



GENERAL SPECIFICATIONS

**GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS
SECTION 050 PNT**

**FORD MOTOR COMPANY
PAINT EQUIPMENT DESIGN SECTION**

11 AUGUST 2006



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GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

1. GENERAL HARD POINTS

The stipulations and requirements set forth in this 050 PNT Document are binding for all the equipment and facilities supplied either as a turnkey package or for any portion of the paint shop.

The 050 PNT Specification is intended to enhance and be read with all sections of the Ford Motor Company Paint Process specifications.

The following points apply to all areas of the project and shall be priced as listed on the Lump Sum proposal forms:

1.1. PROJECT MANAGER

This Contractor shall provide a project manager for this project. The project manager shall meet the following requirements:

- Must be experienced with all Paint shop paint equipment and building construction.
- Must work out of the field trailer and manage all field operations i.e.; this person will also be the field project manager.
- This person must be willing to work weekends.
- This person must have control of his staff, e.g. designers, salesmen, field engineers and start-up personnel.
- This person shall provide a daily written review of the site conditions and a daily joint site inspection with Ford representatives.
- This person shall conduct monthly review meetings for Ford Management

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.2. FAR COORDINATOR

This Contractor shall provide as part of the management staff a FAR Coordinator. The FAR Coordinator shall work with the Ford Motor Co. coordinator as required to maintain timely completion of quote submittals and establish either FORD rejection or acceptance of FAR's. FAR coordinator shall acquire the following signatures on all FAR's: Plant Representative, FSC/PM Project Manager and Ford Motor Co. Coordinator. Evidence that FSC/PM management has accepted the FORD approval or rejection of FAR's shall be attached to each FAR.

The FAR Coordinator shall maintain a FAR matrix broken down by cell activity for all submitted FAR's. The matrix shall include tracking.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.3. SAFETY COORDINATOR

This contractor shall provide a "Dedicated Safety Coordinator" per the latest Section 01100 Safety Guidelines and Information for Contractors. The content of the latest Section 01100 Safety Guidelines and Information for Contractors is part of this contract. Safety coordinator shall provide safety orientation for all contractor employees, Ford project personnel and visitors to the site.



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For Site/Project specific requirements for this item see 070-PNT

1.4. LAUNCH COORDINATOR

This Contractor shall provide a launch coordinator. The launch coordinator shall be on-site a minimum of two (2) weeks prior to start-up and debug of equipment at each major construction phase of installation. The person shall drive the project to completion, coordinate the collection of launch data, manage start-up personnel, manage the completion of punch list items, **organize and conduct a daily launch meetings**, etc. The Launch Coordinator shall sign and distribute the daily launch meeting minutes. The Launch Coordinator shall also manage the Deep Clean of the facility as well as the Production Launch Phase.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.5. PROJECT SCHEDULER AND TIMING CHARTS

The contractor shall submit with the proposal a complete detailed timing chart.

Following award of contract this Contractor shall submit timing charts which indicate the work activities, number of trades and the number of men per trade. Timing charts shall be as generated with **Microsoft Project or Primavera** and include design, Ford approval, fabrication, installation, start-up, debug, facility launch and production launch. Timing charts shall be updated a minimum of once per month following award of contract. For the shutdown periods a detail matrix of work activities shall be formulated which details the work to be completed every 8 hours.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.6. QUALITY CONTROL

This contractor shall provide applicable quality control data as is applicable for this project. The following is a brief list of items included on Ford projects: Concrete Testing Reports, Site Soil Reports, Building Steel Testing Reports, Conveyor Chain Tensile Strength Test Report, E-Coat Dip Tank Lining Test Report and Lining Field Install Monitoring, Building Bolt Torque Report, Conveyor Bolt Torque Report, Building Welding Report, Process Equipment Welding Report, Conveyor Weld and Hanger Report, All IR Scan Reports, Vibration Analysis Reports, Noise Studies, Shop Fabrication and assembly reviews, etc.

To provide the above data, this contractor shall obtain the services of a Third Party Independent Testing Agency for all process equipment, building and conveyor facilities. The Third Party Independent Testing Agency shall be hired by this Contractor and shall report to the Ford Coordinator and the Ford Site Manager.

All Quality Control Data shall be included with the Project Record Books as required per Section 020 PNT.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.7. SITE ORIENTATION

See Section 070 PNT for site orientation requirements for the project.



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1.8. DRUG TESTING

See Section 070 PNT for drug testing requirements for the project

1.9. SITE PARKING AND BUSING

See Section 070 PNT for trades parking and bussing requirements

1.10. MONTHLY REPORTS

Monthly report Standard Section 001-PNT shall be followed for this project if so specified in 070-PNT. The FSC/PM shall establish and maintain web site and shall post the Monthly Reports to the site. The Contractor is to furnish his input for the monthly report in an electronic format.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.11. INSURANCE

Contractor shall obtain all necessary insurance policies prior to starting any site work and for the duration of the project. Ford Motor Company shall be listed as the Beneficiary on all the policies obtained by the Contractor and all of his subcontractors. Copies shall be provided to Ford Project Coordinator prior to any work commencing and also to Contractor's Site Manager for filing on site.

This project may be declared an OCIP (Owner Control Insurance Program) site if indicated in the 070 PNT Document.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.12. STAND-BY ASSISTANCE

See Section 070 PNT for stand-by requirements for the project

1.13. CONSTRUCTION SITE OFFICE

FSC/PM shall coordinate site trailer requirements with his contractors and subcontractors. This Contractor shall provide site trailers which are adequately sized for offices and an enclosed meeting room. FSC/PM trailer shall have the required meeting room. The Contractor trailers shall be on-site and in service within the schedule specified following award of contract. This Contractor shall provide all additional services including phone service.

A total of six (6) parking spaces will be provided at site trailers to be shared by FSC/PM, contractor, Ford and subcontractors.

This Contractor shall have a secretary on-site during day shift. This secretary shall also provide administrative Assistance for the Ford field staff. This secretary shall be on site when the trailers are installed and continue on site until the completion of all contract work. Secretary shall be proficient in Microsoft Office Applications, office administration and secretarial duties.



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Contractor trailers must be a minimum of 30' from the outside wall of the building. See 070 PNT for fire protection requirements and other site-specific requirements.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.14. CONSTRUCTION SITE OFFICE FOR FORD V.O.

The V.O. trailer shall be on-site as required in 070-PNT. The V.O. trailer shall be located adjacent to the full service contractor trailer.

This contractor shall provide one, single width trailer, 60' long for the owner's exclusive use. The V.O. engineers for the duration of the project will occupy the rental unit. The office facilities provided are to be rented complete with fire, theft, liability insurance, etc., provided by this contractor for a period of time from one week following award of contract through the end of the project.

The mobile office rented by the contractor for the owner's use is to be furnished complete or upgraded by this contractor to include the following facilities:

- Exit/Entry steps at two (2) locations
- Common keyed deadbolt locks installed at each entry/exit door
- Internal and functional restroom facilities (serviced/pumped weekly) with tissue paper supply, hand wipe supply and hard soap
- Whiteboard at a conference room area
- Two (2) lockable and separate internal offices
- Two (2) 8'-0" x 3'-6" folding steel top tables
- Twelve (12) folding chairs
- Two (2) Steelcase office desks with chairs (one per office)
- Twenty-five (25) hard hats, manufactured by Fibre-Metal or Norton, Class "B", with ratchet type adjustable suspension for the owner's exclusive use
- Fifty (50) sets of visitors safety glasses, complete with side shields for the owners exclusive use
- Fifty (50) a pair of owner approved, disposable, lint free, paint department acceptable, sanitary coveralls and hairnets of various sizes for the owner's exclusive use.
- Dedicated electrical services to the mobile office facility installed complete and removed as requested to suit timing as specified by the owner
- Dedicated, communication (coaxial) cable, with communication card for programming terminal and installation of communication services from the rented facility to the assembly plant broadband/-computer communication network to access OUTLOOK, CPARS, etc.
- Lockable storage room and offices
- Two (2) drawing stick files

Trailer ventilation system shall be with ductwork on the supply side and ductwork on the return side. Heating and cooling unit shall be enclosed inside the trailer common area and not in the office space.

The contractor's proposal is to include all costs required to lease for use by the V.O. engineers the following pieces of equipment. The equipment is to be installed for use in the rented office. The equipment is to be leased by the contractor and by lease agreement is to be fully insured for loss, damage, theft, etc. for the duration of the lease period. The following equipment is to be leased with full service contract for the duration of the project by this contractor:



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- One (1) Pitney Bowes, Model 9860 Fax machine. Provide 8.5"x11" paper supply and a comprehensive service contract to maintain the equipment for the duration of the lease.
- One (1) Hewlett Packard Series 4000se Laser Printer, complete with (2) extra toner cartridges, four (16) MB Printer RAM, One (1) Pacifica Data Products (25 in 1) cartridge and one (1) fifteen foot inter-connectable.
- Two (2) Dell 2000 MHZ (minimum) computers (w/ minimum of 60 GB hard drive, 512 MB RAM) complete with 19" Trinitron monitor, keyboard, 3.5 floppy disk drive, Read/Write CD – ROM drive with box of 25 R/W CD, locking stands for all equipment, covers, and Microsoft office package professional edition containing, Excel software, MS Word 2000 and Microsoft Project, Photo Editor, Power Point and a high speed modem. This contractor shall work with the Plant PC coordinator to establish tie in to the plant communications systems. Plant must provide the PC NET cards.

The contractor shall lease for duration of the project a "new" duplicating machine (similar to KONICA Model 2590) with minimum five (5) bin collating feature, 8.5 X 11, 11 X 8.5, 8.5 x 14, and 11 x 17 paper trays, reduction feature, enlargement feature, auto feeder, and scanning capability. Copy rate shall be minimum 1 copy per second. The contractor shall provide all costs, fees, maintenance, materials and supplier. Include at minimum 5,000 sheets of high quality bonded paper for use in this office facility. The lease agreement is to include on-site repair and inspection services with automatic monthly cleaning/inspection, etc. and a 24-hour service notification.

The contractor's proposal is to include the services of a laborer to maintain the cleanliness of the owner's rented office facility. The contractor's laborer is to mop the office facility (once per week), empty trash containers (daily), clean the restroom (daily), and maintain the appearance of the facility during the duration of the project. Contractor shall remove snow from around the trailer including parking area.

The contractor's proposal is to include all costs associated with renting for the owner's use one (1) five-gallon water cooler. The water cooler provided is to be complete with hot/cold water dispensing capability, lower cooler section, etc. The contractor's proposal is to also provide two (2) bottles/10 gallons of bottled water per week for use in the office facility.

This contractor shall also provide one (1) rechargeable Class "A" fire extinguisher secured as directed by the owner.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.15. TOILET FACILITIES

This Contractor shall provide adequate Portable toilet facilities for all employees and Subcontractors. Adequate hand washing facilities shall also be provided

For Site/Project specific requirements for this item see 070-PNT

1.16. SITE CLEAN-UP AND WASTE DISPOSAL

All scrap, garbage, trash and hazardous waste generated by this project shall be disposed of off-site at approved disposal sites by this Contractor under the direction as given by the M.S.A. (Master Supplier Agreement) waste disposal contractor. Trash and scrap gondolas shall be provided by FSC and managed such that a clean and orderly site is maintained at all times. **NO** trash heaps, garbage mounds, scrap piles, etc. will be allowed on site. Ford will assist the contractor in managing site clean up following the first warning of unsatisfactory compliance with cleaning directives from Plant or Ford personnel; back charges



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will then be issued. A Ford Site approved M.S.A. waste disposal contractor must be used and contracted as directed in the DED. The Contractor must maintain a safe clean site at all times.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

The following points apply to all areas of the project. The related costs to perform the required work related to 050 PNT content shall be included on the project proposal forms.

1.17. **GENERAL**

See Section 070 PNT for Ford project coordinator and field engineer assignments

1.18. **PLANT LOCATION**

See Section 070 PNT for the Plant name and Address

1.19. **FULL SERVICE/PROGRAM MANAGEMENT CONTRACT**

If the project dictates the Full Service Requirement, the FSC will be responsible for the complete and proper execution of the project. Full Service places a burden on this FSC to identify fully all field conditions. Requests for extras will be greatly scrutinized.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.20. **WORK WEEK AND LABOR CLEARANCE**

See Section 070 PNT for workweek and labor clearance requirements for the project.

1.21. **SITE MEETINGS**

Weekly site meetings will be held at the job site in the site trailer. The FSC/PM and all Subcontractor representatives shall be present for the meeting. NOTE: This meeting is strictly a joint FORD and FSC/PM meeting with the sole purpose of maintaining high levels of communication between all parties involved. If any meeting converts to a prime/sub design or open issue meeting, the FORD representatives will abandon the meeting until such time that the FSC/PM and their subcontractors have organized themselves.

The weekly meeting minutes shall clearly indicate cost issues discussed. Cost claims must be clarified on a weekly basis.

Meeting minutes shall be recorded by a secretary and typed by the Company conducting the meeting and submitted to Ford within 48 hours following the meeting.

There will also be a Monthly Meeting held with Ford management to review work progress along with the overall project status. Monthly project status books must be submitted prior to the monthly review meetings. The Monthly Meeting will be lead by the FSC/PM. Monthly Meeting books shall be submitted and distributed on a CD, one per participant.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.



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1.22. DESIGN REVIEW MEETINGS

This Contractor shall conduct design review meetings for the new and reworked paint facilities included in this contract. This contractor shall also participate in overall team review meetings with the conveyor contractor, robot contractor and building contractor. Equipment and facility design, site, building, and open issues shall be reviewed at separate meetings as required. The FSC or the Program Manager as applicable shall coordinate all meetings with Ford and the respective Contractors.

Design reviews shall be conducted as a minimum during two (2) meetings per week until all Ford review approvals are received by the contractor. The Ford Plant and Contractor Personnel shall participate. Design reviews shall be a minimum of 4 hours in length and may be conducted at the site or at Ford VO. Minutes shall be recorded and specific R&M related points of discussion shall be highlighted for management review and reporting.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.23. DRAWINGS FOR FORD REVIEW

See Section **070 PNT** Submittal requirements

This contractor shall be responsible for providing and maintaining a set of stick files of approval drawings in the Ford Motor Co. trailer.

Ford retains the option of requesting 11 x 17" files of approval drawings.

1.24. OPEN ISSUES MATRIX

This Contractor shall develop an open issues matrix and update the matrix on a weekly basis.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.25. STANDARD SPECIFICATIONS

All applicable standard specifications and miscellaneous documents that are on the FORD web shall be accessed by this contractor using the "B to B" address. Standards and branch drawings only available in hard copy will be provided to the contractor upon request. See attached list of standard specifications as indicated in the **070 PNT**.

For FSC or PM Site/Project specific requirements for this item see **070-PNT** and Section 2.0 of this specification.

1.26. PERMITS AND LABOR CLEARANCES

Contractor and his subcontractors shall obtain all necessary Building Permits and Labor Clearances, and where new installation or demolition work is required in the existing facilities shall obtain Labor Clearance from the facilities.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.



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1.27. OFF SITE WAREHOUSING

See Section 070 PNT for off site warehousing requirements

1.28. SITE ACCESS

The Contractor shall have full responsibility to secure site from all visitors and traffic. This shall include issuing of visitors passes, maintaining a visitor log, etc. All visitors must complete the site safety orientation.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.29. CONTRACT ASSIGNMENTS

Conveyor, Paint Automation, Abatement, and Paint Robotics contractors may be selected by Ford where indicated in the DED, and will be assigned to a successful Contractor or the Program Manager. It shall be this Contractor's or the Program Manager's responsibility to coordinate all engineering, fabrication, modular build, installation, interferences, safety, site clean-up, facility launch, production launch, stand-by, base line data collection, training, spare parts and final documentation delivery for the above contracts with no additional cost to Ford and on time with regards to a complete project schedule. Paint automation and robotics contractors shall participate in all programs implemented by the, FSC or the PM such as safety, daily clean-up, equipment clean-up and maintenance during facilities launch, film build evaluation, ISO-9000 requirements, FTPM requirements, ECPL compliance, etc. These contractors will have their portion of the above expense included in their quotations to Ford.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.30. NATIONAL MAINTENANCE AGREEMENTS

The rework and installation shall be constructed under the terms of the National Maintenance Agreements.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.31. ON SITE VEHICLES

All on site vehicles shall adhere to plant safety standards.

See Section **070 PNT** for Ford restrictions on the type and quantity of on site vehicles (carts, etc) that will be allowed on site.

1.32. DEEP CLEANING

See Section 070 PNT for site specific deep cleaning requirements

1.33. FIRE PROTECTION

All equipment and building fire protection shall comply with Specification 060 PNT. Documents related to approval and review shall be considered part of the record book documentation.



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Fire protection for each cell shall be included in that cell proposal (such as building, spray booth complete all zones including automation and robotics, ovens, etc.). Thus Bidders shall include fire protection for each cell in their proposal as a separate item.

This contractor shall provide fire protection piping flow switches at new fire risers at each piece of process equipment to indicate location of water flow, as detailed in Section 060 PNT. All fire protection items shall be incorporated into the total facility fire alarm system.

For Project specific Fire Protection Bulletin requirements for this item see 070-PNT.

1.34. FIRE WATCH REQUIREMENTS

When required by the plant safety coordinator, the contractor shall include fire watch while the construction is in progress.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.35. CONFINED SPACE REQUIREMENTS

The Contractors shall adhere to all OSHA, Federal, State, Local, and Plant confined space requirements. In existing facilities, Ford will dictate those areas defined as confined space. The local Ford Safety Engineer must approve the Contractor's confined space program which shall include fully trained personnel, fully trained rescue teams, and approved equipment.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.36. FACILITIES LAUNCH

Facilities launch cost shall be identified as a line item for each Cell.

It is the intent of Ford that all new or modified installations be performance tested at the design throughput rates. In order to accomplish these tests it will generally be necessary to make special accommodations within the system. These may consist of but not be limited to the following:

- Temporary Conveyor Routing
 - Temporary Over Head Conveyor
 - Temporary Floor Conveyor
- Manual Handling to Test Units
- Temporary Conveyor and Process Control Logic to Accommodate the Launch
- Foiling Units
- Paint Thickness Documentation
- Oven Heat Curves
- Etc

Refer to 020-PNT, **070-PNT**, the DEDs and Hard points for the facility launch requirements that are the responsibility of the Contractor. It should be noted that frequently there will be several companies involved in the launch. It is required that all the companies cooperate with each other and the FSC/PM, who will be leading the launch.



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1.37. NRTL REQUIREMENTS

Where specified in the DED, all new, revised/modified and/or relocated process and facilities equipment control panels and installation shall be in compliance with UL listing and labeling and **has to be certified by NRTL (Nationally Recognized Testing Laboratory)**. Labeling means that all control panels systems have to be reviewed for compliance to safety on Electrical Shock and Electrical Fire and certified by NRTL. For further information please refer to Ford 16950 Specification. NRTL inspections shall occur at modular build and after installation on site

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.38. TRAINING

Contractor shall provide all detailed training Plans no later than four (4) months after award of contract. Refer to 00200 Instructions to bidders and 020 PNT for additional project training requirements.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.39. CONTRACTOR BREAK AREAS

The Contractor shall not be allowed to use the plant canteens or lunchroom facilities. The contractor shall set up break areas for the Contractor's trade personnel. These areas are to be cleaned on a daily basis. **No food or drink shall be taken into the paint shop.**

If required a separate break trailer shall be provided.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.40. TEMPORARY SERVICES AND UTILITIES

The Contractor shall be responsible for their own temporary telephone, sanitary, toilet, city water, electrical power and compressed air services including any required equipment, line work, metering, connection work and site rework.

Ford shall designate temporary service tap locations for telephone, city water, electrical power and compressed air should the Contractor choose to connect to existing Plant services. The Contractor shall pay for all telephone usage. Ford will pay for normal city water, electrical power and compressed air usage.

Ford shall provide telephone taps, city water, electrical power and compressed air to the extent that they are available and Contractor usage does not impact Plant operations.

The Contractor shall provide their own city water, electrical power, and compressed air for heavy usage type activities such as 480v welding, jack hammering, pile driving, and power washing. The Contractor shall disconnect any service if Ford considers the usage heavy and above normal practices.

For FSC or PM Site/Project specific requirements for this item see **070-PNT**.



1.41. EMERGENCY EVACUATION AND EGRESS ROUTES

The Contractor's responsibility for emergency evacuation, including placards, and egress routing will be as stated in the in **070-PNT**. Generally the FSC/PM has this responsibility. They may choose to delegate this to another contractor such as the Building Contractor.

The Contractor will be required to work with the Company responsible for the egress and evacuation by providing crossovers, overhead clearance, paths from manned areas, drawings etc. necessary for the Responsible Company to obtain approval from the governing authority, and the Plant, which is one of the major steps required for building occupancy.

1.42. LAY DOWN AREAS

Lay down areas will be as specified in **070-PNT** and drawings. The contractor will be responsible for the following:

- Security
- Disposing of all Shipping Materials, Scrap, Trash, Etc. on a Daily Basis
- Keeping the Lay Down Area Neat and Orderly
- Securely Storing Tools

1.43. TEMPORARY OPENINGS FOR CONSTRUCTION

Temporary openings where required will be specified in **070-PNT**. Generally one Contractor will be assigned the responsibility for constructing and maintaining the opening. This includes the responsibility of keeping the opening closed when not in use.

This Contractor will be required to work with the Contractor responsible for the openings and other site Contractors to schedule the use of the opening. It is expected that any damage to the opening will be repaired by the Contractor Causing the Damage.

1.44. SIMULATION

Most projects of consequence require a simulation of the system to verify the design throughput. Either the Process Engineer or the Conveyor Contractor is generally made responsible for this activity. This section is included to give all the cell suppliers an understanding of the derivation of the throughput for each Cell.

Below are the criteria, which Ford uses to simulate and design a standard paint shop. Some of the factors listed below may change for a specific Plant, paint shop arrangement or a specific unit.

