

**MANUFACTURING EQUIPMENT
PURCHASE SPECIFICATION**

Nexteer Automotive

TITLE: Welding Equipment Requirements
ISSUED BY: Process Engineering-Weld Group
REVISION: 008

DATE: 11/9/95
DATE: 10/1/12

NUMBER: SD-1013
APPROVED BY:
SHEET: 1 of 21

Paul M. Beyer
020012
approved for all
pages 1-21

Table of Contents

I. PREFACE AND REFERANCE STANDARDS.....	2
II. GENERAL MACHINE STANDARDS.....	2
III. RESISTANCE WELDING.....	8
IV. GAS METAL ARC WELDING (G.M.A.W.).....	12
V. PLASMA ARC AND GAS TUNGSTEN ARC WELDING.....	17
VI. FRICTION WELDING	18
VII. RUN-OFF VALIDATION.....	20
VIII. RECORD OF REVISIONS	21

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 2 of 21

I. PREFACE AND REFERANCE STANDARDS

A. Intent

1. These specifications are intended to provide a greater degree of standardization to facilitate maintenance and to provide for trouble free operation. There are not intended to inhibit design or progress of the welding industry.

B. Applicable Standards

1. Nexteer Automotive Machinery and Equipment Specifications (SD-000) and all associated standards referenced within SD-000.
2. Safety in Welding and Cutting; ANSI/ASC Z49.1-latest revision level, An American National Standard (available from the American Welding Society, 550 N.W. LeJeune Rd., Miami, Florida), Section 5 - Ventilation, will apply. If welding or cutting involves lasers, ANSI Z136.1 and 136.2 shall also apply.

II. GENERAL MACHINE STANDARDS

A. Mechanical

1. Forces applied within the machine must be controlled and transferred into the base of the machine without distorting the part or affecting the fixture of transfer equipment.
2. Jackscrews should be used to aid in the removing of details subject to jamming, suction, or light press fits.
3. Bushings shall be press-fitted. "Loctite" shall NOT be used on bushings.
4. When the machine is designed to permit breakdown into individual sections, the points are to incorporate keys and keyways to facilitate realignment.
5. When a possible grounding path exists outside of the direct path from part to ground, all precautions should be taken in creating isolation.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 3 of 21

B. Tooling

1. On all piloted fixtures, the male portion shall remain on the machine and the replaceable portion shall contain the female pilot to avoid dirt buildup in the tooling a facilitate cleaning.
2. All tooling coming in direct contact with parts or have a life expectancy less than (3) years, shall be replaceable without removing operating components of the machine. (3) Three sets of these details shall be provided.
3. A list of suggested perishable tooling and spare parts will be supplied to the Process Engineer prior to shipment of the machine to Nexteer.

C. Pneumatics/Hydraulics

1. Weld Cylinder

- a) The piston rod and seals shall be adequately protected from weld spatter and foreign matter by metal scrapper rings or approved boots or shields.

2. Tubing

- a) All air or hydraulic lines within the work envelope which may be exposed to weld spatter or excessive heat must be protected by a weld resistant sleeve material or be sold steel tubing or piping.

D. Cooling

1. Components shall be water-cooled when tool life, tool or part deformation, operator handling, or conductivity is affected.
2. Visual flow indicators shall be installed to monitor coolant flow in all coolant lines to tooling and critical areas. These indicators shall be in an easily observed position.
3. Location of filters and strainers shall be accessible and below any electrical components.

E. Moving Contact Areas

1. Sliding surfaces shall be made from material resistant to scoring and capable of withstanding high temperatures.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 4 of 21

2. Sliding surfaces shall be shielded from weld spatter and debris.

F. Fixture Identification

1. A sufficient number of unused pins in the multi-pin electrical connectors shall be provided to automatically identify each fixture. The machine should have the capability to recognize 16 different fixtures.

G. Fasteners

1. Socket-head cap screws shall be used throughout the machine construction. Hex head bolts are not to be used unless approved in writing by the Process Engineer.
2. Tapered dowel pins or roll pins shall not be used unless approved in writing by the Process Engineer.
3. Locators must give position location so that the part will not shift due to machine movement or when welding gun pressure is applied.

H. Non-Magnetic Properties

1. Components designed for use within the throat or high magnetic field areas, shall be constructed from non-magnetic materials.

I. Footprint

1. A common base shall be provided for the machine to support the main control panel, welding controllers, transformers, monitors, and fixturing with a common point drop for all utilities.
2. The maximum width, length, and height of new equipment are site specific and are limited by the effective receiving-door opening and aisle widths. The Tooling Spec (T-Spec) will include specific footprint limits.

J. Controls

1. A Weld / No-Weld switch shall be located on the operator control station.
 - a) No-Weld operation gives the machine the ability to run in Auto without making a weld.
 - b) Logic path shall be the same, in No-Weld or Weld Mode.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 5 of 21

2. A touch panel HMI shall be used to maintain flexibility. Configuration and operation shall be modeled after existing equipment. Reference drawings are included with the quotation request.
3. The Part Reject "Fault" logic is to be initiated upon the "Arc Start" or "Weld Initiate" signal of the first weld of the application. Machine faults shall be examined to determine if the part will be required to be placed into the reject chute.

K. Counters

1. A programmable counter shall be provided for each of the following:
 - a) To monitor cycles until Weld Tip/ Electrode change
 - b) To monitor cycles until Contact liner change (GMAW)
 - c) To monitor cycles until tip cleaning (GMAW)
 - d) To monitor rejected parts
 - e) To monitor acceptable parts
2. The counter shall be interfaced with the machine controls to enunciate the change message upon completion of the cycle.
3. When applicable, the robot shall be moved to a safe position allowing the operator to easily change the tip.
4. The counters shall be tamper proof and prevent the machine from restarting until the counter is reset.

L. Fault Enunciation

1. Any condition preventing the machine from starting or being manually actuated shall be enunciated. The faults should be specific and provide information as to what condition is preventing the machine from starting.

M. Sensors and Wiring

1. Electrical sensors are to be used to verify the following:
 - a) Part Presence

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 6 of 21

- b) Part Clamped
- c) Part Unclamped
- d) Movements related to machine/operator safety

2. Sensor Types;

- a) Limit Switches
 - (1) Limit switches are not to be directly actuated by the production part.
 - (2) Limit switch bases or target must be slotted to allow adjustment.
- b) Proximity Switches
 - (1) All proximity switches used shall be weld immune.
 - (2) All proximity switches used shall be protected from weld spatter.

3. Cables & Wires

- a) All cables and wires within the work envelope which may be exposed to weld spatter must be protected by a weld spatter resistant sleeve material or coating.

N. Zero Energy Points

- 1. Electrical, pneumatic, and mechanical zero energy points shall correspond. All cams shall have their zero point and direction or rotation marked.

O. Error Proofing

- 1. If mechanical error proofing cannot be accomplished electrical methods can be employed but must be approved by the Process Engineer.
- 2. Any error proofing devices located in the weld area shall be protected from spatter.
- 3. Vendor is responsible to provide "Error-Proof Mater" parts for calibration and verification of error proofing components.
 - a) "Masters" must be made to be durable, hardened details.
 - b) "Masters" must be painted red for identification.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 7 of 21

c) "Masters" may or may not look like the parts

4. Vendor is responsible to provide written procedures regarding both the "Calibration" and "Verification" steps pertaining to "Each" error-proofing component.

a) Measurement Example: If a part is being measured by a sensor, a set of hardened master parts are to be provided with these masters verified for the position at the minimum, and maximum dimensions.

b) Force/Load Example: If a "Controlled" load is applied to any part such as an electrode, a force gage and fixturing to hold the force gage, is to be supplied by the vendor.

P. Fume/ Smoke Collectors

1. The type of Fume/Smoke collector will be site specific and be identified in the (T-Spec). The Process Engineer must approve the size and physical layout of the collector.

Q. Lighting

1. Auxiliary lighting shall be added in the load/unload area of the machine and all other areas where plant lighting is inhibited due to guarding or equipment.

2. Multi-Color Light

a) A multi-color dome style light shall be mounted in plain view outside the cell to indicate the machine is in cycle (Yellow), or the cycle is complete and the part is good (Green), or that the part is rejected (Red).

R. Cycle Start Switch

1. A "flag type whisker switch shall be provided for automatic cycle initiation.

2. The position of this switch must be mobile. Dependent upon machine positioning within the cell, the switch must be capable of being relocated to either side of the operator load/unload position.

S. Reject Bin

1. Vendor shall supply a Red Reject Bin mounted to the side of the machine.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 8 of 21

2. The bin or reject chute must be tied to the machine logic via a sensor to verify that each scrap part is in fact placed in the reject bin.
3. Rejected parts are to exit the rear or side of the machine.

T. Fan

1. An 18" fan shall be mounted at the operator station.

U. Storage Trays

1. All perishable or wear tooling which will be routinely changed with a frequency of once per day or more shall require an organized storage unit (5-S tray) with a suitable quantity of spare tooling. This unit shall be designed with the tooling and process in mind and be placed in location that is easily accessible to the operator.

V. Drawings

1. All Drawings must be approved by the Process Engineer before build can occur.
 - a) These drawings include Mechanical, Electrical, Pneumatic, Cooling Water, Welding Gas, Hydraulic, and Welding Circuit.
2. All Drawings and Parts Lists must be in the Nexteer Standard format (SD-003) before submitting to the Process Engineer.
 - a) Exceptions must be approved in writing by the Process Engineer.

III. RESISTANCE WELDING

A. Welding Rams (Cylinders)

1. Within the design of the welding ram, a Fast Follow-up "device" must be incorporated to insure a constant, calculated force during the collapse of the projection.
2. A load cell shall be designed into the overall welding ram. The load cell type will be site specific and be identified in the (T-Spec.).

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 9 of 21

3. A digital pressure switch and regulator shall be used with the welding cylinder.
4. A MARK-10 brand Force gauge shall be provided by the vendor.
 - a) The force gauge shall be able to mount between the electrode and the part.
 - b) The force gauge shall be easy to load, actuate, and read while being used.

B. Electrodes

1. The electrode design, material type, and coatings, (if applicable), must be approved by the Process Engineer.
2. Standard electrodes and electrode tips are preferred over special electrodes.
3. Electrode tips or caps shall be furnished with removal tools.

C. Weld Controllers

1. The preferred weld controller will be site specific and be identified in the (T-Spec.).
2. All weld controllers must include the Programming Pendant and Programming Software.
3. The weld controller shall be mounted to the machine in an accessible position providing for 130° swing of the access door. If the weld controller does not have a door, panels must be able to be easily removed.
4. Positioning should take into effect that dunnage, parts chutes, and other moving objects might be placed directly next to the machine. Therefore guarding or placement of the controller in a "Recessed" position should be considered to protect the front face of the controller or any projecting buttons or switches.
5. Weld Controllers must have main disconnect/door interlock per Nexteer specifications.

D. Current Path Components

1. The design shall minimize the flexing of the cables and use a rolling shunt wherever possible

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 10 of 21

2. All current path components shall be sized for current demand and flexibility.
3. Shunt drawings must be included in the tool folder drawing package.
4. Copper buss bar stock must be used wherever possible.
5. The secondary loop shall be minimal in length and minimize radial movement.
6. The following grounding components shall be utilized dependent upon movement as specified;
 - a) Linear Movement
 - (1) Flexible Cables
 - (2) Flexible Laminated Shunts

E. Weld Parameters

1. All Welding parameters shall be posted on the machine prior to machine runoff and be included in the operator manuals.

F. Monitors

1. A Welding Monitor shall be used to monitor and display as a minimum, the following characteristics;
 - a) Force
 - b) Current
 - c) Time (cycles or msec)
 - d) Voltage
 - e) Displacement
2. The Welding monitor type will be application and or site specific and be identified in the (T-Spec.).
3. All associated components such as load cells, signal conditioners, toroid, linear variable displacement transducers, etc... are the responsibilities of the vendor.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 11 of 21

4. The Monitor shall be located in an easily accessible position within the view of the operator at the load/unload station.

G. Transformers

1. The brand and type of transformer shall be site specific and identified in the T-spec.
2. Cooling
 - a) The cooling water to the transformer shall be a separate circuit from any other cooling circuit on the machine
 - b) The piping shall be sized for the transformer-cooling requirement.
 - c) The welding transformer shall come equipped with an over-temperature switch on the transformer secondary. A transformer over temperature condition shall cycle stop the machine and indicate the condition to the operator.
3. Grounding
 - a) The secondary of the transformer shall be grounded at the fixture to protect the operator against shorts from primary to secondary.
 - b) If a Ground Detector is required, the type will be site specific and be identified in the (T-Spec.).
4. Placard Requirements
 - a) All transformers shall display a plate with the following information in a convenient readable location:
 - b) Original manufacturer's name and serial number
 - c) Date of manufacture or rebuild.
 - d) Primary voltage and frequency.
 - e) Secondary voltage at each tap connection.
 - f) Rated KVA at 50% of duty cycle.
 - g) Maximum temperature rise and insulation class.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements	NUMBER: SD-1013	
ISSUED BY: Process Engineering-Weld Group	DATE: 11/9/95	APPROVED BY: _____
REVISION: 008	DATE: 10/1/12	SHEET: 12 of 21

h) Primary excitation current with the secondary open circuit.

i) If transformers are rebuilt, then the suppliers name and date of remanufacture shall be engraved.

IV. GAS METAL ARC WELDING (G.M.A.W.)

A. Process

1. Gas - 92% Argon -and- 8% CO², or will be site specific and be identified in the T-spec.
2. Wire - 0.035", AWS# ER-70S-6
3. The containerization of the wire will be site specific and be identified in the T-Spec.

B. Weld Quality

1. Welds must conform to American Welding Society standards specified in; AWS/ANSI D8.8-2007.

C. Welding Power Supply

1. Power supply shall be site specific and be identified in the T-spec.
2. Any programming software for welding power supply shall be provided with equipment.
3. If the power supply has a communications port, it shall be wired via remote to the control panel or operator control station.
4. A removable cover shall guard welding leads.

D. Robot GMAW Welders:

1. Machine Layout

a) Robotic Cell

- (1) The robotic cell shall be based upon our Bill of Process equipment; SD-800151.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements	NUMBER: SD-1013	
ISSUED BY: Process Engineering-Weld Group	DATE: 11/9/95	APPROVED BY: _____
REVISION: 008	DATE: 10/1/12	SHEET: 13 of 21

- (2) The robotic cell shall have rough location guides for fixture alignment and installation.
- (3) The robotic cell shall utilize a solid door to enclose the work envelope. This door shall be the primary safety guard. The door's movement shall be guarded with Light Screens. The Light Screens shall be a secondary safety device, utilized "Only" to protect during the movement of the door. The Light Screens are to be disabled upon completion of the door closure.
- (4) The robotic cell shall incorporate a single TCP (Tool Center Point) independent of the fixture.

b) Robotic Weld Fixtures

- (1) The robotic weld fixtures shall be based upon our Bill of Process tooling; TL-298831.
- (2) The weld fixture shall utilize the following components;
 - (a) TE-CO #54970 Locating Bushings
 - (b) TE-CO #54900 Locating Pins -(These are on the Machine Base)
- (3) The Fixture electrical interface shall be (1) Meter long and consist of the following Weidmuller or Harting brands;
 - (a) Weidmuller Male Insert, Qty. (1), HDC-HD-64SCM, Item #1601720000; or Harting Item #09210643001.
 - (b) Weidmuller Pin, Qty. (64), CS1, 6HD E-18-16SN I2, 5 MALE (NL), Item #1544400000; or Harting Item #150006101 (16GA).
 - (c) Weidmuller Hood, Qty. (1), HDC-HB-24-TSVU1/21P, Item #1212100000; or Harting Item #09300245405.
 - (d) Weidmuller Housing, Qty. (1), HDC-HB-24-AVU, HOUS/B/HEAD (DE), Item #1212400000; or Harting Item #09300240270.
 - (e) Weidmuller DSTV-HD-64 Female (Machine Interface); or Harting Item #09210643001.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements
ISSUED BY: Process Engineering-Weld Group
REVISION: 008

DATE: 11/9/95
DATE: 10/1/12

NUMBER: SD-1013
APPROVED BY: _____
SHEET: 14 of 21

2. Lift/Transfer Cart (Weld Fixtures)
 - a) The Lift/Transfer Cart for the weld fixtures shall be based upon our Bill of Process tooling; TL-295002.
3. Tip Cleaners
 - a) If required, each cell shall have an automatic tip cleaning station and also an anti-spatter station.
 - b) The type of Tip Cleaner will be site specific and will be identified in the (T-Spec.).
4. Controls:
 - a) Operations Panel:
 - b) The following sub routing programs shall be available from the operator control station:
 - (1) "Robot Home"
 - (2) "Tip change" When applicable, the robot shall be moved to a safe position allowing the operator to easily change the tip.
 - (3) "Nozzle Clean" (If Required)
 - (4) "Inch Wire" Forward
 - (5) "Inch Wire" Backward
 - (6) "Gas Purge"
 - (7) "Weld Enable/Disable"
 - (8) "Tool Center Point (TCP) Check"
 - c) It will be necessary to provide hardware input/output interlocks between the machine control PLC and the Fanuc robot controller. The control system must have capability to select up to 16 robot weld programs, sense robot status (faulted, home weld cycle complete, etc), issue command signals, etc.

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 15 of 21

E. Fixed Torch GMAW Welders:

1. Machine Layout

a) Equipment

(1) The welding equipment shall be based upon our Bill of Process equipment; SD-800057

b) Operations

(1) The following functions shall be available per the operator control station;

(2) Torch position home

(3) Torch weld position

(4) Wire inch forward

(5) Weld enable/disable

(6) Wire inch backward

(7) Gas purge

c) Torch Fixturing

(1) Torch adjustability shall require that the fixture be designed and built with micro-adjustability in the X, Y, and Z positions.

F. Weld Torches:

1. Weld guns are site specific and be identified in the (T-Spec.).

2. The torch shall be rated at 100% duty cycle or rated for the application requirements.

3. The vendor shall include within the quote and provide the following:

(a) 30 - spare Weld Tips (per torch)

(b) 3 - spare Nozzles (per torch)

(c) 1 - spare Goose Neck

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements	NUMBER: SD-1013	
ISSUED BY: Process Engineering-Weld Group	DATE: 11/9/95	APPROVED BY: _____
REVISION: 008	DATE: 10/1/12	SHEET: 16 of 21

(d) 1 - spare Outlet Cable (kept to 6 ft minimum)

(e) 3 - spare Liners (10' length)

(f) 1 - spare Diffuser

(g) 1 - set; Welper Welding Pliers

(h) Note: All consumables shall be OEM parts.

G. Wire Feeders:

1. Wire feeder types are site specific and will be identified in the (T-Spec.).
2. Wire feeders shall utilize a four (4)-roll drive mechanism.
3. Wire feeder shall be guarded and interlocked to machine controls to avoid contact with moving components.
4. Wire feeders shall be isolated from the machine base to prevent the potential for electrical shock.
5. Wire feeders shall be accessible from the floor level, unless otherwise specified.
6. The vendor shall include within the quote and provide the following:
 - a) 1 - set of spare Drive Rolls per wire feeder
 - b) 1 - set of Feed Guides per wire feeder

H. Monitors:

1. An IMPACT ArcAgent 2000 weld monitor shall be used to monitor each weld.
2. Each weld shall be monitored for the following: wire feed speed, amperage, voltage, gas flow, and time.
3. The mounting location shall be reviewed and approved by the Process Engineer.
4. The logic of the machine shall assume that the weld is rejected unless proven good by the weld monitor.

I. Spatter Shielding

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 17 of 21

1. Spatter shields shall be designed and installed to protect areas of the part & tooling which may affect the operation of the overall part performance. These areas will be identified in the (T-Spec).

J. General

1. All part location features, hoses, and electrical cables shall be adequately protected from weld spatter. The protection features shall be easily removed for maintenance.
2. All part datum areas, on both the part and tooling, to be adequately protected from spatter.
3. The most direct path to the weld area shall be utilized to accomplish the most conductive grounding path.
4. Tooling should be designed to insure grounding does not occur through bearings, slides, or cylinders.
5. Rotary grounds must be approved by the Process Engineer in charge.
6. The valves and solenoids required for fixture operations shall be mounted to the fixture.
7. All valves associated with fixture movement shall have flow controls, regulators, and pressure gages.
8. Identification Tags with Functional Description and pressure settings are required for each valve.
9. Device identification tags for field-mounted devices shall include a functional description as well as the required number-letter identifier.
10. A pressure switch is required to insure shielding gas availability during welding.
11. Copper coatings shall be used on all details for GMAW machines in areas subject to welding spatter.

V. PLASMA ARC AND GAS TUNGSTEN ARC WELDING

A. Process

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 18 of 21

1. Depending on material type and specific process requirements, gas type will be process/product specific and will be specified in the (T-Spec.).

B. Weld Quality

1. Welds must conform to American Welding Society standards specified in; AWS/ANSI

C. Welding Power Supply

1. Power supply shall be site specific and be identified in the T-spec.
2. All plasma welding equipment and gas tungsten arc welding shall be designed to operate at 100% duty cycle for the required operation.

D. Torches

1. All plasma arc and gas tungsten arc welding torches shall be water cooled unless otherwise specified. Torch cable length shall be minimized.

E. Fixturing

1. The part fixture shall contain the welding circuit ground. The most direct path to the weld area shall be utilized to accomplish the most conductive grounding path.

VI. FRICTION WELDING

A. Process

1. Machine can consist of single or double spindles.
2. Direct drive friction welding systems are preferred over inertia drive systems.

B. Weld Quality

1. Welds must conform to American Welding Society standards specified in; AWS/ANSI
2. Machine controls shall monitor the following parameters.
 - a) Spindle RPM

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 19 of 21

b) Weld Force

c) Weld consumption

(1) Weld time (pre heat, friction, forge)

C. Tooling- Spindle

1. Draw bar actuated collect chuck tooling is preferred.
2. Collets shall grip the part as close to the weld as possible to minimize TIR.
3. Collet tooling shall not mark the parts.
 - a) Collet tooling shall be quick-change details.

D. Tooling - Clamp-Box

1. Clamp box shall be hydraulically activated/controlled.
2. Clamp box tooling shall gripe the part as close to the weld as possible to minimize TIR.
3. Clamp box tooling shall not mark the parts.
4. Clamp box tooling shall be quick-change details.

E. Tooling – Back Stop

1. Machine shall have backstop to transfer forces from forging process through the machine base.
2. Backstop tooling shall be quick-change design.
3. Backstop axial position shall be able to be adjusted either manually or servo.

F. Flash Removal Unit

1. The requirement to incorporate a Flash Removal unit will be process or product specific and be specified in the (T-Spec.). When necessary, the following shall apply;
 - a) Plunge cutting unit
 - b) Shear cutting unit

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements

NUMBER: SD-1013

ISSUED BY: Process Engineering-Weld Group

DATE: 11/9/95

APPROVED BY: _____

REVISION: 008

DATE: 10/1/12

SHEET: 20 of 21

- c) Programmable multi-axis cutting unit

VII. RUN-OFF VALIDATION

A. Testing Equipment and Validation

1. Vendor Responsibilities

- a) Vendor shall be responsible for all Fixturing, Tools, and Equipment, necessary to perform measurable testing required by the product drawing. This equipment shall be located within the facility where the machines are to be run-off.

2. Measuring Equipment Certification

- a) All measuring equipment must be calibrated and certified.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements	DATE: 11/9/95	NUMBER: SD-1013
ISSUED BY: Process Engineering-Weld Group	DATE: 10/1/12	APPROVED BY: _____
REVISION: 008		SHEET: 21 of 21

VIII. RECORD OF REVISIONS

Revision #	Date	Section	Description	Approval Signature
001	11/09/95	All	Original Release	N/A
002	03/01/04	All	Re-Written & Revised	Jerry Jablonski
003	04/14/04	II	Q.3 Added	Jerry Jablonski
-	-	II	N; Title changed to Pneumatics/Hydraulics	-
-	-	II	N.2 Added	-
-	-	IV	D.1.b.3.c ~ Was; Electromatic A460-4x00-A8 Male Connector	-
-	-	IV	D.1.b.3.d ~ Was: Electromatic A460-1P00 Female Connector	-
-	-	IV	D.1.b.4 Added	Jerry Jablonski
004	7/1/04	II	Items A thru Q Re-Organized to assimilate priority	-
-	-	II	J.5; Added: Part Reject "Fault" logic	-
-	-	II	N.3; Added: "Masters" for Error proofing	-
-	-	II	N.4; Added: Procedures - Verifying Error Proofing	-
-	-	IV	D.1.a.3 Added regarding Secondary Light Screen guarding	-
-	-	IV	D.1.a.4 Added TCP points within Machine envelope. (Not Fixture)	-
-	-	IV	E.1.b.2; Added Individual Selection in Dual Torch Process	-
-	-	IV	E.1.c.1; Added Torch Fixture Micro - Adjustability	Jerry Jablonski
005	1/10/06	All	Re-written & Revised	-

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements	NUMBER: SD-1013	
ISSUED BY: Process Engineering-Weld Group	DATE: 11/9/95	APPROVED BY: _____
REVISION: 008	DATE: 10/1/12	SHEET: 22 of 21

-	-	II	B.2; Added "3 sets of details"	-
-	-	II	C.2.a; Added "steel" to tubing requirement	-
-	-	II	G.1; Changed "not acceptable" to "unless approved in writing"	-
-	-	II	I.1; Added "common base" requirement	-
-	-	II	J.1.a); Added "No-Weld" explanation	-
-	-	II	J; Removed "Home All" and "Return All" per SD-1020	-
-	-	II	K: Moved Counters from Sect. IV.J to Sect. II.K	-
-	-	II	M.2.b); Added	-
-	-	II	O.3; Added "Error Proof Master" part clarification on durability and identification	-
-	-	II	O.4; Added Measurement and Force/Load examples	-
-	-	II	Q.1.a).(1).(a); Was IEC204-1	-
-	-	II	R; Added "Cycle Start Switch" section	-
-	-	II	S; Added "Reject Bin" section	-
-	-	II	T; Added "Fan" section	-
-	-	II	V; Added "Drawings" section	-
-	-	III	A.3; Added "pressure switch and regulator" requirement	-
-	-	III	A.4; Added Dillon Force Gauge requirements	-
-	-	III	C.6; Added Main Disconnect/Door Interlock spec.	-
-	-	III	D.6.a); Added "Laminated Shunts"	-
-	-	III	D.6; Removed Radial Movement wording	-
-	-	III	G.3.a); Removed "8 position tap switches"	-

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION

Nexteer Automotive

TITLE: Welding Equipment Requirements	NUMBER: SD-1013
ISSUED BY: Process Engineering-Weld Group	DATE: 11/9/95
REVISION: 008	APPROVED BY: _____
	DATE: 10/1/12
	SHEET: 23 of 21

			preferred"	
-	-	III	G.6.a); Removed "permanently engraved"	-
-	-	IV	D.4.b).(2); Added position explanation for tip change	-
-	-	VII	A.2.a); Removed "ISO	Jerry Jablonski
006	6/1/06	IV	D.1.b).(3) thru (5); Added Electrical Interface detail for Fixture integration	-
		II	M.1.a) thru d).; Added Sensor requirements	-
007	06/05/07	All	Retyped	Jeff Bender
008	9/17/12	All	Revised and Reformatted	Doug VanWormer

SD2449 DIV PROC 100 REV 5/29/96

Note: The above specification was developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability