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Commercial Statement of Work - Capital Equipment

The Commercial Statement of Work (‘‘SOW”) establishes guidelines for an **Equipment Manufacturer (“Supplier”)** to follow in responding to Metaldyne’s **Request for Quote – Capital Equipment (“RFQ”) FRM002045** regarding construction of capital equipment (“the equipment”) for **Metaldyne**. If Supplier must deviate from the SOW, all exceptions must be clearly set out in writing in the proposal. Any proposal made in response to this Statement of Work will be assumed to be in complete adherence to these guidelines unless clearly stated otherwise. All communications between Metaldyne and Supplier relating to this SOW and the RFQ shall be treated as confidential. All formal quotes should be sent to the originator of the RFQ. Formal quotes greater than **$50,000** should also be sent to the Supply Chain - Capital Equipment Buyer.

Supplier’s proposal must be received by the date set in the Metaldyne RFQ and comply with all Metaldyne requirements as stated in the RFQ and the SOW. Upon selection of a Supplier, Metaldyne will prepare a formal Purchase Order (“PO”).

Index

II. SUPPLIER COMMERCIAL PROPOSAL REQUIREMENTS

Quote / Pricing

Unless stated otherwise, a proposal for manufacture and delivery of the equipment should include a formal quote for the complete project. When providing a budgetary quote, the proposal should clearly state that the quote is budgetary. Metaldyne will request a formal quote prior to placing an order for the construction of manufacturing equipment. The formal quote must include a picture and provide sufficient detail and accuracy to permit Metaldyne to generate a purchase order for the equipment. The formal quote should include detailed pricing for all proposed options. Quotes shall be valid for a minimum of sixty (60) days. The Supplier's proposal must identify subcontractors that will participate in the fabrication of the equipment. All pricing for the equipment should be categorized into capital, tooling, and gauging following the generally accepted practices of major OEM's in respect of classifying capital equipment. If Supplier has any questions regarding the classification of an item, contact the Project Engineer at Metaldyne for assistance. Options and exceptions must be detailed on the quote.

Delivery Terms

Supplier must provide a separate line item listing that shows detailed charges for packaging, crating, shipping transportation, insurance, and testing, as well as customs duties, taxes, and brokerage for international shipments. Supplier shall notify Metaldyne of shipment at least ten (10) days prior to actual shipment. Supplier shall further notify Metaldyne of the actual shipment of the Equipment on the date of such shipment, the bill of lading numbers, mode of shipment, carrier, and estimated time of arrival at Metaldyne's facility and provide copies of the shipping documents including commercial invoice, certificate of origin(s) and bill of lading.

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Importation and Duties

If the Purchase Order terms are Delivery Duty Paid (DDP) Metaldyne's facility, the supplier shall be the importer of record for the equipment and all components thereof. Supplier will be responsible for all documentation, duties, tariffs and taxes required to bring the equipment and components into the country that Metaldyne requires, except VAT, which will be paid by Metaldyne's facility in the importing country

Payment Terms

All Invoices must include the PO number. Metaldyne will only make payments on original invoices. All invoices must match PO by line item showing the amount due for that specific line item (i.e., if there are 5 line items on the PO at the 90% pay point, all 5 line items should be listed on the invoice at 90% of the total PO price). Invoices must be submitted to the appropriate Metaldyne location and contact in accordance with PO instructions.

Capital - Standard terms are 90/10 NET 70 DAYS.

Invoice %	Milestones
90%	• Approval by Metaldyne Project Engineer of the following: (1) Specifications (2) Engineering drawings (3) Fixture drawings (4) Tooling layout • Successful completion of **Pre-Acceptance Runoff at Supplier** (Appendix B - Schedule I) • Successful completion of any other pre-defined requirements
10%	• Successful completion of **Final Acceptance Runoff at Metaldyne** (Appendix B - Schedule II) • Successful completion of any other pre-defined requirements

Tooling - Standard terms are 100% NET 70 DAYS after Metaldyne PPAP approval from customer. Customer's Tooling Guidelines are incorporated herein by this reference and may be found at http://metaldyne.com

If Supplier proposes payment terms different than Metaldyne's standard terms, the payment installments must correspond with specific project achievement. Payments should not be based upon issuance of Purchase Order. Any deviation from Metaldyne standard payment terms will negatively impact a supplier's ability to be awarded business.

Warranty

Metaldyne requires warranty terms of 11,520 machine operating hours or two years, whichever is less, beginning the date of Start of Production ("SOP") at Metaldyne. However, in the event that Supplier's standard warranty terms are one (1) year and Supplier charges a premium for a two (2) year warranty, Supplier must separately show the additional cost for the additional year of warranty coverage as an option on their quote.

During the warranty period, the supplier is obliged to rectify all faults or defects which occur or have been discovered in the machinery or equipment immediately and free of charge to Metaldyne. The supplier at its expense shall rectify defects covered by the warranty, which were notified to the supplier in writing within the warranty period, even if the warranty has expired.

Performance Guarantees

Supplier and Metaldyne may establish performance criteria that the Supplier will be required to meet. Unless otherwise agreed in writing, the Equipment Performance Requirements set forth in Metaldyne's RFQ shall govern. The Supplier will be required to guarantee performance for perishable tool costs, quality & process capability requirements, volume throughput, cycle time, manpower, and launch timing as set forth in the Metaldyne RFQ.

Failure Mode & Effect Analysis (FMEA)

It is our expectation that suppliers will have a carried out FMEA analysis of their equipment, a copy of the machine / equipment FMEA will be required 2 weeks prior to the runoff date, on the supplier's floor, of the machine or equipment.

Life Cycle Costs (LCC)

Supplier should provide estimated costs for each of the consumables used in the manufacture of components by the proposed equipment, and also usage of electricity (KW), compressed air (m^3) & coolant (Liters). Values should be stated for cutting & idling. In addition, hydraulic oil (Liters) lubrication oil (Liters) and cutting oil other than coolant (Liters) should be stated along with any change frequency.

Perishable Tooling

The Supplier will provide all perishable tooling needed to perform runoffs on both Supplier's and Metaldyne's floor. Supplier also must list all special order tools and the corresponding price, tooling supplier name, contact name and telephone number, supplier tool identification number and the normal lead-time. The Supplier will provide three (3) sets of tools at completion of operational runoff. Supplier must provide estimated tool life, speeds and feeds. Supplier and Metaldyne will establish a perishable tool cost target per piece and supplier must guarantee it as least during the warranty period. Tools must conform to applicable standards in the industry.

Time Study and Production Estimates

Metaldyne equipment production requirements should be stated in the **Request for Quote – Capital Equipment FRM002045.** Supplier is responsible for the accuracy of its cycle time and production estimates. Supplier is required to commit to a maximum cycle time that will support Metaldyne's production requirements as specified in the **Request for Quote – Capital Equipment FRM002045**. The equipment and the manufacturing process performed thereby shall reliably and repeatedly meet the quoted cycle time and production estimates. Supplier will be responsible for providing additional equipment, at its cost, to make up for any shortfall in production requirements as required by Metaldyne.

Capacity / Efficiency

The base line capacity is based on 240 work days per year, 22.5 hours per day, with five (5) working days per week and 85% efficiency unless otherwise specified. Operator influence should not be considered a factor in determining capacity/efficiency. The efficiency should reflect acceptable amounts of time for tool maintenance, preventative maintenance, periodic clean-up, and any other variable consistent with the operation of the equipment. Supplier must provide the detailed analysis of its efficiencies. Efficiencies must be calculated for individual operations as well as the entire system. Supplier must state expected efficiency of the equipment based upon productive uptime of the equipment as a percentage over a 22.5 -hour (3 shift) period. Metaldyne requires cell/machine uptime of at least 95%. Metaldyne defines uptime as 100% less "Unavailable Time". Unavailable time means the time involved when any of the following shall take place and continue: (i) the Equipment fails to operate,

(ii) the Equipment fails to operate in accordance with the Equipment Specifications; (iii) the Equipment operates inconsistently or erratically; (iv) a component of the Equipment is inoperative which renders the Equipment substantially inoperative for Metaldyne's purposes; (v) the Equipment is not operated by Metaldyne because of potential danger of the Equipment to operators, employees, or property.

Manpower Requirements

The supplier shall be responsible for clearly defining the manpower requirements for the operation of the quoted process. This includes time studies and job responsibilities/roles. Supplier and Metaldyne will agree to a target for manpower. If additional manpower is required due to the Supplier's equipment/process performance, the Supplier may be subject to a penalty to be established between Metaldyne and the Supplier.

Timing and Timing Chart

Supplier must provide with the proposal, at a minimum, the following dates:

- PO Need Date.
- Design and drawing preparation, submission and review (including electrical)
- Design and drawing sign-off by Metaldyne
- Commencement and completion of all stages of manufacture
- Fixtures and gauging due dates, as well as all major purchased components delivery dates.
- Running trials at vendor's facility (if applicable).
- Trial parts due to Supplier, including quantities.
- Start of Equipment Pre-Acceptance Runoff at Supplier's facility.
- Equipment Pre-Acceptance Runoff on Supplier's Floor complete.
- Equipment ready to deliver to Metaldyne.
- Equipment packaging / crating for shipment.
- Estimated shipping.
- Customs clearance (if applicable).
- Equipment Delivery to Metaldyne.
- Commencement and completion of installation.
- Start of Final Acceptance Runoff at Metaldyne.
- Equipment Acceptance at Metaldyne (including capacity confirmation) complete.
- Commissioning
- Submission of final drawings, manuals, etc.

Within no later than (2) two weeks after issuance of a Purchase Order, the Supplier shall provide to the Metaldyne Engineer and Program Manager a detailed **Timing Chart** (see example of a partial chart in **Appendix A**), which is to be updated at a mutually agreeable frequency. The timing chart should show all mutually agreed key milestones. Metaldyne prefers the use of Microsoft Project software. Any situations, that may cause the Supplier to not meet the originally proposed timing, must be documented in writing to Metaldyne's Program Manager and the Project Engineer immediately. The Supplier must identify any performance gap areas and develop contingency plan(s) to recover from delay(s), at Supplier cost.

Project Management

Supplier will be required, at a minimum, to do the following:

- Supplier will assign a project manager who will be Metaldyne's key contact for the duration of the project. The project manager will have full responsibility to assure the project conforms to all Contract requirements.
- Supplier will describe their process and the expected results of Simultaneous Engineering.
- Supplier will assign a multi-discipline technical and administrative project team to execute all aspects of the scope of work of the Contract.
- Supplier will prepare the Equipment layout and arrangement drawings and bills of material to clearly define all aspects of the Equipment to be furnished.

Design Approval and Engineering Changes

- Drawings and other relevant information will be sent to Metaldyne for approval before the start of any manufacturing. Metaldyne will have ten (10) business days to review drawings and information submitted for approval.
- If changes to the Equipment Performance Requirements or Equipment Specifications are proposed by Metaldyne, Supplier will give each such proposal its most serious and prompt attention. Supplier will respond within five (5) business days by stating in writing what effect, if any, such changes will have on the Purchase Price, Delivery Date and other provisions of this Agreement. In the absence of a written statement from Supplier, it shall be conclusively presumed that the provisions of this Agreement shall apply without modification should Metaldyne elect to amend the Equipment Performance Requirements or the Equipment Specifications with the change.
- If changes in the Equipment Performance Requirements or Equipment Specifications are elected by Metaldyne to be incorporated into the Contract, any such changes to the Equipment Performance Requirements or Equipment Specifications shall be evidenced by an amended purchase order. Such amended purchase order shall amend the Equipment Performance Requirements or Equipment Specifications appropriately to incorporate the change and acknowledge the effect, if any, of the change on the Purchase Price, Delivery Date and other provisions of this Agreement. Such amended purchase orders shall be signed by an authorized representative of Metaldyne. If Supplier elects not to accept an amended purchase order as written, Supplier will notify Metaldyne in writing within five (5) business days of its receipt. If such notice is not received by Metaldyne, the amended purchase order shall be deemed accepted.
- Supplier shall promptly advise Metaldyne of all reasonably available technological advances which are known or becomes known to Supplier over the course of performance of its obligations under the Contract which may result in the Equipment having added value (i.e., better performance, design, material, longer useful life, etc.) to Metaldyne. Should Metaldyne elect to incorporate such advances it shall do so with an amended purchase order.

Rigging

- The proposal must clearly identify the responsibility for transportation of the equipment to the Metaldyne facility. This should include allocation of responsibility for rigging at Supplier's location and at the Metaldyne location. Supplier must also clearly define the extent to which the machine/system will be disassembled for shipping. This information should cover the mechanical, electric and hydraulic systems. The supplier is also responsible for communicating the physical size and weight of 'each component' to the Project Engineer at the receiving Metaldyne facility at least 10 days before shipping or 30 days before shipping if Metaldyne is responsible for the transportation.. This information should be detailed enough to allow the receiving facility to determine if the components will fit through available doorways and aisles.
- Supplier will disassemble, prepare, and package the Equipment for shipment for damage free transportation to Metaldyne's facility. Wood packaging must meet ISPM15 (International Standards Phytosanitory Measures). Shipping containers must be designed and constructed to protect the Equipment against dust, moisture, oxidation, vibration, and all other damage during shipment to Metaldyne and comply with government regulations for such shipments.

Setup and Installation

- Supplier will clearly define the role it will take in the installation and set up of the equipment on Metaldyne's floor. This definition should specify whether the Supplier is acting in a supervisory role or performing the installation. The number of persons and the equipment being provided or needed for the installation should also be included. Supplier setup crew/contractors will abide by all Metaldyne, Occupational Safety Health Administration (OSHA) and other health and safety, rules, regulations, practices and procedures.
- Supplier must provide on-site technical support, as required from Metaldyne, from equipment commissioning until after Start of Production (SOP) in which equipment has successfully and consistently run at rate for a minimum of eight weeks.
- Supplier is responsible for ensuring adequate quantities of all spares are available during installation and commissioning period to ensure a successful installation and quick turn around of damaged / faulty parts during installation.

