

	- SPECIFICATION - ASSEMBLY EQUIPMENT	Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 1 of 22
---	--	---

DOCUMENT CONTROL COVER SHEET


RESPONSIBLE	NAME	RESPONSIBLE
Author	Brandon Burrell	Weld Engineering Manager
Reviewer	Darrin Baldinelli	Maintenance Manager
Approver	Chad Raynes	VP of Prog. Mgmt.

ISSUE DATE	REV. #	PAGE #	REASON FOR REVISION
23 Aug 96	2	All	Specification written for production assy equip
07 July 00	3	All	Document format changed
18 Oct 00	4	2	Revised reference to QP402-02
13 Nov 00	5	17	Added LH/RH paint specifications
14 Aug 02	6	All	Updated equipment requirements
14 Jun 04	7	All	Updated equipment requirements
05 Mar 08	8	8	Updated fixtures and tooling
21 May 08	9	14	Stepper rest button criteria
19 June 08	10	6	Update to Poke-Yoke requirements
1 August 08	11	14,17,18	Specify type of equipment
13 August 08	12	10	Define acceptable Reset switches
18 Sept 08	13	6	Define containment of defective material
14 Nov 08	14	5	Define requirements for one piece flow.
18 Nov 08	15	7	Inductive sensor use.
14 April 10	16	1	Organizational Changes

1. PURPOSE

The purpose of this specification is to establish the standard by which SSP assembly equipment is to be built.

2. SCOPE

	<p style="text-align: center;">- SPECIFICATION -</p> <p style="text-align: center;">ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 2 of 22</p>
---	---	---

This specification applies to all production assembly equipment to be used to manufacture production parts. Assembly equipment shall be built to be used in manufacturing work cells and be functionally flexible in nature. Also, SSP does encourage its use of standard stock parts so to minimize special order stock.

3. DEFINITIONS

“Poke-Yoke”: Mistake Proofing

“OSHA”: Occupational Health and Safety Administration

“MSDS”: Material Safety Data Sheet

“EPA”: Environmental Protection Agency

4. PROCEDURE

4.1 QUOTATION

4.1.1 Description of process.

4.1.1.1 The quotation shall include a description of the part(s) processing. This should be detailed for review. A proposal drawing is preferred for all quotes.


4.1.2 Cost of major items being quoted.

4.1.2.1 The cost of each major piece of equipment within the quote shall be detailed individually. The following items are considered capital investment:

- Robots and their controllers
- Weld controllers and weld guns
- Transformers
- Frames and Structures
- PLCs

4.1.3 System requirements

4.1.3.1 Electrical supply: 480 V 60 Hz Single Phase (Incorporate isolated transformers, included in electrical), 3 Phase for other equipment, Spot Weld transformers.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 3 of 22</p>
---	---	---

4.1.3.2 Voltage, phase, and amperage draw demands of the equipment shall be stated.

4.1.3.3 Maximum air pressure shall be **80** psi (use of surge tanks or air amplifiers should be incorporated to meet this requirement) and shall be stated in quote.

4.1.4 Delivery date(s) should be stated within the quote.

4.1.5 A compliance statement to meet assembly equipment specifications is required with each quotation.

4.1.6 Exceptions to our standards to reduce cost, increase performance and/or increase production should be noted as separate issues.

4.1.7 A quoted cycle time for the complete process will be provided during quoted stage. Including load / unload time.

4.1.8 The number of operators to run the cell will be defined in the quotation process.

4.1.9 All equipment shall be warranted for one year starting after the equipment is deemed acceptable through buy off procedures.

4.2 DESIGN

4.2.1 Preliminary design and flow chart:

4.2.1.1 The machine builder shall submit preliminary designs, and processing at 50% and 100% for review by Spartanburg Steel Products to show critical path activities.

