

## A. Quotation / General:

1. This document is constantly being updated. All suppliers must request a copy of the latest specifications when quoting a product.
2. Please apply these standards to all fixtures and tooling unless a specific request is being submitted in the quotation package.
3. The fixture or any machine component will be designed, manufacture, tested and installed according to all applicable OSHA, NEC, CSA, and or local standards and regulations in place at the installation location.
  - a. The vendor is responsible for determining which regulations apply
4. Quotation to include lead-time.
5. Quotation to include Conceptual Skeleton design.
6. The quotation must also include part-to-part cycle, including loading and unloading. ABC Plant engineering representative requesting the quotation may provide a target cycle.
7. The supplier must include any requirements such as part samples, data, etc. required to complete the job on time and to specification.
8. Machinery function and components to be guaranteed for an equivalent of one year of production based upon quoted annual volume. Purchased components on the equipment are warranted for period as specified by the vendor it is purchased from. (Wear items such as punches and drills are not included but must be listed in the quotation).
9. Prices to be quoted F.O.B. ABC and to include installation at ABC Plant
  - a. FOB supplier plant may be requested and negotiated with the ABC Plant
10. Supplier to include utility requirements in quotation.
11. All deliveries are to be made weekdays between 8:00am and 4:00pm.
12. All stand-alone fixtures to include minimum 24 hours of training and start-up assistance. ABC Plant engineering representative to arrange timing.
13. This training should include up to 16 hours at vendor location with onsite visits by ABC plant personnel and minimum one shift start up support by vendor at ABC facility This item may require an additional cost and may be quoted accordingly
14. Large scale projects to include minimum 15 man-days of training and start-up assistance. ABC Plant engineering representative to determine based on scope of project and customer requirements
15. Final payment to be made only after Machinery sign-off is complete.
16. Any deviations or changes from any specifications listed below, must be agreed to in writing by the ABC Plant Engineering / Management, prior to Award of the Purchase Order. Discussions with ABC Group MRO may also need to be held.

## **B. Machine Construction:**

### **1. Electrical Control:**

#### **1.1. PANEL**

- 1.1.1. All electrical components are to be installed into a CSA or local regulatory branch approved enclosure.
- 1.1.2. Electrical panel to include sufficient space for an additional I/O unit.
- 1.1.3. All electrical panels to have a minimum of 20% (large panels) and 10% (small panels) unused space for future additions.
- 1.1.4. All Inputs and outputs to be connected to a separate terminal block. No direct connection.
- 1.1.5. All terminal blocks to be screw type, with a separate power supply on each block. Weidmuller ZIA Series is preferred. Power contacts to be Orange for positive 24VDC, Blue for Negative 24VDC, White for common 110VAC, Green for ground and Red for 110 V AC line voltage.
  - 1.1.5.1. The common voltage supplied to the Output cards to be over current protected on a separate branch
- 1.1.6. The machine is to be equipped with 1 resettable and 1 non-resettable counter. The counters are to register when the machine has produced a good part. It should not count any cycles where the machine has been reset.
- 1.1.7. All the wires in any control panel or junction box to be terminated with properly sized ferrules.
- 1.1.8. All outputs to be 24V DC rated.
- 1.1.9. All control voltage is to be no more than 24 VDC, other than hydraulic solenoid coils (120 volts or less)
- 1.1.10. Electrical wiring to be in accordance with current Local Electrical Code, such as Ontario Hydro Electrical Code or CSA standards.
  - 1.1.10.1. Proof to be provided in the form of an approval label.
- 1.1.11. Electrical receptacle: Two spare 100V electrical receptacles will be mounted on the fixture. One outside the control panel box and one inside the control panel box as a power source for a laptop with its own over current protection not exceeding 5Amp
- 1.1.12. Fixtures to be 110V, 60 hertz and single phase power wherever possible, and unless specified by the ABC plant. Use SW cable, 4 meters in length with a Pass & Seymour L515 series connector. Use 575V 3 phases in case of higher current draw. For 575V 3 phases, use SO cable, 5 meters in length with a Pass & Seymour L1730 series connector. Include cord storage devices for any fixtures that will not be permanently installed.
- 1.1.13. All electric plugs for 120 AC 15 amp to be shock resistant and twist lock type.
- 1.1.14. Main disconnects to be ABB or EATON with a locking device to ensure that power is disconnected prior to the electrical panel opening.
- 1.1.15. All fixtures over 15 amps and 120 AC volts are to have a disconnect switch.

## 1.2. COMPONENTS

1.2.1. Specific brands and types for all electronic devices must be presented to ABC plant for approval to try to ensure commonality and reduce the variability of parts used, even if a specific manufacturer or model is listed below.

1.2.1.1. PLC: Omron / Allen Bradley (ABC Plant to Specify)

1.2.2. All machinery to include PLC's capable of Ethernet connectivity with at least 15% spare (minimum of 4 each) inputs and outputs unless otherwise specified.

1.2.3. PLC must contain minimum 1 Ethernet module

1.2.3.1. Tie in to EIP support for SCADA software.

1.2.3.2. Scanner or Printer Connection

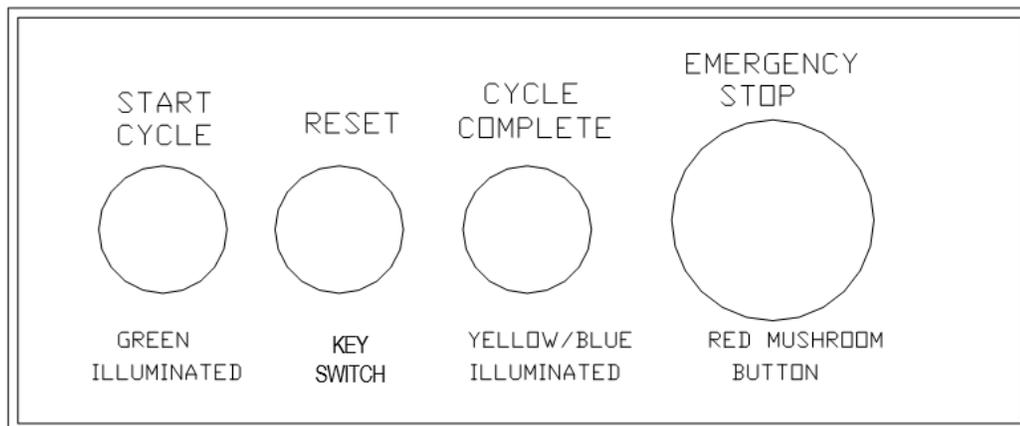
1.2.3.3. Final Check fixtures must include minimum 2 Ethernet ports, or be easily upgraded to ass a second port for connection to ANDON System