Pre-Acceptance Runoff at Supplier and Final Acceptance Runoff at Metaldyne

- Prior to shipment of the Equipment to Metaldyne, the **Pre-Acceptance Runoff at Supplier "Appendix B – Schedule I" and New Equipment Evaluation Appendix C** must be completed.
- Within thirty (30) days of delivery of the Equipment to Metaldyne, or as required by Metaldyne's global location, the Supplier shall be prepared to assist Metaldyne with the Final Acceptance Runoff. All equipment must have a **Final Acceptance Runoff at Metaldyne** "**Appendix B - Schedule II**" completed and approved for final equipment approval and payment authorization. The Acceptance of the Equipment shall in no way release Supplier of any of its obligations hereunder.
- In the event that the Equipment does not pass Final Acceptance Runoff, Metaldyne shall itemize those areas in which the Equipment has failed to perform acceptably. Supplier shall acknowledge said list and inform Metaldyne, in writing, as to when the non-conformance shall be corrected. Supplier agrees that time is of the essence with regard to such modifications. **Metaldyne shall have the right to withhold payment of any funds normally due by virtue of Final Acceptance.** Upon completion of the modifications by Supplier, Supplier shall notify Metaldyne of the same and the Final Acceptance Runoff shall be rerun in its entirety should Metaldyne elect to do so.

Delivery

- All deliveries must be marked with the following information: for the attention of (relevant Program Engineer/ Manager's name), Metaldyne's Purchase Order number and weight and height (clearly stenciled on the box).
- Metaldyne shall have the option to advance delivery dates provided that such advance delivery dates shall not unreasonably interfere with Supplier's manufacturing schedule. Metaldyne shall notify Supplier of its election to advance a delivery date, which the Supplier shall promptly acknowledge. If the Supplier will incur additional costs from advancing delivery dates, the Supplier will submit these to Metaldyne within 10 days after receipt of notice of the advanced delivery request.

Late Delivery

1. Failure to successfully complete the **Pre-Acceptance Runoff** at Supplier by or before the mutually agreed upon date in the **Program Timing Chart** may subject the Supplier to penalties, which will be pre-determined between the Supplier and Metaldyne.
2. Failure to successfully complete the **Final Acceptance Runoff** at Metaldyne by or before the mutually agreed upon date in the **Program Timing Chart**, may subject Supplier to withholding by Metaldyne of **one** percent **(1%)** of the Purchase Price per week. This remedy shall not be the exclusive remedy and does not limit Metaldyne's ability to seek all other recoveries available at law or in equity.

   Supplier will not be subject to the above penalties due to delays that are directly attributable to Metaldyne or its customers.

Performance By Supplier

- Supplier's activities and the performance of its obligations hereunder shall at no time interfere or hinder the operation of Metaldyne's business conducted at Metaldyne's site. Supplier shall keep the premises and the site free from accumulation of waste materials or rubbish caused by the performance of Supplier's obligations hereunder.
- At the completion of the performance of its obligations hereunder, Supplier shall remove from the site all of Supplier's tools, construction equipment, machinery, surplus materials, waste materials and rubbish. Notwithstanding the foregoing, Metaldyne shall be responsible for the removal or the remediation of all materials contaminated with hazardous materials used in Metaldyne's operations; provided, however, is such contamination occurred due to the actions of Supplier or any of its Subcontractors, such removal or remediation shall be at Supplier's sole expense.
- All portions of Supplier's obligations hereunder which Supplier does not perform with its own forces shall be performed under subcontracts. Supplier understands and agrees that no contractual agreement will exist between Metaldyne and any of the Subcontractors. Further, Supplier understands and agrees that it alone is responsible to Metaldyne for all of its obligations hereunder and that any review of Subcontractors by Metaldyne will not in any way make Metaldyne responsible to nor for the actions or failure of any Subcontractor.
- Supplier should clearly state any additional services that it is providing as part of its proposal.

Preventative Maintenance, Repairability and Maintainability

Supplier is to provide a Preventative Maintenance (PM) plan at time of equipment delivery to Metaldyne. The Metaldyne Plant will maintain documentation providing evidence of adhering to the preventative maintenance schedule (frequency) and activities that are mutually agreed to between Supplier and Metaldyne. The schedule and frequency that is developed will be in accordance with generally accepted industry standards and will be worked out between the Metaldyne Plant and Supplier. Supplier will apply the principles of reparability and maintainability contained in the most current SAE publication Repairability and Maintainability Guideline for Manufacturing Machinery and Equipment.

Training & Manuals

The Supplier's proposal to provide operator training for the Equipment and other services should be documented by the Supplier in its formal quote and concurred with by Metaldyne. The duties of operators must be described and included with Supplier's proposal. Supplier needs to clearly state the number of hours and type of training that are included in the proposal. This should include description of the topics to be covered, number of Metaldyne personnel being trained, the location of the training and any additional expenses not included in the quote. Three duplicate sets of instruction manuals in both hard copy and electronic media must be provided including system operator start up, system integration, maintenance and trouble shooting. Machine assembly drawings containing replacement part numbers must be provided and a complete set of detail drawings must be provided on 'specials' for plant reference. Training personnel must be able to speak the native language of the country where the equipment is being installed or Supplier must provide an interpreter. Training manuals must be provided at the time of Pre-Acceptance Runoff.

Spending Curve

Supplier must include with its quotation a time-phase spending curve or an original program budget. During the life of this contract, Metaldyne may request updated spending curves, which should include the original program budget curve and a second curve showing the actual costs incurred at the time of the report with a forecast out to completion of the contract.

Language

Metaldyne requires that the Supplier provide all manuals and drawings in both English and the native language of the country receiving the equipment. All controls, switches warning labels, etc. shall have templates in the language of the country receiving the equipment.

Print Dimensions and Tolerances

Supplier is responsible for ensuring that all dimensions on the part(s) are achieved with proposed process to a capability level described in **Section IV – Equipment Capability Runoff Guidelines & Requirements**.

Drawings and Drawing Approval

- Supplier will provide a complete set of D-size drawings on Metaldyne title block within thirty (30) days of delivery of equipment to Metaldyne. If drawings are in CAD or other electronic form, a reproducible set of drawings must be provided. Supplier must supply prints to all custom components and altered standards including, but not limited to, equipment fixtures, gaging, or any other components.
- Approval of engineering, electrical, layout and other prints by Metaldyne personnel does not relieve the Supplier of final responsibility for the function and capability of the equipment or its tooling.

CAD Data

Supplier is responsible for having the ability to review and analyze two (2) and three (3) dimensional math data in one of the following format types: Unigraphics, SDRC Ideas, ProEngineer, AutoCAD or Catia. Supplier shall advise Metaldyne if it is unable to view data in one of the aforementioned formats.

Service and Spare Parts

- Time is of the essence.
- Response time for a return call is not to exceed 30 minutes.
- Maximum time between receipt of call and arrival of service technician, wear parts, or spare parts in Metaldyne's facility should not be greater than 24 hours. Service parts shall be provided for the life of the equipment at market rates.
- Provide a parts list for all purchased components with supplier name, address and phone number, delivery time and price.
- Metaldyne and Supplier must mutually determine all A, B, C critical category spare parts/wear parts and spare parts/wear parts back-up stock levels at mutually agreed upon supplier location(s) within 90 days after Metaldyne issues a PO for this contract.
- Willingness and conditions of Supplier to place consigned replacement components at a Metaldyne location.
- Location of nearest service center to the Metaldyne location being quoted.
- Number, type, and experience level of servicemen at the above location.
- After hours contact availability twenty-four hours a day, seven days a week year round (24/7/365).
- Spare parts cost structure must be discounted 25%.
- Service technician cost structure must be discounted 25%.
- Wear parts must be provided at no cost during the warranty period.
- In the event the Supplier is unable to provide custom built components in the time frame required by Metaldyne, the Supplier must provide any and all engineering drawings and documentation so that Metaldyne may either build the component or have it built locally.

Currency

Supplier shall quote the price of all equipment in U.S. Dollars. If the equipment destination is a Metaldyne plant that is located outside of the United States, it should also be quoted in the currency of the destination country. The quote should indicate the Foreign Exchange Rate that applies.

Additional Obligations of Metaldyne

- Assign a Program Engineer/Manager who will be Supplier's key contact for the duration of the project.
- Responsible for providing Equipment Performance Requirements to the Supplier (if different from the general Equipment Performance Requirements in the SOW).
- Responsible for all rigging at Metaldyne's facility to insure proper Equipment location and installation including placing the Equipment into position, assembling all components, leveling the Equipment and bringing plant utilities to the Equipment.
- Provide materials and personnel for Pre-Acceptance Runoff at Supplier's facility for design, setup, debug, and tryout. The materials should be within part print specifications with respect to dimensions, materials, and quality levels.
- If required, engineer, furnish and install all foundations, anchor bolts, and associated materials for the Equipment. Engineering data regarding anchor bolt locations, sizes, and foundation loads will be provided by Supplier.
- Engineer, furnish and install all materials necessary to provide required utilities for proper functioning of the Equipment to meet the Equipment Specifications set forth by Supplier. Metaldyne shall provide appropriate shut-offs and/or disconnects for these utilities. Engineering data regarding disconnect locations and utility requirements will be provided by Supplier.
- Assure Supplier that the job site is thoroughly and properly prepared to receive the Equipment and that installation is not impeded by site conditions.
- Provide all necessary labor, supervision, materials, parts and support to enable the start-up, runoff and Final Acceptance Runoff.
- Responsible for all environmental permits, licensing, or other requirements resulting from the use of materials, components, or devices supplied directly by Metaldyne, or used to operate or maintain the Equipment.
- Responsible for providing appropriate tax exemption certificates to Supplier.

Questions

Technical and process questions related to quoting the equipment should be directed to the Metaldyne Project Engineer. Questions of a commercial nature should be directed to the Metaldyne Supply Chain – Capital Equipment Buyer.

III. CONTRACT TERMS AND CONDITIONS - CAPITAL EQUIPMENT PURCHASE ORDERS

A. PARTIES "Seller and/or Supplier as used herein, mean the addressee. "Buyer", as used herein, means Metaldyne.

B. **CONTRACT.** This Capital Equipment Purchase Order and the following Attachments comprise the agreement ("the Contract") whereby Buyer agrees to purchase from Seller and Seller agrees to deliver to Buyer, equipment, fixtures, gauging, and/or tools (hereafter called "Equipment") for use in a Metaldyne facility:

- Commercial Statement of Work – Capital Equipment, associated exhibits, schedules, and addendums, including these Contract Terms and Conditions
- Supplier Proposal as Approved by Buyer
- Manufacturing Equipment Drawings and Part Drawings with Specifications, Revision Level and Date

All terms, conditions, specifications, and other requirements contained in the Attachments are incorporated by reference into this Contract and become a part of the Contract as fully as if expressly set out herein. The Contract contains the entire agreement of the parties with respect to the subject matter hereof and all other terms, conditions, negotiations, proposals or agreements are hereby superceded and excluded.

C. AMENDMENT. No verbal or written order or amendment by Seller shall be binding unless confirmed in writing by Buyer. Seller agrees that Seller's written acceptance of the Contract, or the commencement of any work or service under the Contract shall constitute Seller's acceptance of the Contract. Any and all terms and conditions, whether oral or written, proposed by Seller which are different from or in addition to the Contract are unacceptable to Buyer, are expressly rejected by Buyer, and shall not become a part of the Contract.

D. MATERIALS AND WORKMANSHIP – QUALITY, SUBSTITUTIONS OR CHANGES, WARRANTY

1) **Quality:** All components and materials used in the Equipment delivered to Buyer under this Contract shall be in strict conformity with the Contract. Seller shall maintain test data to substantiate compliance with the foregoing; and Seller's manufacturing processes and inspection system shall be subject to on-site review and verification by representatives of Buyer or Buyer's customers during performance of this Contract.
2) **Substitutions or Changes:** Seller shall be strictly liable for any failure in performance of the Equipment resulting from any substitution or changes made in respect of design, materials or workmanship, or the processes used by Seller in the production of Equipment to be supplied under the Contract. Any substitutions or changes made by Seller in relation to any Equipment or materials ordered hereunder, including substitutions or changes in:
   (a) Materials, workmanship, design, layout, size, or other substitution or change affecting capability, reliability, or productivity; or
   (b) The processes employed by Seller In the production thereof, following Buyer's approval of the original design, function, materials, workmanship or processes either by written notice, prior purchase and acceptance of the item, or Seller's submission of initial samples to Buyer, shall be disclosed to and approved in writing by Buyer in advance of any substitution or change hereunder.
3) **Warranty:** Seller warrants that all Equipment or materials covered by this Contract will be delivered to Buyer with good and marketable title, free and clear of all liens and encumbrances, will be of merchantable quality, will be fit for any specific purpose set out in the Contract, will conform to all drawings, requirements, specifications or other description related thereto including those set out the Contract, and will be of good quality, material and workmanship and free from defects. These warranties also shall constitute conditions precedent, shall survive inspection, acceptance and payment, and shall remain in effect for 11,520 machine hours of production or two years, whichever is less, beginning the date of Start of Production ("SOP") at Metaldyne. Seller will obtain and provide to Buyer, for any and all goods or equipment acquired by Seller and supplied to Buyer under this Contract, a written and signed assurance from the manufacturer that the Buyer obtains the benefit of any manufacturers' warranty. If Seller is unable or fails to provide to Buyer the manufacturers' warranty for acquired goods and equipment, Seller hereby warrants to Buyer the goods or equipment supplied hereunder will perform in accordance with the manufacturers' warranty.
   (a) Claims for nonconformity shall be made to Supplier within such period as is reasonable under the circumstances. Supplier may either send a service representative or have the Equipment returned to its facility at Supplier's expense for inspection. If the Equipment is nonconforming with respect to the above warranties, the Equipment will be replaced or repaired, at Buyer's option, free of any charge to Buyer. Supplier shall also reimburse Buyer for authorized transportation costs.
   (b) The rights and remedies of Buyer set forth herein are cumulative and in addition to any other rights or remedies provided by law or equity.

E. CONTRACT ESSENTIALS, DELIVERY, RISK OF LOSS AND INSURANCE, RIGHT OF REFUSAL, PACKING & CARTAGE, LEIN RIGHTS

1) Conformance with the Buyer's requirements for capability, productivity, and time of delivery are the essence of the contract.

2) Delivery shall not be deemed complete until goods or materials actually have been received, inspected, runoff, and accepted by Buyer.