Below are the terms used for the simulation:

- Net=Net Units per Hour off Chassis (TT + Monotone)
- TT=Net Tu-tone Units off Chassis
- OS=Paint Shop Over speed= 0.05
- DT= Downtime
 - 0.05 for P/E-Coat to E-Coat strip
 - 0.07 for Sealer



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- 0.18 for E-Coat scuff through the exit of the plant (includes 11% for cleaning automation)
- R= Repairs
 - 0.0 for P/E-Coat to E-coat strip
 - 0.0 for Sealer
 - 0.0 for E-Coat scuff through Prime scuff
 - 0.18 Prime scuff through the exit of the plant
- Thus the simulated capacity is as follows
 - Phos/E-Coat to E-Coat strip= $\text{Net} (1+\text{OS}+\text{DT})=\text{Net} * 1.1$
 - Sealer to sealer Strip= $\text{Net} (1+\text{OS}+\text{DT})=\text{Net} * 1.12$
 - E-Coat scuff to Prime Strip= $\text{Net} (1+\text{OS}+\text{DT})=\text{Net} * 1.23$
 - Prime booth and Prime Oven= $\text{Net} (1+\text{OS}+\text{DT})=\text{Net} * 1.23$
 - Prime strip to the exit of the plant (monotones)= $\text{Net} (1+\text{OS}+\text{DT}+\text{R})=\text{Net} * 1.41$
 - Enamel booths and ovens (monotones) = $\text{Net} (1+\text{OS}+\text{DT}+\text{R})=\text{Net} * 1.41$
 - Prime strip to the exit of the plant (monotones and Tu-Tones) = $\text{Net} (1+\text{OS}+\text{DT}+\text{R}) + \text{TT} (1+\text{OS}+\text{DT})=\text{Net} * 1.41 + \text{TT} * 1.23$.
 - Enamel booths and ovens (monotones and Tu-tones) = $\text{Net} (1+\text{OS}+\text{DT}+\text{R}) + \text{TT} (1+\text{OS}+\text{DT})=\text{Net} * 1.41 + \text{TT} * 1.23$.
- Since these are Production rates, there are some criteria that is used to assure the production rates can be achieved in most adverse conditions.
 - The Conveyors supplying a process have a transfer capacity that is 10% above the production rate.
 - Lifts transferring units to an oven or between floors should have 5 seconds of rest time or 10% additional capacity, whichever is greater.
 - Strip banks are sized for the maximum units in process and in transit plus at least 10%.
 - Storage capacity between the Sealer Process and the Prime Booth should accommodate the units sealed during prime booth downtime for cleaning breaks plus units in transit plus 10%.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.45. INVOICING REQUIREMENTS

The invoicing requirements will be as specified in the contract. The following procedure should be followed where applicable.

- After award of the contract, prepare a schedule of values in sufficient detail to be manageable. This is to follow the format of the proposal
- Obtain Ford's approval of the schedule of values (SOV)
- When it is time to invoice, submit the SOV with % complete identified for each item included in the invoice.
- Ford will review and approve/modify the SOV and return it to the Contractor
- The Contractor shall then prepare the invoice complete with the following:
 - The approved SOV
 - The required Waivers
 - The sworn statement
 - The Invoice Cover Sheet is to be on the Contractors letterhead

See 070-PNT for instructions regarding conditional and unconditional waivers.

1.46. NOTICE OF COMMENCEMENT

Ford will prepare a NOTICE OF COMMENCEMENT, which will contain



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- The legal description of the property
- The name and address of Ford as owner of the property
- The name and address of the Ford's designee.
- The name and address of the general contractor if any.
- Statement to potential lien claimant.
- The name and address of the person preparing the notice.
- An affidavit of Ford which verifies the notice.

Ford will submit the Notice of Commencement to the office of the Register of Deeds in the County where the property is located. Ford will post Notice in a conspicuous place on the job site.

For FSC or PM Site/Project specific requirements for this item see 070-PNT.

1.47. NOTICE OF FURNISHING

All Contractors or Subcontractors, furnishing work on the property, are required to file a NOTICE OF FURNISHING with the Owner and the General Contractor.

1.48. CONTRACTOR RESPONSIBILITY

It must be understood that any reference made in these specifications about labor or equipment to be "added," "installed," "furnished," "required," "provided" or other words with similar meanings, shall be performed by this bidder unless otherwise noted.

It is the intent of the owner that the contractors furnish and install a complete and workable system to perform the functions which are described. Although each and every item is not mentioned in the drawings and specifications, it is expected that such items be consistent with codes and good standard practices.

All materials and workmanship entering into the work covered by these specifications and drawings shall be new and shall be the highest quality, which experience and good engineering practice, have shown to be best adapted to such use. All work throughout shall be "first class" and present a neat and clean appearance upon completion.

The contractor shall be responsible for and shall provide all design expertise, labor, materials, supervision, equipment, and all other services required to complete the work of this specification.

Replace with new materials, all facility or equipment (provided by others) damaged during installation.

Discrepancies and/or contradictions in these specifications or the drawings shall be brought to the attention of the Ford Project Coordinator for clarification during the initial quoting of the work.

All control enclosures shall be installed in such a way that no dripping of any process or cleaning material would occur over the enclosure. Any drip trays to protect the enclosures will be the responsibility of the contractor.

Where Unistrut, or a like material, is used to mount field components, any exposed piece presenting a hazard shall be capped with standard matching cap for the material of the Unistrut. All cables entering and exiting Unistrut or cable tray shall be protected with spiral wrap.



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The contractor shall maintain all fluid and air filters until facility launch. Following facility launch, the contractor shall completely clean the equipment, lubricate and replace all fluid and air filters. The record of this shall be included in the Record book.

Shrink-wrap all (100%) assembly modules, equipment, and materials or use covered trucks for shipping to the project site. All the assembly modules, equipment, ducting, materials, etc. must be stored under cover prior to installation.

1.49. INSTRUCTIONS TO BIDDERS

The contractor is to comply with any requirements set out in the Ford Motor Co. Specification Section 00200- Instruction to Bidders.

1.50. TERMINOLOGY

The following terminology shall be adapted throughout General Hard Points and shall apply to all bid documentation including, but not limited to the following: Section 00200, Standard Specifications, Detailed Equipment Descriptions and All Hard Points:

OWNER - Ford Motor Company

CONTRACTOR - A Full Service Contractor-FSC (Global Paint Finishing Supplier) or a Contractor furnishing goods and services under the direction of a PROGRAM MANAGER-PM.

PROGRAM MANAGER –A Company hired by the Owner to manage the implementation of a project.

1.51. ORDER OF PRECEDENCE

Each subsystem of the Building and Process Facilities shall comply with applicable Ford Specifications, Detailed Equipment Descriptions (DED) and Hard Points. In case of discrepancies, where Specific Hard Points provided in place of DED, Specific Hard Points shall take precedence over Standard Hard Points, and Standard hard Points shall take precedence over Standard Specifications. Where DED provided for a particular unit, DED shall take precedence over Standard Hard Points, and Standard Hard Points shall take precedence over Standard Specifications.

1.52. HARD POINTS

All hard points provided with bid documents are issued to emphasize certain items. Hard Points are the integral part of this project specifications and successful Contractor shall comply with All Hard Points just as with Ford Specifications and All Code requirements. These General Hard Points shall take precedence over any Specification.

Content of Clarifications, All Hard Points, All Detailed Equipment Descriptions, All Specifications And All Proposals After Award of Contract Shall Be To Ford Motor Company INTERPRETATION ONLY.



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1.53. PROJECT TEAM

Contractor shall submit Project Team Chart including Lead Purchasing Specialist along with their proposal. Updated resumes of major team members (project manager, project engineers, site superintendent, safety coordinator, lead mechanical and electrical engineers) shall be included for Ford's review. Ford reserves the rights to refuse any of the Contractor's team members without explanation.

1.54. BID MEETING MINUTES

Bid meeting minutes shall become a part of the Contract.

1.55. SCOPE OF SUPPLY

The Contractor shall provide all necessary labor, material, and equipment to design, fabricate, deliver, install and test for all items of equipment outlined in this specification or reasonably implied therein. All equipment, material, and wiring required for the complete operating, fully adjusted and Owner approved system shall be included. The Contractor shall visit the job site, verify all dimensions in the field, and shall submit complete working drawings for approval before starting fabrication. Bid drawings and specifications are intended to establish the standard requirements for fabrication, delivery, and installation of new equipment and/or material. The Contractor shall be responsible for ordering and receiving all material and equipment required under this Contract.

1.56. OMISSIONS

It is understood and agreed by the Contractor that the work herein described shall be installed complete in every detail, even though every item necessarily involved is not particularly mentioned and/or indicated on the drawings.

The Contractor shall provide all labor and materials necessary for the entire completion of the work intended to be described, and shall not avail himself of any manifestly unintentional error or omission should such exist.

1.57. PROPOSAL FORMS

The work shall be priced as indicated on the Proposal Forms.

Bidders shall provide their proposals to BASE BID in accordance with Ford's Request for Quote. All alternates listed by the Owner shall be completely priced; otherwise a Contractor may be disqualified. Each unit in the proposal form shall be completely filled in.

1.58. FIELD CHECKING AND INTERFERENCES

Contractor shall be responsible for site review and all field check. All field interferences shall be the responsibility of the Contractor. All necessary site work shall be the responsibility of this Contractor.



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1.59. ISO COMPLIANCE PROJECT ACTIVITIES AND ISO DOCUMENTATION

This Contractor shall perform the following project related activities: Cost savings (VAVE) Phase, Engineering Phase, Fabrication and Modular Build Phase, Installation Phase, Debug and Prove Out Phase, Facility Launch Phase, and Production Launch Phase, as outlined and specified in Specification Section 020 PNT.

The Contractors are required to provide the records and baseline data in the formats specified in 020-PNT and the Record Book Template provided for each cell. The assembly of the book shall be as shown in the template.

Contractor shall comply with all ISO-9000 requirements for engineering, fabrication and modular build, construction, process set-up, facilities launch, production launch, base line data documentation and training. All test and set-up instrumentation shall be provided by the Contractor and shall be certified by the appropriate agency. All instruments shall be traceable to National Bureau of Standards. Ford will not supply instruments to the Contractor for the duration of the project. All process gages shall be calibrated with traceable gages.

Traceable certificates shall accompany all Lab equipment supplied by Contractor. All Visual Aids shall comply with ISO-9000.

All procedures and documentation for Base Line Data Books, Maintenance and Operating Manuals shall be reviewed with Ford Motor Co. and ISO-9001 coordinators prior to collecting base line data and publishing Manuals.

Refer to Section 020-PNT for the Record Book, Facility launch and Baseline Data requirements.

1.60. SILICON AND ASBESTOS STATEMENT

All equipment and installation materials shall be asbestos-free and silicone-free and shall be compatible with paint shop environment. All materials utilized in the installation shall be tested with paint supplier(s) and signed off as "acceptable" prior to being used.

Contractor shall be responsible for all the testing and use of only acceptable materials. Any consequences due to use of improper materials shall be full responsibility of the Contractor and shall be corrected at his cost.

1.61. SAFETY MEETINGS

This Contractor shall conduct a safety meeting with the FORD UAW Health and Safety representatives prior to the start of field site work.

For each work activity, a task analysis and a risk assessment shall be generated by the Contractor and made available to the site safety representative.

1.62. OSHA REQUIREMENTS

All OSHA requirements related items e.g.; stair design, building egress, confined space, etc. shall be documented for compliance.



1.63. FIELD ACTION REQUESTS

This Contractor shall use the F.A.R. system for this project. The F.A.R. is a notice to the owner that a change in scope is required. A change in scope or an extra cost will not be considered without a correctly submitted F.A.R. This Contractor shall type all FAR's including Ford requests for extra work.

CAUTION

Do not come in with a low bid with the expectations that changes will make up for the short fall. Extras will not be easily justified and offsets will have to be provided to keep the project within the dollar amount agreed to by Ford.

Price mark-up on extras for this contract is indicated in the proposal forms.

1.64. SHOP VISITS

This contractor shall conduct shop visits at all subcontractors and vendors supplying modular equipment for this project. Shop visit buy-off and punch list documentation shall be generated and submitted per the ISO and record book requirements.

1.65. LABELS

All device and panel mounted labels including all field-installed components shall be riveted in place. Chain mounting may be acceptable for field installed components where practical with prior approval of Ford Project Engineers.

1.66. SUBCONTRACTORS

The Contractor is to provide a list of all Ford approved Subcontractors he plans to use on this job, whether it is for engineering or construction as a part of his proposal.

1.67. GENERAL CONDITIONS

General Conditions 00700 shall apply to this contract. Guidelines for the selection of applicable General Conditions Supplements 00800 also applies to this contract. The Contractor must comply with any additional Purchasing issued General or Special Condition requirements.

1.68. LOCKOUT/TAG OUT

Contractor shall provide standard lockout procedure throughout paint shop in compliance with Ford and UAW safety requirements approved by Ford Safety and Security Office. Contractor shall be responsible for all subcontractors' equipment to comply with approved standard.

1.69. QUALITY REQUIREMENTS AND Q1 EVALUATION

Contractor will be checked for compliance with Ford's quality standards. Contractor shall complete all Subcontractors evaluation and all Contractors shall be evaluated by Ford after completion of the project per Ford's Q1.



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1.70. CONTRACTORS ENVIRONMENTAL METHODS STATEMENT

At the time of the bid Ford will provide the contractor with the latest Ford Environmental policies for review.

Contractors and Sub-Contractors shall complete sections IV, V and VI of the attached document EQG01-014.01 provided at the time of the bid based on the current environmental policies. Ford Motor Company will fill in sections I, II and III prior to issuance of the document.

Environmental methods procedures are to be included with the Safety Training Program which is to be presented to all personnel on site.

All contractors and subcontractors are to provide an Environmental Methods Statement with the bid.

1.71. VALVE LOCKING

All valves must be lockable.

1.72. START-UP/SHUTDOWN PROCEDURES

This contractor shall follow the requirements of specification 11575 for gas trains on each new or reworked burner (building process unit) which states:

Safety Checklist and QPS Sheet

1. Prior to Owner acceptance (typically during commissioning) turnover to the Owner a completed safety checklist specific for the type of equipment. These can be found on the Ford Occupational Health and Safety (OH&S) website in the Combustion Equipment Safety (CES) page titled "Safety Checklists". The web address is <http://www.hps.ford.com/gfe/checklists.htm> on the Ford intranet.
2. During training, the supplier or supplier representative shall assist Plant personnel in the completion of quality process system (QPS) sheets for the agreed start-up and shutdown procedures.

1.73. PIPING IDENTIFICATION

All piping above bottom cord of truss shall be labeled for contents and direction of flow. All piping below bottom cord of truss shall be painted and labeled for contents and flow direction. All pipes shall be color-coded and labels shall be painted on the pipe, as detailed in Specification 040 PNT. This applies to the process and building piping.

1.74. VA/VE

VA/VE may be required for this project as directed by the Buyer. Questions with regard to VA/VE requirements must be directed to the Buyer. If VA/VE is conducted, all VA/VE costs must be finalized within two weeks following the VA/VE formal session. After-the-fact VA/VE claimed financial impacts shall not be considered by Ford as the project progresses. All VA/VE items incorporated into the contract are deemed accepted by the contractor.



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Scope reductions that occur during the duration of the project shall be treated as FAR's and processed through the Ford Buyer.

1.75. ELECTRICAL STANDARDS

All electrical equipment, control panels, wiring, hardware, software, engineering, etc. shall be in accordance with the Ford Motor Company Standards listed in Section 2.0 of this specification.

1.76. LUBRICATION

This Contractor shall maintain and lubricate all process and facilities motors until production launch.

All bearings shall be greased at erection to act as a dust seal and be ready for operation.

For Europe refer to local specifications.

The contractor shall coordinate the initial greasing of bearings with the lubricant supplier at the respective assembly plant to preclude the mixing of incompatible greases between contractors at start-up and normal maintenance performed by plant forces.

All bearings shall be lubricated by this Contractor prior to buy-off by Ford Motor Company. A bearing and lubrication schedule shall be submitted and placed in the Record Book.

1.77. SUPPLIER STANDARDIZATION

All electrical equipment such as starters, disconnect switches, transformers, lighting/receptacles and equipment panels, etc. shall be of the same Ford approved manufacturer, as listed in Section 055 PNT.

1.78. MAINTENANCE ACCESS

All equipment that requires annual maintenance shall be easily accessible from catwalks, service platforms or by standing on the floor (by ladder or lift).

1.79. CATHODIC PROTECTION

Provide and install cathodic protection for all underground metal piping, metal fittings and tanks.

Design shall be per Ford Approved sprinkler vendor. Field installation shall be inspected by a 3rd party per section 1.6 Quality Control.

1.80. PUNCH LISTS

All punch lists shall be generated by Contractor and shall be completed prior to the beginning of Facilities Launch. Ford Project Engineers shall issue punch lists after Contractor's own punch lists are completed. All Ford's generated punch lists shall be completed for each system prior to scheduling official four (4) hour buy-off run of that system. Contractor shall be responsible for any delay due to incomplete punch list.



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1.81. SPARES

Contractor shall supply a complete spare parts list with cost per unit for each process and building system. Critical spare parts list shall be provided for each system indicating how many of each recommended components are installed and how many recommended for spare. The above lists shall be supplied no later than four (4) months after award of contract.

1.82. SIGNAGE

Contractor shall install all required signs for building, conveyor and process facilities per Specification 040 PNT and as approved by Ford Project Engineers.

1.83. MAN ASSIGNED MAINTENANCE REQUIREMENTS

The contractor shall be responsible for implementing the requirements, identified as the Contractor's responsibility, in Ford Specification 030 PNT "TEM" and its associated referenced standards 01800 and 01850 regarding assigned maintenance tasks and the associated times to carry out the prescribed tasks.

The intent of this specification is to provide the necessary procedures required to allow full functionality and maintainability of the machine by focusing the maintenance on those tasks that protect the warranty of the machine while optimizing the time required for maintenance.

These sheets are an inherent step in the calculation of the equipment life cycle costs and the times and frequencies allotted to each of the tasks are to be incorporated in the life cycle cost calculation format provided by Ford Motor Company.

The contractor shall utilize the specification during the design phase to ensure the tasks listed can be achieved within the allotted times/frequencies or are not relevant to his equipment design.

The contractor shall provide updated sheets for this equipment to Ford Motor Company prior to commencement of training as well as including them in his O&M manuals.

1.84. ENGINEERING COORDINATION

The building arrangement, clear heights, aisles, access, interior structures, etc shall be optimized for and base on 1) production, maintenance and material handling operation and 2) process and facility equipment requirements, ergonomics and maintenance.

Building related designs, layouts, equipment and arrangements shall not in any way impact production or quality of the product (ex. H&V units mounted in trusses directly over unprotected strip-out lines impacts quality).

Building and site designs shall include all building requirements specified in Project, Process Equipment and Conveyor Hard Points, Standards and Specifications.

For new construction that is an extension or modification to an existing facility or a separate new facility on an existing site, the new building and site designs shall be consistent, match, duplicate, coordinate and blend with existing site arrangements, construction types, systems and operations.



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The Contractor shall submit, prior to any detailed engineering and design or purchase of any equipment and materials, a complete building design criteria describing every facility system to Ford for review (i.e. foundations, aisles and accesses, finish schedules, structural, landscaping, drainage, site and building utilities, H&V, EMS, secondary power, fire protection, etc.).

All existing pressurized underground services and utilities and storm sewers that would be enclosed or covered by new construction shall be re-routed in the new truss space or relocated outside of the new building foot print.

1.85. CONSTRUCTION VENTILATION AND PLANT SEPARATION

No degradation of the air supply, exhaust and balance in existing buildings will be allowed during construction.

The Contractor shall provide dust tight construction walls from finish floor to the under side of the roof deck to separate Plant areas from construction operations. The first eight foot of construction walls shall be fire retardant plywood. Enclosed passageways from enclosed construction areas to the exterior of the building shall be provided. The Contractor shall provide vehicle and pedestrian doors in construction walls for construction access, Plant cross-through traffic and fire egress.

The Contractor shall provide temporary exhaust systems to atmosphere in all construction areas where the possibility exists for dust, dirt, fumes, etc to enter adjacent Plant even if an area is not enclosed such that no dust, dirt, fumes, etc enter adjacent Plant areas.

1.86. EXISTING BUILDING MODIFICATIONS AND FLOOR REINFORCEMENT

This Contractor is responsible for all building modifications necessary for his work. This includes added loading on floors, trusses, walls, etc., reinforcing or movement of structural members in order to clear floor openings, etc.

The Contractor will employ a certified Professional Structural Engineer to engineer and design modifications to the building, reinforce floors, cut holes in the floor, relocate walls, etc. The Contractor is absolutely forbidden to modify the building except per plans and sequences prepared and certified by the Professional Structural Engineer.

The Contractor shall hire a qualified third party inspector to verify the design intent was properly implemented. The Inspection reports shall be submitted to Ford at the time of the inspection and also placed in the project record book.

1.87. PLANT ELEVATOR

The Plant elevators are for the support of production. Contractors are not allowed to use the plant elevator except with Plant approval in writing of the load and time of use. When the Plant gives approval, the Contractor will:

- Provide an operator to assure the elevator is not abused
- Pay for the repair of damages that occur during the Contractor's use.
- Pay for the repair of breakdowns that occur during the Contractor's use.



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1.88. ECPL PLACARD APPROVALS

ECPL Placard approvals and posting must be obtained prior to facility launch of the Project. In order to achieve this, the Contractor must do the following:

- Hire an approved ECPL Placard Contractor
- Prepare a matrix of all the placards and track their status until all are signed off.
- Establish with the Plant the Safety Placard Committee and keep them involved during the engineering phase of the project
- Place a black line of the placard on the panel when the panel is positioned in its permanent location in the plant.
- Arrange for the Safety Committee to review the black line, marking it up, and sign off on the comments. This needs to occur during the start-up and debug phase of the project, since the field devices must be functional.
- Have the placard sub-contractor prepare the final placards, check them against the black lines, get them signed, and place them on the panels

1.89. WEIGHT MARKING OF MANUFACTURING EQUIPMENT

Refer to standard W-KA1 for the requirements of weight marking of machinery and equipment shipped into any Ford Motor Company facility that may be subject to lifting or transportation.

1.90. RISK ASSESSMENT

Refer the North America Pro Forma forms for risk assessment. These documents are to be compiled with a cross functional team where the contractor and Ford Motor Company are both represented. Forms shall be provided by the Ford project coordination upon request.

2. STANDARDS AND CODES

2.1. NATIONAL STANDARDS

The Supplier shall be responsible for the conformance of his work to all applicable codes and practices at Ford, local, state and federal levels. This shall include the application for and provision of any and all necessary licenses and permits as required by the listed governing bodies.

All equipment shall comply with but not be limited to the following agencies.