1.2.3.3.1. Additional features will be added as the ANDON system hardware requirements are finalized.

1.2.4. PLC must contain a RS232 port for peripheral communication.

1.2.4.1. For selector switches or pushbuttons use EATON or OMRON series.

1.2.4.2. A control unit must be installed in the right side of the machine for operation showing the followings controls



1.2.5. For indicator lights use 24V high intensity LED.

1.2.6. All fuse holders to be "Finger Safe" type and equipped with a fault indication light.

1.2.7. All the sensing devices should have **PNP** polarity.

1.2.8. All sensors to be: Omron, HTM, Baluff, Keyence or Baumer.

1.2.9. All relays to be: Omron and AB.

1.2.10. All motor contactors and thermal overload to be ABB or EATON. Thermal overloads to have a range of +/-1Amp of the load current with an adjustable option.

1.2.11. All electric motors on drills, saws, routers, etc, are to be equipped with brakes.

1.2.12. A red emergency stop button must be easily accessible to the operator when machine in the normal position.

## 1.3. WIRING

- 1.3.1. All cables must have a ground wire with no exceptions and all conductors must conform to NEC recommendations.
- 1.3.2. All wiring from the PLC to the control must be guarded (hard pipe and PVC coated).
- 1.3.3. All wiring is to be shielded.
- 1.3.4. All peripheral sensors to be connected to indicated multiport. (M8 Pico Connection) (Use Phoenix contact, Wood head or Lumberg).
  - 1.3.4.1. This item may be waived if identified up front on smaller fixtures with less than 20 sensors
- 1.3.5. All wires, multiport, and peripheral sensors to be labeled and identified with self-laminating labels. The labels should match the electrical schematics and other identifying documentation.
- 1.3.6. All valves, air cylinder coils, switches, lights, proximity switches and cables will be individually labeled and identified on electrical schematics.

#### 1.4. LOGIC

- 1.4.1. All machinery movement to be “closed loop” controlled. (i.e. position to be monitored via sensor with LED) Each function to have its own separate address bit even if several functions activate simultaneously.
- 1.4.2. All PLC’s bits to be labeled and documented with the proper action name. All I/O to be labeled accordingly.
- 1.4.3. No password is to be applied on the PLC, unless specifically requested by the ABC plant.
  - 1.4.3.1. Password will be provided to the vendor by the ABC plant representative
- 1.4.4. HMI modification and update screens to be protected with a password. In any case of password use, a password to be provided by ABC Plant Engineering representative.
- 1.4.5. As an alternate to a password an RFID or magnetic card reader may be used. Please review with the specific ABC plant.
- 1.4.6. Machine to utilize necessary sensors, hardware and machine logic to prevent a part from being cycled more than once. Note Fixture to check first function within the cycle.
- 1.4.7. Program logic for error proofing cannot be defeated. All sensors must be checked that they change state from off to on to off again during the correct phase of the cycle.
- 1.4.8. Irregular state changes must be noted and reacted to if there is a potential for injury to an operator, damage to a part or machine, or the potential to make a defective part.

## 1.5. DRILLS / DC GUNS

1.5.1. Drill units to be Atlas Copco / Desoutter.

1.5.1.1. Model number, stroke and rpm to be determined during design review.

1.5.2. Any Torque measuring application tools such as DC Guns must be the same model used by the Individual ABC Plant. The model needed will be determine according to the torque requirements.

1.5.2.1. This plant uses XXXXXXXXXXXXXXXX (gun manufacturer and preferred model)

1.5.3. All cylinders and drill units or actuating device must have reed switches or sensors to register forward and backward stroke.

1.6. If specified during kickoff, LED lighting would be installed with at least 400 lux of illumination available for operation and maintenance of the fixture. All lighting equipment will be 110 VAC commonly available

## 1.7. ANDON

1.7.1. PLC programming must include 24V output signals to tie in to future ANDON PLC. Signals to be included are Good Part, and Failed Part.

1.7.2. Potential Future upgrades will include communication of an error code.

## 2. **Pneumatic and Hydraulic:**

### 2.1. COMPONENTS

2.1.1. Specific brands and types for all electronic devices must be presented to ABC plant for approval to try to ensure commonality and reduce the variability of parts used, even if a specific manufacturer or model is listed below.

2.1.1.1. Pneumatics: SMC/FESTO (ABC Plant to Specify)

2.1.2. Air cylinders for punching and clamping to be SMC. Unless otherwise specified use flange mount style only. There is to be NO MANUAL PART CLAMPING! These clamping cylinders to have individual flow controls. Air valves to be as per section 2.1.1.

2.1.3. Air directional control valves to be as per section 2.1.1.

2.1.4. Where space restriction necessitates, Dotco "material removal tools" can be used. Suggested model number is 12L580-01

2.1.4.1. Air process and supply components to be as per section 2.1.1 or Parker including: filter regulators, lubricators, and Soft Start/Quick Dump valves.

2.1.5. Plastic tubing sizes to be used: 1/8", 1/4", 3/8", and 1/2" – no metric plumbing to be used without written approval.

2.1.6. For pneumatic hook-up use either Fairview or SMC nipples or couplings. Do not mix supplier on same job. All pneumatics must be easily accessible for maintenance service.