3) Supplier shall bear the risk of loss for the Equipment and any Buyer-Supplied Equipment until it is delivered and unloaded at Buyer's facility. Thereafter, Buyer shall bear risk of loss. While Supplier has the risk of loss, Supplier agrees, at its own expense, to procure and carry suitable fire, sprinkler leakage and extended coverage insurance on material, work-in-process and any furnished items, which comprise or eventually comprise the Equipment (as well as on Buyer-Supplied Equipment). The amount to be insured shall be the actual replacement value of said materials, work-in-process, furnished items and Buyer-Supplied Equipment. Such insurance shall provide a loss payable clause in favor of Buyer as its interest may appear. Upon request, Supplier shall provide certificates of insurance evidencing such insurance signed by an authorized representative of the insurance company. In the event of any material change in or cancellation of the coverage, at least ten (10) days prior written notice will be given to Buyer.

4) Buyer reserves the right to refuse delivery, or return to Seller any of the Equipment, and to cancel all or any part at the Contract, if the Equipment fails to meet the capability and productivity requirements set out in the Contract, or if Seller delivers late, or fails to deliver, all or any part of the Equipment or materials in accordance with the terms of the Contract. Any cost incurred by Buyer in keeping such Equipment or materials prior to such return, together with the cost of returning the same, shall be at the expense of Seller. Acceptance of any part of the Equipment supplied under this Contract, or partial or full payment therefore, shall not bind Buyer to accept any future shipments and not deprive Buyer of the right to withdraw acceptance, and return to Seller, Equipment or materials already accepted that does not meet the specifications and requirements of the Contract.

5) Packing and Cartage. Shipping containers must be designed and constructed to protect the Equipment against dust, moisture, oxidation, vibration, and all other damage during shipment to Buyer. In addition, packaging must meet the Suppliers specifications for the equipment and the Carrier's specifications as published in the Uniform Freight Classification.

6) Supplier hereby waives any and all lien rights it may have with respect to the Equipment or Buyer's site. Supplier shall complete its obligations hereunder free of any laborer's, material man's, mechanic's, or other lien on any part of the Equipment or Buyer's site and shall not voluntarily permit any such lien or claim to be filed or otherwise imposed on any part of the Equipment or Buyer's site. If any such lien or claim is filed and Supplier does not within a reasonable time after receipt of notice thereof either cause such lien to be released and discharged forthwith or in lieu thereof file a bond for payment of such lien in form and amount satisfactory to Buyer, Buyer shall have the right to pay all sums necessary to obtain such release and discharge and to credit all amounts so paid to the Purchase Price.

F. INSPECTION, REJECTION, RETURN & COSTS

1) Inspection and Test. During the period Supplier is manufacturing the Equipment, Buyer shall have the right of access to any of Supplier's or any Subcontractor of Supplier's plants as may be necessary to allow Buyer to review progress, verify that the Equipment is being manufactured so as to conform to the specifications and verify that a progress payment contingency has been completed.

2) Rejection and Return. Buyer shall have the right to reject, rework, or require correction of, any of the Equipment or materials found to be defective in material or workmanship, or which otherwise not in conformance with the drawings, requirements, and specification contained or incorporated in this Contract, after inspection or test at any time. Manufacturing equipment or materials rejected for failure to comply with the specifications or requirements of the Contract, or required to be corrected will be held by Buyer subject to Seller's instructions, or returned to Seller, at Seller's risk and expense including transportation both ways and all handling charges. Buyer's costs of rework or sorting required in respect of such defective Equipment or materials, in order to meet customer requirements or keep its production lines in operation, shall be at Seller's expense.

G. TERMS OF PAYMENT. See Attached Purchase Order and Commercial Statement of Work for stated terms of payment.

H. PRICE

1) The price for the Equipment and work required of Seller under the Contract is as stipulated herein.

2) Any proposed change or increase in price, above the price stated in this Contract has to be agreed to by the Buyer in writing prior to the date of shipment hereunder.

3) If prior to Buyer's final payment of the Purchase Price, Supplier establishes purchase prices for the Equipment that are less than the Purchase Price, this Contract shall be deemed amended to provide such lower price for the Equipment.

4) If Seller fails to provide Equipment that conforms to the specifications set forth in the Contract, Buyer shall be entitled to withhold payment as further described in the Statement of Work.

OTHER MATTERS

1) Indemnity. Supplier shall indemnify, defend and hold Buyer harmless from all liabilities, claims, damages, actions, and causes of action at law or in equity, together with any and all losses, costs, expenses, and attorneys' fees related to the actual or alleged infringement of any United States or foreign intellectual property right (including, without limitation, any right in a patent, copyright, or industrial design, or based on misappropriation or wrongful use of information or documents. In the event the Equipment or any part is held to constitute infringement and the use of the Equipment or part is enjoined, Supplier shall, at its own expense, either procure for Buyer the right to continue using the Equipment or part; or replace with non-infringing Equipment; or modify it so that it becomes non-infringing; or remove the Equipment and refund the purchase price and the transportation and installation cost thereof. This provision shall not apply to any equipment or part that is manufactured by Supplier or third parties to Buyer's design.

Supplier shall indemnify and hold Buyer harmless against any liability, damage, loss, cost or expense (including court costs and reasonable attorney's fees) which Buyer may sustain related in any way to this Contract or the services performed or goods delivered by Supplier under this Contract, which are claimed or made by any person, firm, association or corporation, including employees, agents or subcontractors of Supplier, arising from any cause or for any reason whatsoever. Supplier further agrees, upon receipt of notification from Buyer, to promptly assume full responsibility for the defense of any such suit, action or proceeding. Buyer may, at its option, be represented by and actively participate through its own counsel in any such suit, action or proceeding, and the costs of such representation shall be paid by Supplier.

2) Confidential Information. Supplier acknowledges that Confidential Information will be received from Buyer or otherwise obtained by Supplier under this Contract. Supplier agrees to keep all Confidential Information of Buyer in strictest confidence, and further agrees not to disclose Confidential Information or permit its disclosure to others, or use Confidential Information for other than the purpose of this Contract. Supplier agrees to protect Buyer's Confidential Information using the same degree of care with which it protects its own confidential information, but in no event less than reasonable care. Supplier's obligations under this section will survive the expiration or termination of this Contract. Any developments, devices, or technical information furnished in connection with the Equipment or resulting from development of the Equipment shall not be disclosed to anyone other than authorized personnel of Buyer. No drawings, images, publications or photographs concerning the Equipment shall be made without the written permission of Buyer. All drawings, know-how and confidential information of the Buyer and all rights therein shall remain property of the Buyer and will be kept confidential by Seller. Seller will ensure that any third party who Seller subcontracts any of the work under this Contract will be bound by this Section 2 and all other terms of this Contract.

3) Intellectual Property. Information, design or specifications furnished by Buyer shall not be used for purposes outside the scope of this Contract including use by Supplier for any third party or other party contracting with Supplier. Any patents or patentable inventions, devices or copyrights that result from the engineering, design, or construction of equipment engineered, designed or constructed according to Buyer's design or specifications will be the property of Buyer. Any documents containing an original work of authorship to comply with this Contract, including software developed or modified for such equipment, will be a "work for hire" as that phrase is used in the United States Copyright law and will be the property of Buyer. Seller grants to Buyer a royalty-free, worldwide, permanent and paid-up license to (1) rebuild or reverse engineer any Equipment provided under this Contract, (2) to make, have made, use, have used and sell manufactures, compositions, machines and processes used in the Equipment made for Buyer, and (3) use, repair, modify and sell and operating software incorporated in the use of the Equipment.

4) On-Site Activities. Supplier shall take such steps as may be reasonably necessary to prevent personal injury or property damage during any work hereunder that may be performed by any employees, agents or subcontractors of Supplier at the Buyer's plant and Supplier shall indemnify, hold harmless and defend the Buyer from and against all loss, liability, liens, claims and damages arising from or caused directly or indirectly by any act or omission of such agents, employees or subcontractors of Supplier. Supplier agrees to furnish, on Buyer's request, certificates showing that it carries adequate workers' compensation, public liability and property damage insurance coverage. Supplier further agrees that it will maintain all such coverage in force during the performance of this Contract.

5) Compliance with Laws. Seller certifies and warrants that all the Equipment, goods, materials, and services required hereunder will be and have been produced, and services rendered, in compliance with all applicable Federal, State and municipal laws, rules, regulations, and ordinances. The Seller shall secure and obtain any and all permits, licenses and consents as may be necessary in connection therewith.

6) **Equal Employment Opportunity.** Metaldyne agrees to comply with all provisions of Executive Order 11246 of September 24, 1965 and all rules, regulations, and relevant orders of the Secretary of Labor related to equality of employment opportunity which Executive Order, all regulations and orders are incorporated herein by reference.

7) **Force Majeure.** Neither party shall be liable for damages for delay in delivery arising out of causes beyond its control and without its fault or negligence, including but not limited to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather. If the delay is caused by the delay of a subcontractor of Supplier and if such delay arises out of causes beyond the control of both Supplier and the subcontractor, and without the fault or negligence of either of them, Supplier shall not be liable to Buyer for damages. Supplier will notify Buyer in writing within ten (10) days after the beginning of any such cause. If the event of force majeure continues in effect for more than 30 days, either party may terminate this Contract without further liability.

7) **Minority Business Enterprise Content.** Supplier will report to Buyer all Minority Enterprise activity to enable Buyer to report correct content to Buyer's customers.

8) **Use of Buyer's Name.** Supplier agrees that it will not use Buyer's name whether by including reference to Buyer in any list of customers advertising that its services or products are used by Buyer or otherwise, without written authorization by Buyer's authorized representative.

9) **Remedies.** The rights and remedies reserved to Buyer in this Contract shall be cumulative and additional to all other or further remedies provided in law or equity.

10) **Waiver.** No waiver by Buyer of any of the terms of this Contract shall operate to relieve Seller from responsibility for any prior or subsequent breach hereunder.

11) **Applicable Laws.** This Contract and the rights of the parties under this Contract shall be construed and enforced according to the laws of the state of Michigan.

12) **Remedies for Breach**. In addition to any other rights and remedies that Buyer may have under equity or law for breach of this Contract by Seller, Buyer will have the right to:
    - **(a)** Strict specific performance of each and every provision of this Contract.
    - **(b)** Acquire either from Seller or another source, at Seller's expense additional equipment that is necessary to meet the capability and productivity requirements set out in the Contract,
    - **(c)** Recover from Seller any direct, incidental, consequential, or progressive damages incurred by Buyer as a result of Seller's failure to provide Equipment under this Contract that meet Buyer's requirements for capability, productivity, reliability, or time of delivery, or enter into Seller's premises and remove completed or partially completed equipment and put such equipment to use to meet Buyer's customer's requirements.

13) **Dispute Resolution.** Buyer and Supplier shall, in good faith, first attempt to resolve any dispute, controversy or claim arising out of or relating to this Contract by face-to-face negotiations. If any such dispute, controversy or claim is not resolved within thirty (30) days after such negotiations begin, such dispute, controversy or claim shall be settled by arbitration held in Detroit, Michigan in accordance with the Commercial Arbitration Rules of the American Arbitration Association then in effect except as specifically provided in this Section. If the matter in controversy appears, at the time of demand, to exceed $2,500,000 the panel to be appointed will consist of three (3) neutral arbitrators (collectively, the "arbitrator"); if not in excess of such amount, it will consist of one (1) neutral arbitrator. The arbitrator will allow such discovery as the expeditiously as practicable. The arbitrator will have authority to award relief under legal or equitable principles, including interim or preliminary relief, and to allocate responsibility for the costs of the arbitration in such manner as is determined to be appropriate by the arbitrator. Judgment upon the award rendered by the arbitrator may be entered in any court having in personam and subject matter jurisdiction. Each party will submit to the in personam jurisdiction of the Federal and State courts in Wayne County, Michigan for the purposes of confirming and entering judgment on any such award. The fact that the dispute resolution procedures specified in this Section have been or may be invoked will not excuse either party from performing its obligations under this Contract. During the resolution of any such dispute all parties will continue to perform their respective obligations in good faith, subject to any rights to terminate this Contract that may be available to either of them under this Contract.

14) **Termination for Cause.** Buyer may terminate this Contract without liability if: (a) Supplier is in default of any provision of this Contract and such default is not cured within thirty (30) days of written notice given to Supplier by Buyer; (b) Supplier becomes insolvent, admits in writing of its inability to pay its debts as they mature, files a voluntary petition of bankruptcy, makes an assignment for the benefit of creditors, or a petition under bankruptcy laws is filed against it; or (c) notwithstanding the provisions of Section 6 above, the delay in the progress and completion of Supplier's obligations hereunder extends beyond thirty (30) days. In the event of such termination, Buyer may exercise its rights pursuant to the performance bond, if any, and may procure, upon such terms and in

such manner as Buyer may deem appropriate, equipment similar or substantially similar to the Equipment to be furnished by Supplier hereunder and Supplier shall be liable to Buyer for any excess costs occasioned Buyer thereby.

15) Termination for Convenience. In addition to any other rights of Buyer to cancel or terminate the Contract, Buyer may at its option immediately terminate all or any part of the Contract at any time and for any reason by giving thirty (30) days written notice to Supplier. Upon receipt of notice of termination, Supplier (unless otherwise directed by Buyer) shall (a) terminate promptly all work under this Contract; (b) transfer title and deliver to Buyer the finished work, the work-in process, and all parts and materials which Supplier produced or acquired in accordance with this Contract and which Supplier cannot use in producing goods for itself or for others; and (c) take actions reasonably necessary to protect property in Supplier's possession in which Buyer has an interest. Upon termination by Buyer under this Section 15, Buyer shall pay to Supplier the following amounts without duplication: (i) the Contract Price for all finished work and completed services which conform to the requirements of this Contract and not previously paid for; (ii) Supplier's reasonable cost of the work-in-process and parts and materials transferred to Buyer in accordance with this Section 14; and (iii) Supplier's reasonable cost of settling claims for the obligations Supplier would have had to the subcontractors in the absence of termination. Buyer's obligation upon termination under this Section 15 shall not exceed the obligation Buyer would have had to Supplier in the absence of termination.

16) Performance Bond. The Supplier may be required to purchase a performance bond in the full amount of the proposal. The bond will be used to cover Metaldyne's expenses due to failure of the Supplier to provide the specified equipment by the delivery date. This bond will also be used to cover any expenses incurred by Metaldyne due to breach of contract by the Supplier.

