|  |  |  |
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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | September 22, 2009 | Insertion of the pre-approved suppliers/manufacturers names and review/update of document cross-references |
| 3 | April 30, 2013 | Final Draft – Consolidated Comments Spec Update Project |
| 4 | June 17, 2013 | Finalized for Legal Review. Incorporation of new Commissioning and Computerized Maintenance Management System Data Requirements Specification cross references. |
| 5 | April 22, 2014 | Incorporation of Legal Comments (AV) |
| 6 | July 15, 2014 | Amended to reflect changes related to commissioning specification and name change (AV) |
| 7 | September 24, 2014 | Updated, Finalized Specification – Reference eDOCS #1029446 v5 (AV) |
| 8 | February 11, 2015 | Updated standards and made corrections (AV) |
| **9** | **March 2, 2015** | **Updated, Finalized Specification – Legal Reference eDOCS #5043349 v12 (AV)** |
| 10 | November 11, 2016 | Updated NEMA MG-1 reference to 2016 new version (AV) |
| 11 | February 15, 2017 | Updated standards references. Updated Acceptable Manufacturers for all products (CDP PMO, OMM) (AV) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GEneral

## Scope of Work

### The work of this Section includes the complete supply, delivery, storage, installation, testing and commissioning of the bioreactor aeration blowers, control panels, instruments, equipment guard, supports and appurtenances, and includes all related training of the Region’s staff.

### Unit Responsibility: The work requires that the aeration blower system, complete with all accessories be the end product of one system manufacturer or system supplier. Unless otherwise indicated in the Contract Documents, the Contractor shall obtain each system from the supplier of the equipment, which supplier shall furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features and functions without altering or modifying the Contractor's responsibilities under the Contract Documents. The Contractor is responsible to the Region for providing the equipment systems as specified herein.

### Provide all Computerized Maintenance Management System (CMMS) data requirements, reports, procedures, manuals, instructions and other information as defined by Section 01425 - Computerized Maintenance Management System Data Requirements in a format suitable for uploading to the Region’s CMMS (Maximo). The provision of data must comply with the construction schedule defined and sequenced and timed in accordance with Section 01810 – Equipment Testing and Facility Commissioning.

### Fully coordinate and provide services, documentation and other requirements for commissioning individual elements and entire integrated systems as defined by Section 01810 – Equipment Testing and Facility Commissioning.

### The Contractor shall provide the equipment systems as specified in this Section and in accordance with the design performance and other requirements of Division 13 and the Process Narrative/Process Control Narratives which are included as part of the Contract Documents in the SCADA Appendices.

### *[Consultant to ensure that the Process Narrative/Process Control Narratives are included as appendix documents to the Contract]*

## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]*

### *[List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### *[List Sections specifying products installed but not supplied under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### *[List Sections specifying related requirements.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01060 – Regulatory Requirements

#### Section 01250 –Substitutions

#### Section 01425 – Computerized Maintenance Management System Data Requirements

#### Section 01430 – Operation and Maintenance Data

#### Section 01600 – Material and Equipment

#### Section 01640 – Manufacturers’ Services

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 01820 – Demonstration and Training

#### Section 05503 – Metal Fabrications Mechanical

#### Section 09900 – Paintings and Protective Coatings

#### Section 11010 – Equipment General Requirements.

#### Section 13390 – Package Control Systems

#### Section 16222 – Motors: 1 to 200 kW, 575 V

#### Section 16225 – Motor Control Centre

#### [Division 13 SCADA and Instrumentation – insert applicable sections]

#### Design Guidelines – Section 21 Development and Maintenance of Asset Inventory and Tagging

## References

### Comply with the latest edition of the following codes and standards, and where no standards are listed below a standards authority, all applicable statutes, codes and standards of that authority and all amendments thereto:

#### Acoustical Society of America (ASA)

##### ASA S1.40-2006 (R2016) American National Standard Specifications and Verification Procedures for Sound Calibrators,

#### American Bearing Manufacturers’ Association (ABMA)

##### ANSI/ABMA 11-2014, Load Ratings and Fatigue Life for Roller Bearings, L10 (Basic rating Life- L10)

#### American Society of Mechanical Engineers (ASME):

##### ASME B16.5-2013 Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard.

##### ASME PTC 10-1997 Performance Test Code on Compressors and Exhausters

#### American Society for Testing and Materials (ASTM)

##### ASTM A48/A48M-03 (2016), Standard Specification for Gray Iron Castings.

#### The Electrical and Electronics Manufacturers’ Association of Canada, formerly the Electrical Equipment Manufacturers Advisory Council (EEMAC): M1-7 Motors and Generators. *[EEMAC standards are outdated but may be considered if there are no current equivalent applicable standards available. If EEMAC standards are to be applied, the Consultant will review the standards and approve any references to EEMAC standards in order to meet the Region’s energy efficiency objectives]*

#### American Welding Society (AWS):

##### AWS B2.1/B2.1M-BMG:2009 - ADD1 Standard for Welding Procedure and Performance Qualification.

##### AWS D1.1/D1.1M:2010, Structural Welding Code – Steel (edition 22).

##### AWS QC1:2007, Standard for AWS Certification of Welding Inspectors.

#### National Electrical Manufacturer’s Association (NEMA)

##### NEMA MG 1 -2016 Motors and Generators

#### Ontario Electric Safety Code (OESC).

#### The Canadian Standards Association (CSA).

## Definitions

### kW: Shaft Brake kilowatts is the kW required by the equipment to operate to specification requirements corrected for pressure, temperature, elevation and humidity at the rated inlet volume conditions.

### im3/h: Inlet volume in cubic metres per hour is the volume of air in m3/h entering the blower at inlet conditions.

### sm3/h: Standard volume in cubic metres of air per hour is the volume of air in m3/h at 20 degrees Celsius, 101 kPa absolute and 36 percent relative humidity. The imperial equivalent measurement of air flow is scfm or standard cubic feet per minute at the same conditions.

### Discharge Pressure: The pressure in kilopascals gauge (kPa gauge) at the blower discharge flange at rated capacity.

### Overall Efficiency: The total efficiency for motor, drive, and blower from the motor terminals to the pumped air.

### dBA: An acoustic measurement unit based on decibels (dB) with the A signifying A-weighted factors commonly used in the industry.

### Head Works: Generally refers to the structures and equipment responsible for screen-able solids, fats, oils and grit removal at the inlet of wastewater treatment plants. *[Definition to be amended by the Consultant to describe actual project Head Works details]*.

### VAC/V ac: Voltage Alternating Current.

## Performance Requirements

### Inlet Condition at Inlet Flange: [     ] degrees C, [     ] percent relative humidity, [     ] kPa absolute and elevation [     ] metres above mean sea level.

### Blower(s) design rating for continuous duty at specified inlet conditions:

|  |  |
| --- | --- |
| Parameter | Requirements |
| Quantity |  |
| Design Flow rate | [     ]sm3/h([     ]scfm)(per blower) |
| Maximum kW at design flow and inlet condition | [     ] **kW (at rated inlet condition)** |
| Pressure differential | [     ] kPa |
| Discharge Pressure at discharge flange | [     ]kPa gauge |
| Blower speed | **3,600 rpm, maximum** |

### Capable of a minimum [     ] kPa rise in pressure with a [     ] percent reduction in design flow.

### Meet reduced flow conditions indicated below without entering a surge condition under specified inlet conditions:

|  |  |
| --- | --- |
| Parameter | Requirements |
| Flow rate | [     ] sm3/h ([     ] scfm) (per blower) |
| Discharge Pressure | [     ] kPa gauge |

### Maximum Rotating Assembly Tip Speed: 125 metres per second. First critical speed shall be at least 20 percent above its operating speed.

### Maximum Noise Level (overall): 85 dBA at 1.5m from blower casing with inlet and outlet connected.

## Submittals

### Shop Drawings:

#### Make, model, weight, and power demand (kilowatts) of each equipment assembly. All equipment information to be summarized in electronic format suitable for uploading into the Region’s CMMS (Maximo). Refer to Section 01425 - Computerized Maintenance Management System Data Requirements.

#### Dimensional layout of blower bases, blowers, electric motors, silencers, area sound attenuation measures, valves, vibration isolators and anchor bolts. Manufacturer’s catalog information, descriptive literature, specifications, and the identification of materials of construction are required for blowers, motors, silencers, flexible couplings, shaft couplings, vibration isolators, electrical panels, instrumentation and control devices and other accessories. Performance data showing compliance with the Specification requirements shall include the following:

##### Sample blower curves showing pressure, capacity, kW demand, and efficiency over the entire operating range from 40 percent of design capacity to maximum capacity.

##### Submit data which correlates airflow (in kg/hr) and motor current draw (in amps). Data will be input into the Plant PAC (Programmable Automation Controller) or Programmable Logic Controller (PLC) for calibration use. Refer to Division 13 – SCADA and Instrumentation for details on PLC and Programmable Automation Controller (PAC) equipment [Consultant to amend to project specific requirements].

##### Indicate separately the pressure, capacity, kW demand, and overall efficiency at the guarantee point, and the capacity above which the units should be operated to preclude surging.

##### Show performance data at standard conditions, and also at actual summer and winter design conditions corrected to Site elevation.

##### Certified unwitnessed performance tests in accordance with ASME PTC -10-1997 (Test Code on Compressors and Exhausters) Standards (for one unit only).

#### Detailed structural, mechanical, and electrical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.

#### External utility requirements such as air, water, power, etc., for each component.

#### Detailed electrical drawing of all electrical sub-metering related to the blowers and telemetry to PAC, SCADA and independent communication network for EnerVista system access to metered data.

#### Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, or alarmed.

#### Control panel scaled external/internal layout drawings showing construction and placement of operator interface devices, electrical and other elements.

#### Power and control wiring diagrams, including terminals and numbers.

#### Bill of materials for equipment, components, control panel and instruments.

#### Equipment operation and control narrative, which shall fully align with Division 13 - SCADA and Instrumentation and the Process Narratives/Process Control Narratives which are included as part of the Contract Documents in the SCADA Appendices. A detailed description of the following is required:

##### Blower in Manual and Auto mode.

##### Control Panel, including safety interlocks, adjustable set points, control panel interaction with MCC and plant PLC.

#### Comply with P&ID drawings for Tag numbers related to blower Local Control Panel (LCP), LCP Hand Switches, LCP Pushbuttons, LCP wiring and devices, including vibration transducers (if applicable).

#### Comply with standardized I/O and functionality for the equipment specified in Division 13 - SCADA and Instrumentation.

#### If required, vendor supplied PAC shall conform to Section 13390 – Package Control Systems.

### Information Submittals:

#### Manufacturer’s Certificate of Compliance: For commercial Products, including specific reference to meeting maximum noise level requirements, and painting/coating system(s).

#### Test results of all equipment provided for proper operation, construction, electrical connection and function.

#### Special shipping, storage, protection, and handling instructions.

#### Manufacturer’s Certificate of Proper Installation.

#### Operation and Maintenance Manual.

#### Spare parts list.

#### Service records for maintenance performed during construction.

#### Special guarantee/warranty.

## Extra Materials

### Furnish, tag, and box the following spare parts and special tools for shipment and long term storage:

|  |  |
| --- | --- |
| Item | Quantity |
| Spare coupling | 1 each |
| Bearings | **1** set |
| Air temperature sensor | **1** each |
| Seals and gaskets | **1** set |
| Any special tools required for routine maintenance | **1** set |
| Indicator light bulbs of each size | 1dozen |
| Touchup paint to match finish coat | **4.5** litres |
| **Bearing vibration sensor** | **1 each** |

### Include a list of suggested spare parts required to maintain the equipment in service for a period of five years. Also include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information. The lists shall be in a format that is electronically uploadable to the Region’s CMMS (Maximo). Refer to Section 01425 - Computerized Maintenance Management System Data Requirements.

### Delivery: In accordance with Division 1 – General Requirements.

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

.1 The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

.1 All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

## If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.]

# PRODUCTS

## Acceptable Manufacturers:

### Gardner Denver, Inc. (Lamson).

### Aerzen Canada Inc.

### Hoffman Process, Inc.

### Blower Engineering, Inc.

### Approved Equivalent.

## Service Conditions

### Blowers shall be installed in Head Works with the following conditions:

#### Inlet Air Temperature: minus [     ] to plus [     ] degrees Celsius.

#### Relative Humidity: [     ] to [     ] percent.

#### Secondary Gallery Building Temperature: [     ] to [     ] degrees Celsius.

#### Blower Inlet Pressure: [     ] kPa absolute or less.

## Supplements

### Refer to the supplements to this Section for additional Product information.

## Equipment Description

### Multistage centrifugal type with outboard mounted bearing construction, with impellers keyed to a shaft supported by roller/ ball type bearings. Provide blowers with diaphragm cast integrally with the casing.

### Casing: Rated in accordance with its standard published data sheets for at least a 170 kPa maximum casing pressure.

### Inlet and Outlet Connections: Minimum size [     ] mm inlet [     ] mm discharge compliant with ASME B16.5-2003, 150 pound drilled and tapped flange pattern, and an integral part of the heads. Furnish 6 mm NPT (Nominal Pipe Thread) pressure indicator taps (plugged) on inlet and outlet connections.

### Bearing Thermal Protection: One temperature element for each blower and motor bearing.

### Bearing Vibration Protection: One vibration transducer for each blower bearing. Device I/O shall be conveyed to PAC and SCADA with appropriate programming and graphics development completed for such devices. Refer to Division 13 – SCADA and Instrumentation for additional requirements.

### Bearings: Two each per blower, anti-friction type, that may be lubricated, inspected, or replaced without disassembling blower rotating element. Select bearings on the basis of an L10 Basic Rating Life as defined by the ABMA at rated services conditions of at least 100,000 hours. Provide bearing housing for mounting surfaces of vibration transducers and temperature elements.

### Air Seals: Air seals shall be located where blower shaft passes through both the inlet and outlet heads in order to prevent leakage and assure non-contamination of bearing lubricant. Seals shall be replaceable without having to disconnect inlet or discharge piping. Provide integral type of labyrinth type seals between the stages of the blower to prevent air leakage.

### Mount each blower unit on a common fabricated steel baseplate, flat and parallel to within plus or minus 2.5 mm. Furnish the manufacturer’s standard resilient foundation mounting pads.

### For alignment, provide horizontal and axial jacking bolts at all blower and motor feet.

### Furnish constant level oilers for lubrication when the machine is in operation.

### Materials of Construction

#### Casing: ASTM A48/A48M-03 (2016) Class 30 cast iron. Class 20 cast iron is not acceptable.

#### Impellers: Cast aluminum No. 443 alloy. Statically and dynamically balance each impeller and dynamically balance each complete rotating assembly. Design the rotating assembly to operate at least 20 percent removed from the first critical speed.

#### Shaft: AISI 1045 Carbon steel.

#### Couplings shall meet the requirements of the OHSA and applicable regulations.:

##### [178 mm] spacer flexible coupling

##### Maximum operating speed: [17000 rpm]

##### Maximum Continuous Torque Rating Up to: [1630 inch/lb]

##### Distance Between Shaft Ends (Range): [87.376 to 127.0 mm]

##### Bore Capacity: [12.700 to 47.625 mm]

## Flexible Connections

### Single arch, reinforced, flanged, rubber expansion joint with minimum 200 mm laying length for each blower inlet and outlet connection.

### Design to mate with ASME B16.5-2013, 150 pound flanges. Minimum working pressure range of100 kPa gauge to 380 mm Hg (mercury) vacuum and minimum working temperature rating of at least [     ] degrees Celsius.

### Galvanized split retaining rings at each connection.

### Control unit at discharge flexible connection, suitable for mating to the blower outlet connection, to restrict axial pipe movement.

## Inlet and Discharge Air Silencers

### Provide each blower with high attenuation suction silencing.

### Room sound attenuation measures.

### Silencers:

#### Cylindrical annular flow design.

#### Minimum length to diameter ratio of 3.15.

#### [     ] mm ASME B16.5-2003, 150 pound inlet and outlet flanges.

#### Silencer Internals: 2.0 mm (14 gauge) minimum hot rolled perforated sheet steel and 64 kg/m3 (4 pounds per cubic foot) density mineral fiber acoustical packing.

#### Steel Shell: 2.0 mm (14 gauge) minimum hot rolled steel.

#### Stiffen to minimize vibration and packing settling.

### Performance Data:

#### Maximum allowable pressure loss [     ] mm at [     ] s m3h.

#### Each silencer shall attain the following minimum attenuation characteristics:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octave Band | | | | | | | |
| Mid Frequency (hertz) | 63 | 125 | 250 | 500 | 1K | 2K | 4K |
| Attenuation (dB) | 5 | 10 | 15 | 28 | 37 | 33 | 25 |

## Check Valves

### Provide air check valves on the discharge of each blower suitable for the temperature and pressure conditions encountered.

### Valves to be specifically designed for air and have a maximum resistance of [     ] kPa at [     ] s m3/h.

### Valves to be mounted between ASME B16.5-2003, 150 pound inlet and outlet flanges.

### Clapper disc shall be non-pulsating type with stainless steel trim and silicon seals hinge pin shall be stainless steel.

## Accessories

### Lifting Lugs: Provide suitably attached for all equipment assemblies and components weighing over 50kg.

### Anchor Bolts: Shall be sized by the equipment manufacturer, not less than 13-mm diameter, and as specified in Section 05503 - Metal Fabrications Mechanical. Coating shall be in accordance with Section 09900 – Painting and Protective Coating.

### Piping test ports: Weld to pipe locations as indicated on the Contract Drawings. Port(s) shall be plugged or capped and sized to allow use of an insertion flow meter (such as a Kurz Thermal Mass flow meter).

### Safety Guards: Provide safety guards by the equipment manufacture as specified in Section 01600 - Material and Equipment.

### Equipment Identification Plates: Provide 16 gauge Type 316 stainless steel identification plate to be securely mounted on each separate equipment component and control panel(s) in a readily visible location. Plate shall bear 6 mm high engraved block type black enamel filled equipment identification number and letters.

## Shop Fabrication

### Factory prepare, prime, and finish coat exposed metal surfaces of equipment in accordance with Section 09900 – Painting and Protective Coating.

## Source Quality Control

### Factory Inspections: Inspect control panels for required construction, electrical connection, sub-metering components (if not a Multilin 469) and intended function.

### Factory Tests and Adjustments: Test one blower with its motor and control panel equipment configured the manner in which it will be furnished on Site.

#### Functional Test: Perform test on equipment. Include vibration test, as follows:

##### Dynamically balance rotating parts of each blower and its driving unit before final assembly.

###### Limits: (i) Driving Unit Alone: In compliance with NEMA MG 1-2016 limits. (ii) Complete Rotating Assembly Including Blower, Coupling, and Motor: Less than 125 mils double (total) amplitude when measured on the bearing housing in the vertical plane at design speed.

##### Motor Test: See Section 16222 – Motors: 1 to 200 kW, 575V.

#### Performance Tests: Define performance curves for one of each type of blower supplied by testing a minimum of four points in accordance with ASME Power Test Codes, PTC 10-1997. Provide a performance test report to the Consultant confirming that performance is in accordance with the design requirements and approved by the Consultant.

### Noise Data:

#### The Sound Pressure Level: Not to exceed unloaded sound power level of 85 dBA, reference 20 micronewtons per square metre, at a distance of 1 metre free field.

#### Noise data need not be supplied if equipment manufacturer guarantees, in writing, that sound pressure level at 1.6 metres from any equipment or motor surface, with the equipment operating as specified, shall not exceed 85 dBA when measured with a sound level meter meeting the Type II requirements of ASA S1.40-2006 (R2016).

#### If the sound pressure level of 85 dBA cannot be guaranteed, provide:

##### Sound power levels in decibels (re. watts x 10 to the -12th power) in octave band centre frequencies for the blower and motor combination when operating as designed.

##### Frequency and sound power (or pressure) level of any audible discrete tones.

##### If the character of the source is such that the generated noise is directional, the directivity index and associated direction shall be provided.

##### Information on any design restrictions such as, but not limited to, ventilation requirements for totally enclosed equipment and relocating local controls remotely.

#### Obtain acceptance of test reports from the Consultant prior to shipment of equipment for use on Contract.

## Electrical Components

### General:

#### Comply with the requirements of Section 13390 – Package Control Systems and P&ID Drawings for submittals, instrumentation, controls, electrical components and electrical requirements for control panel construction.

#### Provide all necessary electrical components and wiring for a complete, functional system including all components necessary for air flow meter(s), electrical sub-metering and telemetry to PAC and SCADA.

#### Unless noted otherwise in the Contract Documents, motor starters for constant-speed motors shall be provided in a separate motor control centre specified in Section 16225 – Motor Control Centre. Provide all necessary control functions to properly interface with this motor starter.

## Motors

### Provide squirrel-AC induction motors that meet the requirements of Section 16222 – Motors: 1 to 200 kW, 575V, and as specified herein.

### Blower Motors: In addition, the blower motors shall meet the following specific requirements:

#### Premium efficiency motor designated.

#### Minimum [     ] kw ([     ] HP) direct connected open drip proof motor.

#### Service Factor: 1.15.

#### Insulation: Class F with Class B temperature rise.

#### Nominal Speed: 3,600 rpm (constant or maximum).

#### Application: Constant.

#### Voltage/Phase/Frequency: 600/3 phase/60 Hz.

#### Motor Winding Thermal Protection: Six RTD (two per phase).

#### Bearing Thermal Protection: One temperature element per bearing.

#### Enclosure Type: Open, Drip Proof (ODP) in accordance with Section 16222 – Motors: 1 to 200 kW, 575V.

#### Drive: Direct-drive with flexible couplings and guard.

#### Power Factor: 0.90 (minimum).

#### Efficiency: 0.95 (minimum).

#### Motors to be provided with sub-metering including telemetry to PAC and SCADA. SCADA programming and graphics to be completed incorporating energy related key performance indicators as defined in the Process Narrative/Process Control Narrative included as part of the Contract Documents in the SCADA Appendices.

#### All equipment data to be provided as defined by Section 01430 - Operation and Maintenance Data and in a format capable for upload to the Region’s CMMS (Maximo). Refer to Section 01425 - Computerized Maintenance Management System Data Requirements.

### Terminal Junction Box (TJB): Securely mounted to the blower motor for connecting 600V -3 phase power supply to the blower assembly.

## Controls

### Provide all items, including items not specifically indicated in the Contract Documents, that are required to implement the specified functions and the functions required for proper system operation. Provide panels and controls in accordance with the General Control Requirements and Component Qualities specified in Section 13390 - Package Control Systems.

### Local Control Panels:

#### Tag numbers as defined by the Region’s tagging standard. Refer to Design Guidelines Section 21 - Development and Maintenance of Asset Inventory and Tagging.

#### Painted steel, NEMA 4x, surface mounted.

### Operator Controls and Indicator: As a minimum, provide the following functions on the face of each control panel:

#### Hand switches:

##### Standardized colours for pushbuttons and lights.

##### LOCAL/REMOTE control mode selector switch.

##### START pushbutton and STOP Pushbutton (used at LOCAL mode).

##### ALARM RESET pushbutton.

##### LAMP TEST pushbutton.

#### Status Indicating Lights:

##### Blower RUNNING.

#### Alarm indicating lights:

##### MULTILIN warning light: one light for motor trouble shown in MULTILIN.

##### MULTILIN Equipment SHUTDOWN alarm light.

##### VIBRATION WARNING: one light for blower inlet bearing and one light for blower outlet bearing.

##### VIBRATION SHUTDOWN alarm lights: one light for blower inlet bearing and one light for blower outlet bearing.

##### Any other abnormal shutdown condition as determined by the manufacturer.

#### Panel Mounted Indicators:

##### Dual scale (kW demand and kg/hr of air flow) motor current and air flow indication.

##### Megawatt – hour display: Provide a Modbus master device to collect cumulative real energy consumption (MWh) from blower MULTILIN 469 in MCC, via RS – 485 and send this data to update MWh display on HMI on face of LCP, once per minute. Provide a compact HMI to continuously display energy consumption in MWh as calculated by the MULTILIN 469. Include a terminating network resistor (120 ohm) and capacitor (1nF) at end of RS – 425 at HMI.

##### Components must have Modbus IP connectivity wired back to the network access closet in accordance with the Division 13 Specification Sections. Panel mounted indicator units are device specific based on size.

### Other panel devices:

#### Supply within the panel motor current shut down relay.

### External Interfaces:

#### Transmit the following maintained discrete contact closure outputs from blower Local Control Panel (LCP) to plant PAC. Contacts shall be rated 2A at 120V ac:

##### Blower in REMOTE control mode: Closed when LOCAL/REMOTE selector switch is in REMOTE position to PLC.

##### Blower FAIL general alarm: contact open at any blower condition which stops the blower motor: blower surge shut down and blower vibration. FAIL signal will include any other abnormal shutdown condition as determined by the manufacturer for the protection of the equipment.

##### Blower Warning - contact closed while warning condition is present and automatically resets when condition clears for the following conditions:

##### a) inlet vibration warning

##### b) outlet vibration warning.

#### Transmit the following discrete contact closure outputs from LCP to MCC. Contacts shall be rated 2A at 120V ac:

##### Blower RUN command.

#### LCP receives the following discrete maintained contact closure inputs from PAC. Contact rated for 2A at 120V ac. Provide an interposing relay if current greater than 2A:

##### Blower RUN command.

#### LCP receives the following discrete contact closure inputs from MCC. Contacts shall be rated 10A at 120V ac:

##### ON status.

##### MULTILIN WARNING.

##### MULTILIN SHUTDOWN

#### LCP receives the following analog input signals from MCC:

##### MOTOR PHASE CURRENT, from MULTILIN 469.

#### LCP receives the following RS – 485 Modbus half – duplex RTU protocol

##### Motor kW demand, power factor, kVA, MWh from MULTILIN 469.

##### Modbus IP connectivity between Multilin 469 units and other sub-metering devices by daisy-chaining all Multilin devices and the independent use of EnerVista to allow staff to directly interrogate each device and utilize the full features of the Multilins for a wide variety of information (real-time and archived). Component telemetry to PAC and SCADA shall have Modbus IP connectivity wired back to the network access closet as required by the Division 13 Specifications. *[Consultant to amend if connectivity method is changed to Ethernet or other protocol]*

#### The Contractor shall provide written confirmation to the Consultant of the following system requirements:

##### Contact rating.

##### Contact functionality (maintained or momentary).

##### Standardized I/O compliance (as per Division 13 - SCADA and Instrumentation).

### Functional Requirements:

#### Shut down the blower upon any of the following conditions:

##### High vibration at either blower bearing after a suitable startup time delay.

##### High blower bearing, motor bearing or motor winding high temperature as detected by Multilin as MULTILIN SHUTDOWN.

##### High Motor Current (load) after an appropriate (adjustable) startup time delay.

##### Low Motor Current (low air flow or surge).

#### Provide logic to maintain indication of any condition which causes blower shutdown and inhibit restarting of the blower until the RESET button is pressed.

#### Convert the incoming current transformer signal to a 4 to 20 mA dc signal. Retransmit the 4 to 20 mA DC signal to Plant PLC.

#### LOCAL/REMOTE Control Modes:

##### In the LOCAL Mode, the blower shall be started and stopped manually from the blower control panel.

##### In the REMOTE Mode, the blower shall be started and stopped by the external RUN command.

##### All blower safety shut down and monitoring shall be provided by blower LCP in both LOCAL and REMOTE modes.

#### Provide warning and/or shutdown alarm lights on LCP or additional protective devices as deemed necessary by the blower manufacturer.

#### Pre-shutdown conditions shall be indicated via warning lights which illuminate while the condition is present and automatically go off when the condition clears.

#### Shutdown conditions shall be indicated via alarm lights and require a manual re-set. Specific shutdown conditions which are initiated by the MCC are to be re-set at the MCC. They are also to be indicated at the LCP but are not required to be additionally re-set at the LCP.

#### The blowers shall be tripped if a surge event occurs after an adjustable start-up time delay.

### Provide a system with the following field adjustable set points for vibration and temperature:

#### Warning set points.

#### Shut down set points.

### Power Requirements: Power supply to the panels will be 120 V, AC supplied from the blower MCC. Provide a main power disconnect at the panel.

### Instrumentation:

#### All instrumentation shall be provided as noted in the Contract Documents and as required to implement the specified functions.

#### I/O for all instruments shall be listed with functionality clearly stated and as per P&IDs. All flow, temperature, power, and vibration etc. I/O shall be telemetered to the PAC and be in accordance with the operational requirements set out in Division 13 SCADA and Instrumentation and the Process Narrative/Process Control Narratives which are included as part of the Contract Documents in the SCADA appendices. Vibration Monitor Package: Provide vibration transducers properly mounted on both the blower inlet and outlet bearings.

##### Vibration monitor shall be PMC/Beta 440D Series, two-channel option or an approved equivalent. In addition, provide two DPDT HIGH vibration switch set points per sensor. Set points shall be field adjustable. Time delays shall be field adjustable as well.

##### Vibration monitoring system I/O shall be telemetered to PAC and SCADA in accordance with the P&IDs and Division 13 requirements.

### Special Requirements:

#### Surge protection.

#### Terminal Junction Boxes (TJB): Two, securely mounted to the blower assembly. Pre-wire blower mounted controls to the TJBs. One TJB shall be designated for analogue control circuits and one for 120 VAC control and power circuits

# EXECUTION

## Installation

### The blower equipment shall be installed by the Contractor in accordance with the manufacturer’s templates and written instructions, under the manufacturer’s supervision and with the manufacturer’s assistance.

## Field Quality Control

### Functional Tests: Conduct on each blower unit.

#### Vibration Test:

##### Conduct vibration tests on the complete assembly of each blower unit, consisting of blower and drive unit, connected to the system and in normal operation on Site.

##### Assembly of blower and drive unit connected to system shall not exceed the vibration limits specified in the Contract Documents.

### Performance Test: Conduct on each blower unit.

#### Perform under actual or approved simulated operating conditions.

#### Test for a continuous three hour period without malfunction.

#### Perform the testing in the presence of the Consultant.

#### Test Log: Upon completion of the testing, record the following:

##### Flow measured by plant instrumentation and storage volumes.

##### Blower inlet and discharge pressure.

##### Driving motor voltage and amperage measured for each phase.

##### Testing equipment provided by supplier or Contractor to be confirmed by calibration verification documentation.

#### Adjust, realign, or modify units and retest in accordance with the ASME Power Test Code if necessary.

### Commissioning to be performed in accordance with Section 01810 – Equipment Testing and Facility Commissioning.

## Manufacturers' Services

### The Contractor shall ensure that a manufacturer's representative for the equipment specified in this Section will be present at the Site for the following minimum number of Person-days listed below, travel time excluded:

#### 2 Person-days for installation assistance, inspection, and certification of the installation. The Contractor shall provide the Manufacturer's Certificate of Proper Installation.

#### 1 Person-day for functional and performance testing.

#### 1 Person-day for startup classroom or job Site training of Region's personnel.

#### The Contractor shall ensure that the training will be performed by a technically competent person who may be videotaped by Region staff during the session. Taped sessions will be used for refresher training or for the training of staff absent from the original training session.

#### Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed and approved by the Region or Consultant.

#### Section 01820 – Demonstration and Training.

### Training of the Region's personnel shall be at such times and at such locations as required and approved by the Region.

### Additional required manufacturer’s services are detailed in Section 01640 - Manufacturers' Services, Section 01810 - Equipment Testing and Facility Commissioning, and Section 11010 - General Requirements for additional requirements.

## Supplements

### The supplement listed below, attached following “End of Section”, forms part of this Section:

#### Induction Motor Data Sheet.

**END OF SECTION**

|  |  |
| --- | --- |
| INDUCTION MOTOR DATA SHEET | |
| Project: | |
| Region: | |
| Equipment Name: | |
| Equipment Tag Number(s): | |
| Type: | |
| Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer | |
| Hazardous Location: Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark | |
| Motor Horsepower: | Guaranteed Minimum Efficiency at Full Load: percent |
| Voltage: | Guaranteed Minimum Power Factor at Full Load: percent |
| Phase: | Service Factor (@ rated max. amb. temp.): 1.0  1.15 |
| Frequency: | Enclosure Type: |
| Synchronous Speed: rpm | Mounting Type:  Horizontal Vertical |
| Multispeed, Two-Speed: | Vertical Shaft: Solid Hollow |
| / rpm | Vertical Thrust Capacity (lb): Up Down |
| Constant Horsepower | Adjustable Speed Drive: |
| Variable Torque |  |
| Constant Torque | Operating Speed Range: to % of Rated Speed |
| Winding: One Two | Thermal Protection: |
|  | Space Heater: volts, single phase |
|  | Oversize main terminal (conduit) box for motors |
|  | Terminal for connection of equipment grounding wire in each terminal box |
| Additional Motor Requirements: | |
| Special Features: | |
|  | |
| All data to be listed as per the above Table in addition to the equipment information as defined by Section 01430 - Operation and Maintenance Data and shall be in a format capable for upload to the Region’s CMMS (Maximo). | |
|  | |