2.1.7. Selection of pneumatic valves to be based on following criteria:

2.1.7.1. All moving actuators (except guillotines) must freeze or stop in case of interruption of the light curtains

## 2.2. INSTALLATION

- 2.2.1. All pneumatic components are to be mounted under the fixture table, set back far enough to protect hoses and components from damage. When this is not possible, the components are to be guarded. Please follow the following recommendations unless otherwise specified.
  - 2.2.2. Note that pneumatic safety lockout valve is to be included.
  - 2.2.3. Fixtures with cutting/punching/drilling or other operations that may produce chips are to be equipped with a “safety” air gun (30 psi max) that meets local regulatory approval such as OSHA safety standards, and 6m hose.
  - 2.2.4. Adjustable hydraulic feed control units to be used with automatic feed drills.
  - 2.2.5. Accumulator tank to be equipped with a drain valve at the bottom and Check valve.
  - 2.2.6. Pneumatic valves to be mounted in a common area and identified, using oil and dirt proof labels.
  - 2.2.7. All input air connections to the fixture to be provided at the rear of the fixture.
  - 2.2.8. A pressure gauge must be installed after any pressure regulator. (max. 125 psi)
  - 2.2.9. Air filters regulators with lubrication unit may be required depending on the application. Please review and identify up front.
  - 2.2.10. Air receiver is to have a check valve at inlet to prevent tank from discharging when the feed line is disconnected. A bleed off screw shall be installed for draining moisture and stored air.
  - 2.2.11. A sticker shall be applied to indicate discharge is manual.
  - 2.2.12. Fixture must be able to function at 65 psi. (Air pressure of 85 psi minimum if drills or pneumatic motors are used).
  - 2.2.13. Hoses are to be bundled to prevent whipping.
  - 2.2.14. Hoses, cylinders, motors are to be labeled and correspond to schematic diagram.
  - 2.2.15. Air supply to main inlet on AFD is to be shut off whenever the light curtain beam is interrupted.
  - 2.2.16. Check valve must be installed on all clamping cylinders.
  - 2.2.17. In the event that a receiver tank is used, it must be fed before the lockout.
  - 2.2.18. Air guns to have a maximum nozzle pressure of 29 psi if fixture is so equipped.
  - 2.2.19. All pneumatics cylinders must have two (2) magnetic switches and properly labeled
  - 2.2.20. Lock out valve must be installed on the main line feeding the pneumatic control before pneumatic valving and must be accessible to operator from the operating position.
  - 2.2.21. When the fixture is being sequenced, the last operation will be for the clamps to return to their home position after all other components have returned to their respective home positions. This only holds true whether the fixture is completing a normal cycle. Should the light curtain be interrupted the Reset will initiate on PLC controlled fixture if so equipped.
    - 2.2.21.1. During normal cycle, all operations must be freeze (except guillotine blades return to home position)
  - 2.2.22. The pneumatic valve bank must be physically covered by sheet metal to prevent manual access and operation for overriding the valves.
- 2.3. Pneumatic logic schematics must be supplied with all documentation.

### 3. Safety:

- 3.1. “Special Inspection” approval must take place on all electrically powered equipment. Local Regulators such as Ontario Hydro or CSA are to be consulted for this purpose, and proof of approval in the form of corresponding label must be present on each piece of equipment.
- 3.2. ABC Group’s regulation is that any tooling or machinery to be approved by a third party company. Local ABC plant to provide the name of the company to be used. For contact information contact ABC Plant representative.
  - 3.2.1.No tooling will be allowed on the production line without the appropriate Safety Certification of approval.
- 3.3. Light curtains to be used for guarding wherever possible. Omron F3SN series to be used. The light curtain to be connected to a self-monitoring device, and meet Category 4 requirements (Omron G9SA-301).
  - 3.3.1.Fixtures, if so equipped are to be light curtain dependent and must not function if absent.
  - 3.3.2.Light curtains are to be minimum CSA approved and carry the CSA sticker.
  - 3.3.3.Light curtain control circuit shall have circuit breaker protection.
  - 3.3.4.Light curtain is to be minimum 24” length and have a beam pitch of 20 mm and cover the work area.
  - 3.3.5.Light curtains are to be mounted to the guard.
- 3.4. Two Hand Anti Tie Down
  - 3.4.1.Sliding doors or two hand anti tie downs (THATD) are required for welding or other applications. Please follow the following recommendations unless otherwise specified:
    - 3.4.1.1. THATD must be mounted outwards.
    - 3.4.1.2. THATD must be minimum 24” apart.
    - 3.4.1.3. THATD must be protected from damage.
- 3.5. Manual sliding doors to be equipped with a safety door lock switch, Omron model D4DL or D4NL using power to unlock and a spring to lock the door. The door is to remain locked until the cycle is completed. Automatic doors can be held in place by cylinder pressure. By default when using doors use automatic doors.
- 3.6. Automatic door to be equipped with a Category 4 rated safe beam to prevent any contact with the operator’s hand. The device should disconnect the power to the directional valve of the door once an interruption occurs.
- 3.7. The door directional valve must meet the safety standards of the jurisdiction where it is being installed. The vendor is responsible for determining this standard and meeting it.
- 3.8. The fixture is to be equipped with an easily removable or hinged back door utilizing a single handle for opening. (No tools required) An electrical safety interlock must be included on each door, hard wired to the main control relay (MCR).
- 3.9. E-Stop & Light Curtain circuit to stop the hazardous movement of the work zone actuator (Platen) shall be retrofitted to Single Channel with Monitoring or Category 4 structure with Performance Level “d” as a minimum (according to CSA Z432-04, Clause 8.2). To achieve this architecture, only safety rated components shall be used, i.e. safety relays, safety control relays, Pneumatic valves with monitored spools/poppet closed position.
  - 3.9.1.For HYDRAULIC circuits;
    - 3.9.1.1. to achieve required safety Category 4 on output side of the safety circuit the following shall be implemented:
    - 3.9.1.2. Punch P Val#2 spool position shall be monitored; OR