17) Set-Off. With respect to any monetary obligations of Seller or its subsidiaries or affiliates to Buyer or Buyer's subsidiaries or affiliates, including, without limitation, costs and damages resulting from Seller's failure to timely deliver Equipment, the failure of any Equipment to conform to applicable warranties or any other breach by Seller of this Contract, Buyer may at any time, as applicable, recover, recoup or setoff such amounts by deducting such amounts from any sums that are, or will become, owing, due or payable to Seller or Seller's subsidiaries or affiliates by Buyer or Buyer's subsidiaries or affiliates. Buyer and its subsidiaries or affiliates may do so without notice to Seller or its subsidiaries or affiliates. If any obligation of Seller or its subsidiaries or affiliates to Buyer or its subsidiaries or affiliates is disputed, contingent or unliquidated, Buyer may defer payment of amounts due until such obligation is resolved. Buyer's rights under this Section are in addition to any right of setoff or recoupment provided by law or equity.

18) Audit. If requested by Buyer, Seller will permit Buyer and its authorized representatives to (1) examine all pertinent documents, data or other information relating to the Equipment, Seller's obligations under this Contract or any payment made to the Seller or any claim made by the Seller; (2) view any facility or process relating to the Equipment provided under this Contract, including those relating to production quality; and (3) audit any facility to determine compliance with this Contract.

19) Assignment. Seller will not assign or delegate its obligations under this Contract without the prior written approval of Buyer. Buyer will have the right to assign any benefit or duty under this Contract to a third party upon notice to Seller.

IV. EQUIPMENT CAPABILITY RUNOFF GUIDELINES & REQUIREMENTS

Pre-Acceptance Runoff and Final Acceptance Runoff Guidelines

- Runoffs will be on Supplier's or its subcontractor's floor and on Metaldyne's floor. Supplier must specify the number of personnel they will provide during prove out and runoff at all locations. Supplier should clearly identify any Metaldyne personnel in addition to the manufacturing engineer that will be required for runoff, i.e. machine operator, quality, and maintenance. Supplier must clearly state what gauging and other items the Supplier expects Metaldyne to provide for the runoff at both locations. Supplier will also state the number of trial parts required before the runoff's and dates these parts are required. If the number of trial parts exceed the original number requested, Supplier will be required to pay Metaldyne at Metaldyne's cost. Metaldyne will determine the number of parts required for both runoff's. When the equipment is ready to be runoff, the Supplier is responsible for contacting the Metaldyne Engineer and Program Manager to arrange the runoff.
- Supplier shall check and document all applicable equipment parameters prior to the capability run off. These parameters include, but not limited to, lubricant and coolant types, tooling types, feeds, speeds, production rates, etc. A copy of the above documentation shall be furnished to Metaldyne along with a list of any deviations from Metaldyne equipment specifications or other intended parameters.
- Supplier shall dry run the machine / equipment for a minimum of 24 hours, this run, completed prior to capability run off, will serve as break in period for all machine / equipment components. Metaldyne Engineers must be informed in advance of the planned date for the 24 hour dry run .
- The equipment needs to run at the specified rate during runoff without assistance from Supplier for a minimum of eight (8) hours on both Supplier's and Metaldyne's floors. If equipment stops due to mechanical failure or unplanned stoppage at any time during the runoff, the equipment may be rejected. Metaldyne personnel will have the discretion to accept or reject equipment. Metaldyne requires that the equipment will be capable of running at the production rate prior to Metaldyne's PPAP to customer.

Runoff Format

- Pre-Acceptance Runoff at Supplier

  1. Runoff for Pre-Acceptance -
     - Identify Cycle Time Bottlenecks
     - Gate Review of Production Intent Equipment
     - Check all Fixture Combinations
     - Check Dimensional Capability
       - 100 consecutive pieces thru system with 2.0 Cpk (short-run) for critical characteristics and 1.67 Cpk (short-run) for all other characteristics.
       - Deviations from above must be agreed to in writing between Supplier and Metaldyne.
     - Verify Cycle Rate

- Final Acceptance Runoff at Metaldyne

  1. Runoff for PPAP -
     - Check all Fixture Combinations
     - Check Dimensional Capability
       - 300 consecutive pieces thru system with 2.0 Cpk (short-run) for critical characteristics and 1.67 Ppk (short-run) for all other characteristics.
       - 300 pieces thru system over three (3) distinct time frames (with subgroups) with 1.67 Ppk for critical dimensions.
       - Deviations from above must be agreed to in writing between Supplier and Metaldyne.
     - Cycle Rate – Run at Rate

- Fixtures / Tooling

  1. PPAP - all combinations of fixture / machine or machine type must be assessed.
  2. PPAP - full dimensional layout to be completed for the fixtures/tooling.

- Gages / Inspection and Testing Equipment

  1. Gage R&R
  2. Layout as appropriate.
  3. Repeat Gage R&R at Metaldyne
  4. Cycle Rate at Supplier and Metaldyne as appropriate.
  5. Mistake Proofing – Devices must have fail master and do Gage R&R.

Capability Requirements

Characteristics should be divided into two categories; the first should be significant characteristics. Significant characteristics may be identified by customer requirement, process and design F.M.E.A.'s or any characteristic with a total tolerance of less than .010" (.25 MM). The second category is characteristics that are not considered significant to the fit or function of the part or characteristics with a total tolerance of .010" (.25 MM) or larger.

** The minimum requirements for short-term process capabilities on significant characteristics are 2.0 Ppk (± 6 sigma, bilateral tolerance) within the drawing or process specification. The minimum requirements for short-term capabilities on non-significant characteristics are 1.67 Cpk (± 5 sigma, bilateral tolerance) within the drawing or process specification.

Capability studies for the final acceptance of equipment will be conducted in accordance with the method specified in the latest AIAG Quality System Requirements (Tooling & Equipment Supplement), unless otherwise specified by Metaldyne.

All gages used including CMM must have passed a measurement system analysis. Reference AIAG M.S.A. manual. A minimum of an acceptable gage R & R is required.

All gages shall meet the requirements established in the latest revision of the Measurement Systems Analysis manual (MSA).. **Gages at a minimum shall pass a 10% R&R study before acceptance.** Methods and examples of studies are shown in the MSA manual.

Capability Runoff Guidelines

1. True Position formula: $2\sqrt{x^2+y^2}$

a. Capability of true position or Cp: $Cp = \frac{TPD}{6\sigma_{\max}}$ **

b. Capability of true position with centering or Cpk: $Cpk = \frac{TPD}{2\left(\sqrt{\overline{X}^2+\overline{Y}^2}+3\sigma_{\max}\right)}$ ** $\sigma_{\max}$

means take the highest sigma from the X or Y-axis. *TPD* = True Position Diameter

2a. A coordinate measurement machine runoff requires 100 pieces minimum or 30 pieces minimum per fixture or station. (If the fixture is an A-B load, five pieces from each loading). Each station must pass 10 sigma or 8 sigma ** on its own and the results of all stations combined must pass 6 sigma.

2b. Stat pin gauges require a 100 piece run. Ninety nine percent of the parts must pass 50% pins and all parts must pass 100% pins for 10 sigma capability and ninety five percent of the parts must pass 50% pins and all parts must pass 100% pins for 8 sigma capability. ** Hole diameters must be gauged and recorded. If stat pins are used for runoff, we must have Engineering, Plant Quality Assurance agreement prior to the runoff. A three (3) piece layout with features centered within 50% of the tolerance regardless of feature size (RFS), is required.

2c. An option to 2b for stat pin runoffs on multi-station machines is a minimum of 5 pieces per station on both the roughing and finishing operations with 100% of the parts passing the 50% pins. The hole diameters must be gauged and recorded.

3. The unilateral tolerance (flatness, run-out, parallelism, finish, straightness, etc.) capability formula is: $\overline{X} + 5\sigma$** or $\overline{X} + 4\sigma$ **

4. Capability must be centered within: $\overline{X} \pm 5\sigma$** or $\overline{X} \pm 4\sigma$ **

5. All diameters to include both roundness and taper.

6. Any machine failure cancels the study and a complete rerun is required.

7. Any tool breakage or manual adjustment during a study cancels the study and a complete rerun is required. Excessive tool wear can be charted.

8. The machine is to be operated as it will be run in production e.g. feeds/speeds/cycle times/tooling

9. All "assignable cause" parts must be documented "as to the cause" and corrective action must be taken.

10. If changes are made to the process corrected copies of the process must be attached to the study. The documentation must include the feeds and speeds used on the runoff.

11. If the bonus tolerance is not allowed on the process sheets it may not be used in the capability study.

Note: Any customer or other Metaldyne requirements that surpass these guidelines must be used. These guidelines apply at the tool manufacturing floor and the Metaldyne manufacturing floor.

**** Must meet at a minimum 2.0 Ppk when calculated against print tolerance.**

V. EQUIPMENT COMPONENT SPECIFICATION REQUIREMENTS

General

Supplier will quote with strict adherence to these specifications and any others as specified in the **Request For Quote – Capital Equipment FRM002045**. Requests for deviations from the specifications must be in writing addressed to the author of the request as part of the proposal response.

Safety

The equipment and/or machines must conform to all current safety codes or relevant regulations in force at the time of installation for the Country the State, Province, or Locality where the equipment will be located and operated. In general the Code of Federal Regulations, the Occupational Safety & Health Act, the IEC, and European Union regulations shall apply for all applications of the Commercial Statement of Work. In the event of a dispute between applicable regulations and Metaldyne's Commercial Statement of Work, the highest requirement is to be adhered to at no additional cost to Metaldyne. All components shall be manufactured and/or fabricated and installed in strict compliance with and bear the seal of UL, NEMA, ANSI, ASME, NSF, or other certified testing agent. In addition, all equipment to be installed in Europe must be evaluated for all safety hazards, this evaluation must be documented and a CE symbol posted on the equipment.

Indoor Environment

Any equipment and/or machines that produce mists, dusts, vapors, or fumes must be appropriately ducted, vented, or collected in order to bring the amount of pollutant within the appropriate regulatory limits for the country where the equipment and/or machines will be operated.

Piping that will sweat or cause burns if touched must be insulated or cooled to an appropriate temperature that will not be hazardous to personnel.

Hazard Communication

All chemicals and/or hazardous materials must be minimally labeled with the name of the chemical and/or hazardous material, appropriate hazard warning(s) and name of manufacturer. A Material Safety Data Sheet (MSDS) or its equivalent must be provide to Metaldyne prior to any chemicals and/or hazardous materials being brought on-site.

Ergonomics

Good ergonomic practices shall be used in the design of all fixtures and control placement for ease of loading / unloading and use. Excessive forces needed to move equipment / parts or to operate equipment should be minimized. Unless otherwise specified by Metaldyne, work piece load height must be 38" to 42" from floor and a maximum reach distance of 18", depending on the weight of the part. Machine controls must be properly labeled as to their function and located for easy access

Paint & Finishes

- All painted surfaces should be cleaned and prepared per the paint manufacturer's recommendations to assure good adhesion.
- Materials must be industrial grade paint supplied by a reputable manufacturer and suitable for use on industrial machine equipment.
- All coatings must stand up to periodic hot water high-pressure washing and continuous exposure to various lubricants and oils without deterioration or peeling.
- Basic machine to be color matched to Metaldyne's requirements.
- Machine guards to be safety yellow, or black if wire mesh is used.

Guards

All points of operation, pinch points, and rotating parts must be guarded in a manner as to prevent employees from reaching over, around, or under the guards and into the hazard area(s).

All power transmission mechanisms such as belts, pulleys, shafts, chains, and couplings must be fully guarded on all sides. Light curtains may be used but must be placed at a distance that allows the system to shut down before personnel can enter the hazard area(s). Guarding should be constructed and attached in a manner as to not create safety hazards themselves. Guards should be attached in a manner to allow for quick and easy removal in areas required for routine maintenance. Any doors or gates installed as part of the equipment guards should contain an interlock that will not allow the equipment to operate when open.

Two hand controls / trips must be installed in a manner that prevents accidental or unintentional operation. The two hand controls should be positioned so that both of the operator's hands are required to initiate and be held in-place until the bottom of the cycle is reached (or contain or means to prevent the operator from reaching into the hazard area before the bottom of the cycle is reached).

All brake circuits / clutches should be constructed so that a fault or failure stops the equipment as required and does not allow an unintended cycle.

All perimeter guarding (fencing) installed as a barrier guard should prevent employees from crossing over, under, or around the barrier and into the hazard area. The perimeter guarding should be free of sharp edges and projections, fixed securely to the floor, completely filled in, and positioned so that the bottom of the barrier is no more than 6" off the floor and minimally, the top of the barrier no lower than 60". The top of the barrier should be at least as high as the highest moving piece of equipment within the cell and high enough to prevent any parts from being thrown out.

Noise

The equipment and/or machines must conform to all ANSI, ASME, and OSHA requirements. When in full operation (including all add-ons), all equipment and/or machines noise levels must measure less than 80 dba (not time weighted average).

Power Lockout

All power sources or any other sources of energy of any equipment and/or machines shall have an acceptable means of releasing stored energy and locking that source out (i.e. attaching a lock). Sources of energy include, but are not limited to, hydraulic, pneumatic, electrical, thermal, spring, counter weight, chemical, and flywheel. It is the contractor's responsibility to identify all sources of energy of the equipment and/or machines. All lockout points shall be easily identifiable. These lockout points shall be identified through two parameters. One, the energy source shall be color coded for easy recognition. Second, all energy sources shall be labeled in some manner that corresponds to an identified methodology for locking out the specific power source(s). Further, the contractor shall provide a written lockout procedure with the equipment and/or machines that includes the following items.

- Name of the equipment
- Manufacturer of equipment
- Equipment serial number or other identification
- Identify all sources of energy
- Steps to be taken to release any store energy
- Steps to be taken to lockout all energy sources
- Location of lock out point .

Maintenance, Repair and Operating Materials with Obligatory Coding

No material will be accepted without proper documentation being submitted a minimum of 2 weeks prior to material delivery. Lack of proper documentation may result in the material being rejected and returned to the sender (at their cost).

Type Label / Equipment Identification

A metal type label must be mounted in clear view and must contain the following information: manufacturer, order number, type, model year, machine number, nominal voltage, frequency, nominal current/nominal performance, protection type, weight, other energy consumption (such as compressed air, gas, water, etc.).