4.2.2 Review meeting at Spartanburg Steel Products:

4.2.2.1 When the preliminary designs and flow charts are complete, a review meeting shall be set up at Spartanburg, SC to review the designs and processing. This review meeting *shall* include your Project Engineer, Design Engineer, Weld Engineer, Production Representative, CMM, Safety Engineer, Industrial Engineer, and a Quality Engineer.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 4 of 22</p>
---	---	---

4.2.3 Completed designs - approval by Spartanburg Steel Products:

4.2.3.1 The completed mechanical and control system design shall be approved by SSP before the work can be performed.

4.2.4 Drawing requirements:

4.2.4.1 Original drawings shall be submitted in electronic format. All original drawings required for equipment design, installation, operation, and maintenance of the equipment shall be in AutoCAD or DXF format and will become property of SSP. Drawings shall be delivered to the responsible SSP Project Engineer at the time of equipment delivery.

4.2.4.2 Machine layouts shall include all equipment necessary to the operation of the machine. Include panel locations and drops for power, water, air, and gas lines.


4.2.4.3 There shall be a detailed drawing of each locating pin used and its location in the assembly process along with weld guns and tooling blocks.

4.2.4.4 Separate drawings shall be required for mechanical, electrical, control prints, hydraulic, pneumatic, lubrication and cooling systems as required.

4.2.4.5 Final drawings shall include conditions of approval, all changes and corrections made at time of purchaser acceptance. It shall be the manufacturers responsibility to turn in any changes due to warranty work to the SSP Engineering Department.

4.2.4.6 Three sets of all control system drawings shall be delivered with equipment in the electrical panel. Three program printouts shall also be shipped in the electrical panel. Three sets of backup disks shall be supplied to SSP at time of shipment. Three copies of the ladder logic programming, robot and weld controller files shall also be supplied on both paper and disk.

4.2.4.7 Documentation shall be provided on operator instructions.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 5 of 22</p>
---	---	---

4.2.5 Manuals

4.2.5.1 Three sets of component manuals and one CD ROM shall be supplied to the Project Manager. These manuals and CD shall include product information on all components, PM schedules and other machine specific information.

4.2.6 All software necessary for programming and maintenance adjustments shall be included in quote. PLC and programmable control software version compatibility shall be checked at the time of quote.

4.2.7 One Piece flow of Material

4.2.7.1 Machine design must force one piece of product.

4.2.7.2 The product flow must be designed to separate the WIP and finish good containers as much as possible. (Example: With bulk pack product the finish goods could exit the equipment on the opposite side from the operator.) (Example: With hand stack parts the finish goods should not return to the operator loading the WIP.)

4.3 MACHINE CONSTRUCTION

4.3.1 General Equipment

4.3.1.1 All wear surfaces, nets, consumable parts shall be listed in the BOM and detailed. If these are purchased parts, the supplier's name, part number, and phone number shall be included.

4.3.1.2 Spare parts (unique castings or special adapters) and each weld station shall be quoted separately. The design buy-off shall not be approved without spare parts listing.

4.3.1.3 Standard components shall not be altered. If alterations are required due to design criteria and principles, a separate drawing is required of the component and must be approved by SSP.

4.3.1.4 A list of recommended spare parts shall be supplied after the Final Design Review, and 30 days before equipment arrivals at SSP.

4.3.1.5 Lubrication points shall be located in an accessible place (labeled and standard fittings) for maintenance and grouped together in


	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 6 of 22</p>
---	---	---

one location as deemed possible.

- 4.3.1.6 No control or device shall be adjusted to its maximum or minimum setting. An adequate amount of adjustment shall be made available to allow for future alteration.
- 4.3.1.7 All control panels and robot controller locations shall be approved by SSP.
- 4.3.1.8 The use of a mezzanine shall be discussed for locating control panels and nut feeders.
- 4.3.1.9 Purchased components, when possible, should be from SSP supplied stock parts list. Any deviation from the SSP stock part list needs approval from SSP.

4.3.2 Poke-yoke

- 4.3.2.1 All loose components shall be sensed during the assembly process. Process must shutdown if a component is not present. If a component cannot be sensed, the vendor shall request written allowance from SSP for the deviation.
- 4.3.2.2 Parts shall only be allowed to be loaded in the required position for quality adherence.
- 4.3.2.3 Parts shall be loaded only in the correct sequence (automation).
- 4.3.2.4 If a sensor is used to detect part present, it should detect a stud, bolt or nut for part present, if possible.
- 4.3.2.5 Parts shall be nested and netted to create an acceptable quality product.
- 4.3.2.6 Clamping sequence shall keep the part free of distortion or shifting.
- 4.3.2.7 Clamps shall be closed and activated before the automation sequence can begin.
- 4.3.2.8 If a part ejection system is used, it shall not distort the part.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 7 of 22</p>
---	---	---

4.3.2.9 The machine shall shut down if welds are not correct (through weld controller).

4.3.2.10 All sensors shall be protected from loading/unloading, machine movement and spatter. (Anti-repeat on sensors, guards etc.)

4.3.2.11 A detection system must be used to insure we do not create a defective part. Examples: upside down nut, off location, missing or incorrect fastener.

4.3.2.12 **360 degree inductive sensors shall not be used for nut detection. They do not detect all the defects listed above. Example (Syron sensors)**

4.3.2.13 When defect is detected the automation must disposition the part into a designated containment area.

4.3.3 Fixtures and Tooling

4.3.3.1 Replacement fixture should have same scheme for nets, locators, and clamping as the fixtures that are being replaced. Any deviation from current design shall be approved by either SSP's Project Manager or the Quality Engineer.


4.3.3.2 All locating pins shall be of harden tool steel, contact area minimized to panel, and insulated in accordance to RWMA specifications.

4.3.3.3 All fixtures shall have hardened steel rough locating guides for locating the panels and insulated in accordance to RWMA specifications.


4.3.3.4 All fixtures or holding of the part for assembly purposes shall be separate from the welding surfaces. Parts shall not be located on weld surfaces. All gauging shall be independent of weld backups.

4.3.3.5 Fixtures shall be designed for ease of maintenance and clean up.

4.3.3.6 Tooling shall be easy to access for replacement and clean up.

	<p style="text-align: center;">- SPECIFICATION -</p> <p style="text-align: center;">ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 8 of 22</p>
---	---	---

- 4.3.3.7 Kicker / ejector system should have urethane bristle lining on lifters at part contact.
 - 4.3.3.8 Right and left hand fixtures shall be identified by RH or LH label / stamp and by section 4.3.19.1. of this Assembly Equipment Specification.
 - 4.3.3.9 Springs shall not be used on locating pins (exception electrodes with air blow-off) or any other tooling.
 - 4.3.3.10 Locators on cylinders shall be approved by SSP.
 - 4.3.3.11 Lower electrode blocks for multi-spot welding equipment shall first be approved by SSP before construction is started.
 - 4.3.3.12 Locators, pins and surfaces shall be sturdy and not able to move.
 - 4.3.3.13 All master control surfaces and locators identified by the customer shall be used. No other controls are acceptable.
 - 4.3.3.14 For poke-yoke purposes, components *should* be loaded first into the fixture and then the panel.
 - 4.3.3.15 Tooling, rough locators and locating pins shall be doweled and shall be shimable in X, Y, and Z coordinates.
 - 4.3.3.16 All pin blocks, net blocks, clamps nets, and other locators must have 5mm shim packs pre-installed, before buyoff at suppliers facilities.
 - 4.3.3.17 Regrip stations shall be used when automation is used to unload from WIP racks.
- 4.3.4 CMM Data
- 4.3.4.1 Supplier shall have the responsibility to supply SSP with a certification of fixture datums and nets.
 - 4.3.4.2 Fixture datum's shall be based on CAD coordinates or prints.
 - 4.3.4.3 SSP will supply tolerances for assembly fixtures based on

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 9 of 22</p>
---	---	---

customers tolerances.

4.3.4.4 SSPs Quality Engineer and/or CMM Lab Manager shall review CMM data for disposition.

4.3.4.5 Each fixture shall have a dimensional reference points stamped into the fixture in reference to CAD position.

4.3.4.6 SSP may request a capability analysis from the tool builder. If a capability analysis is required, it should be stated in the RFQ.

4.3.4.7 Final tooling buyoff will be at SSP.

4.3.5 Electrical

4.3.5.1 Conduit and cable entries shall not penetrate the top of terminal boxes. They shall enter from the side or bottom of each box. Tops shall be left accessible for power service.

4.3.5.2 All wiring shall be to current National Electrical Code specifications.

4.3.5.3 All electrical enclosures shall be a minimum NEMA 4 rating.


4.3.5.4 All wiring shall be oil and water-resistant.

4.3.5.5 All conductors shall run in conduit

- Where exposed to physical damage, the conduit shall be rigid galvanized steel.
- Where protected from physical damage, conduit may be liquid tight flexible metal conduit.
- Liquid tight flexible metal conduit shall be used only with listed terminal fittings.
- All conduit shall be fastened and support to meet NEC requirements for the applicable raceway.


4.3.5.6 All panels with programmable controllers shall have a NEMA 15R convenience outlet located at SSP discretion.

4.3.5.7 A minimum of 30% unused panel space and terminal strip shall

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 10 of 22</p>
---	---	--

be maintained for future expansion, in addition to NEC requirements.

- 4.3.5.8 All breakers shall be Square D brand; sized per NEC requirements.
 - 4.3.5.9 Control voltage shall be derived from isolating transformer collocated with the panel.
 - 4.3.5.10 All relays shall be Allen Bradley brand Ice Cube type and shall have indicator lights.
 - 4.3.5.11 Spare wires scheme shall be approved by SSP at the Preliminary Design Review.
 - 4.3.5.12 Reset switch shall be either a knob type or a push button, no keys.
 - 4.3.5.13 Faults which occur due to poke yoke system or part quality may only be reset by a key switch.
 - 4.3.5.14 General machine faults which are not related to any poke yoke system or part quality may be reset by push button or knob.
- 4.3.6 Pneumatic
- 4.3.6.1 All welders shall have a lockable dump valve (Lox) on the airline.
 - 4.3.6.2 Airlines shall be steel tubing (Black Pipe); sized according.
 - 4.3.6.3 Airline hoses to weld guns and valves shall be gray 3/8" diameter synflex #3600-06-003.
 - 4.3.6.4 All valves shall be MAC (Parker) sized accordingly or ISO standard valves.
 - 4.3.6.5 All pressure controls shall be Allen Bradley #836T-T253J or Allen Bradley equivalent.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 11 of 22</p>
---	---	--

4.3.6.6 All pneumatic systems shall be designed for 80 psi (the use of air amplifiers or surge tanks shall be incorporated to meet this requirement).

4.3.6.7 Flow controls shall be required for clamping and index cylinders.

4.3.6.8 All pneumatic systems shall be built complete with filter, regulator and lubricator and must be modular in design and installed in that order.

- Filter-Schrader bellows #04539-3000
- Regulator-Schrader bellows #04569-2000
- Lubricator-Schrader bellows #14579-3000

4.3.6.9 All cylinders which control welding gun(s) shall require an in-line regulator independent of system regulator on MAC valve.

4.3.6.10 An air outlet for remote air powered devices shall be supplied at the front of the machine, installed before the regulator.

4.3.6.11 Air manifolds *shall* be used if applicable.

4.3.6.12 All surge tanks shall use check valves on the inlet side of the tank.

4.3.6.13 Hose clamps shall be installed on all air lines.

4.3.6.14 Air amplifier used shall be Haskel.

4.3.6.15 Air tanks shall be installed with auto drain for water.

4.3.7 Hydraulics

4.3.7.1 Oil reservoirs shall be OHMA.

4.3.7.2 Hydraulic lines shall be seamless steel tubing; size accordingly.

4.3.7.3 All hydraulic lines shall be of Parker hosing sized accordingly.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 12 of 22</p>
---	---	--

4.3.7.4 All hydraulic lines shall have 1/4 turn cut-offs positioned between OHMA reservoir and out-going lines to guns.

4.3.8 Cooling system

4.3.8.1 Water flow shall be designed for 2 GPM's.

4.3.8.2 Each weld tip, transformer, tooling block and weld controller shall have a separate line to the manifold.

4.3.8.3 Water supply/return lines shall be equipped with a thermometer.

4.3.8.4 Water supply to manifolds shall be sized according to the thermodynamic properties of the of the water manifold.

4.3.8.5 Dancing ball visual flow meters should be installed on each return line on manifold.

4.3.8.6 Cooling hoses are not to be hooked up in-series.

4.3.8.7 All machines shall be equipped with water flow switches (Turck) on main return line.


4.3.8.8 All machines shall be equipped with a shut-off valve on main water in and out, and on each separate line from manifold.

4.3.8.9 Cooling lines shall be piped as followed:

- Water In: Blue hose #3600-06-053 (Parker)
- Water Out: Red hose #3600-06-013 (Parker)

4.3.8.10 Water fittings shall be 37 degrees Jic, 3/8" tube X 1/4" NPT (brass) and hose barb 37 degrees Jic, 3/8" tube with swivel end. Parker #30682-6-6-B and/or equivalent.

4.3.8.11 Water manifolds shall be aluminum. No Galvanized Black Pipe. All manifolds shall have at least 20% extra 1/4" NPT ports plugged for future use.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 13 of 22</p>
---	---	--

4.3.8.12 Water hoses to weld guns, transformers, SCR's and copper blocks shall be 3/8" diameter Parker hose.

4.3.8.13 All water return lines shall be one size larger than the supply.

4.3.8.14 Main water supply shall be equipped with circuit setter and strainer.

4.3.9 Automation

4.3.9.1 All equipment shall have Allen Bradley Rockwell processor, exceptions are welders that can be controlled with I/O of weld controller and needs to have SSP approval.

4.3.9.2 Discreet inputs and outputs cards shall be minimal 16 pin.

4.3.9.3 Sinking shall be the input, and sourcing shall be the output. A relay maybe acceptable if approved by SSP.

4.3.9.4 Discreet inputs and outputs shall be 24 VDC max, unless approved by SSP.

4.3.9.5 All wiring to the PLC shall be shrink labeled to the I/O address and easy to read.

4.3.9.6 Wires *shall* only be entering from the sides or bottom of the panel.


4.3.9.7 All sensors shall be plug -in type or fiber optics, hard wiring of sensors are not allowed.

4.3.9.8 Water flow switch shall also be Turck (Part # FCS-N1/2 A4PAP8X-H1141 or FCS-N1/2A4-AP8X-H1141) and placed on the main return line.

4.3.9.9 All cylinders for indexing and clamping shall be equipped with 24VDC PNP cylindicators.


4.3.9.10 All control panels shall be equipped with a 120 V outlet and communication port for the PLC on the side of the panel.

4.3.9.11 All indicator lights, push buttons and selector switches shall be

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 14 of 22</p>
---	---	--

Allen Bradley.

- 4.3.9.12 Palm button location shall be approved by SSP.
- 4.3.9.13 Palm buttons shall be (Pinnacle "Ultra Touch" # UL-101-2P).
- 4.3.9.14 One palm button and E-stop shall be required for stations incorporating a light curtain.
- 4.3.9.15 Palm buttons shall Ideal hand height is 36" to 42" from the floor.
- 4.3.9.16 All palm buttons shall **have** an anti-tie down circuit.
- 4.3.9.17 All panel views shall show power on/off, manual/auto, part present, slide position, machine in cycle, weld complete, each individual sensor, E-stop, faults, cycle times, parts counter, sequence of operations and a down-time counter, to run only one side of a table, if an indexing table is present, add / remove welds, amount of tip dresses, welds to tip maintenance, amount of welds between tip dresses, password protected for editing, and the I/O listing.
- 4.3.9.18 A minimum of 30% panel space and I/O slots shall be left unused.
- 4.3.9.19 Red/yellow/green beacon lights (Allen Bradley) shall be supplied for machine state recognition.
- 4.3.9.20 All locations for sensors shall be approved by SSP engineering.
- 4.3.9.21 All sensors for poke-yoke shall be approved by SSP.
- 4.3.9.22 All sensors shall have its individual input and have anti-repeat programming.
- 4.3.9.23 All palm buttons shall have an anti-tie down circuit.
- 4.3.9.24 The machine shall have the capability of performing its complete operation cycle in the manual mode along with welding.
- 4.3.9.25 The use of switches or push-buttons for controllers will be discussed by SSP.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 15 of 22</p>
---	---	--

4.3.9.26 The automation for all nut welders will be discussed with SSP. These welders shall incorporate either sensors to detect if nut is present or linear transducers.

4.3.9.27 A data highway shall be incorporated, if multiple processors are in use.

4.3.9.28 Stepper reset button shall not be wired to a manual switch/ button.

4.3.10 Weld Schedules

4.3.10.1 The weld schedules shall be verified using a weld current meter.

4.3.10.2 Each weld schedule shall be documented to the appropriate weld nomenclature and have: SCR number, tip force, weld heat, weld name and schedule number.

4.3.11 Weld controllers

4.3.11.1 Medar shall be the specified vendor for resistance weld controllers.

4.3.11.2 Medar 4000S shall be used on all robotics or pedestal type welders.


4.3.11.3 All options shall be set up prior to the vendor run off.

4.3.12 Transformers

4.3.12.1 Transformers for transguns and multi-spot stations shall be sized accordingly to the thickness of the welding operation and the KVA demand needed to produce a high quality weld. All welding transformers shall be sized at a KVA demand 1/3 of the KVA of the transformer.

4.3.12.2 Transformers shall be mounted in a position that will allow water and grease to run off.

4.3.12.3 The location of transformers will be discussed during the design stage with SSP.

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 16 of 22</p>
---	---	--

- 4.3.12.4 Transformers shall be in a location with ease of maintenance taking high priority.
- 4.3.12.5 The lower electrode *should* be the negative terminal connection. (also see 4.15.8)
- 4.3.12.6 If feasible, the positive electrode shall always be in contact with the thinnest workpiece.
- 4.3.12.7 All mounting bolts on transformers shall be stainless steel.
- 4.3.12.8 Isolation transformers shall be used to supply 120 control voltage.
- 4.3.12.9 All fixture type and transguns shall have incorporated ground reactors.

4.3.13 Shunts

- 4.3.13.1 Shunts *should* be sized to adequately supply weld current to the work without affecting weld quality or inconsistency.
- 4.3.13.2 Bend radii on water cooled shunts shall be limited to engineering specifications.
- 4.3.13.3 Shunts *should* also be connected in position where the ease of maintenance specification is taken into consideration.
- 4.3.13.4 Secondary areas shall be minimized and shunts tied together.
- 4.3.13.5 All shunts shall be protected from wear conditions such as the rubbing of two shunts together.

4.3.14 SCR's and Disconnects

- 4.3.14.1 All SCR's shall be sized accordingly water cooled 50% duty cycle from National Electronic.
- 4.3.14.2 All disconnects shall be sized accordingly (200 or 400 amp) Square D.

4.3.15 Resistant Weld Guns

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 17 of 22</p>
---	---	--

- Weld Tip pressure for RW 4caps shall be 400 lbs +/- 10 lbs
- Weld tip pressure for RW 5 caps shall be 600 lbs +/- 10 lbs
- Weld tip pressure for RW 6 caps shall be 900 lbs +/- 10lbs
- Welds shall meet SSP requirements
- Multiple weld pressure shall be available
- Water Flow switches shall be used on weld guns

4.3.15.1 All weld guns shall be labeled, and identification tag visually accessible.

4.3.15.2 Two guns cannot fire at the same time off of the same SCR.

4.3.15.3 All electrodes shall be discussed.

4.3.15.4 Guns shall be mounted such that adjustments are accessible and can be maintained.

4.3.15.5 Detailed drawings of guns shall be given to SSP and spare parts listing.

4.3.15.6 Transguns shall be Voltza (Centerline), or TG Systems guns.

4.3.15.7 All guns shall be on separate regulators.


4.3.16 Ped Welders

4.3.16.1 E-stops shall be incorporated and accessible to the operator.

4.3.16.2 All pneumatic systems shall be built complete with filter, regulator and lubricator and must be modular in design and installed in that order.

- Filter- Schrader bellows #04539-3000
- Regulator-Schrader bellows #04569-2000
- Lubricator-Schrader bellows #14579-3000

4.3.16.3 Electrode style and manufacture will be discussed with SSP Weld

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 18 of 22</p>
---	---	--

Engineering.

4.3.16.4 Palm buttons shall Ideal hand height is 36" to 42" from the floor.

4.3.16.5 All palm buttons shall **have** an anti-tie down circuit.

4.3.17 Gas Metal Arc Welding

- SSP Weld Engineering shall decide on make of welding torch
- Wire size shall be .035, unless Weld Engineer specifies different wire size.
- Wire type shall be ER70S-6
- Gas shall be 90 % Argon / 10 % CO2
- Gas flow shall be 30 to 35 CFH


4.3.18 Tip Dressers

- Tip dress pressure shall be a minimal of 300 lbs.
- Tip dresser shall dress face of electrodes for a minimal of 20 dresses, for a total of 8,000 welds minimal.
- Tip dress brand shall be discussed with SSP Weld Engineering

4.3.19 Cylinders

- 4.3.19.1 If OHMA cylinders are to be used, the oil side of cylinder shall use a hydraulic hose with swivel ends #H 10406 with 060-606 each end X 42" (weatherhead or equivalent).
- 4.3.19.2 Cylinders for clamping, indexing and ejectors shall be Parker, ISI, or Tunker (for robot grippers).
- 4.3.19.3 All cylinders shall be equipped with flow controls.

4.3.20 Nut feeders

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 19 of 22</p>
---	---	--

4.3.20.1 All nut feeders shall be Dengensha.

4.3.20.2 All weld consumables for nut welders shall be equipped with Centerline or Tuffaloy products for piloted nuts.

4.3.21 Portable weld stations

4.3.21.1 All portable hanging guns will be discussed during the design stage.

4.3.21.2 If adequate, all the guns shall be transguns.

4.3.21.3 All laminated shunts for guns shall be detailed with size, specifications and dimensions.

4.3.21.4 See other sections for accessory specifications.

4.3.22 Safety

4.3.22.1 Servodrives shall be approved by SSP.

4.3.22.2 Remove all pinch points from the operators station to the back of the cell.

4.3.22.3 Measured noise level shall be below 92dcb

4.3.22.4 No trip hazards across operators station

4.3.22.5 All energy sources shall able to be locked out.

4.3.22.6 All operator stations require palm buttons; either two handed button or one hand button with a light curtain.


4.3.22.7 All robots shall comply with ANSI standard ANSI / RIA 15.06 – or latest revision.

4.3.22.8 All welding equipment should have provisions to prevent operators and other personnel from being hit by weld sparks.

4.3.22.9 No lifting weight above 51 lbs

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 20 of 22</p>
---	---	--

- 4.3.22.10 Ideal hand height is 36" to 42" from the floor.
 - 4.3.22.11 All equipment shall meet applicable safety standards for OSHA and ANSI compliance.
 - 4.3.22.12 Light curtains shall be STI; size shall be according to welder design.
 - 4.3.22.13 All safety gates shall be equipped with safety interlocks.
 - 4.3.22.14 Escaping air shall be vented away from the operator. When using air exhaust devices, they shall be located to blow away from the operator and shall be equipped with mufflers to minimize noise. Exhaust *may* be vented into machine frame.
 - 4.3.22.15 Hydraulic and pneumatic devices shall be located away from the operator's side of the machine. These items shall be positioned in the frame of the machine or behind something that would possibly shield a rupture.
- 4.3.23 Welder Identification Specifications
- 4.3.23.1 Non-handed assembly equipment shall be painted Imperial Blue, Devoe Paint #58108. Specific fixtures for right and left hand assemblies shall be painted as follows, Left Hand – Safety Yellow, Devoe Paint #DP58158, Right Hand – Safety Green, Devoe Paint #DP58155. Presses shall be painted Pale Blue, Devoe Paint base #7053 and tint #DY16C-3YWY16. Moving parts shall be painted Safety Orange, Devoe Paint base #7055 and tint #K12YI16AY Outside of safety screens shall be painted Medium Yellow, Devoe Paint base #7061 and tint #AX4Y-K20. Inside of safety screens shall be painted Flat Black.
 - 4.3.23.2 Vendor name and address signs *should* not exceed 11" X 17".
- 4.3.24 Ergonomics Specifications - These specifications listed are for the operators comfort. These specifications must be followed as closely as possible to assure an ergonomically sound work area.
- Eye height to be an average of 63".

	<p style="text-align: center;">- SPECIFICATION -</p> <p style="text-align: center;">ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 21 of 22</p>
---	---	--

- Work surface height to be around 32” to 40”.
- There should be no overhead reaching.
- There should be a fan mounted above the palm buttons and in front of the operator, to cool the operator.

4.4 TRYOUT SPECIFICATIONS

4.4.1 Sample Submission:

- 4.4.1.1 Progress reports shall be supplied to Spartanburg Steel Products every three weeks during the construction of the machinery.

4.4.2 Final Tryout:

- 4.4.2.1 Before final tryout, a total of one weld coupon per weld gun with three welds on it shall be peel tested and the results shown to a SSP Quality Representative. Also, panels shall be torn down completely and the nugget size measured before tryout can begin. The weld nugget diameters shall meet SSP's customer requirements. Lastly, at the end of the 300 piece run, a final panel shall be torn down and the weld nugget diameters recorded. The data shall be recorded by SSP Quality Representatives.
- 4.4.2.2 There shall be two final tryout runs conducted on the assembly equipment before it is bought off. The first buyoff shall be conducted at the site of the vendor. It shall include a 30 piece run off. During this run off, the parts being fabricated by the equipment shall be measured to make sure that it is dimensionally capable of running the parts using accepted statistical methodology. The weld quality will also be discussed during this 30 piece run. The specifications for this shall be laid out by Spartanburg Steel's Quality Department. The equipment shall be subjected to a “poke-yoke” audit and shall have 100% compliance. A review of the documentation shall be made during the initial buy off.
- 4.4.2.3 The final buy off shall be conducted at Spartanburg Steel. It shall consist of a 300 piece run off without fault or failure. After the run

	<p>- SPECIFICATION -</p> <p>ASSEMBLY EQUIPMENT</p>	<p>Doc. No.: S02.018 Issued: 14 April 2010 Revision: 16 Page 22 of 22</p>
---	---	--

off, it shall be declared if the machine is capable of what you, the vendor, has designed and built to therefore specifications. SSP shall not accept shipment of equipment without aforementioned documentation.

- 4.4.2.4 Lastly, the quoted machine cycle time shall be confirmed at the final tryout.