- 3.9.1.3. The above valve shall be replaced with safety valve with monitored spool (e.g. Festo MS6-SV-...-E); OR
- 3.9.1.4. The Safety Valve with Monitored spool shall be installed in series with existing Punch P Val#2 Valve
- 3.10. Equipment is to be constructed in such a manner that in case of pressure loss (hydraulic or pneumatic) machine components cannot move, or fall, with the doors open.
- 3.11. For operator safety, drills, etc. are to be equipped with a brake if movement would otherwise continue at the end of the cycle with the door open.
- 3.12. Palm button to be located so that accidental light curtain interruption is avoided. A separate guard may be included for this purpose.
- 3.13. Additional specifications related to safety and ergonomics are included in attached checklist. This checklist is to be considered as part of the build spec.
- 3.14. It is the vendor's responsibility to ensure that machinery safety meets with all local regulatory regulations such as OSHA and CSA, including regulations not specified within this document.
- 3.15. Mechanical Components
  - 3.15.1. The following operations are identified by ABC Group:
    - 3.15.1.1. Class I are those which are considered capable of inflicting critical injury. All class operation type must be guarded by means of a light curtain or a gate.
    - 3.15.1.2. Class II must be guarded by minimum of a two hand anti tie down device

Class I	Class II
Guillotines Saw Cut Router Drills Fly Cut (Chipless cutter) Rotary Cut Die Cut	Punch Toy Tab Rivet Welding Assembly

- 3.16. Control Standards
  - 3.16.1. Safety E-Stop of Light Curtain Broken
    - 3.16.1.1. Interrupts cycle.
    - 3.16.1.2. Guillotines retract.
    - 3.16.1.3. Punches retract.
    - 3.16.1.4. All other actuators remain motionless.
    - 3.16.1.5. Air shut off to drills or pneumatic tools.
    - 3.16.1.6. To reset – use the reset key on the operator control panel.
    - 3.16.1.7. All AFD drill units retract signal and air on to.
    - 3.16.1.8. Any other actuators and clamps retract last except for special application as specified.
  - 3.16.2. Regular Cycle
    - 3.16.2.1. Load part on the nest.
    - 3.16.2.2. Press start button on operator control panel.

- 3.16.2.3. Clamps extend and cycle start lamp (pilot lamp) turns on.
- 3.16.2.4. Air to AFD drill unit turned on (if it is equipped).
- 3.16.2.5. Punches extend (if it is equipped).
- 3.16.2.6. AFD drill units start and start signal off after leaving home position (if it is equipped).
- 3.16.2.7. Guillotines fire in predetermined order (if it is equipped) and then retract
- 3.16.2.8. When all other actuators are in home position, then clamps can retract.
- 3.16.2.9. Cycle complete lamp turns on; cycle start lamp turns off.
- 3.16.2.10. Unloading the part from the nest and cycle complete lamp goes off.
- 3.16.3. Safety Concerns
  - 3.16.3.1. Break light curtain while clamps are extending and they shall stop in mid-stroke but must not have any pressure extending them (no 5/3 center blocked valves cannot be used – refer to sample documentation.)
  - 3.16.3.2. When the operator in path of light curtain all power to PLC outputs that move actuators shall be turned off (refer to sample documentation for wiring procedures).
  - 3.16.3.3. E-Stop and light curtain are wired in series but do not activate a master control relay that has to be reset with a power start push bottom.
  - 3.16.3.4. All tubing and wiring shall be attached to underneath of the tooling plate.
  - 3.16.3.5. Pneumatic manifolds shall be attached to underneath of the tooling plate.

#### 4. Fixture Mechanical Design:

- 4.1. Working height to be defined as the center line of the part being handled.
- 4.2. The fixture mechanical design must comply to all applicable CSA, OSHA, NEC and all applicable standards and regulations and/or local standards and regulations in place at the installation location.
  - 4.2.1. All the mechanical components that experience a load under normal operation of equipment are to be robust design. This includes mechanical frames, brackets, linkages, welding units, supports or clamping units.
  - 4.2.2. Rust prone area if the fixture will be coated with at least two layers of primer and then painted with required color approved by ABC Group.
  - 4.2.3. Please use steel wherever possible. Table top: Steel is preferable (3/4" thick minimum) however Aluminum (3/4" thick) is also acceptable for the tooling plate (table top) on the fixtures.
  - 4.2.4. All fixtures will have a safe way of moving or being relocated. Eye bolts must be supplied if the machine need to be lifted; procedures on how to connect, disconnect, move and relocate the machine are also required.
  - 4.2.5. Design of the fixture including detailing must be done by the supplier and approved by the concerned project engineer from ABC Plant prior to manufacturing. The supplier will still remain design responsible for all technical calculations and eventually functioning of the fixture.
  - 4.2.6. All the items designed and manufactured must have lock washers to prevent it from coming loose during operation and production cycle.

4.2.7. All drawings for the fixture will remain the property of ABC Group and under no circumstances should be used to duplicate the same to manufacture for other customers besides ABC Group. All Drawings including details and any changes made during manufacturing should be updated and provided to ABC Group with the fixture.

4.2.8. All guillotine units, punch units, drill units, rotary units must be designed to be adjustable by 1" each side to accommodate hot parts.

#### 4.3. FIXTURE TABLETOP

4.3.1. The Fixture tabletop is the primary mounting datum for all mechanical assemblies that make up the completed design. The table top is made from Blanchard ground A36 steel plate with a surface finish

4.3.2. Fixture table height to be 34.5" (including table top). However loading height of the part should not exceed 38".

4.3.3. Table must be supported in a level fashion.

4.3.4. Structural steel is used for the table and the table would be painted with quality grade commercial gray paint (Unless otherwise specified) to prevent rust.

4.3.5. If specified otherwise frames should be constructed from 2.0"x2.0"x3/16x1/4" square tubing.

4.3.6. All cutting and punching fixtures to have scrap collection system. To accommodate 22" x 17.5" x 8" bin unless otherwise stated. The other option is to direct all scrap at the back of the fixture. In this case the chute will be minimum 18" high from the floor.

4.3.7. All chute work to be made in such a manner that it could be removed for preventative maintenance. When the chutes on the fixture are in place there should be no room for the operator to insert his/her hand inside to reach the moving components resulting in an injury.

4.3.8. All frames to have rectangular 3.0x8.0x1/4" tube located underneath to lift the fixture using a forklift as required.

4.3.9. Table to must be welded to the frame, if table top is manufactured from steel. If the table top is tooling Aluminum, at the minimum 8 screws (3/8") are required for hold down of table top to frame

4.3.10. Table top to be flush with frame.

4.3.11. All fixtures must be mounted on wheels: two fixed wheel and two rotating wheels (swivel). The phenolic wheels are for 7" diameter for all kind of floor.