Operation Hours Counter

Each machine must be equipped with an operation hours counter. This counter must be switched such that the operational hours of the main wear parts can be registered.

General Equipment Design

A certified floor plan shall be furnished for approval to Metaldyne prior to build. If a special foundation is required, Supplier must supply foundation requirements, allow access to maintenance areas - motors, belts ports, valves, pumps, etc. Visual inspection of fluid level, pressure and other gages must be possible without removal of guards. All equipment tables and base surfaces are to slant to common trough for good chip and coolant control. Eliminate pockets that can trap chips. Mount fixtures, slides, spindles, etc. on small risers. No large flat tables should be incorporated into the equipment design. The equipment must have signal lights visible from any side of the equipment to display equipment-operating status. The equipment must be designed to insure that no damage occurs if machine is clamped or cycled without a part. Dial or Inline transfer machines must provide adequate spacing between stations for ease of tool change and maintenance. All fixture mounts, spindles, slides, etc. must be positively located with dowels, keys or other methods to eliminate misalignment or movement. All spindles, chucks, etc. should be balanced to minimize vibration and improve performance. All equipment must have two (2) machine cycle counters, one (1) resettable and one (1) non-resettable. All equipment will be designed to operate in ambient temperatures ranging between 60 and 110 degrees Fahrenheit. The equipment must be designed in a way for easy access to change out components that require service. All quotes to include amperage the equipment will pull.

Tool Design

Tooling, tool blocks, fixtures, guards, etc. must be designed for ease of tool removal and replacement. All tool drawings must be approved by Metaldyne Engineering prior to build. Tool drawing numbers will be assigned at that time.

Commercially available standard tools must be used whenever possible. Use indexable inserts when possible. Use quick change, easy adjust, and preset tools. Design for a maximum two-minute tool change time. Where drill bushings or bushing plates are used, a slide tool change position or a bushing plate quick release mechanism must be provided.

- Fixtures & tooling must include the necessary electrical and/or physical interlocks. These interlocks will assure correct positioning and/or mating of fixtures or tooling during processing of the part. Cycling of the equipment must be disallowed should any pertinent fixture plates, fixtures or tooling be unlatched or if the interlocks are not made. These interlocks will have the necessary controls / logic incorporated to verify correct functioning of the interlock.
- Design with ability to auto load for future if auto load is not a specific requirement. Part location points must be consistent for all operations. Primary, secondary and tertiary datum scheme should be followed.
- Use rough locators to aid loading and avoid damage to other surfaces or features. Clamp directly over part locators to prevent bowing or distortion.
- Fixture must be designed so that part can not be loaded incorrectly and include devices to ensure parts are properly located, seated and clamped.
- Design to eliminate need for blowing off fixture - use gravity or coolant flush.
- Slant fixture surfaces. Allow for chip clearance and avoid pockets.
- Manifold hydraulic, pneumatic passages into fixture when feasible.
- Include storage area for fixtures when multiple fixtures are used.
- Use quick-change features for multiple fixture set-ups.
- Locator buttons shall be insertable, renewable type.
- Use standards if possible.
- If adjustment is required, use a single trapped ground shim.
- No loose stacks of shim stock.

Leveling & Lifting

Supplier will provide leveling kit, which includes all leveling pads, leveling screws and hold-down bolts. The equipment must be easy to level, and must include machined pad to set the level on. Means should be provided to lift the equipment so that the equipment is balanced (i.e. lift hooks & fork pockets). Wherever required, leveling screws will be furnished with the equipment at time of shipment by Supplier. These screws are to be withdrawn, or

removed, at the time of loading to prevent damage, such as bending. When necessary, Supplier may be required to remove motors, or other machine components to prevent damage or reduce width and/or height of load. Supplier will suitably crate, box, palletize or otherwise secure all loose components for shipment.

Hydraulic

All pump inlets will be equipped with a strainer-type inlet filter. The filter must be accessible without removal of the hydraulic pump. All systems must have a return line filter equipped with a bypass check-valve and back-pressure indicator gauge. Filter nominal flow capacity must be at least 1.5 times greater than the maximum flow rate in the return line. Filters must meet a minimum rating of ISO 17/14 or Beta (15um - 25um)>75.

Systems are to be designed for the lowest feasible operating pressures not to exceed 2500-psi maximum. With written approval, where space is a constraint, clamping circuits may operate at up to 5000 psi. All fixed displacement pump systems must include an appropriate pressure unloading circuit. Special exception may be made for low pressure/low volume applications with written approval from Metaldyne Engineering. All fluid lines shall be high quality seamless steel tubing or suitable hydraulic hose. Tubing and hose must be sized using a minimum safety factor of 4:1 (burst pressure/peak operating pressure). Hydraulic systems must operate at a temperature of no more than 130 degrees Fahrenheit. Minimum acceptable tubing wall thickness is as follows:

TUBE O.D.”	WALL THICKNESS (min.)
¼	.028
5/16	.035
3/8	.035
½	.049
5/8	.065
¾	.065
1	.095
1 ¼	.109
1 ½	.134

All tubing runs shall be supported with cushioned mounting as follows:

TUBE O.D.”	LENGTH BETWEEN SUPPORTS (Feet max.)
1/8 - 3/8	3'
1/2 – 1	5'
1 1/4 – up	7'

Tank return lines must extend below the lowest anticipated fluid level and be isolated from the pump by at least one baffle. Pressure gauges must be glycerin filled and be isolated from pressure spikes by a snubber or “push to test” valve. Gauges should be mounted as close to their respective pressure control device as possible. Reservoir tank capacity (gallons) shall be a minimum of 3 times pump output (gpm). A thermometer and fluid level sight gage must be permanently mounted to the reservoir. Exceptions must be pre-approved by Metaldyne. Smaller tanks may require cooling. Tanks shall include fill ports, drains and clean outs. All valves, valve bodies, and manifolds shall be readily accessible for maintenance. Tool feed circuits for machining operations shall be isolated from all other circuits, which may cause pressure fluctuations during the feed cycle. Pressure and temperature compensated flow control valves must be used for all machining feed applications. Rapid to feed over-ride control valves shall be single solenoid spring return type. Install valve so it must be energized for rapid and will spring return to feed mode. All valve solenoids must be plug-in style if available. Coils on solenoids shall have indicating lights if available. All valves must have an identifying tag attached on or near the device to simplify trouble-shooting and maintenance. All pressure controls and switches must have an identifying tag showing proper pressure setting. Cylinders must have SAE straight thread ports. Integral cushions or deceleration circuits should be used where required to minimize mechanical shock when moving heavy loads at high velocities. Accumulator circuits must be designed to automatically discharge any pressurized fluid upon pump shut-down. Spool type directional valves must be mounted with the spool axis horizontal. All reservoirs must have a plate on the outside specifying the proper type oil to be used. Supplier must use “O-Ring” type hydraulic fittings through out the systems. Connections to vibrating or moving components must have flexible hose connections.

Pneumatic

All valve solenoids must be plug-in style. Coils on solenoids shall have indicating lights if available. Equipment must be provided with one main pneumatic connection point equipped with shut-off valve, filter, and regulator. Shut-off valves must purge air when turned to the off position. If necessary, a lubricator should also be provided following the regulator. Stackable, modular directional control valves should be used. Provide 20% blank manifold stations on machine for future valve additions. Blank stations should be wired back to the control panel. The wire should be labeled as valve spare. All air blow-off lines must be provided with a solenoid controlled shut-off valve so air is only used as needed. Blow off should be set at 30-psi max. All valves must have an identifying tag attached on or near the device to simplify trouble-shooting and maintenance. All pressure controls and switches must have an identifying tag showing proper pressure setting. All pneumatic systems must be able to function on 75-psi compressed air. Supplier must detail the air requirements both pressure and volume for this equipment to clearly indicate the number of CFM's to run the machines.

Tagging

All hydraulic and pneumatic accumulators to be tagged with safety warning instructions. All solenoids to have both ends tagged with their operating function. All hydraulic and air pressure regulator settings to be permanently tagged.

Lube Systems

Reservoirs will have sufficient capacity to operate 120 hours and be capable of filling without equipment shut-down. Reservoirs must have sight gauges for visual checking of oil level. Lubrication systems will have the following fault detection devices to automatically cycle-stop machine and alert the operator of lube fault:

A. Reservoirs must have a low-level warning system.
B. System must have a high-pressure warning switch.
C. Memory type pressure reset indicator pins must be used on each lube outlet.
D. Cycling switches must be used on distribution blocks to monitor cycle.

All tubing runs must be supported. All reservoirs must have a plate on the outside specifying the proper type oil to be used. Lubrication interval and frequency should be controlled automatically by the machine's PLC. A manual lube push-button must also be provided to test cycle the system and reset lube faults.

Broken Tool Sensing

Probes or broken tool detection is recommended on all small drilling, drill reaming and tapping operations. To be quoted as an option. .

Coolant System

All machining systems must provide for containment and ducting of cutting fluids and chips. All cutting fluid and chips must return to a common point on the equipment. The equipment must be designed and plumbed to self-sufficiently clear chips in such a manner where they will not build-up and cause potential malfunctions or quality defects.

- Coolant flow control valves are required at each station.
- Copper tubing not allowed for coolant lines.
- Coolant must be easily turned off to facilitate a "dry" tool change at each station.
- Supplier will provide coolant tank(s) and pump or provide to Metaldyne coolant requirements (GPM, pressure, filtration, and recommended coolant).
- Chip conveyors supplied with machines must provide adequate chip removal to maintain coolant and prevent coolant line plugging. Coolant system including (Tank, Pump, Filtration, Chip conveyor, etc.) must have Metaldyne engineering approval.

Vibration Analysis

Drawing of Rotating Components must be provided to show type and position of internal components for vibration analysis. Assembly drawings of gearboxes and gear driven heads must be provided, specifying number of teeth of each gear and input/output RPM. This information is required in determining various unit frequencies. Completed documentation of vibration analysis is to be placed with electrical drawings at the time machine is shipped. This documentation is to be used as a footprint for future vibration analysis including at the plant after the machine is installed at the plant.

General Electrical Design

ELECTRICAL EQUIPMENT REQUIREMENTS

NOTE: Parameters may change depending on Metaldyne's global location. Deviations and plant specific brand requirements will be given by Program Manager through Metaldyne's Request for Quote – Capital Equipment (FRM002045)

General information and requirements

- This specification shall apply to all equipment purchased by Metaldyne where this specification is attached, by reference, to the RFQ / order.
- The submission of a bid will be regarded as confirmation that the bidder understands and accepts this document. The primary supplier shall be responsible for their sub supplier's compliance to this specification.
- OEM's shall not purchase components until components have been approved. OEM's shall not build panels and enclosures until drawings have been approved. OEM's may submit Bill of Material (BOM) and panel and enclosure layouts for concept approval prior to complete approval drawing set; this will provide time for long lead items to be ordered.
- No deviations or exclusions of any part of this specification will be accepted at the time of quote. A written request for deviation or exclusion can be submitted after the OEM receives the purchase order. The request shall reference the item number of the specification and shall also include the reason for the request with all technological information and cost saving information. General statements, such as "standard machine", shall not supersede this requirement. Metaldyne Engineering will review the request and the OEM will be notified in writing.
- With the aim of achieving a global Metaldyne controls specification the most stringent standards have been reviewed and applied to this specification. The equipment supplier must guarantee that the machine and component parts comply with any legislation in force in the country of destination.
- Wherever possible the equipment supplied will be designed and built to international (IEC) standards. Where an IEC standard is not available, the most stringent standard of the destination countries will be used.
- The following general electrical standards shall be applied to all machines and equipment: other more specific IEC standards shall be used as applicable.

  IEC 204-1 Electrical equipment of industrial machines. Part 1 1992
  IEC 617 Graphical symbols for diagrams. Parts 1 to 13
  IEC 750 Item designation in Electro-technology.
  IEC 439-1 Low voltage switchgear and control-gear assemblies – Part 1
  IEC 947-1 Low voltage switchgear and control-gear assemblies – Part 1
  IEC 1000 EMC requirements
  NFPA 79 Electrical Standard for Industrial Machinery and the National electrical Code (latest revisions.
  NEC 300 Wiring methods
- In some countries, law requires the approval of certain electrical equipment. In this case, the official test authority issues the approval certificate. The approval mark shall be displayed on the device e.g. UL listed for the USA.
- It is the responsibility of the machine or equipment designer to produce a safe design, both mechanically and electrically. The designer must be familiar with risk assessment techniques and apply safety principles to reduce the risks to an acceptable level.
- The machine designer shall make available his risk assessment data and justify his assessments.
- The following safety standards shall be followed to ensure the integrity of the machine.

  EN 954-1 Safety related parts of control systems – General principles of design.

EN 292 Basic concepts, general principles for design.
EN 418 Emergency Stop Equipment; functional aspects; Principles for design.

- Servo drives and motors shall be quoted. . Refer to the plant approved components section of the RFQ for model numbers and I/O modules.
- All equipment shall be capable of communicating on Fipway, Datahighway, Profibus or plant preference.
- If the OEM is unwilling to use the controllers and servos listed in this document a detailed deviation request must be submitted to Metaldyne Controls Engineering. Any such request must give the reason the specified controls will not work, the controls the OEM would like to use and why the controls would make a better machine. Complete part numbers must be included in the deviation required. NOTE: The term "standard" controls and machine will not be sufficient reason for a deviation.
- All control circuits and I/O shall be 24VDC grounded. The use of any 120VAC Components will require written approval from Metaldyne Controls Engineering.
- Low voltage will be in accordance with IEC 38. Therefore the following voltages and frequencies will apply: North America 460V - 60HZ ±10%: Europe 400V 50HZ ±10%. All equipment will be designed to operate using this primary supply. All components required to reduce the primary supply to the system operating voltage(s) shall be provided by the OEM. Primary electrical power applies to the machines final destination.
- Stop functions shall occur through de-energization rather than energization of control devices.
- The equipment builder shall be responsible for the circuit design, and will furnish all electrical equipment completely wired and ready in all respects for field installation. The equipment builder shall also be responsible for the successful operation of the equipment when wired in the field according to diagrams submitted.
- The equipment builder shall supply all hangers, brackets, etc. necessary for the electrical installation.
- The use of absorption materials, covers, housing, etc., mounted around, over, etc. the equipment shall not in any way affect maintenance or hinder proper cooling or air flow.
- Upon request, legible calculations along with appropriate graphic presentation for facilities (buildings and infrastructure), process, mechanical or electrical equipment must be submitted for review.
- At order placement an initial meeting will be arranged to review the design of previously supplied machines and discuss any special requirements which may have the use of non-standard equipment and agree to timing of subsequent reviews
- The submission of Electrical and Fluid power, panel layouts and parts list should be at least 6 weeks prior to the commencement of machine build to allow the component lists to be checked prior to purchase.

