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|  | <p>SPARTANBURG STEEL PRODUCTS Department Procedure</p> <p>PED ASSEMBLY EQUIPMENT SPECIFICATION</p> | <p>Doc. No.: S02.026PEDASMSPEC Issue Date: 13- August- 2008 Revision: 1 Page 2 of 18</p> |
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1. PURPOSE

The purpose of this specification is to establish the standard by which SSP Ped Assembly Equipment is to be built.

2. SCOPE

This specification applies to all production Ped Assembly Equipment to be used to manufacture production parts. Ped Assembly Equipment shall be built to be used in manufacturing work cells and be functionally flexible in nature.

3. RELATED PROCEDURES AND OTHER DOCUMENTS

| <u>Document No.</u> | <u>Description of Document</u> |
|---------------------|--------------------------------|
| QP402-04 | Production Assembly Buyoff |

4. DEFINITIONS

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| “Pok-Yoke”: | Mistake Proofing |
| “OSHA” | Occupational Health and Safety Administration |
| “MSDS” | Material Safety Data Sheet |
| “EPA” | Environmental Protection Agency |

5. PROCEDURE

5.1 QUOTATION

5.1.1 Description of process

5.1.1.1 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.

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5.1.2 Cost of major items being quoted.

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

5.1.2.1.1 Fixture and Poke – Yokes

5.1.2.1.2 Weld controllers and weld tooling

5.1.2.1.3 Transformers

5.1.2.1.4 Frames and Structures

5.1.2.1.5 PLCs

5.1.3 System requirements

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

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

5.1.3.3 Maximum air pressure shall be 60 psi (use of surge tanks or air amplifiers should be incorporated to meet this requirement) and shall be stated in quote.

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

5.1.5 A compliance statement to meet ped assembly fixture specifications is required with each quotation.

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

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

5.1.8 All equipment shall be warranted for one year starting after the first production run.

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5.2 DESIGN

5.2.1 Preliminary design and flow chart:

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

5.2.2 Review meeting at Spartanburg Steel Products:

5.2.2.1 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 *should* include supplier Project Engineer, Design Engineer, Weld Engineer, Production Representative, CMM Safety Engineer, Industrial Engineer, and/or a Quality Engineer.

5.2.3 Completed designs – approval by Spartanburg Steel Products:

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

5.2.4 Drawing requirements:

5.2.4.1 Original drawing shall be submitted in electronic format. All original drawing 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.

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

5.2.4.3 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.

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

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5.2.4.5 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.

5.2.4.6 Three sets of 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.

5.2.4.7 Documentation shall be provided on operator instructions.

5.2.5 Manuals

5.2.5.1 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.

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

5.3 MACHINE CONSTRUCTION

5.3.1 General Equipment

5.3.1.1 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.

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

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

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

5.3.1.5 Lubrication points shall be located in an accessible place (labeled and standard fittings) for maintenance and grouped together in one location as deemed possible.

5.3.1.6 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.

5.3.1.7 All control panels and fastener feeder locations shall be approved by SSP.

5.3.1.8 Purchased components, when possible, should be from SSP supplied stock parts list. Any deviation from the SSP stock part list needs approval from SSP.

5.3.2 Fixture Poke-yokes

5.3.2.1 Parts shall be loaded only one way, in the correct position.

5.3.2.2 Parts shall be loaded only in the correct sequence.

5.3.2.3 Parts shall be nested and netted solidly.

5.3.2.4 Clamping sequence shall keep the part free of distortion or shifting.

5.3.2.5 Clamps shall be closed and activated before the Ped welding sequence can begin.

5.3.2.6 If a part ejection system is used, it shall not distort the part.

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

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

5.3.2.9 Beacon light should be added to machine to identify when machine is OK to run (green light), Welding (yellow light), and faulted (red light).

5.3.3 Fixtures and Tooling

5.3.3.1 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 SSPs project Manager or the Quality Engineer.

5.3.3.2 All locating pins shall be of harden tool steel (58Rc-62Rc), contact area minimized to panel, and insulated in accordance to RWMA specifications.

5.3.3.3 All fixtures shall have aluminum rough locating guides for locating the panels and insulated in accordance to RWMA specifications.

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

5.3.3.5 Tooling shall be easy to access for replacement.

5.3.3.6 Kicker / ejector system should have urethane bristle lining on lifters at part contact.

5.3.3.7 Right and left hand fixtures shall be identified by RH or LH label and by a part number stamp.

5.3.3.8 Springs shall not be used on locating pins or any other tooling. Electrodes with air blow-off are acceptable.

5.3.3.9 Locators on cylinders shall be approved by SSP.

5.3.3.10 Lower electrode blocks for multi-spot or projection welding fixtures shall first be approved by SSP before construction is started.

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5.3.3.11 Locators, pins and surfaces shall be sturdy and not able to move.

5.3.3.12 All master control surfaces and locators identified by the customer shall be used. No other controls are acceptable.

5.3.4 Electrical

5.3.4.1 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.

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

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

5.3.4.4 All wiring shall be oil and water-resistant.

5.3.4.5 All conductors shall run in conduit

5.3.4.5.1 Where exposed to physical damage, the conduit shall be rigid galvanized steel.

5.3.4.5.2 Where protected from physical damage, conduit may be liquid tight flexible metal conduit.

5.3.4.5.3 Liquid tight flexible metal conduit shall be used only with listed terminal fittings.

5.3.4.5.4 All conduit shall be fastened and support to meet NEC requirements for the applicable raceway.

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

5.3.4.7 A minimum of 30% unused panel space and terminal strip shall be maintained for future expansion, in addition to NEC requirements.

5.3.4.8 All breakers shall be Square D brand; sized per NEC requirements.

5.3.4.9 Control voltage shall be derived from isolating transformer co-located with the panel.

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5.3.4.10 All relays shall be Allen Bradley brand Ice Cube type and shall have indicator lights.

5.3.4.11 Spare wires scheme shall be approved by SSP and the Preliminary Design Review.

5.3.4.12 Faults which occur due to poke-yoke system or part quality may only be reset by a key switch.

5.3.4.13 General machine faults which are not related to any poke yoke system or part quality may be reset by push button or knob.

5.3.5 Pneumatic

5.3.5.1 All ped welders shall have a lockable dump valve (Lox) on the airline.

5.3.5.2 Airlines shall be steel tubing (Black Pipe); sized according.

5.3.5.3 Airline hoses to weld guns and valves shall be gray 3/8" diameter synflex #3600-06-003.

5.3.5.4 All valves shall be MAC (Parker) sized accordingly or ISO standard valves.

5.3.5.5 All pressure controls shall be Allen Bradley #836T-T253J or Allen Bradley equivalent.

5.3.5.6 All pneumatic systems shall be designed for 60 psi (the use of air amplifiers or surge tanks shall be incorporated to meet this requirement).

5.3.5.7 Flow controls shall be required for clamping.

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

5.3.5.8.1 Filter-Schrader bellows #04539-3000

5.3.5.8.2 Regulator-Schrader bellows #04569-2000

5.3.5.8.3 Lubricator-Schrader bellows #14579-3000

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5.3.5.9 All cylinders which control welding tooling shall require an in-line regulator independent of system regulator on MAC valve.

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

5.3.5.11 Air manifolds shall be used if applicable.

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

5.3.5.13 Hose clamps shall be installed on all air lines.

5.3.5.14 Air amplifier used shall be Haskel.

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

5.3.6 Hydraulics

5.3.6.1 Oil reservoirs shall be OHMA.

5.3.6.2 Hydraulic lines shall be seamless tubing; size accordingly.

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

5.3.6.4 All hydraulic lines shall have ¼ turn cut-offs positioned between OHMA reservoir and out-going lines to guns.

5.3.7 Cooling System

5.3.7.1 Water flow shall be designed for 2 GPM's

5.3.7.2 Each weld tip, transformer, tooling block and weld controller shall have a separate line to the manifold. Deviations will be considered depending upon the duty cycle of the tool.

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

5.3.7.4 Water supply to manifolds shall be sized according to the

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thermodynamic properties of the water manifold.

- 5.3.7.5 Dancing ball visual flow meters should be installed on each return line on manifold.
 - 5.3.7.6 Cooling hoses are not to be hooked up in-series.
 - 5.3.7.7 Water flow switch shall also be Turck (Part # FCS-N1/2 A4P-AP8X-H1141 or FCS-N1/2A4-N1/2A4-AP8X-H1141) and placed on the main return line.
 - 5.3.7.8 All machines shall be equipped with a shut-off valve on main water in and out, and on each separate line from manifold.
 - 5.3.7.9 Cooling lines shall be piped as followed;
 - 5.3.7.9.1 Water In: Blue hose #3600-06-053 (Parker)
 - 5.3.7.9.2 Water Out: Red hose #3600-06-013 (Parker)
 - 5.3.7.10 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 #30682-6-6B and /or equivalent.
 - 5.3.7.11 Water manifolds shall be Stainless Steel. No Galvanized Black Pipe. All manifolds shall have at least 20% extra 1/4" NPT ports plugged for future use.
 - 5.3.7.12 Water hoses to weld guns, transformers, SCR's and copper blocks shall be 3/8" diameter Parker hose.
 - 5.3.7.13 All water return lines shall be one size larger than the supply.
 - 5.3.7.14 Main water supply shall be equipped with circuit setter and strainer.
- 5.3.8 Automation
- 5.3.8.1 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.

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- 5.3.8.2 Discreet input and output cards shall be minimal 16 pin.
- 5.3.8.3 Sinking shall be the input, and sourcing shall be the output. A relay maybe acceptable if approved by SSP.
- 5.3.8.4 Discreet inputs and outputs shall be 24 VDC max, unless approved by SSP.
- 5.3.8.5 All wiring to the PLC shall be shrink labeled to the I/O address and easy to read.
- 5.3.8.6 Wires shall only be entering from the sides or bottom of the panel.
- 5.3.8.7 All sensors shall be plug-in type or fiber optics, hard wiring of sensors are not allowed.
- 5.3.8.8 Water flow switch shall also be Turck (Part #FCS-N1/2 A4P-AP8X-H1141 or FCS-N1/2A4-AP8X-H1141) and placed on the main return line.
- 5.3.8.9 All cylinders for indexing and clamping shall be equipped with 24VDC PNP indicators.
- 5.3.8.10 All control panels shall be equipped with a 120 V outlet and communication port for the PLC on the side of the panel.
- 5.3.8.11 All indicator lights, push buttons and selector switches shall be Allen Bradley.
- 5.3.8.12 Palm button location shall be approved by SSP.
- 5.3.8.13 Palm buttons shall be (Pinnacle "Ultra Touch" # UL-101-2P).
- 5.3.8.14 One palm button and E-stop shall be required for stations incorporating a light curtain.
- 5.3.8.15 All palm buttons shall have an anti-tie down circuit.

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5.3.8.16 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.

5.3.8.17 Red/yellow/green beacon lights (Allen Bradley) shall be supplied for machine state recognition.

5.3.8.18 All locations for sensors shall be approved by SSP engineering.

5.3.8.19 All sensors for poke-yoke shall be approved by SSP.

5.3.8.20 All sensors shall have its individual input and have anti-repeat programming.

5.3.8.21 The machine shall have the capability of performing its complete operation cycle in the manual mode along with welding.

5.3.8.22 The use of switches or push-buttons for controllers will be discussed by SSP.

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

5.3.9 Weld Schedules

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

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

5.3.10 Weld controllers

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5.3.10.1 WTC shall be the specified vendor for resistance weld controllers.

5.3.10.2 WTC 3400 shall be used on all press or multi station welder.

5.3.10.3 WTC 3415 shall be used on pedestal type welders.

5.3.11 Transformers

5.3.11.1 Transformers for Ped welders and multi-spot stations shall be sized accordingly to the fastener size and thickness of the base material 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.

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

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

5.3.11.4 Transformers shall be in a location with ease of maintenance taking high priority.

5.3.11.5 The lower electrode *should* be the negative terminal connection. (also see 6.15.8)

5.3.11.6 All mounting bolts on transformers shall be stainless steel.

5.3.11.7 Isolation transformers shall be used to supply 120 control voltage.

5.3.12 Shunts

5.3.12.1 Shunts *should* be sized to adequately supply weld current to the work without affecting weld quality or inconsistency.

5.3.12.2 Shunts *should* also be connected in position where the ease of maintenance specification is taken into consideration.

5.3.12.3 Secondary areas shall be minimized and shunts tied together.

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5.3.12.4 All shunts shall be protected from wear conditions such as the rubbing of two shunts together.

5.3.13 SCR's and Disconnects

5.3.13.1 All SCR's shall be sized accordingly water cooled 50% duty cycle from National Electronic.

5.3.13.2 All disconnects shall be sized accordingly (200 or 400 amp) Square D.

5.3.14 Resistant Weld Guns

- Weld tip pressure shall be discussed during design stages
- Welds shall meet SSP requirements

5.3.14.1 All weld guns shall be labeled and identification tag visually accessible for multi-gun stations.

5.3.14.2 All weld consumables for fastener welders shall be equipped with Centerline or Tuffaloy products for piloted fasteners.

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

5.3.14.4 All electrodes shall be discussed in the design stages.

5.3.14.5 Depending on weld gun configurations, all guns should be on separate regulators with same gun configurations grouped.

5.3.15 Cylinders

5.3.15.1 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).

5.3.15.2 All cylinders shall be equipped with flow controls.

5.3.16 Fastener feeders

5.3.16.1 All fastener feeders shall be Quality Feeders or Owosso.

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5.3.17 Safety

- 5.3.17.1 Remove all pinch points from the operators station to the back of the cell.
- 5.3.17.2 No trip hazards across operators station
- 5.3.17.3 All energy sources shall be able to be locked out.
- 5.3.17.4 All operator stations require palm buttons; either two handed button or one hand button with a light curtain.
- 5.3.17.5 Ideal hand height is 36" to 42" from the floor.
- 5.3.17.6 All equipment shall meet applicable safety standards for RWMA, OSHA and ANSI compliance.
- 5.3.17.7 Light curtains shall be Banner; size shall be according to Ped welder design.
- 5.3.17.8 All safety gates shall be equipped with safety interlocks.
- 5.3.17.9 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.
- 5.3.17.10 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 possible shield a rupture.

5.3.18 Welder Identification Specifications

- 5.3.18.1 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 #K12Y116AY. Outside of safety screens shall be painted

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Medium Yellow, Devco Paint base #7061 and tint #AX4Y-K20.
Inside of safety screens shall be painted Flat Black.

5.3.18.2 Vendor name and address signs *should* not exceed 11" x 17".

5.3.19 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.

5.3.19.1 Eye height to be an average of 63".

5.3.19.2 Work surface height to be around 32" to 40".

5.3.19.3 There should be no overhead reaching.

5.3.19.4 There should be a fan mounted above the palm buttons and in front of the operator, to cool the operator.

5.4 **TRYOUT SPECIFICATIONS**

5.4.1 Sample Submission:

5.4.1.1 Progress reports / timelines shall be supplied to Spartanburg Steel Products every two weeks during the construction of the machinery.

5.4.2 Final Tryout:

5.4.2.1 Before final tryout, a total of one weld sample per weld gun with all fasteners welded on it shall be tested and the results shown to a SSP Quality Representative. Lastly, during a 300 piece HVPT, every 50 parts will be torn down and weld integrity will be examined. At the end of the 300 piece run, a final panel shall be torn down and the weld integrity shall be recorded. The data shall be recorded by SSP Quality Representatives.

5.4.2.2 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. The weld

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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.

5.4.2.3 The final buy off shall be conducted a Spartanburg Steel. It shall consist of a 300 piece run off, if shall be declared that 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.

6 RECORDS

- 6.1 Supplier Cycle Time Records
- 6.2 Supplier Production Records