4.3.12. All fixtures must have a foot pedal floor lock or lock brake in either side of operator view.

4.3.13. All fixtures must have a blow hose with air gun coming from fixture's underneath to be accessible for the operator (hose must be long enough to reach all areas of fixture).

#### 4.4. GUARDING

4.4.1. All machine, tooling, moving parts, hot plates, spin welders, etc must be properly guarded

4.4.2. Please follow the OHSA, CSA, Ontario Health and Safety, or other local regulations based on location of installation, not manufacture to avoid injury. Please follow our table standards unless otherwise specified:

4.4.3. Guarding will be AL Extrusion with clear plastic 3/16" minimum thickness polycarbonate. (Lexan or equivalent) Black PVC coated screen guarding (1/2" square mesh) only to be used if authorized in writing.

4.4.4. Height of the guard is to be minimum of 38" from the table top and minimum 72.5" from floor and should meet the CSA Z432-94.

4.4.5. Fastening is to be done to the frame of the table, not the table top.

4.4.6. Pinch points are to be no closer than 8" from the front and 6" from the side and back.

4.4.7. Light curtain where applicable is to be mounted no more than 1/8" from table top. The bottom area must be covered with Aluminum angle all across the length of the fixture.

4.4.8. Guards to be mounted using a minimum of two tabs per side.

4.4.9. Guards 5' and over to have support gussets installed to prevent flexing.

4.4.10. All fixtures must incorporate full side guarding from underneath the table top to cover all pinch points. Guarding will be 1/16" sheet Aluminum mounted from the top tube frame to the bottom tube with access to the air regulator, air supply connection and dome collection bins.

4.4.11. Drill bits and flycutting heads, etc, to have guarding over the cutter and installed in such manner that they can only be removed using tools, however one side may be hinged.

4.4.12. All pinch points are to be guarded.

#### 4.5. SAW FIXTURES

4.5.1. Saw fixtures mounted below the bottom of the fixture are to be enclosed. The motors or blades are accessible from below the table, and limit switches must be installed on any moveable panels to interlock the control circuit to prevent saws from operating when panels or doors are open. If the doors or panels are opened during the saw cycle, the saw must stop. AZ-16 I limit switches is to be used.

4.5.2. Saw and guillotine blades are to be guarded when in the home (rested) position. All guillotine blades must come from the bottom and clamping unit form the top.

4.5.3. Rotary cutters that incorporate the nest/clamp as part of the guard must be designed in such manner that the clamp cannot open unless the cutter is guarded from the operator.

#### 4.6. HOT PLATE WELDERS

4.6.1. Hot plate welders are to have the bottom of the fixture enclosed around the heat stake to prevent the operator from coming into contact with the hot surface. All hot plates are gate operated to further protect the operator.

#### 4.7. GUILLOTINES

4.7.1. Where applicable (guillotines) blades are to be guarded separately. Guillotine's blades must be manufactured from D2; where applicable, blades are positioned underneath of tooling plate.

4.7.2. All guillotine nests must be CNC cut to the CAD data supplied with appropriate shrinkage of the material to be cut. ABC Engineering will supply the shrinkage percentage.

4.7.3. All Guillotine blades must be guarded from exposure at any time during the machine cycle. At no time during a cycle must the operator be able to come in contact with the blade, especially in a situation where the light curtain has been broken

# MACHINERY BUILD SPECIFICATION

## 5. Ergonomics:

- 5.1. Working heights for standing work are as follows;
  - 5.1.1. Light Assembly Work: 90-95cm (36-38”).
  - 5.1.2. Fine/Delicate Work: 95-110cm (38-44”).
  - 5.1.3. Heavy Work: 85-90cm (33-36”).
- 5.2. If the work height is adjustable then the working height is between 85-110cm (33-44”).
- 5.3. Horizontal reaches are maintained below 25cm. (Example: reaching into fixture for part)
- 5.4. For standing work a footrest should be provided at a height between 10-15cm from the floor.
- 5.5. The task can be done directly in front of the body with weight distributed evenly on both feet.
- 5.6. The lines of view are clear so the operator does not have to make awkward postures to load or unload the part or see the necessary displays.
- 5.7. The design minimizes twisting and bending of the body and minimizes elevation of the elbows.
- 5.8. The design allows the task to be done with either hand.
- 5.9. Forces exerted laterally are less than 15 lbs.
- 5.10. Storage bins are easily accessible so that parts can be comfortably picked, as needed using either hand with proper wrist posture.
- 5.11. Handles have grip handle with a diameter of 3.2-4.5cm (1.25-1.75”) and designed so there is no wrist deviation during use.
- 5.12. When placing the part in the fixture’s holding nest or die, the part fits properly without any Excessive force required.
- 5.13. Displays monitored by the operator are positioned at eye level between 150-165cm (60-65”) in height.
- 5.14. Balancers are fully adjustable and do not require excessive force to align tool.

## 6. General:

### 6.1. DEFECTS

- 6.1.1. If a defect is detected the process should stop itself so the defect can be removed/repared and the process restarted
- 6.1.2. Fixture(s)/Tooling are designed with poke-yoke to detect errors in the manufacturing process such as, but not limited to: Missed operations from previous steps, missing features/components, defective features/components, parts not functioning as expects, process interruption
  - 6.1.2.1. Section 11.2.2 of the RFP will clearly identify the poke yoke requirements
- 6.1.3. The machine will sound an alarm and provide a visual indication of the error to the operator
- 6.1.4. The equipment will retain the part and prevent its removal by the operator
- 6.1.5. The only method to release the part is through the use of a reset switch that requires the use of a key
- 6.1.6. Key specifics will be provided by the ABC plant
- 6.1.7. More than likely, there will be more than one person working in the assembly cell (this depends on takt time); however, the cell should be arranged such that one person can do it. This will ensure that the least possible space is consumed.

