added to the resin.
6. The project lead is called to review the paperwork, the material, and the quantities. Approval to proceed is acknowledged by the project lead’s signature, on the promotion form.
7. Only upon receiving approval to proceed, the promotion technician removes the resin drum’s seals and bungs, and the individual components are poured into the resin drum.

Incoming Glass Reinforcement Inspection SOP

Upon completing the Incoming Material SOP, complete the Incoming Reinforcement Inspection Form which requires:

1. Collection of basic information
2. Verification of product’s weight
 - Cut a 1 foot square sample of fiberglass
 - Zero out the scale and record the weight of the sample
 - Compare the samples weight to the company’s declared weight
 - If the difference is greater than 10% then initiate a correction action investigation.

3. Visual inspection
 - Confirm the orientation of the reinforcement is per expectations.
 - Confirm the fiberglass is in its original, clean, undisturbed wrapping.
 - Confirm that the fabric itself is clean, of the correct color, expected texture, and free from any form of contamination.

4. Material that fails the inspection shall be put aside in a specified area and labeled “DO NOT USE”. A corrective action investigation will determine each course of action.

Incoming Foam Inspection SOP

Upon completing the Incoming Material SOP, complete the Incoming Inspection Form which requires:

1. Foam inspection is performed per the following routine:
 - Material dimensions are confirmed against product drawings.
 - Material density is confirmed by cutting an approximate 6”x6”x6” block, confirming measurements by tape measure, and obtaining its weight with digital scales.
 - a) The foam is checked visually for cracks and voids.

2. Should the delivery be poor quality, incorrect type or quantity, packaged incorrectly, or delivered either sooner or later than agreed; then a corrective action investigation shall be conducted to generate a course of action.

Incoming Steel Hold Downs & Lifting Lugs

Upon completing the Incoming Material SOP, complete the Incoming Steel Inspection Form which requires:

1. Collection of basic information such as supplier and batch number etc.
2. Verification of stand dimensions and quantities.
3. Verification of weld quality.
4. Verification of proper dimensions.
5. Assessment of galvanizing quality. (If applicable)

6. Material that fails the inspection shall be put aside in a specified area and labeled “DO NOT USE”. A corrective action investigation will determine a course of action.

Material Storage SOP

The following procedure is to be followed after receiving incoming materials, or returning materials to storage, following use in production.

1. Following the receiving of incoming materials per the Incoming Material SOP, materials are to be promptly moved to their designated storage location.
2. Storage locations are to be considered with storage requirements as documented in the respective MSDS.
3. Materials are to be separated by type and stored in a manner in which they do not present a safety hazard. They must be stored off the ground, on platforms, skids, or other supports. Materials shall be kept free from water, dirt, grease, or other foreign matter, and shall be protected from corrosion.

Inventory Control SOP

The following procedure is to be followed to control inventory:

1. The software “Quick Books” is used to manage inventory levels. Each material is assigned an identification code along with a description of the material. Units are identified by which it is purchased, counted, and inventoried.
2. As incoming material is received, delivered, and backordered, quantities are recorded on the packing slip which is then placed in the purchasing officers tray. Subsequently, the date and quantity of receipt of item is input into “Quick Books” by the purchasing officer.
3. Items and quantities of material used in production, which come from the product’s “bill of material”, are input weekly into “Quick Books” as withdraws based upon the quantity of the product manufactured that week.
4. On the last business day of each month a physical count of all inventory items is performed. Variances between the physical count and the balance shown in “Quick

Books” are rectified. If a second count confirms that physical balance, and all incoming material is shown to have been input correctly, and all withdraws made correctly, then an adjustment is made to the balance in “Quick Books”, forcing it to agree with the physical count.

Material Tracking SOP

The purpose of this procedure is to insure that all materials on the shop floor and in the material storage area, have tracking numbers (i.e. – Lot numbers) attached to them. Allowing shop personnel using these materials, to apply these lot numbers to EFI’s Parts Tracking Program.

1. When materials are received, the receiving clerk will verify product and make certain that all components have some form of identification number. They will also log in the materials according to EFI Receiving Procedures.
2. All materials, whether nexus, mat, roving, resins, etc. will have, and retain their manufacturer’s control number for as long as they are in the shop. In this way, employees using these materials will be able to transfer control numbers to part tags for compliance with EFI’s Part Tracking SOP.
3. All containers of resins will have the appropriate lot number attached as it is pulled from the original drum.
4. Lot numbers of glass mats, roving, etc. will be maintained at the mat table. Lot numbers of chop and filament winding materials will be maintained at the work station, at which they will be used.
5. These procedures will allow employees to transfer lot and/or control numbers directly onto part tags for compliance of EFI’s Part Tracking SOP.

Corrective Action Investigation SOP

The following procedure is to be followed to determine an appropriate response to events which violate SOPs, or through the observance of SOPs, to variables which are identified as being outside of acceptable tolerances.

1. A corrective action investigation can be initiated by the QC Inspector, the Production Lead, the Production Manager; or the Operation Manager.
2. The Corrective Action Report Form is competed which requires the following:
 - a description of the type of event
 - the reason that the event is cause for corrective action
 - background information such as vendor and batch numbers
 - detailing of the decided course of action
3. SOPs should be revised, as necessary, to prevent any circumstances, which may, or may not, have prompted any corrective actions.

Part Tracking SOP

The purpose of this Part Tracking Procedure is to insure that every Edwards Fiberglass supplied part, pipe, tank, etc, can be identified, at any time, as to materials and procedures used in its manufacture.

This identification will include such information as:

- a) Resins used and lot #s
- b) Glass used and lot #s
- c) Lay-up procedures used
- d) Personnel involved

The procedure for this tracking is as follows:

1. A job part tag will be generated by the Production Department for each part or sub-assembly and will be posted on the job part tag board near Production office.
2. This tag will contain, at a minimum, the following information:
 - a) Work order #
 - b) Part description
 - c) Physical dimensions
 - d) Resin type
 - e) Lay-ups

- f) Inspection stops
3. This tag also will contain spaces for the following:
 - a) Resin type and lot number (see Material Tracking Procedure)
 - b) Glass type and lot number (see Material Tracking Procedure)
 4. The supervisor running the job will assign personnel to individual parts according to schedule.
 5. The employee will go to the tag board and review the tag for all pertinent information prior to setting up the mold or cutting kits.
 6. Set up and prepare the mold per the appropriate SOP. Have supervisor or Quality Control check preparation for conformance to job tag.
 7. When first lay up is complete, the employee will initiate the job tag and cross off the first lay up. They will then add to that lay up, the appropriate resin and glass lot numbers. (see Material Tracking Procedure)
 8. As each subsequent lay up is completed, the same info will be added to the tag by the employee doing the work.
 9. Prior to starting the last lay up, the employee doing the work will caliper the part, and if necessary, ask their supervisor to adjust the lay up.
 10. Before beginning each step in the process, the employee must review the job tag to check the lay up information and make sure the appropriate information is on the tag from the previous lay up. If it is not there, the process stops until corrections are made.
 11. The job tag will remain with the part until it is released and inspected.
 12. After release, the employee releasing the part will promptly affix the job tag to the part and notify Quality Control that the part is ready for inspection. No further work is to be performed on the part until it has been passed by QC.
 13. The job tag will be collected by QC, upon passing inspection, and a new preprinted job tag label will be attached to the mold surface. The job tag will then be filed in the appropriate job file in the Production Office.

14. This new job tag label will have a part number per the following example:

Job #	Part type	Part size	Number
6090	E	16"	001

E = elbow

P = pipe

F2 = 2" flange nozzle

F3 = 3" flange nozzle

F4 = 4" flange nozzle

F6 = 6" flange nozzle

Other as designated

MWT24 = 24" top manway

MWS24 = 24" side manway

HD = SS hold downs

LL = SS lifting lugs

L&C = FRP ladder & cage

HR = FRP handrails

15. If the part fails to pass inspection, then a red reject tag will be attached by QC and the appropriate supervisor will be advised. This red tag cannot be removed by anyone except QC. A non-conformance report will be filled out and filed by QC. (see Non Conformance Procedure)
16. This part label will remain on the part throughout the machining and finishing process. Once the part goes into setup, the part number from the label will be transferred to the setup drawing by the setup person. When the setup is done, the document will be returned to the production department in order to record the various part numbers for each setup. This information will be retained in the engineering file along with job tags. This will insure traceability of individual parts for future reference.
17. At this point, the set up person will mark the setup with the job and part number by affixing masking tape to the mold surface and notify supervision or QC that the setup is ready for inspection. This setup will be inspected and tagged prior to moving out of the setup area.
18. During this process all documents will be returned to the production office at the end of each shift. This will ensure that all copies of documents that may receive revisions will be in a central location at the end of each shift.