Documentation

- Supply all information and drawings in the electrical approval drawing set. The approval drawings will be rejected if all required information is not supplied.
- A4 size paper and American size 8 ½ “x11” will be acceptable for approval drawings if all information is legible. All drawings must include the Metaldyne title block. All equipment shall have complete electrical schematics and layouts.
- The equipment layout shall show the location of all control devices (drives, solenoids, switches, etc.) used on the equipment. The equipment layout shall also show the location of the operator’s console, power distribution panel, station control panels, servo panels, main electrical enclosure, interlock boxes, test and gage panels.
- Electrical drawing set shall include layouts for all enclosures, pushbutton panels, and operator consoles and light panels. The electrical drawing set shall also include layouts for all back panels and sub plates etc.
- Fully detailed electronic diagrams will be supplied for any item altered or fabricated by the vendor.
- Cross reference numbers indicating contact location will be shown at the right of each device.
- Sheet numbering shall be sequential; suffix's or alpha's are not acceptable.
- Programmable controllers I/O wire numbering shall follow the I/O address. Hardwired wire numbering shall be by page-line number with sequential digit(s) added.
- I/O device numbering for programmable controllers shall carry the same designation as the I/O address. For hardwired, components shall carry the same designation as the index number (page-line number), i.e. -SQ 254 or -YV 350.
- Devices shall carry the same designation on all control drawings. Once a format is established it is to be used for the complete drawing set.
- All labels must be at least 3 lines, more may be used as needed, and shall contain the following information:
  Location - Where it is STATION 11A (=11A)
  Function - What it does ADVANCE HEAD
  Description - What it is -YV2.15
- Duplicated equipment shall have an original set of drawings. Multiple equipment for the same operation requires their own drawings and drawing number.

- Supplier shall submit with the electrical schematics all hydraulic, lubrication, pneumatic and coolant drawings for approval.
- When the equipment is delivered, two (2) sets A4 or 8 ½ x 11 paper drawings and one (1) disk of logic and a hard copy of the logic shall be included in the control panel. The final drawings must be provided on CD in AutoCAD (.dwg) format.
- All drawings become the property of Metaldyne.
- Drawing set shall be organized as follows:
    - Index
    - Equipment layout
    - Communication distribution layout and controller charts
    - Power distribution
    - Interlocks
    - Station drawings:
        - Motor circuits
        - Control circuits
        - I/O drawings
        - Panel layouts
        - Station layout
        - Material list
        - Cable list
- The index shall be located at the beginning of the electrical drawing set. The index will identify the contents of all sheets.
- The communication distribution layout shall show the cabling, cable part numbers, and addresses of each processor and I/O drop. The controller chart shall show type and model number.
- All equipment manufacturers shall provide an interlock sheet, whether equipment is manual load/unload or automatic. Hard wire interlocks shall be shown.
- The interlock sheet shall identify what signals are required from the interlocked equipment and what signals are provided to interlocked equipment.
- Interlocks shall reference the drawing numbers of the equipment that the interlocks are going to and coming from. The OEM shall be responsible for contacting the suppliers of the other equipment to obtain all the information required. Print numbers and Metaldyne inventory numbers shall be included at top of interlock sheet.
- The material list shall include the following information:
    - Manufacturer's name
    - Part description
    - Complete catalog number (original manufacturer's number)
    - Quantity of all components
    - All drives, panels, enclosures, etc.
    - All components used in panels
    - All devices used for equipment control
- Reference or item numbers shall be included on the bill of material and on the panel layout and equipment layout in order to cross-reference items used.
- The sequence of operation shall be shown in flow chart form.
- Indicate the total Kilowatt and full load amps on the power distribution sheet.
- Indicate all pressure and timers settings in the drawing set beside the device

Grounding

- Copper ground lugs and buss strip shall be used for panel grounding.
- All ground wires must be routed to a single common copper buss strip bonded to the interior of the main electrical panel in accordance with IEC/NEC Grounding standards: All equipment members and/or structural parts are to be grounded to the common ground strip.
- Portable, pendant and resilient mounted equipment shall have ground wires run as above because raceways, wire ways and cable trays are not to be considered as grounding conductors. Raceways include all rigid and flexible conduits including sealtight. Wire ways include all ducting.
- The conductor size of the ground shall be large enough to handle the highest over-current trip device feeding the loads using the conduit.
- The ground lug shall be located in the main disconnect enclosure near the main disconnect switch.

COMPONENT REQUIREMENTS

Main disconnect switches

- Shall have copper pressure lugs. Lugs shall be the maximum size available for frame.
- The minimum distance from the top of the enclosure to incoming terminal lugs of the main disconnect shall be 300 mm.

Safety disconnect switches

- Shall be 600 volts AC, non-fusible.

  The following motors shall have safety disconnects:

  Spare and standby drives
  Motors in remote locations
  Motors above or below floor grade
  Blow off and exhaust fans
- Each safety disconnect switch shall have a tag to identify the switch number and the motor affected. Permanently mount the tag to the disconnect switch.

Bus bars

- Inside the cabinet bus bars will be used to split primary power into secondary circuits.

Enclosures

- Shall be IP54 / NEMA 12, non-ventilated. All enclosures shall require a tool to be used for access. All enclosures shall be hinged. The minimum door width for the main enclosure shall be 700 mm. Lighting shall only be required on enclosures that are 1800 mm H and 450 mm D or greater.
- Enclosures shall be as small as possible and where feasible shall be mounted to the equipment. Enclosures that are mounted to the equipment shall be shipped mounted and wired.
- If the enclosure cannot be mounted to the equipment due to space limitations a freestanding enclosure will be used. Freestanding enclosures shall use cable connectors to connect the enclosure to the equipment.
- All enclosures shall be mounted vertically and all doors shall have a minimum of 135° swing opening.
- The main control enclosure shall have a permanently engraved nameplate affixed to it's exterior in close proximity to the main disconnect switch which lists the equipment's serial number, Metaldyne inventory tag number, wiring diagram number, supply voltage, phase, frequency, the short circuit interrupting capacity and the full load current.
- No components except wiring duct shall be behind mullions. No terminals or back plane components are to be located less than 300 mm or more than 1800 mm from the floor; the dimensions shall include the panel legs, risers, supports, etc.
- Panel mounted I/O devices that are located on or in the same door as the I/O cards may be connected directly to the card terminals.
- To reduce the requirement of panel cooling the use of mounting plates should be avoided and components mounted on a railed grid system.
- Where control panel cooling is considered to be necessary, they shall be equipped with an air conditioning/ heat exchanger unit sized to suit the rating of the equipment fitted, this shall be fed from the load side of the main isolator.
- A thermostat shall be included in the system, set as required by the control equipment. Set it to 52°C. It can generate an operator warning and can inhibit the next auto cycle.
- Air conditioning units containing C. F. C's are not allowed.
- Panel cooling systems drawing filtered air into the panel, or any system that affects the panel I. P. rating, will not be approved.

Junction boxes

- Shall be mounted vertically in an open and accessible location. All doors shall have a minimum of 135° swing opening.
- All enclosures including junction, terminal and pushbutton boxes shall be hinged.
- Junction boxes shall have terminal strips between all panels, consoles, control stations, panel, equipment, wing bases, breakaway sections, etc.
- Builder shall mount all junction boxes vertically.
- Junction boxes for interlocks must be mounted on the outside of safety guarding. Only interlock wiring is allowed in this box.

Panel wiring duct

Shall be white or light gray, with spare capacity of 20%.

Circuit breakers / Fuses

- Circuit breakers should be used wherever possible. Fuses will be FRS-R, FRN-R, FNA, AGC, or GMA types or "J" type fuses. Fuses shall only be used where necessary.
- Fuse block requirements for FRS-R and FRN-R fuses shall be class R, have copper spring reinforced clips and connectors.

Information labels

- Warning labels shall be red laminated with white core. All other labels shall be white laminated with black core.
- Component identification labels shall have letters 3 mm minimum height. All solenoids, limit switches, proximity switches, etc. shall have labels to show the device number. Permanently mount the labels adjacent to device (glue will not be acceptable).

Where it is	STATION 11A (=11A)
Function - What it does	ADVANCE HEAD
Description - What it is	YV 2.15

- Labels for pushbuttons, selector switches, pilot lights, etc. are to be engraved with lettering not less that 3 mm tall and contain the necessary information.

Motor Starters

- To be Self-protected. When self-protected motor starters cannot be used, IEC motor starters shall be used. All starters shall be DIN rail mounted. Self-protected motor starters shall only be used for low duty cycle applications.
- Starters shall be selected and sized to provide 10 years of operation under the equipment rated duty cycle.
- If starters are energized from an output, surge suppressors shall be used across the coil.
- Each starter shall have individual over current protection.
- Combination starters shall have primary and secondary protection

Pushbutton and pilot lights

Metaldyne shall approve push button or Human Readable Interface (HMI) layout prior to build. On machines with more than four (4) indicating lights, a push button is required to test all indicating lights. On machines with four (4) or fewer indicating lights, use push-to-test type lights. Refer to NFPA Standards for further details.

Dual Palm buttons shall meet anti-tie down and anti-repeat requirements.

Function	Push Button	Pilot Light
Master off	Extended Red w/ lock out	Red
Stop	Extended Red	Red
Emergency Stop	Mushroom Red	Red
Safety	Long Guard Red	Red
On	Flush Green	Green
Run	Flush Green	Green
Reset	Flush Yellow	Yellow

- Shall be 22 mm round type with the exception of the "Emergency Stop" and "Return to initial position" pushbuttons.
- N.C. yellow mushroom head buttons shall be used for “Return to initial position".
- Emergency stop buttons shall be large red mushroom head, maintained N.C. contact. No more then one red mushroom head button shall be used on each pushbutton panel.
- All motions shall require a means of manual operation. Softkeys shall be used when an interface panel is used.
- All pilot lights shall be push-to-test type and shall have 24 VDC LED lights only.

Relays

Industrial control relay requirements are as follows:

- IEC relays shall be used and be DIN rail mounted.
- Relays shall be 4 or 8 pole.
- If the relay is energized from an output; surge suppressors shall be used across the coil.

Switches and Sensors

- Part sensing is to be accomplished by way of non-contact switches to keep from marring or damaging the parts.
- Limit switches shall have a 4 pin micro connector.
- Cable operated switches shall be latching type and conform to safety requirements. Each switch shall energize an indicator when it is tripped. With reporting to the operators console and HMI station panel control.
- Proximity sensors shall be totally self contained, tubular 3 wire 24VDC with a 4 pin micro connector. Sensors shall be 8, 12, 18 or 30mm only.
- Photoelectric and fiber optic sensors shall be totally self contained, 18mm tubular 3 wire 24VDC with a 4 pin micro connector.
- Pressure sensors shall be electronic 24VDC with indicating lights or display for pressure setting and have a 4 pin micro connector.
- All limit switches must have individual adjustable trip dogs. Direct contact to switches shall not be acceptable.
- All high level, pallet present, part in position, etc. shall have switches and indicators.
- All cylinders, heads, etc. shall have a forward and return switch. Each forward and returned switch shall have an indicator. Positive position sensing to be a priority. The use of cylinder mounted magnetic reed switches is allowed if there is not enough space for standard switches or sensors.
- Builder shall place all switches, sensors and wires so they are away from wet, oily and chip-covered operations. All switches and sensors shall be in an open and accessible location for service and inspection. All switches and sensors shall be mounted so that indicating lights can be seen.

Solenoids

- 24 VDC solenoids shall have micro 4-pin connectors and indicator lights.
- In hardwired or relay type applications solenoids shall be protected by circuit breakers or fuses and be relay controlled with normally open contacts. Not more than two contacts shall control any solenoid.
- In applications where the solenoid is energized from a programmable controller output, the solenoid shall be protected by a circuit breaker or fuses except when adequate protection is provided by the output module. The wire number shall be the same on both sides of the circuit breaker or fuse.

Terminal Blocks

- DIN rail (type DIN3) mounted terminal blocks shall be used. Terminals shall have a minimum spacing of 6mm. Heavy-duty screw-on end clamps shall be used on all terminal block assemblies. Fused terminals shall include blown fuse indicators.
- All terminals shall be labeled with the wire number.
- Dual level terminal blocks may be used. The lower level of the terminal blocks shall be connected as the common, using the terminal bridge available from the terminal block manufacturer.

Timers and counters

All timing and counting functions, except as required by Metaldyne Safety, are to reside in the logic of the controller. If these functions need to be accessed by the operator or maintenance a screen shall be provided on the interface panel.

Transformer

Requirements are as follows:

100% copper windings.
Have primary and secondary fusing.
Machine tool type only.

Cable & Wiring

Wiring

All 115 VAC control systems shall have a grounded neutral. Step-down transformer shall be fused on the primary and secondary. Conductors shall be of the following minimum size and construction:

Internal Panel Wiring	#16 NTW
Panel to Machine	#14 THHN
Motor Leads	Specified by current requirement (nothing less than #12)

All fault and stop conditions shall be wired normally closed to provide for fail safe operation. All wire raceway should be minimum IMC Metal Conduit. Use of liquid tight flexible conduit and SJO cable should be kept to a minimum and limited to 6’ in length. No wire splices allowed in wire-ways. All Cord devices must be terminated on terminal strips. Refer to NFPA Standards for further details.

- Signal wires are defined to be wiring, typically shielded cables, that contain low level signals used for, but not limited to, position feedback, velocity feedback, communications and measurements. All signal wires are to be kept separate from power wiring to protect against noise spikes, cross talk, etc.
- Shielded cables used for measurements and feedback must be continuous from source to destination without termination.
- Equipment wiring shall be stranded, minimum of 1 mm^2 (16 AWG) for 120VAC and 0.5 mm^2 (18 AWG) for 24VDC.
- Wire insulation color code for control wires:

  230 and higher VAC - Black
  120 VAC - Red
  120VAC neutral – White
  24VDC interlocks - Yellow
  24 VDC signals and controls - Blue
  DC grounded common – White with blue tracer
  Ground - Green/Yellow

- Wire numbers are to remain constant from their source to their destination, and all of the terminations shall reflect the same number. Wires shall be tagged on both sides of the terminal strips. Wire tags shall have characters that are bold, easily legible and protected by a clear, non-yellowing, non-fading.
- When cable connectors are used the terminal block connector shall be used as the terminal strips except if over current protection is required Note: 460VAC shall be wired to terminals. Connectors shall not be used.
- All boxes shall contain both commons. All external devices (e.g. float, pressure, limit, etc.) must have both wires brought to boxes and main panel terminal strips.
- All equipment will have a minimum of 10% spare wires.
- A ground connection shall be provided in each cable.
- A panel mount female receptacle shall be used on the control panel. Tiered terminal type connectors shall be used in the panels. NOTE: No male receptacles shall be used as a power source.
- The builder shall supply a minimum of 5% spare cable length on all cables.
- Rectangular latching type connectors shall be used.
- Cable length for machine mounted devices (solenoids, limit switches, pull cord switches, pressure switches, etc.) will not exceed a maximum of 15m in length and will be run through pipe with protective bushings at both ends. Using a B-Line with protected edges (cable tray) is accepted, too. No more than 1000 mm per cable will be exposed.
- Clamping for cable shall be metal. Plastic and tie wraps are not acceptable.

Raceways and Cable Trays

- Raceways and cable trays containing electric conductors shall not contain any pipe, tube, or equal for steam, water, air, gas, drainage, or any service other than electrical.
- All raceways and cable trays between panels, equipment, etc. shall be totally self-supporting. Provide supporting bridges when required.
- Conduit shall be rigid steel. When flexible conduit is required for the application, metallic seal-tight is the preferred type.
- All raceways will be in an open and accessible location for service and inspection.
- All raceways access covers shall be free of any obstructions.
- Builder shall install raceways and cable trays so they do not interfere with the work envelope of a robot.

Power Supplies (DC) Regulated

- Power supplies shall be regulated.
- Regulated power supplies shall have output regulation of no greater than 0.1% variation for line and load.
- Power supplies shall be sized for a minimum of 125% of their connected load.
- Power supplies 50A and above shall be mounted on the exterior of control enclosure.

Audible Alarms

All machines will have an audible alarm for "Master Start" and "Start Spindles". When the "Master Start" or the "Start Spindles" button is depressed an alarm will sound for the first five (5) seconds. At the end of the five seconds the machine or spindles will be allowed to start. The "Master Start" or the "Start Spindles" button must be held for the first five (5) seconds. The circuits cannot be sealed until the alarm is completed

Interlocks

- It is the supplier’s responsibility to electrically interlock their equipment to other machine support equipment. It is also the supplier's responsibility to contact the suppliers of the other equipment to obtain all the information required for the proper interlocking of equipment. The information concerning the other supplier(s) is available through the appropriate tool or plant engineer.
- Interlock signals shall remain accurate if power is removed from equipment and shall never use normally closed relay contacts for an equipment clear signal.
- Interlocking shall consist of the necessary limit switch and/or contacts. All interlock relays will be in the control panel. If a limit switch is used for both interlocks and machine information, then a double pole switch shall be used. Interlocks are to be designed to only operate when contacts are energized.
- Interlocks shall be effective in all modes of equipment operation.

- All interlocks shall be wired to a separate terminal strip located in the main panel. Any interlocks coming from machine-mounted devices shall come directly from its associated junction box and be wired with yellow wire.
- Clearly label terminal strips and wires including spares.

General Controller Requirements

Controllers

- A twisted pair shall be used for communications between the station controllers. A plastic fiber optic link shall be used for communications only between devices in the same control panel.
- A minimum of 20% spare logic space must be available after the machine control logic is installed. Equipment using distributed controllers shall require a minimum of 10% spare input and 10% spare output points, with cards installed. Equipment using a central controller with distributed I/O shall require a minimum of 10% spare input and 10% spare output points, with card installed at each I/O drop. Equipment using a central controller and I/O shall require a minimum of 20% spare I/O modules along with the capacity of the power supply to handle the extra backplane I/O current requirements.
- All input and output devices shall have a unique I/O point as there will be no serial or parallel wiring of I/O devices allowed.
- All PLC controllers shall include both EEPROM and battery backup.
- Controllers shall have a processor battery low indicator. Locate the indicator on the main control console.
- Manufacturers grounding recommendation shall be followed.
- All dip switch settings and jumpers shall be shown on the drawings.
- A laminated label shall be mounted above each I/O rack engraved with the addresses found on each module.
- The following circuits shall not be connected to the P. L. C. system, except where auxiliary contacts are used for information or diagnostic purposes:
  Initial start up master relay circuit.
  Simple motor, fan and pump circuits which do not require sequence or interlock circuit logic.
  Emergency stops.
  Any guard or personnel safety circuit.
- One device only is permitted per input/output terminal. Circuit breakers that are mounted in groups and protecting similar circuits may be wired in series.
- All ancillary equipment circuit's e.g. lubrication control & monitoring, tool life counting and production part gauging shall be incorporated within the P. L. C. system controls.
- Where an area of user memory is designated by the P. L. C. manufacturer or the relevant software specification for a particular function or purpose, this must be adhered to and not used for any other purpose.
- Master control circuitry shall be incorporated into machine designs such that they conform to sample drawings.
- Main control panels shall be laid out such that the Main Isolator to be flanged-operated and fitted on right hand end of panel. With the Earth stud be fitted adjacent to the main isolator on the back plane and linked to the main earth bar with an appropriately sized Earth cable.
- Diagnostic faults of a critical nature, i.e. those that cause immediate machine damage, shall shut down the machine as soon as they are detected. It should be noted that brakes, regenerative braking circuits and other systems that safeguard the machine will remain active until the machine movement has ceased. Non-critical faults, e.g. lubrication oil level low, shall de- energize automatic cycle after completion of the current machine cycle. Indicator lamps on P. L. C. outputs and proximity switches on P. L. C. inputs shall function normally without series or parallel resistors external to the P. L. C. Dual input indicator lamps shall not be connected in parallel with P. L. C. inputs; this does not apply to L. E. D.'s.
- I/O racks (remote or local), processor racks and power supplies shall be earthed to meet the P. L. C. manufacturer's specifications. Particular attention should be paid to these earthing instructions.
- All circuits shall be powered through the master control relay (KAM) contacts. In addition the power supply to outputs shall also pass through contacts of the guard E- stop.
- Circuit breaker with over current protection shall be provided for the supply, together with a link. The MCB's and links may be terminal mounted. Individual MCB protection for outputs shall only be provided for solenoids.
- Where multicore cables are used for 24-volt circuits, individual cores shall be blue sleeved unless connected to a blue-cored cable via a terminal.
- Connections to contactors feeding external three-phase equipment shall be made through interposing terminals mounted in the control panel.
- Connections between I/O racks and machine equipment should be made directly without interposing terminals.

- When the P. L. C. internal system diagnostic detects a fault, the power to all outputs must be de- energized. Shutdown due to P. L. C. failure shall be indicated on the operator diagnostic system.
- Multi-station transfer-lines and dials must have provisions for manual control of tools slides at each station
- All PLC outputs shall be individually fused

General CNC and Servo Requirements

- Strict adherence to the manufacturer's wiring instruction (especially the proper grounding procedures) is imperative to attain the most efficient operation, as well as the safest operation. All servo-cabling runs are to be continuous without the use of intermediate termination.
- All motors shall have absolute encoders.
- The controllers are powered by 3 phase 460V AC.
- If a blower is used for the purpose of cooling the motor, then a filter with adequate filtering to protect against oil and coolant contamination must be utilized.
- Drive fault contacts are to be utilized in the control circuit.
- Emergency stop circuit must conform to manufacturer's recommendations.
- Mount motor with connectors down, and implement a drip loop for coolant splash.
- Power wires must be routed separate from feedback cables.
- All CNC's shall be properly grounded and protected from electrical noise according to the manufacturer's specifications.
- CNC controls shall include battery backup.
- All drives shall be properly isolated from the line power and grounded as per manufacturer's recommendations.
- Servo drive amplifiers shall not control more than one motor.
- Servo drives are to utilize the serial pulse encoders.
- Flex track bend radius must not exceed 15x cable diameter for inside of flex track.
- External 24 VDC supplies will be regulated and must be set for a minimum of 24 VDC and a maximum of 28 VDC.
- Use manufacturer's approved cables only for all installations.

Transfer Machines

Controls

Transfer machines shall have distributed processors. Usually each workstation shall have an individual processor. A master controller shall also be located at the Main operator panel (Transfer); this processor shall be used to coordinate machine functions, interlocks, safety gates, etc.

Main Operator’s Interface

- The main operator’s interface shall be used to replace pushbuttons, pilot lights and to display the equipment status. Mount the interface with the center of screen 1625 mm from the floor. Note: The "Emergency Stop", "Control On" and "Return to Initial Position" buttons shall be hardwired. Buttons for safety guards shall follow the Safety Specifications.
- Machines shall be capable of single, continuous and run-out cycles. The run-out cycle will automatically cycle the machine until it is empty of parts.
- After emergency stop restart will be allowed from the main operator’s console only. It shall not be necessary to cycle each unit, head, etc. from its station to bring the unit back in cycle. Provide the controls to implement master console restart. Reactivation shall not cause unexpected motions.
- Two socket outlets (120V AC) shall be provided adjacent to the main processor for the connection of test and programming equipment. For the 120V supply, short circuit protection shall be provided by means of a circuit breaker 5A/2A on the secondary side of the transformer. Where the main control panel is balcony mounted the facility as detailed above shall also be provided at the main control console, along with the necessary supplementary programming port(s).

- Each workstation shall have its own control panel. The control panel shall contain the processor, I/O, relays, starters, DC power supplies, servo components etc., required to operate the station. The panels shall be mounted to the station base. Transformers over 5000VA shall be mounted external of the control panel.
- Each station shall use a HMI operating pane (10”, color) as a replacement for buttons and lights except for the "Emergency Stop" button. Buttons for the safety guards shall follow the Safety Specifications. Mount the interface with the center of screen 1625 mm from the floor.
- Each station shall have a selection for either automatic or manual at the station interface. With the station in the manual mode only the station controls will operate the station.
- For the machine to operate automatically all stations must be in the automatic mode and have automatic cycle selected at the main control console.
- Each station shall have the capability to manually clamp and unclamp parts.
- Each station shall have a tool change position and easy access to change the tool.

Power distribution

- Primary disconnect will be supplied with the machine, a Power Distribution panel shall be used for the Primary 3 phase supply to each station.
- Each station shall be fed the 3 phase primary supply from the Power Distribution panel. Each station will cycle independent of any other workstation.
- All control circuits and I/O shall be 24VDC grounded.

Motors

- Two-speed motors shall be consequent pole types. Clutch/brake arrangements shall be used where a motor is cycled more than three times a minute.
- Each motor shall be individually protected against over current on the line side and be controlled by a properly sized starter with circuit breakers. All motors 75 kW and over will use solid-state reduced voltage starting.
- Group starting of motors. The starting of motors shall be in sequence so that a group of motors started simultaneously will not exceed either of the following.

  An aggregate of 75 kW, when the smallest motor is 7.5 kW or larger.
  An aggregate of 55 kW, when the smallest motor is 5.5 kW or larger.

Programming Requirements

- Programs on all machines shall be of the structured programming type in ladder logic.
- Where appropriate, rack and network fault control programming shall be incorporated.
- A text description shall be incorporated at the start of all program listings giving the Metaldyne inventory number, the Component Part Number/Description, Machine Description, and station number.
- Unused input and output addresses shall not be used for internal stores.
- Logic design shall ensure that all sealed circuits are released when the Master Control (KAM relay) is de-energized. Note that movement shall not occur upon power being re- applied to the machine..

Tagging

All motors, solenoids, switches, etc. to be tagged with appropriate device number on or near the location of the device. Refer to NFPA Standards for further details.

Data Storage and Retrieval System

In cases where individual part traceability is a requirement a computer based server will manage an overall database set-up to receive incoming data from each data providing station. The data shall be recorded as a data set linked to the part or assembly’s unique serial number. Along with the data, time and shift information shall also be captured per part. The systems shall also have the ability to manually input calibration times/dates along with operator identification information relative to the calibrations. The system shall be capable of managing data to show complete build histories including failed results and rebuild attempts until a successful build for a failed part occurs.

The data system shall provide production analysis capability including, but not limited to, evaluating uptimes/downtimes, capability (when practical), fault Pareto for part and equipment issues, historical trending by station and by line, etc. Reporting functions are expected to be user friendly and be capable of printing and storing results. The server computer will have all system software required to operate and maintain the line installed. Additionally, all engineering drawings and documents shall be stored on the hard drive.

A quality LCD display and laser printer are required with the system and the entire server and print system is to be mounted in an air conditioned computer enclosure for use at the line, on the plant floor.

Program & Software

Two sets of CD's containing PLC and CNC program backups with documentation are to be provided. PLC programs written using "Rockwell Software Inc. (RS Logix) A.I. Ladder Logistics" software are preferred. Approved special software for machine logic programming to be licensed and furnished to Metaldyne Corporation and considered in purchase price of equipment (including any programming terminal, interface cables, etc.). PLC and CNC programming should contain fault checking and fault diagnostics, to the component level to detect broken/stuck switches, etc. All read only and random access memory will have stored data memory protected by battery backup for a minimum of five hundred seventy six (576) hours.

Error Proofing / Mistaking

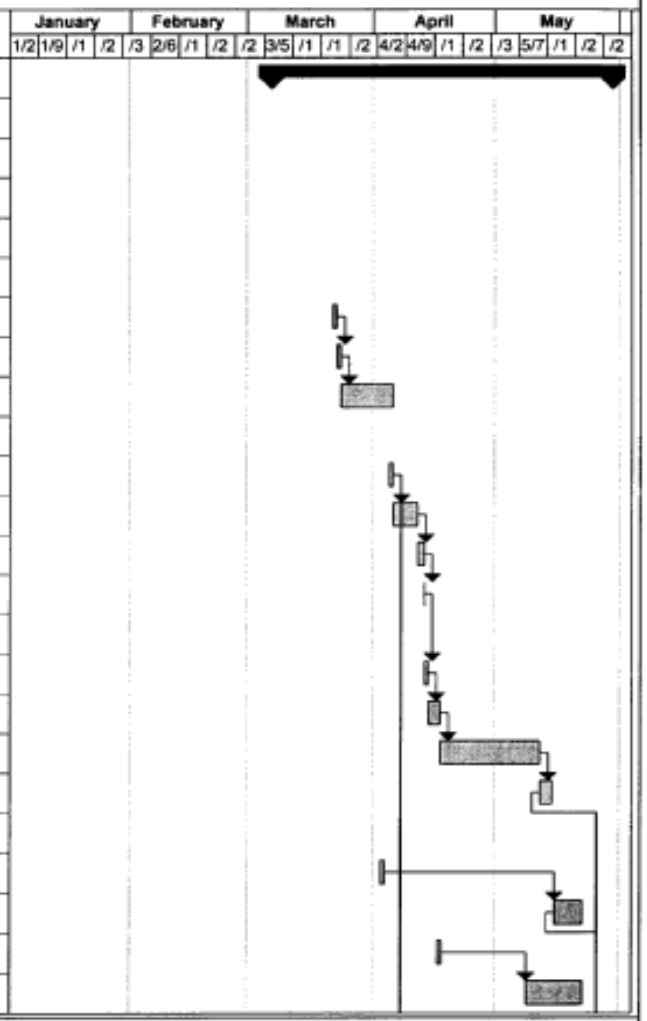
Equipment supplied by Supplier must provide adequate error/mistake proofing to prevent bad product from being generated, as well as a list of all error/mistake proofing devices intended for this equipment.

NP FM 9.02

YOUR COMPANY NAME
JOB
Machine #1

APPENDIX: A

ID	Task Name	Duration	Start	Finish
0	**Machine #1**	**11.9 wks**	**Tue 3/7/00**	**Tue 5/30/00**
1	RECEIVE CUSTOMER PO	0 wks	Tue 3/7/00	Tue 3/7/00
2	RECEIVE CUSTOMER SUPPLIED INFORMATION	0 wks	Thu 3/16/00	Thu 3/16/00
3	**MACHINE DESIGN, BUILD, & SHIP**	**9.7 wks**	**Wed 3/22/00**	**Tue 5/30/00**
4	**DESIGN**	**3.35 wks**	**Wed 3/22/00**	**Thu 4/13/00**
5	CONCEPT	0 hrs	Wed 3/22/00	Wed 3/22/00
6	MECHANICAL DESIGN	8 hrs	Wed 3/22/00	Wed 3/22/00
7	INTERNAL DESIGN REVIEW #1	8 hrs	Thu 3/23/00	Thu 3/23/00
8	MECHANICAL DESIGN	1.8 wks	Fri 3/24/00	Wed 4/5/00
9	CUSTOMER DESIGN APPROVAL	0 wks	Mon 4/3/00	Mon 4/3/00
10	FINALIZE DESIGN	1 day	Wed 4/5/00	Wed 4/5/00
11	DETAIL	4 days	Thu 4/6/00	Tue 4/11/00
12	CHECK & CHANGE	1 day	Wed 4/12/00	Thu 4/13/00
13	RELEASE TO MFG. REVIEW	1 hr	Thu 4/13/00	Thu 4/13/00
14	**MANUFACTURING**	**4.3 wks**	**Thu 4/13/00**	**Mon 5/15/00**
15	PROCESS DETAILS	8 hrs	Thu 4/13/00	Fri 4/14/00
16	SOURCE DETAILS	8 hrs	Fri 4/14/00	Mon 4/17/00
17	MFG. DETAILS	3.7 wks	Mon 4/17/00	Fri 5/12/00
18	DETAILS RECD AND INSPECTED	8 hrs	Fri 5/12/00	Mon 5/15/00
19	**PURCHASING**	**7.2 wks**	**Mon 4/3/00**	**Mon 5/22/00**
20	LONG LEAD TIMES ORDERED	1 day	Mon 4/3/00	Mon 4/3/00
21	LONG LEADS RECEIVED	1 wk	Tue 5/16/00	Mon 5/22/00
22	SHELF ITEMS ORDERED	1 day	Mon 4/17/00	Mon 4/17/00
23	SHELF ITEMS RECEIVED	2 wks	Tue 5/9/00	Mon 5/22/00



Project: Machine #1
Project Manager: your name
Date: Wed 7/19/00

Task | External Tasks | Split
Progress | Project Summary | Rolled Up Split

Customer Engineering Contact:

metaldyne

APPENDIX B - SCHEDULE I

PRE-ACCEPTANCE RUNOFF AT SUPPLIER FORM

Metaldyne Project Engineer / Program Manager Input Required

PROGRAM & EQUIPMENT DESCRIPTION

SUPPLIER NAME & ADDRESS

If applicable, the requirements below are to be verified on the Supplier's floor:

- Has the equipment passed the agreed to quality & process capability (i.e., Ppk, Cpk) requirements? _____
  Comments:

- Has the equipment demonstrated the agreed to Productivity (e.g., cycle time) requirements? _____
  Comments:

- Have all design requirements been met? _____
  Comments:

- Is the equipment in compliance to all applicable safety regulations? _____
  Comments:

- Has the equipment passed the agreed to runoff requirements? _____
  Comments:

- Has the Supplier met the requirements of the contractual agreement? _____
  Comments:

- The approval signatures below give authorization for the delivery of the equipment specified and acknowledges that the pay point of successful Runoff on Supplier's floor has been met.

Metaldyne Project Engineer & Program Manager _____ Date _____

Metaldyne Plant Manager _____ Date _____

SUPPLIER AUTHORIZED REPRESENTATIVE _____ DATE _____

TITLE _____

metaldyne

_____ **APPENDIX B - SCHEDULE II**

FINAL ACCEPTANCE RUNOFF AT METALDYNE FORM

Metaldyne Project Engineer / Program Manager Input Required

PROGRAM & EQUIPMENT DESCRIPTION

SUPPLIER NAME & ADDRESS

If applicable, the requirements below are to be verified on Metaldyne's production floor:

- Has the equipment passed the agreed to quality & process capability requirements (i.e., Ppk, Cpk)? _____
  Comments:

- Has the equipment demonstrated the agreed to Productivity requirements (e.g., cycle time)? _____
  Comments:

- Have design requirements been met and design drawings been delivered? _____
  Comments:

- Is the equipment in compliance to all applicable safety regulations? _____
  Comments:

- Has the equipment passed the agreed to runoff requirements? _____
  Comments:

- Has the Supplier met the requirements of the contractual agreement? _____
  Comments:
- The approval signatures below acknowledge that the pay point of successful runoff on Metaldyne's floor has been met.

Metaldyne Project Engineer & Program Manager _____ Date _____

Metaldyne Plant Manager _____ Date _____

SUPPLIER AUTHORIZED REPRESENTATIVE _____ DATE _____

TITLE _____

APPENDIX C

Facility Location:	
Project Name:	
Equipment:	
EHS Coordinator(s) Completing Form:	
Today's Date & Date of Installation:	

FD = Floor Design Phase ES = Equipment Supplier Phase FI = Floor Installation Phase

		ENVIRONMENTAL REGULATORY REQUIREMENTS	Yes	No	Environmental Impact Details
1	ES	Are any environmental regulatory requirements triggered by the installation of this project? (If yes, list the name of the regulation)			
2	ES	Will waste water be generated as part of this project? (If yes, list the estimated amount & disposal method)			
3	ES	Will a waste stream be generated as part of this project? (If yes, indicate type of waste stream & disposal method)			
4	ES	Will this project generate any outdoor air emissions (emissions piped directly to outdoors)? (If yes, indicate type of emissions)			
5	ES	Will this project require the use of any chemicals that are restricted by government regulations or customer mandates? (If yes, list those chemicals)			
6	ES	Will Underground Storage Tanks be installed as part of this project? (If yes, then authorization from the Corporate EHS Department is required. Provide proposed tank size & contents)			

	CONSUMPTION	Yes	No	ESTIMATED QUANTITY
FD	Process Water			
FD	Cooling Water			
FD	Electricity			
FD	Natural Gas			
FD	Compressed Air			
FD	Other:			

		ISO 14001	Yes	No	New Aspect	Date
1	FI	Does this project create a new environmental aspect for the facility? (If yes, then provide the date that the Aspects Worksheet ENV 14-100 was updated)				
2	FI	Does a new environmental work instruction need to be developed or a current work instruction updated as part of this project? (If yes, provide the document # and revision date)				
3	FI	Does this project affect any of the current Objectives & Targets for the facility? (If yes, provide the date that the O & T Worksheet ENV 14-200 was updated)				

		HAZARD COMMUNICATION (SHMS-6.16)	Yes	No	New Chemical	Date
1	ES	Does this project require any new chemicals or hazardous materials that are not currently part of the facilities chemical inventory? (If yes, provide the date that the chemical inventory was updated)				
2	ES	Does the facility have a current MSDS or equivalent chemical information on-site for all chemicals and hazardous materials to be used with this project? (If no, obtain appropriate chemical information – indicate date information was requested)				

		FIRE PREVENTION / EVACUATION (SHMS-6.10)	Yes	No	NA	Fire Hazard	Date

1	FI	Does this project create potential fire hazards, such as generation of sparks, use of flammable materials, etc.? (If yes, update the facility Fire Prevention Plan & provide date revised.)					

		INDOOR AIR EMISSIONS & NOISE (SHMS 6.12 & 6.14)	Yes	No	NA	Objective Evidence
1	ES	Does this project create any indoor air emissions? (Document type of indoor air contaminant – particulate, oil mist, volatiles, other)				
2	ES	Have the indoor noise levels been determined, either through manufacturer specifications or actual testing, for this project? (Document the noise level)				

		WALKING & WORKING SURFACES (SHMS-6.20)	Yes	No	NA	Comments
1	FD	Are all aisle ways, stairways, and walkovers for this equipment wide enough for the intended use (36" for pedestrian aisle ways & 72" for powered industrial truck aisle ways)?				
2	FI	Does this project create any slip, trip, or fall hazards?				
3	FI	Have the floor and adjacent areas been inspected to ensure that they are appropriately prepared for equipment installation?				
4	FI	Are all elevated work surfaces higher than 48" protected by a hand rail, mid rail, and toe board?				

		CONTROL OF HAZARDOUS ENERGY (SHMS-6.18)	Yes	No	Comments
1	ES	Are all lockout sources (breakers & valves) labeled & easily identifiable on the new equipment?			
2	ES	Has the facility's energy evaluation & lockout form been completed for the new equipment?			

		CONFINED SPACES (SHMS-6.19)		Yes	No	Comments
1	FI	Does the new equipment / process contain any confined spaces?				
	If Yes:	Have the identified confined spaces been labeled as a "Confined Space" or have signs been ordered?				
		Has the facility's Confined Space Program been updated?				

		PROTECTIVE EQUIPMENT (SHMS-6.17)	Yes	No	Date	PPE Required for This Job
1	FI	Has a Job Hazard Assessment been completed for the new equipment? (Not required if Assessment already completed for similar job type within last 3 years – indicate the date new or existing Assessment was completed)				

		CONTRACTORS (SHMS-6.22)	Yes	No	Date	Metaldyne Point-of-Contact
1	FI	Have all contractors to be used in the installation or any on-site work been trained & signed off on Metaldyne safety rules? (indicate date of training)				

		ELECTRICAL (SHMS-6.26)	Yes	No	NA	Comments
1	FD	Do all electrical boxes have at least three feet of clear space in all directions from any openings and operational sides?				
2	FD	Do all electrical panel boxes have lids or doors that are in good working condition?				
3	FI	Is the voltage labeled on all electrical circuit breakers and panels?				
4	FI	Are all circuit breakers clearly labeled as to which direction is “on” and “off”?				
5	FD	Are all electrical equipment, lamps, or conductors lower than seven feet (2 meters) from the normal working surface covered or protected?				

		MACHINE GUARDING (SHMS-6.21)	Yes	No	NA	Comments
1	ES	Are all hazards created by points of operation, pinch points, and rotating parts adequately guarded (cannot reach over, around, or under the guard into point of hazard)?				
2	ES	Are all machine guards constructed and attached in such as manner as to not create safety hazards themselves (sharp edges)?				
3	ES	Are all machine guards securely attached to the equipment & require a tool for removal?				
4	ES	Are all doorways entering into perimeter fencing interlocked?				
5	ES	Are all operable machine guards and doors properly interlocked?				
6	ES	Are all Presence Sensing Devices (light curtains) installed in such a manner that individuals cannot reach around, over, or under into the hazard area?				
7	ES	Do all light curtains stop the machine in sufficient time in order to ensure that employees cannot reach a body part into the hazard area?				
8	ES	Is all perimeter fencing less than six inches off the ground and at least 60 inches high?				
9	ES	Is all perimeter fencing high enough to prevent objects from being thrown out of the cell and at least as high as the highest reach of the enclosed robotics?				
10	ES	Is all perimeter fencing constructed of materials strong enough to withstand the operational forces?				
11	ES	Do all two-hand controls require that they be held in-place throughout the complete operation of the cycle while the operator is exposed to a risk / hazard (using a light curtain in conjunction with two-hand controls eliminates the need to hold the controls down during the entire cycle)?				
12	ES	Are all two hand controls designed and installed in such a way as to require the use of both of the operator’s hands to initiate the cycle?				

		ERGONOMICS	Yes	No	NA	Comments
1	FD	Has the equipment / process been evaluated to attempt to reduce and/or eliminate ergonomic stress factors such as: • repetitive motions • continuous standing • repetitive lifting over 10 lbs. (4.5 kg) • repeated work above shoulder height • repeated hand gripping or wrist twisting • lifting materials greater than 40 lbs. (18.1 kg) from floor • exposure to hot or cold surfaces • repeated twisting of the back • repeated reaching greater than 20” (51 cm)				

Plant Manager’s Signature:	**Date:**
EHS Coordinator(s) Signature:	**Date:**