- 6.1.8. Less space translates to less walking, movement of parts, and waste.
- 6.1.9. U-shaped cells are generally best; however, if this is impossible due to factory floor limitations, other shapes will do.
- 6.1.10. Minimize horizontal work surfaces and tables between operations as these will accumulate parts. These surfaces if required should only hold the defined max number of parts required. The defined max number must be visual to ensure that it is respected
- 6.2. DRILLS AND PUNCHES
  - 6.2.1. All drills and punches to be equipped with a device that directs slugs and chips to a removable and easily accessible tray.
  - 6.2.2. Drill and punch sizes are to be built to maximum part specification plus an allowance for shrinkage. (Note that this is a general rule, actual sizes to be established at the concept sign-off stage).
  - 6.2.3. Multiple punches may be staggered to reduce pneumatic load requirement.
  - 6.2.4. All punches and dies to be easily replaceable without equipment or component disassembly.
  - 6.2.5. One spare set of punches; dies and blades, etc. are to be included.
  - 6.2.6. Punches to be engaged with die a minimum of 6mm prior to switch activation.
  - 6.2.7. Punch and die are to be mounted and located via dowels to a common steel base plate. This ensures that the punch and die cannot be moved relative to each other. The die set position is to be adjustable, in including in the direction perpendicular to the punch travel. Amount of adjustability to be determined at fixture kick off (1" is standard). Punch units must be adjustable on a common plate with die plate
  - 6.2.8. Wherever applicable (if specified) sensors will be mounted to check the presence of tab before punching and presence of hole after punching. This sensor must be an integral part of the punch unit so that whenever a punch unit is moved to meet the checking gauge requirement the sensor moves with the punch unit and no adjustment of the sensor is required
- 6.3. Fixtures will incorporate adjustability in all trim and finishing operations (cuts, punches, drills etc.) (Typical adjustment of 1")
- 6.4. Fixture to be identified front and back with the customer part number with character height of 3cm minimum. Fixture is also to include a nameplate identifying the following: Builder, Machine Application (car line etc.), build completion date, weight, utility requirements, Made in Canada (or country of origin) and statement of ownership. (Property of Ford, General Motors, Chrysler, Nissan, etc.)
- 6.5. The control panel is to be built within the machine frame. In applications where this practice is not feasible, external mounting robust enough to withstand normal handling in the manufacturing environment.
- 6.6. All screw threads to engage a minimum of 1.25x diameter for steel; 2x diameter for aluminum.
- 6.7. Machinery to be painted:
  - 6.7.1. General machine areas-Grey
  - 6.7.2. Guards and protruding areas-yellow
  - 6.7.3. Other color as specified by ABC during machine design review to meet customer specific requirements.
- 6.8. Equipment to be subject to a 30 hour "burn-in". This means that the equipment must be cycled continuously to identify potential failures prior to shipment to ABC-Plant.
- 6.9. Programming may be temporarily changed to achieve this requirement.

- 6.10. Size/ specification of perishable tooling to be posted in conspicuous location on the machine. This includes drill size, length, distance from part, etc. Templates to assist in setting up positions to be included whenever possible.
- 6.11. All Vision sensors must be COGNEX type, unless otherwise directed by the plant, or a specific application requirement. Actual model should be discussed with ABC Plant engineering to try to ensure commonality and reduce the variability of parts used. Written confirmation of the model is required.

## 7. Documentation:

- 7.1. Construction progress tracking will be accomplished by a supplier generated weekly progress report and/or by regular contact with ABC Plant Engineering representative responsible for the project. The method used to be determined by the corresponding ABC Plant Engineering representative.
- 7.2. The ABC-plant Engineering representative to approve the build concept in writing prior to construction.
- 7.3. Deviations from this concept must be clearly identified and approved.
- 7.4. Supplier must complete the attached pre-delivery checklist prior to or along with the shipment of the equipment. All of the requirements of the checklist must be met unless other arrangements have been made and documented in writing.
- 7.5. Copy of PLC programs, schematic (electrical, pneumatic, hydraulic, etc.), ladder diagram, mechanical drawings, operation and utility requirements (including voltage, current draw and approximate CFM) to be included with machine upon delivery. (Two copies)
- 7.6. Supplier to provide a detailed machine layout, including bill of material prior to construction for ABC-Plant approval.
- 7.7. Detailed drawings of non-standard perishable tooling to be provided. (two copies).
- 7.8. Any change after machine sign off to be revised in appropriate documentation and sent to ABC-Plant engineering. Access to and confirmation of the most up to date PLC program to be provided after every modification.
- 7.9. Any deviation from this specification must be documented in writing and signed as evidence of approval by the ABC Plant representative responsible for this program.

## 8. Drawings

8.1. All individual items and assemblies should contain a completed set of engineering drawing. All drawings should be completed to current ISO standards in a clear and organized manner. Drawings are accepted in latest version of Siemens Unigraphics NX in .prt format. If the drawings were created using different CAD software, a complete set of Edrawings must be submitted

### 8.2. DRAWING LAYOUT

8.2.1. All drawings both detail and assembly should be completed using a B sized sheet. As well the title block should contain the following items:

- 8.2.2. Company Header
- 8.2.3. Title (Part Name)
- 8.2.4. Drawn By:
- 8.2.5. Checked By:
- 8.2.6. Units
- 8.2.7. Date
- 8.2.8. Project Number
- 8.2.9. Applied Tolerances
- 8.2.10. Part Number
- 8.2.11. Quantity
- 8.2.12. Size
- 8.2.13. Surface finish
- 8.2.14. Material type

	DWG# : QTY : MAT'L : SIZE :  SURFACE FINISH <sup>80</sup> ✓ UNLESS OTHERWISE NOTED:  FINISH: TUFAM COATING SPECIAL REQ:
TOLERANCES TO APPLY FOR MACHINED SURFACES UNLESS OTHERWISE SPECIFIED FRACTION OR X. ± 0.01 ONE DECIMAL OR X.X ± 0.05 TWO DECIMALS OR X.XX ± 0.02 THREE DECIMALS OR X.XXX ± 0.005 FOUR DECIMALS OR X.XXXX ± 0.002 SQUARENESS: 0.005/FIN ANGULARITY: ±/- 30 MINUTES	TITLE:  DRAWN BY:  CHECKED BY:  SCALE: n/d    INCH METRIC <input checked="" type="checkbox"/> DATE:
TOLERANCE TO APPLY FOR FABRICATION (FLAME CUT ONLY) AND/OR WELDMENT FRACTION OR X. ± 1/16  ALL WELDS TO CONFORM TO THE LATEST REVISION OF CSA OR AWS STANDARDS  REMOVE ALL SHARP CORNERS AND DE-BURR	REVISION HISTORY  THIRD ANGLE PROJECTION JOB NO:

8.2.15. Orthographic Projection

### 8.3. DETAIL DRAFTING

8.3.1. All individual components will require a detailed engineering drawing. All drawing views should be organized and sized in such a manner that every dimensional feature can be visible and dimensioned. Include all required numerical tolerances and GD&T accurately and to the latest ISO standards.