A.H.A.	American Hardware Association
A.I.S.C.	American Institute of Steel Construction
A.N.S.I.	American National Standards Institute
A.S.H.R.A.E	American Society of Heating, Refrigeration and Air Conditioning Engineers
A.S.M.E.	American Society of Mechanical Engineers
A.S.T.M	American Society for Testing Materials
A.W.S.	American Welding Society
C.E.M.A.	Conveyor Equipment Manufacturers Association
C.I.R.I	Canadian Industrial Risk Insurers (In Canadian Plants)
C.S.A.	Canadian Standards Authority
E.P.A.	Environmental Protection Association
F.M.	Factory Mutual Association
G.I.S.O.	General Industry Safety Orders



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I.E.E.E.	Institute of Electrical and Electronic Engineers
I.E.S.	Illuminating Engineering Society
I.P.C.E.A.	Insulated Power Cable Engineers Association
I.R.I.	Industrial Risk Insurers
J.I.C.	Joint Industrial Council
N.E.C.	National Electric Code
N.E.M.A.	National Electrical Manufactures Association
N.F.P.A.	National Fire Protection Association
O.S.H.A.	Occupational Safety and Health Act
S.M.A.C.N.A	Sheet Metal and Air Conditioning Supplier's National Association
S.S.P.C.	Steel Structure Painting Council
T.S.S.A.	Technical Standards and Safety Authority (Canada)
U.L.	Underwriters Laboratory

All equipment shall also conform to all Ford Motor Standard Specifications.

2.2. FORD STANDARDS

All applicable standard specifications and miscellaneous documents that are on the FORD web shall be accessed by this contractor using the B@B address. Standards and branch drawings only available in hard copy will be provided to the contractor upon request.

In addition to applicable Standard Specifications, the following Ford Motor Co. Specifications apply:

Section 001 - PNT	Monthly Book Guidelines
Section 002 - PNT	Program Project Tracking
Section 010 - PNT	Deep Cleaning
Section 020 - PNT	Paint Shop Project Record Book & Facility Launch Requirements
Section 030 - PNT	TEM, MAM, PDM System Implementation
Section 040 - PNT	Signage, Painting and Identification
Section 050 - PNT	General Technical Conditions & Specifications
Section 055 - PNT	Paint Shop Supply Chain
Section 060 - PNT	Paint Shop Fire Protection
Section 070 - PNT	Project Specific General Hard Points
Section 080 - PNT	Paint Shop Building Requirements
Section 500 - PNT	Paint Equipment Electrical Specification
Section 510 - PNT	PLC Programming
Section 770 - PNT	Paint Shop FIS
W-KA1	Weight Marking of Manufacturing Equipment

All applicable sections of the Ford North American Construction Specifications as listed in specification index Section 00010 Table of Contents, available on the Ford B to B web site, shall also apply..

2.3. HAZARDOUS AREA CLASSIFICATIONS

The Contactor shall ensure compliance with all the hazardous area classifications shown on the Ford branch drawings list on the DED and as identified during the design phase. Compliance with all Local, National, NFPA, and related hazardous area classification requirements shall be this Contractor's responsibility.



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

3. DRAWINGS AND SUBMITTAL PROCEDURES

3.1. SCOPE OF WORK

These specifications are intended to be used as a guide in both standardizing engineering drawings and in determining the minimum requirements expected of all contractors in preparing engineering drawings for Ford Motor Co.

This specification is to be read in conjunction with specification 00200.

All drawings are to be on Ford title block sheets, including all subcontractor and equipment vendor submittals as specified in 00200

Where appropriate, all construction material, weld specs, finish, etc. are to be noted on the drawings. This applies to all disciplines: building, sheet metal, structural, piping, equipment, electrical, etc.

A job drawing set is to include, but not be limited to, the following:

1. Title Sheet And Drawing Index
2. Layouts (Including Building Location)
3. All Inclusive In Plant
4. All Inclusive On Roof
5. Individual Items
6. Elevations
7. Cross Sections
8. Structural Arrangements
9. Structural Details
10. Sheet Metal Arrangements
11. Sheet Metal Details
12. Piping Schematics
13. Piping Isometrics
14. Piping Arrangements
15. Piping Details
16. Electrical Schematics
17. Electrical Panel Layouts
18. Electrical Connection Diagrams
19. Electrical Remote Location Drawing
20. Electrical Conduit Layouts
21. Equipment List With Complete Description And Quantity
22. Sequence Of Operation
23. Flow Diagrams
24. Installation Procedures
25. Sub-Contractor Submittal (Including Above)
26. Vendor Submittal (Including Above)

Allow space for Ford review stamp (2.5" x 5") near the title block or at least on the right hand margin of the sheet.

The contractor's name, job number, and drawing number should be placed to the left of the title block or outside of the borderline.



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

Do fill in "date", "scale", "des", "det", and "drawing No.".

Do not fill in Ford "sheet no." until the job is completed and the sheets can be arranged in the proper sequence.

Record all revisions in the proper space on the drawing including the date of change.

Do not use the expression "by others". Be specific. Say "by Ford Motor Co." or "by Electrical Co." or "by equipment vendor". Do not leave any question as to who is responsible.

The drawing Index shall provide for both contractor and Ford sheet numbers. These numbers should be cross-referenced.

Re-submit all corrected drawings for re-approval unless otherwise directed.

Submit only final approved drawings to fabrication, erection, subcontractors and Plant.

For all extra work (bulletins) (FAR's) requiring engineering drawings (almost all of it); submit drawings for approval prior to fabrication or installation.

For installation work claimed by Ford Motor Company plant forces, the same quality engineering drawings are required as if the contractor were doing the installation work. The Contractor shall prepare bid packages for each work item the plant forces want to claim. If the plant forces claim the work the contractor will be required to provide field engineering to insure the work is properly completed and will be required to issue a credit to Ford for the work the plant forces claim.

All general layouts, layouts, sections, and details which are common to more than one item of equipment shall have a separate original drawing for each individual item of equipment.

Show engineering calculations for heating, cooling, humidification, fluid pressures and flow rates, energy loads, paint circulating systems, equipment (fans, pumps, heat exchangers, etc.) sizing, tank capacities, structural designs, roof and floor loads, etc. Submit performance curves for all machinery. This information shall be included on the appropriate drawing or submitted separately as indicated by the Ford project engineer.

In general the minimum drawing scales shall be as follows:

Layouts	1/32" = 1'
General Arrangements	3/16" = 1'
Cross Sections	3/8" = 1'
Details	1/4" = 1'

The prime contractor shall check all sub-contractor and equipment supplier submittals before forwarding to the project engineer for approval. These drawings are to meet the requirements of this specification as well as the project engineering specification. It is the prime contractor's responsibility to ensure compliance before submittal to the project engineer.



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

3.2. ENGINEERING DRAWINGS

Design drawings shall show facility, process, and production and conveyor equipment in the background to the extent requested by Ford. As a minimum, all plan views and full cross-sections shall include equipment backgrounds.

Provide structural load schedules, charts and diagrams on structural design drawings that identify all new and existing loads on all structural components.

Soil boring locations and logs charts shall be placed on the structural drawing. Structural drawings shall specify all soil design parameters, including bearing pressures and strengths.

Provide air balance schedules on mechanical design drawings that include building and process air volumes and balance for winter and summer and production and downtime periods.

Provide electrical loads schedules on electrical design drawings that include all building, process and conveyor loads for each bus duct and substation.

When changes are made to the primary and secondary electrical power system, provide new AutoCAD one line drawing(s) covering the entire Plant. This work shall include any required redrawing of existing electronic and/or hand-drawn drawing(s).

When the project includes rework or modification to a Cell, revised equipment, extended process systems, etc, the Contractor shall be responsible to revise the existing drawing packages for the Cell by removing the obsolete or modified drawings and inserting the revised and new drawings. It is intended that each Cell be described by a **single** drawing set of the reworked Cell. Drawing shall be renumbered as required to provide a logical sequence between preexisting and new drawings for the cell.

3.3. SUBMITTALS FOR REVIEW

The contractor/vendor shall provide two copies of review drawings for each unit showing dimensions of unit, layout of equipment and controls, as specified in section 00200. After review and with comments, the project engineer will return a copy to the contractor for revision or implementation and a copy to the Plant for information and their comments.

Contractor shall review and check all drawings for content, format, and title block compliance, etc. prior to submittal to Ford. **Ford Project Engineers will not serve as Contractor's checkers**, and drawings will be returned for resubmittal if found unchecked.

3.4. SUBMITTALS FOR INTERIM FILE

As drawings are corrected and become "final", the contractor shall also submit one (1) set of prints to the Plant and two (2) sets to the project engineer (1 for office and 1 for job site trailer). Also provide one (1) set of 11x17 inch "As-built" reductions, in book form (flat loose leaf), of the engineering drawings to the project engineer and one (1) set to the Plant.

The sets shall be complete, including mechanical, electrical, and fire protection drawings. All drawings shall be cross referenced (word and symbol).



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

3.5. FINAL “AS BUILT” SUBMITTALS

The final submittals shall be as specified in section 00200 unless specified otherwise.

It is the intent that the “As-Built” documentation be complete by Cell and include all the specified drawings, base line documentation, record book documentation, maintenance manuals etc.

When the project includes rework or modification to a Cell, revised equipment, extended process systems, etc, the Contractor shall be responsible to revise the existing drawing and documentation packages for the Cell by removing the obsolete or modified drawings and documentation and inserting the revised “as-built” drawings and documentations. The Contractor shall also provide revised electronic documentation containing the complete content of the revised Cell including the prior documents that remain valid along with the revised “as-built” documentation. Existing record CD’s shall be replaced with new revised CD’s. The above conditions apply to the “as-built” drawings; launch book/record book; baseline data book; maintenance manuals; etc. Addendum documents to be used in conjunction with the prior documentation **shall not** be allowed.

All electronic documentation including, CDs, DVDs, Memory sticks, etc, shall have as the first document in the file, the drawing list or index of the content of the of the CD, DVD, Memory stick, etc. The drawing list and the index shall have sufficient description on each drawing or item in the index to allow the user to understand the basic content of the document. In addition, the individual items shall be titled such that the transition from the index or drawing list to the actual document can occur without having to search by opening multiple documents.

All CDs, DVDs or other electronic media shall be professionally labeled with the following as a minimum.

- Content of the CD (As-built Drawings Cell A or Maintenance Manual-New Prime Booth)
- Date Generated
- Plant Name
- Project Name and Number
- Format and Version of the Documents
- Ford Logo

3.6. DRAWING NUMBERS

Ford shall supply all drawing numbers for the entire Paint Shop. Contractor shall be responsible to coordinate proper drawing sequences:

- All process mechanical drawings shall have straight numbering without any suffix.
- All process electrical drawings shall have suffix “E” on each sheet.
- All architectural drawings shall have suffix “A” on each sheet.
- All architectural mechanical drawings shall have suffix “AM” on each sheet.
- All architectural electrical drawings shall have suffix “AE” on each sheet.

4. INSURANCE CARRIER REQUIREMENTS

Within 4 weeks of receipt of an order the contractor is to hold a meeting with Ford Motor Company and the insurance carrier to verify requirements and a schedule for approvals.



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

4.1. INSURANCE CARRIER APPROVALS

It shall be the Contractors responsibilities to submit specifications and drawings to the insurance carrier listed in Section 055 PNT for review and comment, and also, to deliver three (3) copies of carrier's stamped drawings to Ford Motor Company.

The Contractor shall obtain the Insurance Carrier's acceptance for all design drawings, calculations, oven design data, and component cut sheets following preliminary review by Ford Motor Co., but before fabrication and construction begins.

4.2. TECHNICAL STANDARDS AND SAFETY AUTHORITY REQUIREMENTS FOR CANADIAN CONTRACTS

Projects that involve installation of combustion components i.e. Gas burners and Gas train components are required by Canadian law to meet the requirements of T.S.S.A. (Technical Standards and Safety Authority). The latest code requirements may be obtained from the address below for a fee. Contractors are advised to register with T.S.S.A. so that the latest codes changes are sent automatically.

Technical Standards and Safety Authority
Fuel Safety Regulations
4th Floor – West Tower
3300 Bloor Street West
Toronto, Ontario M8X 2X4
Tel: (416) 325-2950 / 2924
Fax: (416) 326-1663
Web: www.tssa.org

It is also a requirement under the Canadian Technical Standards and Safety Act, 2000, any person who installs, repairs, services, removes or maintains an appliance or a type of equipment used in handling of, or use of, a hydrocarbon must be registered with T.S.S.A.. If a sub-contractor is used for this installation ensures that they have the proper T.S.S.A. registration numbers for the fuels used.

The sequence by which the Field Approved T.S.S.A. Sticker is obtained for the equipment is as follows:

Obtain TSSA Contractors registration. (Allow 2 to 4 weeks)

Submit Engineering Documentation for Design Approval. (Allow 6 to 10 weeks)

Perform successfully ESA approval on electrical components and panels. (Allow 1 to 2 weeks)

Perform successful Field Review and Approval (Scheduled at design approval, 4 to 6 weeks beyond Design approval date)

These steps are detailed in the following paragraphs.



4.2.1. T.S.S.A. DESIGN APPROVAL

All Designs for heating systems that utilize hydrocarbon fuels must be reviewed by T.S.S.A. engineering. The submittal package should include (3) copies of the following:

- Heater and oven layout drawings.
- Gas train details
- Gas component details
- Sequence of operation
- Electrical schematic drawings

A completed T.S.S.A. Application for Field Approval of Appliances or Equipment. A check for the review fee. Under Canadian law the contractor is responsible for all design review and field approval costs. These costs can be obtained from the address or phone number for T.S.S.A. above. A copy of the Application for Field Approval of Appliances or Equipment is available from the TSSA.

This application requires the Contractors T.S.S.A. registration number. This contractor is responsible to pre-register and have their own number or contract with a pre-registered Canadian contractor for completion of this form.

Review of engineering documents can take up to 10 weeks or longer depending upon the current work load of the T.S.S.A. engineers. The contractor is advised to allow for this time period, though the T.S.S.A. does offer an accelerated review program at an increased cost.

A letter of acceptance will be issued if all codes are met, or a list of design deficiencies that must be corrected prior to field review will be returned. Timely corrections of deficiencies is crucial, re-scheduling of field approval can prove to be very time consuming due to T.S.S.A. field review back-log.

4.2.2. E.S.A. Approvals

Also important prior to the T.S.S.A. Field approval is the Electrical Safety Authority approval. All electrical components and control panels must have C.S.A. or E.S.A. approvals and have E.S.A. approval stickers applied.

Electrical Safety Authority may be contacted by phone at 1-800-559-5356. All site engineering and field review and approval costs are the responsibility of the contractor. These costs can be obtained by calling the E.S.A. office.

It is important to schedule these approval steps into the project schedule and consult with E.S.A. regarding their current backlog. Contractors can not proceed to the next step until this approval has been completed.

4.2.3. T.S.S.A. Field Approval

A T.S.S.A. field review for approval will be scheduled when the engineering review letter is returned. It is very important to schedule the E.S.A. electrical review for approval prior to this final T.S.S.A. review.



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

Under the T.S.S.A code, combustion equipment can be operated (only by a G1 certified gas technician), for start-up and commissioning purposes only without the final T.S.S.A. approval sticker, however the contractor must have the E.S.A. sticker in place and have all deficiency items completed.

The Field T.S.S.A. review for approval involves inspection of all piping connections, tubing connections, proof of safety valve and switch operation, proof of flame safety operation, and that all devices are used in the ranges that they were designed. Once these devices are confirmed and physically proven, a T.S.S.A. Field Approval sticker will be applied to the equipment.

4.2.4. T.S.S.A Approval for High Pressure Piping

In addition to the Equipment required to handle hydrocarbons, T.S.S.A. also has requirements for piping systems and pressure vessels that operate at high pressures. The design pressure delineation for natural gas piping is 125 psig for piping installed outdoors, and/or 66 psig for piping installed indoors.

It is important to note that the approval process is different for piping systems other than the combustion systems. High-pressure piping systems are reviewed by a completely different group of engineers at T.S.S.A. and have completely different forms, and fees. For the latest in codes, forms and questions contact T.S.S.A. at the following:

Technical Standards and Safety Authority
Boilers, Pressure Vessels and Pressure Piping Regulations
4th Floor – West Tower
3300 Bloor Street West
Toronto, Ontario M8X 2X4
Tel: (416) 325-2950 / 2924
Fax: (416) 326-1663
Web: www.tssa.org

4.2.5. T.S.S.A. High Pressure Piping Design Approval

An application form for High Pressure System Approval shall be submitted to the FSD for approval for every piping system installation, accompanied by (3) copies of “site specific drawings” and corresponding bill of materials for the pressure piping system.

The following shall be shown or included:

- The pressure piping code of construction.
- Design and operating pressures of the systems and subsystems.
- Material specifications (as permitted by the code construction)
- Approved fittings (CRN or certified by an agency acceptable to the director or FSD approved)
- Pre-approved piping subassemblies (i.e., shop-built assemblies or buried pipe)
- Completed submittal form with check for processing fee



When the drawings have been reviewed and approved, T.S.S.A. will issue a "P number" for this specific piping system. The piping contractor will require this number to be available, they can not by law work on this system until this number is available.

4.2.6. T.S.S.A. High Pressure Piping Installation

T.S.S.A. will allow connecting pipe by welding, threading, compression fittings or flanges, however flared connections shall not be used. In the event of welded connections, it is advisable to have copies of the certification cards for the welders to insure they have the appropriate welding certifications. T.S.S.A. can require nondestructive examination of the welds by radiography if they deem necessary. The contractor shall check with T.S.S.A. to confirm the latest requirements.

4.2.7. T.S.S.A High Pressure Piping Field Pressure Testing

Pressure testing shall be in accordance with the CSA Z662-99 or ASME Code for Pressure Piping B31.1 or B31.3, except as required or permitted otherwise by this Clause.

Except as permitted by Clause 6.3, all joints shall be hydrostatically tested to not less than 1.5 times the system design pressure, or pneumatically tested to not less than 1.2 times the system design pressure.

Flanged, threaded, or compression-type joints made in the field to connect shop-fabricated, shop-tested, subassemblies may be leak-tested at the operating pressure of the system.

Where the entire system is accessible for inspection, the test pressure shall be held for a minimum of 30 min or for longer if necessary to conduct the examinations for leakage. When a pneumatic test is made, all joints shall be examined for leakage with a suitable leak-detecting solution.

If part of a system has been buried or is otherwise inaccessible for inspection, the test pressure shall be held for 4 hr. for liquid-medium testing or 24 hr for gaseous-medium testing and a recording chart shall be used, unless a pressure test procedure has been approved by the director for the specific installation.

Any evidence of leakage is unacceptable.

All shop pressure tests for piping subassemblies required by this procedure shall be witnessed by a TSSA inspector or by a third party authorized by the director.

All pressure tests of field installations required by this procedure shall be witnessed by a TSSA inspector.

5. R & M PROGRAM

The mechanism by which R & M will be incorporated into the acquisition/ install/production process is embodied in the following five points:

- 1) Data Driven Understanding of Historical Equipment Performance
- 2) Reliability Growth



GENERAL TECHNICAL CONDITIONS AND SPECIFICATIONS

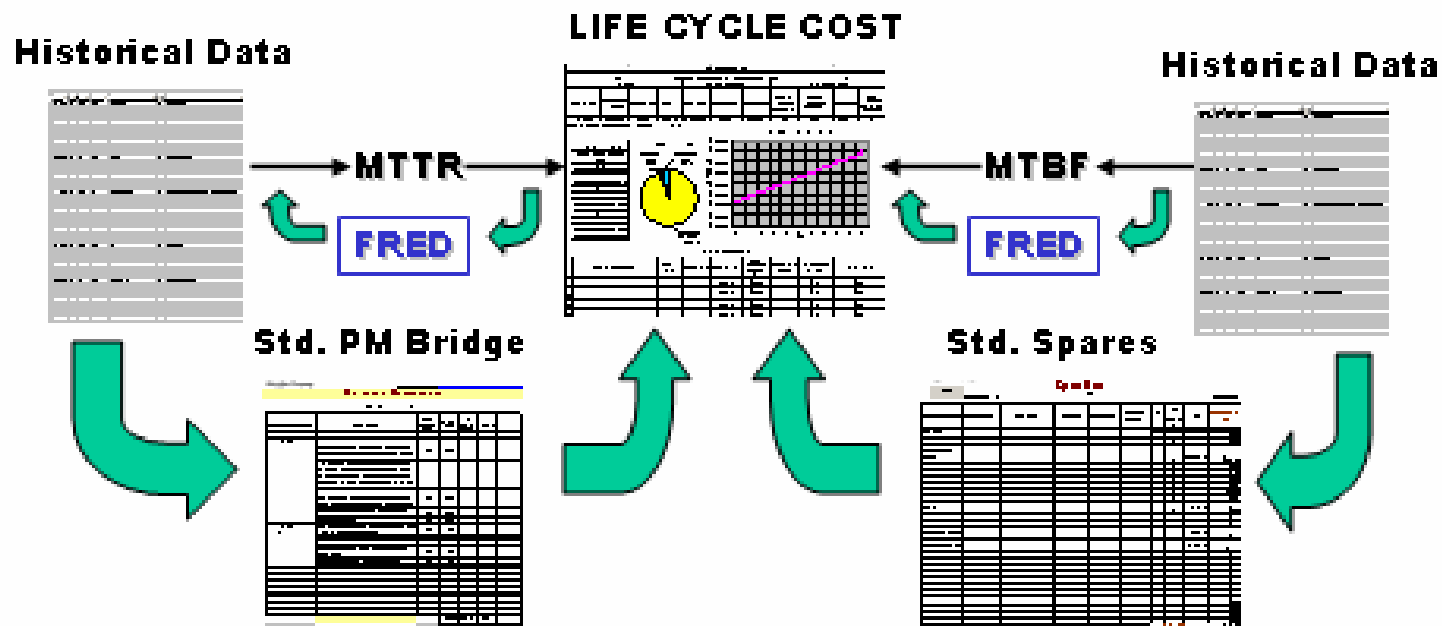
- 3) Sub-Tier Suppliers
- 4) Maintainability & Spares
- 5) Life Cycle Cost

Supplier equity in this process is critical. Successful implementation of this process is the responsibility of both the supplier and Ford Motor Co. acting in concert. The Acquisition Engineer has the responsibility of ensuring that suppliers are compliant with the R&M process and that the process is executed with the highest degree of integrity. The OEM Suppliers must adhere to any supporting documents provided by the Acquisition Engineer.

R&M Five Point Process

1. Historical Data Collection
2. Reliability Growth
3. Sub Tier Supplier R&M
4. Preventive Maintenance & Logistics
5. Life Cycle Cost

Perform Life Cycle Cost Analysis For Every Cell and Major Component





GENERAL TECHNICAL CONDITIONS AND HARD POINTS

5.1. SUPPLIER R & M REQUIREMENTS

Suppliers are to contact Ford Motor Company for the latest issue of the current requirements at the time of bidding.

Suppliers shall reference and follow the R&M Specifications found at <https://web.corpmmfr.ford.com/indexcgi>

6. SOUND LEVELS

Installed system must not exceed noise levels of 80 dBA (ref. 10^{-13} w) as measured on the A-weighted slow response scale. Refer to Ford Motor Co. Manufacturing Standards SX1.

The contractor shall submit with his proposal a request for deviation for any areas in which he cannot meet the Ford Requirements along with all substantiations to support these claims.

6.1. DEVIATION FROM REQUIREMENTS

If equipment exceeds or is expected to exceed the applicable sound level limit required by this standard, the supplier must complete a request for deviation form (refer to W-SX-1), which includes the following:

- A report of the measured sound levels for the equipment as required in Section 6 Test Procedures.
- Details of the feasible engineering controls currently designed into and/ or installed on the equipment.
- Justification of the technological or economic unfeasibility of complying with manufactured Standard W-SX1. This form shall be submitted with the contractors bid.

7. ELEVATION CORRECTIONS

Much of the equipment within Ford's facilities are engineered and cataloged in reference to Standard Temperature and Pressure (STP) conditions. However, some installation sites are located where elevation effects may be pronounced, and the equipment selections must account for the elevation effects.

The site architect shall identify the site elevation for the main grade of each facility. Elevation corrections shall be required for sites where this elevation is greater than 1,000 feet (305 M), or where required by codes. Corrections for equipment located in pits, on roofs, upper floors or platforms do not require corrections beyond the overall site elevation. Elevation corrections for sites at lower site elevations are not required, but may be made at the contractor's discretion.

When elevation corrections are made, all engineering calculations and equipment selections (fans, burners, pumps, transformers, etc.) shall be corrected by a common method of elevation compensation, either by a site gas gravity correction factor or by the local air density. All engineering calculations for determining equipment performance and selections (volumes, mass flows, pressures, heat dissipation, head, flammability, etc.) shall clearly include these corrections. All equipment selections shall clearly identify how elevation is accommodated in the equipment data performance sheets.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Vendor performance for pre-approved, integrated systems (such as ASH units, scrubbers, heaters, pumping systems, electrical equipment, etc.) shall be verified at less than a 1,000 Foot (305M) elevation. Where the pre-approved system is to be installed at a higher elevation, each equipment integrator shall submit to Ford calculations, performance estimates, and anticipated modifications to the tested system's arrangement that are necessary to achieve an acceptable system performance at the site elevation. Performance for similar equipment installed at high elevation may be submitted as an alternate.

8. NEW TECHNOLOGY

8.1. INTRODUCING NEW TECHNOLOGY

Vendor shall not introduce any new technology, software, and/or components without prior written approval of Ford Supervisor. Technology, software and components that have not been used on Ford Motor Co. installations are considered to be new technology. All new technology approvals shall be filed with the Vendors Technology Development Department.

All new technology shall require a Ford Motor Company standard design and process Failure Mode Effect Analysis (FMEA'S) and Life Cycle Cost (LCC) be performed on it by the Vendor.

Ford Paint Engineering will keep all Vendors' FMEA's confidential except those portions the Vendor designates can be released to the plant's Paint Department.

8.2. FMEA's

All new technology equipment shall require a Ford Motor Company standard Design and Process Failure Mode and Effects Analysis (FMEA's) and Life Cycle Cost (LCC) be performed on it by the Vendor. The FMEA data forms and procedures are available from Ford Motor Company. Reference material from the Ford Motor Company course "Equipment R&M Methods Tools" is available in addition to a class being offered at the Ford Human Resource and Development Center.

8.3. DURABILITY TESTING PROCEDURES & ACCEPTANCE PROCESS

Following the FMEA, testing shall be completed to reach a 90% confidence level that a new design will be capable of achieving the desired Mean Time Between Failure before any particular subsystem is released for production. When the new technology is initially introduced into production, a low risk application will be chosen, when possible, with the capability of returning to proven technology if needed.

9. PIPEWORK

9.1. PAINT SHOP STAINLESS STEEL TUBING

Small diameter stainless steel tubing (1/8" OD to 2 1/2" OD), with the appropriate pressure rating, can be used in all paint shop process and utility system piping. Stainless steel tubing is either accepted or recommended for use in the following areas:

- Paint Circulation Systems
- Compressed Air Distribution Systems
- Inert Gas Systems (Nitrogen/Argon)
- DI/RO Water Systems
- Phosphate Chemical Dosing Systems



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

- E-Coat Chemical Dosing Systems

Stainless steel tubing is not recommended for use in 3" and larger process and utility system piping. Process and utility piping systems, in any size, where stainless steel tubing is not recommended are as follows:

- City Water Systems
- Non Potable Waters
- High Pressure Systems
- Process System Drains
- Phosphate Bulk Chemical and Boil Out Delivery

Where stainless steel tubing is acceptable, consult the Ford Motor Company paint shop representative for the minimum acceptable tube gauge (wall thickness) for each tube diameter. Final approval of use must be obtained from Ford Engineering.

9.2. COMPRESSED AIR PIPING

All piping shall be in accordance with Ford Motor Co. Facility Standards as listed in Section 00010.

This contractor shall make all required connections to the primary system. Plant mains are typically 100 PSI (7 bar), however, pneumatic equipment shall be designed for 65 PSI (4.4 bar). All connections to the main or sub main shall be valved. All compressed air drops shall be complete with a quick disconnects, filter & regulator set, water tap and vent and shut-off valve.

Unless otherwise stated all compressed air pipe work will be in heavy weight galvanized pipe (BS 3601 or national equivalent), wherever possible galvanized after fittings of flanges and fittings. Pipe connectors to always be taken from the top of pipe.

All exhaust ports shall have silencers fitted. Final connections to user points shall be in flexible tube with quick disconnect fittings. Capillary piping (below 6 mm) shall be run in soft copper or color coded plastic tube, fully supported over the run length in cable tray.

The contractor will verify existing/proposed on site air quality, and install any necessary quality enhancing equipment, as required by pneumatic equipment suppliers, for correct operation of their equipment and without detriment to Ford manufacturing quality.

Instrument quality air will be provided for all installations to service proportional control valves and for air which will contact process solutions or production units etc. A Coalescent filter shall be installed at each process equipment mains take off point with pressure differential indicators (gauges) which shall be capable of removing 99.99% of oil particulate with carry over not to exceed 0.0014 ppmw oil. It shall be capable of removing 100% of 0.025 micron particles and some particles as small as 0.01 microns. In the case when compressed air is supplied from a building compressed air main, a particulate filter is required. The particulate filter shall be 5 micron (98% efficiency) and shall be installed prior to the coalescent filter. After this filter all compressed air piping shall be as specified in the detailed equipment specification.

9.3. GAS PIPING

All piping will be in accordance with the Ford Motor Co. Facility Standards as listed in Section 00010.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Gas train vent lines shall be sealed weather tight at curbed openings. Vent piping shall be coordinated and grouped to reduce the quantity of roof openings required. Screened vent outlets shall be provided.

Material shall be mild steel, schedule 40 piping A120, 300 lbs. (136 kg) fittings A197 for 2" (50 mm) diameter and larger.

Piping system shall be cleaned, purged and pressure tested according to NFPA 54 and the local gas company. A gas pressure test chart shall be provided with the test report. Gas main and branch piping shall be of seal welded construction. The pressure test is specified to be pneumatic test at 150 PSI (10 bar) for a period of two hours with no allowable pressure loss (minimum requirements).

Gas pressure regulators shall be capable of withstanding a pressure surge to 60 PSIG (bar) – verify maximum allowable component design pressure.

All connections to the main or sub main shall be valved and taken from the top of the main where possible.

9.4. CITY WATER PIPEWORK

All piping shall be in accordance with Ford Motor Co. Facility Standards as listed in Section 00010.

Plant water mains at standard Plant pressures shall be supplied by this contractor unless otherwise specified in the detailed equipment description. The contractor shall make all required connections to the primary system. All connections to the main or sub-main shall be valved. Provide back-flow preventers in all lines that terminate at non-potable water points.

The contractor will sample and determine the quality of the water available at the plant of installation. Multiple sampling, over a period of days, shall be carried out particularly if water is supplied from multiple sources.

All city water piping shall be insulated in its entirety from the source with 1" thick jacketed insulation. Piping material shall be scheduled 40 galvanized seamless steel, A120, with 150 lbs (68 kgs) galvanized malleable iron fittings for 2" (50 mm) diameter and smaller; schedule 40 galvanized seamless steel, threaded, A20, with 125 lbs (57 kgs) flanges, galvanized cast iron for 2 1/2" (64 mm) diameter and larger.

9.5. (HEATING) HOT WATER PIPING

All hot water piping shall be in accordance with Ford Motor Co. Facility Specifications as listed in Section 00010.

All connections to the main or sub main utility lines shall be valved.

All hot water piping shall be insulated in its entirety in accordance with Ford specification 15250.

9.6. CHILLED WATER PIPEWORK

All chilled water piping systems shall be in accordance with Ford Motor Co. Facility Standards as listed in Section 00010.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

All connections to the main utility shall be the same as heating water piping.

Materials and construction methods shall be the same as heating hot water piping.

All chilled water piping shall be insulated in its entirety in accordance with Ford specification 15250.

9.7. DI/RO PIPING

All DI/RO piping shall be stainless steel and shall be in accordance with the Ford Motor Co. Facility Specification as listed in Section 00010.

9.8. HOT WATER GENERATORS

Where required and specified by the project DED the hot water generator shall be in accordance with the facility specification section number 15555.

9.9. CHILLER UNITS

Where required and specified by the project DED the chiller shall be in accordance with the facility specification section 15670.

9.10. COOLING TOWERS

Where required and specified by the project DED the cooling towers shall be of the cross flow type in accordance with the facility specification section 15750.

10. INTERFACES

10.1. BUILDING EQUIPMENT INTERFACES

The contractor must supply all:

- Work Platforms and Raised Work Areas, Including Stairs and Connecting Bridges
- Intermediate Platforms
- Conveyor Equipment Platforms
- Conveyor Equipment Connection Sections
- Conveyor Crossovers to Meet Egress Requirements
- Control Panel Platforms
- Housings/Casings for the Areas Defined in the Technical Specification Sections

The contractor must provide all necessary, anchoring points, vibration absorbers and footplates and install these in the prepared positions provided.

The supplier will provide all necessary details (components and installation drawings) relating to fixture equipment to be integrated into the concrete where these cannot be drilled or poured into place at a later stage. This applies in particular to the steel constructions included in the scope of supply for application equipment.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Scope of supply includes all necessary materials, e.g. screws, dowels, foundation anchors, etc and all drilling which may be necessary on site.

Where anchors / dowels are to be integrated in coated floor surfaces, integrated anchoring systems, with seals where necessary, should be incorporated to ensure that the existing coating is not damaged around bore holes.

Additional wall and ceiling openings and major drillings will be arranged at the Contractor's cost by Ford after submission by the Contractor of a detailed proposal for openings required.

11. EQUIPMENT ACCESS PLATFORMS AND STAIRS

11.1. PLATFORMS AND STAIRS

All required equipment platforms shall be of rigid construction and self supporting, independent of the process equipment, unless specified otherwise, and free of vibration. They shall be fitted with a minimum of 3/16 inch smooth floor plate, and shall be properly safeguarded with hand railings, knee rails, kick plates and ladders, in accordance with Ford Motor Company standard safety platform construction. Platforms shall be of adequate size to facilitate easy access to combustion controls, drives, filters, and equipment, and be so designed that the L/R ratio for columns shall not exceed 120 and beam deflection shall not exceed L/360 inch. (For Europe refer to local specifications). The contractor shall design the platform for an equipment load of 150 lbs/sq. ft (730 kg/sqm).

In Europe, stairways will be designed to standard U-VBX-6. All steelwork is to be installed to British Standard BS449 part 2 1969.

All steps or stairways shall be provided with handrails. All risers of a stairway shall be of equal spacing to meet OSHA requirements of 9" (230 mm).

If the floor area at the bottom of the stairway is sloped or irregular in any way then provide a minimum 36" (1m) X 36" (1m) fabricated landing. This landing height shall be designed to assure equal riser spacing.

If the platform is specified to be hung from building trusses, the contractor shall design the platform for an equipment load of 150 lbs/sq. ft. (730 kg/sqm) minimum. Actual design load to be labeled per Ford and OSHA Standards. The contractor shall calculate the truss panel point loadings and confirm truss capacity with Ford Motor Company.

Should truss reinforcement be required, the work shall be performed by the contractor unless otherwise specified. All overhead platforms shall be provided with stairways and handrails, and shall be provided with sprinkler protection, lights and emergency lighting as required beneath the platform.

No attachments to the building roof steel will be made without prior permission of the Ford Engineer. Where allowed the loads will be taken only at roof truss node points. All steel work is to be loaded construction.

Stairways shall be provided on a minimum of 100 ft (30m) centers and as required by national or local codes if shorter.

All changes in elevation of three steps or less connecting similar surfaces shall be highlighted in caution yellow.



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All stairways shall be provided with a landing at a maximum height of 12'-0" (3.6m).

All external platforms shall use either black iron banded or FRP grating.

All platforms and walkways shall be clearly labeled as to design load carrying capacity (stenciled).

11.2. LADDERS

Any ladder more than 10'-0" (3m) in height shall be provided with safety hoops (caged ladder). This hoop shall extend a minimum of 3'-6" (1.1m) above the platform landing.

The ladder and cages shall comply with OSHA and all Local, State, and Federal Codes.

When ladders are used to ascend heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof. Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.

The landing platforms and ladder offsets shall comply with all OSHA requirements.

12. EXHAUST STACKS

The stack height shall be as set out below unless noted otherwise in the DED when environmental regulations dictate heights greater than those detailed below.

When stack heights are in excess of 30'-0" and the diameter is 14" or greater, they shall be self-supporting from the building floor with only wind loads taken at the roof. Provide self-supporting stacks where the height is less than 30'-0" (9144 mm). If required, provide additional structural support or truss reinforcement to accommodate self supported stacks.

Stacks higher than 30'-0" and with a diameter less than 14", may be guy wired. If required, provide additional structural support or truss reinforcement to accommodate guy wire connections.

Stacks shall extend to a height of 20'-0" (6m) above the penthouse and /or building roof, unless they are within 50'-0" (15.0m) of a fresh air intake, in which case they will extend to a height of 15'-0 (4.5m) above the intake. Extensions to existing stacks and stacks for booth extensions shall conform to these specifications with respect to supports, sprinkler protection, access doors, etc.

Stacks shall be capable of withstanding wind velocities of 100 miles per hour (161 km/hr), unless otherwise specified, and be supported from building platform steel or floor in such a manner that fans may be easily removed for maintenance purposes. No weight shall be transferred back to the building roof and steel. Stack wind loads may be taken at the roof in accordance with the branch drawings.

Where guy wires are required they shall be attached to flat rings, which restrain and hold the stacks. Drilling, punching or piercing of the stack for bolt holes is not permitted. Guy wires shall be sized with a minimum factor of safety of three (3). No guy wire shall be secured to air supply houses, HV & HVAC units, air intakes or other stacks.



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Stacks shall be equipped with (2) 4" (102 mm) diameter holes adjacent to doors located 3'-0" (914 mm) above roof and 90 degree apart for testing. Holes to be 4" (102 mm) welded pipes with threaded pipe caps.

Contractor shall furnish all roof opening framing, unless otherwise specified, including installation of stack sleeves, plates, etc. Contractor shall retain a bonded roofing contractor to flash in roof opening and provide combing, insulation and new roofing material around stack material.

Where exhaust fans are located in either a penthouse or on a structural steel platform, the contractor shall provide a separate structural framework to support all exhaust stacks from the structural platform or the penthouse floor. Stacks shall not be supported by the fan or from the penthouse roof. The stack shall be connected to the fan outlet with a flexible connection for vibration isolation similar to the fan inlet.

12.1. EXHAUST DUCTWORK

The design of exhaust ductwork shall be based on the maximum load possible from the fan with a factor of safety that will insure the ductwork will remain functional for the life of the plant. The Designer shall insure that the duct is properly stiffened to mitigate vibration and hence failures due to fatigue.

13. WELDING REQUIREMENTS

13.1. GENERAL

The requirements listed within this welding specification are intended to provide the minimum requirements for the design, fabrication, welding and quality control of Paint Shop Equipment Systems, conveyors, platforms and associated components (the system) for the Ford Motor Company paint shops. The requirements stipulated in the referenced Standards listed are incorporated by reference except for those requirements that have been exempted in the Contract Documents or in writing by Ford. No verbal changes to the Specification shall be accepted.

This specification shall be used in conjunction with the Ford Motor Company Paint Shop Standards. Conflicts between this Standard and Ford Paint Standards or new processes or procedures shall be provided in writing to the Owner's Representative for resolution. The Owner's Representative shall respond in writing within seven days after receiving notification of conflicts.

The standards shall be of the latest issue date as of the date of the prime contract.

The requirements of this Specification shall apply to the welding design, fabrication and erection of the System.

13.2. REFERENCE STANDARDS

13.2.1. American Welding Society

- D1.1 - Structural Welding Code - Steel
- D1.3 - Structural Welding Code - Sheet Steel
- D1.6 - Structural Welding Code - Stainless Steel
- D9.1 - Sheet Metal Welding Code
- A2.4-93 Symbols for Welding, Brazing and Non-Destructive Examination.
- A3.0 Standard Welding Terms and Definitions
- B2.1 Specification for Welding Procedure and Performance Qualification



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13.2.2. American Manual of Steel Construction

Specification for Structural Joints using A325 or A490 Bolts

American Institute of Steel Construction (AISC) Code of Standard Practice

- a. Paragraph 4.2.1 of the above code shall be modified by deleting the following sentence:
“This approval constitutes the owner’s acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings.”

13.2.3. American Society of Mechanical Engineers

B3 1.1 Power Piping
B31.3 Process Piping
Section V Non-destructive Testing
Section IV Welding and Brazing Qualification

13.2.4. American National Standards Institute

ANSI Standard B 1 8. 2. 1

13.2.5. American Society of Nondestructive Testing

Recommended Practice No. SNT-TC-1A

13.2.6. American Society for Testing and Materials

Appropriate specifications as listed in this document and those made by reference in the listed codes and standards.

13.2.7. Structural Steel Painting Council

Appropriate specifications as listed in this document and those made by reference in the listed codes and standards.

13.2.8. Canadian Welding Bureau

CSA Standard W59-M Welded Steel Construction (Metal Arc Welding)

CSA Standard W178.2 Certification for Welding Inspectors

13.3. QUALITY CONTROL/QUALITY ASSURANCE SUBMITTALS

13.3.1. Fabricators Qualifications

Fabricators of structural steel as defined by the American Institute of Steel Construction (AISC) Code of Standard Practice; Section 2.1 shall be certified to meet the American Institute of Steel Construction (AISC) criteria for Conventional Steel Building Structures



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(Sbd) or Complex Steel Building Structures (Cbd). Additional information can be obtained by visiting www.aisc.org.

Fabricators of non-structural material shall have achieved the classification of Certified Welding Fabricator as defined by the American Welding Society. Additional information can be obtained by visiting www.aws.org.

Fabricators shall submit a copy of their Quality Control Manual, Welding Procedures, and Welder Qualification Test Records to the (Independent Testing Agency (ITA) prior to commencement of fabrication operations.

13.3.2. Erectors Qualifications

Erectors of structural steel as defined by the American Institute of Steel Construction (AISC) Code of Standard Practice, Section 2.1 and primary erectors of tank and enclosures shall be certified to meet the American Welding Society Certified Erector Program. Additional information can be obtained by visiting www.aws.org.

Erectors shall submit a copy of their Quality Control Manual, Welding Procedures, and Welder Qualification Test Records to the ITA prior to commencement of fabrication operations.

13.3.3. Independent Testing Agency (ITA)

Agencies performing Nondestructive testing, which includes review and nondestructive testing of welded and bolted connections, shall meet the requirements of ASTM E543 Standard Practice for Agencies performing Nondestructive Testing.

Personnel performing nondestructive testing shall be qualified by the American Welding Society (AWS) as Welding Inspectors meeting the Certified Welding Inspector or Certified Associate Welding Inspector status or CSA Standard W178.2 Certification for Welding Inspectors, Level 2. A copy of the AWS or CWB certificate and wallet card shall be provide to the Prime Contractor prior to the ITA beginning inspection operations.

Personnel performing nondestructive testing using the ultrasonic, dye penetrant, magnetic particle, radiographic, and eddy current testing shall be qualified by the American Society of Nondestructive Testing SNT-TC-1A and Level I or II, as stipulated within this document. A copy of the technician's certification shall be provided to the Prime Contractor prior beginning inspection operations.

13.3.4. Material Certifications

Materials used to fabricate components of the systems shall have a copy of the mill certification provided to the ITA for review to determine conformance with the project specifications. These documents include:

- a) Structural Steel
- b) Non structural steel as defined by ASIC Code of Standard Practice. Section 2.2
- c) Welding Electrodes and Consumables
- d) Paint



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- e) Welding Gases
- f) Bolts
- g) Washers
- h) Nuts

13.3.5. Pre Job Quality Control/Quality Assurance Meeting

A pre job meeting must be held to discuss the requirements of this Specification. The Project Manager and key personnel for the Prime Contractor, Fabricator, Erector, and ITA must be present. The Prime Contractor must submit a form that verifies each party understands each component of this Specification. Variance from the requirement of the Specification must be presented to the Ford V.O. for clarification.

13.4. DESIGN AND FABRICATION

The system shall be designed in conformance with the AISC Specifications and the requirements stipulated by Ford Motor in the Bid Documents and subsequent revisions.

The welds shall conform to the design requirements of the AWS, CWB (for Canadian operations) or ASME Standards. Tank plate splices shall be welded on both sides of the plate unless the splice lands over a floor beam or column. In this case, a weld joint meeting the requirements of AWS D9.1 Sheet Metal Code, Annex G and qualified to meet the criteria of Section 14.3 is required

Welds placed for on sheet metal on one side of a member shall be welded to backing or meet the requirements of AWS D9.1 Sheet Metal Code, Annex G and qualified to meet the criteria of Section 14.3.

The design and installation of bolts shall conform to the AISC Specification for Structural Joints using ASTM A325 or A490 Bolts, latest edition. Stainless steel and plated bolts shall be used where specified elsewhere herein. **All bolts including the stainless steel bolts, shall be heavy hex fasteners conforming to ANSI Standard B 18.2. 1 (metric thread in Europe).**

Nuts used on ASTM A325 fasteners shall be heavy hex meeting the requirements of ASTM A563 or A194 with wire insert.

The use of lock washers is not permitted with ASTM A325 or A490 fasteners.

The requirements for bolt tension shall be as stated on the design drawings issued to fabricate and erect this System. Snug tight fasteners are not permitted when using ASTM A325 fasteners.

13.5. WELDING PROCESSES

The referenced codes and standards permit the use of several welding processes including the Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Core Arc Welding (FCAW) and Gas Tungsten Arc Welding (GTAW) methods.

The method used to join sheet metal and sheet steel shall be GMAW or FCAW. Joining other products such as structural steel, non structural steel elements, and pipe is to be performed using the method qualified by the fabricator and erector of the System.



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The use of GMAW in the short circuiting mode of wire transfer shall not be permitted to weld products other than sheet metal or sheet steel in accordance with AWS D1.3 or D9.1 Codes. **The fabricator and erector of this system shall submit a detailed method of provisions that will limit this mode of wire transfer to use on sheet metal and sheet steel products.** This document shall be submitted prior to the commencement of fabrication and erection operations.

Filler metal used to join the components shall conform to the filler metal requirements of the applicable Standard and shall have the same corrosion performance as the base metal.

13.6. WELDING PROCEDURE QUALIFICATION

This System is fabricated from a variety of materials including mild steel, low alloy, stainless steels, and galvanized and aluminized sheet steels.

The AWS D1.1, D 1.3, and ASME B3 1.1 and B31.3 Standards provide a comprehensive listing of pre-qualified materials, weld joints, and welding processes. Should materials that are not listed as pre-qualified be introduced into this System, they shall be qualified in conformance with the requirements of this Standard.

The AWS D9.1 Standard does not list pre-qualified welding procedures. The use of materials and welding procedures used under the jurisdiction of these standards shall be qualified in conformance with the respective Standard.

The Procedure Qualification Records and Welding Procedure Specification documents shall be provided to the Ford V.O. representative prior to the commencement of fabrication operations. At the discretion of Ford V.O., the documents submitted by the successful bidder shall be reviewed by the ITA for conformance with this specification at the Contractor's cost.

These records shall be made available to Ford V0 or their designated representative for review at the fabrication shop or field.

These records shall be located at the work station or at each welding machine for use by the fitters and welders.

Weld symbols used on the fabrication and erection drawings shall conform to the AWS A 2.4 Symbols for Welding, Brazing and Non-destructive Examination (European Standards in Europe)

13.7. WELDER QUALIFICATION

Each standard used within this Specification requires the qualification of craftsmen who weld on this system. The fabricator and erector shall review the Standards, which apply to their work and qualify personnel according to the applicable Standard.

The welder's certification shall be effective for the length of time established by the Standard to which the craftsman was qualified.

The fabricator and erector shall submit the welder certification documents to Ford Motor Co. prior to allowing personnel to weld on the System. At the discretion of Ford, these documents shall be submitted to the ITA to verify conformance with this Specification.



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In addition to the welder certification documents, the submittal shall include the name of the welder, position and process qualified in, type of material and product to be welded by the listed welder. At any time during the fabrication or erection of the System, Ford or their designated representative may ask any person welding on this system for proof of identification as named on the list of submitted qualified welders.

13.8. QUALITY CONTROL

The contractor shall make provisions for monitoring of the fabrication and erection of the System. These provisions shall include qualified personnel to inspect the various processes using visual and other non-destructive testing methods and to document material input, fit-up of the various components, welding, cleaning and painting.

The intent of this section is to provide the minimum standards to which this work is to be conducted. It is the responsibility of the Contractor to provide a product that conforms to the Standards listed in Part 2 and the Contract Documents. This may require work in addition to that listed in these notes. At any time throughout the project, Ford VO may elect to monitor the quality control operation in the shop and field. Correction of any deficiencies located is the responsibility of the Contractor who performed the work.

The personnel inspecting this work shall be qualified in conformance with AWS D 1 1, Section 6.1.3.1 or CSA Standard W178.2 M, Level 2. The fabricator and erector shall submit documentation to Ford showing attainment of the CWI, CAWI level or certification from the Canadian Welding Bureau. If the proposed personnel satisfy Part 3 of AWS D1.1, Section 6.1.3.1, the submittal shall show the persons training and experience in metals fabrication including welding and testing. This person shall have thorough knowledge of the Standards referenced in this Specification.

Non-destructive personnel shall have been certified in conformance with the American Society for Non-destructive Testing (ASNT) recommended practice number SNT-TC-IA. Only personnel who have qualified as Level I and are working under a person qualified as Level II or personnel qualified as Level 2 or 3 may perform non-destructive testing. Their records shall be made available to Ford VO or their designated representative.

The inspector shall verify the material listed in the bill of materials for each drawing is used to fabricate the System. The contractor shall provide means of tracing material so that drop is not mixed (i.e. 304 stainless steel mixed in 316 stainless steel). This may be accomplished by marking the material with identifying symbols, colors or tags.

Fit-up of welded connections shall be reviewed prior to welding to determine if the weld joint satisfies the AWS or ASME Standard and the welding procedures submitted to Ford V. O.

All welds shall be visually inspected. The welds shall satisfy the visual acceptance criteria required by the applicable Standard listed in Section 14.2. One exception to those Standards is that there shall be no porosity in the components which are in contact with moisture or subject to positive or negative air pressure.

All welds in contact with moisture or positive or negative air pressure must be tested using the dye penetrant method in conformance with ASTM Standard E709. Welds made in the shop shall be tested in the shop. Field welds shall be tested in the field using the Dye Penetrant method.

A minimum of 30% of full penetration structural welds shall be tested using the ultrasonic testing



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method. The welds must satisfy the criteria listed in Table 6.1 of the AWS D 1.1 Code. Testing must be performed in conformance with Section 6, Part F of the D 1.1 Code. The joints requiring ultrasonic testing shall be noted on the shop and erection drawings.

All pipe welds shall satisfy the Visual Acceptance Criteria of the ASME B3 1.1 or B31.3 Standard.

Pipe welds which are categorized as having service temperatures over 750⁰ F with pressures over 1,025 psi, shall be tested in conformance with Table 136.4 of the ASME B31. 1 Standard. The Contractor will clearly note on their drawings welds that require this testing.

Welds that do not satisfy the acceptance criteria of the applicable Standard shall be repaired in conformance with the repair requirements of the Standard. Re-testing of the repair will be made using the same process by which the flaw was located. Records of all flaws located and repaired shall be provided to Ford. The shop records shall be provided to Ford V0 prior to the component being placed in the final assembly area.

Deficiencies that are in excess of 10% of a process, i.e., weld joints, cleaning, passivating, failure to provide required records, etc., will not be permitted to be erected in the field until corrections are made.

13.9. CLEANING

The free iron associated with the heat-affected zone resulting from the welding operations must be removed to minimize contamination in the paint enclosure and tanks.

Weld spatter must be removed.

Welds made onto stainless steel shall be passivated. It is the fabricators and erectors responsibly to determine the method of passivating the welds that their operations can support. This work will be done at the fabricating shop prior to shipment of components fabricated in the shop. All other welds must be field passivated. Records of this work will be provided to Ford Engineer prior to shipment of the material.

All components shipped for erection onto Ford property shall be power washed using cleaning solutions that are not detrimental to the final product. Refer to ASTM A380, Section 6.3 for additional information. Visual inspection of the completed cleaning operations shall be performed in accordance with ASTM A380, Section 7.2.1. This work must be completed prior to shipment. This is the final step prior to shipping.

13.10. RECORDS

Records required within this Specification shall be provided to Ford V0 in a sequence such that correction of record keeping deficiencies will not interfere with erection operations.

The Contractor shall keep a record of work performed to satisfy this Specification for the units fabricated. These detailed records shall include conformance with fit-up, welding, testing and cleaning criteria established by this Specification. These records will be provided to Ford V0 prior to final assembly. The field contractor shall provide these records prior to final acceptance by Ford V.0.



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14. EQUIPMENT STANDARDS

14.1. FANS

14.1.1. Fan Selection and Sizing Criteria

Fans shall be selected for good operating points with reference to static pressure and CFM (M3/H). As a general rule for cases when the static pressure does not exceed 3" (8 mbar), the supply fan shall be selected with maximum outlet velocity not to exceed 2600 fpm (13m/s). Over 3" (8 mbar) static pressure the maximum fan outlet velocity shall not exceed 3100 fpm (16m/s/).

To ensure that the fan operating point is on the vertical section of the curve, the Contractor shall select the fan that if the static pressure increases by 15%, the delivered volume can be no less than 85% of the design flow. Motors selected shall be sized for 5% excess over the break horsepower requirements for the airflow volume and system resistance.

Fan nametags shall be located on face of pedestal under the drive and list size, weight, arrangement, bearing info, drive info, motor info, rated volume, static pressure, speed belts, sheaves and serial number. Tags shall be screw mounted and of stamped construction, painted data or adhesive mounting are not permitted. Embossed steel tags must be used for manufacturer, model, and serial number with date of manufacture.

The contractor shall be held responsible to make any drive alterations that may be required in the field to satisfy the flow volume and balance requirements all within the scope of these specifications.

Slide bases shall be used for motor frames 5 HP/184T and smaller. Auto tensioning pivot motor bases will be supplied for 7.5 HP through 200 HP/445T maximum frame size.

For swing out fan motors above 60 HP are not to be hung from the fan pedestal for ease of maintenance. They will be mounted above the fan shaft above the bearing pedestal, as in a manually adjusted pivot base. Motor bases shall be MPT or Ford approved equal. Care must be taken to ensure that the pivoted base is mounted in the correct orientation and that the manufacturer's instructions with respect to drive and pivot location are strictly followed.

The pivot base selection and sizing shall be submitted with the certified fan curves.

Note: Mounting a pivot motor base on an Arr. 9 pedestal is unacceptable, unless it is an arrangement 9H horizontal motor mount on the pedestal.

All fan design and ratings shall be in accordance with AMCA Codes and Specifications. Fan rating shall be based upon AMCA Standard No. 210, and construction shall conform to AMCA No. 99, unless noted otherwise.

A certified fan curve with the point of operation indicated must be submitted for each fan, regardless of application. Ford reserves the right to make final selection based on performance characteristics. The curve shall also indicate the curves at 100 RPM increments from the "clean" start point to the final "dirty" point.

Include curve illustration for two fans in parallel if applicable.



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A dynamic balance in accordance with AMCA publication 204-96 shall be made on the entire fan assembly at the factory. Vibration readings shall be filtered at fan speed and shall give a maximum peak to peak vibration displacement of 1.5 mils and the vibration velocity, measured in the X and Y axis on the fan bearing caps, shall not exceed .10 inches/second (2.5 mm/s). The exact amount of vibration displacement shall be permanently recorded on the fan as proof of final dynamic balance at the factory. Fan balancing to the same specification is required after installation in the system.

Fan and motor base isolation shall be as follows:

Supply fans (include cascade and recirculation supply fans) shall be on a common structural base which is supplied with vibration type spring isolators.

Exhaust fans mounted on grade level concrete shall be on a common structural base equipped with Korfund pads. When mounted on elevated concrete or structural steel, they shall be on a common structural base which is supplied with vibration type spring isolators..

14.1.2. Belt Drives and Guards

Drives shall be quick demountable design. Drives shall be sized 25% in excess of motor brake horsepower.

Belts shall be static non-conducting. No drive selection shall be less than 2 groove "B" section. All belts shall be selected as matched sets, and manufactured as listed in 055 PNT or approved equal.

OSHA approved drive guards shall be easily removable without tools.

Grease fittings shall be accessible without removing guards.

V-belt drives shall be protected by guards that encompass all sides of the drive. They shall be fabricated from minimum #16 gauge (1.5 mm) expanded metal in metal frame and be welded construction, welds ground smooth and guards shall be secured by means of bolted clips.

Each guard shall complete with two (2), one-inch diameter holes opposite each shaft for tachometer readings. Guards shall have hinged covers held in place with suitable over center latches (Bassick), rubber latches or Owner approved equal. Separate shaft guards shall be provided. Covers shall incorporate a flattened expanded metal observation panel covering approximately 75% of guard face area. End shaft will be countersunk for the insertion of the tachometer probe.

Shaft and bearing guards shall be removable without tools for vibration readings and maintenance. The use of exposed bearing shaft guards is permissible.

All guards shall be painted safety yellow.



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14.1.3. Fan Bearings

Fan bearings shall be heavy duty, self-aligning, grease lubricated, heavy-duty ball or roller bearing, mounted on welded structural steel pedestals supported from the fan base. Grease fittings for bearings shall be extended to a common point outside of fan shaft for all Class III Size 300 and above fans as a minimum.

For Class II construction, bearings shall be selected for a certified AFBMA-L50 rating of 200,000 hours, minimum average bearing life at maximum performance of the fan. Bearing certification shall be based on each fan operating at a maximum design speed for each AMCA fan class, so that 90% of the bearings will complete or exceed this "Rating Life" before the first perceptible sign of fatigue sets in.

Bearing grease fittings shall be extended to a common point outside the guard with Zerk fittings on the end of extensions to allow bearings to be lubricated without removing the guard.

14.1.4. Exhaust Fans – Wet Scrubber Systems

The fans shall be in accordance with Sections 14.1.1, 14.1.2 and 14.1.3 with the following additional requirements.

Spraybooth exhaust fans shall, as a minimum, be Class II, centrifugal, AMCA Type "C" spark proof construction, single width, single inlet, backward curved airfoil blade, non-overloading type, furnished complete with motor and drive. Fan wheel shall be constructed with split taper bushings to allow for the use of mild steel shafts. Inlet cones shall be stainless steel construction and shall be removable from inside the fan housing. All other parts in contact with the air stream (wheel, scroll, etc.) shall be stainless steel construction. Fans shall be swing-out impeller type to provide ease of cleaning.

No aluminum will be allowed to obtain spark resistance, provide stainless steel inlet cone with a continuously welded Monel rub ring to obtain spark resistance.

The entire rotating assembly and power train shall be mounted on a hinged access door of heavy gauge steel with framing. The door assembly shall be mounted on hinges with ball type bearings and include quick release latches. Sufficient support for the bearing pedestal and attachment to the door shall be provided at the outbound bearing to insure that the weight of the motor and all mounted components does not cause shaft end oscillations. No roller and/or guide plates shall be accepted to support the swing out door's weight.

Gaskets to seal the swing-out assembly at the fan housing shall be extruded rubber, mechanically attached. No foam rubber or adhesives will be allowed. Door gaskets shall be coated with grease at the factory. All access hardware shall be coated with an anti-seize lubricant. All door lock down hardware shall have a minimum 1" diameter threaded shafts and/or cast hand wheels.

Exhaust fans for feather duster, feather duster enclosure and paper pull section shall be mild steel epoxy coated with quick open access door. All other requirements of this section apply.



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Fan housing shall have a 1-1/2" (38 mm) drain. Fan base shall be supported by suitable spring vibration isolators suitable for the service and environment bolted to platform support steel or anchored to penthouse concrete floor. Exhaust fan selection shall be based on a maximum outlet velocity of approximately 2800 fpm (850m/min), and shall have the ability to compensate for a 15% error in calculation of system pressure with a minimum loss of volume.

Fan bearing size shall be based on a minimum average life of 200,000 hours of continuous operation for this service. Bearing assemblies shall be heavy-duty, self-aligning, roller bearing, pillow block, grease lubricated with pressure relief feature.

Fans shall be provided with clean-out door and air inlet guard.

A mechanical anti-back spin device will be provided on all fan shafts that are attached to a common plenum for either the intake or discharge. Anti-back spin device to be mounted between the fan bearings. Proper guarding will be provided.

Contractor shall provide and install 3" diameter half couplings and a flexible hose from all fan housing drains. Drains shall be piped to the wet section of the booth or process waste. For fans mounted above the roof on a structural steel platform, the drain pipes shall be electrically heat traced. Drain line shall be a minimum of 3" (50 mm) diameter with no 90's.

14.1.5. Exhaust Fans – Dry Systems

Exhaust fans shall be Arr. 9, minimum Class II construction, centrifugal with a mild steel inlet cone with a continuously welded Monel rub ring to obtain spark resistance (optional stainless steel cone provided with Ford approval), single width, single inlet, backward curve airfoil blade, non-overloading type furnished with clean-out door, 1-1/2" (40 mm) drain, motor, drive, shaft, belt, and OSHA guards.

The fans shall be in accordance with Sections 14.1.1, 14.1.2, and 14.1.3 with the following additional requirements.

The fan housing drains will be plugged. Fans shall be supplied with punched inlet and outlet flanges to mount the flex connection. The flanges shall be solid welded to the fan housing. The fans shall be mild steel epoxy coated with quick opening access door.

Dry Exhaust Fans connected to a common plenum shall be fitted with a mechanical anti-backspin device

14.1.6. Air Supply Fans

The fans shall be in accordance with Sections 14.1.1, 14.1.2, and 14.1.3 with the following additional requirements.

Air supply fans shall be centrifugal type of not less than Class II Construction, single width, Arrangement 1 or 9H. Depending on the design application use of a DWDI, Arrangement 3 type fans are allowed with Ford approval. All surfaces of the fan, motor base and drive guard exposed to the air stream shall be epoxy coated.



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Recirculation and Cascade type (downstream of the filter house only) filter house fan material specification shall be type "C" spark proof with stainless wheel and cone and epoxy coated housing interior. They shall have the fan drive shaft fitted with a mechanical anti-backspin device.

Fan assemblies located outside of the air house, but not in a penthouse shall be provided with weather protection for motors and drives.

Fan wheel design shall be non-overloading type (backward curved airfoil blade). The fans shall be sized for an outlet velocity of approximately 2800 FPM (14m/s), at an operating point between 65 and 75 % of free air delivery of A.M.C.A. (N.A.F.M.) fan curves. All fan design and ratings shall be in accordance with A.M.C.A. Test Codes and Specifications.

Provide a flexible connection between the fan outlet flange and the supply duct to the plenum and on the fan inlet.

The flexible connection shall be one-piece 3/16" (5 mm) EPDM blend neoprene reinforced rubber.

Fan housing shall have a 3" (75 mm) drain.

Fan selection shall have the ability to compensate for a 15% error in calculation of system pressure with a minimum loss of volume.

14.1.7. High Temperature Fans

The fans shall be in accordance with Sections 14.1.1, 14.1.2, and 14.1.3 with the following additional requirements. Fans operating above 200°F (93°C) shall be in accordance with this section.

Oven exhaust fans, booster fan for agitation air, and recirculation type air seal fans shall be centrifugal, single width, backwardly inclined airfoil blade, non-overloading, class 2, arrangement 1 or arrangement 9H, with heat slinger, 1-1/2 inch (38 mm) diameter drain coupling and plug, inlet screen, and clean-out door with gaskets.

Centrifugal fans shall be sized to handle a specified volume of air against system pressure and not exceed an outlet velocity of 2800 FPM (14m/s) at 5" max, 3000 FPM at 7" max and 3100 FPM above 7". Fan operating point shall be selected at no more than 85% of fan shut-off static pressure.

Fan shaft shall be heat resistant steel, AISI C-1018, 1040 or 1045; ground and polished; sized for first critical speed of at least 1.5 times the maximum speed for the class. Shafts shall be center drilled to facilitate tachometer readings.

Metal fan name tags shall be visible after insulation is applied and are to be located on face of pedestal under drive.

Fan bearings shall be heavy duty, self-aligning, grease lubricated, heavy-duty ball or roller bearing, mounted on welded structural steel pedestals supported from the fan base. Grease fittings for bearings shall be extended to outside of fan shaft guard.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Final bearing selection (ball or roller or split roller) shall be as recommended by the fan manufacturer for maximum life of bearing under fan operating conditions.

Fan non-air stream parts shall be primed and finish coated with 600° F rated high temperature aluminum paint.

The Manufacturing Shop shall insulate the fans and clad per the standard specifications.

All guards shall be painted "Safety Yellow". Provide static pressure test connections at all fans installed in ductwork.

14.1.8. Heater Fan

The fan shall be in accordance with Sections 14.1.1, 14.1.2, and 14.1.3 with the following additional requirements.

The heater fan/s (recirculation, heat exchanger and exhaust) shall be Class III, SWSI, backwardly inclined airfoil blades, removable and all welded wheel, non-overloading, of heavy industrial construction, inlet screens on open inlet fans, outlet velocity 2800 FPM (854m/min) at 5" maximum, 3000 FPM at 7" maximum and 3100 FPM above 7", and a minimum total static pressure as shown below, unless noted otherwise in the Detailed Equipment Specification:

Heater Type	Heater & System Static Pressure (COLD)
Fresh Air Heater (indirect fired) Exhaust air make-up and agitation air make-up for indirect fired ovens	7" W.C (17 mbar)
Radiation Heater	7" W.C (17 mbar)
Convection Heater (direct & indirect fired)	7" W.C (17 mbar)

The Contractor shall calculate all systems in regard to resistance and drive requirements. Detailed calculations shall be submitted for approval.

The heater fan shall be internally mounted in the heater housing, with oversize shaft extended through the side(s) of the heater liner to externally mounted bearings. If required by the specific heater design, provide bar type vanes welded to the back plate of the fan wheel, on the housing side, to create a negative air pressure at the shaft hole through the housing.

Shaft cooler, shaft seal and cooler guard shall be provided where required. Fan casing sides shall be constructed of heat resistant steel (Class III), structurally reinforced, and securely welded to the heater liner at a location reinforced to the outer shell. Fan scroll shall be heat-resistant steel to AMCA Standards, continuous welded to the sides, with a bolted, gasketed access panel, and drain hole at low point of scroll for cleaning. Fan inlet(s) shall be spun from heat resistant steel securely bolted or clamped (if swing-out type) to fan casing side(s).

Plug fan arrangements 9F (floor mount) or arrangement 9H, with motors mounted on unitary base are also acceptable.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Plug fans shall be furnished with insulated mounting panels as manufactured by the fan supplier.

Fan shaft shall be heat resistant steel, AISI C-1018, 1040 or 1045; ground and polished; sized for first critical speed of at least 1.5 times the maximum speed for the class. Shafts shall be center drilled to facilitate tachometer readings. Impellers shall be statically and dynamically balanced and complete fan assembly shall be test balanced at the operating speed prior to shipment.

Metal fan nametags are to be located on face of pedestal under drive.

Fan rating shall be based upon AMCA Standard No. 210, and construction shall conform to AMCA No. 99, unless noted otherwise.

Operating Air Temperature

Up to 800°F (430°)

Above 800°F (430°)

Above 900°F (480°)

Fan Material Selection Air Stream Parts

Mild steel

Corten steel or 304 L stainless steel depending on maximum temperature

316 L stainless steel (including shaft)

Shop drawings shall be accompanied by complete information about fan performance including performance curves, correction factors, etc. Submit fan shaft data and bearing data also.

Non-air stream parts shall be primed and finish coated with 600° F. rated high temperature aluminum paint. All guards shall be painted safety yellow.

14.2. PUMPS

14.2.1. General

Circulation pumps shall be top pull-out design. Depending on the process requirements (flow and pressure), the pumps shall be heavy duty industrial top pull-out vertical centrifugal, vertical turbine, or cantilever type in Europe. Circulation pumps which operate over 115.5 feet of head (3.6 bar) TDH shall be vertical turbines.

Transfer pumps, settling tower supply pumps and pressure filter supply pumps shall be horizontal, ANSI back pull-out design.

All pumps are to include a minimum of a two year warranty (starting with Production Launch which is after Facilities Launch) which meets all general conditions and instructions to bidders. This warranty shall also include labor, materials and shipping.

For each pump type, (turbine, centrifugal, horizontal) pumps shall be of the same manufacturer. A minimum number of pump sizes shall be provided for parts interchangeability. The Owner reserves the right to make final selection based on past performance of the pump manufacturer.

All pump materials of construction shall be suited for temperature, corrosion and abrasion of the solutions being handled. As a minimum, all pumps shall be all iron construction with #316 stainless steel shaft and impeller and stainless steel cover plate. Pumps handling



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Conditioner, Phosphate solution, Post Phosphate rinse water, Passivation solution and D.I. and R.O. water shall be #316 stainless steel construction of all wetted parts with #316 stainless steel cover plate. No brass, bronze or silicone shall be permitted in the construction of any pump without prior approval of the Ford Engineer.

Where pumps have common duties, then supply all such pumps in stainless wetted parts for low spares inventory.

Each pump shall include a 1800 nominal (1450 in Europe) RPM Super High premium efficiency T-Frame motor. Vertically mounted motors shall be utilized for this service complete with proper lifting eyes, and long shaft design to be interchangeable between vertical turbine and vertical barrel mount pumps. Motor running load shall not exceed 95% of motor size for design conditions, excluding service factor of motor.

Pumps/motors shall be sized to provide non-overloading characteristics throughout its operating curve. All pumps shall be selected on the best efficiency point available for the range, or just to the left of the BEP while maintaining interchangeability. Target efficiency point shall be 75% minimum. Impeller diameter shall not exceed 75% of maximum impeller diameter.

Where pumps are connected for multiple operation, then curve selection shall consider individual or multiple running pumps. Submit curves indicating performance when multiple pumps are running.

Individual pump curves shall include minimum and maximum range lines and brake horsepower data.

All pumps supplied shall be capable of starting with discharge valves open or closed.

Couplings shall be rated a minimum of 100% of motor horsepower over the operating curve. Flexible couplings shall be Ford approved as listed in 055 PNT. Couplings shall be enclosed in an OSHA approved guard.

Pumps shall be hydrostatically tested at 150% of their full rated pressure; all necessary adjustments shall be made to pumps prior to shipment.

A stainless steel name plate shall be permanently attached to the pump. The pump name plate shall include model number, size, rated flow rate at TDH, actual impeller diameter, serial number, casing and impeller material. All information shall be stamped into the plate.

All machine bolts, stud nuts and cap screws shall be of the hex head type. Hardware (or parts) requiring special tools shall not be used.

Note: See specific equipment standard for additional pump design criteria e.g. 300-PNT or 600-PNT.

The pump supplier shall provide Ford Motor Company with part list sheets for each pump type and size.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Pumps shall be shipped with impellers adjusted, motors mounted and couplings completely assembled.

A minimum number of power frames will be maintained for interchangeability throughout the system.

Provide flexible connections at all pump outlet connections with a flex-guard safety cover over the coupling.

14.2.2. Vertical Turbines

Vertical turbine pumps shall be in accordance with facilities specification section 11518 with the following exceptions.

Vertical turbine pumps shall be designed such that all bowl and line shaft bearings are below the point at which a hydraulic bypass seal is created and are lubricated by the pumped liquid. No conventional packing or mechanical seal is used to seal against leakage at the discharge head. No grease or oil shall be injected into the pumped solution. The column assembly shall be designed for an enclosed line shaft with seal.

The discharge head shall be designed to carry the entire weight of the bowl and column assembly along with the motor. Suction end of the pump shall terminate one bell diameter from tank bottom or as specified by the pump manufacturer.

The line shaft enclosing tube shall be stainless steel and properly sealed at both ends to prevent solution from entering the tube and coming in contact with the line shaft.

The outer column shall be steel pipe and be designed so that the bearing spacing shall be such as to insure that the pump does not operate in critical frequency. The column size shall provide a solution velocity not less than 5 ft/sec and not greater than 10 ft/sec. The interior of the column shall be free of offsets, burrs, discontinuities and irregularities.

Pump bowls shall be flanged and bolted. Liquid passages shall be extra large to prevent plugging.

The impellers shall be stainless steel machined and finished smooth to insure proper performance. They are to be dynamically balanced on two planes to within hydraulic institute standards. The impellers shall securely fasten to the bowl shaft with stainless steel tapered split collets. Impellers shall be adjusted vertically by external means, except by jack bolts or screws.

Bearings shall be epoxy fiberglass type. Bowl bearings shall be lubricated by the pumped solutions.

14.2.3. Vertical Barrel Mount Pumps

The top pull out construction shall allow removal of the rotating elements without disturbing cover plate, pump casing or piping. The pump design shall include a minimum distance of 28" from the cover plate to the center line of the volute or impeller pumps shall be capable of



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

pump down service and designed to operate under a suction lift. Pump may extend a maximum of 12' longer over standard length.

A tailpipe shall be installed on all pump inlets as specified and approved to by the pump manufacturer. Pump shall be sized for a maximum suction tall pipe inlet velocity of 8 fps. The discharge pipe will be extended through the cover plate and the pipe shall be sized for a maximum velocity not to exceed 11 fps.

The pump casing shall be of the vertical split, end suction tapered design to insure impeller and shaft alignment under load conditions. Discharge flanges shall be 125# ANSI.

The barrel shall be pilot registered fit to the pump power frame and accept a C-Face motor.

Double row thrust and single row radial bearings, as a minimum, shall be located above the cover plate with an air gap and be grease lubricated. Minimum span between bearing centers shall be 8-3/4" with minimum shaft diameter of 2-1/4", up to 40 HP, and a minimum span between bearing centers of 12-1/2" with minimum shaft diameter of 3-1/4", for 50 and 60 HP and 4 1/4" diameter for 75 HP and above, for capacity and head of pump.

The impellers shall be semi-open design. Impellers shall be installed on a keyed shaft with a stainless nut . The impeller running clearance shall be easily adjustable to compensate for wear by means of external jack screws without necessitating the disassembly or removal of the rotating assembly.

The pump shaft shall be of sufficient diameter to withstand maximum pump load with minimum deflection. Maximum shaft deflection at the design point shall not exceed 0.009 inches. The shaft shall be of high strength steel compatible with the liquid being pumps.

The throttle bushing, mounted in a one piece bearing housing, shall be located between the pump liquid end and the column. A suitable deflector shall be mounted on the shaft, adjacent to the throttle bushing. The throttle bushing shall not be used as a bearing.

316 Stainless Steel cover plate shall be fabricated of a minimum 1/2" thick machined plate up to 40 HP, and 1" thick machined plate for 50 HP and above.

The pump casting shall be of he vertical split; end suction tapered design to insure impeller and shaft alignment under load conditions. Discharge flanges shall be 125# ANSI. Pump materials of construction shall be suited for temperature, corrosion and abrasion of the solutions being handled. No bronze, brass or aluminum shall be utilized.

Power frame shall be heavy duty, one-piece cast iron, accurately machined, with greasable ball bearings, sealed against dirt and moisture, including grease Zerk fittings extended through the coupling guard. Minimum power frame HP rating is 40 HP at 1800 RPM.

14.2.4. Vertical Cantilever Pumps (Europe)

Type shall be vertically suspended, bottom suction, direct driven, with no bearings or bushings below sole plate. All pumps of the same size to be jig built to ensure full interchangeability. Pump discharge port shall extend above soleplate and provide a closed surface such that vapors cannot escape.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Drop length shall be 1000 mm nominal (underside of soleplate to pump case suction inlet, with a maximum depth requirement for start up prime of 500 mm from underside of soleplate. Inlet bells will be provided on pump suction of all pumps (not included in above dimensions) and drop extension tubes as required.

Pumps to be able to be soft or direct on line started without detriment. Pump supplier to confirm the acceleration time needed for the pump to reach operating speed.

Long life grease to be used for bearing lubrication providing an interval of two years between bearing overhaul based on 24 hr/day running. Double lip seals mounted on shaft sleeves will be provided to prevent grease entering the solution.

Pumps shall be of Egger or Jeumont manufacture or owner approved equal.

Pumps must be installed with flexible spacer coupling and elbow on the discharge pipe to create a clear space for vertical withdrawal of the unit. No pipe runs to be installed above pump soleplate.

14.2.5. Horizontal Pumps up to 120 PSI (8 BAR)

Suction Pumps shall be in accordance with the facilities specifications section 11516 with the following exceptions.

Horizontal pumps shall be end suction with dimensions conforming in all respects to ANSI B73 IM 1991, (in Europe DIN 24255 ,ISO 2858) vertically-split, single-stage centrifugal pumps with top centerline discharge and "back pull-out" feature.

Casing will be vertically split with self-venting top centerline discharge with an integral foot located directly under the casing for added support. All casings shall be of the "back pull-out" design with registered fit between the pull out assembly and the casing. Jack Screw provision with suction and discharge nozzles cast integrally. Casing shall be provided with gauge taps in suction and discharge nozzles, and in bottom of casing with drain tap.

The casing shall be top discharge with 150 lbs (PN 10) flanges and fully confined gasket.

Fully-open impeller with front edge having contoured vanes curving into the suction for minimum NPSH requirements and maximum efficiency will be provided. Impeller shall be securely fastened to the shaft and be capable of handling solids up to 1/4" diameter (spherical).

All impellers will have radial "pump out" vanes on the back side to reduce pressure on the seal and to reduce axial thrust, stuffing box pressure and aid in eliminating collection of solids at stuffing box throat.

To maintain pump efficiency, pump design must allow clearances within the pump to be restored without removing the pump or pumping elements from the installed location. All pumps will have jack screw provisions for external adjustment of axial clearance between the leading edge of the impeller and casing. This adjustment shall be made by jack bolts at the outboard bearing housing, which moves the impeller forward toward the suction wall of the casing, requiring no shims and by using a simple open end wrench.



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Pump shaft shall be suitable for hook-type sleeve. Shaft material will be SAE 4140 steel. Shaft deflection at all operating points shall not exceed the limits specified by the latest edition of the ANSI B73 specification which will not exceed .002" at the vertical centerline of impeller, and at the seal faces which allows less shaft deflection and longer seal life. Shaft surfaces for all bearings and packing shall be ground to less than 32 micro-inches.

Renewable hook-type shaft sleeve which extends through the stuffing box and gland shall be provided and machined from 316L stainless steel. The shaft sleeve design shall ensure that no solution contacts the shaft of the impeller attachment mechanism. The sleeve shall be relieved for ease of disassembly when mechanical seals are used.

Stuffing box will be suitable for packing cartridge type, single (inside or outside) or cartridge type double-inside mechanical seal without modifications. Stuffing box shall be accurately centered by machined rabbit fits on case and frame adapter. Provided with jacking bolts for faster easier disassembly.

Precision ball bearings to be grease lubricated with a 25,000 hour B-10 life rating. The thrust bearing shall be double row and securely locked in the bearing housing and shall take radial and any unbalanced thrust load. The single row inboard bearing shall be free to float and take only radial loads.

The pump shall be furnished with a Taper Bore or Big Bore mechanical seal chamber that will effectively keep solids away from the seal parts, and ensure adequate cooling of the mechanical seal cavity. The seal chamber MUST accommodate the mechanical seals of more than one manufacturer.

Phosphate horizontal pumps will require cartridge type double mechanical seals with external flushing system. All other pumps shall be furnished with cartridge type single inside mechanical seals with flush line from an internal bypass or taper bore design. Mechanical Seal Glands shall be furnished with a metal-to-metal fit to ensure proper alignment of the seal faces and be cartridge mounted on a stainless steel shaft sleeve. A confined, controlled compression gasket or O-ring shall be used. When required by the pump application, flush, vent and/or drain connections shall be clearly indicated on the gland itself. The flush over mechanical seal faces shall be directed tangentially, not perpendicularly, to eliminate seal face chatter and solids impingement on the seal faces.

A rigid, heavy Cast Iron base plate with factory installed stainless steel drip pan below pump housing shall be furnished and supported on a grouted and/or S.S. frame base. The base shall have a camber top to prevent collection of drips on the base and to ensure rigidity. Install drain pipe to drain trench or drain sump. The pump, power frame and motor surface areas shall be machined for positive alignment. When flange loads are applied to the pump, pump-to-motor shaft misalignment shall not exceed 0.005 inches due to base plate distortion.

14.2.6. Air Diaphragm Pumps

Air diaphragm pumps shall be double diaphragm ball check type with Teflon elastomers chemical and mechanically suitable for application. All parts shall be comprised of #316 stainless steel, including valve seats.

Diaphragm pumps will be installed such that no transmitted vibration occurs from pump to pipes. I.e., install flexible connections, pulsation chambers etc.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Diagram pumps shall have NPT threaded or flanged inlet and outlet connections and a surge suppressor (pulsation dampener) shall be located immediately downstream of the pump discharge to be installed such that no transmitted vibration occurs from pump to pipes (i.e. install flexible connections, pulsation chambers, exhaust silencer/muffler, etc).

14.2.7. Self-Priming Horizontal Waste Pumps

The contractor shall supply and install self-priming horizontal pumps and motors, (1) one of which is a standby, manufactured by Gorman Rupp Inc. or approval equal. The pump shall be mounted on support steel provided and installed by the Contractor.

The pumps shall be of the horizontal, self-priming type, specifically designed to handle (3") diameter spherical solids. The pump casing shall be gray iron or 316 SS for E-coat and Phosphate waste systems. The pump shall be designed to retain adequate liquid in the pump casing to ensure unattended automatic repriming at its rated speed when the pump is restarted.

The pumps shall be equipped with a removable cover plate, allowing complete access to pump interior to permit service and repairs without disturbing the pump volute or the suction or discharge piping.

The pumps shall be equipped with a replaceable 316 S.S. wear plate. Replacement of the wear plate, impeller and seal shall be accomplished through the removable cover plate. The entire rotating assembly shall be removable as a unit without disturbing the pump volute or piping.

The impeller shall be two-vane, open-type, non-clog, 316 S.S. with integral pump-cut vanes on the back shroud. It shall thread onto the pump shaft and be secured with a lock screw, or be keyed onto the pump shaft and secured with S.S. lock nut.

Means shall be provide for external adjustment of the clearance between the impeller and wear plate.

The shaft bearings shall be of ample size and proper design to withstand all radial and thrust loads incurred during normal pump operation. Bearings shall be oil lubricated. The pump shaft shall be protected by a shaft sleeve through the mechanical seal cavity.

The pump shaft shall be sealed against leakage by a single seal with tungsten vs. tungsten carbide seal faces, Viton elastomers, 300 series stainless hardware and spring seal system designed for long life (semi-cartridge type).

The mechanical seal shall be lubricated with oil from separate oil filled reservoir of the pump pedestal. Oil reservoirs shall be of sufficient capacity for one year of operation.

The seal must be removable and replaceable through the cover plate opening.

The pumps shall be direct-coupled drive with T.B. Woods couplings. Belt drive pumps shall be only utilized when appropriate selection is not possible without this drive flexibility. Pump motors will be of the horsepower sized to be completely non-overloading throughout the entire pump operating curve with 25% excess horsepower minimum. All external rotating



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

components shall be enclosed in an approved removable guard. Motor/coupling alignment tabs with double nut hardened bolts will be provided adjacent to all four motor feet.

The motor will be new, provided and installed by this Contractor.

The pump will be mounted on a direct-coupled base complete with a 3.2 inline planetary gear type reducer to facilitate use of a TEFC, 1750 RPM, T frame motor in compliance with the latest Ford Motor Company Specification.

The pump shall include spool flanges on suction and discharge outlets. The spools shall include taps for vents and priming.

14.3. DAMPERS

14.3.1. Manual Dampers (Ambient Temperatures)

All supply air, or exhaust duct runs where two plenums are tied into one fan, shall be provided with volume control dampers of the opposed multi-blade design. Blades shall be linked for single quadrant operator adjustment. Wherever possible, the blade shall span the short duct dimension. Blade length shall not exceed 48"(1.2m).

The volume control dampers shall be complete with raised heavy duty locking quadrants. Quadrants shall be fitted with a sleeve to enclose damper control shaft to minimize leakage. Damper shafts are to be cut on the ends to indicate blade position.

The final setting of the damper quadrant shall be clearly marked with black paint on either side of the adjustment arm. The arm shall be locked in place to prevent slippage from vibration by one of the following methods:

- a) Tack Welded
- b) Pinned or Screwed in Place

This shall be carried out after final acceptance by Ford Motor Company of the baseline data sheets.

All dampers shall be designed and constructed for intended operating temperatures and pressures, with aluminized steel frame and blades.

14.3.2. Manual Dampers (High Temperatures over 200°F)

Manual volume control dampers shall be opposed multi-blade design if installed on suction side of the system. Blades shall be linked for manual quadrant adjustments.

Blades shall be airfoil design with a maximum width of 6" (152 mm), and wherever possible, the blade shall span the short duct dimension.

Dampers shall be #12 gauge (2.8 mm) aluminized steel frames, minimum #14 gauge (2 mm) aluminized steel blades, 3/4" (20 mm) diameter stainless steel shafts, stainless steel flanged sleeve bearings bolted to one side and with a stuffing box on the other side.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

Single blade, 12 gauge (2.8 mm) aluminized steel, balancing dampers shall be installed in pressurized duct systems. 304 stainless steel damper shaft shall be sealed with fiber frax rope stuffing on heavy duty quadrant side. At the opposite side, a seal welded pipe cap shall enclose the shaft end gas tight.

All dampers shall be rated for 750°F (400°C) temperature. All dampers shall have locking quadrants with open and closed position indicated. Insulated ducts shall have raised locking quadrants.

The final setting of the damper quadrant shall be clearly marked with black paint on either side of the adjustment arm. The arm shall be locked in place to prevent slippage from vibration by one of the following methods:

- a) Tack welded
- b) Pinned or screwed in place

This shall be carried out after final acceptance by Ford Motor Company of the baseline data sheets.

14.3.3. Automatic Dampers – Oven High Temperature

Dampers shall be metal to metal seated, one blade butterfly with a 90 degree rotation forward and backward. Leakage shall be less than 1%. The damper shall be constructed to operate at 600°F (315°C) with a pressure difference of 6" W.C.(15 mbar). The maximum velocity through the damper shall not exceed the duct or stack velocity.

Construction of the damper body and damper blade shall be from cold rolled steel finish coated with an aluminized finish or from stainless steel. The body shall include flanges which will fasten the damper to the duct flange. No sandwich type dampers will be permitted. The damper blade must include both horizontal and vertical stiffeners which extend to within 1-1/2" (35 mm) of the outside diameter of the blade. Deflection at this point to be less than 0.05" (1 mm).

The damper shaft shall be 304 stainless to eliminate any corrosion problems in the packing area. The damper shaft shall be one piece construction. Stub shafts are not permitted. Attachment of the shaft to the damper blade will be by means of heat treated bolts. The damper shaft shall be either splined or keyed directly (depending on size) to the actuator. No coupling or linkage will be accepted. The actuator shall be mounted, adjusted and tested prior to shipping to the jobsite. When installed, the damper shaft is parallel with the ground. ***Damper shafts are to be cut on the ends to indicate blade position.***

All automatic dampers shall be proven open and proven closed.

Damper seats shall be 304 stainless steel to eliminate any corrosion problems between the disc and seat and shall be attached to the damper body using heat treated bolts.

The disc is to be centered in the seat utilizing a bearing with locking collar mounting to the actuator bracket. Locking collar is to be secured so that vibration cannot cause the disc to slip.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

The drive side seal is between the inboard carbon bushing and the outboard bearing. The seal is a non-asbestos packing material compressed with a stainless packing follower. The outboard seal shall be similar.

The bracket design is to incorporate gussets, stiffeners, etc. so that actuator stall/max torque can be transmitted to the shaft and disc without bracket deformation.

The specifications show minimum material sizes to be used. Thicker materials are acceptable. The intention is to have the dampers built sufficiently sturdy to eliminate any damper distortion which may occur. The damper manufacturer shall verify all dimensions and sizes and accept all responsibilities for proper damper/actuator operation.

Damper Dimensions:

EQUIVALENT DIAMETER	BODY	FLANGE	DISC	SHAFT DIAMETER	BRACKETS
30" to 40"	1/4"	1/4"	1/4"	1-1/2"	1/4"
42" to 50"	1/4"	1/4"	1/4"	1-3/4"	3/8"
52" to 66"	3/8"	3/8"	3/8"	2"	1/2"
68" to 84"	1/2"	1/2"	1/2"	2-1/2"	5/8"

14.3.4. Automatic Dampers –Abatement

Dampers shall be scissor seated one blade butterfly with a 90 degree rotation forward and backward. Leakage shall be less than 1%. The damper shall be constructed to operate at 200°F (95°C) with a pressure difference of 2" W.C. (5 mbar) The maximum velocity through the damper shall not exceed the spraybooth stack velocity.

Construction of the damper body and damper blade shall be from stainless steel. The body shall include flanges which will fasten the damper to the duct flange. No sandwich type dampers will be permitted. The damper blade must include both horizontal and vertical stiffeners which extend to within 1-1/2" (35 mm) of the outside diameter of the blade. Deflection at this point to be less than 0.05" (1 mm).

The damper shaft shall be 304 stainless to eliminate any corrosion problems in the packing area. The damper shaft shall be one piece construction. Stub shafts are not permitted. The damper shaft shall be either splined or keyed directly (depending on size) to the actuator. Attachment of the shaft to the damper blade will be by means of heat treated bolts. The bolts shall be designed as the weakest point to prevent damage to the shaft and damper blade if a failure occurs. When installed all dampers are to be in such a position that the shaft is horizontal. *All damper shafts are to be saw cut on the ends to indicate blade position.*

The damper seats shall be 304 stainless steel to eliminate any corrosion problems between the disc and seat and shall be attached to the damper body using heat treated bolts.

The disc is to be centered in the seat utilizing a bearing with locking collar mounting to the actuator bracket. Locking collar is to be secured so that vibration cannot cause the disc to slip.



GENERAL TECHNICAL CONDITIONS AND HARD POINTS

The drive side seal is between the inboard carbon bushing and the outboard bearing. The seal is a non-asbestos packing material compressed with a stainless packing follower. The outboard seal shall be similar.

The bracket design is to incorporate gussets, stiffeners, etc. so that actuator stall/max torque can be transmitted to the shaft and disc without bracket deformation.

The specifications show minimum material sizes to be used. Thicker materials are acceptable. The intention is to have the dampers built sufficiently sturdy to eliminate any damper distortion which may occur. The damper manufacturer shall verify all dimensions and sizes and accept all responsibilities for proper damper/actuator operation.

All automatic dampers shall be proven open and proven closed.

Damper Dimensions:

EQUIVALENT DIAMETER	BODY	FLANGE	DISC	SHAFT	BRACKETS
30" to 40"	1/4"	1/4"	1/4"	1-1/2"	1/4"
42" to 50"	1/4"	1/4"	1/4"	1-3/4"	3/8"
52" to 66"	3/8"	3/8"	3/8"	2"	1/2"
68" to 84"	1/2"	1/2"	1/2"	2-1/2"	5/8"

14.3.5. Automatic Dampers - Booth Cascade / Recirculation

Same as the requirements for 14.3.4 only rectangular single blade dampers are allowable. Include positive blade stop for open and closed position. Teflon packing and bearing with stainless steel bearing carrier shall be included.

Damper actuators shall be sized for 150% the calculated torque requirement.

Dampers and actuators are to be pneumatic type per 055-PNT.

All automatic dampers shall be proven open and proven closed.

14.3.6. Fresh Air Intake Dampers

Parallel blade motorized shutdown dampers shall be installed in the intake ductwork. Damper frames shall be a minimum of 2" x 10" x 2" (50 mm x 250 mm x 50 mm) - #14 gauge (2.0 mm) galvanized formed channel with spring steel edge seals, bolted to the ductwork. Blades shall be #16 gauge (1.5 mm) galvanized, pressed from single thickness, on a maximum of 6" (150,.) spacing and 48" (1.2m) long. Blades shall have proper reinforcing breaks and overlapping edge coverage with extruded vinyl edge seals. Shafts shall be 1/2" (13 mm) diameter CRS stubs plated for corrosion resistance, bolted to the blades. Drive blade shaft shall be continuous. Bearings shall be bronze oilite flanged sleeve type pressed into the frame. Linkage shall be external, complete with interconnecting rods mounted in pivoted fasteners riding in bronze bushings.

Dampers are to be fitted with electric operators as specified in Section 055-PNT under electrical controls, the maximum damper size per operator shall not exceed 40 ft² (3.71 m²)



14.4. PROCESS AIR FILTERS

14.4.1. Air House Pre-Filter

Filter Performance Specifications

Filters shall have a Minimum Efficiency Rating Value of eight (MERV-8) or higher when tested in accordance with ASHRAE Standard 52.2 at 492 FPM (2.5 m/sec). Initial resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.30" w.c. (8 mm) or lower. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report. The filters must be rated to operate to at least 2000 CFM (3396m³/hr) and to a final resistance of 1.00" (25 mm) w.c. or higher.

Filter Construction Specifications:

The pre-filters shall be nominal 2" thick pleated filters or 3 ply ring panels with an integral 9 – ½ gage wire ring with a nominal face dimension of 24" x 24" (610 mm x 610 mm) and actual dimensions of 23.4" x 23.4" ±0.1" (594 mm x 594 mm ±2.5 mm). Where installations are made in existing assembly plants, filters shall be of the same size and manufacturer presently utilized. The pleated filters shall contain a media surface area of seventeen (17) square feet (1.6 m²) or greater. The ring panel filters shall be constructed of three (3) plies of synthetic fibers heat sealed or sewn around a frame equal or greater in strength to that of a welded 9-1/2 gage steel wire frame. The ring panel filters shall be self-sealing such that they require no clips on holding frames to stay in place with little or no contaminant bypass. Filters shall be rated to withstand a maximum operating temperature of 200°F (93°C) or higher. Filters shall be classified, as to flammability, by Underwriters Laboratories as UL Class-2 or UL Class-1.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gage (1.5 mm) aluminized steel with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm). Where installations are made in existing assembly plants, filter frames shall be of the same size as presently utilized. All mitered corners must be seam welded to prevent bypass. The filter bank shall be designed for upstream access, and it shall be the Contractor's responsibility to design and provide a suitable means of easy access to air filters for replacing them. The frames shall be supplied with a minimum of four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection and to allow safe access from plenums. When an air house contains both a pre-filter and a primary filter, both filters are to mount in a common frame.

14.4.2. Air House Bank 1 Filters (Primary)

Filter Performance Specifications:

Filters shall have a Minimum Efficiency Rating Value of eight (MERV-8) or higher when tested in accordance with ASHRAE Standard 52.2 at 492 FPM (2.5 m/sec). Initial resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.24" w.c. (6 mm) or lower. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report from an approved independent test lab on a filter they acquired on the open market. The filters shall have a Dust Holding Capacity of 750 grams or higher when tested in accordance with ASHRAE Standard 52.1 to a final resistance of 1.00" w.c.. Compliance with this dust holding capacity specification must be provided in the form of an ASHRAE Standard 52.1 test report from an approved independent test lab on a



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filter they acquired on the open market that indicates an initial resistance at rated flow within $\pm 10\%$ of the initial resistance reported in the ASHRAE Standard 52.2 test report. The filters must be rated to operate to at least 500 FPM (2.54 m/sec) and to a final resistance of 1.00" (25 mm) w.c. or higher. Filter capabilities notwithstanding, it is the contractor's responsibility to ensure that average air volume through each filter shall be limited to 500 FPM or lower with physical arrangement and components ensuring that localized velocity does not exceed 625 FPM (3.2 m/sec) at any point.

Filter Construction Specifications:

The primary filters shall have a nominal face dimension of 24" x 24" (610 mm x 610 mm), with actual dimensions of 23.4" x 23.4" ± 0.1 " (594 mm x 594 mm, ± 2.5 mm). Filters shall consist of one (1) or more pockets of media with a nominal depth of fifteen (15) to twenty (20) inches (380 mm to 510 mm). Filters shall be constructed of two (2) or more plies of synthetic fibers heat sealed or sewn around a frame equal or greater in strength to that of a welded 9- 1/2 gage steel wire frame with support struts between the pockets if more than one pocket is used. Filters shall be self-sealing such that they require no clips on holding frames to stay in place with little or no contaminant bypass. Filters shall use media and construction that makes them self-supporting such that in the total absence of airflow, filters positioned above will not sag to the point of contacting filters positioned below in a built-up filter bank at any point during the filters' useful life. Non-toxic, non-allergenic, non-migrating tackifier shall be applied between the last two layers of media. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500 Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area with smooth laminar airflow at least twelve inches (12", 305 mm) upstream of the filter bank and (12", 305 mm) downstream of the maximum filter depth. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gauge (1.5 mm) galvanized or aluminized steel, with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) with all mitered corners seam welded to prevent by-pass. The filter bank shall be designed for up-stream access. The assembled filter bank will be properly stiffened to limit deflection to 1/4" for every 4 feet from the nearest support structure. Installed frames shall prohibit air by-pass without the use of caulking.

14.4.3. Air House Bank 2 Filters (Secondary)

These filters may also be installed in the booth plenum when specified in the booth specification 100 PNT.

Filter Performance Specifications:

Filters shall have a Minimum Efficiency Rating Value of fourteen (MERV-14) or higher when tested in accordance with ASHRAE Standard 52.2 at 492 FPM (2.5 m/sec). Initial



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resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.55" w.c. (14 mm) or lower. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report from an approved independent test lab on a filter they acquired on the open market. The filters shall have a Dust Holding Capacity of 250 grams or higher when tested in accordance with ASHRAE Standard 52.1 to a final resistance of 1.50" or less. Compliance with this dust holding capacity specification must be provided in the form of an ASHRAE Standard 52.1 test report from an approved independent test lab on a filter they acquired on the open market that indicates an initial resistance at rated flow within $\pm 10\%$ of the initial resistance reported in the ASHRAE Standard 52.2 test report. The filters must be rated to operate to at least 500 FPM (2.54m/sec) and to a final resistance of 1.50" (38 mm) w.c. or higher. Filter capabilities notwithstanding, it is the contractor's responsibility to ensure that average air velocity through each filter shall be limited to 500 FPM or lower with physical arrangement and components ensuring that localized velocity does not exceed 625 FPM (3.2 m/sec) at any point.

Filter Construction Specifications:

The secondary filters shall have a nominal face dimension of 24" x 24" (610 mm x 610 mm), with actual dimensions of 23.4" x 23.4" ± 0.1 " (594 mm x 594 mm, ± 2.5 mm). Filters shall contain a media surface area of sixty-five (65) square feet (6m²) or greater with a nominal depth between eleven and a half (11.5) and thirty (30) inches (290 mm to 760 mm). Filter media shall consist of a mat of synthetic fibers or wet laid glass fibers that will not degrade or break down in moisture, including prolonged submersion in water. Media shall not shed fibers under conditions of severe vibration. Media made from lofted glass fibers is acceptable only as a pre-filter to a layer of waterproof synthetic media that is equal to or greater than the efficiency of the glass fiber pre-filter layer. Filters shall be furnished with integral closed-cell flexible gasket. Open-cell foam gaskets are not acceptable. Filters intended for vertical installation (as opposed to the horizontal orientation sometimes used in paint booth plenums) shall use media and/or construction that makes them self-supporting. This self-supporting requirement is such that in the total absence of airflow, filters positioned above will not sag to the point of contacting filters positioned below in a built-up filter bank at any point during the filters' useful life. All metal components including header, hoops, retaining clips, and other components must be galvanized, aluminized, or stainless steel to minimize corrosion. Cold steel pocket hoops are not acceptable. Support rods, if any, shall be stainless steel to prevent corrosion in harsh environments. Galvanized steel support rods are not acceptable. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500 Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area with smooth laminar airflow at least twelve inches (12", 305 mm) upstream of the filter bank and 12" (305 mm) downstream of the maximum filter depth. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gauge (1.5 mm) stainless steel, with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) with all



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mitered corners seam welded to prevent by-pass. The filter bank shall be designed for upstream access. The frames shall be supplied with four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection to ¼" for every 4 feet from the nearest support structure. Installed frames shall prohibit air by-pass without the use of caulking. Filter frames shall be the same size and assembled with reinforcements in the same manner as frames for the primary filter bank.

14.4.4. Booth Ceiling Filters

Filter Performance Specifications:

Filter media shall have a Minimum Efficiency Rating Value of ten (MERV-10) or higher when tested in accordance with ASHRAE Standard 52.2 at 100 FPM (0.51 m/sec). Initial resistance to airflow at 100 FPM (0.51m/sec) shall be between 0.22" and 0.29" w.c. (5.5 to 7.5 mm). Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report from an approved independent test lab on a filter they acquired on the open market. When tested in accordance with the Viledon Particle Migration Test at an airflow velocity between 100 and 125 FPM and challenged with fused aluminum oxide particles ranging from 10 to 35 microns in size at a rate of 300,000 particles/m³ for a period of 120 minutes or longer and a grid rapping rate of 12 raps per minute, the filter must allow penetration of 20 particles/m³ or less. Compliance with this migration specification must be provided in the form of a single Particle Migration Test Report from an independent agency that indicates an extrapolated initial resistance at 100 FPM flow within +/-10% of the initial resistance reported in the ASHRAE Standard 52.2 test report. Filter capabilities notwithstanding, it is the contractor's responsibility to ensure that localized velocity through the diffusion filters does not exceed 200 FPM (1 m/sec) at any point, including in "flash-off", setting areas", "quiet zones", and inspection areas.

In some cases, owner may specify the use of more restrictive media in an effort to manipulate downdraft airflow. Where high-resistance media is specified, acceptable media includes Viledon PA/560G-5, Viledon PA/560G-5 P, Filtrair CC-700G, and Filtrair CC-800G. High resistance media efficiency must be equal to or greater than the efficiency of the PA/560G-10 or CC600 media it replaces as evidenced by a single ASHRAE Standard 52.2 test report with a Minimum Efficiency Rating Value of ten (MERV-10) and a Particle Migration Test under the conditions articulated above with a penetration of 20 particles/m³ or less. Initial resistance to airflow at 100 FPM (0.5 m/sec) shall be between 0.33" and 0.49" w.c. (8 to 12 mm) for PA/560G-5 and CC-700G and between 0.55" and 0.65" w.c. (13 to 16 mm) for PA/560G-5 P and CC-800G.

Filter Construction Specifications:

Where a blanket ceiling diffusion filter media is specified, cut to size, the diffusion media shall be Viledon PA/560G-10, PA/560G-5, or PA/560G-5 P or Filtrair CC-600G, CC-700G, or CC-800G. The media shall be manufactured from synthetic fibers attached to a woven or continuous filament scrim to prevent fiber attrition. Fiberglass and cotton fibers are not acceptable. The media shall be progressively structured such that fibers on the air entering side are less dense while fibers on the air leaving side are more dense. This depth-loading construction is important to maintain more consistent pressured drop throughout the life of the filter. The media shall be tackified throughout its entire depth with a non-migrating tackifier to aid particle retention. This is most readily accomplished with the use of tacky fibers. Tackifier that is sprayed or rolled onto the media is acceptable only if it consistently penetrates and coats all fibers throughout the entire depth of the filter. The filter shall be self-



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sealing without the need for external clips and shall be printed on the air leaving side to make upside-down installation evident. To help ensure an effective seal, the filter media shall be between 0.80" and 1.25" thick (20 to 32 mm). Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Where a panel ceiling is specified the booth ceiling filter media shall be Viledon PA/560G-10 or Filtrair CC-600G or the high-resistance versions of the same media as articulated above. The media shall be sewn or glued with a silicon free material to a stainless steel wire frame with cross-wires such that the filter can be readily grasped, manipulated, installed, and removed from the downstream (process) side with a single hand without damaging the filter. All other performance and construction specifications for diffusion panels are as indicated above for diffusion media blankets.

Filter manufacturer selection shall be based on plant preference and Vehicle Operations Paint Engineering approval.

Filter Frame Construction Specifications:

When blanket ceiling media is specified, the filter frame construction shall be in accordance with specification 100 PNT. When a panel filter ceiling is specified the frame construction shall be as follows:

The filter holding frame shall be constructed of #16 gage (1.5 mm) 304 stainless steel, size 20" x 20" x 3" x 3/4" (510 x 510 x 3 X 20 mm) outside dimensions or 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) as specified by owner with all mitered corners seam welded to prevent by-pass. Continuously welded fabricated frames are acceptable. In either case, installed frames shall prohibit air by-pass without the use of caulking. The assembled filter bank will be properly stiffened to limit deflection and to allow safe access from plenums.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500P a-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area at least twelve inches 12" (305 mm) upstream and downstream of the filter bank. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports. Magnehelic gages shall be supplied and installed to measure differential pressure across diffusion media in each zone of every paint booth and across the diffusion media and diffusers (if any) in each repair, scuff, inspection, and wax booth

14.4.5. Row #1: Booth Recirculation/Cascade/Carbon Protector Filter

Filter Performance Specifications:

Filters shall have a minimum average removal efficiency on 3 micron paint particles of 82%. Initial resistance to airflow at 400 FPM (2.03m/sec) shall be 0.35" w.c. (6 mm) or lower. The Carbon Protector Primary Filter shall be as listed in Section 055 PNT. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report. The filters must be rated to operated to at least 500



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FPM (2.54m/sec) and to a final resistance of 1.00" (25 mm) w.c. or higher. The filters shall be able to operate up to at least 2.00" (51 mm) w.c. differential pressure without showing structural damage of any kind. Filter capabilities notwithstanding, it is the contractor's responsibility to ensure that average air velocity through each filter shall be limited to 400 FPM (2.03 m/s) or lower with physical arrangement and components ensuring that localized velocity does not exceed 550 FPM (2.8 m/sec) at any point

Filter Construction Specifications:

The primary filter bank shall have a nominal face dimension of 24" x 24" (610 mm x 610 mm), with actual frame dimensions of 23.4" x 23.4" +/- 0.1" (594 mm x 594 mm, +/- 2.5 mm). Filters shall consist of one (1) or more pockets of media with a nominal depth of fifteen (15) to twenty (20) inches (380 mm to 510 mm). Filters shall be constructed of two (2) or more plies of synthetic fibers heat sealed or sewn around a frame equal or greater in strength to that of a welded 9-gage steel wire frame. Filters shall be self-sealing such that they require no clips on holding frames to stay in place with little or no contaminant bypass. Filters shall use media and construction that makes them self-supporting such that in the total absence of airflow, filters positioned above will not sag to the point of contacting filters positioned below in a built-up filter bank at any point during the filters' useful life. Filter media shall consist of a mat of synthetic fibers that will not degrade or break down in moisture, including prolonged submersion in water. Media shall not shed fibers under conditions of severe vibration. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area at least twelve inches (12" or 305 mm) upstream and downstream of the filter bank. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gauge (1.5 mm) stainless steel, with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) with all mitered corners seam welded to prevent by-pass. The filter bank shall be designed for upstream access. The frames shall be supplied with four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection to an acceptable norm.

14.4.6. Row #2: Booth Recirculation/Cascade/Carbon Protector Filter

Filter Performance Specifications:

Filters shall have a minimum average removal efficiency on 2 micron paint particles of 89%. Initial resistance of airflow at 400 FPM (2.03 m/s) shall be 0.40" w.c. or lower. The Carbon Protector Secondary Filter shall be as listed in Section 055 PNT. The filters must be rated to operate to at least 500 FPM (2.54 m/sec) and to a final resistance of 1.50" (37 mm) w.c. or higher. The filters shall be able to operate up to at least 6.00" (51 mm) w.c. differential pressure without showing structural damage of any kind. Filter capabilities notwithstanding,



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it is the contractor's responsibility to ensure that average air velocity through each filter shall be limited to 400 FPM (2.03 m/s) or lower with physical arrangement and components ensuring that localized velocity does not exceed 550 FPM (2.8 m/sec) at a point.

Filter Construction Specifications:

The secondary filters shall have a nominal face dimension of 24" x 24" (610 mm x 610 mm), with actual dimensions of 23.4" x 23.4" ± 0.1 " (594 mm x 594 mm ± 2.5 mm). Filter media must include a mat of synthetic fibers that will not degrade or break down in moisture, including prolonged submersion in water. Media shall not shed fibers under conditions of severe vibration. Media made from lofted or wet-laid glass fibers is acceptable only as a pre-filter to a layer of waterproof synthetic media that is equal to or greater than the efficiency of the glass fiber pre-filter layer. Filters shall be furnished with integral closed-cell flexible gasket. Open-cell foam gaskets are not acceptable. Filters intended for vertical installation (as opposed to the horizontal orientation sometimes used in paint booth plenums) shall use media and/or construction that makes them self-supporting. This self-supporting requirement is such that in the total absence of airflow, filters positioned above will not sag to the point of contacting filters positioned below in a built-up filter bank at any point during the filter's useful life. All metal components including header, hoops, retaining clips, and other components must be galvanized, aluminized or stainless steel or aluminum to minimize corrosion. Cold steel pocket hoops are not acceptable. Support rods, if any, shall be stainless steel to prevent corrosion in harsh environments. Galvanized steel support rods are not acceptable. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500 Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area at least twelve inches (12", 305 mm) upstream and downstream of the filter bank. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gauge (1.5 mm) stainless steel, with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) with all mitered corners seam welded to prevent by-pass. The filter bank shall be designed for up-stream access. The frames shall be supplied with four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection to an acceptable norm. Filter frames shall be the same size and assembled with reinforcements in the same manner as frames for the primary filter bank.

14.4.7. Row #3: Booth Recirculation/Cascade/Carbon Protector Filter

Filter Performance Specifications:

Filters shall have a minimum average removal efficiency of 1 micron paint particles of 90%. Initial resistance to airflow at 400 FPM (2.03 m/s) shall be 0.40" w.c. or lower. The Carbon Protector Third Stage Filter shall be as listed in Section 055 PNT. The filters must be rated to operate to at least 500 FPM (2.54 m/sec) and to a final resistance of 1.50" (37 mm) w.c. or



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higher. The filters shall be able to operate up to at least 6.00" (51 mm) w.c. differential pressure without showing structural damage of any kind. Filter capabilities notwithstanding, it is the contractor's responsibility to ensure that average air velocity through each filter shall be limited to 400 FPM (2.03 m/s) or lower with physical arrangement and components ensuring that localized velocity does not exceed 550 FPM (2.8 m/sec) at any point.

Filter Construction Specifications:

The third stage filters shall have a nominal face dimension of 24' x 24' (610 mm x 610 mm), with actual dimensions of 23.4" x 23.4" ± 1.0 " (594 mm x 594 mm ± 2.5 mm). Filter media must include a mat of synthetic fibers that will not degrade or break down in moisture, including prolonged submersion in water. Media shall not shed fibers under conditions of severe vibration. Media made from lofted or wet-laid glass fibers is acceptable only as a pre-filter to a layer of waterproof synthetic media that is equal to or greater than the efficiency of the glass fiber pre-filter layer. Filters shall be furnished with integral closed-cell flexible gasket. Open-cell foam gaskets are not acceptable. Filters intended for vertical installations (as opposed to the horizontal orientation sometimes used in paint booth plenums) shall use media and/or construction that makes them self-supporting. This self-supporting requirement is such that in the total absence of airflow, filters positioned above will not sag to the point of contacting filters positioned below in a built-up filter bank at any point during the filters' useful life. All metal components including header, hoops, retaining clips and other components must be galvanized, aluminized or stainless steel or aluminum to minimize corrosion in harsh environments. Galvanized steel support rods are not acceptable. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area at least twelve inches (12", 305 mm) upstream and downstream of the filter bank. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gauge (1.5 mm) stainless steel, with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) with all mitered corners seam welded to prevent by-pass. The filter bank shall be designed for up-stream access. The frames shall be supplied with four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection to an acceptable norm. Filter frames shall be the same size and assembled with reinforcements in the same manner as frames for the primary filter bank.

14.4.8. Row #4: Booth Recirculation/Cascade/Carbon Protector Filter

Filter Performance Specifications:

Filters shall have a minimum average removal efficiency of .5 micron paint particles of 95% and a minimum average removal efficiency of .3 micron paint particles of 90%. Initial resistance to airflow at 400 FPM (2.03 m/s) shall be 0.55" w.c. or lower. The Carbon



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Protector Fourth Stage Filter shall be as listed in Section 055 PNT. The filters must be rated to operate to at least 500 FPM (2.54 m/sec) and to a final resistance of 1.50" (37 mm) w.c. or higher. The filters shall be able to operate up to a at least 6.00" (51 mm) w.c. differential pressure without showing structural damage of any kind. Filter capabilities notwithstanding, it is the contractor's responsibility to ensure that average air velocity through each filter shall be limited to 400 FPM (2.03 m/s) or lower with physical arrangement and components ensuring that localized velocity does not exceed 550 FPM (2.8 m/sec) at any point.

Filter Construction Specifications:

The fourth stage filter shall have a nominal face dimension of 24" x 24" (610 mm x 610 mm), with actual dimensions of 23.4" x 23.4" ± 0.1 " (594 mm x 594 mm ± 2.5 min) Filter media must include a mat of synthetic fibers that will not degrade or break down in moisture, including prolonged submersion in water. Media shall not shed fibers under conditions of sever vibration. Media made from lofted or wet-laid glass fibers is acceptable only as a pre-filter to a layer of waterproof synthetic media that is equal to or greater than the efficiency of the glass fiber pre-filter layer. Filters shall be furnished with integral closed-cell flexible gasket. Open-cell foam gaskets are not acceptable. Filters intended for vertical installation (as opposed to the horizontal orientation sometimes used in paint booth plenums) shall use media and/or construction that makes them self-supporting. This self-supporting requirement is such that in the total absence of airflow, filters positioned above will not sag to the point of contacting filters positioned below in a built-up filter bank at any point during the filters' useful life. All metal components including header, hoops, retaining clips, and other components must be galvanized, aluminized or stainless steel or aluminum to minimize corrosion. Cold steel pocket hoops are not acceptable. Support rods, if any, shall be stainless steel to prevent corrosion in harsh environments. Galvanized steel support rods are not acceptable. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500 Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area at least twelve inches (12", 305 mm) upstream and downstream of the filter bank. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gage (1.5 mm) stainless steel, with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm) with all mitered corners seam welded to prevent by-pass. The filter bank shall be designed for up-stream access. The frames shall be supplied with four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection to an acceptable norm. Filter frames shall be the same size and assembled with reinforcements in the same manner as frames for the primary filter bank.



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14.4.9. Oven Fresh Air Filters

Filter Performance Specifications

Filters shall have a Minimum Efficiency Rating Value of eight (MERV-8) or higher when tested in accordance with ASHRAE Standard 52.2 at 492 FPM (2.5 m/sec). Initial resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.30" w.c. (8 mm) or lower. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report. The filters must be rated to operate to at least 2000 CFM (3396m³/hr) and to a final resistance of 1.00" (25 mm) w.c. or higher.

Filter Construction Specifications:

The oven fresh air filters shall be nominal 2" thick pleated filters or 3 ply ring panels with an integral 9 – ½ gage wire ring with a nominal face dimension of 24" x 24" (610 mm x 610 mm) and actual dimensions of 23.4" x 23.4" ±0.1" (594 mm x 594 mm ±2.5 mm). Where installations are made in existing assembly plants, filters shall be of the same size and manufacturer presently utilized. The pleated filters shall contain a media surface area of seventeen (17) square feet (1.6 m²) or greater. The ring panel filters shall be constructed of three (3) plies of synthetic fibers heat sealed or sewn around a frame equal or greater in strength to that of a welded 9-1/2 gage steel wire frame. The ring panel filters shall be self-sealing such that they require no clips on holding frames to stay in place with little or no contaminant bypass. Filters shall be rated to withstand a maximum operating temperature of 200°F (93°C) or higher. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

Filter Frame Construction Specifications:

The filter holding frame shall be constructed of #16 gage. (1.5 mm) aluminized steel with outside dimensions of 24" x 24" x 3" x 3/4" (610 mm x 610 mm x 76 mm x 20 mm). Where installations are made in existing assembly plants, filter frames shall be of the same size as presently utilized. All mitered corners must be seam welded to prevent bypass. The filter bank shall be designed for upstream access, and it shall be the Contractor's responsibility to design and provide a suitable means of easy access to air filters for replacing them. The frames shall be supplied with four stainless steel holding clips per frame (one on each side) that prevent the filter from falling out of the frame and that force the filter against the frame to minimize bypass around the filter. The assembled filter bank will be properly stiffened to limit deflection and to allow safe access from plenums.

14.4.10. High Temperature Recirculation And Agitation Air Filters

Filter Performance Specifications:

Filters shall have a Minimum Efficiency Rating Value of fourteen (MERV-14) or higher when tested in accordance with ASHRAE Standard 52.2 at 492 FPM (2.5 m/sec). To demonstrate the integrity of the seal between the media pack and the filter frame, minimum efficiency for all particles 4.00 microns and larger shall be 99% or greater at all individual levels of incremental dust loading in the ASHRAE 52.2 testing. Initial resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.65" w.c. (17 mm) or lower. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report. The filters must be rated to operate to at least 500 FPM (2.54 m/sec) and to a final resistance of 1.2" (30 mm) w.c. or higher. The filters must also be rated to operate properly to a maximum temperature of 750°F (400°C) or higher. At owner's option, the filter must be rated to operate properly to a maximum temperature of 900°F (480°C) or higher, in which case the initial resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.72" w.c. (18 mm) or lower. Filter capabilities notwithstanding, it is the contractor's responsibility to



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ensure that average air volume through each filter shall be limited to 500 FPM or lower with physical arrangement and components ensuring that localized velocity does not exceed 625 FPM (3.2 m/sec) at any point.

Filter Construction Specifications:

The oven recirculation and agitation air filter bank shall have a nominal face dimension of 24" x 24" x 12" (610 mm x 610 mm x 305 mm), with actual dimensions of 23.4" x 23.4" x 11.5", +/- 0.1" (594 mm x 594 mm x 292 mm, +/- 2.5 mm). Filters shall be constructed with an aluminized steel header with a nominal dimension of 24" x 24" x 1" (610 mm x 610 mm x 25 mm), and actual dimensions of 23.4" x 23.4" x 0.8", +/- 0.1" (594 mm x 594 mm x 20 mm, +/- 2.5 mm) to allow sealing via nominal 1" (25 mm) clamping mechanism (see filter frame construction specifications). Filters shall contain a gross media surface area of one hundred thirty-four (134) square feet (12.8m²) or greater. In the event that owner specifies that the filters must be rated to operate to 900°F (480°C), gross media surface area must be increased to one hundred eighty (180) square feet (16.7m²) or greater.

Filter media shall consist of a wet-laid mat of micro glass fibers utilizing high temperature binders to minimize fiber attrition and binder burn-off. Media shall be evenly spaced to minimize restriction to airflow by the use of 0015 gage corrugated aluminum separators placed between each pleated sheet of media to maintain media spacing. In the event that corrugated aluminum separators are used, the edges must be rolled to reduce media damage and the risk of personal injury.

To minimize damage, racking, and deterioration, the filter frame shall be made from 24-gage or stronger aluminized steel. To reduce the risk of flaking and corrosion, galvanized steel and untreated steel are not acceptable. Upstream and downstream sides of the filter shall have #4 aluminum mesh or expanded aluminized steel face guards. Face guards will be supported by the use of at least two retaining straps on each of the upstream and downstream sides of the filter. These retaining straps shall be aluminized or stainless steel or heavier aluminum with equivalent strength.

To minimize bypass around the filter, all filters must be supplied with integral woven glass fiber gaskets that provide a tight seal on the downstream side of the filter header. To prevent gasket migration, the gasket must be riveted to the filter header in four (4) or more locations and tightly secured. All filter components must be free of silicone-based glues, cements, and binders. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-1.

Differential Pressure Indicator Specifications:

Dwyer Magnehelic silicone-free model 2002-SF or metric equivalent (2000-50 MM-SF, 2002D-SF, or 2000-500Pa-SF) gauges shall be provided with an indicated range of 0 to 2.00" w.c. and 0.05" divisions (or metric equivalent.) Magnehelic gages shall be supplied and installed to measure differential pressure across each bank of filters. To maximize gage accuracy and resolution, Magnehelic gages shall use Dwyer number A-301 static pressure tips with compression fittings located in an unobstructed area at least twelve inches (12", 305 mm) upstream and downstream of the filter bank. The static pressure tips shall be connected to the Magnehelic gages by way of 1/4" (6.35 mm) aluminum or copper tubing and a Dwyer A-310A 3-Way vent valve on each of the high and low pressure ports.



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Filter Frame Construction Specifications:

The filter holding frame shall be of the AAF Torsion-Temp design, or owner approved equal, constructed of #12 gauge aluminized steel. The filter framing shall be welded continuously around each individual filter holding frame section to prevent any potential leakage.

Each row of Torsion-Temp filter openings is stamped from a continuous piece of 12 gauge aluminized sheet steel. One edge of each section is flanged and seam welded leak free to the adjacent section. The torsion bar clamps clamp and seal an entire row of filters to the frame at one time.

For existing installations, for extensions, replacement or additions, the Contractor shall match filters and framing with the existing ones, unless noted otherwise in the DED. For new paint shops and new ovens the Torsion-Temp or equal framing shall be used.

14.4.11. Burner Intake Air Filters

Filter Performance Specifications:

Filters shall have a Minimum Efficiency Rating Value of eight (MERV-8) or higher when tested in accordance with ASHRAE Standard 52.2 at 492 FPM (2.5 m/sec). Initial resistance to airflow at 492 FPM (2.5 m/sec) shall be 0.30" w.c. (8 mm) or lower. Evidence of compliance with all above performance specifications must be provided in the form of a single ASHRAE Standard 52.2 test report. The filters must be rated to operate to at least 1400 CFM (2377m³/hr) and to a final resistance of 1.00" (25 mm) w.c. or higher.

Filter Construction Specifications:

The oven fresh air filters shall be a nominal 2" thick pleated filters or 3 ply ring panels with an integral 9-1/2 gage wire ring with a nominal face dimension of 20" x 20" (510 mm x 510 mm) and actual dimensions of 19.4" x 19.4" ±0.1" (494 mm x 494 mm ±2.5 mm). Where installations are made in existing assembly plants, filters shall be of the same size and manufacturer presently utilized. The pleated filters shall contain a media surface area of seventeen (11) square feet (1m²) or greater. The ring panel filters shall be constructed of three (3) plies of synthetic fibers heat sealed or sewn around a frame equal or greater in strength to that of a welded 9-1/2 gage steel wire frame. The ring panel filters shall be self-sealing such that they require no clips on holding frames to stay in place with little or no contaminant bypass. Filters shall be rated to withstand a maximum operating temperature of 200°F (93°C) or higher. Filters shall be classified as to flammability by Underwriters Laboratories as UL Class-2 or UL Class-1.

14.4.12. Differential Pressure Gauges and Switches

One air filter gauge shall be provided for each separate filter bank for measuring the resistance to air flow through the filters.

Gauges for reading across air filters shall be Dwyer Series 2000 Magnehelic dial type air filter gauge or Owner approved equal. Filter gauges shall be mounted on stand-off brackets and properly identified. All gauges shall have test fittings and shall be provided with three-way vent cocks for venting to atmosphere.

Operating ranges shall be selected that the expected average reading will be at the scale mid point.



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The static pressure taps shall be located a minimum of 12" (300 mm) upstream and downstream from the filter bank in an area of least turbulence.

Switches shall be furnished at all recirculation and fresh air filter banks to initiate a warning light ("Change Filters") at the Panel View.

14.5. MOTORS

14.5.1. Motor Specifications

All motors shall be 1,800 RPM, 460 VAC, three-phase, U- frame or Super "T" frame, in accordance with Ford Motor Company manufacturing standards (WEM-1). Motor horsepower shall be specified 25% above the required brake horsepower.

Booth Recirculation or cascade fans shall not exceed 200 hp without prior approval.

14.6. LIQUID HEAT EXCHANGERS

14.6.1. Plate and Frame Exchangers

The plate and frame heat exchangers shall be in accordance with the facilities specification section 15770 with the following exceptions.

For multiple Heat exchanger systems, provide one common Heat Exchanger plate size for the system/systems as in the entire Phosphate/E-Coat system.

All units shall be designed to conform to ASME Code Stamp and shall be hydrostatically tested at 1-1/2 times the design pressure and stamped accordingly. Twenty percent fouling factor will be used in unit sizing.

Inlet and outlet nozzles along with flanges shall be #316 stainless steel. All nozzles shall extend through the end frame and be located on the fixed end of the frame with clean in place nozzle connections on the process solution nozzles. Heat exchanger shall be designed for a maximum working pressure of 100 psi. maximum allowable pressure drop is 10 psi dirty.

Plate material for all stages shall be #316 stainless steel with a minimum of 0.6 mm thickness. The gasket groove in the plates shall be tapered design to hold 50% of the gasket surface in place by bonding. All plates shall have provisions of attaching to the upper guide bar from the top or bottom side. Plates shall be of the large channel way type suitable for contaminated solutions. All units shall have the same size plates for interchangeability.

The gasket material shall be consistent with the elastomers used in the system. This Contractor shall verify the gaskets will not be altered by system process or cleaning chemicals and shall be common for all heat exchangers on the Phosphate and Electrocoat Systems. The acid cleaning solution will be Muriatic Acid, Nitric acid or as recommended by the Chemical and Heat Exchanger Suppliers.

The heat exchanger frame shall be carbon steel with baked Epoxy enamel paint and shall be designed for extending capacity by 25% without replacing the frame. Tightening bolts shall be SA193-B7, zinc plated Carbon steel. All wetted parts shall be 316 stainless steel. Elevate the H. E. frame and support a minimum of 2" off the drain pan utilizing Stainless Steel feet.



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Top bar shall be designed to support the full weight of all plates (including 25% future capacity) and be manufactured from stainless steel. Movable frame shall be supported from the top guide bar by a roller bearing and guided by the lower guide bar.

An OSHA safety shroud to prevent contact with hot surfaces shall surround the heat exchanger.

A ratchet spanner for unit opening and closing will be supplied with each heat exchanger.

Heat exchangers shall be mounted on a frame with a stainless steel drip pan complete with a single-drain pipe to the drain trench.

14.7. GAS TRAINS

All Gas Trains shall be as detailed in the Ford Specification 11575 and as approved by IRI in the USA.

For systems installed in Canada they shall be as approved by CIRI, TSSA, and ESA.

14.8. VALVES

All valves shall be as specified in the relevant process specifications with respect to materials of construction and type.

All valves shall be tagged and color coded as detailed in specifications 040 PNT and 020 PNT, this includes all cells and related equipment such as gas trains, heating controls, paint pump stations, phosphate system, etc.

All valves shall be selected with a minimum pressure drop in respect to the pressures and flows for the duty to which it is to be subjected, unless stated otherwise in the equipment specifications.

14.9. BURNERS

All burners shall be of the low NO_x design to ensure the NO_x emission rates will fall in the range detailed below.

The burner shall maintain the NO_x emission levels below 75 ppm (0.0903 lbs/MMBTU) under production conditions and at the burner rated output. Guaranteed NO_x and CO emission rates (in units of ppm and lbs/MMBTU) and supporting information describing the low NO_x burner design shall be provided. The measurements shall be volumetric and must be corrected to a standardized dilution level of 3% oxygen.

This specification shall apply to all natural gas burners associated with the oven, air supply house, abatement equipment, hot water generators, etc. The burner design and type shall be as specified in the detailed equipment specifications and section 055PNT Paint shop supply chain.



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15. EMERGENCY SHOWER AND EYE WASH STATIONS

15.1. GENERAL

The contractor shall include emergency showers and eyewash stations as required by all OSHA, Federal, State and Local codes for the equipment provided by the contractor.

The equipment shall be in accordance with ANSI Standard 23587.1-1998.

15.2. TYPES OF EQUIPMENT

Each type of equipment outlined in the standard is designed to perform a specific function; one piece of equipment is not a substitute for another. The Types of equipment covered include:

- a) Emergency Showers
- b) Eyewash Stations
- c) Eye/Face Wash Stations
- d) Combination Equipment

It is the contractors' responsibility to determine the type of equipment required to ensure code compliance.

15.3. EMERGENCY SHOWERS

Emergency showers are designed to provide a deluge large enough to encompass the whole body. Emergency showers should be selected when:

- Large volumes of potentially injurious materials are present. This is the case in many loading areas, continuous process operation areas, chemical storage areas and battery changing areas.
- or -
- Pressurized materials are present and a small volume release would still result in large affected areas.

Emergency showers shall deliver a pattern of flushing fluid (potable water, preserved water, preserved buffered saline solution or other medically acceptable solution manufactured and labeled in accordance with applicable regulations) at least 50.8 cm (20 inches) across, flowing at a rate of at least 75.7 liters (20 gallons) per minutes at a velocity low enough so as not to be injurious to the user. This diameter ensures the entire body receives a direct, fresh supply of flushing fluid. Emergency showers are not to be considered or used for irrigating chemicals from the face and eye, due to the delicate nature of these tissues and the potentially high velocity and volume of water an emergency shower may produce.

The showerhead shall not be less than 82 inches or more than 96 inches from the floor. The spray pattern shall be located at least 16 inches from any obstruction. The control valve shall be designed so that the water flow remains on without requiring the use of the operator's hand. The valve control operating rod or chain (valve actuator) shall not be more than 69 inches above the floor and shall have an open handle of at least 8 inches. Special arrangements for lengthening the actuator control device will be required for physically challenged individuals.



15.4. EMERGENCY EYEWASH STATIONS

Emergency eyewash stations are specially designed to provide controlled flow of flushing fluid to both eyes simultaneously. The unit shall be designed to provide enough room to allow the eyelids to be held open with the hands while the eyes are in the water stream. To maintain a soft controlled flow to the eyes, regulation of the volume and pressure from the station is required. Eyewash stations require an uninterrupted, 15 minute supply of water. They shall be the plumbed type. Plumbed units shall have a volume of flushing fluid available to the user for between 7.5 and 13.25 liters (2.0 and 3.5 gallons) per minute, and the ease of identifying emergency stations by lighting, signs or painted floors. The unit shall be positioned so the water nozzles are between 33 inches and 45 inches from the floor and a minimum of 6 inches from the wall of nearest obstruction. The control valve shall be designed so that the water flow remains in the on position without the use of the operators hands and must remain open until manually shut off. The valve shall be large enough to be easily located and operated by the user.

15.5. EMERGENCY EYE/FACE WASH STATIONS

An enhancement of the eyewash station is the eye/face wash station, a product designed to irrigate the eyes and face simultaneously. An eye/face wash stations delivers a substantially greater volume of flushing fluid (minimum 11.4 lpm/3.0 gpm) than an eyewash station and does so to irrigate the larger target area. In planning equipment selection, one should recognize the probability when a chemical splash affects the eyes; it will also affect the face. With this in mind, eye/face wash stations are strongly recommended when selecting chemical splash irrigation equipment.

15.6. COMBINATION EQUIPMENT

Combination equipment refers to multiple-use stations with a common plumbing inlet. Combinations of shower, eyewash, eye/face wash and drench hose equipment are available in a variety of configurations. Where combination stations are used, the water line must be at least 3.2 cm (1-1/4 inches) in diameter in order to readily supply multiple pieces of equipment. When planning system requirements, it is important to note that it is a standards requirement to be able to operate both shower and eyewash devices simultaneously.

15.7. USE OF EQUIPMENT

As important as the type of equipment selected is how equipment is applied, and what utilities are provided in the workplace. The following factors are to be considered.

15.8. LOCATION OF EQUIPMENT

The location of emergency equipment is critical to its ability to successfully serve its purpose. The eyewash stations shall be within 10 seconds traveling time from the identified contractor hazard. Specific distance references have been removed from the 1998 standard, and it is incumbent upon the contractor to select a location based on the suspected time of travel a person with compromised vision. (To help develop a frame of reference, the average adult walking four miles an hour can travel fifty feet in 10 seconds). At the same time plan to have the emergency shower and eyewash equipment located far enough away from the identified hazard so the user is not in the chemically hazardous spray area. Assure there are no stairways, change in floor levels, walls, potential trip hazards and doors that could be locked unknowingly between the emergency equipment and the work area. Depending on the location of the hazardous materials, it may be necessary to install emergency equipment outdoors.



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Where the possibility of freezing conditions exists, the equipment shall incorporate freeze protection features to meet or exceed the climate zone requirements.

15.9. FLUSHING FLUID TEMPERATURE

The contractor shall ensure that the requirements of the standard and code are complied with.

15.10. WATER DISPOSAL

All emergency units shall be piped by the contractor to the nearest industrial waste pipe or sump.

16. MODULAR BUILD REQUIREMENTS

All equipment must be of modular build design, and fully tested and approved by the V.O. Engineer in the Vendor's shop wherever practicable prior to delivery and installation at the Ford facility.

The purpose of modular build is to design equipment so that, wherever practicable, it can be assembled, tested, and fully debugged in the Vendor's facility under simulated assembly plant conditions. It shall also be designed to be easily and quickly disassembled, shipped, and reinstalled in the assembly plant, significantly reducing installation and debugging time. This also reduces the cost of the field installation, reduces the cost and time required for future rearrangements, reduces assembly plant downtime and launch costs, reduces production losses and associated scrap, and permits the use of the Vendor's own shop expertise for assembly run-off testing and debugging.

The equipment covered by these specifications shall be designed, built, tested, shipped, and installed in a modular configuration. This means that the total system shall consist of modular sections, or sub-systems and components which when connected or interconnected make up the complete system. The concept of modular build is mandatory, and is the basis for all facilities and equipment covered by this specification. The system design shall facilitate use of as few modules as possible. The size of the modules shall be limited only by shipping restrictions.

The entire modular test set-up shall include related facilities and equipment such as spraybooth sections, conveyors, etc., appropriate to this contract. This is to simulate as closely as possible the actual assembly plant installation. The Contractor will determine and provide the related support facilities and equipment that are required for the run-off.

The entire system consisting of the pre-agreed modular sections shall be fully assembled, wired, tested, and debugged in the vendor's facility; including the simulation of interlocks and other equipment that cannot be included for practical reasons. Service connections, mechanical ties, etc. shall utilize suitable quick disconnect methods to facilitate disassembly and reassembly in the assembly plant.

The need for fabrication or "hard connections" during field installation is considered unacceptable except where such methods are required to meet code, for communication integrity, or other justifiable reasons. The Vendor shall provide an itemized listing of all such field work that will be required, and shall obtain written approval from the Ford Project Engineer at design and prior to modular build and run-off at the Vendor's shop.

Critical equipment dimensional relationships shall be set at modular build. Pinning, tie bars, or similar devices/methods shall be used to retain the set relationships for field installation. Time-consuming realignment during field installation is unacceptable.



Modular Build buy off documentation shall be provided and completed per the 020-PNT specification and as indicated in the Record Book template provided.