### 8.4. BILL OF MATERIALS

- 8.4.1. The bill of material must have complete detail list of all the components or parts from the assembly and sub-assemblies drawing Fig. 2. Also, it should list standard components such as air cylinders, light curtains, sensors, etc.
- 8.4.2. Spare part list should be supplied separately for all components that are subject to wear and tear. Spares one each (guillotine blade, punches, dies etc) of all wear components must be supplied with the fixture.
- 8.4.3. The Bill of Materials must be populated for every assembly drawing. The Bill of Materials must show the following information: Part Name, Material, Size and Quantity. Bill of Material information will be entered into the part properties of all individual parts, and populated into the assembly BOM with the use of expressions.

## 9. ABC PLANT SPECIFIC FEATURES

Please follow the following components and recommendations unless otherwise specified:

- 9.1. All machine fasteners are to be Imperil/Metric as specified in the Purchase Order.
- 9.2. Pneumatic Cylinders: SMC/FESTO with (2) END SWITCHES each cylinder.
- 9.3. Pneumatic valves: SMC NVFS3100-5FZ; manifold NVV5FS3 – 01FD-081-03T
- 9.4. Pneumatic: pressure regulator with air filter NAW4000-80316 CDN; if required lubrication unit NAW4000-80264 CND.
- 9.5. Pneumatic Fittings: SMC
- 9.6. Rails and Bearings: Bosch Rexroth or THK
- 9.7. Drill Units: Desoutter
- 9.8. Push Buttons: Omron/ Sprecher Shue
- 9.9. Opto Touch buttons: Allen Bradley or Banner
- 9.10. Light Curtains: Omron F3S-A322L/ Sunx
- 9.11. Sensors: Omron / Sunx / Baumer / Keyence
- 9.12. Vision System: COGNEX
- 9.13. Power Supplies: Omron/Wiedmiller.
- 9.14. PLC and Operators Interfaces: Omron CPM1/CPM1A or Allen Bradley.
- 9.15. Electrical counter: Omron H7EC
- 9.16. Pneumatic Fittings: SMC
- 9.17. Rails and Bearings: Bosch Rexroth or THK
- 9.18. Drill Units: Desoutter
- 9.19. Push Buttons: Omron/ Sprecher Shue
- 9.20. Opto Touch buttons: Allen Bradley or Banner
- 9.21. Light Curtains: Omron F3S-A322L, F3SJ & F3SG / Sunx
- 9.22. Sensors: Omron / Sunx/ Baumer
- 9.23. Power Supplies: Omron/Wiedmiller.
- 9.24. PLC and Operators Interfaces: Omron CPM1/CPM1A or Allen Bradley.
- 9.25. Electrical counter: Omron H7EC
- 9.26. Specified components:
  - 9.26.1. Air guns, (CSA, EC or UL approved)
  - 9.26.2. Alarm to indicate pressure drop below 85 or 65 psi.
  - 9.26.3. Knock out system for part removal where necessary.
  - 9.26.4. Lexan, expanded wire mesh (PVC coated), glass for guard

## CHECKLIST

Type of Fixture:		Inspection Date:	
OEM Manufacturer:		Checked at:	Supplier or ABC
Tooling Source Job #:		Checked by:	
Part #:		Inspection #:	
Part Description:		Customer:	
Molding Cycle Time:		Annual Volume:	
Fixture cycle time: including load and unload		Model Year:	
Build Spec. Revision:		Planned Life (Years):	

### Safety and Approvals

1. \_\_\_\_\_ This equipment is built in accordance with ABC machinery Build Specification and as indicated on the Purchase Order and RFQ requirements.
2. \_\_\_\_\_ The equipment adheres to the current local Electric Safety Code, such as Ontario Hydro Electrical Safety Code and /or CSA Specifications and has received "Special Inspection" approval, where applicable.
3. \_\_\_\_\_ Proof of this approval is present in the form of a corresponding label. Number \_\_\_\_\_
4. \_\_\_\_\_ This equipment complies with CSA Safeguarding of Machinery Z432-94, where applicable.
5. \_\_\_\_\_ All machine pinch point hazards are guarded.
6. \_\_\_\_\_ Opening or removal of removable guards eliminates hazard. (E.g. disables machine via interlock etc.)
7. \_\_\_\_\_ The machine safeguarding design prevents unsafe stopping times and distances.
8. \_\_\_\_\_ Guard mountings are compatible with the strength and duty of the guard.
9. \_\_\_\_\_ The guards do not present any hazards, such as trapping, shear points, rough or sharp edges or any other concerns that may cause injury.
10. \_\_\_\_\_ The machine guarding prevents the material that is being processed from endangering the operator.
11. \_\_\_\_\_ Lockout procedure to be provided for routine maintenance to hazardous areas of the machine.
12. \_\_\_\_\_ The safeguarding systems for the machine have achieved their function with minimal or no Downtime in productivity.
13. \_\_\_\_\_ Machine guarding to incorporate inter-locks tied to the emergency stop.

14. \_\_\_\_\_ Whenever pinch point cannot be guarded protective covers are used.
15. \_\_\_\_\_ Where barrier guarding is used it must remain locked until work cycle is complete.
16. \_\_\_\_\_ When accessible service gates/guarding of the fixture are opened, the machine stops.

### **Machine control:**

17. \_\_\_\_\_ Stop controls are red and maintain a mushroom-type shape.
18. \_\_\_\_\_ All Machine controls and Push buttons are Omron or Eaton.
19. \_\_\_\_\_ Start controls are green include a protective collar. (Unless otherwise specified)
20. \_\_\_\_\_ Reset/Return/Homing controls are yellow.
21. \_\_\_\_\_ Manual functions are black in color.
22. \_\_\_\_\_ All controls are clearly labeled with either words or symbols to identify function.
23. \_\_\_\_\_ The emergency stop device stops the machine as quickly as possible. It is hard wired and isolates the main power whenever used.
24. \_\_\_\_\_ Use of the emergency stop does not return the machine to home position.
25. \_\_\_\_\_ Power-operated work holding devices stops the machine as quickly as possible. It is hard wired and isolates the main power whenever used.
26. \_\_\_\_\_ Hand controls are used to close the door and then begin the machine cycle.
27. \_\_\_\_\_ Where two activation devices are used to start the cycle; anti-tie down self-monitoring device must be used.
28. \_\_\_\_\_ Where possible a Banner Opti-Touch OTB series start button is used.
29. \_\_\_\_\_ Where applicable the Omron F3SN light curtain is used.
30. \_\_\_\_\_ The light curtain is guarded from accidental damage.
31. \_\_\_\_\_ The light curtain is located a minimum distance of 8" (200mm) from all moving objects.

### **Electrical and electronics:**

32. \_\_\_\_\_ PLC is in use with 25% spare I/O (minimum 4 of each).
33. \_\_\_\_\_ PLC has a spare Serial RS232 type port available for CMS signals. (Where applicable)

- 34.\_\_\_\_\_ Panel is labeled and documented accordingly.
- 35.\_\_\_\_\_ Fuse rating are posted in a visible location and identifies all fuses and relays in the panel.
- 36.\_\_\_\_\_ Sufficient space available for expansions of the PLC.
- 37.\_\_\_\_\_ No direct connection of wires to the PLC I/O units. Must have terminal blocks.
- 38.\_\_\_\_\_ All wire are terminated by Ferrules.
- 39.\_\_\_\_\_ All Outputs are 24VDC.
- 40.\_\_\_\_\_ All Sensors are Omron, or Baluff and are PNP polarity.
- 41.\_\_\_\_\_ The machine adheres to the electrical requirements in the latest version of ABC Machinery Build Specification.
- 42.\_\_\_\_\_ PLC has an Ethernet port for integration.

### **PLC Programming:**

- 43.\_\_\_\_\_ Soft copy of the most up to date PLC program is in the manual.
- 44.\_\_\_\_\_ No password is applied on the PLC or HMI modification and programming access.
- 45.\_\_\_\_\_ All bits are labeled according to their action.
- 46.\_\_\_\_\_ All I/O are labeled accordingly, and spare I/O are labeled as spare.
- 47.\_\_\_\_\_ All sensors are being verified for both “OFF” and “ON” state during the PLC program.
- 48.\_\_\_\_\_ No Shift registers of any kind in the programming.
- 49.\_\_\_\_\_ The program is preventing of rerunning the same part twice.
- 50.\_\_\_\_\_ Password entered using HMI hardware or electronic ID card reader.

### **Ergonomics:**

- 51.\_\_\_\_\_ Working heights for standing work are as follows;
- 52.\_\_\_\_\_ a)Light Assembly Work: 90-95cm (36-38”).
- 53.\_\_\_\_\_ b)Fine/Delicate Work: 95-110cm (38-44”).
- 54.\_\_\_\_\_ c)Heavy Work: 85-90cm (33-36”).

- 55.\_\_\_\_\_ If the work height is adjustable then the working height is between 85-110cm (33-44”).
- 56.\_\_\_\_\_ Horizontal reaches are maintained below 25cm. (Example: reaching into fixture for part)
- 57.\_\_\_\_\_ For standing work a footrest should be provided at a height between 10-15cm from the floor.
- 58.\_\_\_\_\_ The task can be done directly in front of the body with weight distributed evenly on both feet.
- 59.\_\_\_\_\_ The lines of view are clear so the operator does not have to make awkward postures to load or unload the part or see the necessary displays.
- 60.\_\_\_\_\_ The design minimizes twisting and bending of the body and minimizes elevation of the elbows.
- 61.\_\_\_\_\_ The design allows the task to be done with either hand.
- 62.\_\_\_\_\_ Forces exerted laterally are less than 15 lbs.
- 63.\_\_\_\_\_ Storage bins are easily accessible so that parts can be comfortably picked, as needed using either hand with proper wrist posture.
- 64.\_\_\_\_\_ Handles have grip handle with a diameter of 3.2-4.5cm (1.25-1.75”) and designed so there is no wrist deviation during use.
- 65.\_\_\_\_\_ When placing the part in the fixture’s holding nest or die, the part fits properly without any Excessive force required.
- 66.\_\_\_\_\_ Displays monitored by the operator are positioned at eye level between 150-165cm (60-65”) in height.
- 67.\_\_\_\_\_ Maintenance or set-up controls are separate from operator controls.
- 68.\_\_\_\_\_ Balancers are fully adjustable and do not require excessive force to align tool.

## **Documentation:**

- 69.\_\_\_\_\_ The machine was provided with 2 identical manuals.
- 70.\_\_\_\_\_ The Manual include at least the following sections:
- a.\_\_\_\_\_ General Information (OEM, over all dimensions, Power information, etc.)
  - b.\_\_\_\_\_ A signed copy of the Safety report.
  - c.\_\_\_\_\_ All Electrical diagrams, Primary circuit, all secondary circuits, safety circuits, PLC units, and any other electrical unit that was not mentioned above.
  - d.\_\_\_\_\_ Pneumatic diagrams
  - e.\_\_\_\_\_ I/O and components list, including a recommended spare parts and components list.

f.\_\_\_\_\_ The most up to date, soft copy of all PLC, HMI and any other programmable Component program

g.\_\_\_\_\_ Hydraulic schematic (where applicable)

h.\_\_\_\_\_ All the components manuals.

i.\_\_\_\_\_ recommended spare parts re-fabrication drawing (Including: Material, treatment,etc.)

71.\_\_\_\_\_ All diagrams are exactly matching the labels and all changes are reflected in the documentation.

Checked By: \_\_\_\_\_ Date: \_\_\_\_\_ Approved / Rejected

In case of a rejection please see attached report.

Notes: