Greater New Haven Water Pollution Control Authority

New Haven, Connecticut

BIDDING REQUIREMENTS
AND
CONTRACT DOCUMENTS

for the construction of the

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility

Project No. CWF 2019-04

Volume 3

PROVIDED FOR INFORMATION ONLY

Request for Proposal for Process Air Compressor Equipment, dated December 2021

APG-Neuros Proposal; High Efficiency Air Bearing Turbo Blower, dated February 2, 2022

JACOBS

Wethersfield, CT

July 2023

Project No. E2X90000 Copy No._____

Greater New Haven Water Pollution Control Authority

New Haven, Connecticut

BIDDING REQUIREMENTS
AND
CONTRACT DOCUMENTS

for purchase of

Process Air Compressor Equipment

Process Air Compressor System for Low Level Nitrogen Removal
East Shore Water Pollution Abatement Facility

Project No. CWF 2019-04

JACOBS

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December 2021

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Copy No._____

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PROCUREMENT REQUIREMENTS

GREATER NEW HAVEN
WATER POLLUTION CONTROL AUTHORITY

NOTICE OF REQUEST FOR PROPOSAL (RFP)
PROCESS AIR COMPRESSOR EQUIPMENT

PROJECT NO. CWF 2019-04
PROCESS AIR COMPRESSOR SYSTEM
FOR LOW LEVEL NITROGEN REMOVAL
EAST SHORE WATER POLLUTION ABATEMENT FACILITY

The Greater New Haven Water Pollution Control Authority intends to pre-select a single supplier to furnish process air compressor equipment and ancillary equipment, including all materials, equipment, or work required including commissioning, training, and performance testing to be incorporated into the Process Air Compressor System for Low Level Nitrogen Removal project at the East Shore Water Pollution Abatement Facility.

Proposals shall be received at the Office of Director of Finance and Administration of the Greater New Haven Water Pollution Control Authority located at 260 East Street, New Haven, Connecticut 06511, until 10:00 a.m., prevailing local time January 20, 2022. Proposals received after that time will not be accepted.

The bidders may be required to attend a virtual interview regarding the technical proposal.

The selected Proposer will be named as the preselected supplier of Process Air Compressor Equipment in the project specifications for the general construction of the Process Air Compressor System for Low Level Nitrogen Removal project. The Contractor shall be responsible for the purchase of the Process Air Compressor Equipment package from the Process Air Compressor Equipment Manufacturer as described herein and in the Proposal. In return, the Proposer must agree to enter into an agreement with the General Contractor who is selected by the Greater New Haven Water Pollution Control Authority to construct the Process Air Compressor System for Low Level Nitrogen Removal, and to provide the equipment and services as established in the Proposal.

The information for Bidders, Proposal, Form of Contract, Plans and Specifications may be examined at the web address https://gnhwpca.com/doing-business-with-gnhwpca/vendor-portal/. All Bidders must obtain the full "RFP" by contacting engineering@gnhwpca.com and referencing the project number CWF 2019-04.

All questions concerning this RFP must be submitted to the Authority via email in writing before 4:00 p.m. on January 7, 2022 (Email: engineering@gnhwpca.com and Karina.massey@jacobs.com). To be given consideration, questions must be received prior to the due date for questions indicated above. This office is the only point where information shall be disseminated. The Authority reserves the right to reject any and all proposals, and to waive informalities and irregularities in the preselection procedure.

All bidders are to note that this project is subject to the following requirements:

1. Any contract awarded under this RFP is expected to be funded in part by the State of Connecticut, Department of Energy and Environmental Protection. Neither the State of Connecticut nor any of

its departments, agencies, or employees is or will be party to this RFP or any resulting contract. This procurement will be subject to the requirements contained in Title 22a, Section 22a-482-4, subsections (h), (j), and (o).

2. Bidders are subject to affirmative action to ensure equal opportunity for employment, as noted in Governor's Executive Orders Three and Seventeen.

3. American Iron and Steel (AIS) requirements of Section 436 of Public Law (P.L.) 113-76, Consolidated Appropriations Acts, 2014.

4. State of Connecticut Wage Rates and Federal Minimum Wage Rates, as determined by the United States Department of Labor under the Davis-Bacon Act.

5. United States Environmental Protection Agency's Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment implementing Section 889 of Public Law 115-232, effective August 13, 2020.

A certified check or bid bond in the amount of ten percent (10%) of the total bid amount must accompany the bid. Said checks or bid bonds will be returned to the unsuccessful bidders upon execution of a contract between the selected firm and the selected Contractor. If any bid is not accompanied by a bid bond or certified check at the specified time for receipt of proposals, the incomplete proposal will not be read and this action will constitute automatic rejection of the bid.

The successful bidder will be required to furnish a performance bond and a labor and materials payment bond to the Greater New Haven Water Pollution Control Authority and the selected Contractor for the amount of the total bid. A certified check cannot be substituted for either bond.

The Greater New Haven Water Pollution Control Authority reserves the right to alter quantities and accept or reject any or all bids or portions of any bids, for any or no reason, including unavailability of appropriated funds as it may deem to be in its best interests.

All bidders are to note that the award of this proposal is subject to the following conditions and contingencies:

1. The approval of such government agencies as may be required by law.

2. The appropriation of adequate funds by the proper agencies.

3. The Proposal Form as provided in these documents, submitted with all applicable certifications and documentation in accordance with the bid documents.

Greater New Haven Water Pollution Control Authority

BY: Gabriel Varca
Director of Finance and Administration

DATED: December 16, 2021

END OF SECTION

REQUEST FOR PROPOSAL

1. DEFINITIONS

1.1. Bidder: Synonymous with Proposer, shall refer to any manufacturer's authorized representative submitting a proposal in response to this Request for Proposal.

1.2. Owner: Greater New Haven Water Pollution Control Authority.

1.3. Engineer: Jacobs

1.4. Contractor: General Contractor to be selected by Owner to perform the work to provide the ESWPAF Process Air Compressor System for Low Level Nitrogen Removal.

1.5. Equipment Manufacturer: The selected Proposer to this request for proposal that will be furnishing the Process Air Compressor Equipment for the ESWPAF Process Air Compressor System for Low Level Nitrogen Removal project.

1.6. Project: The ESWPAF Process Air Compressor System for Low Level Nitrogen Removal Project performed by the Contractor.

2. PROPOSAL

2.1. Proposals for the process air compressor equipment, mailed or delivered in person, shall be one package shall be sealed and be marked “Project CWF 2019-04 Process Air Compressor PROPOSAL DOCUMENTS ENCLOSED.”

2.2. Prepare and submit five (5) hard copies and one (1) electronic (PDF) copy on USB drives.

2.3. The Proposal consists of the following:

2.3.1. Proposal Form: Completed Section 00 41 65-01, Request for Proposal, Proposal Form.

2.3.2. Proposal Submittal Information: Information as shown in Section 44 42 19.05, High Speed Turbo Air Compressors, Part 1, Article 1.05 Submittals, paragraph B Action Submittals.

2.3.3. Proposal Security:

2.3.3.1. Each Proposal shall be accompanied by Proposal Security made payable without condition to Director of Finance and Administration, Greater New Haven Water Pollution Control Authority, in the amount of 10 percent of the Equipment

Manufacturer's Total Bid. Security may be in the form of either a bond or a certified check.

2.3.3.2. Each Bidder's proposal Security will be retained until the selected Equipment Manufacturer has a signed agreement with the Contractor for installation of the Equipment Manufacturer's equipment at the East Shore Water Pollution Abatement Facility.

2.4. The proposal is exempt from Connecticut State sales and use taxes on permanently installed materials and equipment supplied under this proposal.

2.5. All pricing in the proposal shall be free on board the project site, located at 345 East Shore Parkway, New Haven, CT 06405

3. PROPOSAL EVALUATION

3.1. The Engineer will evaluate Proposals as submitted by Equipment Manufacturers according to monetary and non-monetary criteria and review with the Owner. The evaluation process may include an interview held via electronic means. The local representative and the service technician that will support the Owner during service calls must attend the interview.

3.2. Receipt of the submittal by the Owner does not constitute either a direct or implied guarantee to the pre-selected Equipment Manufacturer that prequalification or purchase will be granted. Proposals may be rejected at anytime at the Owners discretion.

3.3. Engineer and Owner may request additional information from the Equipment Manufacturer after submission of the Proposal if any item is unclear or incomplete; or Owner may determine insufficient information was originally submitted and refuse to further consider the manufacturer and/or equipment. The Equipment Manufacturer shall have 7 calendar days from receipt of a written request to submit any requestion additional information to the Owner and Engineer.

4. PROJECT

4.1. The selected Equipment Manufacturer will be named as the preselected supplier of the process air compressors and ancillary equipment in the project specifications for the general construction of the Project. The Contractor will be responsible for the purchase of the Manufacturers Equipment from the Equipment Manufacturer as described herein and in Proposal. In return, Equipment Manufacturer must agree to enter into an agreement with the Contractor who is selected by the Owner to construct the Project, to provide the bonds, equipment and services as established in the Proposal. Equipment Manufacturer must also agree to:

4.1.1. Honor the equipment, materials, and services costs for an expected Project bid opening and Notice to Proceed18 months from the proposal due date.

4.1.2. In the event that the Notice to Proceed date for the General Contract occurs later than 18 months after the proposal due date, Equipment Manufacturer agrees to provide the equipment, materials, and services at a price negotiated with the Owner.

4.1.3. Provide assistance to Engineer in the preparation of the detailed construction documents related to the goods and serviced provided by Equipment Manufacturer.

4.1.4. The Owner reserves the right to delete optional items from the scope of supply and deduct the cost of these optional items from the price.

4.1.5. Agree to the following Payment and Retainage Terms:

4.1.5.1. Payments are subject to the 5 percent retainage imposed upon the General Contractor as part of the larger Project.

4.1.5.2. 10 percent of total price payment upon approval of all shop drawing submittals submitted through the Contractor.

4.1.5.3. 5 percent of total price payment upon approval of Operation and Maintenance manuals.

4.1.5.4. 70 percent of total price payment upon delivery of equipment to the Project site specified in Section 44 42 19.05, High Speed Turbo Air Compressors.

4.1.5.5. 5 percent of total price payment upon completion of installation, O&M training, startup assistance and testing, and successful demonstration testing.

4.1.5.6. 10 percent of total price payment upon completion of all services described in Section 44 42 19.05, High Speed Turbo Air Compressors, including acceptance of the installation by the Owner.

4.1.6. All retainage shall be released upon the Final Completion of the larger project. It is anticipated that the Project will have an 18-month Project duration.

END OF SECTION

REQUEST FOR PROPOSAL
PROPOSAL FORM

Bidder: _____

1. PROPOSAL RECIPIENT.

1.1. This proposal is submitted to:

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511
Reference: Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility
CWF 2019-04
Process Air Compressor Equipment Preselection

2. EQUIPMENT MANUFACTURER'S ACKNOWLEDGEMENTS.

2.1. Equipment Manufacturer accepts all of the terms and conditions of the Request for Proposal (Process Air Compressor Equipment) documents, including without limitation those dealing with consumption guarantees, performance guarantee, and liquidated damages.

2.2. Equipment Manufacturer acknowledges that upon acceptance of proposal, Equipment Manufacturer shall prepare preliminary shop drawings for Engineer to use in completing the construction bid documents. The successful proposal will be included in the bid documents to be advertised for bidding by Contractors who will subsequently provide and install this material as part of the Contract. Payment to the Equipment Manufacturer will be by the Contractor. Bid documents for the Contractor are anticipated to be in 2022 with an 18 month Project duration.

2.3. Equipment Manufacturer has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Equipment Manufacturer has discovered in Proposal Documents, and written resolution thereof by Engineer is acceptable to Equipment Manufacturer.

3. OTHER CONDITIONS.

3.1. Equipment Manufacturer agrees to honor the equipment, materials, and services costs in the Proposal for a Notice to Proceed date to the Contractor within 18 months from the proposal due date.

3.2. In the event that the Notice to Proceed date for the Project occurs later than 18 months after the proposal due date, Equipment Manufacturer agrees to provide the equipment, materials, and services at an adjusted selling price negotiated with the Owner.

3.3. The Authority reserves the right to delete alternate items from the scope of supply and deduct the cost of these optional items from the price.

3.4. If for any reason the Authority does not award the Project, the Authority is under no obligation to purchase the equipment, materials, and services in the Proposal.

3.5. The selected Equipment Manufacturer shall be required to provide Performance and Payment Bonds to the Owner and Contractor as part of their agreement with Contractor. Performance and Payment Bond, each in an amount equal to one hundred percent (100%) of the Lump Sum Cost as security for the faithful performance of this Proposal and as security for the payment of all persons performing Labor and furnishing Materials under this Contract. The surety shall be such surety company or companies that are acceptable to the Owner and Contractor and that are authorized to transact business in the State of Connecticut.

4. CONSUMPTION GUARANTEES.

4.1. The Proposer guarantees that the Process Air Compressor equipment offered in the Proposal will continuously meet the following Guarantees:

> 4.1.1. See Guaranteed Performance under Section 44 42 19.05, High Speed Turbo Air Compressors.

5. PROPOSAL SUBMISSION.

5.1. Completely fill and submit the attached, Proposal Form.

PROPOSAL FORM

Bidder: _____

Project CWF 2019-4: Purchase of Process Air Compressor for Low Level Nitrogen Removal Equipment

Item	Description	Lump Sum Cost USD
1	Process Air Compressor System, as specified in section 44 42 19.05 High Speed Turbo Air Compressors.	

Lump Sum Cost (words)

USD_____

Manufacturer's Extended Warranty:

Cost of extension of specified 1 year warranty to 5 years.
USD_____

Annual Service Contract amount for Years 2 Through 5 of annual recommended maintenance.

USD_____

Equipment Manufacture's Options/Alternates:

The following Options or Alternate Prices are offered in addition to the Base Proposal:

Alternate / Option	Description	Unit Cost USD Add (Deduct)
1		
2		
3		

Addenda Receipt:

Receipt of the following RFP Addenda is hereby acknowledged:

Addendum No. _____ Date: _____
Addendum No. _____ Date: _____
Addendum No. _____ Date: _____

Agreement to Accept the Terms and Provisions of the RFP Documents:

We have reviewed the provisions of the RFP, the RFP Documents attached to the RFP, and the Addenda received and ***agree to accept the provisions without exception*** on any Order resulting from this RFP.

☐ **YES** ☐ **NO**

If NO, our exceptions are listed below a detailed on a separate document attached hereto. We understand that exceptions may be grounds for rejection of the Proposal:

Technical Exceptions:

_____

_____

_____

Authorization:

The undersigned, having carefully examined the RFP Documents hereby offers and agrees to furnish all goods and services for the proposal sums proposed above and in accordance with the provisions set forth in the RFP Documents and the Proposal Form.

This Proposal submitted by:

Company Name: _____
Email Address: _____
Address: _____
_____
_____

Authorized Agent: _____
(name)

Authorized Agent: _____
(Signature)

Title: _____
For example: President, Vice-President

Submitted with this Proposal Form per Specification 00 41 65, Section 2:

1. Proposal Submittal Information
2. Proposal Security

Corporate seal

End of Section

Required Construction Contract Provisions Under the Connecticut Department of Environmental Protection's Clean Water Fund

REQUIRED CONSTRUCTION CONTRACT PROVISIONS UNDER THE CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION'S CLEAN WATER FUND

22a-482-4 (g) Required Provisions for Construction Contracts.

Municipalities must include, when appropriate, subdivisions (1) to (14), inclusive, of this subsection, or their equivalent, in each subagreement and may substitute other terms for "grantee" and "contractor" in their subagreements.

(1) Supersession

The municipality and the contractor agree that the following general provisions, or their equivalent, apply to eligible work to be performed under this contract and that these provisions supersede any conflicting provisions of this contract.

(2) Privity of Contract

This contract is expected to be funded in part by the State of Connecticut. Neither the state, nor any of its departments, agencies, or employees is or will be a party to this contract or any lower tier subcontract. This contract is subject to sections 22a-482-1 to 22a-482-4, inclusive, of the Regulations of Connecticut State Agencies.

(3) Changes for Contracts for Construction.

(A) The municipality may, at any time, without notice to any surety, by written order designated or indicated to be a change order, make any change in the work within the general scope of the subagreement, including but not limited to changes:

(i) in the specifications (including drawings and designs);

(ii) in the time, method, or manner of performance of the work;

(iii) in the municipality-furnished facilities, equipment, materials, services, or site; or

(iv) directing acceleration in the performance of the work.

(B) A change order shall also be any other written or oral order (including direction, instruction, interpretation or determination) from the municipality which causes any change, provided the contractor gives the municipality written notice stating the date, circumstances, and source of the order and that the contractor regards the order as a change order.

(C) Except as provided in subdivision (3) of this subsection, no order, statement, or conduct of the municipality shall be treated as a change under subdivision (3) of this subsection or entitle the contractor to an equitable adjustment.

(D) If any change under subdivision (3) of this subsection causes an increase or decrease in the contractor's cost or the time required to perform any part of the work under this contract, whether or not changed by any order, an equitable adjustment shall be made and the subagreement modified in writing. However, for claims based on defective specifications, no claim for any change under subparagraph (B) of this subdivision shall be allowed for any costs incurred more than 20 days before the contractor gives written notice as required in subparagraph (B) of this subdivision. In the case of defective specifications for which the municipality is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the contractor in attempting to comply with those defective specifications.

(E) If the contractor intends to assert a claim for an equitable adjustment under this clause, he shall, within thirty (30) days after receipt of a written change order under subparagraph (A) of this subdivision, or the furnishing of a written notice under subparagraph (B) of this subdivision, submit to the grantee a written statement setting forth the general nature and monetary extent of such claim. The municipality may extend the

30-day period. The statement of claim may be included in the notice under subparagraph (B) of this subdivision.

(F) No claim by the contractor for an equitable adjustment shall be allowed if made after final payment under this contract.

(4) Changes for Contracts for Supplies.

(A) The municipality may at any time, by a written order and without notice to the sureties, make changes within the general scope of this subagreement in any one or more of the following:

(i) drawings, designs, or specifications, where the supplies to be furnished are to be specially manufactured for the municipality;

(ii) method of shipment or packing; and (iii) place of delivery.

(B) If any change causes an increase or decrease in the cost or the time required to perform any part of the work under this subagreement, whether or not changed by any such order, an equitable adjustment shall be made in the subagreement price or delivery schedule, or both, and the subagreement shall be modified in writing. Any claim by the contractor or adjustment under this clause shall be asserted within thirty (30) days from the date of receipt by the contractor of the notification of change. lf the municipality decides that the facts justify such action, the municipality may receive and act upon any such claim asserted at any time before final payment under this subagreement. Where the cost of property is made obsolete or excessive as a result of a change is included in the contractor's claim for adjustment, the grantee shall have the right to prescribe the manner of disposition of such property. Nothing in this subdivision shall excuse the contractor from proceeding with the subagreement as changed.

(5) Differing Site Conditions.

(A) The contractor shall promptly, and before such conditions are disturbed, notify the municipality in writing of:

(i) subsurface or latent physical conditions at the site differing materially from those indicated in this subagreement; or

(ii) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this subagreement. The municipality shall promptly investigate the conditions and, if it finds that conditions are materially different and will cause an increase or decrease in the contractor's cost or the time required to perform any part of the work under this subagreement, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the subagreement modified in writing.

(B) No claim of the contractor under this subdivision shall be allowed unless the contractor has given notice required in subparagraph (A) of this subdivision. However, the municipality may extend the prescribed time.

(C) No claim by the contractor for an equitable adjustment shall be allowed if asserted after final payment under this subagreement.

(6) Suspension of Work.

(A) The municipality may order the contractor, in writing, to suspend, delay, or interrupt all or any part of the work for such period of time as the municipality may determine to be appropriate for the convenience of the municipality.

(B) If the performance of all or any part of the work is suspended, delayed, or interrupted for an unreasonable period of time by an act of the municipality in administration of the contract, (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this contract

(excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing. However, no adjustment shall be made under this subdivision for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the contractor, or for which an equitable adjustment is provided for, or excluded, under any other provision of the contract.

(C) No claim under this subdivision shall be allowed for any costs incurred more than twenty (20) days before the contractor notified the municipality in writing of the act or failure to act involved (this requirement does not apply to a claim resulting from a suspension order), and unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of such suspension, delay, or interruption, but not later than the date of final payment under the contract.

(7) Termination.

(A) This contract may be terminated in whole or in part in writing by either party in the event of substantial failure by the other party to fulfill its obligations under this subagreement through no fault of the terminating party, provided that no termination may be effected unless the other party is given not less than ten (10) calendar days written notice (delivered by certified mail, return receipt requested) of intent to terminate and an opportunity for consultation with the terminating party prior to termination.

(B) This contract may be terminated in whole or in part in writing by the municipality for its convenience, provided that the contractor is given not less than ten (10) calendar days written notice (delivered by certified mail, return receipt requested) of intent to terminate and an opportunity for consultation with the terminating party prior to termination.

(C) If termination for default is effected by the municipality, an equitable adjustment in the price provided for in this contract shall be made but no amount shall be allowed for anticipated profit on unperformed services or other work, and any payment due to the contractor at the time of termination may be adjusted to cover any additional costs to the municipality because of the contractor's default. If termination for default is effected by the contractor, or if termination for convenience is effected by the municipality, the equitable adjustment shall include a reasonable profit for services or other work performed. The equitable adjustment for any termination shall provide for payment to the contractor for services rendered and expenses incurred prior to the termination in addition to termination settlement costs reasonably incurred by the contractor relating to commitments which had become firm prior to the termination.

(D) Upon receipt of a termination action pursuant to subparagraphs (A) or (B) of this subdivision, the contractor shall promptly discontinue all services affected (unless the notice directs otherwise), and deliver or otherwise make available to the municipality all data, drawings, specifications, reports, estimates, summaries and such other information and materials as may have been accumulated by the contractor in performing this contract whether completed or in process.

(E) Upon termination under subparagraphs (A) or (B) of this subdivision the municipality may take over the work and may award another party a contract to complete the work under this contract.

(F) If, after termination for failure of the contractor to fulfill contractual obligations, it is determined that the contractor had not failed to fulfill contractual obligations, the termination shall be deemed to have been for the convenience of the municipality. In such

event, adjustment of the price provided for in this contract shall be made as provided in subparagraph (C) of this subdivision.

(8) Remedies.

Except as may be otherwise provided in this contract, all claims, counter- claims, disputes, and other matters in question between the municipality and the contractor arising out of or relating to this contract or the breach thereof will be decided by arbitration, if the parties mutually agree, or in a court of competent jurisdiction within the district in which the municipality is located.

(9) Price Reduction for Defective Cost or Pricing Data.

NOTE– This subdivision is applicable to any contract negotiated between the municipality and its contractor in excess of $500,000; negotiated change orders in excess of $500,000 or 10 percent of the contract, whichever is less, affecting the price of a formally advertised, competitively awarded, fixed price contract; or any lower tier subcontract or purchase order in excess of $500,000 or 10 percent of the assistance agreement, whichever is less, under a contract other than a formally advertised, competitively awarded, fixed price subagreement. This subdivision is not applicable for contracts to the extent that they are awarded on the basis of effective price competition.

The contractor and subcontractor, where appropriate, warrant that cost and pricing data submitted for evaluation with respect to negotiation of prices for negotiated contracts, lower tier subcontracts and change orders is based on current, accurate, and complete data supported by their books and records. If the municipality or the Commissioner determines that any price (including profit) negotiated in connection with this contract, any lower tier subcontract, or any amendment thereunder was increased by any significant sums because the data provided was incomplete, inaccurate, or not current at the time of submission, then such price, cost, or profit shall be reduced accordingly, and the contract shall be modified in writing to reflect such reduction. Failure to agree on a reduction shall be subject to subdivision (8) of this subsection.

NOTE– Since the contract is subject to reduction under this subdivision by reason of defective cost or pricing data submitted in connection with lower tier subcontracts, the contractor may wish to include a clause in each lower tier subcontract requiring the lower tier subcontractor to appropriately indemnify the contractor. It is also expected that any lower tier subcontractor subject to such indemnification will generally require substantially similar indemnification for defective cost or pricing data required to be submitted by lower tier subcontractors.

(10) Audit; Access to Records.

(A) The contractor shall maintain books, records, documents, and other evidence directly pertinent to performance on grant work under this contract in accordance with generally accepted accounting principles and practices consistently applied. The contractor shall also maintain the financial information and data used by the contractor in the preparation or support of the cost submission required under section 22a-482-4 (i) (6) for any negotiated contract or change order and a copy of the cost summary submitted to the municipality. The municipality and the Commissioner or any of his or her authorized representatives shall have access to all such books, records, documents, and other evidence for the purpose of inspection, audit and copying during normal business hours. The contractor will provide proper facilities for such access and inspection.

(B) If this is a formally advertised, competitively awarded, fixed price contract, the contractor agrees to make subparagraphs (A) to (F), inclusive, of this subdivision applicable

to all negotiated change orders and contract amendments affecting the contract price. In the case of all other types of prime contracts, the contractor agrees to include subparagraphs (A) to (F), inclusive, of this subdivision in all his subcontracts in excess of $10,000 and to subparagraphs (A) through (F), inclusive, of this subdivision applicable to all change orders directly related to project performance.

(C) Audits conducted under this subdivision shall be in accordance with generally accepted auditing standards and established procedures and guidelines of the reviewing or audit departments and shall meet the requirements of section 7-396a of the General Statutes.

(D) The contractor agrees to disclose all information and reports resulting from access to records under subparagraphs (A) and (B) of this subdivision to any of the parties referred to in subparagraph (A) of this subdivision.

(E) Records under subparagraphs (A) and (B) of this subdivision shall be maintained and made available during performance on assisted work under this contract and until three years from the date of final state payment for the project. In addition, those records which relate to any dispute appeal arising under a grant assistance agreement, to litigation, to the settlement of claims arising out of such performance, or to costs or items to which an audit exception has been taken, shall be maintained and made available until three years after the date of resolution of such appeal, litigation, claim, or exception.

(F) This right of access provision (with respect to financial records) applies to:

(i) negotiated prime subagreements:

(ii) negotiated change orders or contract amendments in excess of $10,000 affecting the price of any formally advertised, competitively awarded, fixed price contract; and

(iii) subcontracts or purchase orders under any contract other than a formally advertised, competitively awarded, fixed price contract. However, this right of access does not apply to a prime contract, lower tier subcontract, or purchase order awarded after effective price competition, except with respect to records pertaining directly to contract performance, (excluding any financial records of the contractor), if there is any indication that fraud, gross abuse, or corrupt practices may be involved or if the contract is terminated for default or for convenience.

(11) Covenant Against Contingent Fees.

The contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the contractor for the purpose of securing business. For breach or violation of this warranty the grantee shall have the right to annul this agreement without liability or, at its discretion, to deduct from the contract price or consideration, or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

(12) Gratuities.

(A) If the municipality finds, after a notice and hearing, that the contractor, or any of the contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of the municipality or the state, in an attempt to secure a contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this agreement, the municipality may, by written notice to the contractor, terminate this agreement. The municipality may also pursue other rights and remedies that the law or this agreement provides. However, the existence of the facts on which the municipality bases such findings shall be in issue and may be reviewed in proceedings under subdivision (8) of this subsection.

(B) In the event this contract is terminated, as provided in subparagraph (A) of this subdivision, the municipality may pursue the same remedies against the contractor as it could pursue in the event of a breach of the contract by the contractor and, as a penalty, in addition to any other damages to which it may be entitled by law, may pursue exemplary damages in an amount (as determined by the grantee) which shall be not less than three nor more than ten times the costs the contractor incurs in providing any such gratuities to any such officer or employee.

(13) Responsibility of the Contractor.

(A) The contractor agrees to perform all work under this agreement in accordance with this agreement's designs, drawings, and specifications.

(B) The contractor warrants and guarantees for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials, equipment or workmanship; and the contractor shall promptly make whatever adjustments or corrections necessary to cure such defects, including repairs of any damage to other parts of the system resulting from such defects. The municipality shall give notice to the contractor of observed defects with reasonable promptness. In the event that the contractor fails to make adjustments, repairs, corrections or other work that may be made necessary by such defect, the municipality may do so and charge the contractor the cost incurred. The performance bond shall remain in full force and effect through the guarantee period.

(C) The contractor's obligations under this subdivision are in addition to the contractor's other express or implied warranties under this agreement or state law and in no way diminish any other rights that the municipality may have against the contractor for faulty material, equipment, or work.

(14) Final Payment.

Upon satisfactory completion of the work performed under this agreement, as a condition before final payment under this agreement, or as a termination settlement under this agreement, the contractor shall execute and deliver to the municipality a release of all claims against the municipality arising under or by virtue of this agreement, except claims which are specifically exempted by the contractor to be set forth therein. Unless otherwise provided in this agreement or by state law or otherwise expressly agreed to by the parties to this agreement, final payment under this agreement or settlement upon termination of this agreement shall not constitute a waiver of the municipality's claims against the contractor or his sureties under this agreement or applicable performance and payment bonds.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WATER

MEMORANDUM

SUBJECT: Prohibition on Certain Telecommunication and Video Surveillance Services or Equipment in the SRF Programs

FROM: Kiri Anderer, P.E., Acting Associate Branch Chief
Infrastructure Branch, OGWDW

KIRSTEN ANDERER
Digitally signed by KIRSTEN ANDERER
Date: 2020.12.11 07:55:52 -05'00'

Michael Deane, Branch Chief
State Revolving Fund Branch, OWM

MICHAEL DEANE
Digitally signed by MICHAEL DEANE
Date: 2020.12.11 17:56:38 -05'00'

TO: SRF Branch Chiefs
Regions 1-10

Effective August 13, 2020, recipients and subrecipients of EPA funded assistance agreements, including borrowers under EPA funded revolving loan funds, must comply with regulations at 2 CFR 200.216, *Prohibition on certain telecommunication and video surveillance services or equipment*, implementing section 889 of Public Law 115-232. The regulation prohibits the use of Federal funds to procure (enter into, extend, or renew contracts) or obtain equipment, systems, or services that use "covered telecommunications equipment or services" identified in the regulation as a substantial or essential component of any system, or as critical technology as part of any system. Prohibitions extend to the use of Federal funds by recipients and subrecipients to enter into a contract with an entity that "uses any equipment, system, or service that uses covered telecommunications equipment or services" as a substantial or essential component of any system, or as critical technology as part of any system. Certain equipment, systems, or services, including equipment, systems, or services produced or provided by entities subject to the prohibition are recorded in the System for Award Management exclusion list.

As described in section 889 of Public Law 115-232, covered telecommunications equipment or services includes:

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
- For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- Telecommunications or video surveillance services provided by such entities or using such equipment.

- Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Applicability in the State Revolving Fund (SRF) Programs

Clean Water and Drinking Water SRF (CWSRF and DWSRF) programs may not expend equivalency funds for these products on or after August 13, 2020. States must ensure that equivalency assistance agreements include the telecommunications prohibition condition provided by EPA's Office of Grants and Debarment (OGD) in OGD's most recent EPA General Terms and Conditions. The condition must also be in construction contracts associated with equivalency assistance agreements.

There is no exhaustive list of components and services that fall under the prohibition. State SRF managers and local assistance recipients should exercise due diligence and be particularly mindful of project components with internet or cellular connections. For example, recipients should be mindful of automatic meter reading (AMR) technology and advanced metering infrastructure (AMI), instrumentation control systems (e.g. process control systems, distributed control systems and programmable logic controls), and security cameras and other electronic security measures to ensure that those items are procured from a non-excluded entity. Items included in the prohibition are not eligible SRF costs, and the SRF programs cannot reimburse borrowers for these costs.

The prohibition also applies to the CWSRF administrative funds (if states are billing those costs to the federal CWSRF capitalization grant) and the four DWSRF set-asides. States should be mindful of items such as cell phones, computers, and mobile WiFi routers or hotspots funded by those accounts.

If you have questions on the implementation of this grant condition, please contact Michael Deane at Deane.Michael@epa.gov or Kiri Anderer at Anderer.Kirsten@epa.gov.

Eff: 8/13/2020

Per EPA Guidance, the following language must be inserted in all bid/Specification documents to ensure proper compliance to the Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment:

Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment
This term and condition implements 2 CFR 200.216 and is effective for obligations and expenditures of EPA financial assistance funding on or after 8/13/2020. As required by 2 CFR 200.216, EPA recipients and subrecipients, including borrowers under EPA funded revolving loan fund programs, are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities). Recipients, subrecipients, and borrowers also may not use EPA funds to purchase: a. For the purpose of public safety, security of government facilities, physical security surveillance of critical Page 4 of 29 infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities). b. Telecommunications or video surveillance services provided by such entities or using such equipment. c. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country. Consistent with 2 CFR 200.471, costs incurred for telecommunications and video surveillance services or equipment such as phones, internet, video surveillance, and cloud servers are allowable except for the following circumstances: a. Obligating or expending EPA funds for covered telecommunications and video surveillance services or equipment or services as described in 2 CFR 200.216 to: (1) Procure or obtain, extend or renew a contract to procure or obtain; (2) Enter into a contract (or extend or renew a contract) to procure; or (3) Obtain the equipment, services, or systems. Certain prohibited equipment, systems, or services, including equipment, systems, or services produced or provided by entities identified in section 889, are recorded in the System for Award Management exclusion list.

Executive Order No. Three

STATE OF CONNECTICUT
BY HIS EXCELLENCY
THOMAS J. MESKILL
GOVERNOR
EXECUTIVE ORDER NO. THREE

WHEREAS, sections 4-61d (b) and 4-11a of the 1969 supplement to the general statutes require nondiscrimination clauses in state contracts and subcontracts for construction on public buildings, other public works and goods and services and

WHEREAS, section 4-61e (c) of the 1969 supplement to the general statutes requires the labor department to encourage and enforce compliance with this policy by both employers and labor unions, and to promote equal employment opportunities, and

WHEREAS, the government of this state recognizes the duty and desirability of its leadership in providing equal employment opportunity, by implementing these laws.

NOW, THEREFORE, I, THOMAS J. MESKILL, Governor of the State of Connecticut, acting by virtue of the authority vested in me under section twelve of article fourth of the constitution of the state, as supplemented by section 3-1 of the general statutes, do hereby ORDER and DIRECT, as follows, by this Executive Order:

I

The labor commissioner shall be responsible for the administration of this Order and shall adopt such regulations as he deems necessary and appropriate to achieve the purposes of this Order. Upon the promulgation of this Order, the commissioner of finance and control shall issue a directive forthwith to all state agencies, that henceforth all state con-tracts and subcontracts for construction on public buildings, other public works and goods and services shall contain a pro-vision rendering such contract or subcontract subject to this Order, and that such contract or subcontract may be canceled, terminated or suspended by the labor commissioner for violation of or noncompliance with this Order or state and federal laws concerning nondiscrimination, notwithstanding that the labor commissioner is not a party to such contract or subcontract.

II

Each contractor having a contracting containing the provisions prescribed in section 4-11a of the 1969 supplement to the general statutes, shall file and shall cause each of his subcontractors to file, compliance reports with the contracting agency or the labor commissioner, as may be directed. Such reports shall be filed within such times and shall contain such information as to employment policies and statistics of the contractor and each subcontractor, and shall be in such form as the labor commissioner may prescribe. Bidders or prospective contractors or subcontractors may be required to state whether they have participated in any previous contract subject to the provisions of this Order of any preceding similar Order, and in that event to submit on behalf of themselves and their proposed subcontractors compliance reports prior to or as an initial part of their bid or negotiation of a contract.

III

Whenever the contractor or subcontractor has a collective bargaining agreement or contract or understanding with a labor organization or employment agency as defined in section 31-122 of the general statutes, the compliance report shall identify the said organization or agency and the contracting agency or the labor commissioner may require a compliance report to be filed with the contracting agency or the labor commissioner, as may be directed, by such organization or agency, signed by an authorized officer or agent of such organization or agency, with supporting information, to the effect that the signer's practices and policies including but not limited to matters concerning personnel, training, apprenticeship, member-ship, grievance and representation, and upgrading, do not discriminate on grounds of race, color, religious creed, age, sex or national origin, or ancestry of any individual, and that the signer will either affirmatively cooperate in the implementation of the policy and provisions of this Order, or that it consents and agrees that recruitment, employment and the terms and conditions of employment under the proposed contract shall be in accordance with the purposes and provisions of the Order.

IV

The labor commissioner may by regulation exempt certain classes of contracts, subcontracts or purchase order from the implementation of this Order, for standard commercial supplies or raw materials, for less than specified amounts of money or numbers of workers or for subcontractors below a specified tier. The labor commissioner may also provide by regulation for the exemption of facilities of a contractor which are in all respect a separate and distinct from activities of the contractor related to the performance of the state contract, provided only that such exemption will not interfere with or impede the implementation of this Order, and provided further, that in the absence of such an exemption, all facilities shall be covered by the provisions of this Order.

V

Each contracting agency shall be primarily responsible for obtaining compliance with the regulations of the labor commissioner with respect to contracts entered into by such agency or its contractors. All contracting agencies shall comply with the regulations of the labor commissioner in discharging their primary responsibility for securing compliance with the provisions of contracts and otherwise with the terms of this Order and of the regulations of the labor commissioner issued pursuant to this Order. They are directed to cooperate with the labor commissioner and to furnish the labor commissioner such information and assistance as he may require in the performance of his functions under this Order. They are further directed to appoint or designate from among the personnel of each agency, compliance officers, whose duty shall be to seek compliance with the objectives of this Order by conference, conciliation, mediation, or persuasion.

VI

The labor commissioner may investigate the employment practices and procedures of any state contractor or sub-contractor and the practices and policies of any labor organization or employment agency hereinabove described, relating to employment under the state contract, as concerns nondiscrimination by such organization or agency as hereinabove described, or the labor commissioner may initiate such investigation by the appropriate contract agency, to determine whether or not the contractual provisions, hereinabove specified or statutes of the state respecting they have been violated. Such investigation shall be conducted in accordance with the procedures established by the labor commissioner and the investigating agency shall report to the labor commissioner any action taken or recommended.

VII

The labor commissioner shall receive and investigate or cause to be investigated complaints by employees or prospective employees of a state contractor or subcontractor or member or applicants for membership or apprenticeship or training in a labor organization or employment agency hereinabove described, which allege discrimination contrary to the contractual provisions specified hereinabove or state statutes requiring nondiscrimination in employment opportunity. If this investigation is conducted for the labor commissioner by a contracting agency, that agency shall report to the labor commissioner what action has been taken or is recommended with regard to such complaints.

VIII

The labor commissioner shall use his best efforts directly and through contracting agencies, or other interested federal, state and local agencies, contractors and all other available instrumentalities, including the commission on human rights and opportunities, the executive committee on human rights and opportunities, and the apprenticeship council under its mandate to provide advice and counsel to the labor commissioner in providing equal employment opportunities to all apprentices and provide training, employment and upgrading opportunities for disadvantaged workers, in accordance with section 31-51 (d) of the 1969 supplement to the general statutes, to cause any labor organization or any employment agency whose members are engaged in work under government contracts or referring workers or providing or supervising apprentice-ship or training for or in the course of work under a state contract or subcontract to cooperate in the implementation of the purposes of this Order. The labor commissioner shall in appropriate cases notify the commission on human rights and opportunities or other appropriate state or federal agencies whenever it has reason to believe that the practices of any such organization or agency violate equal employment opportunity requirements or state or federal law.

IX

The labor commissioner or any agency officer or employee in the executive branch designated by regulation of the labor commissioner may hold such hearings, public or private, as the labor commissioner may deem advisable for compliance, enforcement or educational purposes under this Order.

X

(a) The labor commissioner may hold or cause to be held hearings, prior to imposing ordering or recommending the imposition or penalties and sanctions under this Order. No order for disbarment or any contractor from further state contracts shall be made without affording the contractor an opportunity for a hearing. In accordance with such regulations as the labor commissioner may adopt, the commissioner or the appropriate contracting agency may

(1) Publish or cause to be published the names of contractors or labor organizations or employment agencies as hereinabove described which it has concluded have complied or failed to comply with the provisions of this Order or the regulations of the labor commissioner in implementing this Order.

(2) Recommend to the commission on human rights and opportunities that in cases in which there is substantial or material violation or threat thereof of the contractual provision or related state statutes concerned herein, appropriate proceedings be brought to enforce them, including proceedings by the commission on its own motion under chapter 563 of the general statutes and the enjoining, within the limitations or applicable law, of organizations, individuals or groups who prevent directly or indirectly or seek to prevent directly or indirectly compliance with the provisions of this Order.

(3) Recommend that criminal proceedings be brought under chapter 939 of the general statutes.

(4) Cancel, terminate, suspend or cause to be canceled, terminated, or suspended in accordance with law any contract or any portion or portions thereof for failure of the contractor or subcontractor to comply with the nondiscrimination provisions of the contract. Contracts may be canceled, terminated, suspended absolutely or their continuance conditioned upon a pro-gram for future compliance approved by the contracting agency.

(5) Provide that any contracting agency shall refrain from entering into any further contract or extensions or modifications of existing contracts with any contractor until he has satisfied the labor commissioner that he has established and will carry out personnel and employment policies compliant with this Order.

(6) Under regulations prescribed by the labor commissioner each contracting agency shall make reasonable efforts within a reasonable period of time to secure compliance with the contract provisions of this Order by methods of convenience, conciliation, mediation or persuasion, before other proceedings shall be instituted under this Order or before a state contract shall be can-celled or terminated in whole or in part for failure of the contractor or subcontractor to com-ply with the contract provisions of state statute and this Order.

(b) Any contracting agency taking any action authorized by this Order, whether on its own motion or as directed by the labor commissioner or pursuant to his regulations shall promptly notify him of such action. Whenever the labor commissioner makes a determination under this order, he shall promptly notify the appropriate contracting agency and other interested federal, state and local agencies of the action recommended. The state and local agency or agencies shall take such action and shall report the results thereof to the labor commissioner within such time as he shall specify.

XI

If the labor commissioner shall so direct, contracting agencies shall not enter into contracts with any bidder or prospective contractor unless he has satisfactorily complied with the provisions of this Order, or submits a program for compliance acceptable to the labor commissioner, or if the labor commissioner so authorizes, to the contracting agency.

XII

Whenever a contracting agency cancels or terminates a contract, or a contractor has been disbarred from further government contracts because of noncompliance with the contract provisions with regard to nondiscrimination, the labor com-missioner or the contracting agency shall rescind such disbarment, upon the satisfaction of the labor commissioner that the contractor has purged himself of such noncompliance and will thenceforth carry out personnel and employment policies of non-discrimination in compliance with the provision of this Order.

XIII

The labor commissioner may delegate to any officer, agency or employee in the executive branch any function or duty of the labor commissioner under this Order except authority to promulgate regulations of a general nature.

XIV

This Executive Order supplements the Executive Order issued on September 28, 1967. All regulations, orders, instructions, designations and other directives issued heretofore in these premises, including these issued by the heads of various departments or agencies under or pursuant to prior order or statute, shall remain in full force and effect, unless and until revoked or superseded by appropriate authority, to the extent that they are not inconsistent with this Order.

This Order shall become effective thirty days after the date of this Order.

Dated at Hartford, Connecticut, this 16th day of June, 1971.

_____

GOVERNOR

GUIDELINES AND RULES
OF STATE LABOR COMMISSIONER
IMPLEMENTING GOVERNOR'S EXECUTIVE
ORDER NO. THREE

SEC. 1 PERSONS AND FIRMS SUBJECT TO EXECUTIVE ORDER NO. THREE AND GUIDELINES AND RULES.

a. Every contractor, or subcontractor as defined in Sec. 2 hereof, supplier of goods or services, vendor, bidder and prospective contractor or subcontractor, having ten or more employees as defined in Sec. 3 of these guidelines, having or entering into or bidding to enter into any type of contractual relationship with the State of Connecticut or any of its agencies, boards, commissions, departments or officers, and if the consideration, cost, subject matter or value of the goods or services exceeds $5,000.00, shall be subject to the Governor's Executive Order No. Three and these Guidelines and Rules.

b. A copy of the Governor's Executive Order No. Three and of these Guidelines and Rules shall be available to each said contractor, subcontractor, supplier, vendor, bidder and prospective contractor and subcontractor, and the said Executive Order No. Three and these Guidelines and Rules shall be incorporate by reference and made a part of the contract, purchase order, agreement or document concerned. A copy of the Executive Order and of these Guidelines and Rules shall be furnished to a contracting party or bidder on request.

c. All persons, partnerships, associations, firms, corporations and other entities having less than ten employees as defined in Sec. 3 at the time of the bid and execution of the contract and continuing through the performance of the contract are exempt from the provisions of the said Executive Order and these Guidelines and Rules. All contracts, subcontracts, purchase orders and agreements wherein the consideration ins $5,000.00 or less shall be exempt from Executive Order No. Three and from these Guidelines and Rules.

SEC. 2 SUBCONTRACTORS

As used herein, subcontractors are persons, partnerships, associations, firms or corporations or other entities having contractual relationship with a contractor who in turn has a contract with the State of Connecticut or any of its agencies, board, commissions or departments. Subcontractors below this tier are exempt from the Executive Order and from these Guidelines and Rules.

SEC. 3 EMPLOYEES

As used herein, employees are persons working full or part-time irrespective of personnel classification whose wages, salaries, or earnings are subject to the Federal Insurance Contribution Act and/or to Federal Withholding Tax as a matter of law (whether in fact or not any actual withholding occurs in a given case), in an employee-employer relationship at the time of bid, contract execution, or offer or acceptance, and/or during any time thereafter during the existence of the performance period of the contract to the conclusion thereof.

SEC. 4 REPORTS

a. Prior to the execution of the contract or prior to acceptance of a bid, as the case may be, the contractor, subcontractor, bidder or vendor shall file a report with the State Labor Commissioner, which report shall be complete and contain all of the information therein prescribed. The report shall be on Form E.0.3-1, a facsimile of which is attached hereto and made a part hereof, or in lieu thereof the contractor, subcontractor, bidder or vendor shall submit a detailed report containing all of the information required in Form E.O. 3-1.

b. The Labor Commissioner may require the filing of additional reports prior to final payment or prior to any renewal or extension of the contract and during the duration of the contract at such times as the Commissioner may, in his discretion, from time to time deem necessary. The Labor Commissioner may require the filing of additional information or reports, and the contractor, subcontractor, bidder or vendor shall furnish said information or report within the times prescribed by the Labor Commissioner.

c. The Labor Commissioner may, at his discretion, also require timely statistical reports on the number of minority employees employed or to be employed in the performance of the contract, and the Labor Commissioner may de-fine such minority groups or persons.

d. Reports filed pursuant to these Guidelines and Rules in Implementation of Executive Order No. Three are not public records subject to public inspection, but may be inspected only by federal and state officials having jurisdiction and authority to investigate matters of this type. All federal and state agencies empowered by law to investigate matters relating to Executive order No. Three shall have access to these reports for inspection or copying during regular business hours.

e. Any person who willfully, wantonly or through negligence destroys or permits to be destroyed, alters or allows to be altered after filing any reports submitted in compliance herewith shall be subject to penalties as pre-scribed by law.

SEC. 5. MANDATORY CLAUSES IN DOCUMENTS

a. All contracts shall contain the following provisions verbatim:

This contract is subject in the provisions of Executive Order No. Three of Governor Thomas J. Meskill promulgated June 16, 1971 and, as such, this contract may be canceled, terminated or suspended by the state labor commissioner for violation of or noncompliance with said Executive Order No. Three, or any state or federal law concerning nondiscrimination, notwithstanding that the labor commissioner is not a party to this contract. The parties to this contract, as part of the consideration hereof, agree that said Executive Order No. Three is incorporated herein by reference and made a part hereof. The parties agree to abide by said Executive Order and agree that the state labor commissioner shall have continuing jurisdiction in respect to contract performance in regard to nondiscrimination, until the contract is completed or terminated prior to completion.

The (contractor), (subcontractor), (bidder), (vendor) agrees, as part consideration hereof, that his (order) (contract) is subject to the Guidelines and Rules issued by the state labor commissioner to implement Executive Order No. Three, and that he will not discriminate in his employment practices or policies, will file all reports as required, and will fully cooperate with the State of Connecticut and the state labor commissioner.

These provisions are in addition to and not in lieu of other clauses required by law.*

*N.B. The above paragraphs contain requirements additional to those set forth in July 16, 1971 directive to state agencies.

b. Every purchase order or like form submitted by a vendor or bidder, as applicable, shall contain the following clause verbatim:

Vendor agrees, as part of the consideration hereof, that this order is subject to the provisions of Executive Order No. Three and the Guidelines and Rules issued by the Labor Commissioner implementing said Order as to nondiscrimination, and vendor agrees to comply therewith.

c. Where preprinted contract forms have been prescribed by federal authority and the rules of the federal agency prohibit the alteration thereof, the compliance officer of the State agency concerned shall submit to the Labor Commissioner a suggested short form or addendum acceptable to the federal agency, and such cases, after approval by the Labor Commissioner, said clause may be substituted.

SEC. 6. COOPERATION OF STATE AGENCIES, BOARDS AND COMMISSIONS

Every agency, board, commission and departments of the State of Connecticut shall cooperate with the Labor Commissioner in the implantation of Executive Order No. Three and shall furnish such information and assistance as the Labor Commissioner may from time to time request.

SEC. 7. INVESTIGATIONS, COMPLAINTS

The Labor Commissioner may initiate an investigation upon receipt of a complaint alleging discrimination. The Labor Commissioner may request that an investigation be conducted by the State agency which is the party to the contract in question. Investigations shall be conducted in accordance with acceptable legal standards, safeguarding the rights of all parties involved, and obtaining all of the relevant facts necessary for a complete determination of the issues. If the Labor Commissioner is not satisfied with the investigation or any part thereof he may order it to continue or to proceed further.

SEC. 8. HEARINGS

The Labor Commissioner or officers designed by the heads of the State agencies, boards and commissions may conduct hearings on complaints filed. Hearings shall be held only after a report of the complaint has been filed with the Labor Commissioner and after a hearing on the complaint has been authorized or directed by the Labor Commission-er. Hearings shall be in accordance with the accepted principles of administrative law. All parties shall be afforded the opportunity to a full, fair, impartial and complete hearing, the opportunity to examine and cross examine witnesses and to be present at all sessions of the hearing. If any party is vulnerable to a charge of a violation of the law, he shall be afforded the opportunity to procure counsel who say be present at the hearing.

SEC. 9. EQUAL EMPLOYMENT OPPORTUNITIES

All State contracting agencies, employers, and labor unions shall use their best efforts to provide equal employment opportunities to all apprentices and to provide training, employment and upgrading opportunities for disadvantaged workers in accordance with section 31-51 (d) of the General Statutes.

SEC. 10. DUTIES OF CONTRACTING AGENCIES.

All State contracting agencies shall be responsible for compliance with said Executive Order and with all state and federal laws relating to equal employment opportunities. All contracting agencies conducting investigations for the Labor Commissioner pursuant to Executive Order No. Three and these Guidelines and Rules shall report to the Labor Commissioner the action taken or recommended with regard to each complaint filed. Each officer of the executive department, every commissioner, and each executive head of each State agency, board and commission in the executive branch of the State government is expected to assume the responsibility of seeing to complete compliance with the Governor's Executive Order No. Three and shall forthwith take steps to assure and guarantee that there shall be no discrimination within their departments, agencies, boards or commissions in the performance of any state contract or subcontract on the basis of race, creed, color, sex, age, national origin or national ancestry, or in any way in violation of any state or federal law relating thereto.

BY VIRTUE OF THE AUTHORITY VESTED IN ME PURSUANT TO EXECUTIVE ORDER NO. THREE EFFECTIVE JULY 16, 1971, AND THE GENERAL STATUTES OF CONNECTICUT.

Date in Wethersfield, Connecticut this 19th day of Nov. , 1971,

Jack Fusari
Labor Commissioner

Executive Order No. Seventeen

STATE OF CONNECTICUT
THOMAS J. MESKILL
GOVERNOR
EXECUTIVE ORDER NO. SEVENTEEN

WHEREAS, Section 31-247 of the General statutes of Connecticut as amended requires the maintaining of the established free services of the Connecticut State Employment Service to both employers and prospective employees and

WHEREAS, Section 31-5 of the General Statutes of Connecticut requires that no compensation or fee shall be charged or received directly or indirectly for the services of the Connecticut State Employment Service and

WHEREAS, large numbers of our citizens who have served in the Armed Forces of our nation are returned to civilian life in our state and seeking employment in civilian occupations and

WHEREAS, we owe a duty as well as gratitude to these returning veterans including the duty to find suitable employment for them and

WHEREAS, many of our handicapped citizens are fully capable of employment and are entitled to be placed in suitable employment and

WHEREAS, many of the citizens of our state who are unemployed are unaware of the job openings and employment opportunities which do in fact exist in our state and

WHEREAS, notwithstanding the free services of the Connecticut State Employment Service, many of our Connecticut employers do not use its free services or do not avail themselves fully of all the services offered.

NOW, THEREFORE, I, Thomas J. Meskill, Governor of the State of Connecticut, acting by virtue of the authority vested in me under the fourth article of the Constitution of the State and in accordance with Section 3-1 of the General Statutes, do hereby ORDER and DIRECT, as follows, by this Executive Order:

I

The Labor Commissioner shall be responsible for the administration of this Order and shall do all acts necessary and appropriate to achieve its purpose. Upon the promulgation of this Order, the Commissioner of Finance and Control shall issue a directive forthwith to all state agencies that henceforth all state contracts and subcontracts for construction on public buildings, other public works and goods and services shall contain a provision rendering such contract or subcontract subject to this Order, and that such contract or subcontract may be canceled, terminated or suspended by the Labor Commissioner for violation of or noncompliance with this Order, notwithstanding that the Labor Commissioner is not a party to such contract or subcontract.

II

Every contractor and subcontractor having a contract with the state or any of its agencies, boards, commissions, or departments, every individual partnership, corporation, or business entity having business with the state or who or which seeks to do business in the state, and every bidder or prospective bidder who submits a bid or replies to an invitation
to bid on any state contract shall list all employees openings with the office of the Connecticut State Employment Service in the area where the work is in be performed or where the services are to be rendered.

III

All state contracts shall contain a clause which shall be a condition of the contract that the contractor and any subcontractor holding a contract directly under the contractor shall list all employment openings with the Connecticut State Employment Service. The Labor Commissioner may allow exceptions to listings of employment openings which the contractor proposes to fill from within its organization from employees on the rolls of contractor on the date of publication of the invitation to bid or the date on which the public announcement was published or promulgated advising of the program concerned.

IV

Each contracting agency of the state shall be primarily responsible for obtaining compliance with this Executive Order. Each contracting agency shall appoint or designate from amount its personnel one or more persons who shall be responsible for compliance with the objectives of this Order

V

The Labor Commissioner shall be an is hereby empowered to inspect the books, records, payroll and personnel data of each individual or business entity subject to this Executive Order and may hold hearings or conference, formal or informal, in pursuance of the duties and responsibilities hereunto delegated to the Labor Commissioner.

VI

The Labor Commissioner or any agency officer or employee in the executive branch designated by regulation of the Labor Commissioner may hold such hearings, public or private, as the Labor Commissioner may deem advisable for compliance, enforcement or educational purposes under this Order.

VII

(a) The Labor Commissioner may hold or cause to be held hearings, prior to imposing, ordering, or recommending the imposition of penalties and sanctions under this Order. In accordance herewith, the Commissioner or the appropriate contracting agency may suspend, cancel, terminate, or cause to be suspended, canceled, or terminated in accordance with
law any contract or any portion or portions thereof for failure of the contractor or subcontractor to comply with the listing provisions of the contract. Contracts may be canceled, terminated, suspended absolutely or their continuance conditioned upon a program for future compliance approved by the contracting agency.

(b) Any contracting agency taking any action authorized by this Order, whether on its own motion or as directed by the Labor Commissioner, shall promptly notify him of such action. Whenever the Labor Commissioner makes a determination under this Order, he shall promptly notify the appropriate contracting agency of the action recommended. The agency shall report the results to the Labor Commissioner promptly.

If the Labor Commissioner shall so direct, contracting agencies shall not enter into contracts with any bidder or prospective contractor unless he has satisfactorily complied with the provisions of this Order.

This Order shall become effective sixty days after the date of this Order.

Dated at Hartford, Connecticut, this 15th day of February, 1973.

_____
Governor

American Iron and Steel Act
DEEP Revised

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

Memorandum

To: All Connecticut Municipalities, Water Pollution Control Facilities, and Consultants

Date: May 28, 2015

Re: Revised American Iron and Steel Memorandum

The Department of Energy and Environmental Protection's (DEEP) Municipal Water Pollution Control Section has updated the American Iron and Steel (AIS) memorandum that was distributed on May 19, 2014.

On June 10, 2014, the Water Resources Reform and Development Act of 2014 (WRRDA) was signed into law by President Obama, which amended the Federal Water Pollution Control Act (FWPCA). The FWPCA section 608 extended the AIS provision that was originally scheduled to expire on September 30, 2014.

This means that AIS is now a **permanent** project requirement for all Connecticut Clean Water Fund (CWF) projects.

The effective date for the newly codified AIS provision is the date of enactment of the WRRDA, or June 10, 2014.

A recent Environmental Protection Agency (EPA) memorandum dated September 18, 2014 indicates that EPA intends to interpret the WRRDA language for the AIS requirement in the same manner as described in an earlier EPA guidance memo dated March 20, 2014. Therefore, the March 20, 2014 EPA memorandum shall still serve as the final EPA AIS guidance on how to apply the AIS requirement, and it is attached to the revised CWF memo.

The final memorandum is now available on our website at http://www.ct.gov/dep/cwp.

Sincerely,

George V. Hicks, P.E.
Supervising Sanitary Engineer
Bureau of Water Protection & Land Reuse

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

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Revised Clean Water Fund Memorandum (2014-001a)

TO: All Connecticut Municipalities and Consultants

RE: Implementation of American Iron and Steel provisions on Connecticut Clean Water Fund Projects

I. PURPOSE

To provide clarification on the applicability of American Iron and Steel (AIS) provisions to construction projects funded by the Connecticut Clean Water Fund (CWF).

II. GOVERNING FEDERAL PUBLIC LAW

Section 436 of Public Law (P.L.) 113-76, Consolidated Appropriations Act, 2014.

III. APPLICABILITY

All Connecticut CWF projects must use "iron and steel products" (Section III.A) that are "produced in the United States" for construction projects. The final Environmental Protection Agency (EPA) AIS guidance memorandum dated March 20, 2014 ("final EPA AIS guidance") on how to apply the AIS requirement is attached.

This memorandum summarizes the final EPA AIS guidance, and describes how it relates specifically to Connecticut CWF projects. Section III.C details what is required for a CWF project that is subject to the AIS provisions. Any definitions provided by the final EPA AIS guidance are included in Section IV.

Section 436 of P.L. 113-76 excludes products (Section III.B) to the AIS requirement, as well as a waiver request process to exclude products or the entire project from AIS requirements (Section III.D).

A. Applicable Iron and Steel Products

1. The AIS requirement applies to all of the following products:
   a. Lined or unlined pipes and fittings;
   b. Manholes covers and other "municipal castings";
   c. Hydrants;
   d. Tanks;
   e. Flanges;
   f. Pipe clamps and restraints;
   g. Valves;
   h. "Structural steel";
   i. Reinforced precast concrete; or
   j. "Construction materials".

   Refer to Section IV for further clarification of items b, h, and j.

2. Each project item listed in Section III.A.1 and is considered to be "primarily iron or steel", or comprised of greater than 50% iron or "steel" as measured by cost, becomes subject to the AIS requirement.
   a. The cost used to determine AIS applicability shall be based on the material costs, and shall include the cost to pour and cast iron and/or steel components.
   b. The cost used to determine AIS applicability shall not include assembly cost.

3. Unlike the products listed in Section III.A.1.a – h and j, all reinforced precast concrete used in applicable products is subject to the AIS requirement, no matter how much iron or steel comprises the reinforced precast concrete. The reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. The casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

4. "Construction materials" are any products that become permanently incorporated into the project, even if those products may be considered temporary in most instances. For example, any iron or steel sheeting or piles that are not removed after construction is completed are considered to be "construction materials" subject to the AIS requirement.

B. Excluded Products

1. The AIS requirement does <u>not</u> apply to any mechanical and/or electrical components, equipment and systems. Mechanical and electrical components, equipment and systems are not considered construction materials.

2. The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials, and are therefore NOT subject to the AIS requirement:
   a. Pumps;
   b. Motors;
   c. Gear reducers;
   d. Drives (including variable frequency drives (VFDs));
   e. Electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators);
   f. Mixers;
   g. Gates;
   h. Motorized screens (such as traveling screens);
   i. Blowers/aeration equipment;
   j. Compressors;
   k. Meters, sensors, controls and switches;
   l. Supervisory control and data acquisition (SCADA);
   m. Membrane bioreactor systems;
   n. Membrane filtration systems;
   o. Filters, clarifiers and clarifier mechanisms;
   p. Rakes, grinders;
   q. Disinfection systems;
   r. Presses (including belt presses);
   s. Conveyors, cranes;
   t. HVAC (excluding ductwork), water heaters, heat exchangers;
   u. Generators;

v. Cabinetry and housings (such as electrical boxes/enclosures);
w. Lighting fixtures;
x. Electrical conduit;
y. Emergency life systems;
z. Metal office furniture, shelving;
aa. Laboratory equipment, analytical instrumentation; and
bb. Dewatering equipment.

3. Raw materials such as iron ore, limestone, and iron/steel scrap are not covered by the AIS requirement. If any raw materials are being applied as a coating, the raw materials are similarly not covered.

C. AIS Requirements

1. For each item that meets the criteria indicated in Sections III.A, the iron and steel products contained in that item must be "produced in the United States (US)".
   a. All manufacturing processes must take place in the US, with the exception of metallurgical processes involving the refinement of steel additives.
   b. Manufacturing processes covered by the AIS requirement include: melting, refining, forming, rolling, drawing, refining, finishing, fabricating, coating.
   c. In the case of reinforced precast concrete, the casting of the concrete must also occur in the US. The cement and other raw materials used in the concrete production may come from non-US sources.
   d. Each domestic iron and steel product must remain in the US for the entire manufacturing process; otherwise, it will be considered foreign source material.
   e. Non-iron or steel components of an iron and steel product may come from non-US sources.

2. The construction contract language contained in **Appendix 4 of the attached final EPA AIS guidance** must be included in the CWF contract documents in order to obtain CWF approval of the engineering plans and specifications.

3. Certification for AIS compliance
   a. Certification must be provided for all items in Section III.A.
   b. Types of Certification
      i. Step certification process: Each handler (supplier, fabricator, manufacturer, processor, etc) of the iron and steel products certifies that their step in the process was domestically performed.
      ii. Final manufacturer certification: Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US.
   c. AIS compliance certification must be provided on company letterhead, in the format provided by **Appendix 5 of the attached final EPA AIS guidance**.
   d. These certifications shall be collected and maintained by the municipality, and must be available upon request by either the EPA or the DEEP.

D. Waiver Request Process

1. A waiver from the AIS requirement may be requested for a CWF project if at least one of the following conditions is sufficiently demonstrated:
   a. The AIS requirement will increase the cost of the overall project by more than 25 percent, as demonstrated by the inclusion of a bid alternate and backup calculations;

b. The iron and steel products are not produced in the United States in sufficient and "reasonably available quantities" and of "satisfactory quality", as demonstrated by soliciting proposals from at least three manufacturers; or
c. The AIS requirement is inconsistent with the public interest.

2. Waiver Request Format
   a. The waiver request must include a table with responses to the "Information Checklist for Waiver Request" in **Appendix 1 of the attached final EPA AIS guidance**.
   b. Evaluation of the waiver request shall include the criteria in the "HQ Review Checklist for Waiver Request" in **Appendix 2 of the attached final EPA AIS guidance.**
   c. Waiver requests shall be submitted to the Connecticut Department of Energy and Environmental Protection (DEEP) for initial screening.
   d. If the DEEP determines that a waiver to the AIS requirement has been sufficiently demonstrated, the DEEP will forward the waiver request to the EPA.

3. Final Waiver Determination
   a. The waiver request shall be made available on the EPA website and the DEEP CWF webpage.
   b. The EPA shall allow for informal public input for at least 15 days prior to making a determination.

IV. DEFINITIONS

AIS: American Iron and Steel

Assistant recipients: A borrower or grantee that receives funding from a State CWSRF program. In the case of Connecticut CWF projects, "assistance recipients" are the municipalities, as defined below.

CGS: Connecticut General Statutes

Construction materials: Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the applicable project, not including mechanical and/or electrical components, equipment and systems.

Some construction materials may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

CWF: Connecticut Clean Water Fund

CWSRF: Clean Water State Revolving Fund

DEEP: Connecticut Department of Energy and Environmental Protection

Electrical equipment: Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

EPA: Federal Environmental Protection Agency

FWPCA: Federal Water Pollution Control Act

Final EPA AIS Guidance: This refers to the attached EPA Memorandum entitled "Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014" dated March 20, 2014.

HVAC: Heating, ventilation, and air conditioning

Municipality: Any "municipality" eligible for the CWF, as defined in Section 22a-475 of the CGS. The municipalities are the "assistance recipients" for the purposes of the AIS requirement.

Iron and Steel Products: The term "iron and steel products" means the following products are made of "primarily iron or steel": lined or unlined pipes and fittings, manholes covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

Mechanical equipment: Mechanical equipment is typically that which has motorized parts and/or is powered by a motor.

Municipal castings: Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;
- Meter Boxes;
- Service Boxes;
- Steel Hinged Hatches, Square and Rectangular;
- Steel Riser Rings;

- Trash receptacles;
- Tree Grates;
- Tree Guards;
- Trench Grates; and
- Valve Boxes, Covers and Risers.

Primarily Iron or Steel: To be considered "primarily iron or steel", the product must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

P.L.: Public Law

Production in the US: For the purposes of the AIS requirement, "production in the US" of the iron or steel used in an applicable product requires that all manufacturing processes must take place in the US, except metallurgical processes involving refinement of steel additives.

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

SCADA: Supervisory control and data acquisition

Steel: An alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel includes carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

Step Certification: A step certification is a process under which each handler (supplier, fabricator, manufacturer, processor, etc.) of the iron and steel products certifies that their step in the process was domestically performed.

Structural steel: Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes. Some structural steel may overlap with what is also considered "construction materials" (see definition above).

RCSA: Regulations of the Connecticut State Agencies

US: United States

VFDs: Variable frequency drives

WRRDA: Water Resources Reform and Development Act of 2014

5/28/2015
Date

George V. Hicks, P.E.
Supervising Sanitary Engineer
Bureau of Water Protection & Land Reuse

Attachment: EPA Memorandum: "Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014" dated March 20, 2014.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: For Andrew D. Sawyers, Director
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term ''iron and steel products'' means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the ''Administrator'') finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with "split" funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger

project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12)

<u>Covered Iron and Steel Products</u>

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

Lined or unlined pipes or fittings;
Manhole Covers;
Municipal Castings (defined in more detail below);
Hydrants;
Tanks;
Flanges;
Pipe clamps and restraints;
Valves;
Structural steel (defined in more detail below);
Reinforced precast concrete; and
Construction materials (defined in more detail below).

12) What does the term 'primarily iron or steel' mean?

'Primarily iron or steel' places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does 'produced in the United States' mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of 'municipal castings'?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is 'structural steel'?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a 'construction material' for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a 'construction material' for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: http://www.epa.gov/oig/hotline.htm.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm

2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests • Does the waiver request include the following information? — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market • Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials • Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers? • Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information) • Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials • Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 3: Example Loan Agreement Language

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel Requirement") unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

Appendix 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of _____ ("Purchaser") and the _____ (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

American Iron and Steel Provisions - Bidder Certification

The Bidder ("Contractor") acknowledges to and for the benefit of the Greater New Haven Water Pollution Control Authority ("Purchaser") and the State of Connecticut ("State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Please Print

Bidder (Contractor): By:

Name of Contractor (Company)	Signature
Address	Print Name
City/State/Zip Code	Date

* *

CONTRACTOR'S EXEMPT PURCHASE CERTIFICATE

Town ____ Grant or Loan Identifier _______

Contract Name ____ Contract Number _________

I hereby certify under penalties of (FALSE STATEMENT) that I am engaged in the performance of a construction contract funded by the following named exempt agency or organization:

Department of Environmental Protection
79 Elm Street, Hartford, Connecticut

That such agency is, to the best of my knowledge and belief, exempt from the Education, Welfare and Public Health Tax (Sales and Use Tax) because it is a branch of the State Government, in accordance with Regulation 12-426-18 of the Sales and Use Tax Division of the State Department of Revenue Services.

That this certificate is issued to cover all purchases of material and supplies to be physically incorporated in and become a permanent part of the project referred to above.

__________________________ ___________
Signature of CONTRACTOR Date

Name of Firm: ____________________________

Business Address: __________________________

____

* *

SPECIFICATIONS

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Bidder as part of the proposal for Engineer's review. The Equipment Manufacturer will formally re-submit the Action Submittal items through the Contractor for approval.

B. Informational Submittal: Information submitted by Equipment Manufacturer that does not require Engineer's approval.

C. Preliminary Operation and Maintenance (O&M) Data: Initial and subsequent submissions for Engineer's review.

D. Final O&M Data: Engineer-accepted data, submitted as specified herein.

E. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of Goods. Examples of typical maintenance operations are cleaning, lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

F. Operation and Maintenance Manual: Provided by the Equipment Manufacturer for the equipment provided as part of the Process Air Compressor for Low Level Nitrogen Removal contract.

G. Asset Management Forms: Forms provided by the Owner for the Equipment Manufacturer to record product and equipment data.

1.02 PROJECT COORDINATION

A. Onsite Coordination:

1. Contractor will coordinate the activities at the Point of Destination related to the Goods furnished under this Contract.
2. Equipment Manufacturer shall fully coordinate its activities with Contractor and other Contractors. This includes promptly bringing to Engineer's and Contractor's attention any conflict or coordination problem.

1.03 CONTRACT PROGRESS REPORTING

A. Progress Schedule:

1. Bar chart schedule demonstrating Equipment Manufacturer's plan for fulfilling Contract requirements.
2. Information shall be comprehensive and shall represent all activities, including submittals and procurement necessary to complete Contract.
3. Typical minimum detail on the schedule shall include, but not be limited to, the following:
   a. Delivery durations and date(s) of Shop Drawings and Sample submittals.
   b. Delivery durations and date(s) of Operation and Maintenance Data.
   c. When in relation to previous schedule items the Equipment Manufacturer places purchase orders with major subcontractors and suppliers.
   d. When in relation to previous schedule items the Equipment Manufacturer orders castings and forgings.
   e. When in relation to previous schedule items of starting assembly of specified Goods.
   f. Duration of finishing assembly of specified Goods.
   g. When in relation to previous schedule items the testing at plant is to be done.
   h. When in relation to previous schedule items to expect the shipment from Equipment Manufacturer.
   i. When in relation to previous schedule items to expect the arrival of equipment at Point of Destination.
4. Assist Contractor in determining the most current schedule information on the Contract items, including whether Equipment Manufacturer is on schedule or delayed. These requirements apply fully to telephone inquiries, personal visits, letters, or other communication.
5. Schedule Reporting: Submit Notice of Schedule Impact at any time that a Progress Schedule activity is delayed by 5 or more days.
   a. Complete and submit to party named on the form attached.
   b. Transmit completed form either in facsimile, e-mail, or mail via registered overnight mail service.

1.04 SUBMITTAL PROCEDURES

A. Direct submittals to Engineer at the following address, unless specified otherwise:

1. JACOBS
   Attn: Karina Massey
   100 Great Meadow Rd Suite 707
   Wethersfield, CT 06109
2. E-mail: Karina.massey@jacobs.com; cc mricozzi@gnhwpca.com & jmegale@gnhwpca.org

B. Electronic Submittals: Submittals shall, unless specifically accepted, be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal book marking from an index page to major sections of the document.
3. PDF files shall be set to open “Bookmarks and Page” view.
4. Add general information to each PDF file, including title, subject, author, and keywords.
5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch. No other paper sizes will be accepted.
6. Submit new electronic files for each resubmittal.
7. Include a copy of the Transmittal of Equipment Manufacturer’s Submittal form, located at end of section, with each electronic file.
8. Engineer will reject submittal that is not electronically submitted, unless specifically accepted. All submittals from the Equipment Manufacturer are to be submitted via the Contractor during construction.
9. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
10. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

C. Transmittal of Submittal:

1. Review each submittal and check for compliance with Contract Documents.
2. Stamp each submittal with uniform approval stamp before submitting; stamp to include Project name, submittal number, Specification number, Equipment Manufacturer’s reviewer name, date of Equipment Manufacturer’s approval, and statement certifying that submittal has

been reviewed, checked, and approved for compliance with Contract Documents. Engineer will not review submittals that do not bear Equipment Manufacturer's certification as required by the General Conditions, and will return them without action.

3. Complete, sign, and transmit with each submittal package, one Transmittal of Equipment Manufacturer's Submittal form in format approved by Engineer.
4. Identify each submittal with the following:
    a. Numbering and Tracking System:
        1) Sequentially number each submittal.
        2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
    b. Specification section and paragraph to which submittal applies.
    c. Project title and Owner's project number.
    d. Date of transmittal.
    e. Names of Equipment Manufacturer, Subcontractor or Supplier, and manufacturer as appropriate.
5. Identify and describe each deviation or variation from Contract Documents.

D. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
3. Index with labeled tab dividers in orderly manner.

E. Timeliness of Submittal: Schedule and submit in accordance with the Equipment Manufacturer's Progress Schedule, and requirements of individual Specification sections.

F. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Equipment Manufacturer's submittal and transmit response to Equipment Manufacturer not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed due to delays in providing Goods or Special Services caused by rejection and subsequent resubmittals.

G. Resubmittals: Clearly identify each correction or change made.

H. Incomplete Submittals:

1. Engineer will return entire submittal for Equipment Manufacturer's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
   a. Equipment Manufacturer's certification as required by the General Conditions.
   b. Transmittal of Equipment Manufacturer's Submittal, completed and signed.
   c. Insufficient number of copies.

I. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Engineer will keep one copy and return all remaining copies to Equipment Manufacturer.

J. Action Submittals:

1. Prepare and submit as required by individual Specification sections.
2. Shop Drawings:
   a. Copies: Submit in electronic PDF Format.
   b. Identify and Indicate:
      1) Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
      2) Goods and Component Title: Identical to title shown on Drawings.
      3) Critical field dimensions and relationships to other critical features. Note dimensions established by field measurement.
      4) Project-specific information drawn accurately to scale.
   c. Manufacturer's standard schematic drawings and diagrams as follows:
      1) Modify to delete information that is not applicable.
      2) Supplement standard information to provide information specifically applicable.
   d. Product Data: Provide as specified in individual Specifications.

e. Foreign Manufacturers: When proposed, include following additional information:
   1) Names and addresses of at least two companies that maintain technical service representatives close to Project.
   2) Complete list of spare parts and accessories for each piece of equipment.

3. Samples:
   a. Quantity: Two, unless otherwise specified in individual Specifications.
   b. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
      1) Manufacturer name.
      2) Model number.
      3) Material.
      4) Sample source.
   c. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
   d. Full-size Samples:
      1) Size as indicated in individual Specification section.
      2) Cured and finished in manner specified.
      3) Physically identical with Goods proposed for use.

K. Action Submittal Dispositions: Engineer will review, mark, and stamp as appropriate, and distribute marked-up copies as noted:

1. Approved:
   a. Equipment Manufacturer may provide Goods or Special Services covered by submittal.
   b. Distribution: Electronic.
2. Approved as Noted:
   a. Equipment Manufacturer may provide Goods or Special Services covered by submittal, in accordance with Engineer's notations.
   b. Distribution: Electronic.
3. Partial Approval, Resubmit as Noted:
   a. Make corrections or obtain missing portions, and resubmit.
   b. Except for portions indicated, Equipment Manufacturer may begin to provide Goods or Special Services covered by submittal, in accordance with Engineer's notations.
   c. Distribution: Electronic.
4. Revise and Resubmit:
   a. Equipment Manufacturer may not provide Goods or Special Services covered by submittal.
   b. Distribution: Electronic.

L. Informational Submittals:

1. Copies: Electronic copies, unless otherwise indicated in individual Specification section.
2. Refer to individual Specification sections for specific submittal requirements.
3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward submittal to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will return with review comments to Equipment Manufacturer, and require that submittal be corrected and resubmitted.

1.05 OPERATION AND MAINTENANCE (O&M) DATA

A. Format and Scheduling:

1. Preliminary Data:
   a. Format: Instructional Manual.
   b. Submit subsequent to Engineer approval of Shop Drawings, but prior to shipment date.
   c. Submit two copies for Engineer's review.
      1) If data meets conditions of the Contract:
         a) One copy will be returned to Equipment Manufacturer.
         b) One copy will be retained in Engineer's file.
      2) If data does not meet conditions of the Contract:
         a) All copies will be returned to Equipment Manufacturer with Engineer's comments (on separate document) for revision.
         b) Resubmit same number of copies, revised in accordance with Engineer's comments.
2. Final Data:
   a. Submit at the time of shipment of Goods.
   b. Format: Instructional Manual and Electronic Media.
   c. Data: Submit 3 hard copies and one electronic copies.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
   a. Project title.
   b. Designate applicable system, equipment, material, or finish.

c. Identity of separate structure as applicable.
d. Identity of general subject matter covered in manual.
e. Identity of equipment number, if applicable, and Specification section.

4. Title Page:
   a. Equipment Manufacturer's name, address, and telephone number.
   b. Subcontractor, supplier, or maintenance contractor's name, address, and telephone number, as appropriate.
      1) Identify area of responsibility of each.
      2) Provide name and telephone number of local source of supply for parts and replacement.
5. Table of Contents:
   a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
   b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
6. Paper: 20-pound minimum, white for typed pages.
7. Text: Manufacturer's printed data, or neatly typewritten.
8. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
9. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:

1. Portable Document Format (PDF):
   a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on USB drive.
   b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
   c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.
   d. Data shall be represented on the Asset Management Forms provided at the end of this section.

D. Data Content:

1. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.

c. Function, normal operating characteristics, and limiting conditions.
d. Performance curves, engineering data, nameplate data, and tests.
e. Complete nomenclature and commercial number of replaceable parts.
f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
g. Spare parts ordering instructions.
h. Where applicable, identify installed spares and other provisions for future work (for example, reserved panel space, unused components, wiring, terminals).

2. Color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
   a. Format:
      1) Provide reinforced, punched, binder tab; bind in with text.
      2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
      3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
      4) Identify Specification section and product on Drawings and envelopes.
   b. Relations of component parts of equipment and systems.
   c. Control and flow diagrams.
   d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
   a. Format:
      1) Organize in consistent format under separate heading for each different procedure.
      2) Provide logical sequence of instructions for each procedure.
      3) Provide information sheet for Contractor's personnel, including:
         a) Proper procedures in event of failure.
         b) Instances that might affect validity of warranties.
   b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
   c. Operating Procedures:
      1) Startup, break-in, routine, and normal operating instructions.
      2) Test procedures and results of factory tests where required.
      3) Regulation, control, stopping, and emergency instructions.

4) Description of operation sequence by control manufacturer.
5) Shutdown instructions for both short and extended duration.
6) Summer and winter operating instructions, as applicable.
7) Safety precautions.
8) Special operating instructions.

d. Maintenance and Overhaul Procedures:
1) Routine maintenance.
2) Guide to troubleshooting.
3) Disassembly, removal, repair, reinstallation, and re-assembly.

E. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data, nameplate data, and tests.
c. Complete nomenclature and commercial number of replaceable parts.
d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards:
a. Electrical service.
b. Controls.
c. Communications.
3. List of electrical relay settings and control and alarm contact settings.
4. Electrical interconnection wiring diagram, including control and lighting systems.
5. Operating Procedures:
a. Routine and normal operating instructions.
b. Sequences required.
c. Safety precautions.
d. Special operating instructions.
6. Maintenance Procedures:
a. Routine maintenance.
b. Guide to troubleshooting.
c. Adjustment and checking.
d. List of relay settings, control and alarm contact settings.
7. Manufacturer’s printed operating and maintenance instructions.
8. List of original manufacturer’s spare parts, manufacturer’s current prices, and recommended quantities to be maintained in storage.

F. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable item, respective unit or system, and for components or sub-units.
2. Format:
   a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
   b. Each Maintenance Summary may take as many pages as required.
   c. Use only 8-1/2-inch by 11-inch size paper.
   d. Complete using typewriter or electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
   a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
   b. "Unit" is the unit of measure for ordering the part.
   c. "Quantity" is the number of units recommended.
   d. "Unit Cost" is the current purchase price.

1.06 SUPPLEMENTS

A. The Supplements listed below, following "End of Section," are part of this Specification:

1. Notice of Schedule Impact.
2. Transmittal of Equipment Manufacturer's Submittal Form.
3. Asset Maintenance Forms:
   a. Asset Summary Form.
   b. Maintenance Summary Form.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

NOTICE OF SCHEDULE IMPACT

(Send this form as addressed if delay is over 5 days. Send either via e-mail.)

To: _____

Attention: _____

Address: _____

E-mail: _____

RE: Contract No.: _____

Name of Contract: _____

Type of Goods: _____

Nature of Delay: _____

New Estimated Date for Final Shop Drawings: _____

New Estimated Date for Start of Manufacture: _____

New Estimated Date for Finish of Manufacture: _____

New Estimated Date for Shipment: _____

New Estimated Date for Arrival at Point of Destination: _____

EQUIPMENT MANUFACTURER:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ Telephone: _____

E-mail: _____

By (Name/Title): _____ Date: _____

TRANSMITTAL OF EQUIPMENT MANUFACTURER'S SUBMITTAL
(ATTACH TO EACH SUBMITTAL)

Date: _____

TO:_____
_____
_____
_____
_____

Submittal No.:_____
☐ New Submittal ☐ Resubmittal
Project:_____
Project No.:_____
Specification Section No.:_____
(Cover only one section with each transmittal)
Schedule Date of Submittal:
_____

FROM:_____
Equipment Manufacturer
_____
_____
_____

SUBMITTAL TYPE: ☐ Shop Drawing ☐ Sample ☐ Informational

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

EQUIPMENT MANUFACTURER hereby certifies that (i) EQUIPMENT MANUFACTURER has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By:_____
EQUIPMENT MANUFACTURER (Authorized Signature)

ASSET SUMMARY FORM

Owner Name: GNHWPCA **Project Number/Name:** _____

General:

Description: _____ Tag #: _____

Type: _____

Area: _____

Building/Room: _____

Vendor: _____ Website: _____

Manufacturer: _____ Website: _____

Model #: _____ Serial #: _____ Mfg Job #: _____
if serial # is unavailable

Install Date: _____ Purchase Date: _____

Start-up Date: _____ Warranty End Date: _____

Specification(s):

Pump Size/Size	Pump Flow	Pump Head	Pump Media

HP	Frame	RPM	Voltage

Component(s):

		Specifications (if applicable)			
ID	Component Name - Mfg.	HP	Frame	RPM	Voltage
1					
2					
3					
4					
5					

ASSET SUMMARY FORM cont.

Attachment(s):

ID	Attachment Name
1	
2	
3	

Existing Asset(s):

If replacing existing asset, record the tag and descripition of each existing asset:

Tag	Description

Contact Information:

General Contr.: _____ Email: _____

Phone: _____

Design Engineer: _____ Email: _____

Phone: _____

Sub-Contractor: _____ Email: _____

Phone: _____

For Owner Use Only:

Representative: _____ CMMS Upload Date: _____

CMMS Asset ID: _____

ASSET SUMMARY FORM

Owner Name: GNHWPCA **Project Number/Name:** _____

General:

Description: _____ Tag #: _____

Type: _____

Area: _____

Building/Room: _____

Vendor: _____ Website: _____

Manufacturer: _____ Website: _____

Model #: _____ Serial #: _____ Mfg Job #: _____
if serial # is unavailable

Install Date: _____ Purchase Date: _____

Start-up Date: _____ Warranty End Date: _____

Specification(s):

Pump Size/Size	Pump Flow	Pump Head	Pump Media

HP	Frame	RPM	Voltage

Component(s):

		Specifications (if applicable)			
ID	Component Name - Mfg.	HP	Frame	RPM	Voltage
1					
2					
3					
4					
5					

ASSET SUMMARY FORM cont.

Attachment(s):

ID	Attachment Name
1	
2	
3	

Existing Asset(s):

If replacing existing asset, record the tag and descripition of each existing asset:

Tag	Description

Contact Information:

General Contr.: _____ Email: _____

Phone: _____

Design Engineer: _____ Email: _____

Phone: _____

Sub-Contractor: _____ Email: _____

Phone: _____

For Owner Use Only:

Representative: _____ CMMS Upload Date: _____

CMMS Asset ID: _____

SECTION 01 43 34
SPECIAL SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Startup Assistance: Assistance provided from the Equipment Manufacturer in order to plan out the testing phase of the project.

B. Factory Testing: Controlled tests necessary to demonstrate that Equipment meet specified performance requirements.

C. Functional Testing: Field tests necessary to demonstrate that installed Equipment function and operate in the manner intended. Functional testing is a prerequisite to demonstration testing when specified.

D. Demonstration Testing: Field tests necessary to demonstrate, after successful functional testing, that Equipment meet specified performance requirements within acceptable tolerances as specified.

E. Installing Contractor: The entity, under separate contract with the Contractor, whose responsibilities include the installation of the Equipment provided under this Contract.

1.02 MANUFACTURER'S REPRESENTATIVE

A. Where Special Services are specified, Equipment Manufacturer shall furnish a qualified representative of manufacturer.

B. If manufacturer's representative is found deficient in training or experience by Contractor or Engineer, furnish replacement representative after acceptance of resume and other qualification documentation of proposed representative.

1.03 INSTALLATION ASSISTANCE

A. See Section 44 42 19.05, High Speed Turbo Air Compressors.

1.04 COMMISSIONING ASSISTANCE

A. Startup Assistance: Where specified, furnish representative to assist installing contractor with startup of furnished Equipment:

1. Equipment Manufacturer's representative shall be present during prestartup meetings.

2. Furnish labor and materials, tools, instruments, and services for checking, testing, and startup specified.
3. Develop a standard record of testing. This record shall:
   a. Be subject to approval of Engineer.
   b. Include name of Equipment and subsystem, if applicable.
   c. Have provisions for recording dates of completion for checking, inspection by manufacturer, verification of instrumentation and controls, and completion of subsystem tests.
   d. Allow space for describing problems remaining with Equipment, and for signature of Engineer indicating acceptance.

B. Functional Testing: Where specified, assist installing contractor in performing functional (or run) testing of furnished Equipment. Furnish representative to assist with test and necessary adjustments.

C. Demonstration Testing: Where specified, assist installing contractor in conducting demonstration testing of furnished Equipment. Furnish representative to assist with tests as specified for the particular Equipment and to correct malfunctions.

1.05 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by Equipment Manufacturer's representative.

B. Such form shall certify signing party is a duly authorized representative of Equipment Manufacturer, is empowered by Equipment Manufacturer to inspect, approve, and operate their Equipment and is authorized to make recommendations required to ensure that the Equipment are complete and operational.

1.06 DEMONSTRATION AND TRAINING

A. Where specified, furnish Equipment Manufacturer's representative to instruct Contractor's personnel in proper operation and maintenance techniques for the furnished Equipment:

B. Training services may include classroom or onsite instruction, either prestartup or post-startup, as stated in the Specifications.

C. Prestartup Training:

1. Prestartup training shall be completed at least 14 days prior to actual startup.
2. Operation and Maintenance Data shall be reviewed and accepted before initiation of prestartup training.

D. Post-Startup Training: Furnish and coordinate specified manufacturers' services and Equipment Manufacturer's personnel for post-startup training of Owner's operating and maintenance personnel.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. Forms: Manufacturer's Certificate of Proper Installation.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

CONTRACTOR: _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- ☐ Installed in accordance with manufacturer's recommendations.
- ☐ Inspected, checked, and adjusted.
- ☐ Serviced with proper initial lubricants.
- ☐ Electrical and mechanical connections meet quality and safety standards.
- ☐ All applicable safety equipment has been properly installed.
- ☐ Functional tests.
- ☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate its equipment and (iii) authorized to make recommendations required to ensure that the Equipment furnished by the Equipment Manufacturer are complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Equipment Manufacturer: _____

Manufacturer's Authorized Representative: _____

(Authorized Signature)

SECTION 01 61 01
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. As specified in Section 44 42 19.05, High Speed Turbo Air Compressors.

1.02 PREPARATION FOR SHIPMENT

A. Where specified, factory test results shall be reviewed and accepted by Contractor or Engineer before Equipment are shipped.

B. When practical, Equipment shall be factory assembled. When impractical:

1. Furnish assembly instructions.
2. Mark or tag the separate parts and assemblies for field assembly.
3. Cover machined and unpainted parts that may be damaged by elements with a strippable protective coating.

C. Package or crate Equipment to provide protection from damage during shipping, handling, and storage.

D. Marking: Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of project and Equipment Manufacturer, equipment number, and approximate weight.

E. Spare Parts and Special Tools:

1. Deliver at same time as Equipment delivery.
2. Mark to identify associated products by name, equipment, and part number.
3. Package parts for protection against damage from elements during shipping, handling, and storage.
4. Ship in boxes or containers marked to indicate contents and as stated above.

F. Accessories:

1. Deliver at same time as Equipment delivery.
2. Furnish accessories required to place each item of equipment in full operation.
3. Accessories include, but are not limited to, adequate oil and grease as required for first lubrication of equipment and additional maintenance required by manufacturer prior to Contractor turning equipment over to

Owner, light bulbs, fuses, hydrant wrenches, valve keys, chain operators, special tools, and other items as required for initial operation.

1.03 DELIVERY OF EQUIPMENT

A. Notify Contractor, on Equipment Manufacturer's Notice of Shipment of Equipment form attached to this Section, 15 days prior to shipment of Equipment in accordance with Article 6 of General Conditions. Provide all applicable information requested on form.

B. In accordance with Article 6 of the General Conditions, provide 24-hour telephone notice prior to expected delivery time at the Point of Destination. Notice shall include approximate hour of delivery.

C. Delivery of Equipment shall be made during regular daytime working hours, Monday through Friday, unless other arrangements have been made previously with the Contractor.

D. Inspection on Delivery:

1. Construction Contractor will record receipt of Equipment at the Point of Destination.
2. Upon receipt of Equipment at the Point of Destination, Construction Contractor and Engineer will inspect for completeness and evidence of damage during shipment.
3. Should there appear to be damage, Construction Contractor or Engineer will immediately inform the transportation carrier.
4. Damaged or incomplete Equipment to be returned to Equipment Manufacturer for replacement will not be unloaded, except as necessary to expedite return shipment.
5. Equipment Manufacturer shall expedite replacement of damaged, incomplete, or lost items.

1.04 UNLOADING OF EQUIPMENT

A. After acceptance by inspecting party, Equipment will be unloaded by Construction Contractor in accordance with manufacturer's instructions, or as specified.

1.05 SUPPLEMENTS

A. The Supplements listed below, following “End of Section,” are part of this Specification:

1. Equipment Manufacturer's Notice of Shipment of Equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

EQUIPMENT MANUFACTURER'S NOTICE OF SHIPMENT OF EQUIPMENT

Delivery of this notice should be either via fax, e-mail, or registered overnight mail to Contractor, Engineer and Owner.

To: _____

Attention: _____

Address: _____

_____

Fax No.: _____

E-mail: _____

RE: Contract No.: _____

Name of Contract: _____

Equipment to be Shipped: _____

_____

ATTACH BILL(S) OF LADING FOR ALL SHIPMENTS TO THIS FORM.

Date of Shipment: _____

Manner of Shipment/Name of Carrier: _____

Anticipated Date of Delivery: _____

Special Equipment or Services Required for Unloading/Storage: _____

_____

_____

EQUIPMENT MANUFACTURER:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ Telephone: _____

E-mail: _____

By (Name/Title): _____ Date: _____

SECTION 44 42 19.05
HIGH SPEED TURBO AIR COMPRESSORS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers the work and services necessary to design, fabricate, test, deliver to site, and startup of High Speed Turbo Air Compressors and all appurtenances as specified herein.

B. The compressors shall be complete pre-packaged units. High efficiency, high speed motors shall be furnished as an integral part of the compressor core assembly. In general, each compressor shall be housed in a sound attenuating enclosure with flanged inlet and outlet connections, shall have an inlet air filter, inlet silencer, inlet and outlet flexible joints, outlet silencer, check valve, electric actuated isolation valve, blow-off valve and silencer, motor cooling air outlet silencer, adjustable frequency drive, instruments and integral local control panel, magnetic bearings, uninterruptible power supply (UPS) and other appurtenances as described in this specification section needed for a complete system. Harmonic filters required to reduce harmonic distortion to the limits specified herein, shall also be supplied either in separate enclosures or inside the compressor enclosures. The compressor system shall also be supplied with a single master control panel (MCP), located remotely, to monitor and control the compressors based on operational requirements and motor run time. The same supplier shall furnish the turbo air compressors and accessories.

C. The compressors will be installed in the Process Air Facility at the East Shore Water Pollution Abatement Facility with suction taken from a plenum within the building and discharged to a common discharge manifold to supply air for aeration within the Biological Reactor Basins (Bioreactors).

D. Compressors shall be complete pre-packaged units as described below:

1. High efficiency, high speed, single-stage, radial centrifugal turbo air compressor with magnetic bearing and direct coupled electric motor providing absolutely oil-free air to the aeration system.
2. A UL listed adjustable Frequency Drive (AFD) to vary the speed of the motor/compressor.
3. An inlet filter and inlet silencer.
4. AFD/motor cooling air outlet silencer.
5. Discharge check valve.
6. Discharge butterfly isolation valve (electrically actuated).

7. Blowoff valve with flanged silencer.
8. Inlet and outlet flexible connections.
9. Pressure and temperature monitoring devices.
10. Local Control Panel (LCP) with uninterruptible power supply (UPS) mounted and prewired on a common base plate with each turbo air compressor.
11. A single Main Control Panel (MCP), located remotely as shown on the drawings to monitor and cycle all of the compressors based on air requirements and motor run time. The master panel shall be designed to control all compressors, including standby unit.
12. Harmonic filters.

E. The compressor equipment shall be produced and assembled by the compressor manufacturer at a facility owned and operated by the compressor manufacturer and under the direct supervision and control of the compressor manufacturer.

F. The compressor manufacturer may provide the compressor control panels and adjustable frequency drives from another manufacturer. However, all of this equipment shall be the responsibility of the compressor manufacturer to furnish and coordinate.

G. Compressors shall be automatically sequenced, through the MCP, to control compressor speed and number of compressors based on either system flow or a constant discharge header pressure with mode selection and setpoints received from Plant SCADA over a Rockwell EtherNet/IP network when MCP is remote mode or received from MCP when in local mode.

H. Supplier of High Speed Turbo Air Compressor system shall participate in applications software (PLC and OIT programming) workshops. The purpose of the workshop is to coordinate project scope of work, system functionality, network communications and messaging, alarms, displays, and required interlocks between Plant SCADA, MCP, and LCPs. Workshop can be conducted remotely via Zoom or Microsoft Teams or through telephone conference. Provide total minimum of 8 hours for the workshops during design and 40 hours for workshops and coordination with the SCADA developer during construction and programming.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Bearing Manufacturers' Association (ABMA).
2. American Iron and Steel Institute (AISI).
3. American National Standards Institute (ANSI).

4. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
5. American Society of Mechanical Engineers (ASME):
   a. PTC-13, Performance Test Code on Compressors and Exhausters.
   b. PTC 36, Measurement of Industrial Sound.
6. ASTM International (ASTM):
   a. A48/A48M, Standard Specification for Gray Iron Castings.
   b. A278, Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 343 degrees C.
7. Institute of Electrical and Electronics Engineers (IEEE):
   a. 85, Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery.
   b. 112, Standard Test Procedures for Polyphase Induction Motors and Generators.
8. National Electrical Manufacturers Association (NEMA): MG 1, Motors and Generators.
9. Occupational Safety and Health Administration (OSHA).
10. Underwriters Laboratories, Inc. (UL):
    a. 674, Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
    b. 1283, Standard for Safety for Electromagnetic Interference Filters.

1.03 DEFINITIONS

A. Actual Cubic Feet per Minute (acfm): Air volume in cubic feet per minute corrected to Site conditions of elevation, temperature, and relative humidity.

B. Ambient (Inlet) Pressure: absolute pressure of the ambient air measured in the vicinity of the compressor inlet measured at the stagnation condition. This will equal barometric pressure under typical conditions.

C. Ambient (Inlet) Temperature: total temperature of the ambient air in the vicinity of the compressor package, but unaffected by it.

D. Input Horsepower (IHP): Input horsepower (or wire power) is the total horsepower required to operate the compressor motor and all ancillary equipment drive motors.

E. Compressor Package: Compressor package is defined by the limits of the scope of supply as specified in the overall project contractual agreement pertaining to the compressor installation. This shall include all deliverable components including valves, control panels, disconnects, etc. as specified herein to form an operational machine including but not limited to inlet, discharge, and all power devices that affect power consumption.

F. Discharge Pressure: Pressure in pounds per square inch gauge (psig) at compressor package discharge flange. Typically measured downstream of the check valve at rated capacity.

G. Inlet Cubic Feet per Minute (icfm): The rate of flow which is determined by delivered mass flow rate divided by inlet total density as defined by the inlet to the package. Air volume in cubic feet per minute entering compressor at inlet pressure and temperature conditions corrected for Site conditions and includes inlet filter and inlet line losses.

H. Overall (Wire to Air) Efficiency: Is the wire to air isentropic efficiency of the entire compressor package. This includes energy losses from all components within the compressor package. This is the ratio of total measured wire-to-air (system) power demand to the power of compression due to an assumed reversible, adiabatic compression process with constant entropy.

I. Pressure Rise: Difference between pressure at the compressor package discharge flange (typically downstream of the check valve) and the package inlet flange in pounds per square inch (psi).

J. Standard Cubic Feet per Minute (scfm): Air volume in cubic feet per minute corrected to standard conditions of 68 degrees F, 14.70 psia, and 36 percent relative humidity.

K. Compressor Package Total Wire Power (kW or hp): The compressor package total wire power is the electrical power measured at the power input to the compressor package. This shall include all power consuming electrical components of the compressor package as required for installation and normal operation. i.e., drive motor, motor cooling fan, magnetic bearing and controller, bearing cooling fans, coolant pump and heat exchanger, enclosure and package cooling fan, sine wave filter or output reactor, variable frequency drive and cooling fan, input choke or line reactor, harmonic filter, local control panel, PLC or processor, HMI and miscellaneous electronics, voltage transformer(s), DC power supplies, power conditioner, etc. If the compressor package receives multiple power feeds, this is the sum of all wire powers measured individually.

1.04 COMPRESSOR DESIGN CRITERIA

A. Each Turbo Air Compressor system shall be designed for the following conditions of service:

Table 1
Design Criteria Summary Table

Total Number of Compressors	6 (5 duty, 1 standby)
Method of Operation	In parallel, continuous system operation with cycling of units as determined by air demand of the system
Compressor Type	High Speed Turbo
Drive Type	Direct coupled
Design Site Elevation (NAVD 88)	19 feet
Inlet Pressure	Ambient
Maximum Compressor Inlet Pressure Loss (air pipes, dirty filter and inlet silencer)	0.25 psi
Design Total Compressor System Capacity	43,600 scfm
Design Discharge Pressure[1]	7.7 to 10.25 psig
Package Discharge Flange	ANSI 150-pound. bolt pattern
Primary Air Source	Ambient air
Package Inlet Flange	ANSI 150 lb. bolt pattern[2]
Available Power Voltage	480 V
Available Power Phase/Frequency	3-Phase / 60 Hz
Maximum Noise at 3 Feet (free field)(3)	<80 dba
Allowable vibration level	<1 mm/sec

[1]The discharge pressure (delivered pressure) as measured downstream of the check valve.

[2]The inlet pipe is the piping between the inlet flange and the compressor inlet filter.

[3]When measured in accordance with ASME PTC 36, Measurement of Industrial Sound, and operating at the maximum design capacities.

B. Compressor continuous duty design operating conditions at design service conditions listed below:

Table 2
Continuous Duty Design Operating Conditions (5 Duty, 1 Standby)

Design Operating Condition	Total Air Rate (scfm)	Inlet Temperature (deg. F)	Relative Humidity (%)
Winter	9,500 to 31,900	-5 to 82	54 to 74
Fall/Spring	9,500 to 39,000	15 to 74	54 to 85
Summer	13,000 to 43,600	40 to 104	50 to 86

Notes:

1) Each discharge operating condition shall be considered at a discharge pressure range between 7.7 and 10.25 psig.

2) Maximum dewpoint of 84 degrees Fahrenheit.

a. Compressors shall be capable of continuously operating on any points on Table 2.
b. Total Power Consumption: Manufacturer shall supply Total Power Consumption for all listed operating design points under all service conditions.

2. Compressor Requirements:
   a. The system shall be designed to operate continuously over the entire air requirement range. One standby compressor shall be available at all times over the entire air requirement range.
   b. Individual compressors shall ALL be identical in size.
   c. All compressors shall be sequenced through a Master Control Panel (MCP).
   d. Manufacturer shall confirm 5 duty units will meet the specified range of operating design points.
3. Motor Size (hp): As determined by Supplier, not to exceed 600 hp at 480 volts.

1.05 SUBMITTALS

A. General: Administrative, shop drawings, samples, quality control, and contract closeout submittals shall conform to the requirements of Section 01 30 00, Administrative Requirements. All submittal dimensions, calculations, and other information shall be in English units of measure.

B. Action Submittals:

1. Proposal Submittal: Submittals provided with the Proposal Documents shall be for the purpose of determining responsiveness and shall be used by the Owner in selecting the successful compressor manufacturer. Proposal Documents must adequately represent the facilities to be constructed. Use the key words at the beginning of each item below for tab labels in the submittal. Submittals required with proposal documents:
   a. Scope:
      1) Identify all items in the Manufacturer's proposal including equipment and manufacturer services provided. Manufacturer shall also clearly state all items specifically not included in the proposal.
      2) A manufacturing and delivery schedule for the compressor and all appurtenances specified herein.
   b. Exceptions:
      1) Identify any exceptions to these Proposal Documents. Exceptions will be considered during the evaluation process.
      2) Provide any recommendations to make the compressor systems more cost-effective. For each recommendation, identify any sacrifices in terms of operational flexibility, system performance, or operations and maintenance requirements.
      3) Identify any components that are not specified but are necessary to provide a fully operational compressor system. Missing items should be included as separate alternate/options line items on the Form of Quotation.
   c. Installation List: Include a comprehensive list of high speed turbo air compressors installed in the United States and Canada. The list must include equipment model, flow, head, horsepower, service application and years in service. Include a reference contact name with phone number and email for each installation.
   d. Service Network: Manufacturer shall describe their current service network by listing the nearest factory authorized service center and /or qualified service representative. Identify service technicians and include pertinent certifications to substantiate their knowledge and expertise. Manufacturer shall list locations of the nearest parts warehouse and the types and quantities of spare parts kept in stock.

e. Technical:
   1) Mechanical:
      a) Data on the characteristics and performance of the units to indicate ability to meet the system performance specified herein.
      b) Compressor curves showing package discharge pressure and flow capacity, wire to air efficiency and compressor package total wire power demand over the entire range from shutoff to maximum capacity. Clearly show the surge pressure and surge margin associated with each of the performance speed curves. Provide compressor curves for all design operating conditions specified herein.
         (1) On the performance curves indicate the pressure (psig), flow capacity (scfm), power demand (hp), and wire to air efficiency at guarantee points as per Table 2 above.
         (2) Furnish performance curves at full speed and a minimum of four lower speeds to indicate specified volume turndown. Include the capacity line above which the unit should be operated to preclude surging. Include the capacity line below which the unit should be operated to preclude run out.
         (3) Flow ranges (plus or minus for a given operating condition) will not be acceptable.
      c) Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction for the compressor and all appurtenances.
      d) General Arrangement Drawings: Drawings of the compressor system/equipment and all appurtenances (including plans and elevations) based on the conceptual Process Air Facility drawings provided herein.
      e) Equipment: Preliminary Equipment list detailing manufacturers, suppliers, and materials of construction for all major components and appurtenances. Also provide the recommended lifting height and horizontal clearances required for removal and maintenance of the equipment.
      f) Estimated compressor sound level data, for both inlet and radiated conditions, and description of sound

control measures required to meet the specified sound levels.

g) Maximum heat dissipation from compressor enclosure to the space and any ventilation requirements.

h) Provide information about internal and external heat exchangers if applicable. If external heat exchangers are required, provide remote location installation and mounting requirements.

2) Instrumentation and Control:

a) Process and Instrumentation Diagrams: Provide process and instrumentation diagrams (P&IDs) for the compressor system. Clearly delineate on P&IDs those items, including piping, that are part of the manufacturer's scope of supply and those items to be provided by Contractor.

b) Instrumentation: Describe instrumentation, software, hardware, control features, remote system, monitoring, data storage, and alarms. Provide a control system block diagram identifying PLC hardware.

c) Provide an instrument list showing make, model number, and process variable range.

3) Electrical:

a) Provide the total connected and expected electrical demand in kW, kVA, HP, and amperes for each compressor when operating at 100 percent load. Provide the required load information and power requirements for any compressor components that are externally mounted from each compressor enclosure.

b) List all components that will require a separate power supply other than the 480V power supply that is provided to each dedicated compressor enclosure. Additionally, provide the voltage and ampacity requirements for each power feed to all equipment remotely mounted from each compressor enclosure.

c) Provide detailed data on all electrical equipment associated with the proposed compressor system. The literature provided shall, as a minimum, include the following:

(1) Catalog cut sheets on the AFD, harmonic mitigating equipment, compressor motor, enclosure disconnecting means, and all other electrical equipment located within each compressor enclosure. The cut sheets provided

shall include the maximum ampacity and temperature ratings associated with the AFDs and harmonic mitigating equipment proposed.

(2) Voltage and amperage ratings for the AFD and the associated harmonic mitigating equipment located within each compressor enclosure. Each AFD provided shall be sized at 1.15 X the nameplate rating of the motor.

(3) One-line diagram for each compressor enclosure that includes the disconnecting means, control power transformer, AFD, harmonic mitigating equipment, and the specific controls associated with each compressor.

(4) Minimum short circuit ratings of all equipment that is located within each compressor enclosure. All AFDs and associated equipment provided shall be provided with a minimum short circuit ratings of 65KA rms symmetrical.

(5) Calculations that verify the proposed harmonic mitigating equipment meets the harmonic limits specified under all specified operating conditions.

(6) Enclosure proposed for all electrical equipment located either within each compressor enclosure or remotely mounted from the compressor enclosure.

(7) Documentation to verify that the compressor and all associated electrical equipment provided is UL certified.

(8) Detailed drawings that includes the front elevation and the internal control panel logic of the Master Control Panel (MCP). Additionally, the associated enclosure ratings and the materials used to construct the Master Control Panel (MCP) shall be included.

(9) Detailed data on the proposed compressor motor. The data provided shall include the manufacturer and the enclosure ratings provided with the motor. The voltage, amperage, frequency, and service factor ratings shall also be included in the literature provided. The data shall include documentation that verifies that the proposed motor is inverter duty rated as specified.

(10) Detailed catalog cut sheets on the AFD and the associated harmonic filters proposed. The submitted information shall clearly indicate that the electrical equipment proposed is suitable for installation within the environment in which the compressors will be installed. The maximum allowable temperature ratings for all electrical equipment proposed shall be provided.

(11) List any special requirements for the compressors or any electrical equipment associated with the compressor system proposed.

f. Energy Requirements:
   1) Provide estimated annual energy requirements for system, in kWh based on the guaranteed power requirements listed in the Specification herein. Describe assumptions for energy calculations: nameplate power, absorbed power, efficiency, etc. Provide estimated maximum demand in kW for the system. Use an electricity cost of $0.125/kWh.
   2) Submit Table 3 under Article 1.10, herein, fully completed by the Manufacturer, showing guaranteed wire power.
   3) Engineer to perform 20-year life cycle cost as part of the evaluation process.

g. Warranties: Provide information on the compressor system equipment warrantees, specific to this Project, including those described herein.

h. Warranty and Service Agreements: Submit a detailed description of the manufacturer's extended warranty and service agreement options.
   1) Extended Warranty: Include a detailed description of the manufacturer's extended warranty options, modified as necessary to meet requirements specified herein. Description shall include pricing structure.
   2) Service Agreements: Include a detailed description of the manufacturer's service options. Description shall include pricing structure.

2. Shop Drawings and Product Data (to be provided after Equipment Manufacturers selection):
   a. Structural: Anchorage and bracing data sheets and Drawings as required.
   b. Bill of Materials: Complete bill of materials of all components and equipment supplied. Bill of materials shall include make and

model number and replacement cost of the primary components including, but not limited to, the following:

1) Compressor.
2) Motor.
3) AFD.
4) PLC.
5) Harmonic filters.
6) Heat exchangers.
7) Instruments and Sensors (temp, pressure, magnetic bearing controller, etc.).
8) Control transformer.
9) Local control panels
10) Uninterruptible power supply (UPS).
11) Master Control Panel (MCP).

c. Spare Parts: Include a list of manufacturer-recommended spare parts and nearest supplier (identify supplier's name and address, and other pertinent contact information). Include a statement of availability of all parts.

d. Documentation of modifications to the manufacturer's standard design to meet the requirements specified in this section and where the manufacturer's standard design does not comply with the specified performance, features, functions, and materials of construction specified herein.

e. Mechanical:

1) Complete Specifications, descriptive drawings, catalog cuts, and descriptive literature which shall include make, model, dimensions and weight of the compressors, motors, and accessories. Include weight of largest components requiring removal for maintenance.
2) Number of required units for each operating design point, including one standby unit.
3) Detailed layout drawings and dimensional data, including minimum clearance distances around equipment required to access equipment for normal service, repair, and removal.
4) Data on the characteristics and performance of the units to indicate ability to meet the system performance specified herein:
   a) Compressor curves showing package discharge pressure and flow capacity, wire to air efficiency and compressor package total wire power demand over the entire range from shutoff to maximum capacity. Clearly show the surge pressure and surge margin associated with each of the performance speed curves.

Provide compressor curves for all design operating conditions specified herein.

(1) On the performance curves indicate the pressure (psig), flow capacity (scfm), power demand (hp), and wire to air efficiency at guarantee points.

(2) Furnish performance curves at full speed and a at least four lower speeds including minimum speed to indicate specified volume turndown. The capacity line above which the unit should be operated to preclude surging. The capacity line below which the unit should be operated to preclude run out.

5) Inlet and discharge flexible connectors.
6) Inlet air filter and silencer.
7) Heat exchangers if required.
8) Air cooling system fans and waste heat exhaust silencer, etc.
9) Blow-off valve (and electric actuator) and silencer.
10) Check valve.
11) Discharge isolation valve and electric actuator and silencer.
12) Enclosure details.
13) Estimated compressor sound level data, for both inlet and radiated conditions, and description of sound control measures required to meet the specified sound levels.
14) Maximum heat dissipation from compressor enclosure to the space and any ventilation requirements.
15) Provide information about internal and external heat exchangers. If external heat exchangers are required, provide remote location installation and mounting requirements.

f. Electrical:

1) Motor Data: Complete motor data shall be submitted with the driven machinery shop drawings. Motor data shall include items applicable to this motor, such as:
   a) Descriptive information.
   b) Nameplate data in accordance with NEMA MG 1.
   c) Service factor.
   d) Voltage, phase, and frequency ratings.
   e) Full load current.
   f) Locked rotor current.
   g) No load current.
   h) Full load speed.
   i) Safe stall time.

j) Insulation class and temperature rise classification. Certification that motors are inverter duty rated.
k) Multispeed load classification (for example, variable torque).
l) Guaranteed maximum full load wire-to-air power. Also provide nominal air-to-airpower at 1/2 and 3/4 load.
m) Description, rating, and wiring diagram of thermal protection or over temperature protection.
n) Power factor at 1/2, 3/4, and full design flows and conditions.

2) Total wire-to air power consumption per unit for each operating design point.
3) System wiring diagrams, with recommended power feeder conductors sizes and feeder breaker sizes.
4) Bearing type, lubrication, and life.
5) Adjustable Frequency Drive Data:
a) Overall drive system operating data, including efficiencies, input currents, and power factors, at driven equipment actual load and rated system input voltage, at 0, 40, 60, 80, 100, and 110 percent of rated speed.
b) Information on harmonics generated by the drive, along with descriptive information on all reactors, filters, or other harmonics mitigation equipment.
c) Complete system rating, including all nameplate data, continuous operation load capability throughout speed range of 0 to 120 percent of rated speed.
6) UPS installed in each LCP:
a) Estimated load when on UPS.
b) Estimated time for UPS to power critical loads.
c) Estimated load of Magnetic Bearing on UPS.

g. Outline drawings for all items that are shipped loose.

3. Quality of Construction and Qualifications:
a. Proof of listing for Compressor Package by the Nationally Recognized Testing Laboratory (NRTL) such as UL/CSA certification in accordance with UL 1450 or equivalent TUV certification on the same model and size proposed. Certification must be demonstrated prior to acceptance of proposed equipment.
b. Statement of conformance letter stating conformance to specifications with all exceptions noted. Statement of conformance must be signed by an individual authorized to make such statements.

4. American Iron and Steel Bidders Certification.

5. Manufacturer's Certification that Bidder, if not Manufacturer, is authorized by Manufacturer to submit Proposal and Manufacturer will abide by submitted Proposal.
6. Proof of Financial Strength: supply documentation to demonstrate the financial strength of the firm bidding and the Manufacturer.

C. Informational Submittals (to be provided after Equipment Manufacturer selection):

1. Detailed factory test procedure with complete piping and instrumentation configuration diagram per ASME PTC-13 showing inlet and discharge air test pipe size. The location, type, and quantity of all major instruments necessary for performance data, including those on air, water, and lube oil with corresponding distances from reference points, shall be identified per ASME PTC-13 requirements. As a minimum, the detailed test plan shall include:
   a. Quality control procedures.
   b. Test procedure and method of calculating results.
   c. Functional testing of entire package, including oil lube system, instrumentation, ancillary components, and LCP.
   d. Insert the actual test report in the Operations and Maintenance Manual.
   e. Field Test: Submit a detailed test procedure for complete compressor systems.
2. Sound power values when measured in accordance with ASME PTC 36, Measurement of Industrial Sound.
3. Master Control Panel (MCP) Factory Test Results:
   a. Submit factory test plan outlining all required testing activities within this section for Engineer approval a minimum of 2 weeks prior to testing.
   b. Submit factory test results including manufacturer’s quality assurance.
   c. Include copies of original test data collection forms.
4. Manufacturer’s Field Report: Submit manufacturer’s field report of inspections, tests, and observations for all items furnished under this section.
5. Operation and maintenance data as specified in Section 01 30 00, Administrative Requirements.
6. Manufacturer’s written equipment, material and spare parts storage and safeguard instructions including any special shipping, storage and protection, and handling instructions.
7. Manufacturer’s printed installation instructions.
8. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 34, Special Services.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: All compressors and appurtenances furnished under this Section shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. Compressor manufacturer shall also provide a written warranty for the compressor and compressor package and shall state that they have reviewed the design and application and that the equipment has not been misapplied.

B. The manufacturer of the high-speed turbo air compressors shall be completely responsible for the proper design or selection of their system components, including but not limited to; compressors, adjustable frequency drives, harmonic filters, heat exchangers, blow-off valves, and all applicable compressor controls. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the Drawings and Specifications.

C. Equipment must meet the detailed requirements specified herein. Manufacturers shall not state a “standard product” cannot meet the spec. Such products shall be modified, redesigned from the standard mode for this specific project, and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the Specification.

1.07 DELIVERY, STORAGE AND HANDLING

A. Shipping:

1. Ship equipment, materials and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which they are intended.
3. Deliver spare parts at same time as pertinent equipment.

B. Receiving:

1. The Manufacturer shall provide an authorized representative to witness, inspect and inventory items upon delivery to Site.
2. The Contractor shall verify all items on manifest have been off-loaded and are undamaged.
3. Confirmation from the Contractor that items have been received.

4. The Contractor shall inspect each box to confirm that each spare part has been received.
5. The Contractor shall photograph each item off-loaded.
6. The Manufacturer shall obtain Contractor's signature on the bill of lading confirming that each item was delivered and provide a copy to the Owner and Engineer.

C. The Manufacturer shall submit written equipment, material and spare parts storage and safeguard instructions.

D. The Contractor shall store equipment per Manufacturer's written instructions.

1.08 OPERATING ENVIRONMENT

A. Compressor package will be installed in an indoor, dry, moderately dusty, mildly corrosive, non-hazardous building located at a wastewater treatment plant: Typical building temperatures from 50 to 105 degrees F. The building is a ventilated, industrial space. All equipment, including controls and electronics provided by the Manufacturer shall be suitable for continuous and standby operation in such an environment.

1.09 WARRANTY

A. The Manufacturer shall provide a standard 1-year warranty for compressors and appurtenances to commence upon Owner's acceptance of partial utilization of equipment.

B. Provide the additional cost for an extended warranty for Owner's consideration as follows:

1. Additional 4-year warranty (total of five).
2. Compressors and appurtenances shall be warranted to be free from defects in workmanship, design or material. If the equipment should fail during the 5-year warranty period due to a defective part(s), it shall be replaced and the unit(s) restored to service at no expense to the Owner.
3. The 5-year warranty shall include cost of parts and labor.

C. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with the warranties made under the general warranty requirements of Contract Documents.

D. Time and materials required to correct defective equipment shall be provided by the compressor manufacturer at no additional cost to Owner.

E. Compressor manufacturer shall guarantee to ship any parts required for emergency repairs on all compressors within 5 working days of acknowledged receipt of the order, or the parts are free of charge to the Owner.

1.10 POWER GUARANTEE

A. Guaranteed Performance: The manufacturer shall submit guaranteed compressor package total wire power (kW) values with the proposal and submittal at the listed design points for both 7.7 psig and 10.25 psig discharge pressures as outlined in Table 3 below. The wire power shall include all losses associated with the compressor package at all specified operating points. The completed table shall be submitted by Manufacturer with the proposal and will be considered the basis of the power guarantee and all related requirements as specified herein.

B. Actual Performance: The actual performance of the compressor package total wire power (kW) will be obtained during the factory performance test as specified herein. Include the results for each compressor package with the factory performance test submittal.

Table 3
Guaranteed Performance Evaluation [1]

Operating Condition	Total Flow (scfm)	Inlet Temp. (deg. F)	Relative Humidity (%)	Recommended No. of Compressors Online [3]	Flow per Compressor (scfm) [3]	Total Wire Power per Compressor Package (kW)[2]	Power Evaluation Factor	Factored Total Wire Power per Compressor Package (kW)
Condition 1	9,500	-5	54				0.15	
Condition 2	31,900	-5	54				0.20	
Condition 3	16,000	60	70				0.30	
Condition 4	13,000	40	86				0.20	
Condition 5	43,600	104	50				0.15	

[1] Allowable Deviation: Flow 0%, Pressure 0%, Power + 1 %.

[2] Guaranteed data shall be provided for each compressor package at each discharge operating condition at both discharge pressures of 7.7 and 10.25 psig.

[3] Manufacturer to provide recommended number of online compressors at the given operating condition. This shall be used to determine flow per compressor for each test condition.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Magnetic bearing turbo air compressors shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

B. Magnetic bearing turbo air compressors that meet all of the requirements of this Specification.

C. Alternate compressor and package selections must submit itemized descriptions of how the selection differs from the Specifications.

2.02 MATERIALS

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Manufacturer may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

B. Major compressor components shall be manufactured from the following materials.

1. Casings and Inlet Inducer: High-strength aluminum alloy.
2. Impellers: High-strength forged aluminum alloy.
3. Rotor Shafts: Alloy steel or titanium alloy with permanent magnets.
4. Compressor and Motor Frame: Welded steel.
5. Inlet and Outlet Accessories: Hot dipped galvanized steel.
6. Expansion Joints: AISI Type 316 stainless steel.
7. Check Valve: AISI Type 316 stainless steel/FKM seal.

2.03 EQUIPMENT FEATURES

A. General:

1. The compressors shall meet all design, performance and operating criteria listed in the Design Criteria portion of this section.
2. The compressors shall be of single-stage centrifugal design utilizing oil free non-contacting magnetic bearing technology with the following design characteristics.
   a. The compressors shall be designed for heavy, continuous, industrial service, be capable of providing a minimum of 6 starts

per hour and have a minimum design life of 20 years before any major rebuild will be needed.

b. The compressors will withstand up to 5,000 shutdowns under full power failure without damage to the bearings.
c. Regardless of theoretical bearing life calculations, the bearings shall be sized for a minimum of expected 20,000 on/off cycles between major overhauls. Bearings that fail before 20,000 on/off cycles shall be replaced by the Compressor Manufacturer at no cost to the Owner.
d. Operate within specified vibration levels without overloading the drive motor.
e. The rotor shall remain levitated at all times while power is being supplied to the turbo air compressor. Turbo air compressors with rotors that rest on bearings while in the standby mode with power supplied to the compressor shall not be considered as an equal.
f. Operate without sign of distress when operating at specified operating point and at off design conditions.
g. Have a pressure-volume curve, which extends from the design system pressure to the upper system surge pressure with a continuously rising pressure characteristic.
h. Will not surge at or above specified flow rates corresponding to specified differential pressure.
i. The maximum input motor horsepower should not exceed specified nameplate horsepower when operating at design flows.
j. The turbo air compressor must deliver oil-free and non-pulsation air at all times to the aeration process.

3. Design compressor cooling system to consist of liquid or air cooling. Design liquid cooling system as a closed loop system, requiring no external connections or water supply from the plant. Provide cooling system capable of accommodating range of ambient conditions expected.
3. Supply each compressor with a sound enclosure covering the entire compressor package; fabricated of stainless steel or aluminum. Design sound enclosure to permit easy inspection and maintenance of all compressor package components. Provide quick release panels, each with at least two handle locations and weighing less than 55 pounds (as mandated by OSHA), enabling easy and quick access for routine maintenance of the compressor package components. Should the panels be heavier than 55 pounds, supply hinged doors with the appropriate frame, reinforcements, and supporting elements.
4. Wire to air power must include all motor, thermal, mechanical and electrical losses of the turbo air compressor as well as losses of all auxiliary equipment such as all lubrication systems, cooling systems, etc.

5. The compressors shall be capable of variable speed operation with a minimum turndown no higher than 45 percent from its maximum capacity over the entire temperature range and shall use an integral adjustable frequency drive. Turndown of the compressors must be sufficient to ensure that gaps do not occur during transition; overlapping should occur at any continuous duty design operating conditions; refer to Table 2 herein. Each compressor shall be capable of operating continuously and satisfactorily at any point between the minimum and maximum flows without any surge, vibration, hunting, or excessive heating of bearings or motor.
6. Rotor critical speed must be a minimum of 20 percent above the operating design speed. Each compressor shall be designed to operate to maximize overall system efficiency over the range of operating conditions.
7. Maximum unfiltered peak-to-peak radial or axial displacement of the rotor shaft shall not exceed 1.25 mils at all operating speeds when measured at on the motor or the turbo air compressor base.
8. Free field (R=infinity) sound pressure level without accessories shall not exceed 80 dBA at any point 3 feet from the turbo air compressor assembly, including inlet air filter, when operating at specified air flow rates and differential pressure.
9. Complete compressor package shall be certified by a NRTL such as UL, CSA, or TUV.

B. Compressors:

1. Casing: The spiral volute casing with horizontal intake and vertical discharge connection shall be provided with intake and discharge flanges in accordance with and manufactured to DIN 2576, PN 10 standards. The compressor inlet inducer shall be integral to the compressor volute.
2. Impellers:
   a. The impeller shall be shaped from a solid forging on a numerical machining center using computer aided manufacturing technology to ensure consistent efficiency.
   b. Semi-open impeller design with three dimensional shaped blades optimized for the design range of each compressor.
   c. The impeller shall be attached directly to the motor shaft using an aircraft technology fastener system without a coupling or keyway.
   d. The impeller shall be a standard design configuration.
3. Magnetic Bearing System:
   a. The motor rotor shaft shall be continuously levitated in a magnetic field by the magnetic bearing system. This system shall consist of two radial and two axial active magnetic bearings, two rotor

position sensors, and a magnetic bearing controller (MBC). Compressors that use bearing systems that contact stationary parts during start up or if power is lost are not an acceptable alternate.

b. The position sensors shall continuously measure the shaft position and send a signal to the MBC controlling the energy in the active magnetic bearings keeping the motor rotor shaft levitated and centered.

c. There shall be no mechanical contact at any time between any moving and stationary surfaces during the compressor operation eliminating friction and wearing of all moving parts.

d. The magnetic bearing system shall not require any oil lubrication.

e. The magnetic bearing controller shall be powered by a three-phase, 60-Hz with a power supply that has the same voltage as the main power supply. The magnetic bearing shall be powered from UPS in LCP to provide power during power interruptions.

f. The bearings shall be designed to a minimum of 20,000 starts or a minimum of 10 years between replacements.

g. The compressors shall withstand up to 5,000 shutdowns under full power failure without damage to the bearings.

4. Noise Enclosure:

a. The high speed unit shall be enclosed in a noise reduction system that reduces the noise levels to less than 80 dBA.

b. Enclosure panels shall be easily removable for inspection of the high speed unit.

c. For all panels heavier than 50 pounds, hinged doors must be supplied. The compressor package enclosure shall protect against falling water, condensation, and dust.

d. Noise enclosure shall be designed for easy inspection and maintenance of all compressor package components.

C. Each compressor shall be designed with a flanged inlet to introduce air from an outside air source through an inlet filter.

D. Intake and filter performance losses shall be included by the compressor vendor in the compressor performance calculation. Filters shall be easily serviceable.

E. Compressors shall not allow heat caused by motor or electrical cooling to be exhausted into compressor room.

F. Each compressor shall be supplied with built in vibration isolating mounts. Compressor manufacturer shall be responsible for attenuating noise and vibration in the compressor package such that no special installation base shall be required nor shall any vibration from the compressor package be

transmitted to the floor or intake and discharge base or the piping. Manufacturer shall supply acceptable vibration levels for the entire compressor assembly over the entire operational range of the supplied unit.

G. Each compressor shall be equipped with an integrated, electrically actuated blow-off valve. The valve discharge shall also be supplied with a properly sized blow-off silencer.

H. Noise criteria: Each compressor enclosure and blow-off valve shall not exceed 80 dBA at 100 percent speed and 9.5 psig discharge pressure. Manufacturer shall supply sound pressure levels (dBA) at 100 percent speed and discharge pressure and for all operating design points outlined in this specification.

2.04 ELECTRICAL COMPONENTS AND ACCESSORIES

A. Provide all necessary electrical components and wiring on the compressor skid for a complete, functional compressor system. All equipment on the compressor skid shall be prewired.

B. Wiring: The Drawings and Specifications indicate the anticipated wiring for the equipment provided under this section. All wiring shall meet the requirements of NFPA 70 or nationally recognized testing laboratory. All insulation shall be rated 600 volts, minimum. All low-voltage (24V dc) analog signals shall be run in twisted, shielded pair cable with 600-volt rated insulation.

C. Power Disconnect: Compressors shall be provided with an externally operable power disconnect located on the enclosure exterior accessible from the front of the compressor enclosure.

D. Compressor Drive Motor:

1. Each compressor shall be supplied with a Permanent Magnet Synchronous Motor (PMSM) high speed motor that has no physical connection between stator and shaft, therefore eliminating brushes, slip rings, or break resistors. The PMSM must be combined with a Sine-Wave Filter (Sinus Filter) and Input Line Reactor to maintain cool motor operation and constant motor efficiency with motor turndown. Induction or Brushless DC motors shall not be acceptable.
2. Each motor shall operate on 460/480 volts, three-phase, 60-Hz input power. The maximum allowable motor horsepower shall be as specified in the Design Criteria. Motors shall be premium efficiency type.

3. The motor shall be able to start under the starting conditions required. Compressor manufacturer shall be responsible for coordinating the starting torque requirement of the compressor and the motor with the AFD to ensure proper operation of the system.
4. Motor shall have a guaranteed minimum efficiency of 95 percent.
5. The motor rotor shaft shall be supported by magnetic bearings at all times while power is supplied to the turbo-compressor providing a smooth vibration free rotation over the entire speed range. Compressors that use bearing systems that contact stationary parts during start up or if power is lost are not an acceptable alternate.
6. The motor shall be air cooled by a cooling fan that is mounted directly to the bottom end of the motor rotor shaft or liquid cooled.
7. Additional requirements for the compressor motors are:
    a. Insulation: Epoxy coated Class H rated to 180 degrees C (356 degrees F).
    b. Stator Temperature Monitoring: Internal thermocouple embedded in motor windings with triple redundancy.
    c. Maximum Ambient Temperature: 105 degrees F.
    d. Minimum Ambient Temperature: 50 degrees F.

E. Adjustable Frequency Drive:

1. Adjustable frequency drive (AFD) shall be manufacturer's standard design, generally of the pulse-width modulation design, with all necessary components to provide a complete and functioning compressor system capable of meeting the design requirements.
2. A six-pulse AFD shall be acceptable provided that the harmonic mitigating equipment provided with each compressor allows the cumulative number of compressors in operation to meet the specified harmonic limits. Alternatively, higher pulse AFDs can also be provided in lieu of a six-pulse AFD to better mitigate the harmonics generated at the source of the non-linear load provided that the overall harmonic limits specified are met.
3. AFD inverter shall be listed by a National Recognized Testing Laboratory (NRTL).
4. AFD shall have a service and support facility operation in the U.S.A. for supply, support, and the provision of replacement components.
5. Drive shall be integrally mounted within the compressor enclosure.
6. AFD shall have a sinusoidal filter consisting of an inductor and capacitor filter to increase motor life.
7. The adjustable frequency drive shall be integrally mounted within compressor enclosure, the associated harmonic filter for harmonics mitigation shall be mounted in a companion standalone NEMA 12 enclosure or mounted within the compressor enclosure.

8. Adjustable frequency drive provided for each compressor shall have a components and design strategy to mitigate the impacts of heat and stress on the PMSM that decrease motor life. Each AFD shall have an integrated user interface that includes field bus connection and support software. Provide control of AFD via Compressor LCP touch screen.
9. Harmonic Distortion Limits:
   a. Normal and Standby Source Harmonic Distortion Limits: Compute the normal and standby source harmonic distortion limits. Using the one-line diagrams, compute the normal and standby source individual and total current and voltage harmonic distortion at the point identified as the PCC. The PCC is the switchgear bus the compressor is connected to. The current and voltage harmonic distortion shall not exceed limits specified herein. Use the values of short circuit current I_{SC} and demand load current I_L specified on diagrams. The harmonic calculations shall be performed with all compressors in operation.
   b. Percent total voltage harmonic distortion at the PCC shall not exceed 5 percent.
   c. The short circuit current available at the PCC is 38,500A RMS symmetrical at 480V.
      1) Note that the short circuit available depends on equipment procured therefore coordination between the Vendor and Electrical System Analysis provider will be required.
   d. Compute normal source and the standby source individual and total current harmonic distortion at the PCC in accordance with IEEE Standard 519. Individual current harmonic distortion and the total demand distortion expressed as percent of maximum demand load current I_L for PCC shall not exceed values specified in Table 4 below for both the normal and standby sources.

Table 4

Individual Harmonic Order (Odd Harmonics)	Harmonic Current Distortion Percent of Max. Demand Load Current IL1
h < 11	4.0
11 ≤ h < 17	2.0
17 ≤ h < 23	1.5
23 ≤ h < 35	0.6
35 ≤ h	0.3
Total Demand Distortion (TDD)	5.0

Table 4	
Individual Harmonic Order (Odd Harmonics)	**Harmonic Current Distortion Percent of Max. Demand Load Current IL1**
[1]For harmonic computations, assume all compressors are in operation and that these compressors are operating at full load.	
[2]Limits specified in Table 1 are for AFDs utilizing six-pulse rectifiers. Supplier may choose to provide higher than six-pulse rectifiers or harmonic filters in order to meet the current distortion limits. For converters higher than six pulses, the limits for characteristic harmonics are increased by a factor of √ (q/6), where q is the pulse number, provided that the amplitudes of non-characteristic harmonics are less than 25 percent. Characteristic harmonics are defined as kq±1 where k is an integer and q is the pulse number.	

F. Passive Harmonic Filter:

1. Ampere rating suitable for driven equipment, de-rated for altitude as required.
2. Open magnetics and capacitor assembly to achieve specified harmonic distortion requirements.
3. Enclosure: NEMA 2.
4. Manufacturer: MTE Matrix AP, or-equal.

2.05 APPURTENANCES

A. Inlet Filter and Silencer:

1. Each compressor shall be provided with an inlet filter and silencer.
2. Provide inlet filter units that are 98 percent efficient at 10-micron.
3. Inlet filter shall be installed in the plenum as shown on conceptual Process Air Facility drawings provided herein.
4. Inlet silencer shall reduce sound power levels at inlet filter as indicated in Table 1, Design Criteria Summary Table.

B. Panel Filter Element: Each compressor shall be supplied with a 24-gauge galvanized steel frame, adhesive potted on all four sides. Upstream and downstream, 24-gauge galvanized, flattened, expanded metal screens. Pleat separating glue beads on upstream side, full-face 1/4-inch closed-cell neoprene rubber gasket on downstream side. Includes synthetic medium, 98 percent efficient at 10-micron (nom). Max (clean) initial pressure drop at rated flow 0.5 inch of water. Max (dirty) final pressure drop 6 inches of water.

C. Inlet and Discharge Expansion Joint: Provide each compressor with an inlet and discharge expansion joint capable of withstanding the vacuum, pressure,

and high discharge air temperature up to 300 degrees F under all operating conditions. The expansion joints shall include carbon steel flanges drilled for standard ANSI 150-pound pattern. The expansion joints shall be stainless steel bellows or EPDM type.

D. Each compressor package shall include a flexible connector to be installed on the discharge aeration piping prior to the main air header. The flexible connectors shall be sized for a standard pipe diameter and shall prevent the transmission of noise and vibrations from the compressor package into the piping. The flexible connector shall be suitable for the maximum operating temperature and pressure ratings of the equipment in the air stream. Provide stainless steel restraining bolts and hardware.

E. Each compressor shall be supplied with an electrically actuated butterfly valve for the compressor discharge, which shall be fully closed when the compressor is not in operation and opened when the compressor is called to start. Valves and electric actuators shall be Type V510 as follows:

1. Type V510 Lug Style Butterfly Valve, Resilient Seated, 2 Inches to 20 Inches for Low Pressure Process Air Service:
   a. Lug style cast-iron body, aluminum bronze discs, Type 316 stainless steel one-piece stem, self-lubricating sleeve type bushings, EPDM replaceable resilient seat suitable for operating temperatures up to 250 degrees F, 150 psi working pressure rating, bubble-tight at 50 psi differential pressure, valve body to fit between ASME B16.1 Class 125/150 flanges.
   b. Manufacturers and Products:
      1) Bray Controls; Series 31.
      2) Tyco/Keystone; Model AR2.
      3) Or-equal.
2. Electric Motor Actuators, 480 Volts:
   a. General:
      1) Comply with latest version of AWWA C542.
      2) Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
      3) Controls integral with actuator and fully equipped as specified in AWWA C542.
      4) Stem protection for rising stem valves.
   b. Actuator Operation—General:
      1) Suitable for full 90-degree rotation of quarter-turn valves or for use on multiturn valves, as applicable.
      2) Manual override handwheel.
      3) Valve position indication.

4) Operate from FULL CLOSED to FULL OPEN positions or the reverse in 60 seconds maximum.

c. Open-Close(O/C) Service:
1) Size motors for one complete OPEN-CLOSE-OPEN cycle no less than once every 10 minutes.
2) LOCAL-OFF-REMOTE Selector Switch, padlockable in each position:
a) Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in LOCAL position.
b) Remote OPEN-STOP-CLOSE momentary control dry contact inputs in REMOTE position. Integral seal-in circuits for remote OPEN and CLOSE commands; valve travel stops when remote STOP contact opens.
c) Auxiliary contact that closes in REMOTE position.
3) OPEN and CLOSED indicating lights.
4) Integral reversing motor starter with built-in overload protection.
5) Integral or externally mounted power disconnect switch, lockable in the off position.

d. Limit Switch:
1) Single-pole, double-throw (SPDT) type, field adjustable, with contacts rated for 5 amps at 120V ac.
2) Each valve actuator to have a minimum of two auxiliary transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
3) Housed in actuator control enclosure.

e. Valve shall remain in last position upon loss of signal.

f. Manufacturers and Products:
1) Rotork Controls; IQ/IQT Series.
2) Flowserve Limitorque; MX/QX Series.
3) AUMA; SA/SQ Series.

F. Blow-off Valve: Provide manufacturer’s standard actuated valve. Controls for the valve shall be mounted in each LCP.

G. Each compressor shall be supplied with one Type 316 stainless steel wafer-style, dual-disc check valve installed on the discharge line. Check valves shall be Type V612 as follows:

1. Type V612 Double Disc Swing Check Valve 2 Inches to 48 Inches:
a. Wafer style, spring loaded, Type 316 stainless steel body and discs, EPDM resilient seats, and Type 316 stainless steel spring, hinge pin, and stop pin.

b. Valves 2 inches through 12 inches rated 200 psi nonshock working pressure and valves 14 inches through 48 inches rated 150 psi nonshock working pressure.
c. Temperature Rating: -20 to 300 degrees F.
d. Maximum Headloss through Valve: 0.2 psi when installed in vertical.

H. Each compressor shall be equipped with flanged silencers sized to reduce sound power levels as specified herein for blow-off valve discharge and air cooling waste heat exhaust vent.

I. Each compressor shall be equipped, at a minimum, with the following integrated instrumentation:

1. Inlet differential pressure sensor (before and after each inlet filter).
2. Compressor inlet pressure sensor.
3. Compressor discharge pressure sensor.
4. Compressor inlet temperature sensor.
5. Compressor discharge temperature sensor.
6. Air flow sensor (or method to calculate it).
7. Compressor speed sensor (or method to estimate it).
8. Magnetic bearing controller system.

J. Equipment identification Plate: 16-gauge Type 304 stainless steel with 3/8 inch die-stamped equipment tag number securely mounted in a readily visible location.

K. Anchors: Manufacturer shall size and supply anchor bolts.

L. Provide lifting eyes on the equipment housing for lifting equipment.

2.06 INSTRUMENTATION AND CONTROLS

A. General:

1. Each compressor shall be supplied with a Rockwell ControlLogix PLC or approved controller local control panel (LCP). LCPs shall be Manufacturer’s standard controls.
2. A Rockwell ControlLogix PLC-based master control panel (MCP), used to interface with LCPs and Plant SCADA over Rockwell EtherNet/IP, to sequence compressors ON and OFF, control compressor flow and pressure requirements, and control total air flow as described herein. The manufacturer shall develop and provide the hardware and programming to perform control functions. These functions are identified herein as the MCP control. Note that PLC in MCP shall not

be the sole controller for individual compressors. Remote I/O racks in LCP connected to PLC in MCP is not acceptable. Each LCP shall be provided with associated PLC processor.

3. The MCP shall be capable of receiving a Header Pressure set-point from Plant SCADA. Plant SCADA shall also be able to designate the Lead, Lag1, Lag2, Lag3, Lag 4, and standby compressor. These can also be set locally at the MCP OIT.
4. PLC program shall be clearly annotated defining critical functions. Program shall be ladder or function block.

B. Local Control Panel (LCP):

1. General:
   a. The LCP shall provide for control of all components of an individual compressor. The LCP shall provide all control and monitoring functions required for the operation, monitoring, and protection of the compressor including, but not limited to, timing, interlocks, and permissive functions required for safe operation of its specific compressor.
   b. The LCP shall be factory assembled and wired such that field wiring shall consist only of connection to panel terminals.
   c. All controls and instruments shall fail into a safe condition. The controls shall be designed such that the compressor cannot operate unless the controls are energized, nor can they operate with any defective controls.
   d. Communications between LCPs and MCP shall be via Rockwell EtherNet/IP. Provide unmanaged Ethernet switch if required.
   e. LCP programming and assembly shall support local (manual) stand-alone compressor operation without interface with Main Control Panel (MCP). Interface with MCP required for remote (automatic) start-stop and set-point control and sequencing of compressors.
2. Functional Requirements:
   a. The compressors shall start under an automatic sequence initiated by the local start signal at the LCP when in LOCAL control, or the remote start signal from the MCP when in REMOTE control.
   b. There shall be three means of shutting down the compressor:
      1) Normal Stop: Initiated by pushing the local stop button or remote stop from the plant SCADA. Machine normally stops such that no surging occurs.
      2) Soft Stop Initiated by surge.

3) Emergency Stop Initiated by:
   a) Pushing EMERGENCY STOP button on the local OIT screen. Restart shall require manual reset of the EMERGENCY STOP button.
   b) MCP PLC failure.
4) Power Loss: Upon restoration of power, the system shall require manual restart at MCP or SCADA.

c. The surge detection system shall bypass air through the blow-off valve or shut down the compressor.
d. The compressor machine control and protection system shall include the following instrumentation, as a minimum:
   1) Compressor inlet air temperature transmitter.
   2) Compressor discharge air temperature transmitter.
   3) Compressor inlet air pressure transmitter.
   4) Compressor discharge air pressure transmitter.
   5) Inlet air filter differential pressure Transmitter.
   6) The temperature monitoring system shall monitor and display actual winding temperatures at the LCP. A high temperature (as determined by the compressor manufacturer) shuts down the compressor and gives an alarm. The alarm/shutdown shall be displayed until reset.
   7) Air flow measurement indication (calculated).
   8) Compressor speed and indication.

3. Panel Construction:
   a. Rated to match compressor enclosure and suitable for indoor installation.
   b. Heat rejected by the LCP components shall be cooled by air fans and rejected to the compressor room. Electric motor cooling exhaust shall be rejected to outside of the compressor room.
   c. Power distribution within panel. Circuit breakers only. Fuses considered under specific exceptions.
   d. All conductors clearly marked with permanent labels; handwritten labels not acceptable.
   e. Provide Panel Mounted Operator Interface Terminal (OIT), incorporating manufacturer's standard functions, controls, alarms, and meters in easy-to-interpret operator interface displays.
   f. An unmanaged Ethernet switch shall be provided at each compressor LCP for connecting a portable computer to access OIT, PLC, or communications to MCP.
   g. Each LCP will be supplied with an uninterruptible power supply (UPS) 120V ac control power source and suitable voltage for magnetic bearings.
      1) UPS shall provide power for the magnetic bearings and controlled shutdown during power failure.

h. Power supply for blowoff valve shall be from the LCP.

4. LCP Interfaces with MCP:
   a. All status, alarms, and compressor process variables monitored at the LCP shall be communicated to the MCP, including but not limited to the following items:
      1) Compressor ON.
      2) Compressor FAULT.
      3) Motor Speed.
      4) Inlet Air Temperature.
      5) Inlet Air Filter Differential Pressure.
      6) Surge Parameters and alarms.
      7) Differential Pressure (Inlet/Discharge).
      8) Discharge pressure.
      9) Discharge Isolation Valve OPEN/CLOSE status. Wired directly to the MCP.

C. Master Control Panel (MCP):

1. General:
   a. Provide one MCP capable of controlling all compressors.
   b. MCP shall incorporate non-redundant PLC arrangement.
   c. Rockwell PanelView Plus 6 1500 (15-inch display) Operator Interface Terminal (OIT) to control each compressor unit.
2. Functional Requirements:
   a. The MCP shall bring compressors online and offline, increase/decrease online compressor capacity resulting in a gradual increase/decrease of air throughout the entire range of one to multiple compressors online. In the event of a compressor failure, the next compressor in the preselected start sequence shall come online. Provide control scheme to operate with a minimum number of compressors online while maintaining maximum system efficiency.
   b. On return of power, following a loss of plant power, the compressors shall not restart until the SYSTEM START is initiated by the operator from the MCP or from SCADA. On receiving the RUN command, the MCP shall initiate a sequenced re-start of the compressors. During power outage and return of power, the magnetic bearing shall be powered down through the UPS.
   c. The MCP shall control compressor operation to ensure one available to run compressor remains in standby.
   d. Compressor Control: In Auto Mode, the MCP shall generate commands to the LCPs to start/stop compressors and adjust compressor capacity to maintain the process air flow based on

either a flow, pressure or DO setpoint (control mode to be operator selectable). Pressure control shall be the primary control mode. The MCP shall provide air header flow control over a range of 5,000 to 50,000 scfm with any of the compressors in service. When the MCP is in LOCAL mode, the sequence selection, discharge mode and setpoint will be manually entered by the operator at the MCP. When the MCP is in REMOTE mode, the sequence selection, discharge mode and setpoint will be received from plant SCADA HMI.

e. The OIT for the MCP shall be configured to display multiple graphic screens for displaying operating variables, valve positions, and other relevant data. Operating screens shall include as a minimum:
   1) Screen for start sequence selection of compressors, and compressor SYSTEM START initiation. The compressors shall start in the selected sequence when SYSTEM START is initiated from the MCP or from SCADA.
   2) Discharge pressure setpoint adjustment.
   3) Displays and controls shall be provided to monitor all process variables related to each compressor including signals from two air header pressure transmitters used for control of the compressors when in pressure control mode.
   4) Monitor and modify all process related setpoints, as required.
   5) Display all alarm conditions within entire compressor system.
   6) Control of the compressors and air flow as a manual function.
   7) As a minimum, the MCP shall have status indicators for each compressor as follows:
      a) Compressor in remote.
      b) Compressor ready for start.
      c) Compressor on.
      d) Common alarm.
      e) Compressor START/STOP signal.
      f) Calculated air flow.
      g) AFD speed.

3. Panel Construction:
   a. Enclosure shall be a freestanding NEMA 12 . Enclosure shall be constructed of painted steel or unpainted aluminum, 14 gauge minimum.
   b. The dimensions of the panel shall be freestanding approximately 24 inches wide, 72 inches tall, and 24 inches deep.
   c. Full height, fully gasketed access doors.

d. Latches: Three-point, Southco Type 44.
e. Handles: Keylock handle.
f. Hinges: Full length, continuous, piano type, steel hinges with stainless steel pins.
g. Power distribution within panel. Circuit breakers only. Fuses considered under specific exceptions.
h. All conductors clearly marked with permanent labels, handwritten labels not acceptable.
i. The MCP will be supplied with an integral uninterruptible power supply (UPS) 120V ac control power source.
j. An unmanaged Ethernet switch shall be provided at the MCP for connection to the individual LCPs, the Plant SCADA, and to laptop.
k. Provide dc power supplies as required for lower voltage device and control requirements.
l. Provide the following fully prewired inputs/outputs:
    1) 16 digital inputs.
    2) 16 digital outputs. Provide interposing relays. Relay shall be provided with mechanical or electrical indication that relay is On. Provide pushbutton or lever on relay to manually test output.
    3) 4 analog inputs. Special note: Provide two fused 24V dc circuit to power the two 2-wire discharge pressure transmitters, provided by Contractor under construction contract, to be connected to one of the analog inputs. The pressure transmitters are redundant.
    4) 4 analog outputs.

4. MCP Interfaces with plant SCADA:
    a. All control, monitoring, and alarm signals available to the MCP shall be made available to the plant SCADA via the data Communication system. Data shall be organized within contiguous memory blocks in the MCP PLC to simplify coordination and interface with the plant SCADA.
    b. MCP Control Interfaces with the plant SCADA shall include but not be limited to the following:
        1) Discharge isolation valve positions.
        2) Discharge header pressure.
        3) Discharge air flow (Calculated).
        4) Air flow setpoint.
        5) Compressor status, conditions, and alarms.
        6) Sequence selections.
        7) MCP ON status.
        8) MCP FAIL status.
        9) MCP IN REMOTE.

10) MCP READY.
11) Header pressure HIGH alarm.
12) Header pressure LOW alarm.
13) MCP SHUTDOWN command.

2.07 SOURCE QUALITY CONTROL

A. Factory Testing:

1. All furnished compressors and components supplied within this specification shall be tested. Testing of similar size units and components not actually furnished will not be allowed.
2. The compressor package manufacturer must submit a factory test procedure for approval. Pre-requisite for scheduling the factory test is an approved test procedure at least 2 weeks prior to scheduling the factory test.
3. The test procedure shall include the completed attached supplement, Process and Fluid Components and Electrical Power Related Components – Factory Testing Summary Checklists.
4. The test procedure shall include a sketch of the test setup showing the piping and instrumentation.
5. Upon completion of assembly, the compressor system shall be tested at the place of assembly. Provide 4 weeks' notice, in writing, for the witnessing of the testing.
6. Owner and/or Engineer may witness shop tests, inspect and check testing equipment used, and observe the calibration of pressure gauges and transducers. Pressure measurement devices calibrated at a location remote from the factory will not be acceptable. The use of computer data acquisition systems shall be acceptable. However, all readings must be independently verifiable from certified and/or calibrated instruments.
7. Allow proper time for inspection and witnessing of shop testing of material and equipment. Proper time shall be defined as the time required to successfully complete the specified factory test. Each compressor package shall be factory tested for a duration not less than 4 hours under varying operating conditions.
8. Each individual compressor package including blowoff valve and LCP shall be tested before shipment. The LCP shall be connected to all enclosure instruments, and appurtenances. All start/stop and running sequences and all safety alarm systems shall be tested. The witnessing engineer shall sign the test procedures and results, certifying that the assembled compressors, auxiliaries, blowoff valves, and control panel were tested together, as a system, in the compressor manufacturer's shop.
9. Each compressor package shall be tested in accordance with the ASME Wire-to-Air Performance Test Code for Compressor Systems, PTC-13-2018. Tests shall be conducted using the job motor at actual voltage and

frequency. Calibrated high-accuracy power analyzers shall measure the package wire power at the package power input terminals and include all auxiliary system electric loads as per Section 4-1 of the ASME PTC-13. The test shall include determination of the surge point and verification of the guarantee points. Power factor for each compressor shall be tested. The manufacturer shall verify the compressor motors operate at a power factor equal to or higher than that specified.

10. The compressor delivered flow rate (scfm) and discharge pressure (psi) shall be guaranteed with no negative tolerance. There shall be no other tolerances or measuring uncertainties used in reporting test results. The witnessing Engineer shall sign each copy of the test data log sheet certifying that the required tests were performed in strict accordance with these Specifications and the ASME PTC-13.
    a. The capacity of the compressor shall be defined as described in the ASME PTC-13.
    b. The test shall construct operating curves of inlet to discharge pressure plotted against delivered flow rate (SCFM).
    c. All test equipment shall be calibrated and certified by an independent test agency no more than 12 months prior to the test date. Certificates shall show the stability of calibration over a period of at least 1 year per ISO 9001. All test equipment shall be per Section 4 of ASME PTC-13.
    d. Velocity vibration versus frequency levels shall be recorded within 10-1,000 and 10-10,000 Hz frequency range.
    e. Appurtenances, fittings or specially configured piping on the inlet or the outlet of the machine will ONLY be permitted if they were submitted as part of the Shop Drawing review AND that they can be installed with the equipment and preserve the existing building design. Distance that the machine extends into the room and the centerline elevation of the common discharge header shall be maintained.
11. The compressor test report shall present computations in exact accordance with Section 5 and 6 of ASME PTC-13 with performance curves showing capacity, pressure, and wire power.
12. Provide total power consumption calculations for each compressor for each specified operating conditions.
13. Test results of the motors and compressors shall be included in the Operation and Maintenance Manual.
14. The manufacturer shall provide copies of the test data and all certifications of Factory Testing for approval by the Engineer prior to shipping equipment.
15. The equipment manufacturer shall furnish all air and ground transportation, lodging, miscellaneous travel expenses, and meals for two representatives of Owner and the Engineer for a total of 3 people.

All Factory Tests to be available for the owner and engineer to witness via remote means such as Microsoft Teams or Zoom. The equipment manufacturer shall furnish all air and ground transportation, lodging, miscellaneous travel expenses, and meals for the initial witness testing and any subsequent testing necessitated by failed tests.

B. Master Control Panel Factory Tests:

1. The Owner and Engineer reserves the right to witness the tests specified herein and to inspect the fabrication procedures at any time during the fabrication of the panel.
2. Witnessed panel factory tests shall be conducted per pre-approved factory test plan procedures.
3. Provide 4 weeks' notice, in writing, for the witnessing of the testing.
4. Perform functional tests as follows:
    a. Gather and furnish test information necessary to show conformance to specified requirements.
    b. Manufacturer's Test Representative shall certify test results.
    c. Perform tests on panel(s) actually furnished after construction is complete and final application software is loaded onto all PLCs and OITs.
    d. Simulate interlocks and signals from other connected equipment in order to demonstrate specified operator interface functions and controls.
    e. Provide temporary test software to simulate properly operating motors and valves when actual motors or valves are not connected.
5. Testing shall include, as a minimum:
    a. Inspection for proper construction.
    b. Verification of conformance with OIT standards.
    c. Verification of SCADA remote monitoring and control functions:
        1) Provide test screen for simulating outputs from SCADA and display SCADA monitored points.
    d. Monitoring and control of all connected devices, included those provided by others including two air discharge header pressure transmitters.
    e. Compressors Lead and Lag selections.
    f. Alarm functions.
    g. Switching logic between available and not available compressors.
    h. Power recovery.
    i. All automatic sequences including:
        1) Normal start.
        2) Normal stop.
        3) Controlled shutdown.

4) Local E-stop.
5) Remote E-stop.
6) Power recovery.

j. Obtain acceptance of test reports from Engineer prior to shipment of equipment.

2.08 SHOP PAINTING

A. The compressor enclosure shall be factory painted per manufacturer's standard system and color for interior installation for all cast iron and carbon steel. Aluminum, stainless steel, and brass shall not be painted.

B. Manufacturer shall furnish small quantity kits for touchup painting and for painting other small areas identical to factory paint system and color.

2.09 ACCESSORIES

A. Provide four lifting eyes on the equipment housing and lifting beam as required.

B. Provide touchup paint for field painting. Coating type and color shall match shop paint coating.

C. Tools: Manufacturer shall furnish two sets of special tools required for complete assembly or disassembly of compressor system components for each type or size of compressor specified, together with a neat metal box (or boxes) for the same. The tool kit(s) shall be sufficiently complete to permit normal repair and maintenance of all equipment furnished.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manufacturer shall coordinate the installation, finishing, and the commissioning of the compressors and all appurtenances in accordance with the manufacturer's recommendations and shall furnish written instructions to Engineer. Manufacturer shall inspect installation and provide a certificate of proper installation prior to startup and testing.

B. The compressor supplier shall supply compressor packages shipped completely pre-assembled. Only accessories, silencers, electrical/control connections, discharge air pipe connections, inlet air connections, etc. shall be installed onsite under separate contract.

C. All compressor package deficiencies must be corrected prior to startup or testing.

3.02 STARTUP ASSISTANCE AND TESTING

A. Functional Testing:

1. After the installation of the units and all appurtenances, each unit shall be subjected to functional testing as defined herein. The functional tests shall be conducted under the installation contract by the Manufacturer's Representative. The functional tests shall demonstrate that under all conditions of operation each unit:
   a. Has not been damaged by transportation or installation.
   b. Has been properly installed.
   c. Has no mechanical defect.
   d. Is in proper alignment.
   e. Has been properly connected.
   f. Has current to all motor electrical leads balanced.
   g. Has been properly connected.
   h. Has fully functional instruments that are properly calibrated and set.
   i. Will start, run, and stop in the prescribed manner.
   j. Will run through entire range of specified pressure and flow.
   k. Is free of overheating of any parts.
   l. Is free of all objectionable vibration.
   m. Is free of excessive noise.
   n. Is free of overloading of any parts.
   o. Shall operate as specified with the control system.
2. After each blower has passed functional testing outlined above, the blower system shall pass a functional test to prove the blowers and controls will operate as specified herein. The blower system must pass this functional test before proceeding with demonstration testing. Details of the system functional test requirements will be developed during the construction contract.
3. All labor, and incidentals required to complete the functional tests will be provided by the Contractor under the installation contract. The compressor Manufacturer shall prepare functional testing procedures, assist during functional testing and approve functional testing results. The Contractor shall provide testing equipment including, but not limit to portable power monitoring equipment, recording devices, and pressure sensors to verify field testing results. The compressor Manufacturer shall coordinate all testing requirements with the Engineer prior to commencing functional testing.

B. Demonstration Testing:

1. Once the Manufacturer confirms compressors are correctly installed and properly functioning, the compressors can be connected to diffuser piping to conduct demonstration testing prior to placing compressors in service,
2. Conduct a demonstration test on each set of compressors including instrumentation, controls, and valves. The test shall demonstrate that the compressors will be operated in the entire range of specified pressure and flow while in remote with control from SCADA. The test shall be conducted with the aeration basins full of plant effluent or mixed liquor at normal operating levels.
3. Conduct demonstration of each compressor's ability to be manually restarted through LCP, MCP and SCADA following a plant wide power failure.
4. A Demonstration Test Log shall be submitted to Engineer on completion of each test which records the compressor model number, compressor serial number, test date, beginning test time, ending test time, motor horsepower, motor speed, amperage draw, and all of the key operating parameters specified in the Design Criteria. In addition to this information, Table 5 must be completed during field startup and testing to demonstrate proper operation. Functional test results shall be certified by the manufacturer/manufacturer's representative and witnessed by Engineer.

Table 5
Compressor Demonstration Test Results

Design Point	Input kW Reading	Discharge Mass Flow (scfm)	Discharge Pressure (psig)	Ambient Temp. (degrees F)	Discharge Temp. (degrees F)	Relative Humidity (%)
1						
2						
3						
4						
5						
6						
7						
8						

5. The Contractor will provide, calibrate, and install all temporary gauges and meters, shall make necessary tapped holes in the pipes and install all

temporary piping and wiring required for the demonstration tests. Written test procedures will be submitted to the Engineer for approval a minimum of 60 days prior to testing.

6. For any packages that do not operate properly, corrective measures shall be taken by the Manufacturer at no additional expense to the Owner.
7. Demonstration Testing shall verify that the compressors will operate across the entire range of specified pressures and flows while in remote with control from SCADA.
8. Conduct a minimum of 8-hour demonstration test on multiple scenarios where various numbers of compressors are operating. The test shall demonstrate that the compressors are able to sequence on and off as lead and lag systems as required to maintain the pressure set point received from SCADA. Demonstration testing shall verify the compressors properly operate across the entire range of specified operating flows.

C. Harmonic Distortion Tests: The manufacturer shall retain an independent harmonic testing company to conduct a harmonic distortion tests on the new operational compressor system under the installation contract as outlined below:

1. With each new compressor, as well as combinations of each compressor up to the full operating load, measure current harmonic distortion at the PCC for all harmonics up to 35th harmonic.
2. Show that the percent current harmonic distortion is below specified limits.
3. Measure total voltage distortion at the MCC with two new compressors operating at full load.
4. Measured results should approximate Engineer-approved calculations submitted by the compressor manufacturer.
5. Provide distortion analyser, current, and potential transformers required for the test set up.
6. Submit a test plan for Engineer’s review and approval prior to implementing the actual test. An approved test plan is mandatory before conducting a test.
7. Provide at least 2 weeks’ notice before conducting test.
8. Submit all test documentation for approval.

D. Compressors failing to meet the specifications to the satisfaction of Engineer shall be corrected and re-tested by the Equipment Manufacturer. If a packaged compressor fails the second test, the unit will be rejected and the Equipment Manufacturer shall furnish a unit which shall perform as specified.

3.03 MANUFACTURER'S SERVICES

A. Contractor will coordinate the work schedule of the manufacturer's service personnel during construction, testing, startup, and acceptance.

B. Provide services of a factory trained service engineer, specifically trained on the type of equipment specified. Submit qualifications of service engineer for approval.

C. Manufacturer's field services provided under the installation contract include followings:

1. 1 site visit of 5 person-days for installation assistance.
2. 1 site visit of 5 person-days for functional testing.
3. 1 site visit of 5 person-days for demonstration testing.
4. 1 site visit of 2 person-days for PAC Local Control Panel and instrumentation communicate with MCP prior to startup.
5. 1 site visit of 5 person-days for coordination with SCADA.
6. 1 site visit of 4 person-days for pre-training prior to startup. Training shall not commence until a detailed lesson plan for each training activity has been reviewed and accepted by Engineer.
7. 1 site visit of 8 person-days for Operation and Maintenance Training. Training shall consist of 2 shifts for Operators and 2 shifts for maintenance staff at a minimum. Training shall not commence until a detailed lesson plan for each training activity has been reviewed and accepted by Engineer.

D. See Section 01 43 34, Special Services.

3.04 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Process and Fluid Components and Electrical Power Related Component – Factory Testing Summary Checklists.
2. Process Air Compressor Facility Preliminary Drawings.

END OF SECTION

PROCESS AND FLUID COMPONENTS AND ELECTRICAL POWER RELATED COMPONENTS -- FACTORY TESTING CHECKLISTS

1. Process and Fluid Components:

No.	Component	Included in Performance Boundary		
		Included in Test	Determine by Calculation	Not Applicable
1	Inlet filter			
2	Inlet silencer			
3	Discharge silencer			
4	Inlet isolation valve			
5	Throttling valve			
6	After cooler			
7	Misc. pipe and fittings			
8	Inlet air cooler			
9	Discharge check valve			
10	Discharge isolation valve			
11	Enclosure doors or panel openings			
12	Estimated system inlet press. drop			
13	Blow-off valve			
14	Blow-off silencer			
15	Additional components not listed shall be included as forming the compressor package.			

2. Electric Power Related Components:

No.	Component	Included in Performance Boundary		
		Included in Test	Determine by Calculation	Not Applicable
1	Drive Motor			
2	Motor Cooling Fan(s)			
3	Magnetic Bearing and Controller			
4	Bearing cooling fan(s)			
5	Coolant Pumps			
6	Lubrication Pumps and Accessories			
7	Heat Exchanger Fans			
8	Package Cooling Fan			
9	VFD			
10	VFD Line Side Power Conditioning Equipment			
11	VFD Load Side Power Conditioning Equipment			
12	Eddy Current or Variable Speed Clutch			
13	Operation Control Panel(s)			
14	Power/Isolation Transformers and Power Supplies			
15	Power Conditioner			
16	Compressor and Motor Cooling			
17	VFD Cooling			
18	Electronics compartment A/C			
19	Additional components not listed shall be included as forming the compressor package.			

SHEET KEYNOTES

1. CONTRACTOR TO FIELD VERIFY TOP OF EXISTING GRATING ELEVATION AND CONSTRUCT AIR FACILITY FLOOR ELEVATION TO MATCH.

SHEET KEYNOTES

2. REMOVABLE RAILS FOR 8'-0" SECTION ONLY.
3. INSULATE PIPE IN ELECTRICAL ROOM.

AUTOMATIC TRANSFER SWITCH
480V PANELBOARD DP-55
208/120V PANELBOARD LP-55
A 55-DA-301
96'-0"
6'-8" 4'-0" 13'-4" 4'-0" 8'-0" 4'-0" 8'-0" 4'-0" 8'-0" 4'-0" 8'-0" 4'-0" 8'-0" 4'-0" 8'-0"
LOUVER, TYPICAL OF 6
BLOWER AIR FILTER, TYPICAL OF 6
ELECTRICAL ROOM ⊗ 18.38
14'-0"
39'-4"
NORTH PLENUM ⊗ 18.38
5'-4"
38'-0"
SOUTH PLENUM ⊗ 18.38
⊗ 10.75± UP
SUBSTATION NO. 7
8" CMU WALL, TYPICAL
PASSIVE HARMONIC FILTER, TYP OF 6
38'-0"
34'-8"
FRONT
⊗ 10.75± UP
6'- 1/2 " 4'-9" 4'-9" 4'-9" 4'-9" 4'-9" 4'-8 1/2 "
PROCESS AIR COMPRESSOR NO. 1
PROCESS AIR COMPRESSOR NO. 2
PROCESS AIR COMPRESSOR NO. 3
PROCESS AIR COMPRESSOR NO. 4
PROCESS AIR COMPRESSOR NO. 5
PROCESS AIR COMPRESSOR NO. 6
SUBSTATION NO. 7 POWER MONITORING CONTROL SYSTEM PANEL (PMCS)
36" DISCHARGE HEADER, SEE DWG 50-D-201 FOR CONTINUATION
PROCESS AIR COMPRESSOR ROOM ⊗ 18.38 (1) TYP
⊗ 18.38 CONCRETE LANDING (2)
3'-4" 2'-0" 8'-0" 3'-4" 19'-0"
(3)
AL LADDER TO ROOF
BLOWERS MASTER CONTROL PANEL (MCP)
EXPANSION JOINT
TOP OF EXISTING GRATING EL 18.38± (1)
5'-4" 3'-4" 12'-0" 3'-4" 6'-0" 12'-0" 4'-0" 12'-0" 4'-0" 12'-0" 4'-0" 12'-0" 4'-0" 8'-0" 6'-0"
⊗ 18.38
(1) ⊗ 18.38
UP ⊗ 17.58
25'-9" 20'-0"
GRATING WALKWAY TO ACCESS VALVE
TOP OF EXST AERATION BASIN WALL EL 17.45±
A 55-DA-301
INSULATED TRANSLUCENT PANEL, TYP OF 5
AERATION BASIN
AERATION BASIN

N

FLOOR PLAN

1/4"=1'-0"

NO.	DATE	DR	CHK	APVD	BY	APVD
DSGN	R SIEBERS	SA KORCSMAROS	REVISION		DL LYNCH	

Jacobs

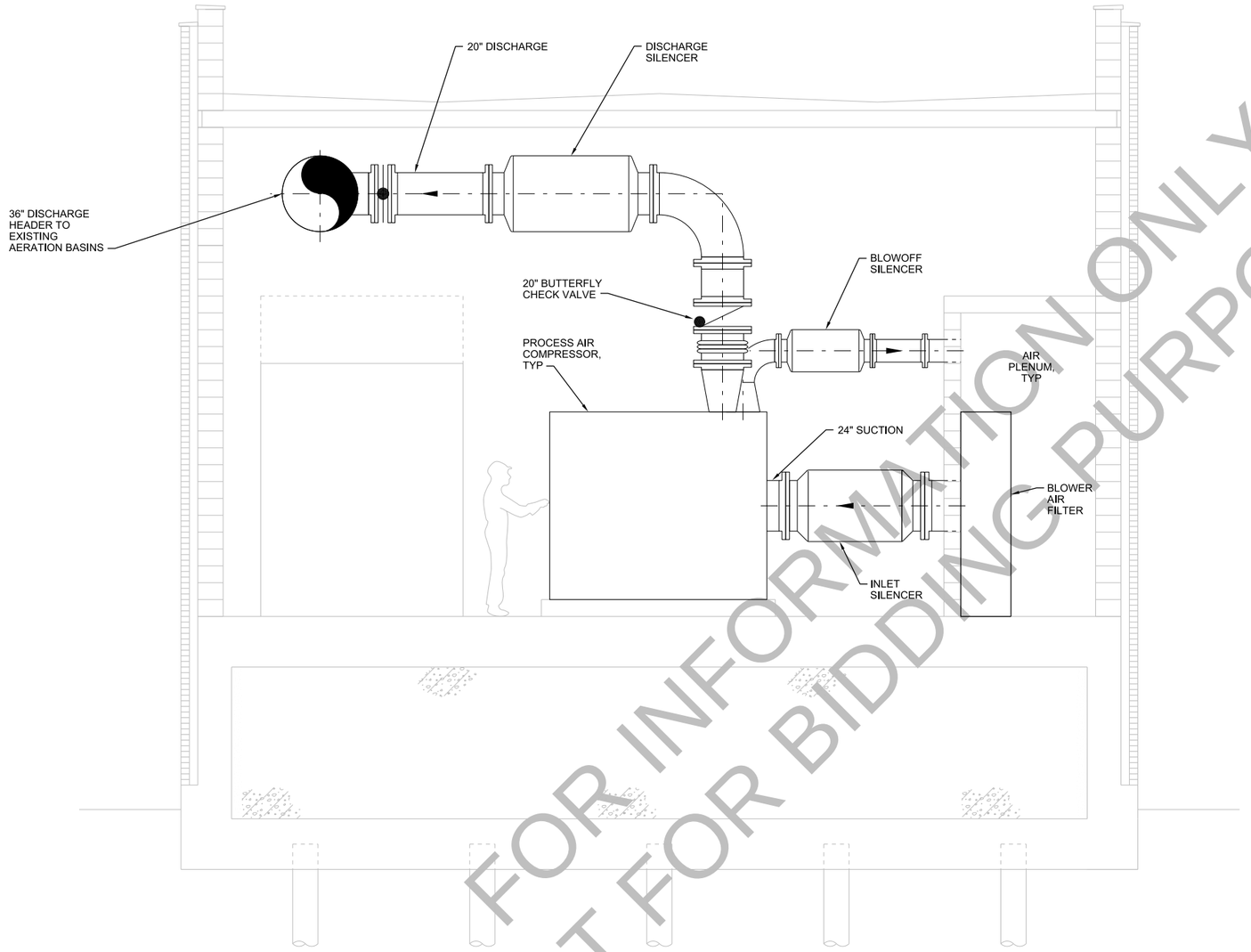
PROCESS AIR FACILITY
ARCHITECTURAL FLOOR PLAN

PROCESS AIR COMPRESSOR SYSTEM FOR LOW LEVEL NITROGEN REMOVAL at the EAST SHORE WATER POLLUTION ABATEMENT FACILITY
Greater New Haven Water Pollution Control Authority
New Haven, CT

PRELIMINARY DESIGN REPORT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JULY 2021
PROJ	E2X90000
DWG	55-A-201
SHEET	X of X



A SECTION
3/8"=1'-0"
55-A-201

NO.	DATE	REVISION	BY	APVD
DSGN	K BAIRD	DR SA KORCSMAROS CHK	APVD	DL LYNCH

PROCESS AIR COMPRESSOR SYSTEM
FOR LOW LEVEL NITROGEN REMOVAL
at the
EAST SHORE WATER POLLUTION
ABATEMENT FACILITY
Greater New Haven Water Pollution Control Authority
New Haven, CT

Jacobs

PROCESS AIR FACILITY
PROCESS MECHANICAL SECTION

PRELIMINARY DESIGN REPORT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JULY 2021
PROJ	E2X90000
DWG	55-D-301
SHEET	X of X

High Efficiency Air Bearing Turbo Blower

APGN Inc.
1270 Michele Bohec
Blainville, Quebec Canada
J7C 5S4

Clean
Compact
Affordable
Energy Efficient

Project CWF 2019-04 Process Air Compressor
PROPOSAL DOCUMENTS ENCLOSED

Office of Director of Finance and Administration of the Greater New Haven Water Pollution Control Authority located at 260 East Street, New Haven, Connecticut 06511

Proudly made in the USA

Proposal Package

Issued: February 2, 2022

Production & Test Facility
160 Banker Road
Plattsburgh, NY 12901, USA
Toll Free: 866 592-9482
Fax: 450 939-2115

Table of Contents

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Turbo Blower System Evaluation Summary

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Greater New Haven Water Pollution Control Authority
Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Reference: Notice of Request for Proposal (RFP)
Process Air Compressor Equipment

Subject: Turbo Blower System Evaluation Summary

Dear Gabriel,

We are pleased to submit our Turbo Blower System Evaluation Summary herein for Greater New Haven Water Pollution Control Authority Project in reply to the referenced RFP.

Turbo Blower System Evaluation Summary:

APGN Inc, dba APG-Neuros confirms that our proposal package, for providing six (6) factory assembled APGN500 Magnetic Bearing Single Core High Speed Turbo Blowers (5 Duty + 1 Standby) and Master Control Panel MCP, is in full compliance with the RFP, Addendum 1 and 2 and the Technical Requirements in Section 44 42 19.05, High Speed Turbo Air Compressors, Part 1, Article 1.05 Submittals, paragraph B Action Submittals. “with no exceptions” and exceeds the RFP requirements.

APG-Neuros is offering the following benefits in the proposal package at No Additional Cost to the Greater New Haven Water Pollution Control Authority:

- **Extended warranty for an additional nine (9) year warranty for a total of ten (10) years (Comprehensive Warranty).**
- **Annual Service Contract extended for three (3) years from year 2 through 5.**
- **Integrated Harmonic Filter inside the blower enclosure to reduce footprint required in the blower room and this will eliminate external electrical cabling requirements and reduce installation complexity.**
- **Vibration Sensor and Bearing Temperature Sensor to protect the blower, prevent any possible major component damage and to measure and trend blower components health**.
- **Integrated Inlet Silencer inside the blower enclosure. This will eliminate inlet losses, reduce power consumption, eliminate outside silencer installation. Also, this innovative design will reduce the footprint.**

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Item 1- Equipment Cost

We are confident that our proposal presents competitive total installed capital costs when taking into consideration the cost of high-quality components, cost of installing the new APGN500 Magnetic Bearing Single Core High Speed Turbo Blowers, necessary to meet the total required system air flow for current and future loading scenarios.

Please refer to Proposal Form: Section 00 41 65-01

Item 2 - Life Cycle Cost

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – f. Energy Requirements

- **Construction**
  APG-Neuros blowers' configuration of six (6) factory assembled APGN500 Magnetic Bearing Single Core High Speed Turbo Blowers (5 Duty + 1 Standby) and Master Control Panel MCP are easily fitting in the existing blower room as shown on the record drawings without the need of any modifications to accommodate the new blowers.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – e. Technical – 1) Mechanical – d. General Arrangement Drawings

- **Durability**

  Our High-Speed Turbo Blowers currently achieve the highest installed base of any HSTB manufacture, with over 1500 units installed and over 600 WWTP in North America.

  Product availability level is over 99.5% with our installed fleet operating hours exceeding 93 million hours by end of 2021 (Reliability curve is included).

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – c. Installation List

- **Efficiency**

  APG-Neuros is recognized for its high-efficiency Turbo Blower technology that modernized the water and wastewater treatment market. APG-Neuros introduced highly innovative aeration solutions built around affordable high efficiency Turbo Blowers.

  APG-Neuros produced Turbo Blowers are supported with our smart controls and our knowledge of smart aeration systems built with artificial intelligence, controls efficiently with each customer's operating platform, with virtually no scheduled maintenance requirements.

  Through application of lessons learned for the past 15 years, several product improvements have been applied since 2006 to extend product reliability, increase availability, increase flow turndown, and improve efficiency. A full technical paper about our product improvements and timeline is attached as part of this proposal.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – e. Technical – 1) Mechanical – a. Performance Data

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – f. Energy Requirements

Item 3 - Equipment Features and Performance

Our proposal includes a complete Turbo Blower "Plug and Play" package with integrated built-in PLC based Local Control Panel (LCP), and an internal inlet Filter/Silencer eliminating the need of external components, panels, silencers or filtration. Our blower includes all required electrical and mechanical components installed internally in the blower enclosure

We feel confident that our product will operate adequately in the blower room ambient conditions.

Our blower integrated inlet filtration system is designed to maintain an improved inlet pressure loss across the filter.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B –b. Exceptions – 1. No Exception Statement

Please refer to APG Neuros Confirmation Statements – Technical Specification

Item 4 - Current Equipment Installations / Experience

Fox Metro, IL Testimonial
"The Fox Metro Water Reclamation District has four dual core 700 HP blowers and 3 250 HP blowers. Wondering if this plant and our firm can be highlighted in any publications or marketing materials. I know the client is very happy with APG Neuros."
Mark Halm, Project Manager, Deuchler.

Monroe County Water Resource Recovery, NY Testimonial
"With great customer service and 24/7, tailored yearly PM program with your staff working onsite that truly cares, detailed and specific department training program you provide giving us long reliable lasting equipment, every business should consider your company for their next equipment selection."
David Sam Tuccio
Monroe County Water Resource Recovery
Rochester, NY

Our APGN500 Magnetic Bearing Blower comes with SKF magnetic bearings and high-speed electric motors which are ideal for applications demanding high speeds and low vibration and offers 130,000 magnetic bearings and high-speed electric motor references in operation across many industries.

We offer a most proven product with more than 1500 blowers installed in the United States and Canada with over 15 years in operation at more than 600 WWTPs. Over 30% of our customers

are repeat customers in the United States and Canada, including 20 installations in 9 WWTPs with Jacob's leadership. Our continuous technological improvements applied successfully lead to our very reliable operation, with measured availability level over 99.7%.

We pride ourselves with our culture of innovation and high customer responsiveness. We innovate and adapt our product to help our customers to solve their challenges and meet their objectives. We do not sell a standard product. We customize our product and aeration systems to meet the need of every customer. To do this successfully, we employ over 50 engineers, including many with wastewater treatment design experience, in designing Turbo Blowers combined with knowledge of wastewater treatment plants, aeration system automation, processes, electrical, mechanical and instrumentation engineering.

We have one unit installation at Metro Denver since December 2019. The product is doing great, and Metro Denver is considering adding more units in the future.

We have a contract with Central Contra Costa SD in California to deliver 3 x 1.1 MW Magnetic Bearing blowers in Q2 2022.

We have a contract with City of Las Vegas with Jacob's leadership to deliver 4 x 1.1 MW Magnetic Bearing blowers, one unit during Q2 2022 and three during Q3 2022.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – c. Installation List.

Item 5 - Service Location and Parts Availability

We offer Greater New Haven Water Pollution Control Authority a highly responsive product support system including services of our Regional Field Service Managers dedicated to your support, with visits to your facility periodically to monitor the operation, provide educational and refresher training and help resolve any technical or commercial issues.

APG-Neuros has 13 Startup & Field Service Engineers located at the Plattsburgh, NY facility and more than 25 factory certified field service technicians located across the United States that can commission or troubleshoot our Turbo Blowers.

We will provide strong proximity support with our employees located within driving distance from Greater New Haven Water Pollution Control Authority:

- APG-Neuros Aeration Control Manager and I&C, Steven Kestel, who is located in Pennsylvania - 4 hours driving time from New Haven, CT
- APG-Neuros Technical Services Manager, Adam Norcross, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT.
- APG-Neuros Production Manager and Start-up Manager, Brandon Chamberlain, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Senior Regional Manager, Chris James, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Field Technician, Chris Violette, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT

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Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

- APG-Neuros Field Technician, Brett Carnright, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Field Technician, Jim Green, who is located in Berryville, VA – 6 hours driving time from New Haven, CT
- APG-Neuros Field Technician, Scott Dublanyk, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Director of Sales and Qualified Service Engineer, Craig Phelps, who is located in Blainville, QC – 7 hours driving time from New Haven, CT

APG-Neuros maintains more than $12 million worth of components in our Plattsburgh, NY facility supplying new parts within 24 hours with 24/7 customer service. All repairs, parts and technical services will be in the US and provided to Greater New Haven Water Pollution Control Authority from our support facilities in the US.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – d. Service Network

Item 6 - Warranty and Performance Guarantee

- **Warranty**

  APG-Neuros exceeds the RFP warranty requirement for one (1) year.
  Products and parts, when shipped, are free from defects in materials and workmanship and its start-up and maintenance services will be performed in a professional manner, and

  APG-Neuros included, **at no additional cost**, an extended warranty for an additional (Nine) 9-years warranty for a total of ten (10) years.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – h. Warranty and Service Agreement

- **Performance Guarantee**

  APG-Neuros confirms that the proposed blowers' configuration and the equipment provided meets the performance requirements as defined in this Request for Proposal (RFP) and the Manufacturer's completed Guaranteed Wire Power Table.

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – f. Energy Requirements -2. Guaranteed wire power: Table 3 Under Article 1.10

Item 7 - Operational Ease

APG-Neuros High Speed Turbo Blower is an award winning smart connected product package that includes within the enclosure all required Electrical, Mechanical, PLC and Harmonic Filter. There is no requirement for external installation or connections of stand-alone harmonic filters, air filters and silencers.

APG-Neuros provides high-quality electrical and mechanical components that are UL listed. We include Allen Bradley PLC in each blower package and the Master Control Panel MCP; considered essential for seamless integration with the plant SCADA and offers protection, control, and monitoring.

APG-Neuros turbo blowers provides a possibility for blower heat exhaust system which is completely integral to the blower enclosure. This facilitates the discharge of discharge heat to outside blower room

- APG-Neuros turbo blower can run in local or remote mode. Blower parameters and control can be sent to SCADA/MCP via Ethernet
- No electric starters required
- Low Noise – no hearing protection required. Blowers operate at 80 dBa +/- 2dBa
- No inlet flume required. APG-Neuros filters are integral to turbo blower housing. No external mounting of filters or silencers required
- No vibration transmitted to floor or room. APG-Neuros has internal vibration isolation mounts on the blower core frame
- Zero heat gain to blower room (upon the client's request).

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – 3. Electrical

Item 8 - Maintenance Ease

Our blower is designed for "condition-based maintenance (CBM)" and does not require periodic scheduled maintenance/repair/overhauling. Our blower includes remote monitoring and diagnostics and has all the sensors required for continuous monitoring and diagnostics.
Cleaning / changing air filters is the only required maintenance of APG-Neuros High Speed Turbo Blowers to ensure continuous operation and optimum performance for its life span.
Depending on the cleanliness of the blower room and influent air, filter cleanings/replacement may be required only once a year.

Item 9 – Constructability (General Blower Room Layout is included).

APG-Neuros provides high-quality electrical and mechanical components that are UL listed. We include a PLC in each blower package with no limitation on number of analog and digital Inputs and Outputs; considered essential for seamless integration with the plant SCADA and offers protection, control, and monitoring.

APG-Neuros Blowers do not require any specific foundation. Thanks to the blower's compact size and limited vibration, the turbo blower requires no special foundation work.

- Low Installation Cost
  - No external control panel required. All panels, VFD, harmonics filters, sinus filter, and cooling system are integral to the blower
  - Easy electrical wiring – only incoming power and ethernet communication cable required
  - Smaller discharge pipe and fittings
  - No concrete pads required. APG-Neuros blowers have leveling or anchoring feet

  - Easy blower installation time. Estimated at two-four hours per blower, if piping and electrical are stubbed up and ready
- Allen Bradley PLC based with PanelView Plus 7 HMI.
- APG-Neuros turbo blowers provides a possibility for blower heat exhaust system which is completely integral to the blower enclosure. This facilitates the discharge of discharge heat to outside blower room.
- Harmonic Filter is included in our scope and can be integrally installed inside the blower enclosure, which will reduce footprint required in the blower room and will eliminate the external electrical cabling requirements and reduce installation costs.

Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – e. Technical – 1) Mechanical – d. General Arrangement Drawing

Please refer to Proposal Submittal Information: Section 44 42 19.05 Article 1.05B – e. Technical – 1) Mechanical - c. Catalog Information.

We trust that you will find our proposal complete and product offering to be innovative, high quality and competitive. APG-Neuros is committed to supplying and supporting the Turbo Blowers for Greater New Haven Water Pollution Control Authority.

Project and look forward to your favorable review of our offer, and a successful conclusion of our proposal efforts.

Yours truly,

APG-Neuros Sales Department
sales@apg-neuros.com

APG-Neuros Company Profile

Manufacturer of High Efficiency Turbo Blowers & Aeration Systems

Advanced aerospace technology, energy efficiency and quality are the driving forces behind our products. Reliable and low maintenance, APG-Neuros Turbo Blowers and Aeration Systems provide our customers with environmentally sustainable solutions in a variety of different wastewater treatment applications. APG-Neuros has been leading the way through innovation and education in the turbo blower market, modernizing an aging industry.

ABOUT US

APG-Neuros is recognized as the force behind the successful introduction of the high speed turbo blower technology in the wastewater treatment markets in North America, Western Europe and the Middle East.

APG-Neuros is a privately-owned company with headquarters located in Quebec, Canada and production facility in Plattsburgh, NY. Engineers and owners recognize our company as the force behind the successful market introduction of the high-speed turbo blower technology in the wastewater treatment market. We are an award-winning company that strives for continuous technological developments and innovations. We own our technological foundation, conducting in-house R&D programs to keep innovating and improving our products and services. Since 2005, we have followed a focused approach, based on aerospace models, for product introduction. Our approach highlights our technical competency, proven design, high quality components, and UL & CSA certification.

This focused approach has led to the success of our products and the wide acceptance of the High Speed blower technology in the wastewater treatment and industrial sectors in North America. We have achieved over 1,000% growth in our sales revenue, exceeding $200 million in cumulative sales between 2006 and 2019. Our blowers currently achieve the highest installed base of any High Speed Turbo Blower manufacturer, with over 1,350 units installed and more than 100 units on order in North America and Europe. Combined with deliveries from our partner Neuros, worldwide installations exceed 5,000 units.

Industry leading experts and think-tanks have awarded APG-Neuros on numerous occasions. In 2011 and 2012, APG-Neuros received the Artemis Project and APEX awards for most promising companies in the water industry for applying innovative and sustainable product to address water industry challenges. In 2012, the company also received the Product Innovation Award from Frost & Sullivan in the aeration technology market in North America. Frost & Sullivan evaluated APG-Neuros blowers against key competitors based on criteria such as the innovative element of the product that leverages leading edge technologies, the value added features, customer benefits of the product, the increased customer Return on Investment leading to decision on acquisition. In 2013, 2015, and 2016 PROFIT 500 Magazine listed APG-Neuros on the top 500 of Canada's Fastest-Growing Companies. In July 2016, the company was honored by the Canadian Business Executive with 2016 "Best of Canada" award. Finally, in July 2017 APG-Neuros CEO was awarded as "Best Turbo Blower Manufacturer CEO – North America" by CEO Monthly.

Our Facilities

PRODUCTION & TESTING

APG-Neuros Production & Testing Facility
Plattsburgh, NY, United States

APG-Neuros Production & Testing plant is located in a 60,000 square foot facility in Plattsburgh, NY, approximately 75 miles south of Montreal, QC where all the high speed turbo blowers are assembled, tested and inspected. It houses engineering, testing, assembly, field service, administrative, quality control and support personnel. The facility's warehouse has a large spare parts inventory for quick response time to support its operational fleet.

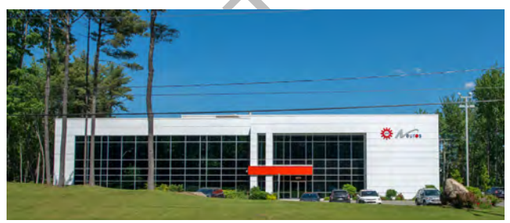
The production plant has two state of the art test cells for conducting acceptance testing. The test cells and associated equipment are fully ISO 5389 and ASME PTC-10 compliant and can test cores as well as complete packages. Each test cell has a Data Acquisition System to monitor pressure, flow, vibration, power and temperature. Top of the line equipment is used for data verification and all equipment is calibrated to national and international standards. Every test cell has its own control room where customers can witness test. APG-Neuros has 12 test technicians in this production facility dedicated to high speed turbo blowers.

HEADQUARTERS

APG-Neuros Headquarters
Blainville, QC, Canada

The Headquarters of APG-Neuros is located in a 32,000 square foot facility in Blainville, QC Canada where the supply of blowers is managed and engineered. It houses the executive, finance, administrative, engineering, support, research and development, customer service, quality control, repair/overhaul, and assembly/testing personnel.

There are currently over 70 employees in the two facilities.



COMPANY OVERVIEW

OUR VISION

To be recognized as the reference technology company for producing innovative products, including the Turbo Blowers, Turbo Compressors, and other efficient and affordable technology products.

OUR MISSION

APG-Neuros is committed to achieving customer satisfaction by providing quality products and services delivered on time. To establish close presence to our customers and build local relationships to help them use our product more effectively and optimize their preformance.

OUR VALUES

1 ***Innovation***

We strive for continuous technological development and innovation. We conduct in-house R&D programs to keep innovating and improving our products and services.

2 ***Integrity***

Promote a culture of transparency, continuous improvements and strive for a sustainable business model.

3 ***Team***

Ensure employee empowerment and fulfillment through continued skills development and career advancement.

4 ***Environment***

We strive to limit the impact of our activities and our product on the environment.

Company History

15 YEARS OF ACHIEVEMENT

Since 2005, APG-Neuros has been leading the way through innovation and education in the turbo blower market, modernizing an aging industry. Today, it is recognized as the force behind the successful introduction of high speed turbo blower technology in the wastewater treatment markets in North America, Western Europe and the Middle East.

2005 — THE COMPANY WAS ESTABLISHED

APG-Neuros was established in Blainville, QC Canada.

2006 — FIRST TURBO BLOWER INSTALLATION

First Turbo Blower Installed in Saint-Pie, QC. The blower was installed outdoors.

2010 — NEW FACILITIES

APG-Neuros opened the Plattsburgh, NY US production facility and the new headquarters in Blainville, QC Canada.

2011-2019 — AWARDS

APG-Neuros became the recipient of a multitude of industry and business awards for its work in innovation, modernization and education of the wastewater treatment market.

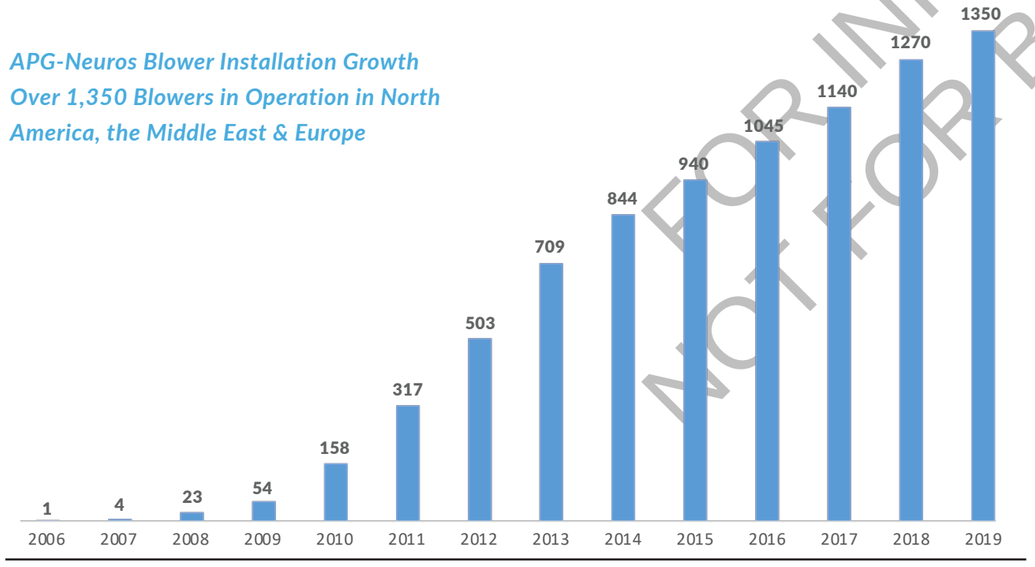
2019 — OVER 5,000 BLOWERS INSTALLED WORLDWIDE

Over 1,350 blowers installed in North America, Europe and the Middle East and over 5,000 blowers installed worldwide.

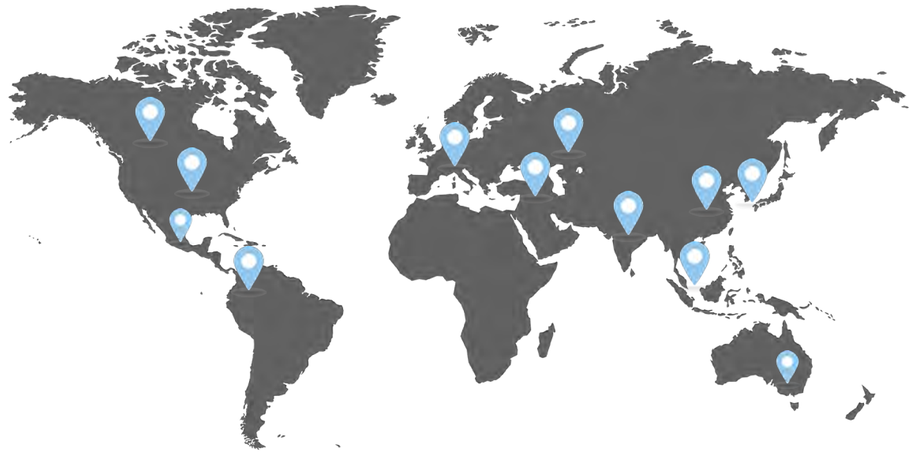
TODAY — NEW CAPABILITIES TURN-KEY SOLUTIONS

Today, APG-Neuros provides its customers with turn-key solutions including blowers, aeration control systems, diffusers, pipework, instrumentation and remote monitoring.

APG-Neuros Blower Installation Growth
Over 1,350 Blowers in Operation in North America, the Middle East & Europe



Over 5,000 Turbo Blowers Installed Worldwide

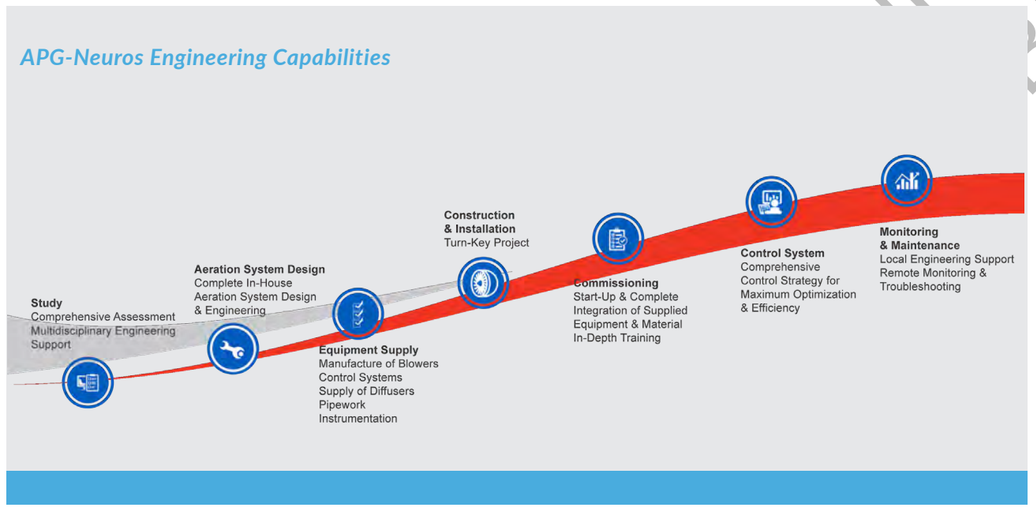


Our Services

APG-Neuros provides turn-key solutions for its customers - from study phase to after-sale support, monitoring and maintenance.

APG-Neuros is a privately owned high growth company. Its corporate structure is based on business models of successful industrial and aeronautic companies. APG-Neuros Senior Management, Sales, Operations Management and Finance teams are located in Montreal, Quebec, Canada. APG-Neuros also employs Sales, Technical Service and Support staff located in the US, Canada and Europe, in close proximity to its customers. Additionally, APG-Neuros has developed a highly efficient Field Service Network comprised of internal commercial and technical service teams and Field Service Engineers as well as Third-Party service providers located within proximity to its customers. In addition to its local resources in North America, APG-Neuros has direct access to Neuros technical resources with high level technical competencies in the areas of compressor, air bearing, permanent magnet synchronous motor and controls technologies. The technical resources from Neuros have been relocated to APG-Neuros in a systematic manner consistent with its operations growth in the western world. Through obtaining/developing the internal resources required to design, produce and test the equipment in-house, APG-Neuros is able to successfully meet accelerated submittal and delivery schedules without compromising quality or customer satisfaction.

APG-Neuros Engineering Capabilities



WHAT WE CAN DO

We help our customers every step of the way

STUDY & AUDIT ASSESSMENT

We assist our customers with comprehensive assessment and audits to determine the best possible solutions for each of their needs including multidisciplinary engineering support.

AERATION SYSTEM DESIGN

Complete in-house engineering & design of aeration systems. Process simulation, mechanical/electrical design, layout & drawings. PLC/SCADA controls and communications.

EQUIPMENT SUPPLY & INSTALLATION

Manufacture of Turbo Blowers, Control Systems, Supply of Diffusers, Pipework, Instrumentation, etc. We also take care of construction and installation for you.

COMMISSIONING

Testing, Start-Up and Complete integration of the supplied equipment & material. In-depth on-site training.

CONTROL SYSTEMS

Comprehensive Control Strategy for Maximum Optimization & Efficiency designed by APG-Neuros in-house.

MONITORING & MAINTENANCE

Local engineering support. Remote Monitoring & Troubleshooting System - reduced maintenance costs, historical data trends and preventive maintenance.

OUR INSTALLATIONS

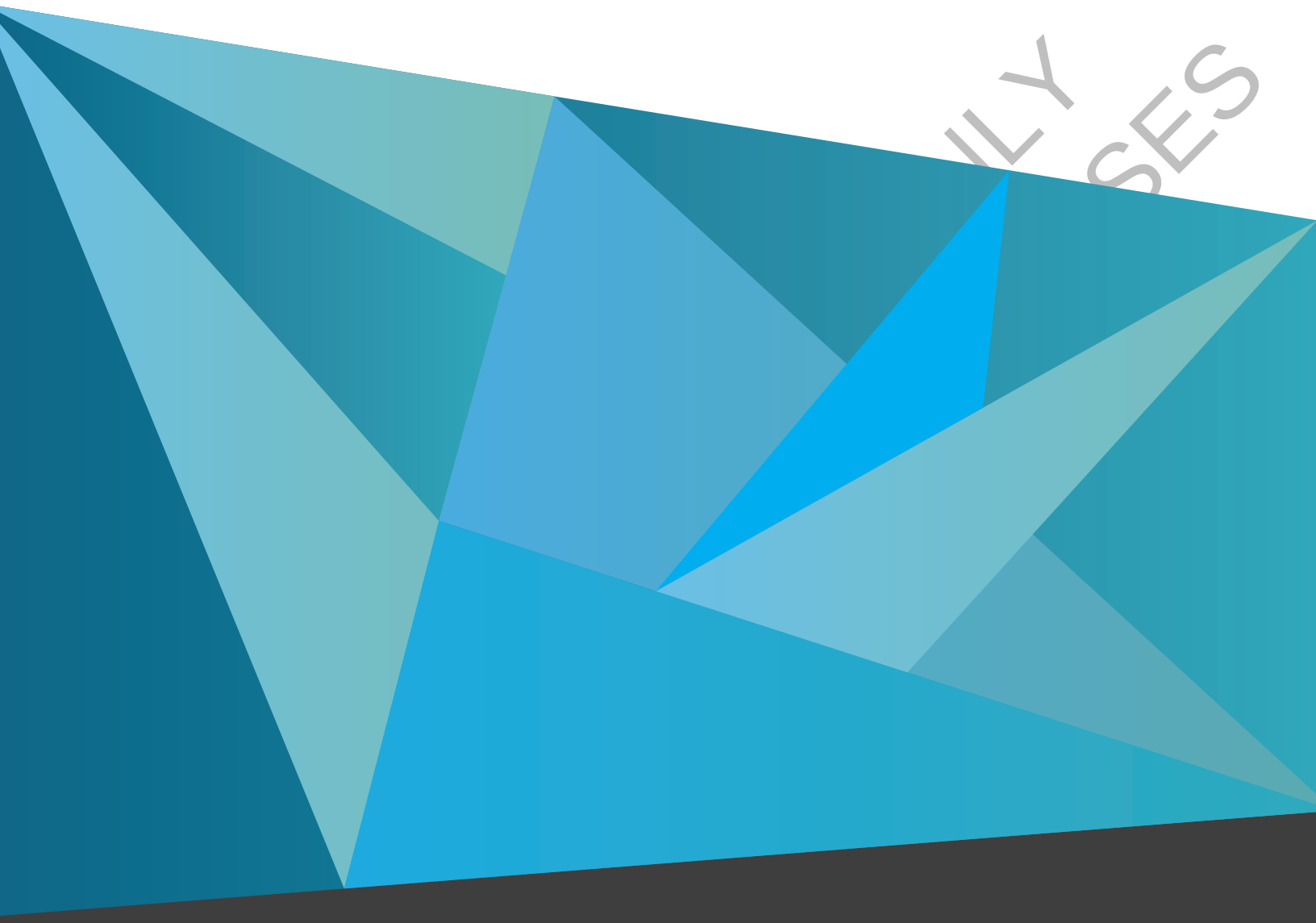
OVER 5,000 TURBO BLOWERS WORLDWIDE

1. New York City, NY
2. Washington D.C.
3. Abu Dhabi, UAE
4. London, UK
5. King County, WA
6. Cincinnati, OH

OUR INSTALLATIONS

OVER 5,000 TURBO BLOWERS WORLDWIDE

1. **Bend, OR**
2. **Brembate, Italy**
3. **Pumpkinvine, GA**
4. **Las Vegas Valley, NV**
5. **Hollister, CA**



Contact

info@apg-neuros.com
sales@apg-neuros.com
www.apg-neuros.com

Phone

T: + 1-450-939-0799
TF: +1-866-592-9482
UK: + 0800-3689-274

Address

1270 Michele-Bohec
Blainville, QC J7C 5S4
Canada

APG-Neuros Confirmation Statements

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Equipment Manufacturer Agreement

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Equipment Manufacturer Agreement

This is to confirm that APGN Inc. proposed package is in compliance with Section 00 41 65: Article 4 – Project.

"4.1. The selected Equipment Manufacturer will be named as the preselected supplier of the process air compressors and ancillary equipment in the project specifications for the general construction of the Project. The Contractor will be responsible for the purchase of the Manufacturers Equipment from the Equipment Manufacturer as described herein and in Proposal. In return, Equipment Manufacturer must agree to enter into an agreement with the Contractor who is selected by the Owner to construct the Project, to provide the bonds, equipment and services as established in the Proposal. Equipment Manufacturer must also agree to:

4.1.1. Honor the equipment, materials, and services costs for an expected Project bid opening and Notice to Proceed18 months from the proposal due date.
4.1.2. In the event that the Notice to Proceed date for the General Contract occurs later than 18 months after the proposal due date, Equipment Manufacturer agrees to provide the equipment, materials, and services at a price negotiated with the Owner.
4.1.3. Provide assistance to Engineer in the preparation of the detailed construction documents related to the goods and serviced provided by Equipment Manufacturer.
4.1.4. The Owner reserves the right to delete optional items from the scope of supply and deduct the cost of these optional items from the price.
4.1.5. Agree to the following Payment and Retainage Terms:
4.1.5.1. Payments are subject to the 5 percent retainage imposed upon the General Contractor as part of the larger Project.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

4.1.5.2. 10 percent of total price payment upon approval of all shop drawing submittals submitted through the Contractor.
4.1.5.3. 5 percent of total price payment upon approval of Operation and Maintenance manuals.
4.1.5.4. 70 percent of total price payment upon delivery of equipment to the Project site specified in Section 44 42 19.05, High Speed Turbo Air Compressors.
4.1.5.5. 5 percent of total price payment upon completion of installation, O&M training, startup assistance and testing, and successful demonstration testing.
4.1.5.6. 10 percent of total price payment upon completion of all services described in Section 44 42 19.05, High Speed Turbo Air Compressors, including acceptance of the installation by the Owner.

4.1.6. All retainage shall be released upon the Final Completion of the larger project. It is anticipated that the Project will have an 18-month Project duration."

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Terms Acceptance

APG – Neuros
1270, Michele-Bohec
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Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Equipment Manufacturer Terms Acceptance

This is to confirm that APGN Inc accepts all of the terms and conditions of the Request for Proposal (Process Air Compressor Equipment) documents, including without limitation those dealing with consumption guarantees, performance guarantee, and liquidated damages.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
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Performance Guarantee

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Equipment Manufacturer Performance Guarantee

This is to confirm that APGN Inc. proposed blowers' configuration and the equipment provided shall meet the performance requirements as defined in this Request for Proposal (RFP), Addendum No.1 & 2 and the Manufacturer's completed Guaranteed Wire Power Table.

Additionnally, APGN Inc. guarantees that the Process Air Compressor equipment offered in the Proposal will continuously meet the following Guarantees:

4.1.1. See Guaranteed Performance under Section 44 42 19.05, High Speed Turbo Air Compressors.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
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Shop Drawings

APG – Neuros
1270, Michele-Bohec
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February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Equipment Manufacturer Shop Drawings

This is to confirm that APGN Inc. acknowledges that upon acceptance of proposal, Equipment Manufacturer shall prepare preliminary shop drawings for Engineer to use in completing the construction bid documents. The successful proposal will be included in the bid documents to be advertised for bidding by Contractors who will subsequently provide and install this material as part of the Contract. Payment to the Equipment Manufacturer will be by the Contractor. Bid documents for the Contractor are anticipated to be in 2022 with an 18 months project duration.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
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Notice of Conflicts

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Equipment Manufacturer Conflicts Notice

This is to confirm that APGN Inc. did not find any conflicts, errors, ambiguities, or discrepancies that Equipment Manufacturer has discovered in Proposal Documents, and written resolution thereof by Engineer is acceptable to equipment Manufacturer.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Other Conditions

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Equipment Manufacturer Other Conditions

This is to confirm that APGN Inc. accepts the following:

"3.1. Equipment Manufacturer agrees to honor the equipment, materials, and services costs in the Proposal for a Notice to Proceed date to the Contractor within 18 months from the proposal due date.
3.2. In the event that the Notice to Proceed date for the Project occurs later than 18 months after the proposal due date, Equipment Manufacturer agrees to provide the equipment, materials, and services at an adjusted selling price negotiated with the Owner.
3.3. The Authority reserves the right to delete alternate items from the scope of supply and deduct the cost of these optional items from the price.
3.4. If for any reason the Authority does not award the Project, the Authority is under no obligation to purchase the equipment, materials, and services in the Proposal.
3.5. The selected Equipment Manufacturer shall be required to provide Performance and Payment Bonds to the Owner and Contractor as part of their agreement with Contractor. Performance and Payment Bond, each in an amount equal to one hundred percent (100%) of the Lump Sum Cost as security for the faithful performance of this Proposal and as security for the payment of all persons performing Labor and furnishing Materials under this Contract. The surety shall be such surety company or companies that are acceptable to the Owner and Contractor and that are authorized to transact business in the State of Connecticut.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Technical Specification

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Compliance with Blowers Technical Specification

This is to confirm that APGN Inc. submittal package is in full compliance with the technical specification and confirms that the proposed blowers' configuration and the equipment provided shall meet the performance requirements as defined in this Request for Proposal (RFP), Addendum No.1 & 2 and the Manufacturer's completed Guaranteed Wire Power Table.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Number of Blowers Rerquired

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Compliance with 5 duty blower to achieve the requested flow

This is to confirm that APGN Inc. submittal package is in full compliance with the technical specification and confirms that the proposed blowers' configuration and the equipment provided shall meet the performance requirements with 5 duty blowers as defined in this Request for Proposal (RFP), Addendum No.1 & 2 and the Manufacturer's completed Guaranteed Wire Power Table.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Proposal Form: Section 00 41 65-01

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

REQUEST FOR PROPOSAL
PROPOSAL FORM

Bidder: APGN Inc. dba APG Neuros

1. PROPOSAL RECIPIENT.

1.1. This proposal is submitted to:

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511
Reference: Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility
CWF 2019-04
Process Air Compressor Equipment Preselection

2. EQUIPMENT MANUFACTURER'S ACKNOWLEDGEMENTS.

2.1. Equipment Manufacturer accepts all of the terms and conditions of the Request for Proposal (Process Air Compressor Equipment) documents, including without limitation those dealing with consumption guarantees, performance guarantee, and liquidated damages.

2.2. Equipment Manufacturer acknowledges that upon acceptance of proposal, Equipment Manufacturer shall prepare preliminary shop drawings for Engineer to use in completing the construction bid documents. The successful proposal will be included in the bid documents to be advertised for bidding by Contractors who will subsequently provide and install this material as part of the Contract. Payment to the Equipment Manufacturer will be by the Contractor. Bid documents for the Contractor are anticipated to be in 2022 with an 18 month Project duration.

2.3. Equipment Manufacturer has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Equipment Manufacturer has discovered in Proposal Documents, and written resolution thereof by Engineer is acceptable to Equipment Manufacturer.

3. OTHER CONDITIONS.

3.1. Equipment Manufacturer agrees to honor the equipment, materials, and services costs in the Proposal for a Notice to Proceed date to the Contractor within 18 months from the proposal due date.

3.2. In the event that the Notice to Proceed date for the Project occurs later than 18 months after the proposal due date, Equipment Manufacturer agrees to provide the equipment, materials, and services at an adjusted selling price negotiated with the Owner.

3.3. The Authority reserves the right to delete alternate items from the scope of supply and deduct the cost of these optional items from the price.

3.4. If for any reason the Authority does not award the Project, the Authority is under no obligation to purchase the equipment, materials, and services in the Proposal.

3.5. The selected Equipment Manufacturer shall be required to provide Performance and Payment Bonds to the Owner and Contractor as part of their agreement with Contractor. Performance and Payment Bond, each in an amount equal to one hundred percent (100%) of the Lump Sum Cost as security for the faithful performance of this Proposal and as security for the payment of all persons performing Labor and furnishing Materials under this Contract. The surety shall be such surety company or companies that are acceptable to the Owner and Contractor and that are authorized to transact business in the State of Connecticut.

4. CONSUMPTION GUARANTEES.

4.1. The Proposer guarantees that the Process Air Compressor equipment offered in the Proposal will continuously meet the following Guarantees:

4.1.1. See Guaranteed Performance under Section 44 42 19.05, High Speed Turbo Air Compressors.

5. PROPOSAL SUBMISSION.

5.1. Completely fill and submit the attached, Proposal Form.

APG Neuros confirms full compliance with Specification Section 44 42 19 and Addendum No.1 & 2.
The equipment model proposed by APG Neuros complies with the attached Technical Specifications.
Each technical feature required by the Technical Specification is provided.
No exceptions to the technical specifications or general requirements are taken by APG Neuros, as stated on the Proposal Form

PROPOSAL FORM

Bidder: APGN Inc. dba APG Neuros

Project CWF 2019-4: Purchase of Process Air Compressor for Low Level Nitrogen Removal Equipment

Item	Description	Lump Sum Cost USD
1	Process Air Compressor System, as specified in section 44 42 19.05 High Speed Turbo Air Compressors.	$1,356,343

Lump Sum Cost (words)

USD One Million Three Hundred Fifty Six Thousand Three Hundred Forty Three

Manufacturer's Extended Warranty:

Cost of extension of specified 1 year warranty to ~~5 years.~~ 10 years

USD Extended Warranty to Ten Years is offered at NO ADDITIONAL COST

Annual Service Contract amount for Years 2 Through 5 of annual recommended maintenance.

USD Annual Service Contract extended for three (3) years from year 2 through 5. at NO ADDITIONAL COST

Equipment Manufacture's Options/Alternates:

The following Options or Alternate Prices are offered in addition to the Base Proposal:

Alternate / Option	Description	Unit Cost USD Add (Deduct)
1	Integrated Harmonic Filter inside the blower enclosure	Included at at NO ADDITIONAL COST
2	Vibration Sensor & Bearing Temperature Sensor	Included at at NO ADDITIONAL COST
3	Upgrade to Stainless Steel Body Check Valve	Included at at NO ADDITIONAL COST
4	MCP ControlLogix Upgrade	$9,950.00

Addenda Receipt:

Receipt of the following RFP Addenda is hereby acknowledged:

Addendum No.	1	Date:	January 14, 2022
Addendum No.	2	Date:	January 26, 2022
Addendum No.		Date:	

Agreement to Accept the Terms and Provisions of the RFP Documents:

We have reviewed the provisions of the RFP, the RFP Documents attached to the RFP, and the Addenda received and ***agree to accept the provisions without exception*** on any Order resulting from this RFP.

☑ **YES** ☐ **NO**

If NO, our exceptions are listed below a detailed on a separate document attached hereto. We understand that exceptions may be grounds for rejection of the Proposal:

Technical Exceptions:

APGN Inc, dba APG-Neuros confirms that our proposal is in full compliance "with no exceptions" with RFP requirements and Addendum No.1 & 2 with the highest quality, performance, durability, and longevity of the equipment.

Authorization:

The undersigned, having carefully examined the RFP Documents hereby offers and agrees to furnish all goods and services for the proposal sums proposed above and in accordance with the provisions set forth in the RFP Documents and the Proposal Form.

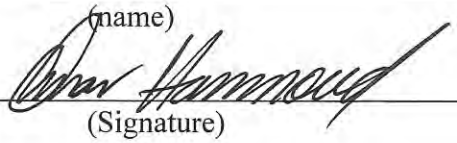
This Proposal submitted by:

Company Name: APGN Inc. dba APG Neuros

Email Address: sales@apg-neuros.com

Address: 1270 Michele-Bohec, Blainville, QC J7C 5S4 Canada
160 Banker Road, Plattsburgh NY 12901 United States

Authorized Agent: Omar Hammoud
(name)

Authorized Agent: 
(Signature)

Title: President & CEO
For example: President, Vice-President

Submitted with this Proposal Form per Specification 00 41 65, Section 2:

1. Proposal Submittal Information
2. Proposal Security

Corporate seal

End of Section

APGN INC.
1270 Michele-Bohec
Blainville, Quebec J7C 5S4 Canada
450-939-0799, www.apg-neuros.com

Proposal Security

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

a. Proposal Security – Bid Bond

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

No. 500003044-01

BID BOND

Travelers Casualty and Surety Company of America
Hartford, CT 06183

CONTRACTOR:
(Name, legal status and address)

APGN Inc.
1270 Michele-Bohec
Blainville, Quebec J7C 5S4

SURETY:
(Name, legal status and principal place of business)

Travelers Casualty and Surety Company of America
Travelers Bond & FP -One Tower Square S203A
Hartford, Connecticut 06183

OWNER:
(Name, legal status and address)

GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
260 East Street
New Haven, CT 06511

BOND AMOUNT: Ten percent of tender price------(10%)

PROJECT:
(Name, location or address, and Project number, if any)

CWF 2019-04 - Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Notwithstanding the terms and conditions of this Bond and of the Contract, the Surety shall be liable under this Bond only for the physical carrying out of the construction work and for the supply of the equipment specified in the Contract; furthermore and without limiting the generality of the foregoing, the Surety shall not be liable under this Bond for any liquidated damages, nor for any obligation to procure or maintain any insurance policy, nor for any obligation, claim or damages relating, directly or indirectly, to design, Performance Tests, warranties or guarantees, Performance Guarantees and Corrective Action as a result of failure to meet Performance Guarantees (capitalised terms having the meanings set forth in the Contract). Any such real or implied damages, obligations or claims provided for in the Contract are excluded from this Bond.

Notwithstanding the terms and conditions of this bond and the Contract, the guarantee(s) stated as well as maintenance and maintenance related will be covered by this bond for a period not exceeding two (2) years after the completion of the work. The Bond will be renewable at the option of the Surety, if required. It is understood that the renewal will not modify nor cumulate the amount of the bond. The non-renewal of this bond shall not constitute an event of default of this bond.

Signed and sealed this 12th day of January, 2022.

APGN Inc.

VICE MOSSA

(Principal) *(Seal)*

Mohamed Salah

(Witness)

DIRECTOR OF FINANCE

(Title)

Travelers Casualty and Surety Company of America

(Surety) **Diane Poulin** *(Seal)*

Diane Guerette

(Witness) Diane Guerette

Attorney-in-fact

(Title)

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Diane Poulin** of **Montreal** , their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this **12th** day of **January** , **2022** .

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

b. Confirmation Letter for Security retainage

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Confirmation Letter for Security Retainage

This is to confirm that APGN Inc. accepts the following:

> *"2.3.3.2. Each Bidder's proposal Security will be retained until the selected Equipment Manufacturer has a signed agreement with the Contractor for installation of the Equipment Manufacturer's equipment at the East Shore Water Pollution Abatement Facility."*

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Connecticut State Sales and Use Taxes Exemption

"The proposal is exempted from Connecticut State sales and use taxes on permanently installed materials and equipment supplied under this proposal"

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Form **W-8BEN-E**
(Rev. July 2017)
Department of the Treasury
Internal Revenue Service

Certificate of Status of Beneficial Owner for United States Tax Withholding and Reporting (Entities)

▶ For use by entities. Individuals must use Form W-8BEN. ▶ Section references are to the Internal Revenue Code.
▶ Go to *www.irs.gov/FormW8BENE* for instructions and the latest information.
▶ Give this form to the withholding agent or payer. Do not send to the IRS.

OMB No. 1545-1621

Do NOT use this form for: **Instead use Form:**

- U.S. entity or U.S. citizen or resident W-9
- A foreign individual . . . . . W-8BEN (Individual) or Form 8233
- A foreign individual or entity claiming that income is effectively connected with the conduct of trade or business within the U.S. (unless claiming treaty benefits) W-8ECI
- A foreign partnership, a foreign simple trust, or a foreign grantor trust (unless claiming treaty benefits) (see instructions for exceptions) . . W-8IMY
- A foreign government, international organization, foreign central bank of issue, foreign tax-exempt organization, foreign private foundation, or government of a U.S. possession claiming that income is effectively connected U.S. income or that is claiming the applicability of section(s) 115(2), 501(c), 892, 895, or 1443(b) (unless claiming treaty benefits) (see instructions for other exceptions) . . . . . W-8ECI or W-8EXP
- Any person acting as an intermediary (including a qualified intermediary acting as a qualified derivatives dealer) W-8IMY

Part I Identification of Beneficial Owner

1 Name of organization that is the beneficial owner
APGN Inc.

2 Country of incorporation or organization
Canada

3 Name of disregarded entity receiving the payment (if applicable, see instructions)

4 Chapter 3 Status (entity type) (Must check one box only):
☑ Corporation ☐ Disregarded entity ☐ Partnership
☐ Simple trust ☐ Grantor trust ☐ Complex trust ☐ Estate ☐ Government
☐ Central Bank of Issue ☐ Tax-exempt organization ☐ Private foundation ☐ International organization

If you entered disregarded entity, partnership, simple trust, or grantor trust above, is the entity a hybrid making a treaty claim? If "Yes" complete Part III. ☐ Yes ☐ No

5 Chapter 4 Status (FATCA status) (See instructions for details and complete the certification below for the entity's applicable status.)

- ☐ Nonparticipating FFI (including an FFI related to a Reporting IGA FFI other than a deemed-compliant FFI, participating FFI, or exempt beneficial owner).
- ☐ Participating FFI.
- ☐ Reporting Model 1 FFI.
- ☐ Reporting Model 2 FFI.
- ☐ Registered deemed-compliant FFI (other than a reporting Model 1 FFI, sponsored FFI, or nonreporting IGA FFI covered in Part XII). See instructions.
- ☐ Sponsored FFI. Complete Part IV.
- ☐ Certified deemed-compliant nonregistering local bank. Complete Part V.
- ☐ Certified deemed-compliant FFI with only low-value accounts. Complete Part VI.
- ☐ Certified deemed-compliant sponsored, closely held investment vehicle. Complete Part VII.
- ☐ Certified deemed-compliant limited life debt investment entity. Complete Part VIII.
- ☐ Certain investment entities that do not maintain financial accounts. Complete Part IX.
- ☐ Owner-documented FFI. Complete Part X.
- ☐ Restricted distributor. Complete Part XI.
- ☐ Nonreporting IGA FFI. Complete Part XII.
- ☐ Foreign government, government of a U.S. possession, or foreign central bank of issue. Complete Part XIII.
- ☐ International organization. Complete Part XIV.
- ☐ Exempt retirement plans. Complete Part XV.
- ☐ Entity wholly owned by exempt beneficial owners. Complete Part XVI.
- ☐ Territory financial institution. Complete Part XVII.
- ☐ Excepted nonfinancial group entity. Complete Part XVIII.
- ☐ Excepted nonfinancial start-up company. Complete Part XIX.
- ☐ Excepted nonfinancial entity in liquidation or bankruptcy. Complete Part XX.
- ☐ 501(c) organization. Complete Part XXI.
- ☐ Nonprofit organization. Complete Part XXII.
- ☐ Publicly traded NFFE or NFFE affiliate of a publicly traded corporation. Complete Part XXIII.
- ☐ Excepted territory NFFE. Complete Part XXIV.
- ☑ Active NFFE. Complete Part XXV.
- ☐ Passive NFFE. Complete Part XXVI.
- ☐ Excepted inter-affiliate FFI. Complete Part XXVII.
- ☐ Direct reporting NFFE.
- ☐ Sponsored direct reporting NFFE. Complete Part XXVIII.
- ☐ Account that is not a financial account.

6 Permanent residence address (street, apt. or suite no., or rural route). **Do not use a P.O. box or in-care-of address** (other than a registered address).
1270 Michele-Bohec

City or town, state or province. Include postal code where appropriate.
Blainville, QC

Country
Canada

7 Mailing address (if different from above)
1270 Michele-Bohec

City or town, state or province. Include postal code where appropriate.
Blainville, QC

Country
Canada

8 U.S. taxpayer identification number (TIN), if required

9a GIIN

b Foreign TIN
98-1049944

10 Reference number(s) (see instructions)

Note: Please complete remainder of the form including signing the form in Part XXX.

Part II **Disregarded Entity or Branch Receiving Payment.** (Complete only if a disregarded entity with a GIIN or a branch of an FFI in a country other than the FFI's country of residence. See instructions.)

11 Chapter 4 Status (FATCA status) of disregarded entity or branch receiving payment

☐ Branch treated as nonparticipating FFI. ☐ Reporting Model 1 FFI. ☐ U.S. Branch.

☐ Participating FFI. ☐ Reporting Model 2 FFI.

12 Address of disregarded entity or branch (street, apt. or suite no., or rural route). **Do not use a P.O. box or in-care-of address** (other than a registered address).

City or town, state or province. Include postal code where appropriate.

Country

13 GIIN (if any)

Part III **Claim of Tax Treaty Benefits** (if applicable). (For chapter 3 purposes only.)

14 I certify that (check all that apply):

a ☑ The beneficial owner is a resident of **Canada** within the meaning of the income tax treaty between the United States and that country.

b ☐X The beneficial owner derives the item (or items) of income for which the treaty benefits are claimed, and, if applicable, meets the requirements of the treaty provision dealing with limitation on benefits. The following are types of limitation on benefits provisions that may be included in an applicable tax treaty (check only one; see instructions):

☐ Government
☐ Tax exempt pension trust or pension fund
☐ Other tax exempt organization
☐ Publicly traded corporation
☐ Subsidiary of a publicly traded corporation
☐ Company that meets the ownership and base erosion test
☐ Company that meets the derivative benefits test
☑ Company with an item of income that meets active trade or business test
☐ Favorable discretionary determination by the U.S. competent authority received
☐ Other (specify Article and paragraph):

c ☐ The beneficial owner is claiming treaty benefits for U.S. source dividends received from a foreign corporation or interest from a U.S. trade or business of a foreign corporation and meets qualified resident status (see instructions).

15 **Special rates and conditions** (if applicable—see instructions):
The beneficial owner is claiming the provisions of Article and paragraph **ARTICLES V&VII**
of the treaty identified on line 14a above to claim a **0%** rate of withholding on (specify type of income): **Business profit**
Explain the additional conditions in the Article the beneficial owner meets to be eligible for the rate of withholding: **The taxpayer is a resident of Canada and does not carry on business in the U.S. through a permanet establishment. Consequently, under Articles V&VII of the Canada-US Tax treaty, the taxpayer is exempt from U.S. Federal Income Tax on any profits derived from sales in the U.S..**

Part IV **Sponsored FFI**

16 Name of sponsoring entity:

17 **Check whichever box applies.**

☐ I certify that the entity identified in Part I:

- Is an investment entity;
- Is not a QI, WP (except to the extent permitted in the withholding foreign partnership agreement), or WT; and
- Has agreed with the entity identified above (that is not a nonparticipating FFI) to act as the sponsoring entity for this entity.

☐ I certify that the entity identified in Part I:

- Is a controlled foreign corporation as defined in section 957(a);
- Is not a QI, WP, or WT;
- Is wholly owned, directly or indirectly, by the U.S. financial institution identified above that agrees to act as the sponsoring entity for this entity; and
- Shares a common electronic account system with the sponsoring entity (identified above) that enables the sponsoring entity to identify all account holders and payees of the entity and to access all account and customer information maintained by the entity including, but not limited to, customer identification information, customer documentation, account balance, and all payments made to account holders or payees.

Part V Certified Deemed-Compliant Nonregistering Local Bank

18 ☐ I certify that the FFI identified in Part I:

- Operates and is licensed solely as a bank or credit union (or similar cooperative credit organization operated without profit) in its country of incorporation or organization;
- Engages primarily in the business of receiving deposits from and making loans to, with respect to a bank, retail customers unrelated to such bank and, with respect to a credit union or similar cooperative credit organization, members, provided that no member has a greater than 5% interest in such credit union or cooperative credit organization;
- Does not solicit account holders outside its country of organization;
- Has no fixed place of business outside such country (for this purpose, a fixed place of business does not include a location that is not advertised to the public and from which the FFI performs solely administrative support functions);
- Has no more than $175 million in assets on its balance sheet and, if it is a member of an expanded affiliated group, the group has no more than $500 million in total assets on its consolidated or combined balance sheets; and
- Does not have any member of its expanded affiliated group that is a foreign financial institution, other than a foreign financial institution that is incorporated or organized in the same country as the FFI identified in Part I and that meets the requirements set forth in this part.

Part VI Certified Deemed-Compliant FFI with Only Low-Value Accounts

19 ☐ I certify that the FFI identified in Part I:

- Is not engaged primarily in the business of investing, reinvesting, or trading in securities, partnership interests, commodities, notional principal contracts, insurance or annuity contracts, or any interest (including a futures or forward contract or option) in such security, partnership interest, commodity, notional principal contract, insurance contract or annuity contract;
- No financial account maintained by the FFI or any member of its expanded affiliated group, if any, has a balance or value in excess of $50,000 (as determined after applying applicable account aggregation rules); and
- Neither the FFI nor the entire expanded affiliated group, if any, of the FFI, have more than $50 million in assets on its consolidated or combined balance sheet as of the end of its most recent accounting year.

Part VII Certified Deemed-Compliant Sponsored, Closely Held Investment Vehicle

20 Name of sponsoring entity: _____

21 ☐ I certify that the entity identified in Part I:

- Is an FFI solely because it is an investment entity described in Regulations section 1.1471-5(e)(4);
- Is not a QI, WP, or WT;
- Will have all of its due diligence, withholding, and reporting responsibilities (determined as if the FFI were a participating FFI) fulfilled by the sponsoring entity identified on line 20; and
- 20 or fewer individuals own all of the debt and equity interests in the entity (disregarding debt interests owned by U.S. financial institutions, participating FFIs, registered deemed-compliant FFIs, and certified deemed-compliant FFIs and equity interests owned by an entity if that entity owns 100% of the equity interests in the FFI and is itself a sponsored FFI).

Part VIII Certified Deemed-Compliant Limited Life Debt Investment Entity

22 ☐ I certify that the entity identified in Part I:

- Was in existence as of January 17, 2013;
- Issued all classes of its debt or equity interests to investors on or before January 17, 2013, pursuant to a trust indenture or similar agreement; and
- Is certified deemed-compliant because it satisfies the requirements to be treated as a limited life debt investment entity (such as the restrictions with respect to its assets and other requirements under Regulations section 1.1471-5(f)(2)(iv)).

Part IX Certain Investment Entities that Do Not Maintain Financial Accounts

23 ☐ I certify that the entity identified in Part I:

- Is a financial institution solely because it is an investment entity described in Regulations section 1.1471-5(e)(4)(i)(A), and
- Does not maintain financial accounts.

Part X Owner-Documented FFI

Note: This status only applies if the U.S. financial institution, participating FFI, or reporting Model 1 FFI to which this form is given has agreed that it will treat the FFI as an owner-documented FFI (see instructions for eligibility requirements). In addition, the FFI must make the certifications below.

24a ☐ (All owner-documented FFIs check here) I certify that the FFI identified in Part I:

- Does not act as an intermediary;
- Does not accept deposits in the ordinary course of a banking or similar business;
- Does not hold, as a substantial portion of its business, financial assets for the account of others;
- Is not an insurance company (or the holding company of an insurance company) that issues or is obligated to make payments with respect to a financial account;
- Is not owned by or in an expanded affiliated group with an entity that accepts deposits in the ordinary course of a banking or similar business, holds, as a substantial portion of its business, financial assets for the account of others, or is an insurance company (or the holding company of an insurance company) that issues or is obligated to make payments with respect to a financial account;
- Does not maintain a financial account for any nonparticipating FFI; and
- Does not have any specified U.S. persons that own an equity interest or debt interest (other than a debt interest that is not a financial account or that has a balance or value not exceeding $50,000) in the FFI other than those identified on the FFI owner reporting statement.

Part X Owner-Documented FFI *(continued)*

Check box 24b or 24c, whichever applies.

b ☐ I certify that the FFI identified in Part I:

- Has provided, or will provide, an FFI owner reporting statement that contains:
  - (I) The name, address, TIN (if any), chapter 4 status, and type of documentation provided (if required) of every individual and specified U.S. person that owns a direct or indirect equity interest in the owner-documented FFI (looking through all entities other than specified U.S. persons);
  - (II) The name, address, TIN (if any), and chapter 4 status of every individual and specified U.S. person that owns a debt interest in the owner-documented FFI (including any indirect debt interest, which includes debt interests in any entity that directly or indirectly owns the payee or any direct or indirect equity interest in a debt holder of the payee) that constitutes a financial account in excess of $50,000 (disregarding all such debt interests owned by participating FFIs, registered deemed-compliant FFIs, certified deemed-compliant FFIs, excepted NFFEs, exempt beneficial owners, or U.S. persons other than specified U.S. persons); and
  - (III) Any additional information the withholding agent requests in order to fulfill its obligations with respect to the entity.
- Has provided, or will provide, valid documentation meeting the requirements of Regulations section 1.1471-3(d)(6)(iii) for each person identified in the FFI owner reporting statement.

c ☐ I certify that the FFI identified in Part I has provided, or will provide, an auditor's letter, signed within 4 years of the date of payment, from an independent accounting firm or legal representative with a location in the United States stating that the firm or representative has reviewed the FFI's documentation with respect to all of its owners and debt holders identified in Regulations section 1.1471-3(d)(6)(iv)(A)(2), and that the FFI meets all the requirements to be an owner-documented FFI. The FFI identified in Part I has also provided, or will provide, an FFI owner reporting statement of its owners that are specified U.S. persons and Form(s) W-9, with applicable waivers.

Check box 24d if applicable (optional, see instructions).

d ☐ I certify that the entity identified on line 1 is a trust that does not have any contingent beneficiaries or designated classes with unidentified beneficiaries.

Part XI Restricted Distributor

25a ☐ (All restricted distributors check here) I certify that the entity identified in Part I:

- Operates as a distributor with respect to debt or equity interests of the restricted fund with respect to which this form is furnished;
- Provides investment services to at least 30 customers unrelated to each other and less than half of its customers are related to each other;
- Is required to perform AML due diligence procedures under the anti-money laundering laws of its country of organization (which is an FATF-compliant jurisdiction);
- Operates solely in its country of incorporation or organization, has no fixed place of business outside of that country, and has the same country of incorporation or organization as all members of its affiliated group, if any;
- Does not solicit customers outside its country of incorporation or organization;
- Has no more than $175 million in total assets under management and no more than $7 million in gross revenue on its income statement for the most recent accounting year;
- Is not a member of an expanded affiliated group that has more than $500 million in total assets under management or more than $20 million in gross revenue for its most recent accounting year on a combined or consolidated income statement; and
- Does not distribute any debt or securities of the restricted fund to specified U.S. persons, passive NFFEs with one or more substantial U.S. owners, or nonparticipating FFIs.

Check box 25b or 25c, whichever applies.

I further certify that with respect to all sales of debt or equity interests in the restricted fund with respect to which this form is furnished that are made after December 31, 2011, the entity identified in Part I:

b ☐ Has been bound by a distribution agreement that contained a general prohibition on the sale of debt or securities to U.S. entities and U.S. resident individuals and is currently bound by a distribution agreement that contains a prohibition of the sale of debt or securities to any specified U.S. person, passive NFFE with one or more substantial U.S. owners, or nonparticipating FFI.

c ☐ Is currently bound by a distribution agreement that contains a prohibition on the sale of debt or securities to any specified U.S. person, passive NFFE with one or more substantial U.S. owners, or nonparticipating FFI and, for all sales made prior to the time that such a restriction was included in its distribution agreement, has reviewed all accounts related to such sales in accordance with the procedures identified in Regulations section 1.1471-4(c) applicable to preexisting accounts and has redeemed or retired any, or caused the restricted fund to transfer the securities to a distributor that is a participating FFI or reporting Model 1 FFI securities which were sold to specified U.S. persons, passive NFFEs with one or more substantial U.S. owners, or nonparticipating FFIs.

Part XII Nonreporting IGA FFI

26 ☐ I certify that the entity identified in Part I:

- Meets the requirements to be considered a nonreporting financial institution pursuant to an applicable IGA between the United States and _____. The applicable IGA is a ☐ Model 1 IGA or a ☐ Model 2 IGA; and
- Is treated as a _____ under the provisions of the applicable IGA or Treasury regulations (if applicable, see instructions);
- If you are a trustee documented trust or a sponsored entity, provide the name of the trustee or sponsor _____.

The trustee is: ☐ U.S. ☐ Foreign

Part XIII Foreign Government, Government of a U.S. Possession, or Foreign Central Bank of Issue

27 ☐ I certify that the entity identified in Part I is the beneficial owner of the payment, and is not engaged in commercial financial activities of a type engaged in by an insurance company, custodial institution, or depository institution with respect to the payments, accounts, or obligations for which this form is submitted (except as permitted in Regulations section 1.1471-6(h)(2)).

Part XIV International Organization

Check box 28a or 28b, whichever applies.

28a ☐ I certify that the entity identified in Part I is an international organization described in section 7701(a)(18).

b ☐ I certify that the entity identified in Part I:

- Is comprised primarily of foreign governments;
- Is recognized as an intergovernmental or supranational organization under a foreign law similar to the International Organizations Immunities Act or that has in effect a headquarters agreement with a foreign government;
- The benefit of the entity's income does not inure to any private person; and
- Is the beneficial owner of the payment and is not engaged in commercial financial activities of a type engaged in by an insurance company, custodial institution, or depository institution with respect to the payments, accounts, or obligations for which this form is submitted (except as permitted in Regulations section 1.1471-6(h)(2)).

Part XV Exempt Retirement Plans

Check box 29a, b, c, d, e, or f, whichever applies.

29a ☐ I certify that the entity identified in Part I:

- Is established in a country with which the United States has an income tax treaty in force (see Part III if claiming treaty benefits);
- Is operated principally to administer or provide pension or retirement benefits; and
- Is entitled to treaty benefits on income that the fund derives from U.S. sources (or would be entitled to benefits if it derived any such income) as a resident of the other country which satisfies any applicable limitation on benefits requirement.

b ☐ I certify that the entity identified in Part I:

- Is organized for the provision of retirement, disability, or death benefits (or any combination thereof) to beneficiaries that are former employees of one or more employers in consideration for services rendered;
- No single beneficiary has a right to more than 5% of the FFI's assets;
- Is subject to government regulation and provides annual information reporting about its beneficiaries to the relevant tax authorities in the country in which the fund is established or operated; and
  - (i) Is generally exempt from tax on investment income under the laws of the country in which it is established or operates due to its status as a retirement or pension plan;
  - (ii) Receives at least 50% of its total contributions from sponsoring employers (disregarding transfers of assets from other plans described in this part, retirement and pension accounts described in an applicable Model 1 or Model 2 IGA, other retirement funds described in an applicable Model 1 or Model 2 IGA, or accounts described in Regulations section 1.1471-5(b)(2)(i)(A));
  - (iii) Either does not permit or penalizes distributions or withdrawals made before the occurrence of specified events related to retirement, disability, or death (except rollover distributions to accounts described in Regulations section 1.1471-5(b)(2)(i)(A) (referring to retirement and pension accounts), to retirement and pension accounts described in an applicable Model 1 or Model 2 IGA, or to other retirement funds described in this part or in an applicable Model 1 or Model 2 IGA); or
  - (iv) Limits contributions by employees to the fund by reference to earned income of the employee or may not exceed $50,000 annually.

c ☐ I certify that the entity identified in Part I:

- Is organized for the provision of retirement, disability, or death benefits (or any combination thereof) to beneficiaries that are former employees of one or more employers in consideration for services rendered;
- Has fewer than 50 participants;
- Is sponsored by one or more employers each of which is not an investment entity or passive NFFE;
- Employee and employer contributions to the fund (disregarding transfers of assets from other plans described in this part, retirement and pension accounts described in an applicable Model 1 or Model 2 IGA, or accounts described in Regulations section 1.1471-5(b)(2)(i)(A)) are limited by reference to earned income and compensation of the employee, respectively;
- Participants that are not residents of the country in which the fund is established or operated are not entitled to more than 20% of the fund's assets; and
- Is subject to government regulation and provides annual information reporting about its beneficiaries to the relevant tax authorities in the country in which the fund is established or operates.

Part XV Exempt Retirement Plans *(continued)*

d ☐ I certify that the entity identified in Part I is formed pursuant to a pension plan that would meet the requirements of section 401(a), other than the requirement that the plan be funded by a trust created or organized in the United States.

e ☐ I certify that the entity identified in Part I is established exclusively to earn income for the benefit of one or more retirement funds described in this part or in an applicable Model 1 or Model 2 IGA, or accounts described in Regulations section 1.1471-5(b)(2)(i)(A) (referring to retirement and pension accounts), or retirement and pension accounts described in an applicable Model 1 or Model 2 IGA.

f ☐ I certify that the entity identified in Part I:

- Is established and sponsored by a foreign government, international organization, central bank of issue, or government of a U.S. possession (each as defined in Regulations section 1.1471-6) or an exempt beneficial owner described in an applicable Model 1 or Model 2 IGA to provide retirement, disability, or death benefits to beneficiaries or participants that are current or former employees of the sponsor (or persons designated by such employees); or

- Is established and sponsored by a foreign government, international organization, central bank of issue, or government of a U.S. possession (each as defined in Regulations section 1.1471-6) or an exempt beneficial owner described in an applicable Model 1 or Model 2 IGA to provide retirement, disability, or death benefits to beneficiaries or participants that are not current or former employees of such sponsor, but are in consideration of personal services performed for the sponsor.

Part XVI Entity Wholly Owned by Exempt Beneficial Owners

30 ☐ I certify that the entity identified in Part I:

- Is an FFI solely because it is an investment entity;
- Each direct holder of an equity interest in the investment entity is an exempt beneficial owner described in Regulations section 1.1471-6 or in an applicable Model 1 or Model 2 IGA;
- Each direct holder of a debt interest in the investment entity is either a depository institution (with respect to a loan made to such entity) or an exempt beneficial owner described in Regulations section 1.1471-6 or an applicable Model 1 or Model 2 IGA.
- Has provided an owner reporting statement that contains the name, address, TIN (if any), chapter 4 status, and a description of the type of documentation provided to the withholding agent for every person that owns a debt interest constituting a financial account or direct equity interest in the entity; and
- Has provided documentation establishing that every owner of the entity is an entity described in Regulations section 1.1471-6(b), (c), (d), (e), (f) and/or (g) without regard to whether such owners are beneficial owners.

Part XVII Territory Financial Institution

31 ☐ I certify that the entity identified in Part I is a financial institution (other than an investment entity) that is incorporated or organized under the laws of a possession of the United States.

Part XVIII Excepted Nonfinancial Group Entity

32 ☐ I certify that the entity identified in Part I:

- Is a holding company, treasury center, or captive finance company and substantially all of the entity's activities are functions described in Regulations section 1.1471-5(e)(6)(i)(C) through (E);
- Is a member of a nonfinancial group described in Regulations section 1.1471-5(e)(5)(i)(B);
- Is not a depository or custodial institution (other than for members of the entity's expanded affiliated group); and
- Does not function (or hold itself out) as an investment fund, such as a private equity fund, venture capital fund, leveraged buyout fund, or any investment vehicle with an investment strategy to acquire or fund companies and then hold interests in those companies as capital assets for investment purposes.

Part XIX Excepted Nonfinancial Start-Up Company

33 ☐ I certify that the entity identified in Part I:

- Was formed on (or, in the case of a new line of business, the date of board resolution approving the new line of business) _____ (date must be less than 24 months prior to date of payment);
- Is not yet operating a business and has no prior operating history or is investing capital in assets with the intent to operate a new line of business other than that of a financial institution or passive NFFE;
- Is investing capital into assets with the intent to operate a business other than that of a financial institution; and
- Does not function (or hold itself out) as an investment fund, such as a private equity fund, venture capital fund, leveraged buyout fund, or any investment vehicle whose purpose is to acquire or fund companies and then hold interests in those companies as capital assets for investment purposes.

Part XX Excepted Nonfinancial Entity in Liquidation or Bankruptcy

34 ☐ I certify that the entity identified in Part I:

- Filed a plan of liquidation, filed a plan of reorganization, or filed for bankruptcy on _____;
- During the past 5 years has not been engaged in business as a financial institution or acted as a passive NFFE;
- Is either liquidating or emerging from a reorganization or bankruptcy with the intent to continue or recommence operations as a nonfinancial entity; and
- Has, or will provide, documentary evidence such as a bankruptcy filing or other public documentation that supports its claim if it remains in bankruptcy or liquidation for more than 3 years.

Part XXI 501(c) Organization

35 ☐ I certify that the entity identified in Part I is a 501(c) organization that:

- Has been issued a determination letter from the IRS that is currently in effect concluding that the payee is a section 501(c) organization that is dated _____; **or**
- Has provided a copy of an opinion from U.S. counsel certifying that the payee is a section 501(c) organization (without regard to whether the payee is a foreign private foundation).

Part XXII Nonprofit Organization

36 ☐ I certify that the entity identified in Part I is a nonprofit organization that meets the following requirements.

- The entity is established and maintained in its country of residence exclusively for religious, charitable, scientific, artistic, cultural or educational purposes;
- The entity is exempt from income tax in its country of residence;
- The entity has no shareholders or members who have a proprietary or beneficial interest in its income or assets;
- Neither the applicable laws of the entity's country of residence nor the entity's formation documents permit any income or assets of the entity to be distributed to, or applied for the benefit of, a private person or noncharitable entity other than pursuant to the conduct of the entity's charitable activities or as payment of reasonable compensation for services rendered or payment representing the fair market value of property which the entity has purchased; **and**
- The applicable laws of the entity's country of residence or the entity's formation documents require that, upon the entity's liquidation or dissolution, all of its assets be distributed to an entity that is a foreign government, an integral part of a foreign government, a controlled entity of a foreign government, or another organization that is described in this part or escheats to the government of the entity's country of residence or any political subdivision thereof.

Part XXIII Publicly Traded NFFE or NFFE Affiliate of a Publicly Traded Corporation

Check box 37a or 37b, whichever applies.

37a ☐ I certify that:

- The entity identified in Part I is a foreign corporation that is not a financial institution; **and**
- The stock of such corporation is regularly traded on one or more established securities markets, including _____ (name one securities exchange upon which the stock is regularly traded).

b ☐ I certify that:

- The entity identified in Part I is a foreign corporation that is not a financial institution;
- The entity identified in Part I is a member of the same expanded affiliated group as an entity the stock of which is regularly traded on an established securities market;
- The name of the entity, the stock of which is regularly traded on an established securities market, is _____; **and**
- The name of the securities market on which the stock is regularly traded is _____.

Part XXIV Excepted Territory NFFE

38 ☐ I certify that:

- The entity identified in Part I is an entity that is organized in a possession of the United States;
- The entity identified in Part I:
  - (i) Does not accept deposits in the ordinary course of a banking or similar business;
  - (ii) Does not hold, as a substantial portion of its business, financial assets for the account of others; **or**
  - (iii) Is not an insurance company (or the holding company of an insurance company) that issues or is obligated to make payments with respect to a financial account; **and**
- All of the owners of the entity identified in Part I are bona fide residents of the possession in which the NFFE is organized or incorporated.

Part XXV Active NFFE

39 ☑ I certify that:

- The entity identified in Part I is a foreign entity that is not a financial institution;
- Less than 50% of such entity's gross income for the preceding calendar year is passive income; **and**
- Less than 50% of the assets held by such entity are assets that produce or are held for the production of passive income (calculated as a weighted average of the percentage of passive assets measured quarterly) (see instructions for the definition of passive income).

Part XXVI Passive NFFE

40a ☐ I certify that the entity identified in Part I is a foreign entity that is not a financial institution (other than an investment entity organized in a possession of the United States) and is not certifying its status as a publicly traded NFFE (or affiliate), excepted territory NFFE, active NFFE, direct reporting NFFE, or sponsored direct reporting NFFE.

Check box 40b or 40c, whichever applies.

b ☐ I further certify that the entity identified in Part I has no substantial U.S. owners (or, if applicable, no controlling U.S. persons); **or**

c ☐ I further certify that the entity identified in Part I has provided the name, address, and TIN of each substantial U.S. owner (or, if applicable, controlling U.S. person) of the NFFE in Part XXIX.

Part XXVII Excepted Inter-Affiliate FFI

41 ☐ I certify that the entity identified in Part I:

- Is a member of an expanded affiliated group;
- Does not maintain financial accounts (other than accounts maintained for members of its expanded affiliated group);
- Does not make withholdable payments to any person other than to members of its expanded affiliated group;
- Does not hold an account (other than depository accounts in the country in which the entity is operating to pay for expenses) with or receive payments from any withholding agent other than a member of its expanded affiliated group; and
- Has not agreed to report under Regulations section 1.1471-4(d)(2)(ii)(C) or otherwise act as an agent for chapter 4 purposes on behalf of any financial institution, including a member of its expanded affiliated group.

Part XXVIII Sponsored Direct Reporting NFFE (see instructions for when this is permitted)

42 Name of sponsoring entity:

43 ☐ I certify that the entity identified in Part I is a direct reporting NFFE that is sponsored by the entity identified on line 42.

Part XXIX Substantial U.S. Owners of Passive NFFE

As required by Part XXVI, provide the name, address, and TIN of each substantial U.S. owner of the NFFE. Please see the instructions for a definition of substantial U.S. owner. If providing the form to an FFI treated as a reporting Model 1 FFI or reporting Model 2 FFI, an NFFE may also use this part for reporting its controlling U.S. persons under an applicable IGA.

Name	Address	TIN

Part XXX Certification

Under penalties of perjury, I declare that I have examined the information on this form and to the best of my knowledge and belief it is true, correct, and complete. I further certify under penalties of perjury that:

- The entity identified on line 1 of this form is the beneficial owner of all the income to which this form relates, is using this form to certify its status for chapter 4 purposes, or is a merchant submitting this form for purposes of section 6050W;
- The entity identified on line 1 of this form is not a U.S. person;
- The income to which this form relates is: (a) not effectively connected with the conduct of a trade or business in the United States, (b) effectively connected but is not subject to tax under an income tax treaty, or (c) the partner's share of a partnership's effectively connected income; and
- For broker transactions or barter exchanges, the beneficial owner is an exempt foreign person as defined in the instructions.

Furthermore, I authorize this form to be provided to any withholding agent that has control, receipt, or custody of the income of which the entity on line 1 is the beneficial owner or any withholding agent that can disburse or make payments of the income of which the entity on line 1 is the beneficial owner.

I agree that I will submit a new form within 30 days if any certification on this form becomes incorrect.

Sign Here ▶ Omar Hammoud — Omar Hammoud — 04-15-2021

Signature of individual authorized to sign for beneficial owner | Print Name | Date (MM-DD-YYYY)

☑ I certify that I have the capacity to sign for the entity identified on line 1 of this form.

Proposal Free on Board Confirmation

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Confirmation Letter for Free on board

This is to confirm that APGN Inc. accepts the following:

> *"2.5. All pricing in the proposal shall be free on board the project site, located at 345 East Shore Parkway, New Haven, CT 06405"*

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Proposal Submittal Information: Section 44 42 19.05 Article 1.05.B

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

1. Proposal Submittal

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

a. Scope

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

1. Equipment Proposal

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

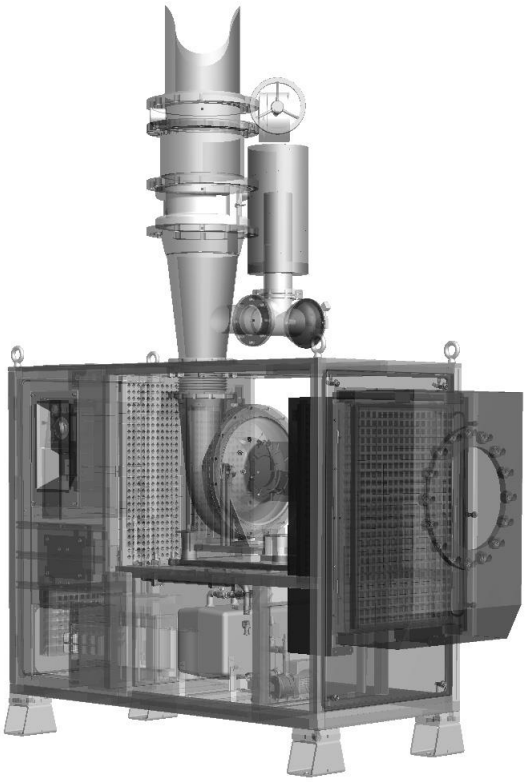
Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

High Speed Turbo Blower

Bid Scope of Supply
Proposal # 11395

Submitted by:

APGN Inc. *dba* APG – Neuros



Neuros Turbo Blower Core

APGN Inc. *dba* APG-Neuros
1270 Michèle-Bohec, Blainville, Québec J7C 5S4, Canada, Tel : (450) 939-0799
www.apg-neuros.com

February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Reference: Section 44 42 19.05– High Speed Turbo Air Compressors – Addendum 1 & 2

Subject: Request for Proposal – Supply of Process Aeration Equipment

Dear Gabriel,

APG-Neuros is pleased to submit the following proposal in response to the above referenced inquiry.

APG-Neuros Turbo Blower Scope of Supply:

A. APGN Inc, dba APG-Neuros confirms that our proposal package, for providing Six (6) factory assembled APGN500 Single Core High Speed Turbo Blowers, is in full compliance with the RFP, and the Technical Requirements in Section 44 42 19.05 "with no exceptions" and exceeds the RFP requirements, to be installed *indoors*, rated for conditions as shown on the specification, complete with integrated components as follows:

- Blower Core;
  - High Efficiency Forged Aluminum Impeller
  - Permanent Magnet Synchronous Motor
  - Magnetic Bearing
  - Titanium Shaft
  - Internal vibration and dynamic effect Absorption Mounts
  - Internal Expansion Joint

- Blower Local Control Panel;
  - 10" HMI Touch Screen
  - PLC Based Controller
  - Uninterruptible Power Supply for PLC - Industrial grade – (10 minutes)
  - Provisions for Remote Control capability via Ethernet, LAN or Hard wiring

- Vacon Variable Frequency Drive and Inverter
  - UL, CE & CSA certified
  - Built in Speed measurement
  - 3ph/60Hz/480 Volts

- Harmonic Filter
  - Passive type meets IEEE 519 Total Harmonic Distortion
  - Integrated inside the blower enclosure (Optional – At no additional cost)

- Equipment Sensors & Instruments;
  - Temperature sensors for motor, bearing, inlet and discharge air flow
  - Pressure sensors for inlet and discharge conditions
  - Pressure sensor and alert for air filter condition
  - Built in Flow Indication
  - Built in vibration sensor and transmitter (Optional – At no additional cost)

- All above components within a sound attenuating enclosure with;
  - 24" *Flanged* Inlet
  - 16" Discharge Expansion Cone
  - Inlet air filters

B. Each blower is complete with following ship-loose items:

- One (1) Blow-off bypass valve to blow off air flow during start/shutdown sequence
- One (1) Flanged Blow-off silencer to silence air flow during start/shutdown sequence
- One (1) Discharge Check Valve - Wafer, 16" (Cast Iron Body)
- One (1) Electrically Actuated Butterfly Valve - Lugged, 16" (Carbon Steel Body)
- One (1) Flexible connector for discharge (w/retaining rings and control rods), 16"
- One (1) Flexible connector for discharge aeration piping prior to the main air header (w/retaining rings and control rods), 16"
- One (1) Flexible connector for inlet (w/retaining rings and control rods), 24"

C. Master Control Panel

- One (1) Master Control Panel Allen Bradley PLC CompactLogix L7 series to control the blowers.

D. Submittal Information: Copies as required

- Qualifications of APG-Neuros
- Quality of construction
- Power Guarantee
- Product Data
- Detailed Drawings
- Quality Control
- Certified Blower test
- Operation and Maintenance Manuals

E. Payment Terms:

As per Section 00 41 65 – 4. Project – 4.1.5: Payment and Retainage Terms.

F. Proposal Validity and Seller Terms and Conditions

- This proposal, unless otherwise specified herein this document, is subject to the Seller's General Terms and Conditions of Sales available upon request.
- Final price is subject to change contingent on final conformed specification review, if applicable.

G. Factory Inspection and Tests

- Factory Acceptance Performance Test (As per Section 44 42 19 – 2.07 Source Quality Control – A. Factory Testing)
- All air and ground transportation, lodging, miscellaneous travel expenses, and meals for two representatives of Owner and the Engineer for a total of 3 people are included.

H. Warranty

(As per Section 44 42 19 – 1.09 Warranty)

- Extended warranty for an additional nine (9) year warranty for a total of ten (10) years (Comprehensive Warranty) at No Additional Cost to the Greater New Haven Water Pollution Control Authority
- Annual Service Contract extended for three (3) years from year 2 through 5 at No Additional Cost to the Greater New Haven Water Pollution Control Authority

I. Technical Support

(As per Section 44 42 19 – 3.03 Manufacturer's services)

- 1 site visit of 5 person-days for installation assistance.
- 1 site visit of 5 person-days for functional testing.
- 1 site visit of 5 person-days for demonstration testing.
- 1 site visit of 2 person-days for PAC Local Control Panel and instrumentation communicate with MCP prior to startup.
- 1 site visit of 5 person-days for coordination with SCADA.
- 1 site visit of 4 person-days for pre-training prior to startup. Training shall not commence until a detailed lesson plan for each training activity has been reviewed and accepted by Engineer.
- 1 site visit of 8 person-days for Operation and Maintenance Training.
- Training shall consist of 2 shifts for Operators and 2 shifts for maintenance staff at a minimum. Training shall not commence until a detailed lesson plan for each training activity has been reviewed and accepted by Engineer.

J. Spare parts

- One (1) spare set of inlet filters for each blower provided
- Two (2) sets of all special tools required for operation and maintenance, and complete assembly or disassembly of the Turbo Blower Equipment.

K. Quality Assurance / Certifications

- APG-Neuros Turbo Blower is UL1450/CSA & CE certified
- APG-Neuros production system is certified to ISO 9001

L. Freight

- F.O.B. Jobsite

M. Delivery Lead time

- Submittals shall be issued two (2) weeks from manufacturers acceptance of PO
- Blowers shall be shipped eight (8) to ten (10) weeks from approval of shop drawings.

N. Exclusions

The following items are not included in this scope of supply and shall be the responsibility of others.

- Blower Installation
- Piping for suction, discharge, gauge, vent, seal, etc. and miscellaneous fittings
- External Air filter not included

We appreciate the opportunity to quote APG-Neuros Turbo Blowers and look forward to a successful project.

For any questions regarding Sales, Procurement, Service and Warranty information, please contact:

APG-Neuros Sales Department
1270 Michèle-Bohec
Blainville, Québec J7C 5S4
Phone 450-939-0799
Fax 450-939-2115
sales@apg-neuros.com

2. Delivery Schedule

- **Submittals shall be issued Two (2) weeks from manufacturers acceptance of PO**
- **Blowers shall be shipped Eight (8) to Ten (10) weeks from approval of shop drawings.**

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

b. Exceptions

APGN Inc, dba APG-Neuros confirms that our proposal is in full compliance "with no exceptions" with RFP requirements and Addendum No.1 & 2 with the highest quality, performance, durability, and longevity of the equipment.

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1. No Exceptions Statement

APG – Neuros
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February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: "No Exceptions" Statement

This is to confirm that APGN Inc. submittal package are in full compliance with the technical specification and confirms that the proposed blowers' configuration and the equipment provided shall meet the performance requirements as defined in this Request for Proposal (RFP), Addendum No.1 & 2 and the Manufacturer's completed Guaranteed Wire Power Table.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

2. Recommendations

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

The proposed equipment from APG Neuros exceeds the specifications and offers higher performing options which would reduce the cost of installation and reduce the footprint of the blower. The following items are not required for the APGN500 proper functioning:

- **Harmonic Filter:** APG-Neuros provides the option to have the harmonic filter internal to the blower (at no additional cost) required to reduce harmonics negative effect on the plant electrical system. Our harmonic filters internally installed in our enclosure will reduce footprint required in the blower room and will eliminate external electrical cabling requirements and reduce installation costs. The other manufacturers do not include a harmonic filter in their product. Externally mounted harmonic filters increase the required footprint and involves external cabling and additional installation cost.
- **External Filter/Silencer:** APG-Neuros High Speed Turbo Blower, does not require external inlet filter, external inlet silencer or external discharge silencer in addition to an external inlet silencer.
  Providing external components increases the installation and maintenance costs and requires more footprint. Ourproposed equipment meets the 80 dbA sound level without the need for the inlet silencer.

- **Programmable Logic Control (PLC) :** APG-Neuros utilizes a true dedicated high capability PLC with HMI color touch screen. It is known that the other manufacturers substitutes the PLC with proprietary basic micro-communicator CPU based controls. CPU controller board is a manufacturer purpose design microprocessor with limited processing capability, internal inputs, outputs and memory. These outputs and inputs are very limiting from a program perspective with no possibility to set up the control system to adapt and respond to changing operating requirements and cannot process

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individual error messages or warnings and dynamically adjust and continue uninterrupted operation. The basic issue with the CPU control is that there is not enough programming and communication capability to adapt with the facilty control aricheture for a reliable operation around the year with the changing operating conditions. APG-Neuros dedicated PLC for each blower provides all the above services.

- **Vibration Sensor and Bearing Temperature Sensor :** APG-Neuros provides bearing temperature sensor and a Vibration sensor in each of the turbo blowers at no additional cost. Unlike the Other manufacturers, APG-Neuros Turbo Blowers continuously monitor core vibration and bearing temperature to protect the blower and prevent any possible major component damage. APG-Neuros Blower includes a vibration sensor and transmitter to protect the core and continuously monitor the vibration level of the blower core which is recommended as a method to measure and trend blower components health.
- **Heat Load Rejection :** APG-Neuros turbo blowers provides an air cooling system completely integral to the blower enclosure with no external connection. Ithe heat can be discharged to the blower room or to an external pipe. Other manufacturer are know to exhaust hot air to the blower room creating major losses in the blower efficiency and remarkably raising the room temperature which may affect the blowers and other electrical components in the blower room. or require external piping arrangement to exhaust hot air to the outside which require more pipework, time and maintenance.

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3. Necessary Components not specified

The proposed Equipment exceeds the specifications and requires less items as explained in the Recommandation section. No other components are required for proper functioning of the equipment as it is a plug and play equipment.

We are offering the following items that are not listed in the specifications:

- Vibration Sensor and Bearing Temperature at no additional cost
- Integrated Harmonic Filter at no additional cost
- 10 years warranty at no additional cost
- No heat rejection to the blower room

APG – Neuros
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c. Installation List

We offer a most proven product with more than 1500 blowers with over 15 years in operation at more than 600 WWTPs in North America. Over 30% of our customers are repeat customers in the United States and Canada. Our continuous technological improvements applied successfully lead to our very reliable operation, with measured availability level over 99.7%.

We have more than 20 blowers installed with Jacobs in 9 WWTPS, some of which have been running for the last 12 years.

Our installation in West Haven, CT is an example of successful experience as it has been running for the last 10 years with over 99.7% reliability.

APG – Neuros
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Fox Metro, IL Testimonial

“The Fox Metro Water Reclamation District has four dual core 700 HP blowers and 3 250 HP blowers. Wondering if this plant and our firm can be highlighted in any publications or marketing materials. I know the client is very happy with APG Neuros.”

Mark Halm,

Project Manager,

Deuchler.

Monroe County Water Resource Recovery, NY Testimonial

“With great customer service and 24/7, tailored yearly PM program with your staff working on site that truly cares, detailed and specific department training program you provide giving us long reliable lasting equipment, every business should consider your company for their next equipment selection.”

David Sam Tuccio,

Monroe County Water Resource Recovery,

Rochester, NY

APG – Neuros
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Our APGN500 Magnetic Bearing Blower comes with SKF magnetic bearings and high-speed electric motors which are ideal for applications demanding high speeds and low vibration and offers 130,000 magnetic bearings and high-speed electric motor references in operation across many industries.

We have one unit 1 MW Magnetic Bearing installation at Metro Denver since December 2019. The product is doing great and Metro Denver is considering adding more units in the future.

We have a contract with Central Contra Costa SD in California to deliver 3 x 1.1 MW Magnetic Bearing blowers in Q2 2022.

We have a contract with City of Las Vegas with Jacob's leadership to deliver 4 x 1.1 MW Magnetic Bearing blowers, one unit during Q2 2022 and three during Q3 2022.

APG – Neuros
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Tel : (450) 939-0799, www.apg-neuros.com

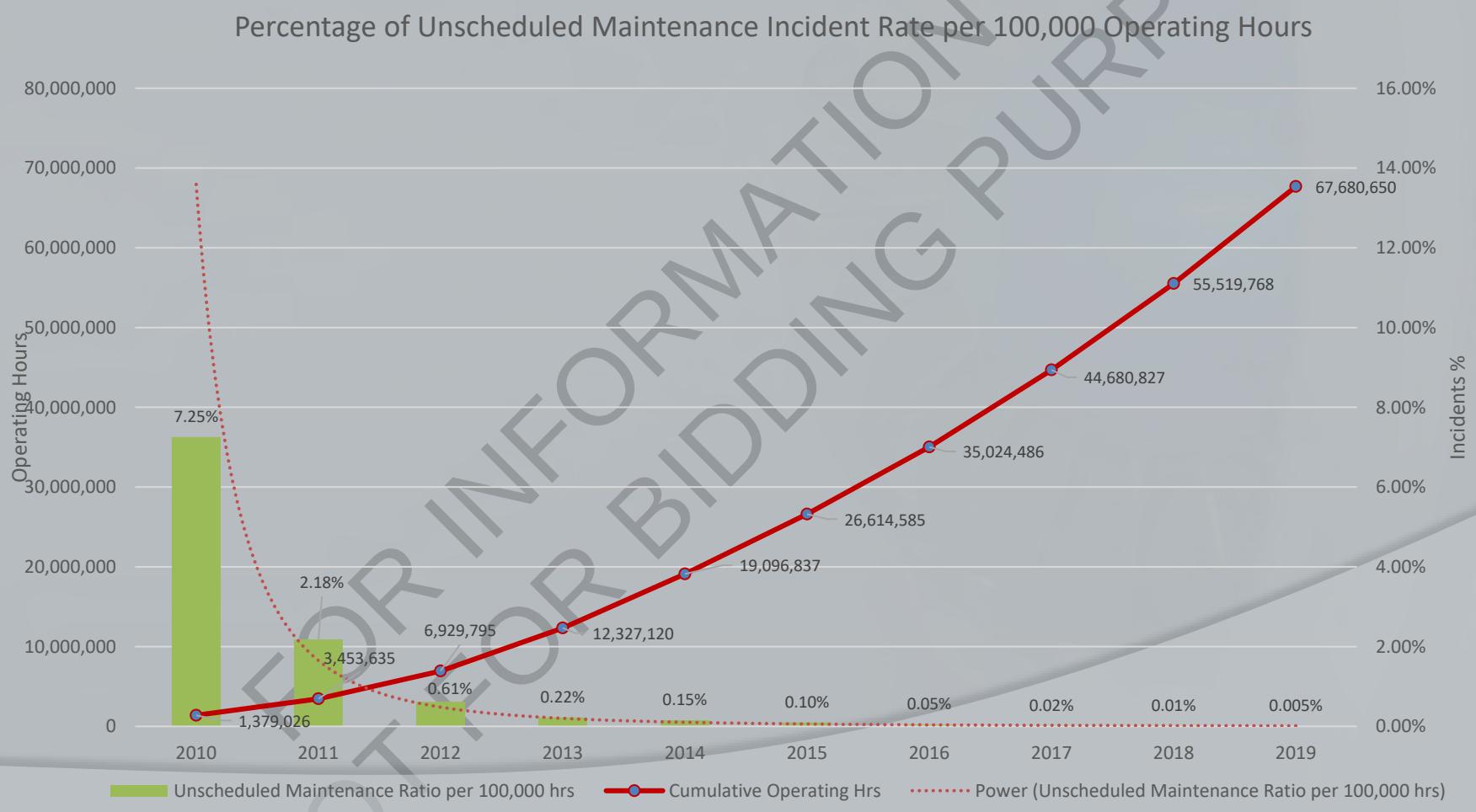
Market Leader

Over 1,500 units in North America

More than 600 installations

Fleet Reliability Improvement over 10 years

> 67 Million Operating Hours
> 99% availability level



APG-Neuros High Speed Turbo Blower - Full Installation List
February 2022

Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
06-0001	SNC Lavalin, QC	15-Jul-06	Quebec	1 x NX75-C060					Activated Sludge	Mickael Labrie	Project manager	450-772-0952	mecano@ctbm.ca
06-0002	Hollister, CA	1-Nov-09	California	5 x NX100-C050 4 x NX150-C080	2599	SCFM	11.6	PSIG	GE MBR + Aeration	James Heitzman Jose J. Rodriguez	Project Manager II Operations Supervisor	831-206-0065 831-637-7100	james.heitzman@veolia.com jose.rodriguez@veoliawaterna.com
07-0002	Lynden, WA	4-Jan-07	Washington	2 x NX50-C070	22.6	m3/min	0.62	BarG	Aerobic Digester / Blower not size properly	Michael Kim Robert Patrick	Water/Wastewater Superintendent Maintenance Electrician	360-354-0633 360_815-5769	Kinm@lyndenwa.org patrickr@lyndenwa.org
07-0003	Rupert, ID	26-Feb-08	Idaho	4 x NX300-C060					Extended Aeration Basin	David Joyce	Water Superintendent	208-434-2432	David.Joyce@rupert.id.us
07-0004	Tooele, UT	12-Aug-08	Utah	3 x NX75-C070	37.1	m3/min	0.43	BarG	aerate an oxidation ditch with fine bubble diffusers	Ray Henninger	Superintendent	435-882-1952	rayh@TooeleCity.org
07-0006	SanFelipe, NM	15-Feb-09	New Mexico	2 x NX100-C070	1515	SCFM	8	PSIG	MBS + Aeraion	Larry Hall Marvin Martinez Paul Kennedy	Superintendent Water & Wastewater Specialist EXT Engineer	505-927-9605 505.231.2262	larryh@aquaenviron.com marvin.martinez@soudermiller.com paul.kennedy@soudermiller.com
07-0007	Roseburgh, OR	2-Jan-08	Oregon	1 x NX75-C050					Activated Sludge	Kevin Bruton	Plant Manager	541-530-7557	Kevin.Bruton@CH2M.com
07-0008	Orangeville, ON	20-Jun-09	Ontario	1 x NX75-C080					extended aeration cells	Jeff Hardy	Wastewater supervisor	519-941-0440 #4701	jhardy@orangeville.ca
07-0009	James River HRSD Lease and buy	1-Aug-07	Virginia	1 x NX200-C070					Activated Sludge	Rob Luma	Superintendent	757-833-1740	rluma@hrsd.com
07-0010	Clark County-Lease and buy	28-Oct-10	Nevada	1 x NX100-C070						Will Smith David A. Pearce	Plant Operations Supervisor Maintenance & Lift Station Supervisor	702-668-8441/ cell: 702-210-3399 702)622-2942	wsmith@cleanwaterteam.com dpearce@cleanwaterteam.com
07-0012	Kingston Ravenview, ON	1-Jun-08	Ontario	4 x NX150-C100					BAF plant	Stephen King	Maintenance Supervisor	613-546-1181 #2166	sking@utilitieskingston.com
08-0001	Boisbriand, QC	7-Jul-09	Quebec	3 x NX125-C100					Biofiltration	Eric Faubert	Superviseur unsine traitement des eaux	450-435-1954 # 346	efaubert@ville.boisbriand.qc.ca
08-0002	Eloy, AZ	18-Aug-08	Arizona	3 x NX75-C070					2 x Plant Package	Jack Cook Jr.	Superintendent	520-483-4465	jack.cookjr@corecivic.com
08-0004	Brightwater, WA	27-Oct-10	Washington	7 x NX300-C080	5000	SCFM	12	PSIG	GE MBR	Blaine Rambough	Wastewater Maintenance Supervisor	206-579-2000	blaine.rambough@kingcounty.gov
08-0005	City of Benicia, CA	1-Nov-08	California	3 x NX75-C070	1300	SCFM	8	PSIG	Activated Sludge	Jeff Gregory	WWTP Superintendent	707-590-3322	Jeff.Gregory@ci.benicia.ca.us
08-0006	Richmond, UT	28-Jun-09	Utah	2 x NX150-C070	2180	SCFM	8.4	PSIG	MBR	Troy Hooley Jeremy Kimpton	Plant Manager City Administrator	435-764-5454 435-994-1572	thooley@richmondutah.org jkimpton@richmondutah.org
08-0007	Pumpkinvine, GA	17-Feb-10	Georgia	3 x NX100-C070 2 x NX75-C070	1356	SCFM	9.11	PSIG		Russell Kelly Mark Filer	Wastewater Division Manager Plant Superintendent	C:404-536-0966 O:678-224-4082 C:678-207-8582	rkelly@paulding.gov mfiler@paulding.gov
08-0008	Blaine Lighthouse Point, WA	13-May-10	Washington	4 x NX75-C080	893	SCFM	10.22	PSIG	Activated Sludge	Matt Luttrell	Lead Operator	360-332-3718	MLutrell@cityofblaine.com

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
08-0009	United Oil Recovery, CT	19-Nov-09	Connecticut	1 x NX100-C070						Joe Renkiewicz Eric Congdon	Manager	203-627-6190 203-631-0343	joe.renkiewicz@tradebe.com eric.congdon@tradebe.com
08-0010	West Travis	14-Jul-09	Texas	2 x NX50-C040	1395	SCFM	5	PSIG		Michael Sarot	General Manager	512-897-7898	msarot@wtcpua.org
08-0011	Alderwood-Picnic Point	21-Jul-09	Washington	4 x NX100-C060 4 x NX75-C080	2100	SCFM	8	PSIG		Joe Carter Manuel Semana Kevin Sykes Corey Ott	WWTF Manager Senior Facilities Mechanic SCADA / Electrical Manager SCADA Systems Lead	425-787-1940 Ext. 8311 425-787-3271 425-248-0029	jcarter@awwd.com MSemana@awwd.com KSykes@awwd.com cott@awwd.com
08-0012	King County South Point WWTP	1-Aug-09	Washington	2 x NX100-C060	2200	SCFM	8.11	PSIG		Lester Van Gerder Bill Bailey	Maintenance Supervisor Mechanical Lead	206-263-1827 206-263-1739	Lester.vangelder@kingcounty.gov william.bailey@kingcounty.gov
08-0013	NAPA Sanitation district	1-Mar-09	California	2 x NX300-C080					Activated Sludge	Mark C. Egan Steve Palko	Plant Maintenance Supervisor Equipment Maintenance Specialist	707-258-6020#607 707-312-1774	MEgan@napasan.com spalko@napasan.com
08-0014	Rock Creek, OR	5-Oct-09	Oregon	1 x NX300-C070	6000	SCFM	8.7	PSIG	Activated Sludge	Chad King			kingc@cleanwaterservices.org
08-0015	Lake Haven, WA	29-Jan-09	Washington	1 x NX300-C080	5512	SCFM	11.41	PSIG	Activated Sludge	John Barton Brian Richardson John Kercher	Wastewater Operations Manager Wastewater Operations Supervisor	253-945-1642 253-945-1660 253-561-1357	jbarton@lakehaven.org brichardson@lakehaven.org jkercher@lakehaven.org
08-0016	Eagle Mountain, UT	9-Jun-09	Utah	1 x NX75-C070						Mach Straw Brody Kinder	Plant Manager Waste Water Supervisor	801-789-6678 801-789-6691	mstraw@emcity.org bkinder@emcity.org
08-0017	Las Vegas Valley Phase 1, NV	1-Jun-10	Nevada	2 x NX300-C080						Joseph Lin	Engineer	702-875-7062	joseph.lin@lvvwd.com
08-0018	EMWD-Moreno Valley-SCATT	1-Jan-10	California	1 x NX300-C060	6000	SCFM	8.8	PSIG		Matthew Melendrez Greg Henson	Director of Water Reclamation Plant Manager	951-928-3777 #4303 951-928-3777 #7200	melendrm@emwd.org
08-0019	Granby, QC	1-Apr-13	Quebec	1 x NX300-C060						Claude Ouimette	Coordonateur divison des eaux	450-776-8363	couimette@ville.granby.qc.ca
08-0020	Pinellas County Utilities, FL	8-Jul-09	Florida	2 x NX300-C070					Aeration	Ivy Drexler Mike McRorey Chuck Fry	Plant Manager Assistant Plant Manager Maintenance Manager	P:727-582-7023 C:774-991-2009 P:727-582-7009 C:806-778-2129	idrexler@pinellascounty.org mmcrorey@pinellascounty.org cfry@co.pinellas.fl.us
08-0021	Gig Harbour	30-Oct-09	Washington	2 x NX50-C070 2 x NX75-C070 1 x NX100-C070						Darrell Winans	Plant Supervisor	253-851-8999	winansd@cityofgigharbor.net
08-0022	City of Bremerton WWTP	26-Jan-09	Washington	1 x NX100-C050					Activated Sludge	Rick Zimburean	Maintenance Supervisor	360-473-5449	rick.zimburean@ci.bremerton.wa.us
08-0023	Kingston West WWTP-Cataraqui	23-Sep-09	Ontario	2 NX150-C070	3000	SCFM	10	PSIG	Activated Sludge	Wayne MacKenize	Subforeperson	613-546-1181	wmackenize@utilitieskingston.com
09-0001	Rockland(Buy America)	23-Sep-10	Maine	3 x NX100-C070	1900	SCFM	9.5	PSIG	Activated Sludge	Terry Pinto	Plant Director	207-594-0324	tpinto@ci.rockland.me.us

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09-0002	Throops(Buy America), PA	14-Dec-11	Pennsylvania	1 x NX200-C070 3 x NX100-C070	4000	SCFM	9.1	PSIG		Michael Matechak Robert Davis	Executive Director Plant Superintendent	570-489-7563 570-489-7563	DIRECTOR@LRBSA.COM superintendent@lrbsa.com
09-0003	East Windsor-MUA, NJ	15-Jun-10	New Jersey	2 x NX200-C070					Activated Sludge	Darren Zujkowski	East Windsor MUA Utilities O&M Manager	609-443-7611 # 6612	dzujkowski@eastwindsormua.com
09-0004	Webster, MA	24-May-11	Massachusetts	2 x NX150-C070-125						William G. Burke	Superintendent	508-949-3865	wburke@webster-ma.gov
09-0005	Franklin, NH	28-Sep-10	New Hampshire	2 x NX150-C060 2 x NX100-C0?0					Activated Sludge	Anthony Brown Ken Noyes		603-934-2809 603-528-6746	anthony.brown@des.nh.gov ken.noyes@des.nh.gov
09-0006	Mesquite, NV	28-Jan-11	Nevada	2 x NX150-C070-125	2000	SCFM	8.8	PSIG	Digester	Randon Potter Randy Woods	Plant Manager Plant Lead operator	702-346-5124 702-232-5001	rpotter@mesquitenv.gov rwoods@mesquitenv.gov
09-0007	Ironhouse, CA	1-Feb-11	California	3 x NX200-C050 3 x NX300-C060	5568	ICFM	5.12	PSIG	GE MBR	Chris Christean	Plant Manager	925-625-2279	christean@isd.us.com
09-0008	South Windsor, CT	7-Sep-10	Connecticut	3 x NX100-C050	2700	SCFM	7.46	PSIG	MLE process	Tim Friend	Plant Supervisor	860-289-0185	Timothy.Friend@southwindsor.org
09-0009	Stafford, CT	1-Jan-11	Connecticut	2 x NX50-C050	1400	CFM	6.4	PSIG		Rick Hartenstein	Superintendent	860-684-4914	hartenstein@staffordct.org
09-0010	Stuart Draft, VA	21-Aug-10	Virginia	2 x NX150-C080	2336	SCFM	9.8	PSIG	Activated Sludge	Tony Morse Doug Ayres	Director of Treatment Operations Plant Supervisor	540-245-5229 P-540-337-1880 C-540-490-2425	tmorse@co.augusta.va.us dayres@co.augusta.va.us
09-0011	American Bottom, IL	28-Sep-10	Illinois	1 x NX600-C080	9600	SCFM	12.5	PSIG		Kelly R. Smith	Operations Manager	618-337-1710 Ext 209	kellys@americanbottoms.com
09-0012	West Haven, CT	19-Aug-11	Connecticut	5 x NX200-C050	4855	SCFM	7.5	PSIG	Activated Sludge	Jack Crosby	Superintendent	203- 937-3637	JCrosby@westhaven-ct.gov
09-0013	Proctors Creek, VA	30-Jul-12	Virginia	6 x NX300-C080 4 x NX300-C060	6100	SCFM	8.2	PSIG	IFAS process	Scott Morris Scott Hall	Plant Manager	804-768-7557 804-892-7808	morrissc@chesterfield.gov halljs@chesterfield.gov
09-0014	New Milford, CT	11-Jan-11	Connecticut	1 x NX50-C070						Ken Cook	Instrumentation	860-355-2805 860-488-1810	kcook@nmwpca.org
09-0015	Picton, ON	1-Oct-10	Ontario	4 x NX100-C060	60.9	m3/min	8.8	PSIG	aerate digesters, Storage tanks, Aeration tanks	Landon Wiltshire	Supervisor	613-476-2148	lwiltshire@pecounty.on.ca
09-0016	Plover(#1 assembly in PL), WI	25-Mar-11	Wisconsin	3 x NX150-C070					Activated Sludge	Rich Boden Lyle Lutz	Superintendent Asst Wasterwater Manager	715-345-5259 715-340-2953	rboden@ploverwi.gov llutz@ploverwi.gov
09-0017	Valdosta, GA	25-Feb-11	Georgia	3 x NX75-C070 4 x NX75-C060					Activated Sludge	Kenneth Lowe Keith Martin Tom Hess Randy Jones	Assistant Superintendent Plant Superintendent Maintenance Superintendent Maintenance Supervisor	229-333-1855 229-333-1855 229-333-1855 229-333-1855	klowe@valdostacity.com skmartin@valdostacity.com thess@valdostacity.com rjones@valdostacity.com
09-0018	Parsippany, NJ	12-Jul-11	New Jersey	3 x NX300-C060 2 x NX150-C050	2708	SCFM	6.7	PSIG	BNR Plant	Steven Vetrero Phil Bober Frank Lorito	Maintenance Superintendent Assistant Superintendent	973-428-7593 973-428-7593 973-428-7416	svetrero@parsippany.net pbober@parsippany.net florito@parsippany.net

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
09-0019	EMWD-Phase II APAD	1-Aug-11	California	1 x NX300-C060 1 x NX300-C060	6000	SCFM	8.8	PSIG		Matthew Melendrez Greg Henson	Director of Water Reclamation Plant Manager	951-928-3777 #4303 951-928-3777 #7201	melendrm@emwd.org
09-0020	Jacksonville Beach, FL	9-Oct-09	Florida	3 x NX50-C080 3 x NX200-C080	3200	SCFM	12.5	PSIG	SBR	Chuck Saunders Will Rivers	Maintenance Supervisor Maintenance	904-270-1608 904-333-9535	csaunders@jaxbchfl.net wrivers@jaxbchfl.net
09-0021	James River, VA	18-Oct-10	Virginia	3 x NX300-C060	8400	SCFM	7.5	PSIG		Rob Luma Dean Lowery	Superintendent Electrical & Instrumentation Superintendent	757-833-1740 757-274-4947	rluma@hrsd.com dlowery@hrsd.com
09-0022	Falling Creek, VA	9-Aug-10	Virginia	6 x NX300 -C070	5800	SCFM	8.4	PSIG	IFAS process	Scott Morris Austin French	Plant Manager Chief Plant Operator	804-768-7557 804-717-6093	morrissc@chesterfield.gov FrenchA@chesterfield.gov
09-0024	Moores Creek WWTP, VA	1-Dec-12	Virginia	3 x NX300-C060 2 x NX200-C060	4390	CFM	9.33	PSIG	Activated Sludge	Greg Morris Tim Castillo	Maintenance Manager Operations	434-977-2970#120	gmorris@rivanna.org
09-0025	Sherbrooke, QC	12-Apr-10	Quebec	1 x NX100-C060						Andre Lacharite		819-564-6241 819-571-6469	Andre.lacharite@ville.sherbrooke.qc.ca
09-0026	South Kingstown, RI	11-Feb-10	Rhode Island	2 x NX100-C050	2768	SCFM	5.25	PSIG	Mix liquor Aeration	Katy Perez	Superintendent	401-788-9772	kperez@southkingstownri.com
10-0001	Ogdensburg, NY	28-Jul-10	New York	4 x NX50-C050	1050	SCFM	6.8	PSIG		Christian Fout	Water Quality Supervisor	518-578-5677	cfout@danc.org
10-0002	SKF, CA	10-Jun-10	California	2 x NX200-C080 4 x NX300-C070	6300	SCFM	9.17	PSIG	Activated Sludge	Gabriel Jimenez		559-647-1625	gjimenez@skfcsd.org
10-0003	Durham, NH	14-Dec-10	New Hampshire	2 x NX75-C070					Activated Sludge	Dan Peterson	Superintendent	603-868-2274	fax: 603-868-5005
10-0004	Brockville, ON	1-Feb-12	Ontario	3 x NX150-C070						Phil Wood	Chief Operator	613-342-8772	pwood@brockville.com
10-0006	Richland (ARRA), WA	18-Oct-10	Washington	2 x NX300-C080-250						Steve Brewer	Wastewater Manager	509-942-7481	sbrewer@ci.richland.wa.us
10-0007	Linda County, CA	7-Feb-12	California	2 x NX300-C080	4400	SCFM	11.69	PSIG		Brian Davis John Harvey	Engineer Superintendent	530-743-2482 530-743-2756	bdavis@lindawater.com jharvey@lindawater.com
10-0008	Long Branch, NJ	31-Aug-11	New Jersey	3 x NX125-C070-125						Joseph Martone	Executive Director	732-222-0500 #116	lbsamartone@comcast.net
10-0009	Boat Harbor-HRSD, VA	1-Feb-12	Virginia	1 x NX150-C060-125					Activated Sludge	Ken Sands	Chief Operator	757-244-1670	ksands@hrsd.com
10-0010	Crossville, TN	2-Mar-11	Tennessee	2 x NX150-C070	2950	SCFM	8.56	PSIG	Activated Sludge	Darian Dykes	Manager for Veolia Water	931-484-6257	darian.dykes@veolia.com
10-0011	Modesto Siemens, CA	18-Aug-15	California	4 x NX150-C070					MBR & Aeration Basins	Laura Anhalt, Ben Koehler, Noland Harris, Michael Martin, Randy Loflin,	Wastewater Treatment Plant Manager Utilities Plant Supervisor Maintenance Supervisor Utilities Electrical Supervisor PLC Specialist	209-342-4502 209-577-6288 209-471-0387 209-577-6235 209-577-6200	lanhalt@modestogov.com bkoehler@modestogov.com nharris@modestogov.com mmartin@modestogov.com rloflin@modestogov.com
10-0015	Shelton, WA	17-Aug-11	Washington	5 x NX50-C060					Activated Sludge	Brent Armstrong		360-229-6767	brent.armstrong@shetlonwa.gov

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
10-0016	McAllen-North Plant, TX	29-Jun-12	Texas	3 x NX100-C050 5 x NX300-C070	2700	SCFM	5.4	PSIG	Aerobic Digester and Sludge Thickener Aeration	Jose L. Moreno Ramon Trevino	Plant Manager Supervisor	956-681-1780 956-681-1785	jomoreno@mcallen.net Ramon.trevino@mcallen.net
10-0017	Ballanger-McKinney, MD	26-Sep-12	Maryland	2 x NX200-C060 2 x NX200-C080 7 x NX300-C050 5 x NX300-C060	5800	SCFM	8.7	PSIG	GE MBR	Robert Money Leo Miller Mike Carlson	Superintendent Maintenance Supervisor Operator	301-600-3417	BMoney@FrederickCountyMD.gov lmiller@frederickcountymd.gov mcarlson@frederickmd.gov
10-0018	Arnprior, ON	15-Feb-11	Ontario	1 x NX50-C060-30 1 x NX75-C050	1300	AM3/HR	55	KPAG	Activated Sludge	Mike Trumble	Waterworks Supervisor	613-623-4231# 1834	mtrumble@arnprior.ca
10-0019	Garland, TX	29-Mar-11	Texas	1 x NX300-C060 1 x NX300-C070	5800	SCFM	7.8	PSIG		Sherry Hartsock	Maintenance Scheduler	972-205-2717	shartsock@garlandtx.gov
10-0020	Marlborough, MA	17-Jun-11	Massachusetts	2 x NX100-C060 2 x NX075-C060					diffused aeration in our secondary aeration tanks	Dennis L'Homme	Head Treatment Plant Operator	508-624-6919	dlhomme@marlborough-ma.gov
10-0021	Clark County, NV	28-Oct-10	Nevada	1 x NX300-C070	5800	SCFM	8.4	PSIG		Will Smith David A. Pearce	Plant Operations Supervisor Maintenance & Lift Station Supervisor	702-668-8441/ cell: 702-210-3399 702)622-2942	wsmith@cleanwaterteam.com dpearce@cleanwaterteam.com
10-0022	Dryden,NY	28-Feb-12	New York	2 x NX50-C080 2 x NX50-C070 1 x NX50-C060-30	635	SCFM	10.5	PSIg		David Coish	Chief 3A Operator	607-427-2850	boxerlovers1673@gmail.com
10-0023	Kimberly Clark, WI	16-Oct-10	Wisconsin	1 x NX500-C100	6500	SCFM	14	PSIG	nonwovens manufacturing process	Michael Born	Supervisor	920-721-4521	mborn@kcc.com
10-0024	Deux-Montagnes, QC	8-Nov-10	Quebec	3 x NX150-C050-125	3200	ACFM	462	mbarg	Activated Sludge	Benjamin Crampond	Directeur General Adjoint	514-208-5161	benjamin.crampond@aquatech-inc.com
10-0025	Harris County, TX	8-Dec-10	Texas	3 x NX75-C060						Jose Alfarenga	Lead Operator	832-731-1673	texas@consolidated.net
10-0026	HRSD ARMY BASE, VA	4-Aug-15	Virginia	2 x NX150-C060 5 x NX300-C080	4750	SCFM	11.7	PSIG		Brian McNamara Jeff Powell	Plant Manager Superintendent	757-440-2521 757-440-2523	bmcnamara@hrsd.com jpowell@hrsd.com
10-0028	Gresham, OR	3-Aug-11	Oregon	2 x NX100-C060	1750	SCFM	7.4	PSIG	Activated Sludge	Jeff Egan Adam McClymont	Maintenance Supervisor Plant Manager	503-307-3258	jeff.egan@jacobs.com Adam.McClymont@jacobs.com
10-0029	Granite City, IL	1-Mar-11	Illinois	2 x NX300-C050 1 x NX100-C050	2200	SCFM	6.7	PSIG	a pre-aeration basin upstream	William Jones Jeff Hamilton Keith Watson	Assistant Superintendent Superintendent General Foreman of Maintenance	616-452-6229 618-910-9191 618-447-6809	bjones@granitecity.illinois.gov jhamilton@granitecity.illinois.gov kwatson@granitecity.illinois.gov
10-0030	City of Florence, SC	1-Jan-13	South Carolina	3 x NX50-C060 5 x NX300-C070	5537	SCFM	10.5	PSIG	Activated Sludge	Michael Hemingway	Superintendent	843-665-3236	mhemingway@cityofflorence.com
10-0032	OCWA Carleton Place, ON	1-Dec-10	Ontario	1 x NX50-C060	1000	SCFM	8	PSIG	Activated Sludge	Mandi Larose	Operations & Maintenance Team Lead	613-257-9430	mlarose@ocwa.com

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10-0033	Campbell River, BC	14-Dec-11	British Columbia	3 x NX150-C060	3300	SCFM	8	PSIG		Steve Roehr	Wastewater and Drainage Supervisor	250-203-3973	steve.roehr@campbellriver.ca
10-0034	OCWA Matheson, ON	19-Nov-10	Ontario	1 x NX50-C080	620	SCFM	8.4	PSIG	stab tank, aeration tank, digester and return sludge	Dale Waghorn	Supervisor	705-642-5341	DWaghorn@ocwa.com
10-0036	St-Joseph WWTP, IL	16-Jun-11	Illinois	1 x NX50-C050					Digester	Mike Peters	Superintendent	214-840-4412	mike.peters@stjosephillinois.org
10-0037	Athatbasca, AB	23-Feb-11	Alberta	2 x NX100-C060						Terry Kosinski	Outside superintendent	780-689-8621	wtp@athabaska.ca
10-0038	Wheaton, IL	6-Jun-11	Illinois	1 x NX200-C060					Activated Sludge	Matthew A. Larson P.E. Sue Baert Dave Bullard	Executive Director Plant Superintendent Maintenance Supervisor	312-292-1609 630-740-6792 630-740-6654	larson@wsd.dst.il.us baert@wsd.dst.il.us Bullard@wsd.dst.il.us
10-0039	Bull Hide Creek WWTP, TX	28-Sep-11	Texas	2 x NX150-C100					Activated Sludge & BNR	Scott Espen	Plant Manager	254-379-4391	scotte@wacotx.gov
10-0040A	Scottsdale, AZ (Gainey Ranch)	23-May-11	Arizona	3 x NX50-C060	1340	SCFM	7.5	PSIG		Art Nunez Chris LoMonaco	Director of Wastewater Operator IV	480 263 1240 480-312-8771 (Office) 480-721-1165	anunez@scottsdaleaz.gov CLOMONACO@SCOTTSDALEAZ.GOV
10-0040B	Scottsdale, AZ (Water Campus)	23-May-11	Arizona	3 x NX300-C080-250	4980	SCFM	9.8	PSIG		Art Nunez Michael Hecox Tim West	Director of Wastewater Operator IV Maintenance Tech III	480 263 1240 480-312-8771 (Office) 480-312-8767 480-349-5628	anunez@scottsdaleaz.gov mhecox@scottsdaleaz.gov atewst@scottsdaleaz.gov
10-0041	Lott Alliance, WA	6-Jun-11	Washington	1 x NX400-C100	6000	SCFM	12	PSIG	BNR process	Gabe Brannon	Instrumentation	360-580-9780	GabeBrannon@lottcleanwater.org
10-0042	Fairfield, CT	18-Mar-11	Connecticut	1 x NX300-C070	6750	SCFM	7.41	PSIG		Joseph Michelangelo	Director of Public Works	203-256-3010	jmichelangelo@town.fairfield.ct.us
10-0043	Woonsocket, RI	7-Dec-10	Rhode Island	3 x NX300-C050					Activated Sludge	Jim Lauzon			jlauzon1@ch2m.com
10-0045	City of Vancouver, WA	25-Feb-11	Washington	1 x NX300-C060	6100	SCFM	8.1	PSIG		Matt McCallum Eric Schadler	Wastewater Utility Asset Manager Chief Operator	360-608-3447, 360-695-0092	Matt.McCallum@jacobs.com Eric.Schadler@cityofvancouver.us
10-0046	EMWD-San Jacinto, CA	24-Mar-14	California	2 x NX350-C070	6400	SCFM	8.5	PSIG		Matthew Melendrez Matt Verosik Chuck Norberg	Director of Water Reclamation Plant Manager Electrical	951-928-3777 #4303 951-928-3777 #7100 602-501-5394	melendrm@emwd.org verosikm@emwd.org norbergc@emwd.org
10-0047	Sugarland, TX	10-Jun-11	Texas	1 x NX50-C050 1 x NX100-C050	1400	SCFM	6.8	PSIG	Aeration	Greg Graf	Plant Maintenance Crew Leader	281-980-2183 x 7502	greg.graf@brazos.org
10-0048	City of Bryan, TX	7-Jul-11	Texas	1 x NX150-C060	3000	SCFM	8	PSIG		Mark Jurica Victor Harris	Treatment & Compliance Manager Treatment Supervisor	979-209-5900 979-229-7259	mjurica@bryantx.gov vharris@bryantx.gov
10-0049	Monroe County (Phase I, II & III), NY	7-Nov-11	New York	10 X NX350-C080	5250	SCFM	12.5	PSIG		David Tuccio	project manager for FEV Aeration	585-753-7695	DTuccio@monroecounty.gov
10-0050	Erie WWTP, PA	5-Oct-11	Pennsylvania	6 x NX300-C070	6000	SCFM	8	PSIG	Typical Aeration	Len Malinowski	Maintenance Superintendent	814-870-1360	lmalinowski@erie.pa.us

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
10-0051	Heinz, OR	11-Jan-11	Oregon	1 x NX300-C070	5200	SCFM	10.2	PSIG	Typical Aeration	Bob Pharmer Jess Farrow	Stover Group ENG Maintenance	405-385-2439 208-447-7131	rpharmer@stovergroupeng.com jess.farrow@kraftheinz.com
10-0052	Daphne, AL	20-Apr-11	Alabama	3 x NX150-C060	3500	CFM	9	PSIG	Activated Sludge	Sharon Surra	Water Reclamation Manager	251-753-6726	sharon@daphneutilities.com
10-0053	Longview, TX	23-Aug-11	Texas	1 x NX150-C070 1 x NX150-C070-125	2200	SCFM	11	PSIG		Scott Baggett Chris Snapp	Plant Manager Utility Maintenance & Technology Manager	903-291-5220 903-291-5243	sbaggett@longviewtexas.gov csnapp@longviewtexas.gov
10-0054	City of Dryden, ON	12-Jul-12	Ontario	2 x NX100-C100					Digesters and SBR's	Dean Walker	Plant Manager	807-223-2367	dwalker@dryden.ca
10-0055	Dannon, UT	5-Apr-11	Utah	3 X NX75-C070 3 x NX150-C080	1200	SCFM	11.7	PSIG		Steve Sandquist Craig Dinehart	Utility Supervisor	801-301-7407 801-618-9822	steve.sandquist@dannon.com craig.dinehart@dannon.com
10-0056	Orange Park, FL	1-Aug-11	Florida	2 x NX50-C080	615	SCFM	7.9	PSIG	SBR wastewater plants	Roger Rich	Superintendent of Utilities	904-264-7411	rrich@townop.com
10-0057	Ellsworth, ME	1-Oct-12	Maine	3 x NX75-C080	1170	SCFM	8.75	PSIG		Michael Harris	Wastewater Superintendent	207-667-7315	mharris@cityofellsworthme.org
10-0058	Shelton Phase II, WA	17-Apr-12	Washington	1 x NX50-C070-30 1 x NX50-C080-30	800	SCFM	6.5	PSIG		Brent Armstrong	Lead Operator	360-229-6767	brent.armstrong@shetlonwa.gov
10-0059	OCWA Port Elgin, ON	17-Jun-11	Ontario	1 x NX75-C050	6100	SCFM	9.1	PSIG		Adam Stanley	Operations Manager	519-385-2799	adam.stanley@saugeenshores.ca
10-0060	Glendale Heights, IL	7-May-10	Illinois	1 x NX150-C070 2 x NX150-C070	3050	SCFM	9	PSIG	Aerobic Digester Typical Aeration	Brian Maritato Jeff McCumber Chuck Fonte	Manager WPCF	630-909-5131 630-909-5131 630-942-1963	brian_maritato@glendaleheights.org jeff_mccumber@glendaleheights.org cfonte@glendaleheights.org
11-0001	Jackson Miller, TN	2-Feb-12	Tennessee	3 x NX200-C060 3 x NX200-C060	4550	SCFM	5.4	PSIG		Edmond O'Neill David Hale	Plant Engineer Plant Maintenance Supervisor	731-422-7214 731-422-7525 731-267-3403	eoneill@jaxenergy.com dhale@jaxenergy.com
11-0002	Brantford, ON	6-Oct-11	Ontario	1 x NX200-C050	7428	nm3/h	52	kPaG	fine bubble aeration	Ron Lynes John Smith	Plant Manager Maintenance	519-759-4150 ext 5825 519-732-3937	RLynes@brantford.ca smithj@brantford.ca
11-0003	Vancouver Marin Park, WA	1-May-11	Washington	1 x NX300-C070	6100	SCFM	9.1	PSIG	Activated Sludge	Matt McCallum	Wastewater Utility Asset Manager	360-608-3447	Matt.McCallum@jacobs.com
11-0004	Azle Creek, TX	8-Jan-13	Texas	1 x NX75-C080 3 x NX150-C080	2200	SCFM	11	PSIG	BNR system and to aerate our Sludge Holding Tank	Kenneth Richards	Wastewater Plant Superintendent	817-444-2678	krichards@cityofazle.org
11-0005	Delta Diablo, CA	27-Feb-12	California	3 x NX300-C060						Joaquin Gonzalez	Operations Manager	925-756-1967ext 1971	joaquing@deltadiablo.org
11-0007	Hattisburg, MS	21-Dec-11	Mississippi	1 x NX600-C060	13000	SCFM	6.6	PSIG		Alan Howe Arnold Landrun Mike Hill	Director General Manager WWTP Contractor	601-408-0586 601-545-4530 601-319-8560	ahowe@hattiesburgms.com alandrum@hattiesburgms.com
11-0008A	Cincinnati, OH-Little Miami	18-Mar-13	Ohio	4 x NX500-C070	8165	SCFM	8.8	PSIG		David Bauer Kevin Cunningham	Operations Maintenance	513-352-4921 513-368-1566	david.bauer@cincinnati-oh.gov kevin.cunningham@cincinnati-oh.gov

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
11-0008B	Cincinnati, OH - Mud Creek	14-May-12	Ohio	4 x NX300-C070-250	4770	SCFM	8.3	PSIG		Tim Hauck Tommy Goodman	Operations Maintenance	513-352-4923	Timothy.hauck@cincinnati-oh.gov tom.goodman@cincinnati-oh.gov
11-0009	City of Warsaw, IN	28-Sep-11	Indiana	1 x NX200-C060	3900	SCFM	8	PSIG	aerobic digester	Larry Hyden Brian Davison	Assistant Utility Manager Utility Manager	574-372-9562 574-372-9562	lhyden@warsaw.in.gov bdavison@warsaw.in.gov
11-0010	Spokane, WA	16-Jun-11	Washington	2 x NX100-C060 3 x NX200-C050 3 x NX300-C070	4550	SCFM	5.4	PSIG	GE MBR	Nathen Dahl Valerie Garcia Tony Benavidez	Project Manager Operations Supervisor	509-389-5894 951-883-4030 509-688-3862	nathan.dahl@jacobs.com valerie.garcia@jacobs.com anthony.benavidezl@jacobs.com
11-0011	Repentigny, QC	17-May-12	Quebec	3 x NX300-C050	7886	SCFM	7.11	PSIG		Christian Boulanger	Directeur de l'usine	450-470-3001 ext 3883	boulanger.christian@ville.repentigny.qc.ca
11-0012	Pima County, AZ	1-Aug-13	Arizona	5 x NX600-C100	8000	SCFM	14.5	PSIG		Patrick J. Padilla John Sherlock	Maintenance Supervisor Deputy Director of Treatement	520-405-3168 520-443-6100	patrick.padilla@jacobs.com john.sherlock@pima.gov
11-0013	Fox River Grove, IL	12-Jan-12	Illinois	1 x NX30-C050	650	SCFM	6.5	PSIG	Digesters	Tim Zintl	Superintendent	847-639-8360	t.zintl@foxrivergrove.org
11-0014	Richmond, VA	10-Jul-12	Virginia	2 x NX200-C060	4000	SCFM	9	PSIG		Donald Carter	Environmental Compliance Officer	804-646-8266	Donald.Carter@richmond.gov
11-0015	Goleta, CA	24-Oct-12	California	3 x NX150-C070	3000	SCFM	9.3	PSIG		Chuck Smonikar	Facilities Maintenance Supervisor	805-967-4519	csmolnikar@goletasanitary.org
11-0016	Iowa City, IA	9-Nov-11	Iowa	1 x NX200-C070	4000	SCFM	7.5	PSIG		Brad Herrig	Senior Maintenance Worker	319-631-1137	Brad-Herrig@iowa-city.org
11-0017	Hackesttown-Huma, NJ	19-Jan-12	New Jersey	2 x NX075-C050	1700	SCFM	7.5	PSIG		Kathleen Corcoran Pete Tynan	Executive Director Sewer Utility Superintendent	908-852-3622 908-852-3622	kcorcoran@hmua.com ptynan@hmua.com
11-0018	College Place, WA	24-Feb-12	Washington	3 x NX75-C060	1400	SCFM	8	PSIG	2 blowers to SBR and 1 to Holding tank	Paul Olson	ESD environmental Director	509-386-3852	Paul.Olson1@jacobs.com
11-0019	Vacaville, CA	26-Jun-12	California	2 x NX300-C070	6200	SCFM	9	PSIG	Aeration 3 trains	Jeff Cooley Jeremy Clarke	Utilities Operations Manager	C: 707-469-6413 C: 707-249-2834	jcooley@cityofvacaville.com jeremy.clarke@cityofvacaville.com
11-0020	City of Millbrae, CA	27-Jul-12	California	3 x NX75-C050	1725	SCFM	8	PSIG		Craig Centis Doug Bacchi	Superintendent-WPCP Sr. Maintenance Mechanic	650-259-2388 650-784-8540	ccentis@ci.millbrae.ca.us dbacchi@ci.millbrae.ca.us
11-0021	City of Barstow, CA	6-Aug-12	California	2 x NX200-C060	3500	SCFM	7.5	PSIG	Activated Sludge & Aerobic Digester	Kody Tompkins	Chief Plant Operator	760-252-2538	ktompkins@barstowca.org
11-0022	Trento, IT	13-Dec-11	Italy	3 x NX150-C060					Nitrification/Denitrification Basins	Croce Matteo	Application Engineer	011 39 02 89257.1	mcroce@dda.ascopompe.com
11-0023	Rutland, VT	3-Apr-12	Vermont	1 x NX150-C070	2000	SCFM	10	PSIG		David Joyce Robert Protivanski	Superintendent Chief Wastewater Operator	208-434-2432 802-773-1851	davidj@rutlandcity.com bobp@rutlandcity.org
11-0024	Grand Rapids, MI	3-Jul-12	Michigan	2 x NX50-C070	1000	SCFM	6	PSIG		Dave Harris Bill Smith	O & M Supervisor Maintenance Supervisor	616-456-3639 616-456-3915	dharris@grand-rapids.mi.us bsmith@grand-rapids.mi.us
11-0025	Warren Township, NJ	12-Mar-12	New Jersey	2 x NX50-C060	1100	SCFM	9.25	PSIG		Pete Kavalus	Senior Operator	908-963-6651	pkavalus@nsuwater.com

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11-0026	Thompson's Creek, TX	2-Jul-13	Texas	1 x NX200-C070	3600	SCFM	10	PSIG		Mark Jurica	Superivsor	979-209-5030	mjurica@bryantx.gov
11-0027	Pagosa Spring, CO	15-May-12	Colorado	2 x NX150-C100	1250	SCFM	10	PSIG	Aeraion- Digesters	Jimmy Jameson	WWTP Supervisor	970-731-2691	
11-0028	OCWA Port Elgin phase II, ON	19-Dec-11	Ontario	1 x NX50-C060	1320	SCFM	6.5	PSIG		Cory McNeil	OCWA Operations Manager	1 866 716 6292 x223	CMcNeil@ocwa.com
11-0029	Williamsport, PA	5-Nov-12	Pennsylvania	3 x NX200-C070					Activated Sludge	Steve Benner Vernon D. Wykoff	Waste Water Manager Plant Superintendent	570-323-5528 570-323-5528	sbenner@wmwa-wsa.org vwykoff@wmwa-wsa.org
11-0030	Lyons, NY	8-Dec-11	New York	1 x NX50-C060	800	SCFM	6	PSIG	Activated Sludge	Marc Chadwick	Chief Operator	315-945-1099	mchadwick@wcwsa.org
11-0031	Alexandria, VA	20-Aug-13	Virginia	1 x NX30-C080 2 x NX75-C080 2 x NX150-C080-125	2200	SCFM	10.3	PSIG		Grace Richardson	Sustainability Coordinator	703-549-3381	grace.richardson@alexrenew.com
11-0032	Seneca, MD	12-Dec-14	Maryland	2 x NX300-C060	7000	SCFM	7.8	PSIG		Sam Amad Larry Cline Larry Lewis	Superintendent Materials Planner Maintenance Unit Coordinator	301-206-7900 301-206-7926 301-206-7921	Sam Amad@wsscwater.com Larry.Cline@wsscwater.com Larry.Lewis@wsscwater.com
11-0033	Fox Lake, IL	20-Jun-12	Illinois	2 x NX200-C070	3500	SCFM	9.5	PSIG	MLE Bio-N Removal	John Tomson		847-587-3694 847-815-7576	thompsoj@foxlake.org
11-0034	City of Joliet, IL	15-May-12	Illinois	2 x NX350-C070	8000	SCFM	7.5	PSIG	Conventional aeration basins	Nicholas Gornick	Plant Supervisor	815-405-3666	ngornick@jolietcity.org
11-0035	Stansbury Park, UT	1-Oct-12	Utah	2 x NX200-C070	3500	SCFM	7.5	PSIG		Brett Palmer	Manager	435-882-7922	spid@trilobyte.net
11-0036	Oak Lodge, OR	13-Sep-12	Oregon	2 x NX50-C080-30	280	SCFM	11.2	PSIG		John Krogstad Davis Hawkings	Supervisor of the Division Interim Superintendant	503-786-7615 503-353-4211	johnk@olwsd.org david@olwsd.org
11-0038	Deux-Montagne Phase II, QC	31-May-12	Quebec	1 x NX150-C050-125	3200	ACFM	462	MBARG		Stephane Giguere	Directeur General Adjoint	450-623-1072 Ext. 227	sgiguere@sjdl.qc.ca
11-0039	Camp Pendleton, CA-SRTTP-SBR	22-Feb-13	California	7 x NX150-C100	2240	SCFM	12	PSIG		Troy Prewett EJ Colia	Maintenance Supervisor Chief Plant Operator	C:760-834-1882 C:760-834-1082	tprewett@percwater.com ecolia@percwater.com
11-0040	Westerly, RI	22-Mar-12	Rhode Island	2 x NX200-C060	4300	SCFM	7.7	PSIG		De Gemmis, Nicholas	Utilities Superintendent	860-510-8301	Nicholas.DeGemmis@ch2m.com
11-0041	Crystal Beach, ON	16-Oct-12	Ontario	3 x NX75-C070	1133	SCFM	8.5	PSIG		Frank Vasko	Plant Manager	289-668-0698	frank.vasko@niagararegion.ca
11-0042	Penetaguishene WPCP, ON	13-Apr-16	Ontario	2 x NX75-C050	1638	SCFM	6.7	PSIG	not install	Mark Charlebois	Chief Wastewater Operator	705-549-8784	mcharlebois@penetanguishene.ca
11-0043	Patuxent WRF, MD	12-Feb-13	Maryland	2 x NX150-C060	3217	SCFM	7.8	PSIG		Dave Miller Robert Kraus	Project Superintendent Utilities Team Manager	443-292-8236 443-685-5172	pwkrau18@aacounty.org
11-0044	West Warwick, RI	22-Feb-12	Rhode Island	2 x NX150-C060	3000	SCFM	9	PSIG		Harrison Songolo	Assistant Superintendent	401-822-9228	hsongolo@westwarwickri.org
11-0045	MESA, AZ	7-Feb-12	Arizona	3 x NX200-C070	3200	SCFM	10.5	PSIG	Extended Aeration BRN process	Al Hickok	Supervisor	480-644-3541	alan.hickok@mesaaz.gov

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11-0046	Holston IWTP, TN	4-Jan-12	Tennessee	1 x NX100-C070	2000	ICFM	10.7	PSIG		Aaron Marshall Chris Smith Larry Reynolds	Maintenance Operations Engineering	423-444-3697 423-278-0615	aaron.marshall@baesystems.com chris.smith15@baesystems.com larry.reynolds@baesystems.com
11-0047	Decatur, IL	11-May-12	Illinois	2 x NX350-C070	8000	SCFM	9	PSIG		David Collard Don Miller JD Malone	Director of Operations and Compliance Engineer Operations Manager	217-422-6931 ext. 214 217-620-1433 217-422-6931 ext. 226	davidc@sddcleanwater.org DonM@sddcleanwater.org JamesM@sddcleanwater.org
11-0048	Hudson, WI Try & Buy	15-Nov-11	Wisconsin	1 x NX50-C060	1200	ICFM	6.6	PSIG		Jim Schreiber	Engineer	715-386-4769	DonM@sddcleanwater.org
11-0049	Western Lake Superior SD, MN	12-Apr-12	Minnesota	1 x NX200-C060	4680	SCFM	6.5	PSIG	The low pressure air in the final contact tank can also add dissolved oxygen to the effluent if needed	Al Parrella Joseph Schleret Jim Simmons Nathan Hartman Andy Klingsporn Lee McInnes	Operations Manager	218-740-4769 218-591-9027 218-740-4767 218-740-4762 218-740-4803 218-740-4854	JamesM@sddcleanwater.org
11-0050	Lockport, NY	15-Aug-12	New York	2 x NX200-C060	4200	SCFM	8	PSIG	fine air diffusers	James Nunnari	Superintendent Chief Operator	716-433-1612	jnunnari@lockportny.gov
11-0051	Pepper's Ferry, VA	12-Dec-11	Virginia	1 x NX200-C080	3900	SCFM	9.35	PSIG		R. Clarke Wallcraft Ryan L. Hendrix Michael H. Hutchison Dickie R. Turner	Executive Director Deputy Executive Director Plant Superintendent Maintenance Manager	P:540-639-3947 C:540-257-0241	cwallcraft@pfrwta.com rhendrix@pfrwta.com mhutchison@pfrwta.com dturner@pfrwta.com
11-0052	Orlando WRT Conserv II WRF, FL	30-Jan-13	Florida	5 x NX300-C050	6630	SCFM	8.3	PSIG	Modified Extended Aeration	Luis Ramos Keith Jordan Steve Shelnutt Aaron Green	Maintenance Supervisor Chief Operator Plant Manager IT	C:407-709-3778 C:407-325-5653 C:407-509-5597 P: 407-246-4085	luis.ramos@cityoforlando.net keith.jordan@cityoforlando.net steve.shelnutt@cityoforlando.net aaron.green@cityoforlando.net
11-0053	Town of Cary, NC	3-May-12	North Carolina	1 x NX350-C070	7486	SCFM	8	PSIG	Aeration	Jarrod A. Buchanan Larry James Josh Cummings	Plant Manager Maintenance Supervisor Plant Engineer	919-633-9016 919-580-3798 919-810-1505	jarrod.buchanan@townofcary.org larry.james@townofcary.org Josh.Cummings@townofcary.org
11-0054	Western Wake, NC	5-May-14	North Carolina	2 x NX300-C080 2 x NX350-C070	5534	SCFM	10.2	PSIG		Damon Forney Tim Thomas Chris Andres	Plant Manager Team Leader, WWWRF Operational Supervisor	O:919-535-5649 C:919-824-2715 O:919-535-5642 C:919-337-8757 O:919-535-5641 C:812-786-4947	damon.forney@townofcary.org tim.thomas@townofcary.org chris.andres@townofcary.org

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11-0055	Alderwood-Picnic Point, WA	28-Aug-12	Washington	1 x NX50-C080	744	SCFM	12.4	PSIG	MBR	Joe Carter Manuel Semana Kevin Sykes Corey Ott	WWTF Manager Senior Facilities Mechanic SCADA / Electrical Manager SCADA Systems Lead	425-787-1940 Ext. 8311 425-787-3271 425-248-0029	jcarter@awwd.com MSemana@awwd.com KSykes@awwd.com cott@awwd.com
11-0056	Linden Roselle, NJ	8-Apr-13	New Jersey	3 x NX600-C060	14000	SCFM	8	PSIG		Gary G. Fare Robert Matlaga	Executive Director	908-862-7100	gfare@lrsanj.org rmatlaga@lrsanj.org
11-0057	Orange Cove, CA	3-Nov-12	California	1 x NX75-C050	1800	SCFM	5.8	PSIG		David Del Bosque	WWT Operator	559-626-4801	ddelbosque@cityoforangecove.com
11-0058	Ellenville, NY	13-Nov-12	New York	3 x NX30-C060 1 x NX50-C060	515	SCFM	9.3	PSIG	Digestors	Michel Ryman	Chief Operator	845-647-9080	mryman@villageofellenville.com
11-0059	Lott Alliance Phase II, WA	14-Aug-13	Washington	2 x NX50-C080					Scum Reactor	Gabe Brannon	Instrumentation	360-580-9780	GabeBrannon@lottcleanwater.org
12-0001	C.M.S.A	30-Jul-12	California	2 x NX150-C060	3000	SCFM	8.5	PSIG		Paul Bruemmer Kevin Lewis	Treatement Plant Manager	O: 415-459-1455,133C:415-720-0785	pbruemmer@cmsa.us klewis@cmsa.us
12-0002	Kimberly Clark-Lexington, NC	14-Jan-13	North Carolina	1 x NX700-C100	10,800	SCFM	13.8	PSIG	nonwovens manufacturing process	Timothy Thompson	Lex 1 Maintenance Planner	336-218-6625	timothy.thompson@hyh.com
12-0003	JEA Talleyrand, FL	5-Mar-13	Florida	4 x NX700-C070	15,980	SCFM	10	PSIG	Aeration	Todd Gilbert Chris Howard	Electrician & Instrumentation Tech Operation Coordinator	P:904-665-7199 C:904-903-6332 P:904-665-7941 C:904-477-5358	gilbta2@jea.com howacj@jea.com
12-0004	Village of Manteno, IL	7-May-12	Illinois	3 x NX75-C050	2215	SCFM	14.22	PSIG		Terry		815-954-1199	information@villageofmanteno.com
12-0005	American Falls WWTP, ID	8-Oct-13	Idaho	3 x NX75-C080	1019	SCFM	9.4	PSIG		Peter Cortez	Superintendent	208-226-2827	pcortez@co.power.id.us
12-0006	Wheaton SD, IL phase II	4-Sep-12	illinois	1 x NX200-C050	5760	SCFM	7	PSIG		Bruce W. Tunaitis	Maintenance Supervisor	630-668-1515 ext 109.	Tunaitis@wsd.dst.il.us
12-0008	Peoria, AZ	9-Oct-10	Arizona	1 x NX75-C070	1268	SCFM	9.57	PSIG		Tom Jessing	Lead Utility Plant Operator	623-764-8618	thomas.jessing@peoriaaz.gov
12-0009	Bucklin Point, RI	18-Mar-13	Rhode Island	2 x NX300-C070	6000	SCFM	9.3	PSIG		Dominic De Chiara		401-461-6540 #7 &#0	cs@narrabay.com
12-0010	City of Camden, SC	4-Aug-14	South Carolina	3 x NX100-C070 5 x NX50-C070	1820	SCFM	10	PSIG	Aeration, Sludge Holding & Digester	Kyle Smith	Plant Manager	803-424-4036 #2	ksmith@camdensc.org
12-0011	UOSA, VA	25-Jun-13	Virginia	2 x NX600-C060	6700	CFM	8.8	PSIG		Bob Canham Stephen Myers	Manager	703-227-0235	robert.canham@uosa.org stephen.myers@uosa.org
12-0012	South San Francisco, CA	5-Feb-13	California	1 x NX300-C070	5500	SCFM	8.4	PSIG	Activated Sludge	Brian Schumaker Arran Gordon	Superintendent Maintenance Supervisor	650-829-3844 650 829 3850	Brian.Schumacker@ssf.net Arran.Gordon@ssf.net
12-0013	Canada Malting, AB	26-Mar-13	Alberta	1 x NX200-C100	2300	SCFM	13	PSIG		Rick Armstrong	Plant Manager	403-571-7020	rick.armstrong@canadamalting.com
12-0014	Midwest City, OK	3-Sep-13	Oklahoma	3 x NX300-C100-250						Chris Thomas Thomas West	Plant Manager Maintenance Manager	405-424-3363 405-739-1534	cthomas@midwestcityok.org twest@midwestcityok.org

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12-0015	Ajinomoto, NC	6-Jan-12	North Carolina	1 x NX100-C060	2251	SCFM	8.54	PSIG		Kevin Adams Jeff Robertson Allen Weathington Mike Thompson	Utilities Manager Maintenance Manager Utilities Forman Maintenance Planner	919-255-0040 919-255-0128 843-425-2806	adamsk@ajiusa.com robertsonj@ajiusa.com weathingtona@ajiusa.com ThompsonM@ajiusa.com
12-0016	Linda County Phase II, CA	6-Aug-12	California	1 x NX75-C080	1220	SCFM	11.23	PSIG		Brian Davis John Harvey	Engineer Superintendent	530-743-2482 530-743-2756	bdavis@lindawater.com jharvey@lindawater.com
12-0017	Harry Still SR. WWTP, AL	3-Jan-13	Alabama	4 x NX50-C070	780	SCFM	8	PSIG		James Dean	Plant Manager	251-580-1853	JDean@NBUMAIL.COM
12-0018A	City of Bryan, TX Phase II	6-Oct-13	Texas	1 x NX150-C060	3000	SCFM	8	PSIG		Mark Jurica Victor Harris	Treatment & Compliance Manager	979-209-5900 979-229-7259	mjurica@bryantx.gov vharris@bryantx.gov
12-0018B	City of Bryan, TX (Still Creek)	6-Oct-13	Texas	1 x NX200-C000						Mark Jurica Victor Harris	Treatment & Compliance Manager	530-743-2482 530-743-2756	bdavis@lindawater.com jharvey@lindawater.com
12-0020	Camp Pendlton NRTTP, CA	21-Nov-14	California	4 x NX150-C100 3 x NX150-C070	2175	SCFM	12	PISIG	SBR and Digester process	Robert Mespeca Phil Starks	Maintenance Supervisor Chief Plant Operator	C:760-636-3370	rnespeca@percwater.com pstarks@percwater.com
12-0021	Wilsonville WWTP, OR	9-Jul-13	Oregon	3 x NX100-C060	1700	SCFM	8	PSIG	GE MBR	Ted Michaelidis	Civil Engineer	503-682-1077 ext. 20838	ted.michaelidis@ch2m.com
12-0022	Metro NPD Denver, CO	31-Aug-16	Colorado	6 x NX350-C100	4308	SCFM	12.5	PSIG	Aeraion	Ryan Robinson	Maintenance Supervisor	303-286-3417	rrobinson@mwrd.dst.co.us
12-0023	Iowa City, IA	17-Jul-13	Iowa	1 x NX200-C070	4000	CFM	7.5	PSIG		Brad Herrig	Senior Maintenance Worker	319-631-1137	Brad-Herrig@iowa-city.org
12-0024	Metro Vancouver-Annacis Island, BC	21-Oct-13	British Columbia	1 x NX700-C080	330	NCMM	80	kPaG		Vince Chiu	Superintendent, MWWTP	604-523-7107	vince.chiu@metrovancouve
12-0025	Modesto Phase II, CA	16-Oct-15	California	6 x NX300-C060	6600	SCFM	8.75	PSIG	MBR & Aeration Basins	Laura Anhalt, Ben Koehler, Noland Harris,	Wastewater Treatment Plant Manager Utilities Plant	209-342-4502 209-577-6288 209-471-0387	lanhalt@modestogov.com bkoehler@modestogov.com nharris@modestogov.com
12-0026	Brembate, Italy	3-Sep-12	Italy	1 x NX150-C050					Nitrification Basins	Croce Matteo	Application Engineer	011 39 02 89257.1	mcroce@dda.ascopompe.com
12-0027	Gun Lake, MI	13-Nov-12	Michigan	1 x NX100-C060	1730	ICFM	8.8	PSIG		Larry Knowles David Cooper	Director	269-509-1000 269-720-1017	lknowles@gunlakesewer.org dcooper@gunlakesewer.org
12-0028	Woodbrand, OH	27-Feb-13	Ohio	1 x NX150-C070	2200	SCFM	7.4	PSIG		Mike Chicwak	Maintenance Supervisor	216-408-8677	
12-0029	Three Rivers-TRRWA, WA	15-May-13	Washington	1 x NX200-C060	4600	SCFM	7.87	PSIG		Duane Leaf	Superintendent	360-577-2040	leaf@cowlitz-wpc.org
12-0031	Marine Sanitation, CA	15-Mar-13	California	3 x NX30-C070	470	SCFM	9.63	PSIG		Tony Rubio	Waste Water Facilities Manager	415-435-1501#106	trubio@sani5.org
12-0032	King County South Point WWTP	2-Apr-13	Washington	2 x NX200-C060	4500	SCFM	7.5	PSIG	agitation air in our mixed liquor channels and pre-aeration in the primary clarifiers for grit removal	Lester Van Gerlder Bill Bailey	Maintenance Supervisor Mechanical Lead	206-263-1827 206-263-1739	lester.vangekder@kingcounty.gov william.bailey@kingcounty.gov
12-0034	Ternium-Monterey, Mexico	9-Apr-13	Mexico	2 x NX150-C060						Marcela Portillo Ordonez		52-81-1790-8355	marcela.portillo@ambbio.com
12-0035	Monterey Regional, CA	29-Jul-13	California	2 x NX200-C100	3000	SCFM	11.4	PSIG		Bret Boateman Neil Keith Israel	Maintenance Manager Operations General Manager	831-402-7628 831-372-3367	bretb@my1water.org
12-0036	Cornwall WWTP, ON	20-Aug-14	Ontario	3 x NX200-C100	2874	SCFM	14.85	PSIG		Olivier Decroix		514-260-3641	olivier.decroix@veolia.com

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
12-0037	EMWD-San Jacinto II CA	0-Jan-00	California	1 x NX300-C060					GE MBR	Matthew Melendrez Matt Verosik Chuck Norberg	Director of Water Reclamation Plant Manager Electrical	951-928-3777#4303 951-928-3777#7100 602-501-5394	melendrm@emwd.org verosikm@emwd.org norbergc@emwd.org
12-0038	Oxford, AL	18-Dec-12	Alabama	1 x NX100-C060	2225	SCFM	8.5	PSIG		Wayne Livinston Max Gaskins	General Manager Chief Operator	205-365-8028 P: 256-405-6821 C: 256-310-9856	wlivinston@oxfordwater.com mgaskins@oxfordwater.com
12-0039	Raritan TWSP-MUA, NJ	13-Mar-13	New Jersey	2 x NX200-C050	5400	SCFM	7.5	PSIG	Traditional aeration process	Gregory LaFerla	Chief Operator	908-782-7453 # 13	BMiller@rtmua.com
12-0041	Central Ohau Wahiawa, Hawaii	4-Feb-14	Hawaii	6 x NX100-C080	1700	SCFM	7.9	PSIG		Aric Takazawa		808-286-6568	
12-0042	MT Vernon, IN	4-Dec-12	Indiana	3 x NX100-C070	1564	SCFM	8	PSIG		Chuck Gray	Operator	812-838-3396	cgray@mountvernon-in.com
12-0044	City of Jacksonville, IL	22-Jan-13	Illinois	1 x NX300-C060-250	6675	ICFM	7.5	PSIG		Leland Walker	Ass. To the Director of Operation	217-479-4648	jaxwwtp@jacksonvilleil.com
12-0045	City of Plano,IL	24-Jan-13	Illinois	1 x NX75-C070	1100	SCFM	8.5	PSIG		Darrin Boyer	Water Reclamation Superintendent	630-552-8007 630-669-0625	Dbboyer2006@comcast.net
12-0046	El Toro WD-Laguna Woods, CA	4-Mar-13	California	1 x NX75-C050	1650	SCFM	5.8	PSIG	Aerobic Digester (WAC)	Mark Pade	Chief Operator	949-837-7050 #103	mpade@etwd.com
12-0047	City of Palacios, TX	20-Aug-13	Texas	2 x NX50-C070 2 x NX100-C070	950	SCFM	8	PSIG		Darrell Robbins	Public Works Director	361-404-0265	drobbins@cityofpalacios.org
12-0048	Cortland, NY WWTP	5-Feb-13	New York	3 x NX100-C070	1880	SCFM	9.5	PSIG		Bruce Adams Ed Poole	Superintendent Operator	607-423-2630 607-745-9802	badams@cortland.org epoole@cortland.org
12-0049	City of Eugene, OR	19-Mar-13	Oregon	1 x NX700-C070	16000	SCFM		7.5 PSIG		Jon Diller	City of Eugene WW Division	541-682-8606	JDiller@ci.eugene.or.us
12-0050	JRS (PWTRP) Caldwell, ID	30-Jul-13	Idaho	5 x NX150-C070	2820	SCFM	8.43	PSIG	Traditional aeration process manual valces	John Prigge Johnny Perez	Enviremental Manager Enviromental Compliance	208-369-8851 208-890-4356	john.prigge@simplot.com perezj5@simplot.com
12-0051	Riverside, CA	24-Sep-15	California	4 x NX300-C050	7760	SCFM	6	PSIG	GE MBR	Brent Keaster	Maintenance Manager	W 651-351-6181 C 951-231-5223 or ? 951-351-6140	bkeaster@riversideca.gov
12-0052	Jeffersonville, IN	4-Nov-13	Indiana	2 x NX200-C080	3100	SCFM	11	PSIG		Hagan Alsep	Maintenance Supervisor	812-285-6451	halsept@CityofJeff.net
12-0053	Lynnwood WWTP, WA	22-Oct-13	Washington	1 x NX150-C100	2350	SCFM	12	PSIG	Activated Sludge	John Ewell Ryan Reynolds	Treatment Plant Supervisor	425-670-5251	jewell@ci.lynnwood.wa.us RReynolds@lynnwoodwa.gov
12-0054	Mount Pleasant, SC	9-Jul-14	South Carolina	4 x NX150-C070	3100	SCFM	7.5	PSIG		Greg Hill Troy Newton Matt Reaves	Operations Supervisor Wastewater Operations Foreman Contractor Garney	843-200-9305 (Mobile) 407-408-1228 843-375-5778 (Office)	greghill@mpwonline.com troynewton@mpwonline.com mreaves@garney.com
12-0055	City of Great Falls, MT	1-Jun-14	Montana	5 x NX350-C080	5250	SCFM	10	PSIG		Randy Kerkes Rodney Lance	Maintenance Manager Assistant Plant Manager	406-788-6680 406-761-7004 EXT:204 406-761-7004 EXT:203	randy.kerkes@veolia.com rodney.lance@veolia.com
12-0056	City of Clarkston WWTP, WA	13-Nov-13	Washington	3 x NX150-C070	2850	SCFM	9	PSIG	Areation	Wes Ison	WWTP Superintendent	509-758-1674	clarkstonwwtp@qwestoffice.net

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
12-0057	Fishing River, MO	16-Apr-13	Missouri	5 x NX100-C070	1500	SCFM	9.5	PSIG	Areation	Andres Nelson Charles Stevens	Maintenance Supervisor Chief Plant OperatorUtilities Director	816-804-8915 816-439-4500	andres.nelson@kcmo.org utilities@ci.liberty.mo.us
12-0058	North Attleborough, MA	25-Oct-13	Massachusetts	4 x NX75-C050 1 x NX50-C060	1250	SCFM	8	PSIG		Valerie A. Flaherty		508-695-7872	vflaherty@nattleboro.com
12-0059A	Stonington Borough, CT (Borough)	26-Aug-13	Massachusetts	3 x NX50-C080	780	SCFM	7.2	PSIG		Bill Waterhouse		860-535-1333	bill.waterhouse@suez-na.com
12-0059B	Stonington Borough, CT (Mystic)	26-Aug-13	Massachusetts	2 x NX50-C080	780	SCFM	7.2	PSIG		Gerry Miner		860-245-4275	gerry.miner@suez-na.com
12-0059C	Stonington Borough, CT (Pawcatuck)	19-Jun-13	Massachusetts	2 x NX50-C070	975	SCFM	8.6	PSiG		Glenn Tatro	Superintendent	860-599-4548	
12-0060	City of Hastings, NE	15-Jan-14	Nebraska	2 x NX150-C070	2500	SCFM	9.5	PSIG	Aeration	Jeff Ochsner Brandan Lubken Brian Douglas (quotes) Dave Pearce	Plant Superintendent Superintendent Instrument Tech Operations	402-462-3538 402-262-3673 402-462-3519 402-462-3506	jochsner@hastingsutilities.com dpeara@hastingsutilities.com
12-0061	West Perth-OCWA, ON	12-Mar-13	Ontario	1 x NX200-C060	4800	ICFM	8.2	PSIG	aerobic digesters & primary supply for the extended aeration cells	Richard Wright	Environmental Services Coordinator	519-301-4388	rwright@westperth.com
12-0062	Post Point, WA	3-Dec-13	Washington	2 x NX200-C060 2 x NX300-C060	3900	SCFM	8.55	PSIG		Karl Lowry	Superintendent	360-778-7850	
12-0063	Jackson, WI	1-May-13	Wisconsin	2 x NX50-C070	920	CFM	8	PSIG	Activated Sludge	Jeff Deitsch	WWTP Supervisor	262-677-9001	utilitysupt@villageofjackson.com
12-0064	Stratford, ON	10-Sep-13	Ontario	1 x NX350-C070	7100	SCFM	9	PSIG	Activated Sludge	Marcel Misuraca	Senior Operation Manager	519-271-9071	mmisuraca@ocwa.com sbeech@ocwa.com
12-0065	City of Timmins, ON	20-Nov-14	Ontario	4 x NX200-C080	6000	CFM	10.4	PSIG		Dean McGee Sean Beech	O&M Team Lead|Southwest Region	705-365-7512 519-276-8333	dean.mcgee@timmins.ca
12-0066	Decatur Phase II, IL	10-Apr-13	Illinois	2 x NX350-C070	8000	CFM	9	PSIG		Roger Dudley	Maintenance Engineer	217-620-0309 #256	davidc@sddcleanwater.org
12-0067	City of Thunder Bay, ON	24-Mar-14	Ontario	1 x NX050-C080 3 x NX350-C080	800	CFM	11	PSIG		Mark Wilson Michael Brown Patty Wilson	Operations Supervisor Maintenance Supervisor Operations	807-625-2589 807-625-2044	DonM@sddcleanwater.org
12-0068	Chimalistac, Mexico	30-Jul-13	Mexico	3 x NX350-C080						Daniel Molina	Plan supervisor	55 3294-7513	JamesM@sddcleanwater.org
12-0069	Fairfield II, CT	23-May-13	Connecticut	1 x NX150-C060	3330	SCFM	7.4	PSIG		Joseph Michelangelo	Director of Public Works	203-256-3010	jmichelangelo@town.fairfield.ct.us
12-0070	North Conway, NH	12-Sep-13	New Hampshire	1 x NX50-C050	1110	SCFM	6.3	PSIG		Peter N. LaBonte	Chief Operator	603 356-5382	plabonte@ncwph.org
12-0071	Huntington WWTP, IN	21-May-13	Indiana	3 x NX300-C070-250	5700	SCFM	8	PSIG		Kirk Strass	Superintendent	260-356-2314	kirk.strass@huntington.in.us

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
12-0072	Thorn Creek, IL	10-Sep-13	Illinois	1 x NX350-C070	6000	SCFM	10.5	PSIG		Don Matthews Phil Luck Lucas J. Streicher Jennifer A. Hindel, PE	Water Superintendent Executive Director Director of Operations	708-756-5380 708-754-0525, Ext 32 708-754-0525 ext. 23 708-754-0525 ext. 16	pluck@thorncreekbasin.org lstreicher@thorncreekbasin.org jhindel@thorncreekbasin.org
12-0073	Killingly WWTP, CT	30-Oct-13	Connecticut	2 x NX150-C060	3300	SCFM	8	PSIG		Joseph Couture	Assistant Project Manager	860 779 5392	Joseph.Couture@suez-na.com
12-0074	Wessex-DEMO_1	18-Mar-13	United Kingdom	1 x NX100-C050	2650	SCFM	7.11	PSIG		Mark Briknell	Engineer	0 11 44 0 7585 966 059	mbricknell@corgin.co.uk
12-0075	Union City, TN	16-Jul-14	Tennessee	3 x NX100-C050	3000	CFM	5.9	PSIG		Jason Moss	Waste water Director	731-885-9144	ucwwdirector@unioncitytn.gov wastewater@ken-tennwireless.com
13-0001	Rock Creek, OR	19-Aug-13	Oregon	1 x NX300-C070	6000	SCFM	8.7	PSIG		Bill Gulacy	Plant Operation Manager, Rock Creek WWTP	503-547-8036	gulacyb@cleanwaterservices.com
13-0002	Hartville, OH	2-Jul-14	Ohio	2 x NX50-C060	1000	SCFM	7.8	PSIG		Jim Baxter Tom Graber	Plant Manager Assistant Plant Manager	330-877-2861 330-877-2861	jbaxter@hartvilleoh.com tgraber@hartvilleoh.com
13-0003	Idaho Falls, ID	6-Nov-14	Idaho	4 x NX350-C080	5000	SCFM	10	PSIG		Larry Martin	Operator	208-612-8476	lmartinr@idahofallsidaho.gov
13-0004	Avon Lake, OH	30-May-13	Ohio	1 x NX150-C070	3000	SCFM	9	PSIG	Activated Sludge	Steve Baytos	WPCC Manager	440-933-3185	sbaytos@avonlakewater.org
13-0005A	City of London,ON Adelaide	5-Nov-14	Ontario	2 x NX200-C050	140	m3/min	47	KPAG		Mark Spitzig	Operations and Maintenance Manager	519-661-0670	mspitzig@london.ca
13-0005B	City of London, ON Oxford PCP	19-Aug-14	Ontario	1 x NX100-C070	65	m3/min	46	kPaG		Mark Spitzig	Operations and Maintenance Manager	519-661-0670	mspitzig@london.ca
13-0005C	City of London, ON Vauxhall PCP 2	9-Oct-14	Ontario	1 x NX50-C060	30	m3/min	45	KPAG		Mark Spitzig	Operations and Maintenance Manager	519-661-0670	mspitzig@london.ca
13-0006	James River Refurbishing (B-C)	2-Dec-13	Virginia	1 x NX300-C060						Bob Rutherford			
13-0008	Boat Harbor, VA	27-Nov-13	Virginia	1 x NX150-C060-125 1 x NX50-C060	1240	SCFM	8	PSIG		Ken Sands	Chief Operator	757-375-6922	ksands@hrsd.com
13-0009	Pepper's Ferry RWTA, VA	27-Feb-14	Virginia	1 x NX250-C070	4950	SCFM	9.4	PSIG		R. Clarke Wallcraft Ryan L. Hendrix Michael H. Hutchison Dickie R. Turner	Executive Director Deputy Executive Director Plant Superintendent Maintenance Manager	P:540-639-3947 C:540-257-0241	cwallcraft@pfrwta.com rhendrix@pfrwta.com mhutchison@pfrwta.com dturner@pfrwta.com
13-0011	Goldsboro, NC	1-Aug-13	North Carolina	1 x NX300-C070	6800	SCFM	7.7	PSIG		Bert Sherman	Superintendent	919-735-3329	RSherman@goldsboronc.gov
13-0012	Bend, OR	23-Jun-16	Oregon	4 x NX300-C060 1 x NX200-C060	6000	SCFM	7.6	PSIG		Lance Finney	Maintenance Lead	541-322-6339.	lfinney@bendoregon.gov
13-0013	Lebanon WWTP, NH	15-Sep-15	New Hampshire	3 x NX75-C050	1600	SCFM	7	PSIG		Daniel Knox Tom Carter	Plant Manager Maintenance Supervisor	603-298-5986	Daniel.know@lebanonnh.gov tom.carter@lebcity.com
13-0015	Brembate-Italy	28-Sep-13	Italy	1 x NX150-C070					Nitrification Basins				

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13-0016	Thames Water UK	21-May-14	United Kingdom	2 x NX600-C050									
13-0017	Covidien, NC	27-Aug-13	North Carolina	2 x NX200-C070	3100	SCFM	10.6	PSIG		Brian Alls	Instrumentation/Electrical Supervisor	919-878-7039 919-878-2800	brian.alls@mallinckrodt.com
13-0018	Ravenna WWTP, OH	18-Sep-13	Ohio	2 x NX100-C060	2300	SCFM	7.5	PSIG		Bill Tuck		330-703-3145	
13-0019	San Marcos, TX	15-Dec-13	Texas	1 x NX300-C070	6000	SCFM	6.25	PSIG		~~EJ Hindy~~ Paul Shropshire Mike Beck	~~Assistant Project Manager~~	~~512-393-8365 (O)~~ ~~281-923-5627 (M)~~ 512-393-8345 512-393-8345	Ej.Hindy@jacobs.com Paul.Shropshire@jacobs.com
13-0020	SJRA Plant, TX	9-Sep-15	Texas	6 x NX300-C100	5000	SCFM	14.5	PSIG		Phillip Smith Ron McCullough Lois Worrell	Utilities Maintenance Superintendent	936-828-7223	psmith@sjra.net rmccullough@sjra.net lworrell@sjra.net
13-0021	St-Johns, FL	13-Oct-15	Florida	5 x NX75-C080	1111	SCFM	8.6	PSIG	Aeration	Chuck Jones	Lead Operator	P:904-209-2691 C:904-495-8276	cjones@sjcfl.us
13-0022	City of Shelton Phase II, CT	13-May-14	Connecticut	2 x NX100-C100	1400	SCFM	13	PSIG		Garritt Ogden	Plant Maintenance	203-410-0768	g.ogden@cityofshelton.org
13-0023	Paso Robles, CA	29-Oct-14	California	3 x NX150-C100	2500	SCFM	12.4	PSIG			Mark Schmitz / Ernie Valenzuela	661-440-1551	Evalenzuela@prcity.com
13-0024	Pepper's Ferry PLC	1-Dec-11	Virginia	This project consists in the upgrade of the existing LCP on the blower NX200 on site from AB to Modicon.						R. Clarke Wallcraft Ryan L. Hendrix Michael H. Hutchison Dickie R. Turner	Executive Director Deputy Executive Director Plant Superintendent Maintenance Manager	P:540-639-3947 C:540-257-0241	cwallcraft@pfrwta.com rhendrix@pfrwta.com mhutchison@pfrwta.com dturner@pfrwta.com
13-0025	City of Norway, MI	3-Dec-13	Michigan	1 x NX50-C080	1250	SCFM	8	PSIG		Brock Johnson	Wastewater supervisor	906-563-9961	wwtp@norwaymi.gov
13-0026	Avon Lake II, OH	29-Dec-14	Ohio	2 x NX200-C060	4530	SCFM	7.6	PSIG		Steve Baytos		440-933-3185	sbaytos@avonlakewater.org
13-0027	Lauren County, SC	4-Dec-14	South Carolina	2 x NX100-C080	1650	SCFM	10	PSIG	Aeration	Barry Templeton Justin Kuykendakk	Wastewater Facilities manager Operations	864-923-0097 864-684-0989	btempleton@lcwsc.com jkuykendall@lcwsc.com
13-0028	Cox Creek, MD	2-Jan-15	Maryland	2 x NX50-C070 2 x NX300-C060 5 x NX300-C050	1000	SCFM	7.4	PSIG	GE MBR	Matt Barrett Michael Smith	Contractor Maintenance Supervisor	802-233-5197 410-302-6292	Pwsmitt77@aacounty.org
13-0029	OCWA Marathon, ON	17-Oct-13	Ontario	1 x NX50-C060	1250	SCFM	7.8	PSIG	stab tank, aeration tank, digester and return sludge	Jason Leblanc	Operations Manager	807-728-3323	jleblanc@nwi.com
13-0034	Pigeon Creek, PA	20-Aug-14	Pennsylvania	3 x NX050-C080	948	SCFM	6.5	PSIG			Site Manager	724-239-2381	
13-0035	Port Darlington, ON	15-Feb-16	Ontario	3 x NX150-C080	4000	SCMH	65.5	KPAG		Ken Towrie	Chief Maintenance Operator	905-623-7937	ken.towrie@durham.ca
13-0036	Watsonville, CA	3-Dec-13	California	1 x NX150-C100	2450	SCFM	8	PSIG	Activated Sludge	James Johnson Kevin Silviera	Utilities Maintenance Supervisor Wastewater Division Manager	831-768-3177 831-768-3175	james.johnson@cityofwatsonville.org kevin.silviera@cityofwatsonville.org
13-0038	Madison WWTP, IN	17-Jun-14	Indiana	1 x NX150-C070	3100	SCFM	7.9	PSIG		Leon Pottschmidt			leonp@mitchellstark.com

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13-0040	Fallbrook, CA	11-Nov-14	California	6 x NX100-C070	1720	SCFM	8.6	PSIG		Owni Toma Mark April	Environmental Compliance Technician Mechanical Technician	760-728-1125,1152 760-728-1125,1154	Ownit@fpud.com marka@fpud.com
13-0041	Keene NH WWTP	20-Nov-14	New Hampshire	2 x NX150-C080	2300	SCFM	9	PSIG		Aaron Costa	Operations Manager	603-357-9836	ACOSTA@ci.keene.nh.us
13-0042	Victoria-Sechelt, BC	20-Jan-15	British Columbia	2 x NX50-C070 1 x NX75-C070	1503	NCMH	9.4	PSIG		Angela Smith	Plant Supervisor	604-989-1578	Asmith@sechelt.ca
13-0043	Pinellas-South Cross Bayou, FL	15-Aug-14	Florida	3 x NX400M-C050	9445	SCFM	6.8	PSIG	Aeration	Ivy Drexler Mike McRorey Chuck Fry	Plant Manager Assistant Plant Manager Maintenance Manager	P:727-582-7023 C:774-991-2009 P:727-582-7009 C:806-778-2129	idrexler@pinellascounty.org mmcrorey@pinellascounty.org cfry@co.pinellas.fl.us
13-0044	Manchester-Shortville, NY	30-Jan-14	New York	1 x NX75-C050	1410	SCFM	7	PSIG		Gordon Eddington		315 277 0162	
13-0048	Orangeburg, SC	11-Feb-16	South Carolina	5 x NX200-C070	3950	SCFM	9.65	PSIG	Activated Sludge & SHT	Benji Brickle		803-707-4502	bbrickle@orbgdpu.com
13-0049	Pepper's Ferry III, VA	11-Mar-14	Virginia	1 x NX250-C070	4950	SCFM	9.4	PSIG		R. Clarke Wallcraft Ryan L. Hendrix Michael H. Hutchison Dickie R. Turner	Executive Director Deputy Executive Director Plant Superintendent Maintenance Manager	P:540-639-3947 C:540-257-0241	cwallcraft@pfrwta.com rhendrix@pfrwta.com mhutchison@pfrwta.com dturner@pfrwta.com
13-0051	Nice, France	17-Jul-16	France	1 x NX700-C100						Arnaud Rostan		33 0 608 642831	
13-0057	City of Shelton IV, CT	13-May-14	Connecticut	1 x NX100-C100	1400	SCFM	13	PSIG		Garritt Ogden	Plant Maintenance	203-410-0768	g.ogden@cityofshelton.org
13-0058	EleEle, Hawaii	20-Oct-15	Hawaii	2 x NX50-C050	1100	SCFM	7	PSIG		Sanny Molina	Hawaii Engineering Services Inc.	808-841-0033	sanny@hiengineering.com
13-0060	City of Hastings, MI	13-Jun-14	Michigan	1 x NX100-C070	2000	SCFM	8.3	PSIG		George Holzworth	Operations Supervisor	269-908-0977	gholzworth@wadetrim.com george.holzworth@meadhunt.com
13-0061	Hermosillo, Mexico	12-Dec-16	Mexico	5 x NX350-C070						Tubalcain Marin		521-662-174-6533 +52 662 366 0463	
13-0062	Metro Grit-Syracuse, NY	9-Jun-15	New York	3 x NX50-C060	1040	SCFM	6.1	PSIG		Brian Stone Kevin Scriven@ongoy.net	Maintenance Coordinator Maintenance Crew Leader	315-800-9352 315-435-5024 x 227	brianstone@ongov.net kevinscriven@ongov.net
13-0063	Addison, IL	1-Sep-14	Illinois	1 x NX300-C060	6270	SCFM	7	PSIG		Doug Armstrong	Plant Supervisor	224-301-4934	darmstrong@addison-il.org
13-0064	Bensenville, IL	20-Sep-16	Illinois	3 x NX150-C070	3000	SCFM	9	PSIG		Mark Swayne	Superintendant	630-350-3486	mswayne@bensenville.il.us
13-0066	City of Sanger, CA	2-Apr-15	California	2 x NX150-C060	2200	SCFM	7.5	PSIG	GE MBR	Ron Franz	Plant Manager	559-513-9612	RonF@ci.sanger.ca.us
13-0067	Blaine, WA	27-Aug-14	Washington	1 x NX50-C060					GE MBR	Christina (Chrissy)Ness	Lead Operator	360-332-8311 x 3501	cness@cityofblaine.com
13-0068	Silver Creek, NY	13-Mar-15	New York	2 x NX50-C050	1369	SCFM	6.4	PSIG		David Voigt	Lead Operator	716-969-4340 716-785-1234	silvercreeksewer@yahoo.com
13-0069	Marlay Taylor, MD	10-Sep-15	Maryland	6 x NX150-C060	3035	SCFM	8.1	PSIG		Morgan O'Dell	Assistant Superintendent	P-1-301-862-3915 C-1-443-624-1628	modell@metcom.org

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
13-0070	Pearl Harbor, Hawaii	23-Oct-14	Hawaii	1 x NX200-C070	4220	SCFM	8.5	PSIG		Paul Carter	Chief Operator	808-474-2202	
13-0072	Bordighera, Italy	29-Jul-14	Italy	1 x NX75-C060					Nitrification Basins	Matteo CROCE	Application Engineer	39 02 89257234	mcroce@ascopompe.com]
13-0073	Mammoth, CA	8-Sep-14	California	2 x NX75-C070	1100	SCFM	6.7	PSIG		Rob Motley	Plant Maintenance Supervisor	760-920-2822	rmotley@mcwd.dst.ca.us
13-0074	Suncor Energy, CO	15-Jan-14	Colorado	1 x NX75-C080	800	SCFM	10	PSIG		Kim Slim		303-286-5853	
13-0075	Waukesha, WI	18-Dec-16	Wisconsin	3 x NX300-C080	6100	SCFM	9	PSIG		Jeff Harenda Nate Tillis	Plant Maintenance Maintenance Supervisor	262-524-3629 262-524-3626	JHarenda@waukesha-wi.gov ntillis@waukesha-wi.gov
13-0076	DC Filtrate-Blue Plains, MD	19-Dec-17	Maryland	12 x NX150-C100	2000	SCFM	12.2	PSIG		Vernon New Shawna Martinelli Laura Knox Salil Kharkar	PC Construction Engineer Process Engineer Maintenance Director Director of Operations	704-609-0719 202-568-2675 202-412-9345 202-812-0013	vnew@pcconstruction.com shawna.martinelli@dcwater.com laura.knox@dcwater.com salil.kharkar@dcwater.com
13-0077	Reidsville, NC	26-Jul-16	North Carolina	3 x NX150-C070	2460	SCFM	8.5	PSIG		Scott Bryan	Superintendent	336-349-1102	sBryan@reidsville.gov
13-0080	Crystal Lake, IL	24-Apr-14	Illinois	1 x NX150-C060	2750	SCFM	7		PSIG	Jim Huchel Daniel Langguth Sam Ferraro	Superintendent Wastewater Superintendent Division Supervisor	815-356-3700 847-587-3694	jhuchel@crystallake.org sferraro@crystallake.org
13-0081	Washington County SD, NY	15-Oct-14	New York	2 x NX50-C060	1000	SCFM	7.5	PSIG		Ray Hoag	Chief Operator	518-747-6967	rhoag@washingtoncountyny.gov
13-0082	Delhi, ON	21-May-15	Ontario	3 x NX100-C080	3030	NCMH	60	KPAG		Martin Konietzny		519 909 0674	martin.konietzny@veolia.com
13-2006	A_James River Refurbishing	1-Jul-13	Virginia	1 x NX300-C060	8400	SCFM	7.5	PSIG		Joe Battersby		757-833-1743	jbattersby@hrsd.com
13-2007	Boat Harbour, VA	28-Apr-13	Virginia	1 x NX150-C060-125 1 x NX50-C060	2400	SCFM	8	PSIG		Matthew Russell Billy Phelps Laura Shields	Electrical, controls Maintenance Superintendent	757-274-5787 757-244-1674 757-244-1672	mrussell@hrsd.com wphelps@hrsd.com lshields@hrsd.com
14-0001	Glen Cove WWTP, NY	23-Apr-15	New York	1 x NX300-C080	5811	SCFM	7.76	PSIG		John Koziarz (RJ Industries)	Project Manager	516-493-7350	jkoziarz@rjii.net
14-0002	Thunder Bay NX50, ON	15-Aug-14	Ontario	1 x NX050-C080	800	SCFM	11	PSIG		Mark Wilson Michael Brown Patty Wilson	Operations Supervisor Maintenance Supervisor Operations	807-625-2589 807-625-2044	mwilson@thunderbay.ca mikebrown@thunderbay.ca pwilson@thunderbay.ca
14-0003	Parsipanny, NJ-REFURB	15-May-15	New Jersey	3 x NX300-C060 2 x NX150-C050	5760	SCFM	9	PSIG		Steven Vetrero Phil Bober Frank Lorito	Maintenance Superintendent Assistant Superintendent	973-428-7593 973-428-7593 973-428-7416	svetrero@parsippany.net pbober@parsippany.net florito@parsippany.net
14-0005	Christchurch, UK ASP2	10-Nov-15	United Kingdom	3 x NX50-C060						Wayne Culver Eamon Connoly		05738 063 559 75 5726 6636	wayne.culver@trant.co.uk eamon.connolly@trant.co.uk
14-0006	Christchurch, UK-ASP3	5-Jun-15	United Kingdom	3 x NX50-C070									
14-0007	Muncie, IN	2-Dec-14	Indiana	1 x NX350-C070	7076	SCFM	8	PSIG		John Barlow	Superintendent	765-808-1512	jcbarlow@msdeng.com
14-0008	Village of Carol Stream, IL	1-Oct-14	Illinois	1 x NX150-C070	2350	CFM	9.9	PSIG		Andrew Warmus Nicholas Lenzi	Operations Supervisor CH2M Project Manager	630-488-0003 630-653-5663 224-500-7864	Andy.Warmus@ch2m.com Nicholas.lenzi@jacobs.com

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
14-0011	City of Joliet, IL	10-Sep-14	Illinois	2 x NX350-C070	8000	SCFM	7.5	PSIG		Nicholas Gornick	Plant Supervisor	815-724-3675	ngornick@jolietcity.org
14-0012	City of Manteca, CA	1-Sep-15	California	3 x NX150-C060	3333	SCFM	7.55	PSIG		Tim Carroll Bill Perry	Wastewater Maintenance Supervisor Lead Wastewater Maintenance Worker	209-456-8470 209-481-4575	tcarroll@ci.manteca.ca.us bperry@ci.manteca.ca.us
14-0013	Goldsboro, NC-Replacement	11-Sep-14	North Carolina	1 x NX200-C070	4185	SCFM	7.7	PSIG		Bert Sherman	Superintendent	919-735-5529	RSherman@goldsboronc.gov
14-0014	Chambers Creek, WA	8-Oct-16	Washington	4 x NX300-C080	5200	SCFM	11	PSIG		Barnaby Hoit		206-579-4021	barnaby@mcclureandsons.com
14-0015	City of Wilson, NC	27-Aug-15	North Carolina	1 x NX300-C070 1 x NX350-C070	7246	SCFM	9.52	PSIG		Jimmy Pridgen Nicholas Eatmon	Water Reclamation Manager Operation and Maintenance Supervisor	252-205-2519 252-291-4017	jpridgen@WILSONNC.ORG nearmon@wilsonnc.org
14-0016	Everett, WA	2-Sep-15	Washington	1 x NX100-C060	2200	SCFM	7.6	PSIG	Areation	Matt Gagner	WPCF Maintenance Supervisor	425-257-6795	mgagner@everettwa.gov
14-0017	City of Visalia, CA	13-Mar-17	California	4 x NX300-C060	7484	SCFM	6.34	PSIG	GE MBR	Jim Hestily Jeffrey B. Misenhimer	Water Conservation Plant Superintendent	559-713-4174	jim.hestily@visalia.city
14-0018	Milleys Creek, AL	28-Apr-16	Alabama	3 x NX75-C080	1250	SCFM	8.2	PSIG		Daniel Young Scott Milner Kenneth W. Causey	Plant Supervisor Operations Operations	P:334-206-8800, C:334-206-1795 P:334-206-8800 P:334-206-8800	dyoung@mwwssb.com smilner@mwwssb.com kwcausey@mwwssb.com
14-0019	Portbury, England, UK	24-Aug-15	United Kingdom	1 x NX100-C060						Mark Bricknell		01785 229 300	mbricknell@corgin.co.uk
14-0021	City of Woonsocket, RI	18-Jul-16	Rhode Island	1 x NX300-C050	6500	SCFM	7.5	PSIG		Leslie Sjobom		401-597-6201	leslie.sjobom@ch2m.com
14-0022	Twin Falls, ID	2-Jun-15	Idaho	4 x NX300-C070						Jack Bennion Harry Stites	Project Manager Assistant Project Manager	208-280-1038 208-316-5096	Jack.bennion@jacobs.com harry.stites@jacobs.com
14-0023	Mid-Halton, ON	15-Nov-17	Ontario	2 x NX200 -C050	8500	NCMH	310	NBARG		Benny Seminerio	Mech Super	905-825-6000 ext 7544	benny.seminerio@halton.ca
14-0025	Lexington II, NC	22-Jul-15	North Carolina	1 x NX300-C100	3667	SCFM	14	PSIG	nonwovens manufacturing process	Chris Willoughby	Lex 1 Maintenance Planner	336-242-6616	Chris.W.willoughby@hyh.com
14-0026	Intl. Airport of Houston, TX	5-Jul-16	Texas	7 x NX350-C70	7100	SCFM	7.5	PSIG		Ken Brown Jason Francis	City of Houston Operator	713-504-7705 832-590-9577	ken.brown@houstontx.gov jason.francis@houstontx.gov
14-0027	City of Woodland, CA	10-Dec-16	California	2 x NX200-C070 2 x NX300-C070	4100	SCFM	8	PSIG		Anthony Gedatus		530-867-2742	anthony.gedatus@cityofwoodland.org
14-0028	Opequon WRF, VA	2-Aug-15	Virginia	4 NX150-C070	3075	SCFM	8.1	PSIG		Richard Wadkins Robert Evans Ken Fisher	Facility Manager Maintenance Manager Chief Operator	540-665-9867 540-335-1142 540-665-9867 304-303-3123 540-665-9867 540-303-8825	richard.wadkins@winchesterva.gov robert.evens@winchesterva.gov Ken.fisher@winchesterva.gov
14-0030	Michael Foods, MN	18-Feb-15	Minnesota	1 x NX350-C070	7168	SCFM	8.2	PSIG	Aeration	Darren Reid	WWTP Operations Maintenance	507-237-4581 phone 507-317-4075 Cell	darren.reid@michaelfoods.com

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
14-0031	Kitchener WWTP, ON	11-Jul-18	Ontario	5 x NX350-C080	8050	NCMH	73	KPAG		Kyle Walton	O & M Team Lead	519-748-4141 ext. 227	kwalton@ocwa.com
14-0032	BELMONT, ON	13-Mar-15	Ontario	1 x NX100-C060	2170	SCFM	8.1	PSIG		Trevor Martin	Superintendent	519-617-0485	tmartin@centralelgin.org
14-0033	ST. MARY'S, ON	23-Jun-15	Ontario	1 x NX150-C070	3086	SCFM	8.5	PSIG		Renee Hornick		519-274-0997	RHornick@ocwa.com
14-0034	Tillamook, OR	16-Feb-15	Oregon	2 x NX300-C100-250	3600	SCFM	11	PSIG		Steven Blahut	Plant Manager	503-825-1336	sblahut@tillamook.com
14-0036	Bremerton, WA	25-Mar-15	Washington	1 x NX100-C070	2200	SCFM	7	PSIG		Rick Zimburean	Maintenance Supervisor	360-471-5168	rick.zimburean@ci.bremerton.wa.us
14-0037	Manatee, FL	9-Mar-17	Florida	2 x NX300-C060	6600	SCFM	8.7	PSIG		Malissa Dicky Jon Van Waardhuizen	SCADA Technician	O: 941-792-8811,5181 941-348-7100	malissa.dicky@mymanatee.org Jonathon.VanWaardhuizen@mymanatee.org
14-0038	McAllen South Plant, TX	30-Nov-17	Texas	6 x NX300-C080 1 X NX50-C070	5750	SCFM	10.3	PSIG	NX 300 Aeration NX 100 Post air UV	Edgar Tijerina Fernando Perez	Plant Manager Supervisor	956- 681-1751 956-681-1756	edgartijerina@mcallen.net fperez@mcallen.net
14-0039	South San Francisco II, CA	23-Jan-16	California	1 x NX350-C080	6700	SCFM	10.3	PSIG		Brian Schumaker Arran Gordon	Superintendent Maintenance Supervisor	650-829-3844 650 829 3850	Brian.Schumacker@ssf.net Arran.Gordon@ssf.net
14-0040	Western Riverside, CA	2-Mar-17	California	2 x NX200-C070	3500	SCFM	8.5	PSIG		Scott Page Michael Snow		760-443-7413 951-789-5189	SPage@wmwd.com msnow@wmwd.com
14-0041	Metro Vancouver II, BC	13-Apr-16	British Columbia	3 x NX700-C080	330	NCMM	80	KPAG		Vince Chiu	Superintendent, WWTP,	604-523-7107	vince.chiu@metrovancouver.org
14-0043	Summit County - Snake River, CO	12-Nov-15	Colorado	1 x NX50-C080 1 x NX75-C080	940	SCFM	8.2	PSIG		Stone Turner		970-468-5794	stoner.turner@summitcountyco.gov
14-0044A	Evansville, IN	1-Oct-15	Indiana	3 x NX350-C070	7500	SCFM	7.5	PSIG		Joe Dickman	Chief Operator	812-454-2584	jdickman@ewsu.com
14-0044B	Evansville, IN	1-Oct-15	Indiana	3 x NX200-C060	4100	SCFM	7.5	PSIG		Chris Bauer	Chief Operator	812-483-8544	cbauer@ewsu.com
14-0045	Scotts Valley, CA	7-Jul-15	California	1 x NX50-C080	800	SCFM	8.5	PSIG	Areriation 2 Tanks	Scott Hamby	Wastewater Division Manager	831-438-0732	shamby@scottsvalley.org
14-0046	Crystal Lake, IL	30-Apr-15	Illinois	2 x NX150-C060	2750	SCFM	7	PSIG		Chris Olson		773-908-5343	colson@independentmech.com
14-0047	Fort Collins-Drake, CO	21-Oct-15	Colorado	2 x NX200-C100						Link Mueller	Project Manager	970-222-0465	LMueller@fcgov.com
14-0048	Moline, IL	26-Oct-17	Illinois	4 x NX100-C080	2000	SCFM	8.9	PSIG		Greg Pyles	Operations Manager	309-798-7032	gpyles@moline.il.us
14-0049	Owen Sound, ON	12-Jan-17	Ontario	3 x NX150-C100	2530	NCMH	14.8	PSIG		Catherine petit		514-334-7230 ext 3195	catherine.petit@veolia.com
14-0052	Lowestoft, UK	16-Apr-15	United Kingdom	1 x NX350-C070						Paul Ellis	Project Manager (Jacobs LED Ltd)	011 44 0 7841 499899	
15-0001	Niagara on the Lake, ON	10-Aug-18	Ontario	3 x NX75-C080	2057	NCMH	69	KPAG		Bob Pysher		905-685-4225 ext. 3657	bob.pysher@niagararegion.ca
15-0002	Shady Cove, OR	12-May-15	Oregon	1 x NX50-C060	3500	SCFM	7.75	PSIG		Carl Tappert	District Manager	541-664-6300	ctappert@rvss.us
15-0003	Salt Creek, IL	5-Jul-15	Illinois	1 x NX200-C060	3500	SCFM	7.75	PSIG		Kris Komorn	Project Manager (DMI)	847-212-1147	kkomorn@dahmemechanical.com
15-0004	Frederick, MD	28-Jun-18	Maryland	4 x NX200-C070	4000	SCFM	8.3	PSIG		Jason Michael	Superintendent	301-600-1809	jburrier@cityoffrederick.com

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
15-0005	South Cary, NC	2-Jun-16	North Carolina	1 x NX350-C070	8530	SCFM	7.7	PSIG	Digester	Jarrod A. Buchanan Larry James Josh Cummings	Plant Manager Maintenance Supervisor Plant Engineer	919-633-9016 919-580-3798 919-810-1505	jarrod.buchanan@townofcary.org larry.james@townofcary.org Josh.Cummings@townofcary.org
15-0006	City of Genoa, IL	25-Jul-15	Illinois	1 x NX75-C070	1300	SCFM	6.82	PSIG		Janice Melton	Sewer, Streets, and Forestry Supervisor	815-784-7131	jmelton@genoa-il.com
15-0007	Wasaga Beach OCWA, ON	20-Oct-15	Ontario	1 x NX200-C060	8719	Nm3/hr	53	KPAG		Karen Lorente	Regional Manager	705-429-2525	klorente@ocwa.com
15-0008	Kingsville OCWA, ON	13-Nov-15	Ontario	1 x NX100-C070	3698	Nm3/hr	61	KPAG		Karen Burgess		519-738-3038	kburgess@ocwa.com
15-0009	RM Clayton, Atlanta	13-Apr-16	Georgia	4 x NX700-C080	12500	SCFM	9.1	PSIG		Danial Sabou Julius Bell Kelley, Christian D.	Plant Manager Plant Maintenance Supervisor Asset and Accountability	404-565-8903 404 798-1022 678-358-1363	dsabou@atlantaga.gov JCBell@AtlantaGa.Gov CDKelley@AtlantaGa.Gov
15-0010	Roane County, TN	29-Dec-15	Tennessee	2 x NX75-C070	1000	SCFM	8.4	PSIG		Majel Leach Casey	Pretreatment coordinator	423-506-4384 865-360-0242 865-591-8377	magentaroane@comcast.net
15-0011	NBC,RI	28-May-15	Rhode Island	2 x NX350-C070	7910	SCFM	8.4	PSIG		Eugene Sorkin		401-641-3271	ESorkin@narrabay.com
15-0012	Canada Malting, AB-Ph. 2	8-Dec-15	Alberta	1 x NX400-C100	6000	SCFM	14.22	PSIG		Rick Armstrong	Plant Manager	403-518-3495	rick.armstrong@canadamalting.com
15-0013	Orangeville, ON	14-Jun-17	Ontario	3 x NX150-C100	3968	CMHR	85	kPaG		Jeff Hardy	Wastewater Supervisor	519-941-0440	jhardy@orangeville.ca
15-0014	Copperas Cove, TX	9-Jun-16	Texas	4 x NX100-C060	2006	SCFM	7	PSIG		Chris Altott Thomas Brooks	Wastewater Superintendent Senior Operater	254-547-0751 254-547-9966	caltott@copperascovetx.gov tbrooks@copperascovetx.gov
15-0015	North River, NY	30-Jan-18	New York	9 x NX350-C100	4567	SCFM	14.2	PSIG		Kiah Miller Chris Kearney	Plant Chief	646-530-1811 212-491-5050	millerk@dep.nyc.gov kearneyc@dep.nyc.gov
15-0016	26th Ward, NY	24-Aug-17	New York	5 x NX700-C070	13500	SCFM	8	PSIG		Kevin McCormick James McCann	Deputy Plant Chief	347-451-4493	kmccormick@dep.nyc.gov JMcCann@dep.nyc.gov
15-0019	Stayner WWTP, ON	9-Aug-16	Ontario	2 x NX50-C060	850	SCFM	7	PSIG		Glenn Price		705-445-1581 ext 3315	gprice@collingwood.ca
15-0020	Sudbury, ON	9-Dec-15	Ontario	1 x NX350-C070	8170	CFM	8	PSIG		Bob Lee	Maitenance Officer	705-674-4455 ext:4817	bob.lee@greatersudbury.ca
15-0021	Chatham, ON	17-Dec-15	Ontario	1 x NX300-C070	8000	SCMH	8	PSIG		Dhanna Niriella	Supervisor South/ Central PUC `	226-312-2023 ext 4338	dhanan@chatham-kent.ca
15-0022	Leonardtown, MD	18-Nov-16	Maryland	3 x NX50-C060	1200	SCFM	7	PSIG		Jay Johnson	Utilities Superintendent	240-298-4451	jay.johnson@leonardtownmd.gov
15-0023	Cypress Hill, TX	9-May-17	Texas	5 x NX50-C060	1030	SCFM	8	PSIG	2 x Digesters, 3 x Aeration	TR Riley Michael Butler	Plant Manager Operator	281-303-6405 281-889-9964	tr@eaglewatermanagement.com mikeyb77375@gmail.com
15-0024	Ear Falls, ON	29-Oct-15	Ontario	1 x NX50-C070	928	SCFM	8.4	PSIG		Rob Eady	Operations Manager	807-222-3479	ready@ear-falls.com
15-0025	Town of Plympton-Wyoming, ON	8-Oct-15	Ontario	1 x NX50-C060	1130	SCFM	7	PSIG		Peter Ollos		905-491-3060	Pollos@ocwa.com
15-0026	Wadsworth, OH	10-Dec-15	Ohio	1 x NX150-C070	2500	SCFM	7.5	PSIG		Christ Babcok Herman Maruschke	Superintendent	330-336-2894 216-798-7800	jclark@wadsworthcity.org hmaruschke@wadsworthcity.org

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Project #	Project Name	Startup completion date	State	System Description	Flow (Rated performance)	Unit of measure	Head (Discharge Pressure)	Unit of measure	Type of Process	Site Contact	Title	Site Number	Site Email
15-0027	Roanoke, VA	13-Apr-18	Virginia	2 x NX700-C070	1450	SCFM	10.03	PSIG		S. Scott Shirley Tommy Shaver	Director of Wastewater Operations	540-283-8270 540-537-5894	Stephen.Shirley@WesternVaWater.org Tommy.Shaver@WesternVaWater.org
15-0028	Fenton, MO	15-Mar-16	Missouri	1 x NX150-C070	3374	SCFM	8	PSIG		Tod Heller Shane Babson Jon Winslow Nathan Shroyer	Senior Operator	636-861-6701 314-335-2042 636-861-6704 636-861-6703	theller@stlmsd.com sbabson@stlmsd.com jwinslow@stlmsd.com nshroyer@stlmsd.com
15-0029	HRRSA, VA	6-Aug-15	Virginia	1 x NX350-C070	7200	SCFM	8	PSIG		Harvey Morris	Maintenance supervisor	540-434-1053	hmorris@hrrsa.org
15-0030	Bensenville, IL	23-Mar-16	Illinois	3 x NX150-C070	3000	SCFM	9	PSIG		Mark Swayne	Superintendant	630-350-3486	mswayne@bensenville.il.us
15-0031	Corona, CA	29-Jun-16	California	2 x NX30-C060	350	ACFM	5.5	PSIG		Frank Garza Roger Johnson		951-279-3665 915-830-1441	frank.garza@ci.coronaca.us roger.johnson@ci.coronaca.us
15-0032	Fredonia, NY	22-Jul-16	New York	2 x NX100-C050	2450	SCFM	7	PSIG		Betsy Sly Kenny Porter Tony Mistretta.	Engineer Senior Operator Maintenance Mechanic	716-366-0057	fwwtp@netsync.net
15-0033	JEA-Upgrades, FL	2-Jan-16	Florida	4 x NX700-C070	15980	SCFM	10	PSIG		Todd Gilbert	Electrician & Instrumentation Tech	904-545-7238	gilbta2@jea.com
15-0034	Chillicothe, IL	9-Aug-16	Illinois	2 x NX75-C060	1412	SCFM	8	PSIG		David Day		309-274-3583	chilisd@frontier.com
15-0035	Kingsport, TN	2-Sep-16	Tennessee	1 x NX150-C060	3300	SCFM	7.1	PSIG	Aeration	Niki Ensor Tom Hensley	Water/Wastewater Facilities Manager Wastewater Plant Superintendant	423-914-9433 423-229-9394	nikiensor@kingsporttn.gov TomHensley@kingsporttn.gov
15-0036	Harlingen, TX	3-Aug-17	Texas	3 x NX300-C070	5765	SCFM	9.22	PSIG	Aeration	Bernardino Quintana, Jesus Guevara	WWTP Superintendent Chief Operator	956-440-6513 956-440-6521	bquintana@hwws.com jguevara@hwws.com
15-0038	Norway, MI	9-Nov-17	Michigan	2 x NX75-C070	1470	CFM	8.5	PSIG		Brock Johnson	Wastewater supervisor	906-563-9961	wwtp@norwaymi.gov
15-0039	Beddington phase II	10-Jun-16	United Kingdom	1 x NX600-C050	400	m3/min	3.05	BarG		Alan Jenner	MEICA Lead		alan.jenner@costain.com
15-0040	EMWD-Temecula, CA	8-Jun-19	California	3 x NX200S-C060 3 x NX600-C070	4521	SCFM	7.4	PSIG	Plant # 3 Air Scour Plant # 3 Aeration	Matthew Melendrez Clete Fracchiolla Ron Ceallos Ken Tagney	Director of Water Reclamation Plant Manager Plant Shift Supervisor Plant Shift Supervisor	951-928-3777 #4303 951-928-3777 #7401 951-928-3777 #7403 951-928-3777 #7402	melendrm@emwd.org fracchic@emwd.org ceballor@emwd.org tangneyk@emwd.org
15-0042	USD, CA	7-Jun-16	California	1 x NX600-C070	12000	SCFM	9.4	PSIG		Scott Martin Michael Hovey	Coach, Facilities Manitenance FMC Planner/Scheduler	510-477-7576 510-477-7683	scottm@unionsanitary.ca.gov mikeh@unionsanitary.ca.gov
15-0043	Fox Metro South, IL	5-Dec-18	Illinois	3 x NX200-C080	3922	ACFM	9.2	PSIG		Doug Bakers Andrew Deitchman	Superintendent Project amanager	573-218-0146 630-897-4651	adeichman@deuchler.com
15-0045	Burbank, CA	26-Jul-16	California	3 x NX350-C070	5150	SCFM	8.16	PSIG		Linda Martinez		818-972-1115	linda.martinez@suez-na.com
15-0047	Livingston, NJ	8-Jun-17	New Jersey	3 x NX100-C070	2000	SCFM	8	PSIG		Joe Greco	Superintendent	973-535-7944	jgreco@livingstonnj.org

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15-0048	Salida Sanitary District, CA	14-Dec-16	California	3 x NX30-C070 3 x NX100-C100	390	SCFM	8.4	PSIG		Linda Walker	Operations Manager	209-346-0289	LWalker@salidasanitary.net
15-0049	Elmhurst, IL	23-Feb-17	Illinois	3 x NX150-C070	2850	SCFM	8.5	PSIG		Larry Leable		847-878-7100	lars@bollerconstruction.com
15-0050	Bayshore RSA, NJ	3-Aug-16	New Jersey	1 x NX350-C070	7500	SCFM	7.25	PSIG		Roy Anderson	Assistant Superintendent/ Maintenance Supervisor	732-739-1095	roy.anderson@bayshorersa.com
15-0051	Suncor, CO	9-May-16	Colorado	1 x NX100-C100	1000	SCFM	11.5	PSIG		Tony Gibbons		303-386-5590	tgibbons@suncor.com
15-0053	Vallecitos, CA	29-Feb-16	California	1 x NX75-C070	1470	SCFM	9.5	PSIG		Dale Austin		O:760-744-0460,237 C:760-468-3686	daustin@vwd.org
15-0054	Periodistas, MX	30-Mar-17	Mexico	3 x NX100 -C100						Dulce Vazquez		521 (81) 8345 9359	dulce.vazquez@ambbio.com
16-0001	Greenway, ON	15-Feb-18	Ontario	1 x NX100-C050	300	m3/min	48	kPaG		Mark Spitzig	Operations and	519-661-0670	mspitzig@london.ca
16-0003	Bergen Point, NY	27-Jun-17	New York	2 x NX100-C050	2200	SCFM	6	PSIG		Dale Grudier Jr Frank Oliveri	Assistant Plant Supervisor Maintenance Supervisor	631-854-4045 631-854-4045	dale.grudier@suffolkcountyny.gov frank.oliveri@suffolkcountyny.gov
16-0004	Kimberly Clark Hendersonville, NC	29-Jul-16	North Carolina	1 x NX700-C080	6200	SCFM	8	PSIG	nonwovens manufacturing process	Josh Henri Jerry Gilliam	Senior Electrical Engineer Maintenance Planner	423-534-6608 828-697-4033	Josh.D.Henri@kcc.com jerry.gilliam@kcc.com
16-0005	Fox Metro North, IL	29-May-18	Illinois	4 x NX700-C070	17560	CFM	7.75	PSIG		Chris Morphey John E. Odean Joel Ilseman	Maintenance Supervisor Operations Foreman Operations Supervisor	630-301-6840 630-892-4378 630-892-4378	cmorphey@foxmetro.org jodean@foxmetro.dst.il.us jilseman@foxmetro.org
16-0007	Town of Aylmer, ON	14-Oct-16	Ontario	1 x NX75-C070	1262	SCFM	8.36	PSIG					
16-0008	Granite City, IL- Phase II	24-Mar-17	Illinois	1 x NX300-C050	7500	SCFM	7.2	PSIG		William Jones Jeff Hamilton Keith Watson	Assistant Superintendent Superintendent General Foreman of Maintenance	616-452-6229 618-910-9191 618-447-6809	bjones@granitecity.illinois.gov jhamilton@granitecity.illinois.gov kwatson@granitecity.illinois.gov
16-0011	San Elijo Joint Power Authority, CA	9-Mar-17	California	3 x NX75-C080	1321	SCFM	10.5	PSIG		Michael Henke		760-801-1238	henkem@sejpa.org
16-0015	Goleta, CA	16-Mar-17	California	1 x NX100-C080	1400	SCFM	9.3	PSIG		Chuck Smolnikar		805-967-4519	
16-0016	Golden Gate, FL	8-Feb-18	Florida	2 x NX150-C060	2500	SCFM	8.4	PSIG	Aeration (2 Zones)	Richard Stefanko Frank Gawlinski Wade Bassett	Plant Supervisor Operator Operato	239-455-3439	Richard.Stefanko@colliercountyfl.gov Frank.Gawlinski@colliercountyfl.gov Wade.Bassett@colliercountyfl.gov
16-0017	Lehigh Acres, FL	14-Mar-18	Florida	1 x NX75-C060 1 x NX100 C050 1 x NX150-C060	1300	ACFM	8	PSIG			Plant Operator	C: 239-222-3260	ckimball@uswatercorp.net
16-0018	San Luis Obispo, CA	14-Jul-17	California	1 x NX200-C060	4100	SCFM	8	PSIG		Chris Lehman	WRRF Operator	805-431-4372	clehman@slccity.org

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16-0020	Salineville, OH	1-Mar-17	Ohio	2 x NX30-C050	600	SCFM	6.2	PSIG		Michelle Maynard		234-564-9785	Mmaynard1995@gmail.com
16-0021	Brembate,, IT Phase III	9-Jan-17	Italy	1 x NX150-C070									
16-0022	Bayshore RSA Phase II	18-Jan-18	New Jersey	1 x NX350-C070	7500	SCFM	7.25	PSIG		Roy Anderson	Assistant Superintendent/ Maintenance Supervisor	732-739-1095	roy.anderson@bayshorersa.com
16-0023	City of Salem, OR	17-Feb-17	Oregon	1 x NX200-C060	4700	SCFM	7.05	PSIG		Glen Putman		503-588-6380	gputman@cityofsalem.net
16-0025	Plymouth, IN	11-Apr-17	Indiana	1 x NX100-C070 2 x NX150-C070	1893	SCFM	9	PSIG		Cleon Wagoner	Maintenance Supervisor	574-936-3017	
16-0026	Lowville, NY	20-Jan-17	New York	3 x NX100-C070	1900	SCFM	8.8	PSIG		Colin Fayle	Plant Operator	315-376-4464	wwtp@villageoflowville.org
16-0027	Westfield, NY	12-May-17	New York	3 x NX150-C060	3400	SCFM	7	PSIG					
16-0028	Capinteria	20-Apr-17	California	2 x NX75-C070	1100	SCFM	9.25	PSIG					
16-0030	American Falls, ID-Phase II	23-Mar-17	Idaho	1 x NX30-C080	300	SCFM	8.24	PSIG		Peter Cortez	Superintendent	208-226-2827	pcortez@co.power.id.us
16-0031	Harlingen, TX-Phase II	4-Oct-17	Texas	2 x NX75-C050	1600	SCFM	7	PSIG	Digester	Jim Vallely Bernardino Quintana	Wastewater Service Director Wastewater Superintendent	956-440-6516 956-440-6513	jvalley@hwws.com bquintana@hwws.com
16-0032	South Huron Valley, MI	26-Apr-18	Michigan	2 x NX200D-C070	4308	SCFM	9	PSIG					
16-0036	Friarsgate, SC	10-Aug-16	South Carolina	1 x NX50-C050	1343	SCFM	7.2	PSIG		Jimmy Holland		334-206-1722	jholland@wkdixon.com
16-0037	Fairfield Suisun Sewer District, CA	19-Jul-19	California	4 x NX350-C070	8250	CFM	7.8	PSIG		Jordan Damerel Dave Harrold	Director of Enginnering Maintenance Supervisor	707-429-8930 O:707-428-9156 C:707-365-1837	jdamerel@fssd.com dharrold@fssd.com
16-0038	Bradford, ON	26-Apr-17	Ontario	1 x NX150-C070	84	CMM	70	kPaG		Brad Sullivan	Wastewater Treatment Plant Supervisor	905-775-3252 ext 7102	bsullivan@townofbwg.com
16-0039	Vallecitos, CA Ph II	1-Jun-17	California	1 x NX100D-C070	1400	SCFM	9.5	PSIG		Dale Austin		760-744-0460	
16-0040	Battle Creek, MI	19-Jul-18	Michigan	4 x NX350-C070	7500	SCFM	8.5	PSIG					
16-0041	Orillia, ON	24-Oct-19	Ontario	3 x NX200-C060	7000	NCMH	56.8	kPaG		Jasani Vallabhadas	Superintendant of Wastewater	905-850-1242	jasaniv@malfar.ca
16-0042	Isla Blanca, TX	22-Sep-17	Texas	2 x NX150-C060	4000	CFM	6.8	PSIG	Aeration (4 basins)	Mark Garza Fransisco Guzman	Manager Assistant Manager	956-572-0395 956-371-1345	mgarza@lmwd.org, fguzman@lmwd.org
16-0043	Patuxent, MD	18-Oct-18	Maryland	1 x NX200-C060 2 x NX300-C060	4570	SCFM	8	PSIG		Dave Miller Robert Kraus	Project Superintendent Utilities Team Manager	443-292-8236 443-685-5172	pwkrau18@aacounty.org
16-0045	Broadholme, UK	30-Jan-18	United Kingdom	2 x NX300-C060									
16-0046	TOHO-South Bermuda, FL	31-May-18	Florida	4 x NX350-C080	7000	SCFM	8	PSIG	Aeration	Don Vedner	Chief Operator II	P:407-944-5077 C:407-501-1259	dvedner@tohowater.com
16-0047	Port Isabel, TX	27-Nov-18	Texas	1 x NX200-C060	4000	SCFM	8	PSIG		Mark Garza Fransisco Guzman	Manager Assistant Manager	956-572-0395 956-371-1345	mgarza@lmwd.org, fguzman@lmwd.org

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16-0049	Lemont , IL	29-Aug-17	Illinois	1 x NX150-C070	2700	SCFM	9.2	PSIG		Mark Kursell, PE	Principal Mechanical Engineer	708-588-4182	KursellM@mwrd.org
17-0002	Addison, IL-Phase II	27-Apr-17	Illinois	1 x NX150-C070	2600	SCFM	7	PSIG		Doug Armstrong	Plant Supervisor	224-301-4934	darmstrong@addison-il.org
17-0006	Crown Point, IN	12-Jan-18	Indiana	2 x NX150-C070	2905	SCFM	8.6	PSIG	Waste Water Treatment	Chris Previs	Wastewater Superintendent	219-662-3255	cprevis@crownpoint.in.gov
17-0007	Howard Grove, WI	17-Dec-17	Wisconsin	1 x NX75-C060	1300	SCFM	8.2	PSIG	Waste Water Treatment	David Wright	Plant Manager	920-565-3029 920-377-6039	hgwwtf@howardsgrove.org
17-0008	Dekalb, IL	19-Sep-19	Illinois	4 x NX150-C080	2550	SCFM	9.8	PSIG					
17-0011	Durango, CO	28-Feb-19	Colorado	3 x NX200-C080	2700	SCFM	8.7	PSIG	Aeraion	Chanel Fitch-Kirkpatrick Joe Wise	Chief Plant Operator	970-759-4707 970-375-4895	chanel.kirkpatrick@durangogov.org joe.wise@durangogov.org
17-0013	Michael Foods, Lenox. IA	28-Sep-17	Iowa	1 x NX350-C070	6000	SCFM	8.5	PSIG	Aeration	Jeremy Robinson	Plant Supervisor	712-542-7055	jeremy.robinson@michaelfoods.com
17-0014	Soldotna, AK	#N/A	Alaska	3 x NX100D-C060	2200	SCFM	8.5	PSIG		CO Robert Hays Site Email	Project Manager Utility Department Manager	907.714.1235 907.262.4205	corudstrom@soldotna.org rhays@soldotna.org uoperator@soldotna.org
17-0015	Shelton, CT Phase III	26-Jul-18	Connecticut	1 x NX100-C100	1400	SCFM	13	PSIG		Garritt Ogden	Plant Maintenance	203-410-0768	g.ogden@cityofshelton.org
17-0016	Bristol, TN	27-Sep-18	Tennessee	3 x NX150S-C060	3100	SCFM	7.8	PSIG		William (Bill) Davidson Matthew Dake	Assistant Manager Project Manager	423-340-0993 423-989-5570	Bill.Davidson@inframark.com Matthew.Dake@inframark.com
17-0017	Coleshill, UK	22-May-18	United Kingdom	1 x NX150-C050									
17-0021	Seven Springs, FL	27-Jul-18	Florida	2 x NX75-C050 2 x NX150-C060	2017	SCFM	5	PSIG		Terry Henry Chris Chument	Op. Manager Op. Lead	727-243-4570 727-389-8616	thenry@uswatercorp.net cchumenti@uswatercorp.net
17-0022	Noblesville, IN	26-Sep-18	Indiana	3 x NX300S-C100	4100	SCFM	11	PSIG		Gene Stafford	Plant Operator	317-432-8248	gstafford@Noblesville.in.us
17-0023	West Lafayette, IN	8-Feb-18	Indiana	2 x NX200S-C050	5500	SCFM	7.2	PSIG		Jim Bjork Adam Huwe	Instrumentation specialist Opertions Supervisor	765-775-5145 765-775-5145	jbjork@wl.in.gov phuwe@wl.in.gov
17-0025	West Walton, UK	3-Jul-18	United Kingdom	2 x NX200-C050									
17-0026	Wilson Creek, TX	18-Jul-19	Texas	1 x NX300-C080	4600	SCFM	11.2	PSIG		Jason Pittsigner	Chief Operator	972-442-5405	jpittsigner@ntmwd.com
17-0027	OCWA Marathon, ON	12-Dec-17	Ontario	1 x NX30-C060	668	SCFM	7	PSIG	stab tank, aeration tank, digester and return sludge	Rodger Betts	Operations Manager	807-229-1186	rodger.betts@nwi.ca
17-0028	Rutland, VT	27-Jun-18	Vermont	1 x NX100D - C070	2094	SCFM	9.8	PSIG		David Joyce Robert Protivanski	Superintendent Chief Wastewater Operator	208-434-2432 802-773-1851	davidj@rutlandcity.com bobp@rutlandcity.org
17-0029	City Of Conroe, TX	31-Aug-18	Texas	2 x NX300-C070	4691	SCFM	9	PSIG		Greg Hall	Project Superintendent-Contractor	407-402-1845 936-522-3836 or 936-522-3885 Oprion 0	ghalljr@cityofconroe.org
17-0030	Elmvale, ON	24-May-18	Ontario	1 x NX100-C060	1750	SCFM	7.5	PSIG		Hank Andres	Senior Water & Wasetwater Process Engineer	905.271.3696	handres@ocwa.com
17-0031	St. Johns - Ponte Vedra, FL	28-Jun-19	Florida	4 x NX75-C070	1300	SCFM	9.52	PSIG	Aeration	Mark Mashburn	Operation Supervisor	P:904-209-2757 C: 904-669-7490	mmashburn@sjcfl.us

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17-0032	Meary Veg, UK	28-Jun-18	United Kingdom	3 x NX100-C060									
17-0033	BSA, NY	14-Dec-18	New York	5 x NX700S-C080	1100	SCFM	10	PSIG					
18-0001	Alderwood Picnic Point II	19-Sep-18	Washington	2 x NX150S-C070	2500	SCFM	8.7	PSIG		Joe Carter Manuel Semana Kevin Sykes Corey Ott	WWTF Manager Senior Facilities Mechanic SCADA / Electrical Manager SCADA Systems Lead	425-787-1940 Ext. 8311 425-787-3271 425-248-0029	jcarter@awwd.com MSemana@awwd.com KSykes@awwd.com cott@awwd.com
18-0002	Gig Harbor	20-Jun-19	Washington	1 x NX100D-C070	2041	SCFM	9.1	PSIG		Darrell Winans	Plant Supervisor	253-851-8999	winansd@cityofgigharbor.net
18-0003	Lake Haven II, WA	31-Oct-19	Washington	4 x NX150S-C080	2330	SCFM	11.5	PSIG		John Barton Brian Richardson John Kercher	Wastewater Operations Manager Wastewater Operations Supervisor	253-945-1642 253-945-1660 253-561-1357	jbarton@lakehaven.org brichardson@lakehaven.org jkercher@lakehaven.org
18-0004	Penoles, MX	#N/A	Mexico	2 x NX30-C050									
18-0005	Pottersburg (London, ON)	15-Jun-18	Ontario	1 x NX400-C050	328	m3/min	48	KPA		Mark Spitzig	Operations and Maintenance Manager	519-661-0670	mspitzig@london.ca
18-0006	Oconomowoc, WI	10-Aug-18	Wisconsin	1 x NX150S-C070	2500	SCFM	7.4	PSIG		Kevin Freber	Operations Manager	262-569-2192 262-354-5265	kfreber@oconomowoc-wi.gov
18-0008	Gig Harbor-PLC Upgrade	#N/A	Washington	5 x CompactLogix LCP						Darrell Winans	Plant Supervisor	253-851-8999	winansd@cityofgigharbor.net
18-0009	Charlotte, NC	30-Apr-20	North Carolina	2 x NX300D-C100	4500	SCFM	11.5	PSIG		Jeffrey Woolard	Lead Operator	743-333-1897	jswoolard@montrose-env.com
18-0010	Matheson, ON (OCWA)	29-Aug-18	Ontario	1 x NX50-C080	500	SCFM	8.6	PSIG					
18-0011	WLSSD WWTF Duluth, MN, Phase 2	1-Mar-19	Minnesota	1 x NX200S-C060	3700	SCFM	6.5	PSIG	The low pressure air in the final contact tank can also add dissolved oxygen to the effluent if needed	Al Parrella Joseph Schleret Jim Simmons Nathan Hartman Andy Klingsporn Lee McInnes	Manager Operations and Maintenance Planner Scheduler Senior engineer Lead Operator Lead Operator	218-740-4769 218-591-9027 218-740-4767 218-740-4762 218-740-4803 218-740-4854	al.parrella@wlssd.com Joseph.Schleret@wlssd.com jim.simmons@wlssd.com Nathan.hartman@wlssd.com Andrew.Klingsporn@wlssd.com lee.mcinnes@wlssd.com
18-0013	Sacramento,CA	20-Apr-20	California	3 x NX200-C060	4050	SCFM	8.3	PSIG		Daniel DiBiasio	HYCHEM Team	P: 916-875-9341	dibiasiod@sacsewer.com
18-0014	Manteca II,CA	21-May-19	California	3 x NX200D-C080 1 x NX100-C070	1890	SCFM	7.6	PSIG		Tim Carroll Bill Perry	Wastewater Maintenance Supervisor Lead Wastewater Maintenance Worker	209-456-8470 209-481-4575	tcarroll@ci.manteca.ca.us bperry@ci.manteca.ca.us
18-0015	Orbit Energy, RI	28-Feb-20	Rhode Island	1 x NX300D-C100 1 x NX150-C100	2250	SCFM	11.5	PSIG					
18-0018	Sidney,OH	16-May-19	Ohio	1 x NX100-C060 2 x NX200-C050	2000	SCFM	7	PSIG					

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18-0021	Goldsboro II, NC	18-Jan-19	North Carolina	2 x NX300-C070	6933	SCFM	7.7	PSIG		Bert Sherman	Superintendent	919-735-5529	RSherman@goldsboronc.gov
18-0026	Clacton Holland Haven ,UK	7-Dec-18	United Kingdom	2 x NX100-C070									
18-0029	Dunstable, UK	6-Nov-18	United Kingdom	1 x NX200-C060									
18-0030	Manchester-Shortsville II, NY	18-Dec-18	New York	1 x NX50-C080	900	SCFM	7	PSIG					
18-0031	Brantford II, ON	6-Jun-19	Ontario	2 x NX300-C050	12190	nm3/hr	52	kPaG		Jim Sehl John Smith	Plant Manager Maintenance	519-759-4150 ext 5825 519-732-3937	RLynes@brantford.ca smithj@brantford.ca
18-0034	Heinz, OR II	22-Aug-19	Oregon	3 x NX500DS-C080	7500	SCFM	9.5	PSIG	Aeration	Bob Pharmer Jess Farrow	Stover Group ENG Maintenance	405-385-2439 208-447-7131	rpharmer@stovergroupeng.com jess.farrow@kraftheinz.com
18-0035	Sudbury II, ON	6-Feb-20	Ontario	1 x NX350-C070	12932	nm3/hr	55	KPA		Akli Ben-Anteur	water/wasterwater projects engineer	705-674-4455 ext:4457	akli.ben-anteur@greatersudbury.com
18-0036	West Perth II, ON	17-Jan-20	Ontario	2 x NX200-C060	3797	SCFM	8.5	PSIG					
18-0037	Lambton County, ON	27-Nov-19	Ontario	1 x NX50-C070	31	nm3/min	41.4	KPA					
18-0043	Westfield II, NY	15-Oct-19	New York	1 x NX50-C060	1288	SCFM	6	PSIG					
19-0003	Georgetown, CO	16-Sep-19	Colorado	3 x NX50-C070	606	SCFM	7.5	PSIG		Jimmy Vass Ryan Zabel	Superintendent Public Work Supervisor	720-447-1755 303-518-3094	jvass@velocityci.com gtownutilities@townofgeorgetown.us
19-0010	Kenai, AK	27-Sep-19	Alaska	3 x NX50-C050	1459	SCFM	5.7	PSIG					
19-0011	Westside, AL	6-Nov-19	Alabama	2 x NX30-C070	576	SCFM	8.5	PSIG		James Dean	Plant Manager	251-580-1853	Jamesdean@mbumail.com
19-0013	Half Moon Bay, CA	19-Dec-19	California	2 x NX200D-C060						Kishen Prathivadi		650-726-0124	kishen@samcleanswater.org
19-0016	North Sitra, Bahrain	11-Oct-19	Bahrain	1 x NX150-C100									
19-0017	Hawaii Kai, HI	17-Jan-20	Hawaii	2 x NX75-C060	1728	SCFM	8.3	PSIG		Matt Lazecki		916-275-4740	Matthew.lasecki@amwater.com
19-0020	Paris, ON	18-Dec-19	Ontario	1 x NX200-C060	4125	SCFM	9	PSIG					
19-0021 (11-0037)	Millipore, NH	13-Dec-19	New Hampshire	3 x NX75-C060									
19-0022	Van Wert, OH	17-Apr-20	Ohio	1 x NX150-C070	3300	SCFM	9.2	PSIG					
19-0036	City Of Petrolia, ON	18-Jun-20	Ontario	1 x NX100D-C080	2759	nm3/h	75	kPaG					
19-0037	Michael foods II, MN	18-Aug-20	Minnesota	1 x NX150-C060	3326	SCFM	7.8	PSIG					
20-0007	Oxford II, ON	22-May-20	Ontario	2 x NX100-C070	76	m3/min	46	kPa					

Jacobs Installation List

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

APG-Neuros High Speed Turbo Blower - Jacobs Installation List

February 2022

Country	Project #	Project Name	Facility Location	State	Model	Core	Qty.	Ship Date
USA	10-0029	Granite City	Granite City	Illinois	NX100	C050	1	Dec-10
USA	10-0029	Granite City	Granite City	illinois	NX300	C050	2	Dec-10
USA	12-0003	JEA Talleyrand	Jacksonville	Florida	NX700	C070	4	Jul-12
USA	19-0010	Kenai WWTP	Kenai	Alaska	NX50	C050	3	Jul-19
USA	17-0003	Coffee Creek - Edmond,	Edmond	Oklahoma	NX300	C060	3	Jul-19
USA	17-0003	Coffee Creek - Edmond	Edmond	Oklahoma	NX200	C060	1	Jul-19
CANADA	18-0037	County of Lambton	Lambton	Ontario	NX50	C070	1	Jul-19
USA	19-0018	Haikey Creek, OK	Broken Arrow	Oklahoma	NX300	C080	4	Aug-20
USA	19-0028	Marine Park	Vancouver	washington	NX300	C070	1	Dec-20

APG-Neuros
1270 Michele Bohec, Quebec Canada, J7C 5S4
P:1 877 717-4150
sales@apg-neuros.com

d. Service Network

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

1. Active Service Organizations in the vicinity of the Owner

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

We offer Greater New Haven WWTP a highly responsive product support system including services of our Regional Field Service Managers dedicated to your support, with visits to your facilities periodically to monitor the operation, provide educational and refresher training and help resolve any technical or commercial issues.

APG-Neuros has 13 Startup & Field Service Engineers located at the Plattsburgh, NY facility and more than 25 factory certified field service technicians located across the United States that can commission or troubleshoot our Turbo Blowers.

We will provide strong proximity support with our employees located within driving distance from Greater New Haven, CT:

- APG-Neuros Technical Services Manager, Adam Norcorss, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT.
- APG-Neuros Production Manager and Start-up Manager, Brandon Chamberlain, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Senior Regional Manager, Chris James, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Field Technician, Chris Violette, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Field Technician, Brett Carnright, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Field Technician, Scott Dublanyk, who is located in Plattsburgh, NY – 5 hours driving time from New Haven, CT
- APG-Neuros Director of Sales and Qualified Service Technician, Craig Phelps, who is located in Blainville, QC – 7 hours driving time from New Haven, CT
- APG-Neuros Aeration Control Manager and I&C, Steven Kestel, who is located in Pennsylvania – 4 hours driving time from New Haven, CT
- APG-Neuros Field Technician, James Green, who is located in . ŜNNèØfftŜΣ ± ! - c hours driving time from New Haven, CT

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

2. Resumes

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Brandon Chamberlain
Production Manager

Expertise Summary

Over 6 years' experience working with APG-Neuros blower systems, over 12 years experience in Manufacturing:

Production Manager

- Oversee production in the Plattsburgh facility
- Manage production and testing schedules
- Training employees in production methods
- Oversee witness testing for various Customers
- Work with QA and Engineering to ensure all work is performed to the project's specifications
- Work with Project Management on site start-up planning, scheduling & review of services required
- Review test results and advise accordingly
- Work with Engineering for new products and test requirements
- Oversee Electrical safety within the facility and start-ups
- Implement Lean manufacturing strategies for process improvements

Lead Test Technician

- Ensure safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Trained in NFPA 70E 2015, 2018
- Experience factory testing hundreds of blower packages and cores
- Extensive knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Harmonic Filter
  - Sine Wave Filter
  - LCP
  - Blow-Off Valve
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix, MicroLogix)
  - Siemens (S7)
  - General Electric (VersaMax)
  - Schneider (Modicon MD-340)
  - Cimon (XPanel)
- Extensive knowledge working with Windows-based PC software, as well as troubleshooting communication and hardware problems within
- Able to quickly and effectively troubleshoot problems within the blower package, along with identifying inconsistencies outside the blower enclosure (site related)
- Extensive experience working with blower enclosure liquid cooling systems, including mechanical piping (where applicable)
- Extensive knowledge programming associated hardware within the blower enclosure including:
  - VFD
  - PLC
  - HMI
  - Managed Network Switches
  - UPS systems
- Extensive knowledge of the blower to identify how it may respond to certain operating conditions

Field Service Engineer / Start-up Technician

- Trained in the stringent safety protocols of the United Kingdom
- Work with clients and engineers to determine the most effective method of controlling the blowers in an aeration application.
- Assist SCADA and MCP developers on changes to logic that may need to occur to meet the control demands of the blower system to match process.
- Well versed in development, implementation and adherence of APG-Neuros' Start-Up procedures.
- Experience in upgrading and installing new software in PLCs and HMIs currently in operation at client's sites.
- Basic understanding of wastewater treatment processes and associated P&ID.
- Completed numerous safety presentations for client construction sites.
- Providing enhanced support to technicians working at customer sites during and after working hours.
- Mid-level experience in changing PLC logic to adapt the blower to run in non-standard conditions.

Education

- A.A.S. Electrical Engineering Technology, SUNY Canton
- B.A Computer Information Technology, Southern New Hampshire University

Professional Registrations

- 10-hour General Industry OHSA card
- 10-hour construction OHSA card
- LEAN Six-Sigma Green Belt
- NFPA-70E certificate 2018 standards
- Universal HVAC License

Relevant Project Experience

Completed Start-ups and field Service on the following:

- Rochester, NY
- Keene, NH
- Jacksonville, FL
- Parsippany, NJ
- Syracuse, NY
- Fox Lake, IL
- Christ Church, UK
- Royal port Burry, UK
- Lowestoft, UK
- Conroe, TX
- Kingston, ON
- St. Johns, FL
- South Windsor, CT
- West Haven, CT
- Howard County, MD
- Richland, VA
- Warwick, RI
- Alexandria, VA
- Western wake, NC
- Linden Roselle, NJ
- Hillsborough, FL
- Bucklin Point, RI
- Riverside, CA
- Stonington, CT

Brandon Chamberlain
Production Manager

- Killingly, CT
- San Jacinto, TX
- Shelton, CT
- Reidsville, NC
- Washington County, NY
- Visalia, CA
- Mileys Creek, AL
- Woodland, CA
- Opequon, VA
- Atlanta, GA
- Roane County, TN
- Copperas Cove, TX
- North River, NY
- Bensenville, IL
- Chillicothe, IL
- Buffalo, NY

Adam C Norcross
Test / Technical Services / Field Service Technician

Expertise Summary:

Over six years of experience working with APG-Neuros blower systems, including the following:

Test Technician/Technical Services Technician

- Ensure Safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Trained in NFPA 70E.
- Experience factory testing of blower packages and cores.
- Extensive knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Harmonic Filter
  - Sine Wave Filter
  - LCP
  - Blow-Off Valve
- Extensive knowledge of troubleshooting VFD's while using Combivis 6.
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix, MicroLogix)
  - Siemens (S7)
  - Schneider (Modicon MD-340)
  - CIMON
- Experience working with Windows-based PC software.
- Able to quickly and effectively troubleshoot problems within the blower package, along with identifying inconsistencies outside the blower enclosure (site related).
- Extensive experience working with blower enclosure liquid cooling systems, including mechanical piping (where applicable).
- Knowledge programming associated hardware within the blower enclosure including:
  - VFD
  - PLC
  - HMI
- Knowledge with how the blower reacts to different situations.

Field Service Engineer / Start-up Technician

- Work with Customers and Engineers to determine the most effective method of controlling the blowers in an aeration application.
- Well versed in adherence of APG-Neuros' Start-Up procedures.
- Experience in upgrading and installing new software in PLCs and HMIs currently in operation at Customer's sites.
- Basic understanding of wastewater treatment processes and associated P&ID.
- Completed numerous safety presentations for Customer construction sites.

Adam C Norcross
Test / Technical Services / Field Service Technician

Professional Registrations:

- OSHA 10 Hour Construction
- OSHA 10 Hour General Industry

Education:
A.A.S. Manufacturing

Relevant Project Experience:

As of 02 January 2020, Completed Service/Start-ups in:

- Atlanta, GA
- Ballenger McKinney, MD
- Clark County, NV
- Corona, CA
- Cox Creek, MD
- Cypress Hill, TX
- Daphne, AL
- Decatur, IL
- Ellenville, NY
- Ellsworth, ME
- Elmhurst, IL
- Fox Lake, IL
- Fox River Grove, IL
- Greater Peoria, IL
- Hackettstown, NJ
- Harlingen, TX
- Hollister, CA
- JEA, FL
- Killingly, CT
- Livingston, NJ
- Long Brach, NJ
- NBC, RI
- Orangeville, ON
- Pagosa Springs, CO
- Paso Robles, CA
- Riverside, CA
- South Valley, UT
- Stayner, ON
- Stonington Borough, CT
- Unified Sanitary District, CA
- Valdosta, GA

Scott Dublanyk
Field Service Technician

Expertise Summary

Field Service Engineer / Start-up Technician

- Ensure Safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Sensors
  - Harmonic Filter
  - Sine Wave Filter
  - Logic Control Panel
  - Blow-Off Valve
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix / MicroLogix)
- Knowledge programming associated hardware within the blower enclosure including:
  - PLC
  - VFD
  - HMI
- Efficient working from electrical and mechanical drawings
- Extensive knowledge working with Windows based PC software
- Efficient at troubleshooting electrical, mechanical, and communication issues
- Able to troubleshoot problems quickly and effectively within the blower package, along with identifying inconsistencies outside the blower enclosure (site related).
- Knowledge of the blower enabling the ability to identify how it may respond to certain operating conditions.
- Work with Customers and Engineers to apply the most effective method of controlling the blowers in applications
- Assist SCADA and APGN Automation Team with blower integration including hardwiring controls, ethernet communication, and applying changes to logic to meet the control demands of the blower system and site process.
- Basic understanding of development, implementation, and adherence of APG-Neuros' Start-Up procedures
- Basic understanding of wastewater treatment processes and associated P&ID.

Education

AAS Business Administration

AAS Telecommunications Technology

Scott Dublanyk
Field Service Technician

Relevant Experience

As of March, 2021, Completed Start-Up/Field Service at:

Linden Roselle, NJ
Warwick, RI
Bayshore, NJ
Hackettstown, NJ
Knoxville, TN
Spokane, WA
South Cary, NC
Iron House, CA
Chillicothe, IL
Brightwater, WA
Monroe County, NY
Shelton. WA
IAH, TX
Paso Robles, CA
Fallbrook, CA
Visallia, CA
North River, NY
Boisbriand, QC
Long Branch, NJ
Raritan, NJ
Rockland, ME
Seven Springs, FL
Keene, NH
Athabasca, AB
Jackson Miller, TN
Daphne, AL
Lehigh Acres, FL
Manatee, FL
Michael Foods, IA
Iowa City, IA
Ellenville, NY
Metro Vancouver, BC
Campbell River, BC
Kitchener, ON
Pinellas, FL

Michael Magee
Field Service Technician

Expertise Summary

Field Service Engineer / Start-up Technician

- Ensure Safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Sensors
  - Harmonic Filter
  - Sine Wave Filter
  - Logic Control Panel
  - Blow-Off Valve
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix / MicroLogix)
- Knowledge programming associated hardware within the blower enclosure including:
  - PLC
  - VFD
  - HMI
- Efficient working from electrical and mechanical drawings
- Extensive knowledge working with Windows based PC software
- Efficient at troubleshooting electrical, mechanical, and communication issues
- Able to troubleshoot problems quickly and effectively within the blower package, along with identifying inconsistencies outside the blower enclosure (site related).
- Knowledge of the blower enabling the ability to identify how it may respond to certain operating conditions.
- Work with Customers and Engineers to apply the most effective method of controlling the blowers in applications
- Assist SCADA and APGN Automation Team with blower integration including hardwiring controls, ethernet communication, and applying changes to logic to meet the control demands of the blower system and site process.
- Basic understanding of development, implementation, and adherence of APG-Neuros' Start-Up procedures
- Basic understanding of wastewater treatment processes and associated P&ID.

Education

BA Business Administration

AA Degree, Liberal Arts

AA Degree , Microprocessors

Michael Magee
Field Service Technician

Relevant Experience

As of March, 2021, Completed Start-Up/Field Service at:

Rock Island, IL
Village of Oregon, WI
Delta Diablo, CA
Oceanside, CA
Westminster, MD
Spokane, WA
Martin Way, WA
Chico, CA
Haikey Creek, OK
Alderwood, WA
Oro Loma, CA
Vallecitos. CA
Blaine, WA
McCain Foods, WA
Vancouver, WA
Camp Pendleton, CA
Scotts Valley, CA
Vacaville, CA
Idaho Falls, ID
King County, WA
Hollister, CA
Sacramento, CA

Christopher Violette
Test Technician / Field Service Technician

Expertise Summary:

About 3 years of experience working with APG-Neuros blower systems, including the following:

Test Technician

- Over 2,000 hours of test cell experience.
- Ensure Safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Experience factory testing of blower packages and cores.
- Extensive knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Harmonic Filter
  - Sine Wave Filter
  - LCP
  - Blow-Off Valve
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix, MicroLogix)
  - Siemens (S7)
  - General Electric (VersaMax)
  - Schneider (Modicon MD-340)
  - Cimon (XPanel)
- Able to quickly and effectively troubleshoot problems within the blower package, along with identifying inconsistencies outside the blower enclosure (site related).
- Extensive experience working with blower enclosure liquid cooling systems, including mechanical piping (where applicable).
- knowledge programming associated hardware within the blower enclosure including:
  - VFD
  - PLC
  - HMI
  - UPS systems
- Extensive knowledge of the blower to identify how it may respond to certain operating conditions.

Field Service Technician / Start-up Technician

- Work with Customers and Engineers to determine the most effective method of controlling the blowers in an aeration application.
- Well versed in development, implementation and adherence of APG-Neuros' Start-Up procedures.
- Experience in upgrading and installing new software in PLCs and HMIs currently in operation at Customer's sites.
- Basic understanding of wastewater treatment processes and associated P&ID.
- Completed numerous safety presentations for client construction sites.

Education:

- **Mechanical Engineering Technology**

- **Technical Drafting**

Professional Registrations

- Adult First Aid/CPR/AED (exp. 2/19/2020)
- 10 Hour OSHA General Industry Safety Course
- Hazards of Electricity NFPA 70E
- Canadian Work Permit (exp. 07/30/2021)

Relevant Project Experience:

As of 31 Dec 2018, Completed Service/Start-ups in:

- Danielson, CT
- South Windsor, CT
- Fort Edwards, NY
- Lowville, NY
- St. Petersburgh, FL
- Cincinnati, OH
- Cincinnati, OH
- Scotts Valley, CA
- Paso Robles, CA
- Westfield, NY
- Burbank, CA
- South San Francisco, CA
- Riverton, UT
- Scottsdale, AZ
- Brooklyn, NY
- Harlingen, TX
- Oakley, CA
- Conroe, TX
- Moline, IL
- Hollister, CA
- Rockland, ME
- Carleton Place, ON
- Delta, BC
- Crystal Beach, ON
- Oakville, ON
- Villa Park, IL
- Chatham, ON
- Orangeville, ON
- Elmvale, ON
- Matheson, ON
- Port Elgin, ON
- East Windsor, NJ
- Acworth, GA
- Oswego, IL
- Linden, NJ
- Hackettstown, NJ
- Parsippany, NJ
- Addison, IL
- Villa Park, IL
- Corona, CA
- Sauget, IL
- Granite City, IL
- West Haven, CT
- New York, NY
- Union, CA
- Liberty, MO
- Curtis Bay, MD
- West Haven, CT
- Boisbriand, QC
- Woodinville, WA
- Brockville, ON
- Campbell River, BC
- Brantford, ON
- Chicago Heights, IL
- Peoria, IL
- Niagara On the Lake, ON
- Providence, RI
- Commerce City, CO
- Lathrop, CA
- Crown Point, IN
- Noblesville, IN

Christopher F. James
Regional Field Service Manager

Expertise Summary:

Over 8 years' experience working with APG-Neuros blower systems, including the following:

Regional Field Service Manager

- Responsible for over 200 sites in the US and Canada.
- Routine site visits conducted on a biweekly basis to both new sites and existing.
- Provide onsite training of personnel on maintenance and blower operation.
- Review of internal and external field service deployments.
- Manage technical and non-technical support inquires.
- Updating sites with the most current procedures.

Production Manager

- Oversee production in the Plattsburgh facility.
- Create production and testing schedules for projects.
- Train employees in production methods.
- Work with various engineering firms for witness testing
- Work with QA and Engineering to ensure all work is performed to the project's specifications
- Work with Project Management on site start-up planning, scheduling & review of service required.
- Review test results and advise accordingly.
- Work with Engineering for new products and test requirements.

Test Department Supervisor

- Ensure Safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Trained in NFPA 70E. 2015
- Experience factory testing hundreds of blower packages and cores.
- Extensive knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Harmonic Filter
  - Sine Wave Filter
  - LCP
  - Blow-Off Valve
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix, MicroLogix)
  - Siemens (S7)
  - General Electric (VersaMax)
  - Schneider (Modicon MD-340)
  - Cimon (XPanel)
- Extensive knowledge working with Windows based PC software, as well as troubleshooting communication and hardware problems within.
- Able to quickly and effectively troubleshoot problems within the blower package, along with identifying inconsistencies outside the blower enclosure (site related).
- Extensive experience working with blower enclosure liquid cooling systems, including mechanical piping (where applicable).
- Extensive knowledge programming associated hardware within the blower enclosure including:
  - VFD
  - PLC

  - HMI
  - Managed Network Switches
  - UPS systems
- Extensive knowledge of the blower to identify how it may respond to certain operating conditions.

Field Service Engineer / Start-up Technician

- Work with clients and engineers to determine the most effective method of controlling the blowers in an aeration application.
- Assist SCADA and MCP developers on changes to logic that may need to occur to meet the control demands of the blower system to match process.
- Well versed in development, implementation and adherence of APG-Neuros' Start-Up procedures.
- Experience in upgrading and installing new software in PLCs and HMIs currently in operation at client's sites.
- Basic understanding of wastewater treatment processes and associated P&ID.
- Completed numerous safety presentations for client construction sites.
- Providing enhanced support to technicians working at customer sites during and after working hours.
- Mid-level experience in changing PLC logic to adapt the blower to run in non-standard conditions.
- OHSA 10 hour general and construction cards

Education:

A.A.S. Industrial Engineering Technology, CCC

B.A. Industrial Psychology

Relevant Project Experience:

Completed Service visits to sites in the following states / provinces:

- Maine
- New Hampshire
- Connecticut
- Massachusetts
- Rhode Island
- New Jersey
- New York
- Pennsylvania
- Virginia
- Quebec, Canada
- Ontario, Canada

Brett Carnright
Test Technician / Field Service Technician

Expertise Summary:

Over 3 years of experience working with APG-Neuros blower systems, including the following:

Test Technician

- Over 4,000 hours of test cell experience.
- Ensure Safe work practices are always followed (proper PPE, awareness of hazards, etc.)
- Deep knowledge in factory testing of turbo blower packages and cores.
- Extensive experience working with Professional Engineers (PE) during factory testing.
- Extensive knowledge of the proper operation and can quickly notice minor and major issues during testing.
- Over 1,000 hours assisting the automation department in developing and upgrading PLC and HMI software.
- Involved in improving factory testing procedures and writing manuals.
- Involved in research and development projects while working with the Engineering department.
- A vast amount of knowledge in reading electrical drawings.
- Extensive knowledge of installation and removal of all components within the blower package including:
  - Core
  - VFD
  - Cooling System
  - Harmonic Filter
  - Sine Wave Filter
  - LCP
  - Blow-Off Valve
- Experience working with the following PLC Manufacturer's products and their associated programming software:
  - Allen Bradley (CompactLogix, MicroLogix)
  - Siemens (S7)
  - General Electric (VersaMax)
  - Schneider (Modicon MD-340)
  - Cimon (XPanel)
- Able to quickly and effectively troubleshoot problems within the blower package.
- Extensive experience working with blower enclosure liquid cooling systems, including mechanical piping (where applicable).
- Knowledge programming associated hardware within the blower enclosure including:
  - VFD
  - PLC
  - HMI
  - UPS systems
- Extensive knowledge of the blower to identify how it may respond to certain operating conditions.

Field Service Technician / Start-up Technician

- Work with Customers and Engineers to determine the most effective method of controlling the blowers in an aeration application.
- Extensive troubleshooting skills of the turbo blower during site operation.
- Skills in troubleshooting components in wastewater systems (dissolved oxygen sensors, flow meters, automatic valves) and identifying issues in a wastewater system non-related to the turbo blower.
- Well versed in development, implementation and adherence of APG-Neuros' Start-Up procedures.
- Extensive experience working with site automation departments for SCADA communication.

- Experience in upgrading and installing new software in PLCs and HMIs currently in operation at Customer's sites.
- Basic understanding of wastewater treatment processes and associated P&ID.
- Completed numerous safety presentations for Customer construction sites.

Education:

Wind Energy & Turbine Technology, Clinton Community College, Plattsburgh, New York

Professional Registrations:

- NFPA 70E OSHA Training
- Adult First Aid/CPR/AED Training

Relevant Project Experience:

As of 31 DEC 2018, Completed Service/Start-ups in (but not limited to):

- Athabasca, AB
- Atlanta, GA
- Kalamazoo, MI
- Barstow, CA
- Bend, OR
- Bradenton, FL
- Brooklyn, NY
- Boisbriand, QC
- Burbank, CA
- Camp Pendleton, CA
- Campbell River, BC
- Cincinnati, OH
- Cincinnati, OH
- Conroe, TX
- Conroe, TX
- Crown Point, IN
- Crystal Lake, IL
- Dryden, NY
- Hattiesburg, MS
- Hollister, CA
- Huron, MI
- Jacksonville, FL
- Jacksonville, IL
- Kissimmee, FL
- Kitchener, ON
- Lathrop, CA
- Leon, MX
- Marathon, ON
- Manchester, NY
- Moreno Valley, CA
- McAllen, TX
- Noblesville, IN
- Oconomowoc, WI
- Olympia, WA
- Orange Park, FL
- Oswego, IL
- Peoria, IL
- Portland, OR
- Providence, RI
- Richland, WA
- Riverside, CA
- Rutland, VT
- San Luis Obispo, CA
- Scottsdale, AZ
- Sonora, MX
- San Marcos, TX
- San Francisco, CA
- Sudbury, ON
- Tampa Bay, FL
- Union, CA
- Walla Walla, WA
- West Babylon, NY

3. Active Parts Stocking Warehouse and Service Facility

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

APG-Neuros maintains more than $12 million worth of spare parts inventory, including air filters, sensors, cores and ready for shipping units in our Plattsburgh, NY facility supplying new parts within 24 hours. All repairs, parts and technical services will be in the US and provided to the Greater New HavenWastewater Treatment Plant from our support facilities in the US.

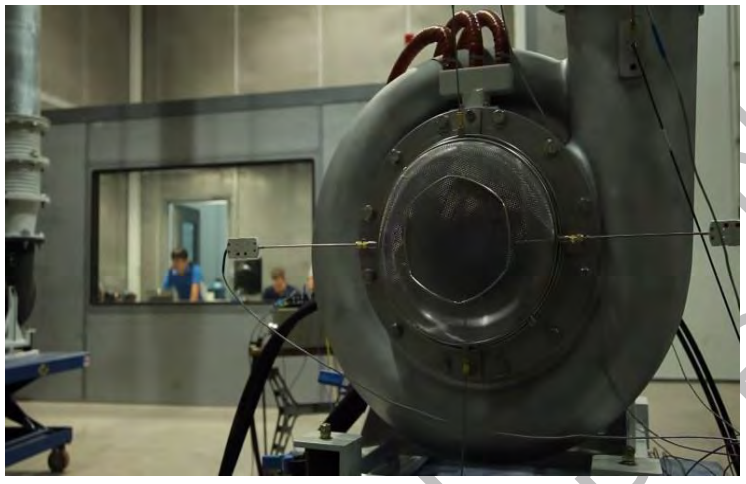
APG-Neuros stock is always full and ready to support around 1500 existing installations in over 600 different facilities and does not have to order parts from overseas or manufacture to order.

Stocked spare parts include:

- Blower cores (motor, shaft. Bearing, impeller)
- Variable frequency drives
- Harmonic Filters
- Input Reactors
- Programmable Logic Controllers
- HMI touchscreens
- Inlet Air filters
- Fuses
- Sensors (Vibration, temperature, pressure)
- Valves (Check valves and Isolation)
- Blow off Valves (with silencer)

Best method of contact is via phone or email. APG-Neuros provides 24/7 customer support via the **+1(855) 423-2746** telephone line. The email address for customer support is Customerservice@apg- neuros.com; and for ordering spare parts: Spareparts@apg-neuros.com

Our Production and testing Facility at Plattsburgh, NY has 15 based service technicians who are doing the testing of the units as well as the start up and commissioning. The same team is working on the life cycle of each blower from production till the start up and then field service and trouble shooting.



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4. APG-Neuros Stocking Distributors in North America

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

APG-Neuros Stocking Distributors in North America

Company	Representative	Email	Phone Number	Address	City	State	Country	Zipcode
USA								
B. L. Anderson	Mark Gasvoda	mark@blanderson.com	765-463-1518	4801 Tazer Dr.	Lafayette	IN	USA	47905
B. L. Anderson	Rick Kocerha	rick@blanderson.com	765-463-1518	4801 Tazer Dr.	Lafayette	IN	USA	47905
B. L. Anderson	Matt Boone	matt@blanderson.com	614-790-0344	46 W North Street	Worthington	OH	USA	43085
B. L. Anderson	Gary Prehm	gary@blanderson.com	765-463-1518	4801 Tazer Dr.	Lafayette	IN	USA	47905
B. L. Anderson	Brad Gasvoda	brad@blanderson.com	765-463-1518	4801 Tazer Dr.	Lafayette	IN	USA	47905
Mulchahy Shaw Water	Tom Mulcahy	tmulcahy@mulcahyshaw.com	262-241-1199	N57 W6316 Center Street	Cedarburg	WI	USA	53012
Mulchahy Shaw Water	Rich Knoelke	rknoelke@mulcahyshaw.com	262-241-1199	N57 W6316 Center Street	Cedarburg	WI	USA	53012
Carter and VerPlanck	Tyler Tedcastle	tylertedcastle@carterverplanck.com	850-264-9391	4910 West Cypress Street	Tampa	FL	USA	33607
Carter and VerPlanck	Eric Freeman	ericfreeman@carterverplanck.com	865-617-9944	110 Mathis Drive, Suite 206	Dickson	TN	USA	37055
Carter and VerPlanck	Glenn House	glennhouse@carterverplanck.com	770-530-1801	4910 West Cypress Street	Tampa	FL	USA	33607
Carter and VerPlanck	Brandon Lang	blang@cviwater.com	813-481-5200	4910 West Cypress Street	Tampa	FL	USA	33607
Carter and VerPlanck	Dave Hartwig	davehartwig@carterverplanck.com	813-240-1199	4910 West Cypress Street	Tampa	FL	USA	33607
Carter and VerPlanck	Saade Chibani	saadechibani@carterverplanck.com	813-340-9889	4910 West Cypress Street	Tampa	FL	USA	33607
Carter and VerPlanck	Ken Walker	kenwalker@carterverplanck.com	561-866-0655	4910 West Cypress Street	Tampa	FL	USA	33607
Carter and VerPlanck	Dan Loy	danloy@carterverplanck.com	904-608-0346	4910 West Cypress Street	Tampa	FL	USA	33607
JGM Valves	Joey	Joey@jgmvalve.com	248-926-6200	1155 Welch Road, Ste D	Commerce	MI	USA	48390
EPI Environmental	Steve Squires	steves@electricpump.com	800-383-7867	4280 East 14th Street	Des Moines	IA	USA	50313
EPI Environmental	Tom Miller	tomm@electricpump.com	800-383-7867	4280 East 14th Street	Des Moines	IA	USA	50313
EPI Environmental	Steven Forsythe	stevenf@electricpump.com	800-211-6432	201 4th Avenue SW	New Prague	MN	USA	56071
EPI Environmental	Rob Wright	robw@electricpump.com	800-211-6432	201 4th Avenue SW	New Prague	MN	USA	56071
Shupe & Associates	Phil Shupe	phil@shupeandassoc.com	501-834-4271	6160 Getty Drive	North Little Rock	AR	USA	72117
Shupe & Associates	Anne Crouch	anne@shupeandassoc.com	501-834-4271	6160 Getty Drive	North Little Rock	AR	USA	72117
Fluid Process & Pumps LLC	Carl	cd@fluidprocess.net	504-733-1330	P.O. Box 10608	New Orleans	LA	USA	70181
Fluid Process & Pumps LLC	Glen Smith	gs@fluidprocess.net	504-733-1330	P.O. Box 10608	New Orleans	LA	USA	70181
Fluid Process & Pumps LLC	Michael Guidry	mg@fluidprocess.net	504-733-1330	P.O. Box 10608	New Orleans	LA	USA	70181
Fluid Process & Pumps LLC	Ken Barlow	fpp_kb@bellsouth.net	601-664-0233	P.O. Box 1578	Florence	MS	USA	39073
Ressler & Asssociates	Ken Ressler	kressler@resslerassociates.com	636 391 8992	PO Box 4018	Ballwin	MO	USA	63002
Letts Van Kirk & Associates	Rick	jack@midamericapump.com	913-713-7111	5600 Inland Drive	Kansas City	KS	USA	66106
Letts Van Kirk & Associates	Jeff Selby	jeff@lettsvankirk.com		5600 Inland Drive	Kansas City	KS	USA	66106
Koester Associates	Mark Koester	mark@koesterassociates.com	315-697-3800	3101 Seneca Turnpike	Canastota	NY	USA	13032
Koester Associates	Peter Radosta	peter@koesterassociates.com	315-697-3800	3101 Seneca Turnpike	Canastota	NY	USA	13032
Koester Associates	Tom Whetham	tomw@koesterassociates.com	315-697-3800	3101 Seneca Turnpike	Canastota	NY	USA	13032
Koester Associates	Wayne Dodsworth	wayned@koesterassociates.com	315-697-3800	3101 Seneca Turnpike	Canastota	NY	USA	13032
Koester Associates	Rick Buckles	rick@koesterassociates.com	315-697-3800	3101 Seneca Turnpike	Canastota	NY	USA	13032
Koester Associates	Sheena Williams	sheenaw@koesterassociates.com	315-697-3800	3101 Seneca Turnpike	Canastota	NY	USA	13032
Vision Equipment	David Bartlett	david@visionequipment.net	830-755-8819	6 Falls View	Fair Oaks Ranch	TX	USA	78015
Vision Equipment	Hershel Ezzell	hershel@visionequipment.net	281-361-2933	5830 Laurel Caverns Drive	Kingwood	TX	USA	77345
Vision Equipment	Bryan black	bryan@visionequipment.net	361-215-3866	802 Cantwell Lane	Corpus Christi	TX	USA	78408
Vision Equipment	Keisha Antoine	keisha@visionequipment.et	832-356-3903	802 Cantwell Lane	Corpus Christi	TX	USA	77379
Vision Equipment	Jodie Robertson	jodie@visionequipment.net	817-584-3689	907 West Lake Drive	Weatherford	TX	USA	76087
Vision Equipment	Ron Shindoll	ron@visionequipment.net	214-957-5066	1930 Meadow Way	Terrell	TX	USA	75160

APG-Neuros Stocking Distributors in North America

Company	Representative	Email	Phone Number	Address	City	State	Country	Zipcode
Vision Equipment	Brian Robertson	brian@visionequipment.net	817-584-3689	907 West Lake Drive	Weatherford	TX	USA	76087
Haynes Equipment Company	Tony Moraska	tonymoraska@haynes-equipment.com	405-755-1357	117 NW 132nd St.	Oklahoma City	OK	USA	73114
Heyward	Tim Bishop	tbishop@heyward.net	704-583-2305 x 214	2101-A Cambridge Beltway Drive	Charlotte	NC	USA	28273
Heyward	Gary Broome	gbroome@heyward.net	704-583-2305 x 215	2101-A Cambridge Beltway Drive	Charlotte	NC	USA	28273
Heyward	Jim Cooper	jcooper@heyward.net	704-583-2305 x 212	2101-A Cambridge Beltway Drive	Charlotte	NC	USA	28273
Heyward	Ed Crowell	ecrowell@heyward.net	704-583-2305 x 202	2101-A Cambridge Beltway Drive	Charlotte	NC	USA	28273
Heyward	Mike Davis	mdavis@heyward.net	704-583-2305	2101-A Cambridge Beltway Drive	Charlotte	NC	USA	28273
Heyward	Benji Watkins	bwatkins@heyward.net	704-583-2305 x 245	2101-A Cambridge Beltway Drive	Charlotte	NC	USA	28273
Rockwell Solutions	Kent Rockwell	kent@rockwellsolutions.us	949-275-8100	21163 Newport Coast Drive, Suite 492	Newport Coast	CA	USA	92657
Davidson Sales & Engineering	Paul Mora	paul_mora@dseslc.com	801-977-9200	2441 South 3850 West, Site 'B'	West Valley City	UT	USA	84120
Water Technology Group	Charles Greaves	cgreaves@wtrgroup.com	303-8859889	14452 W 44th Ave.	Golden	CO	USA	80403
Hawaii Engineering Services, Inc		mike@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
Hawaii Engineering Services, Inc		mack@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
Hawaii Engineering Services, Inc		nicol@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
Hawaii Engineering Services, Inc		ron@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
Hawaii Engineering Services, Inc		sanny@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
Hawaii Engineering Services, Inc		rudy@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
Hawaii Engineering Services, Inc		marc@hiengineering.com	808-841-0033	240 Puuhale Rd ste:202	Honolulu	HI	USA	96819
APSCO LLC.	Main Office	dmcbain@apsco-llc.com	425-822-3335	1120 8th Street	Kirkland	WA	USA	98033
APSCO LLC.	Main Office	jkernkamp@apsco-inc.com	425-822-3335	1120 8th Street	Kirkland	WA	USA	98033
APSCO LLC.	Main Office	jbuckman@apsco-llc.com	425-822-3335	PO Box 2639	Kirkland	WA	USA	98033
APSCO LLC.	Corvallis Office	sclark@apsco-llc.com	541-754-7292	922 NW Circle Blvd. Box #405, Ste. 160	Corvallis	OR	USA	97330-1410
INECO Industrial Equip. Comp.	Ed Morales	morales@ineco.us	787-760-2425	Rd. 877, Km 0.8	Rio Piedras	PR	USA	00924
Mexico								
Pro Agua	Juan Negrete	janegrete@proagua.mx	55-5659-2784	Viena No. 198, Colonia del Carmen	Mexico, D.F.	Mexico D.F.	Mexico	04100
Canada								
Ramtech Environmental Products	Jeff Kundert	jkundert@ramtech.ca	403-221-8585	Unit B, 2130 - 33 Avenue SW	Calgary	AB	Canada	T2T 1Z6
Ramtech Environmental Products	Sharna Batey	sbatey@ramtechltd.com	403-221-8585	Unit B, 2130 - 33 Avenue SW	Calgary	AB	Canada	T2T 1Z6
Ramtech Environmental Products	Gord Cassie	gcassie@ramtechltd.com	403-221-8585	Unit B, 2130 - 33 Avenue SW	Calgary	AB	Canada	T2T 1Z6
Ramtech Environmental Products	Anders Nielsen	anielsen@ramtechltd.com	403-221-8585	Unit B, 2130 - 33 Avenue SW	Calgary	AB	Canada	T2T 1Z6
Ramtech Environmental Products	Aura Weinberger	aweinberger@ramtechltd.com	403-221-8585	Unit B, 2130 - 33 Avenue SW	Calgary	AB	Canada	T2T 1Z6
ENV Treatment Systems Inc.	Ed Pikovnik	envinc@interlog.com		70 High Street	Etobicoke	ON	Canada	M8Y 3N9
ENV Treatment Systems Inc.		leew-env@uniserve.com	905-799-1060	70 High Street	Etobicoke	ON	Canada	M8Y 3N9
ENV Treatment Systems Inc.		ephinc@sympatico.ca		70 High Street	Etobicoke	ON	Canada	M8Y 3N9
Metcon Sales & Engineering Ltd.	Matthew Nicolak	matthewn@metconeng.com	905-738-2355 Ext 231	15 Connie Crescent, Unit 3	Concord	ON	Canada	L4K 1L3

5. APG-Neuros Customer Service and Aftermarket Team Organization

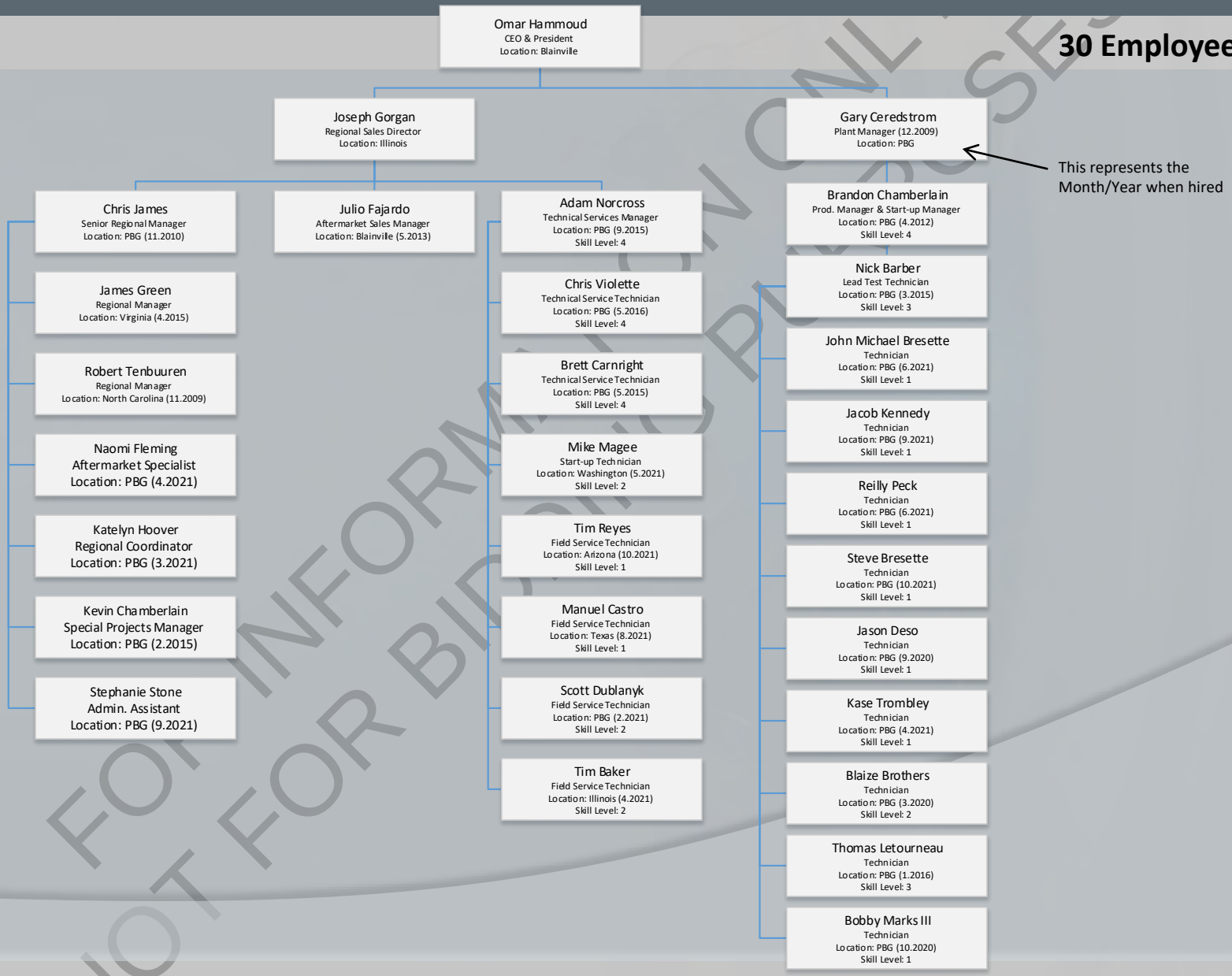
APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

APG-Neuros
Customer Service and Aftermarket

Team Organization

Aftermarket Team Organizational Chart

30 Employees



Skill Levels

Skill Levels	Test Tech	Field Service Tech (PBG and Remote)
Level 1	• Able to test complete package and core test with no supervision. • Complete understanding of blower operation. • Beginner level of troubleshooting blower issues. • Can competently upload/download KEB and Rockwell programs. • Has not travelled on their own in the field and are still learning the field service processes. Understands APGN drawings	• Has completed Level 1 Field Tech Training in PBG. • Complete understanding of blower operation. • Can competently upload/download KEB and Rockwell programs. • Has not travelled on their own in the field and are still learning the field service process. • Minimum 4 trips, additional trips to be completed if needed.
Level 2	• Includes all of tech level 1 skills. • Can troubleshoot and resolve most issues found during testing in Plattsburgh test cells. • Can complete EPRM/Field Service and minor troubleshooting in the field. • Can complete witness-testing of cores and packages • Can complete local blower start-up on Rockwell PLC platform.	• Includes all of tech level 1 skills. • Has completed Level 2 Field Tech Training in PBG. • Can complete the following Field Service visits on their own with little support needed: EPRM, core swaps including start-up of cores and BOV/Min speed testing, VFD swaps, Blower Health Checks, Minor troubleshooting, Blower start-up and commissioning. • Promote Aftermarket products and services
Level 3	• Includes all of tech level 1 & 2 skills. • Can complete start-ups on blowers with several PLC platforms • Can troubleshoot VFD issues in the field independently • Has strong understanding of Blower/wastewater operations • Has experience with navigating Blower PLC programs in Rockwell • Can assist automation department with testing new PLC and HMI programs in test cell. • Can interpret supplier drawings and apply them to our product.	• Includes all of tech level 1 & 2 skills. • Can complete start-ups on blowers with several PLC platforms. • Can complete Aftermarket blower upgrades . • Can troubleshoot VFD issues in the field. • Has strong understanding of Blower/wastewater operations. • Can assist in training new test technicians and assist those with less experience.
Level 4	• Includes all of tech level 1, 2, & 3 skills. • Can navigate their way around most PLC program platforms • Is working with Automation on blower MCP/SCADA integration • Able to troubleshoot blower using PLC program.	• Includes all of tech level 1, 2, & 3 skills. • Can navigate their way around most PLC program platforms. • Is working with Automation on blower MCP/SCADA integration. • Able to troubleshoot blower using PLC program. • Able to do Company presentations to existing customers while on site.
Level 5	• Includes all of tech level 1, 2, 3, & 4 skills. • Can complete SCADA and MCP integrations on their own. • Can fix programs related issues and upgrades in field with little assistance from automation	N/A

Key Responsibilities

Admin Assistant
Responsible for arranging travel and maintaining updated schedule of service technicians availability.

Special Projects Coordinator
Responsible for technical review of upgrades, prepare quotes and management of upgrades from receipt of PO up till time of site visit.

Aftermarket Specialist
Responsible for quote creation, follow up with customers and invoicing for spares parts and repairs.

Regional Coordinator
Responsible for the creation, follow up distribution and coordination of EPRM, AMMSP & LCP quotes.

Regional Manager
Responsible for contacting sites for customer management, commercial and technical actions follow ups, courtesy visits and site relations.

Senior Regional Manager
Responsible for managing the five positions listed above and coordination with others in the Aftermarket group.

Technician (Plattsburgh)
Execution of customer site visit based on skill level and availability. A shared resource with the test department.

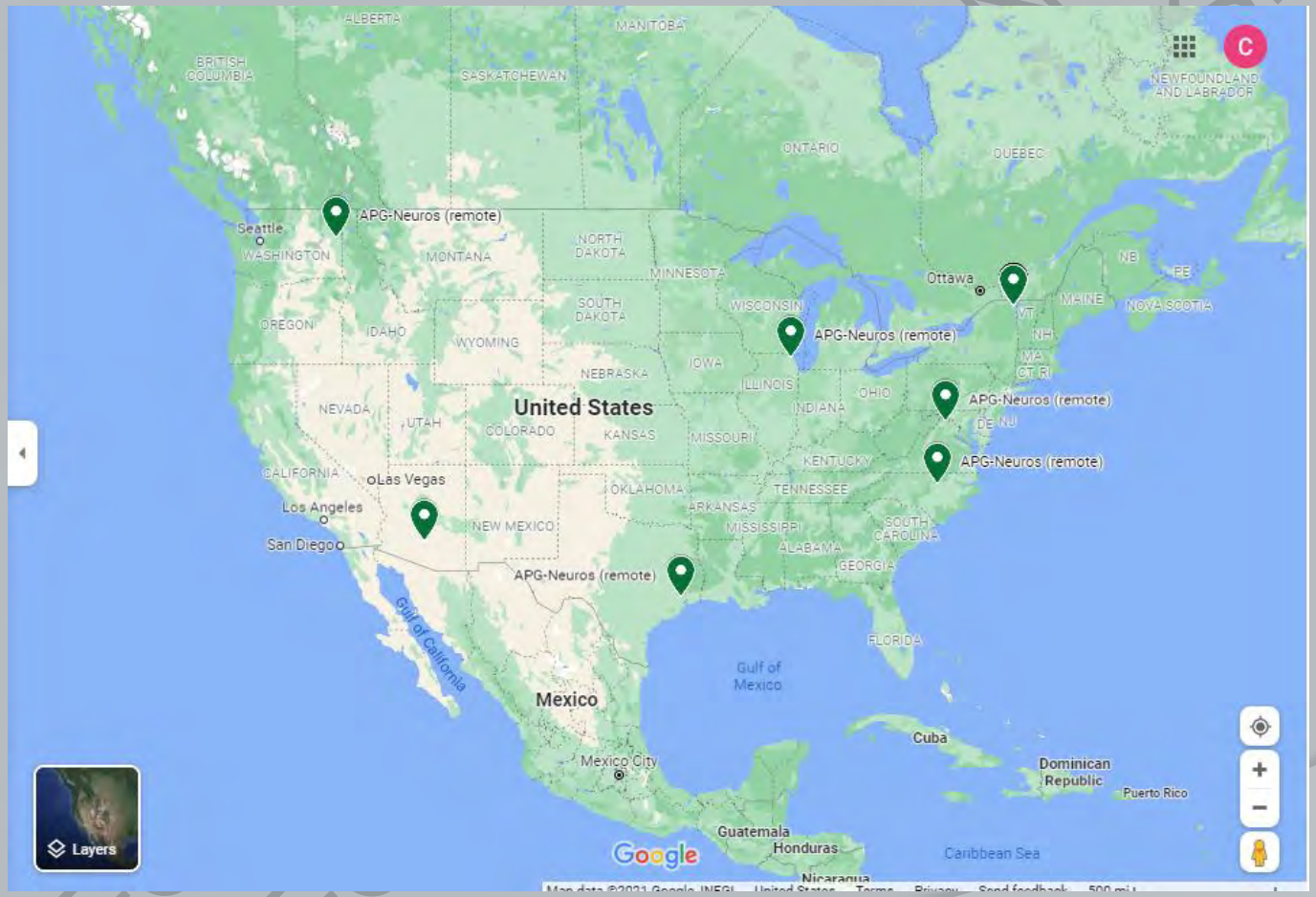
Field Service Technician (Remote)
Execution of customer site visits for preventive maintenance and trouble-shooting based on required skill level and geographical proximity.

Technical Service Technician
Responsible for incoming customer service calls, case entry and assisting customers and remote technicians while on site for service.

Technical Services Manager
Responsible for managing technical service & field service technicians, preparation of technical scope for site visits and post service visit follow-up.

Aftermarket Sales Manager
Responsible for managing sales of Aftermarket strategy, creating services product offerings and services ensuring customer satisfaction

Geographical Location-Tech's & Regional Managers



Market Leader

Over 1,500 units in North America

More than 600 installations

e. Technical

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1) Mechanical

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a. Performance Data

APG – Neuros
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Tel : (450) 939-0799, www.apg-neuros.com

Greater New Haven - APG- Neuros Turbo Blower - Performance Data									
Ambient Conditions									
Application	Aeration								
Blower Installation Location	Indoor								
Working Fluid	Air								
Ambient Pressure	14.69								psia
Design Conditions	DP1	DP2	DP3	DP4	DP5	DP6	DP7	DP8	
Inlet Pressure	14.44	14.44	14.44	14.44	14.44	14.44	14.44	14.44	psia
Inlet Temperature	-5.0	-5.0	82.0	82.0	-5.0	-5.0	82.0	82.0	°F
Relative Humidity	54	54	74	74	54	54	74	74	%
Duty Discharge Pressure	**7.70**	**7.70**	**7.70**	**7.70**	**10.25**	**10.25**	**10.25**	**10.25**	psig
System Flow Rate	9,500	31,900	9,500	31,900	9,500	31,900	9,500	31,900	SCFM
Flow Rate per Blower	9,500	7,975	9,500	7,975	9,500	7,975	9,500	7,975	SCFM
Blower Units on Duty	1	4	1	4	1	4	1	4	Units
Blower Units Stand By	5	2	5	2	5	2	5	2	Units
Available Blower Performance									
Model	**APGN500-C060**								
Rated Motor Output Power	**470**								HP
Power @ Design Condition per Blower	**281**	**234**	**348**	**287**	**351**	**295**	**433**	**361**	**bhp**
Wire-to-Air Power @ Design Condition per Blower	**232**	**193**	**287**	**237**	**290**	**243**	**357**	**298**	**kW**
Maximum Air Flow @ Duty Discharge Pressure per Blower	12,784	12,784	11,440	11,440	11,958	11,958	10,701	10,701	SCFM
Minimum Air Flow @ Duty Discharge Pressure per Blower	4,506	4,506	4,033	4,033	5,265	5,265	4,712	4,712	SCFM
Turndown from Maximum to Minimum	64.8%	64.8%	64.8%	64.8%	56.0%	56.0%	56.0%	56.0%	%
Discharge Temperature @ Design Condition	65.6	64.7	167.5	165.7	83.5	83.2	188.3	187.2	°F
Maximum Discharge Pressure	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	psig
Rise-to-Surge	8.25	8.25	8.25	8.25	5.70	5.70	5.70	5.70	psig

Note:
SCFM defined at 68 Deg F,14.696 psia and 36% relative humidity
Wire power figures are reported based on ASME PTC-13 Performance Test Code standard
Noise Level : +/- 2dB

APGN Inc.
1270 Michèle-Bohec, Blainville, QC, J7C-5S4
Tel: 450-939-0799 Fax: 450 939 2115
www.apg-neuros.com

Greater New Haven - APG- Neuros Turbo Blower - Performance Data									
Ambient Conditions									
Application	Aeration								
Blower Installation Location	Indoor								
Working Fluid	Air								
Ambient Pressure	14.69								psia
Design Conditions	DP1	DP2	DP3	DP4	DP5	DP6	DP7	DP8	
Inlet Pressure	14.44	14.44	14.44	14.44	14.44	14.44	14.44	14.44	psia
Inlet Temperature	15.0	15.0	74.0	74.0	15.0	15.0	74.0	74.0	°F
Relative Humidity	54	54	85	85	54	54	85	85	%
Duty Discharge Pressure	**7.70**	**7.70**	**7.70**	**7.70**	**10.25**	**10.25**	**10.25**	**10.25**	psig
System Flow Rate	9,500	39,000	9,500	39,000	9,500	39,000	9,500	39,000	SCFM
Flow Rate per Blower	9,500	9,750	9,500	9,750	9,500	9,750	9,500	9,750	SCFM
Blower Units on Duty	1	4	1	4	1	4	1	4	Units
Blower Units Stand By	5	2	5	2	5	2	5	2	Units
Available Blower Performance									
Model	**APGN500-C060**								
Rated Motor Output Power	**470**								HP
Power @ Design Condition per Blower	**293**	**302**	**340**	**352**	**367**	**378**	**424**	**437**	**bhp**
Wire-to-Air Power @ Design Condition per Blower	**242**	**249**	**281**	**291**	**303**	**312**	**350**	**361**	**kW**
Maximum Air Flow @ Duty Discharge Pressure per Blower	12,500	12,500	11,559	11,559	11,693	11,693	10,812	10,812	SCFM
Minimum Air Flow @ Duty Discharge Pressure per Blower	4,406	4,406	4,074	4,074	5,148	5,148	4,760	4,760	SCFM
Turndown from Maximum to Minimum	64.8%	64.8%	64.8%	64.8%	56.0%	56.0%	56.0%	56.0%	%
Discharge Temperature @ Design Condition	88.9	89.1	158.0	158.5	107.5	107.7	178.6	178.9	°F
Maximum Discharge Pressure	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	psig
Rise-to-Surge	8.25	8.25	8.25	8.25	5.70	5.70	5.70	5.70	psig

Note:
SCFM defined at 68 Deg F,14.696 psia and 36% relative humidity
Wire power figures are reported based on ASME PTC-13 Performance Test Code standard
Noise Level : +/- 2dB

APGN Inc.
1270 Michèle-Bohec, Blainville, QC, J7C-5S4
Tel: 450-939-0799 Fax: 450 939 2115
www.apg-neuros.com

Greater New Haven - APG- Neuros Turbo Blower - Performance Data									
Ambient Conditions									
Application	Aeration								
Blower Installation Location	Indoor								
Working Fluid	Air								
Ambient Pressure	14.69								psia
Design Conditions	DP1	DP2	DP3	DP4	DP5	DP6	DP7	DP8	
Inlet Pressure	14.44	14.44	14.44	14.44	14.44	14.44	14.44	14.44	psia
Inlet Temperature	40.0	40.0	104.0	104.0	40.0	40.0	104.0	104.0	°F
Relative Humidity	50	50	86	86	50	50	86	86	%
Duty Discharge Pressure	**7.70**	**7.70**	**7.70**	**7.70**	**10.25**	**10.25**	**10.25**	**10.25**	psig
System Flow Rate	13,000	43,600	13,000	43,600	13,000	43,600	13,000	43,600	SCFM
Flow Rate per Blower	6,500	8,720	6,500	8,720	6,500	8,720	6,500	8,720	SCFM
Blower Units on Duty	2	5	2	5	2	5	2	5	Units
Blower Units Stand By	4	1	4	1	4	1	4	1	Units
Available Blower Performance									
Model	**APGN500-C060**								
Rated Motor Output Power	**470**								HP
Power @ Design Condition per Blower	**208**	**284**	**251**	**343**	**267**	**356**	**318**	**428**	**bhp**
Wire-to-Air Power @ Design Condition per Blower	**172**	**234**	**207**	**283**	**221**	**294**	**263**	**354**	**kW**
Maximum Air Flow @ Duty Discharge Pressure per Blower	12,156	12,156	10,862	10,862	11,371	11,371	10,160	10,160	SCFM
Minimum Air Flow @ Duty Discharge Pressure per Blower	4,285	4,285	3,829	3,829	5,006	5,006	4,473	4,473	SCFM
Turndown from Maximum to Minimum	64.8%	64.8%	64.8%	64.8%	56.0%	56.0%	56.0%	56.0%	%
Discharge Temperature @ Design Condition	116.2	117.4	190.2	192.4	137.9	137.1	213.4	214.3	°F
Maximum Discharge Pressure	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	psig
Rise-to-Surge	8.25	8.25	8.25	8.25	5.70	5.70	5.70	5.70	psig

Note:
SCFM defined at 68 Deg F,14.696 psia and 36% relative humidity
Wire power figures are reported based on ASME PTC-13 Performance Test Code standard
Noise Level : +/- 2dB

APGN Inc.
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Tel: 450-939-0799 Fax: 450 939 2115
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b. Performance Curves

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1. Wire to Air Efficiency Curves

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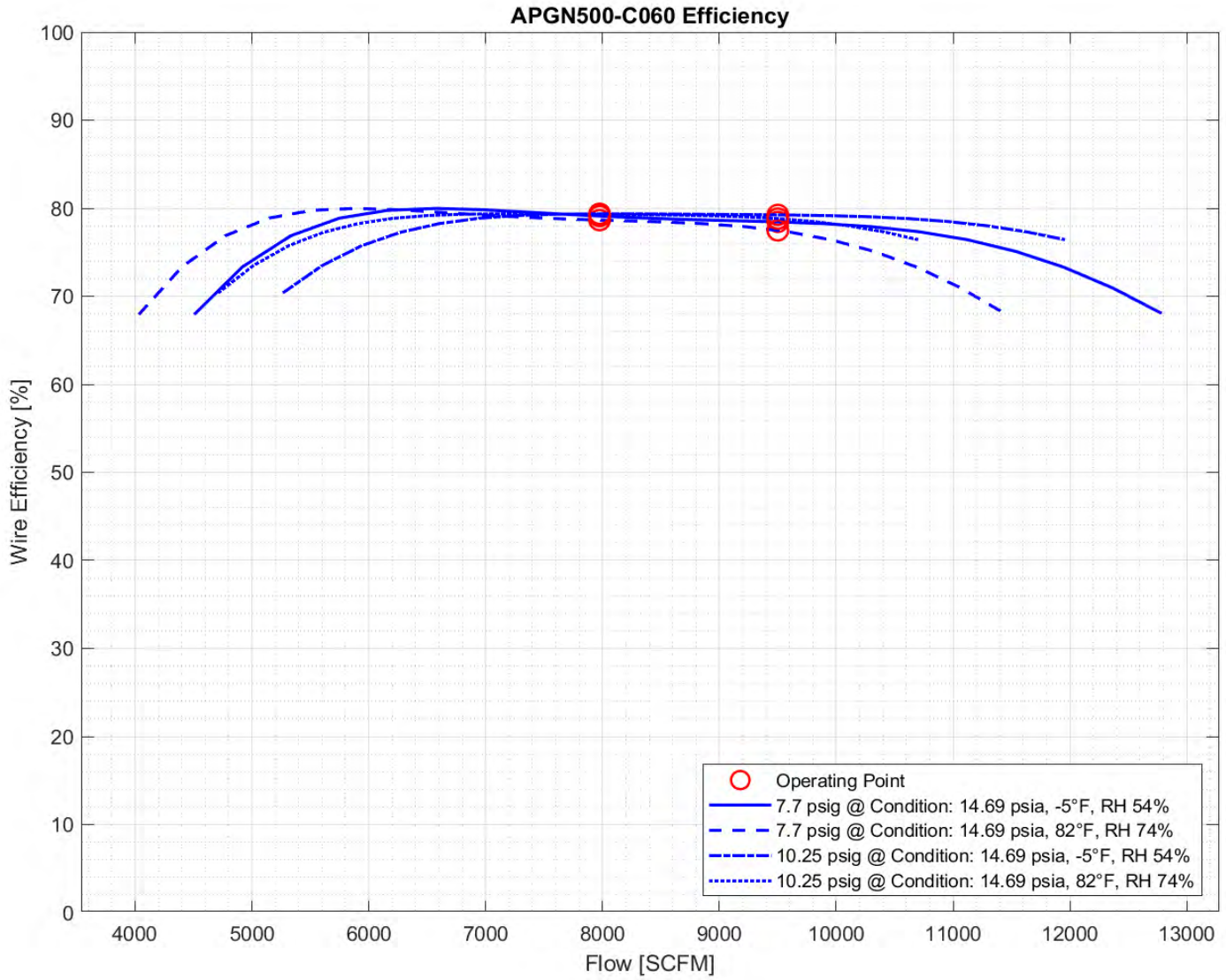
Greater New Haven - APG - Neuros Turbo Blower - Performance Curves



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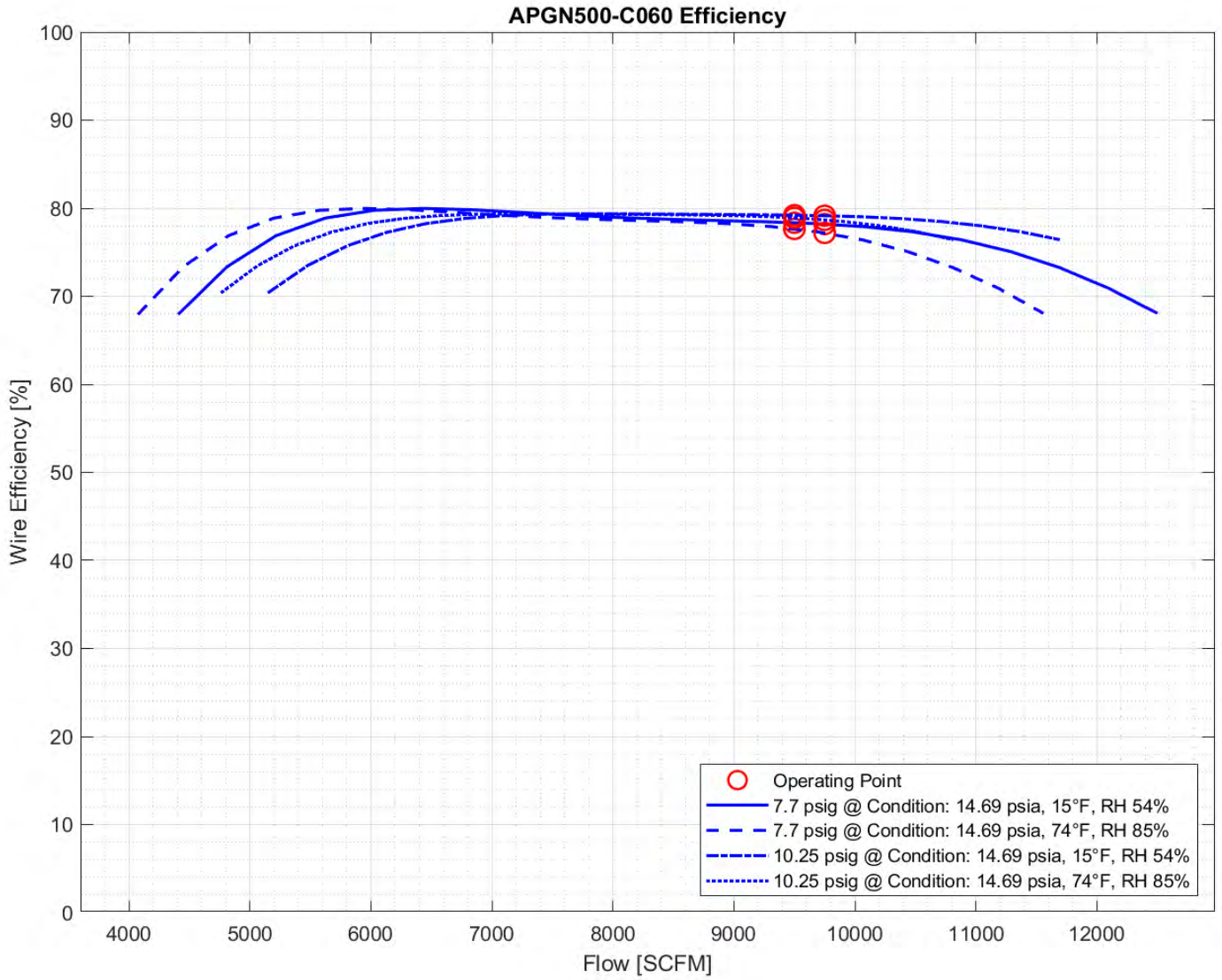
Greater New Haven - APG - Neuros Turbo Blower - Performance Curves



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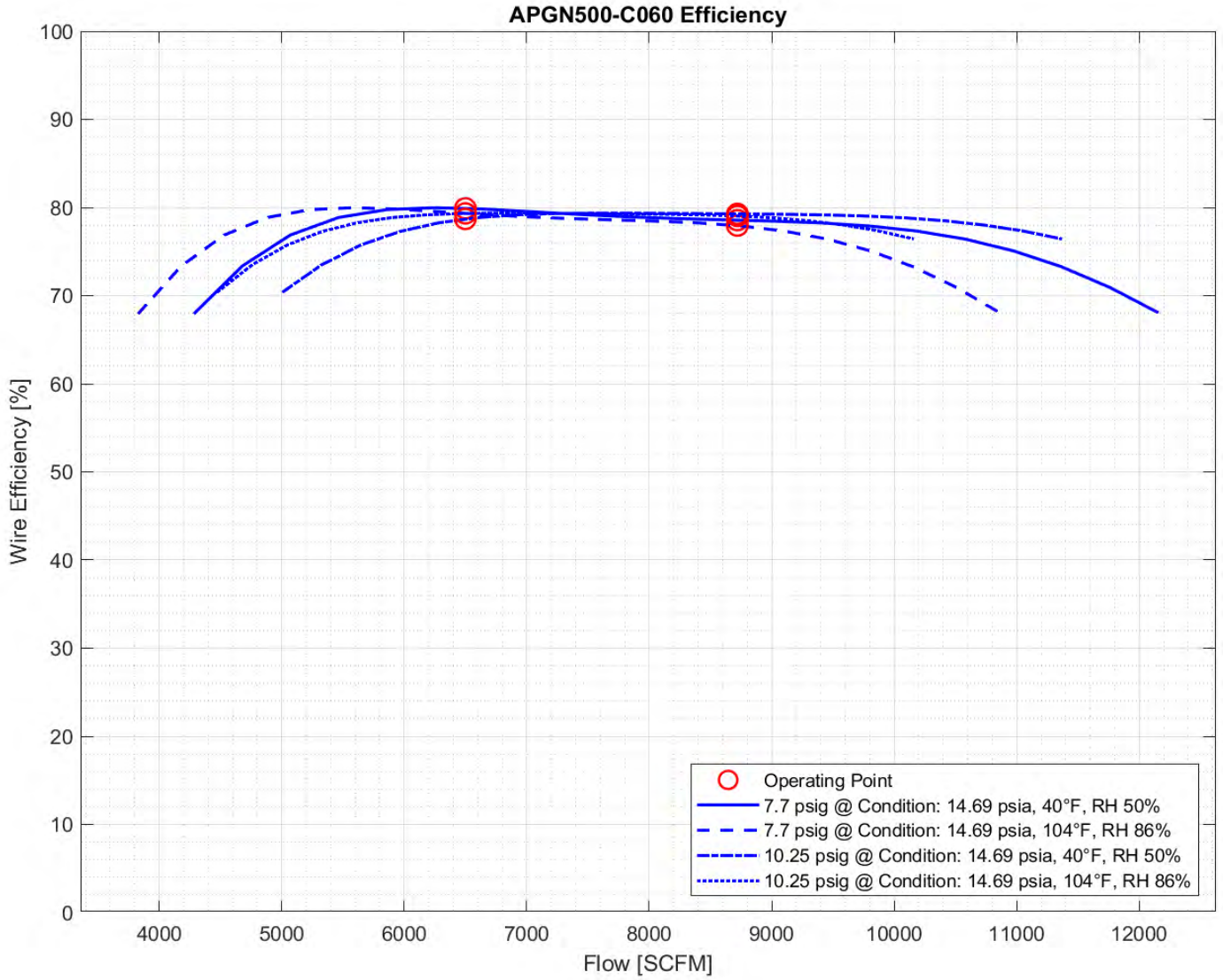

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2. Wire Power Curves

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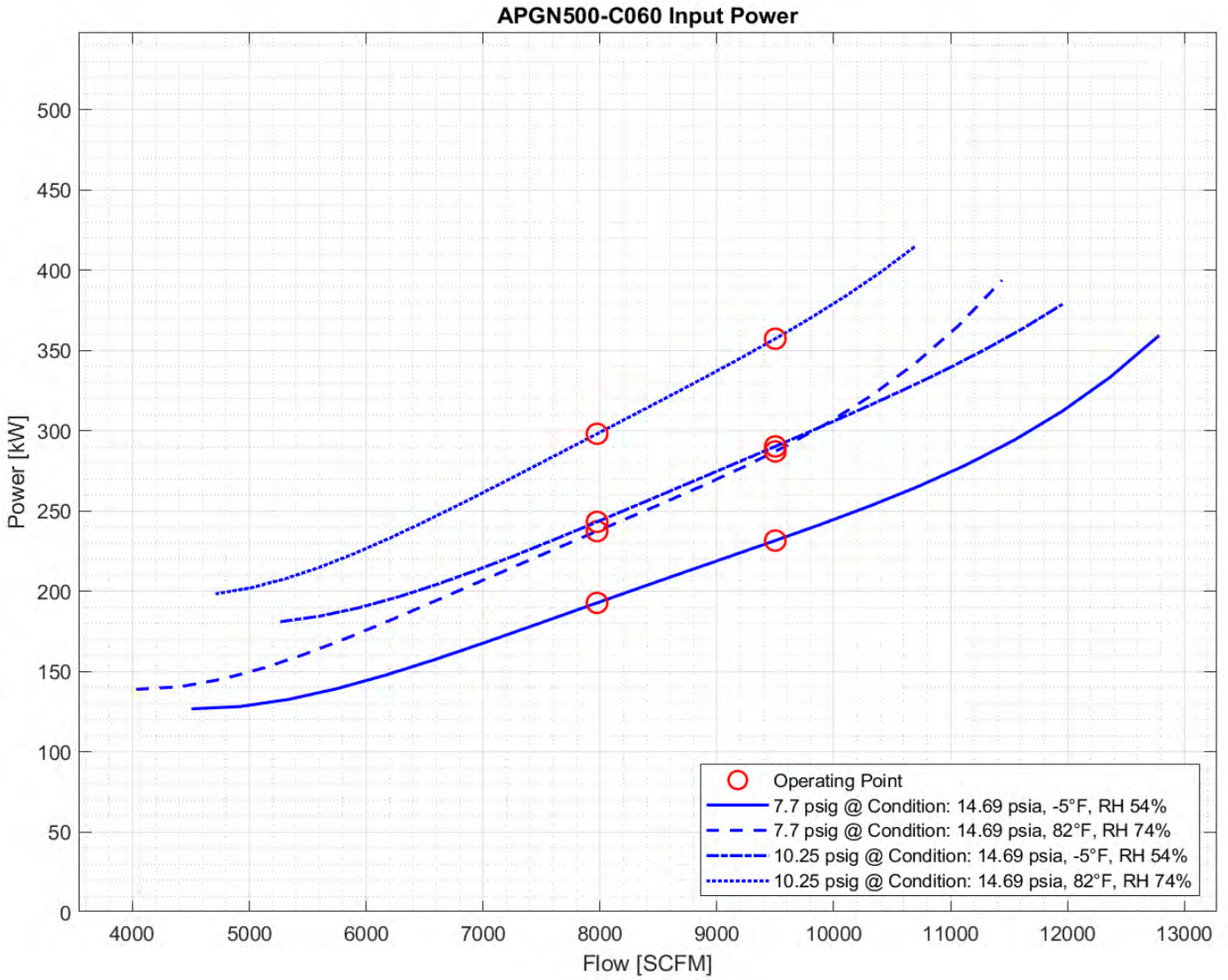

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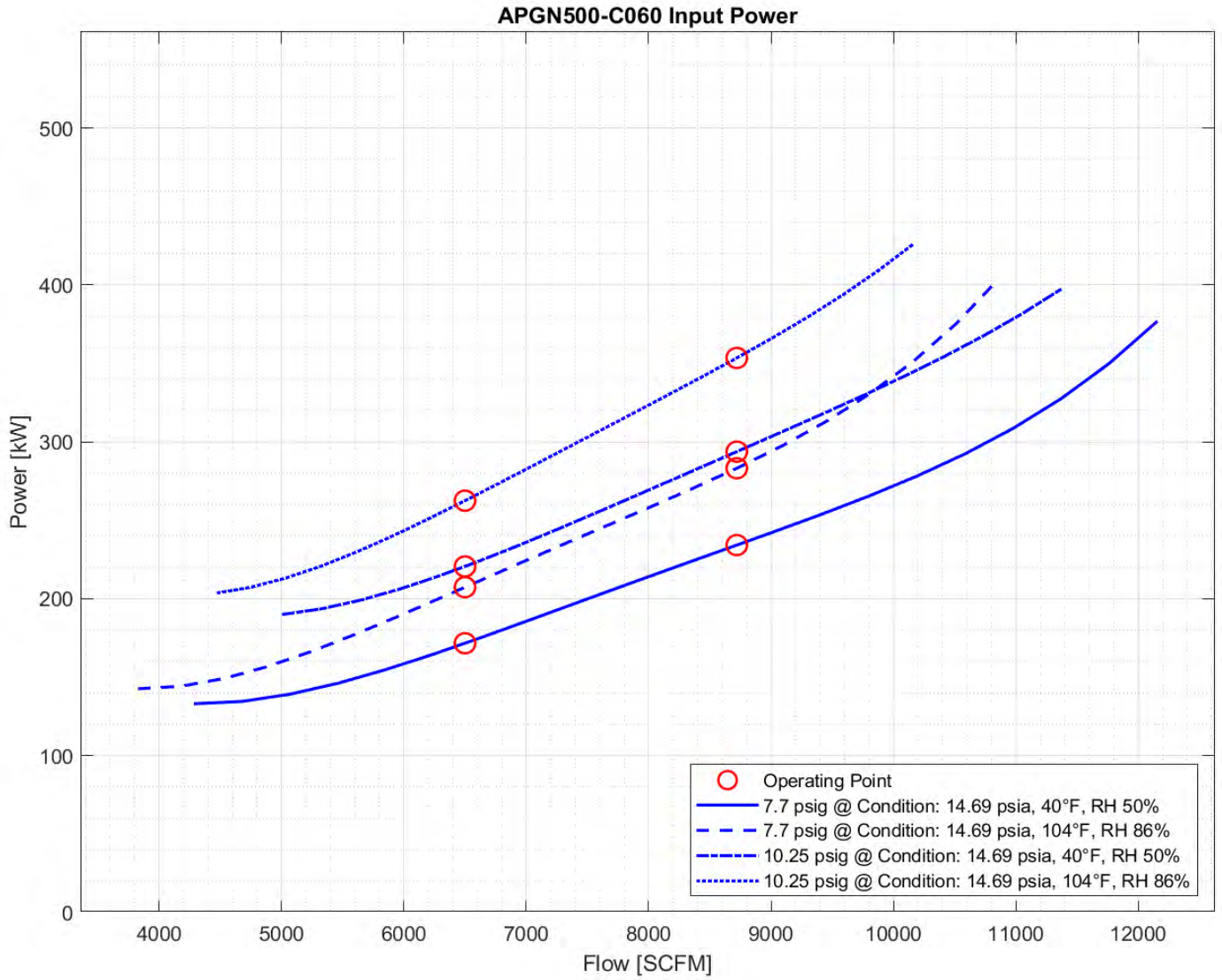

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3. Performance Curves

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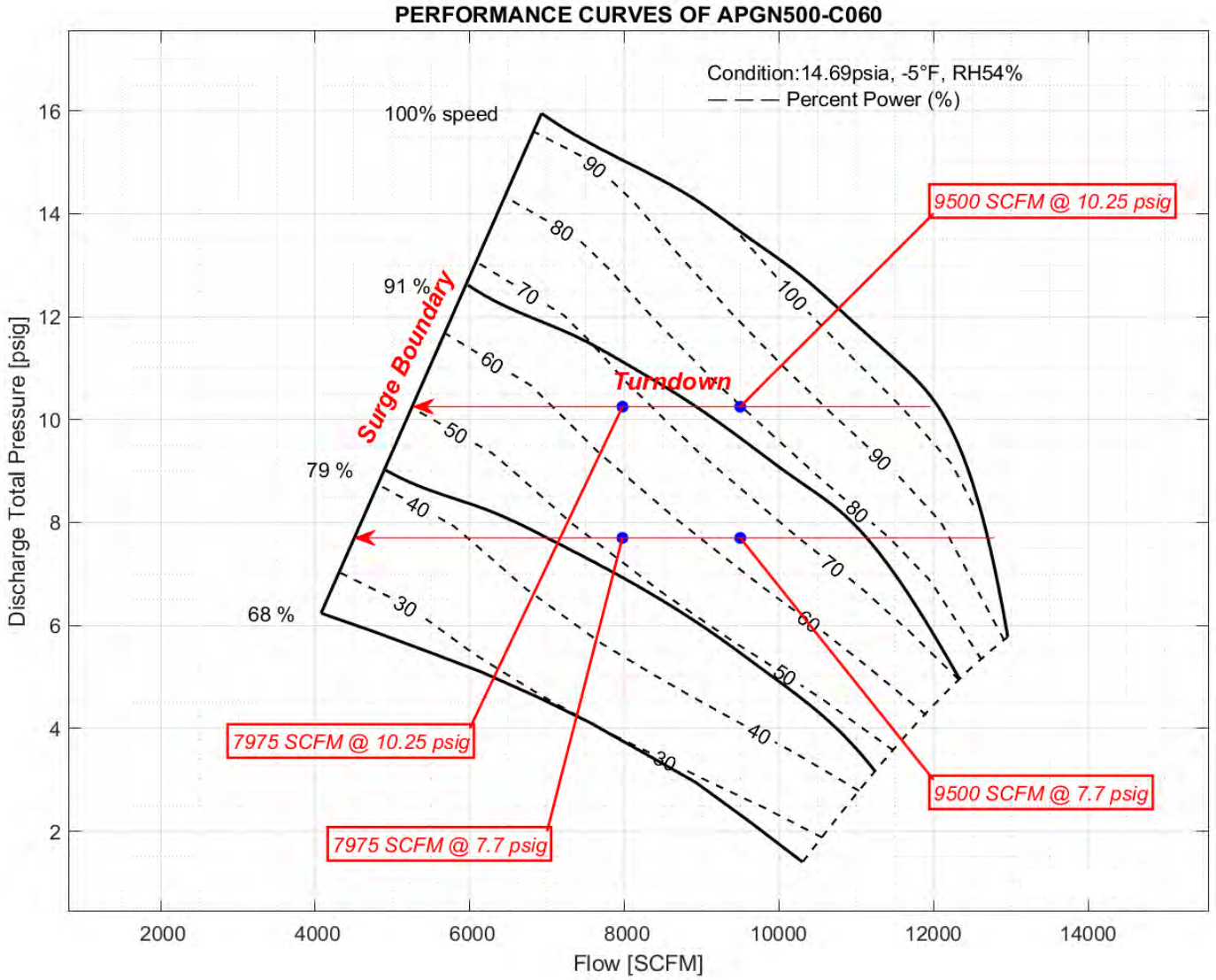
Greater New Haven - APG - Neuros Turbo Blower - Performance Curves



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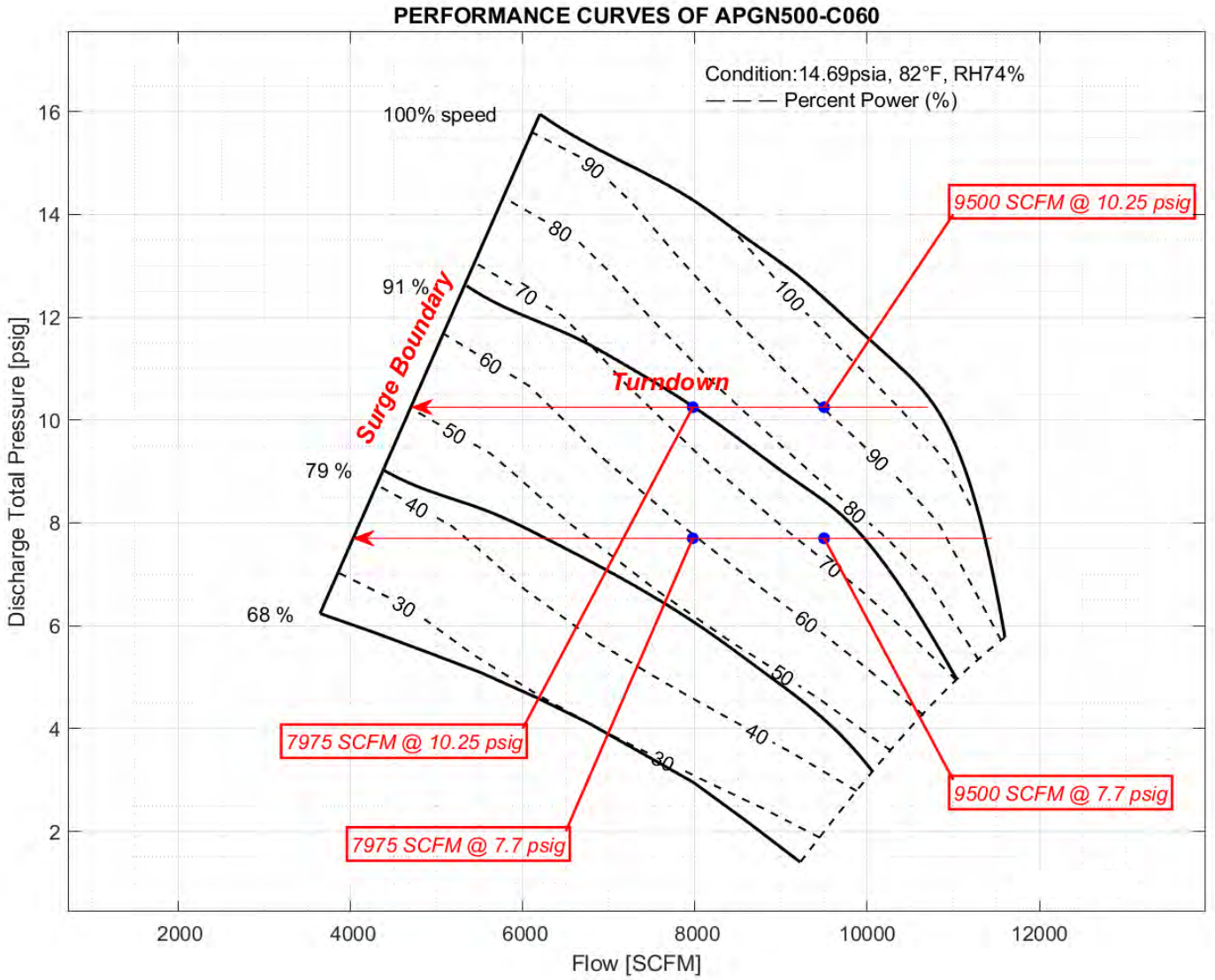

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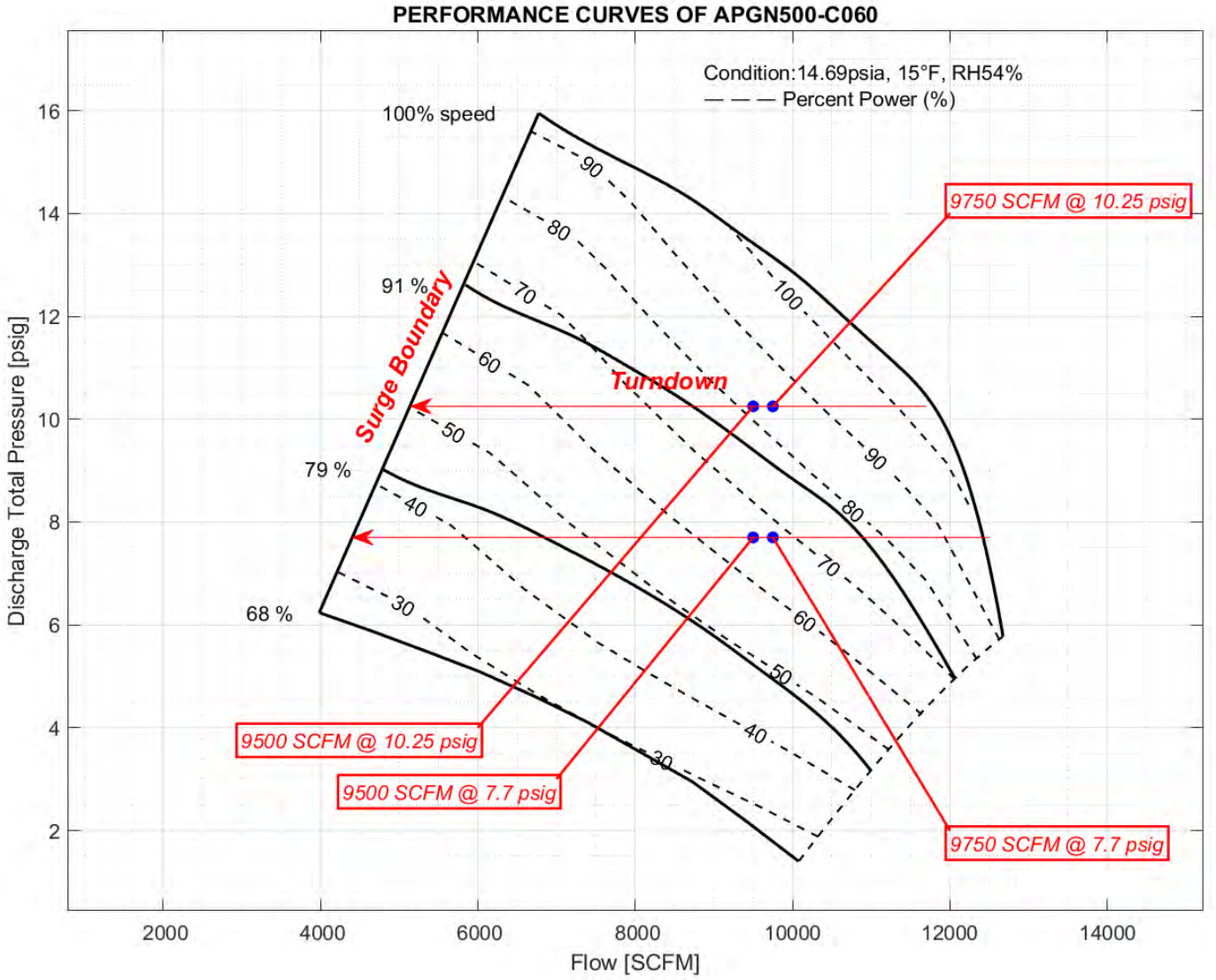
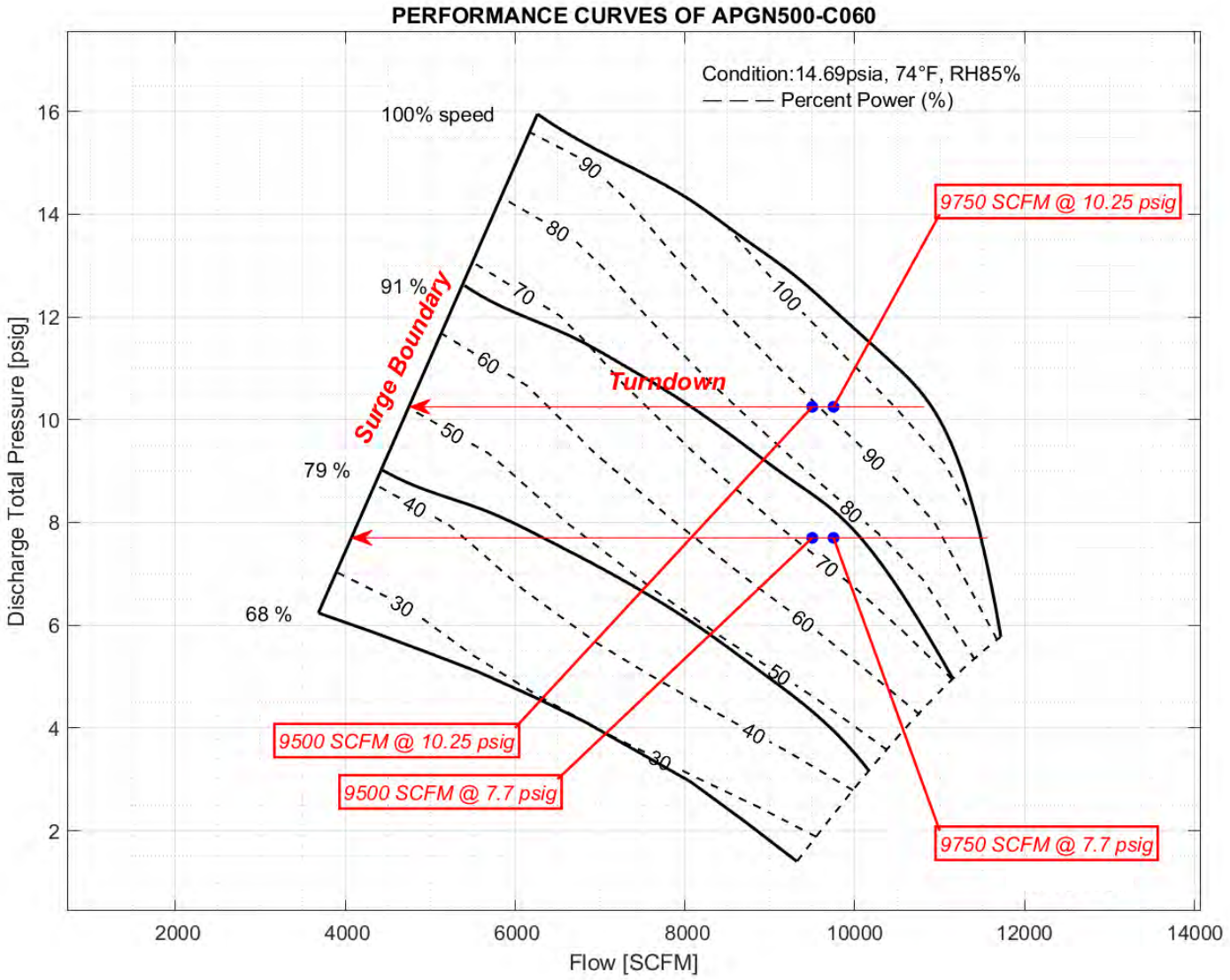
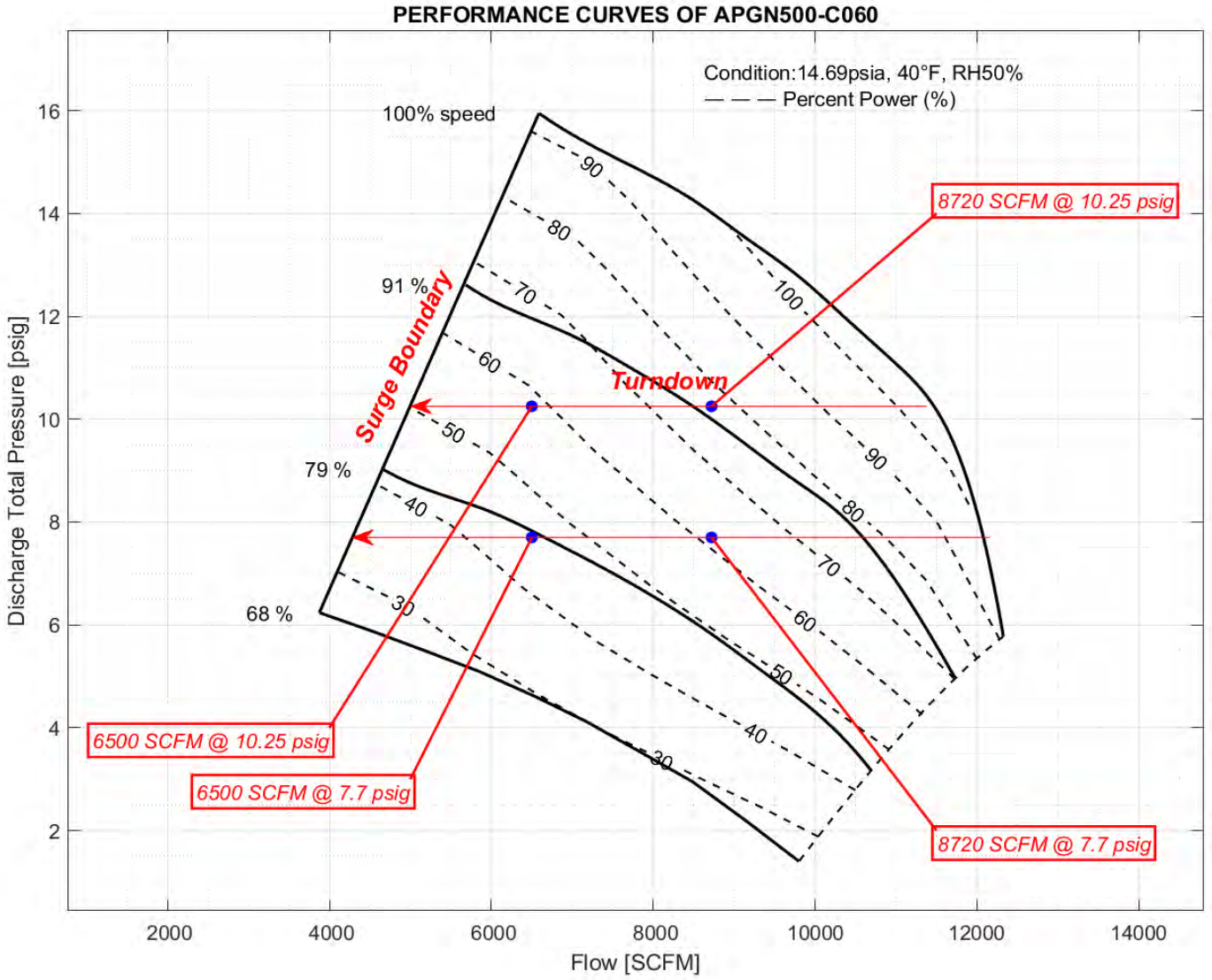


Greater New Haven - APG - Neuros Turbo Blower - Performance Curves



Greater New Haven - APG - Neuros Turbo Blower - Performance Curves



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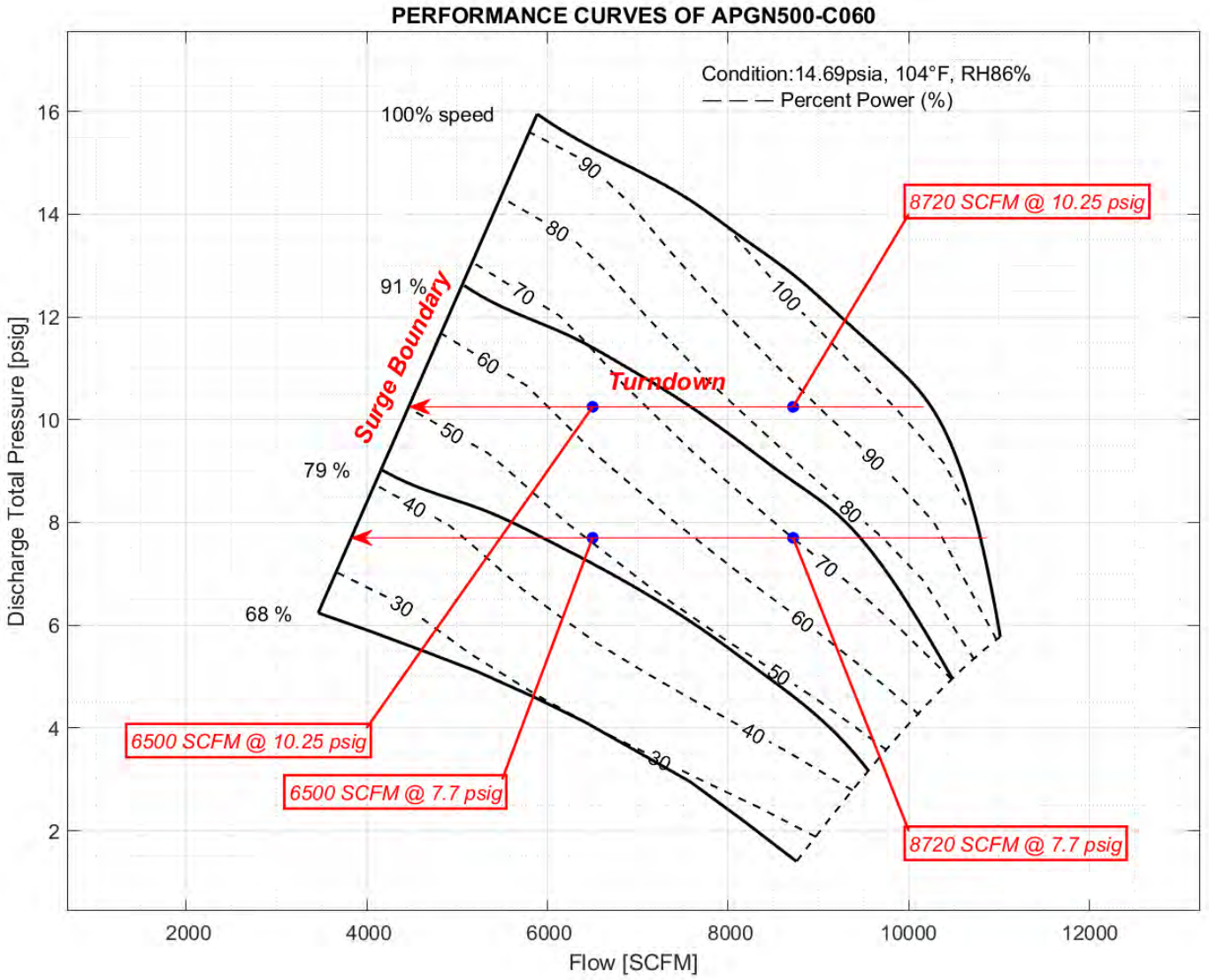
Greater New Haven - APG - Neuros Turbo Blower - Performance Curves



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c. Catalog Information

APG – Neuros
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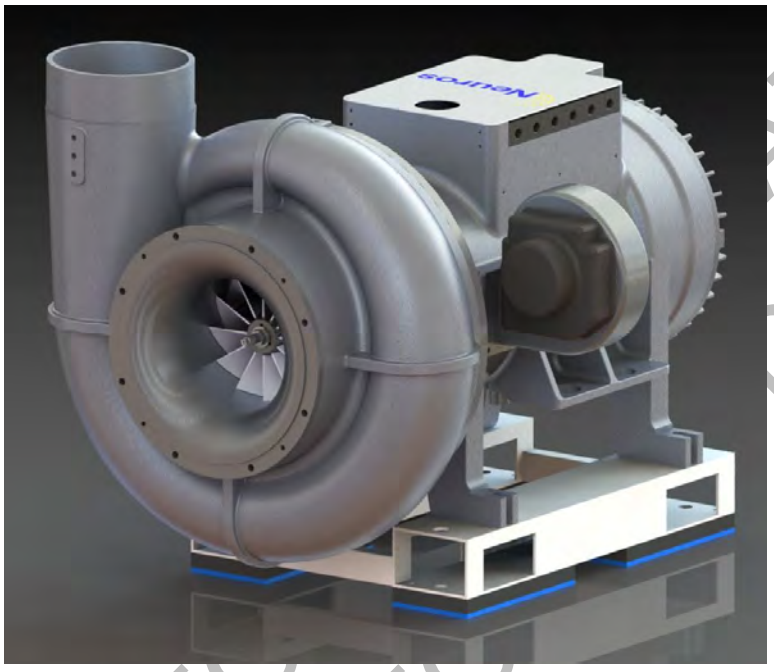
APGN500 SERIES TURBO BLOWER

FACT SHEET

1. up to 40% more energy efficient*
2. excellent reliability with SKF magnetic bearing
3. wide turndown ratio
4. remarkable reduction in energy/ maintenance/installation costs
5. low noise and vibration
6. “plug & play” turbo blower low cost easy installation
7. user-friendly control system
8. minimal maintenance and downtime



UP TO	OVER	UP TO	BELOW
40%	50%	80%	80 dBA
Energy Savings	Smaller Footprint	Turndown	Low Noise

* than other blower technologies

APGN500 SERIES TURBO BLOWER - Performance Data

Overview

Series	APGN
Blower Installation Location	Indoor/outdoor (canopy)
Working Fluid	Air
Number of stages	Single stage

Operating Conditions

Performance Testing	ASME PTC 10
	ASME PTC 13
	ISO 5389

Turbo Blower Design Specifications

Design pressure range	5 - 15 psig
Design suction flow rate	4000 - 13000 SCFM
Operating speed range	12,900 - 21,000 RPM
Motor rating (horsepower)	470 - 940 HP
Casing design pressure	284 psig
Casing design temperature	302 °F

Technical Specifications

Bearing	Active Magnetic Bearing
Motor	Permanent Magnet Synchronous Motor
Winding Insulation class	Class F
Winding temperature rise	Class B
Coupling	Direct coupling
Motor starter	Variable Frequency Drive
Harmonic filter	Outside or integrated inside the blower enclosure
Power supply	380 - 500V, 3 phase, 50/60 Hz *
Inlet configuration	Louver/flange
Discharge configuration	Vertical/cone extension from KS to ANSI
Noise	< 80 dBA
Motor/VFD cooling	Water/air cooling - fully enclosed
Product design life	30 years

* Medium voltage is available upon request

APGN500 SERIES TURBO BLOWER - Performance Data

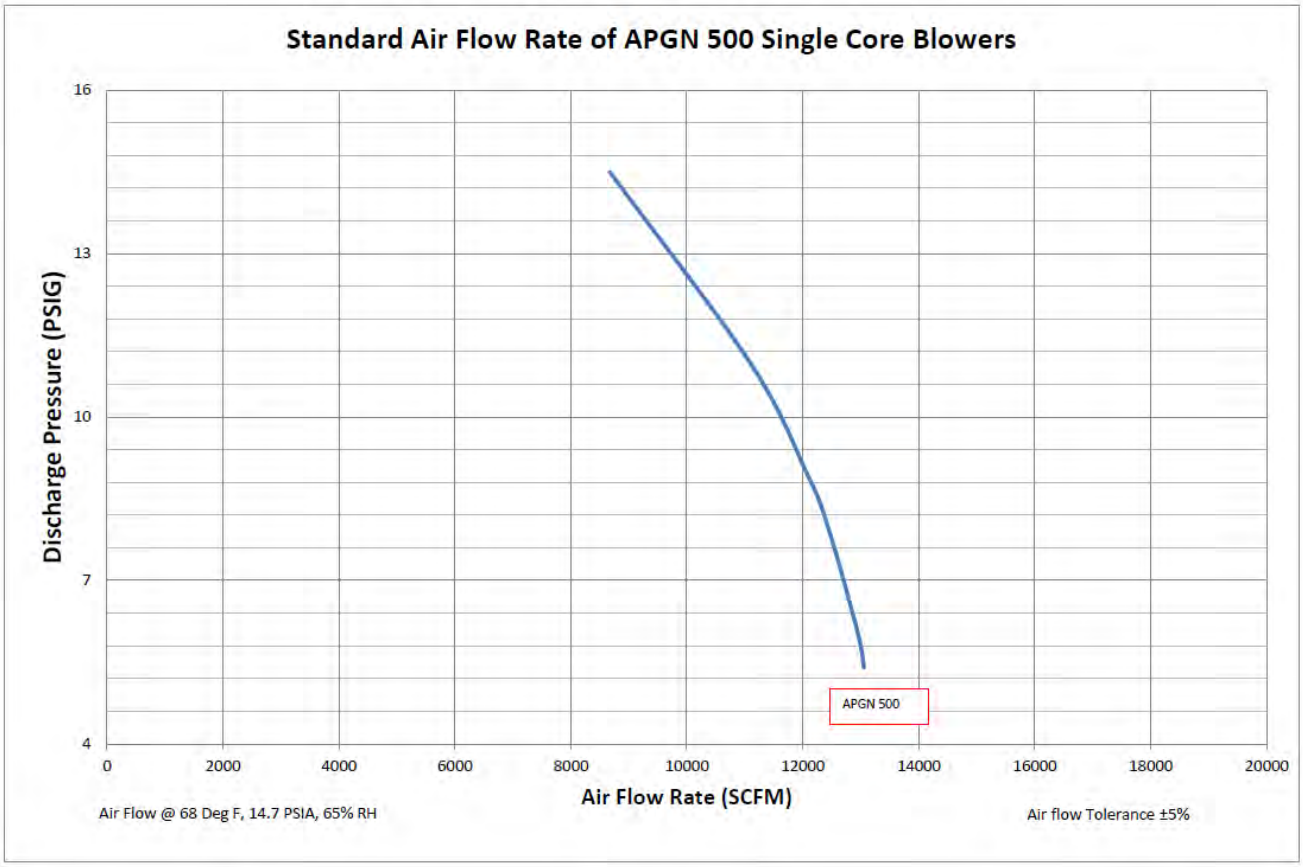
Controls and Monitoring

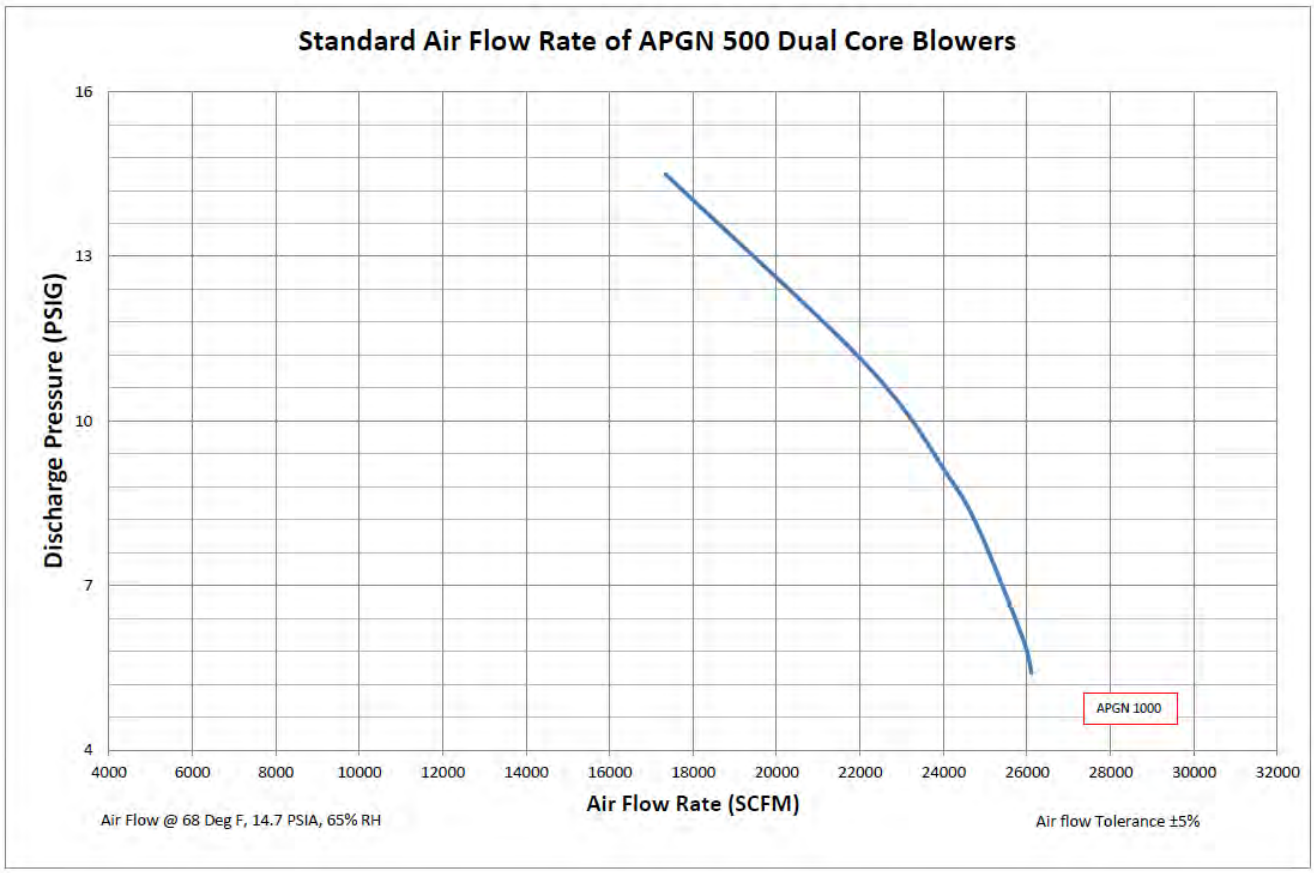
Control panel	PLC based (Allen Bradley, Siemens, Modicon, GE, Mitsubishi)
Control method	Flow/speed/pressure/dissolved oxygen
Integrated pressure sensors	Ambient, discharge, filter pressure drop
Integrated temperature sensors	Suction, discharge, motor, bearing
Vibration monitoring	Active Magnetic Bearing

Material of Construction

Blower casing	Aluminum Alloy
Impeller	Forged aluminum alloy (AL7075)
Active Magnetic Bearing	Mix of copper, Silicon Steel Lamination
Shaft	STS Steel
Blow-off valve	Carbon steel electro pneumatic
Blower enclosure	Powder coated steel with sound dampening material
Blower enclosure skid	Structural steel construction with fork lift access ports
Electrical components coating	IEC 60721-3-3 class 3C3 Conformal Coating

APGN500 SERIES TURBO BLOWER - Performance Data

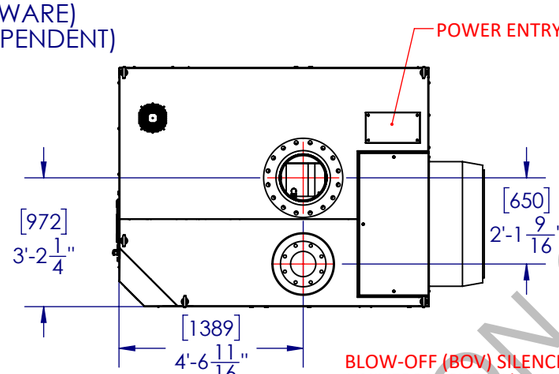


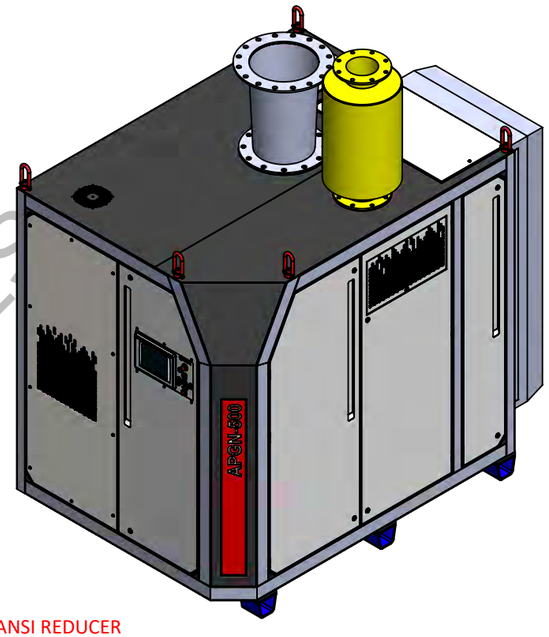


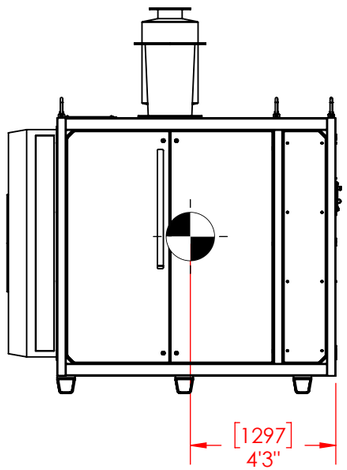
d. General Arrangement Drawings

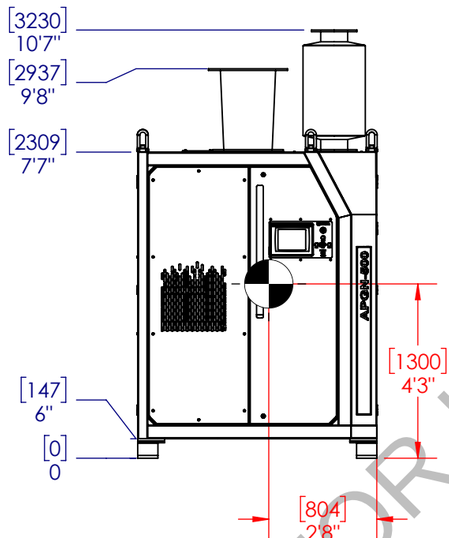
APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

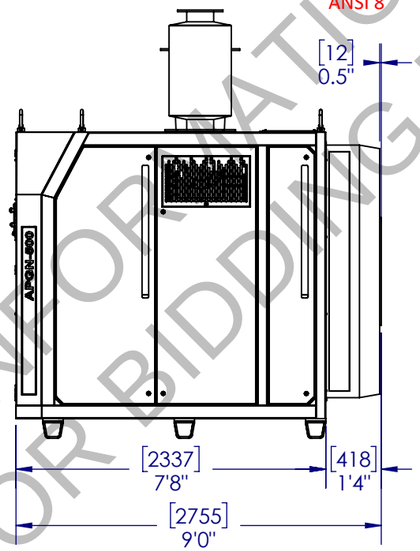
NOTE 1
1. MATERIAL: CARBON STEEL.
2. PAINT: POWLAC EY ZINC PRIMER, AND GREY COLOR, FILM THINKNESS EACH 60µ (101~106g/m²)
3. LIFTING INSTRUCTIONS : FROM LATERAL SIDE OR TOP
4. MINIMUM CLEARANCE REQUIRED FOR FILTER REMOVAL AND MAINTENANCE : 42 INCHES
5. COOLING SYSTEM: CLOSED LOOP WATER-GLYCOL AND AIR CONVECTION
6. FOR CABLING, REFER TO ELECTRICAL RATING SHOWN ON BLOWER NAMEPLATE
7. WEIGHT APPROX.: 6735 Lbs. (DEPENDING ON INSTALLED HARDWARE)
8. DISCHARGE CONE NOT SHOWN (CAN BE 16" OR 18" FLOW DEPENDENT)

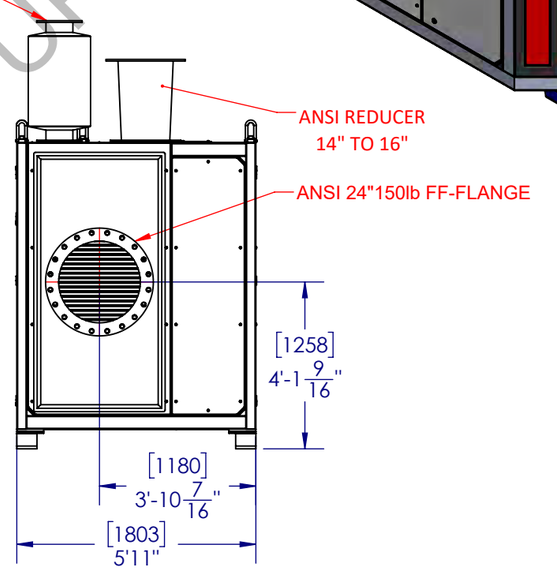


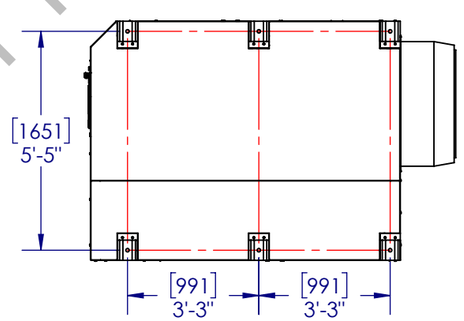












NOTE 2

1. ISOMETRIC VIEW IS NOT TO SCALE
2. ALL DIMENSIONS ARE IN FEET&INCHES
3. DUAL DIMENSIONS ARE IN MILLIMETERS

APGN INC.
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Québec, CANADA, J7C 5S4
Tel: (450) 939-0799
Fax : (450) 939-2115

UNLESS OTHERWISE NOTED :
ALL DIMENSIONS ARE IN INCHES
PROJECTION

FOR : GENERAL ARRANGEMENT
TITLE : APGN500 TURBO BLOWER
ANCHORING FEET - FLANGE INLET

PROJECT NO.	DRAWING NO. G-500220226-A	REV : 00	
DRAWN BY. A. BOR	14-01-2022	MASTER No. -	
CHECKED BY. L.STURZU	14-01-2022	REFERENCE No. -	
APPR. BY.		SCALE : 1:40	DWG SIZE : B
FILE NAME : APGN500-AF-IFH24-DC16-A			SHEET 1 OF 1

e. Dimensional Drawing with Clearances and Materials of Construction

The proposed configuration offers the following:

- Smaller discharge piping (16")
- Smaller enclosure
- No need for inline silencer or discharge silencer.

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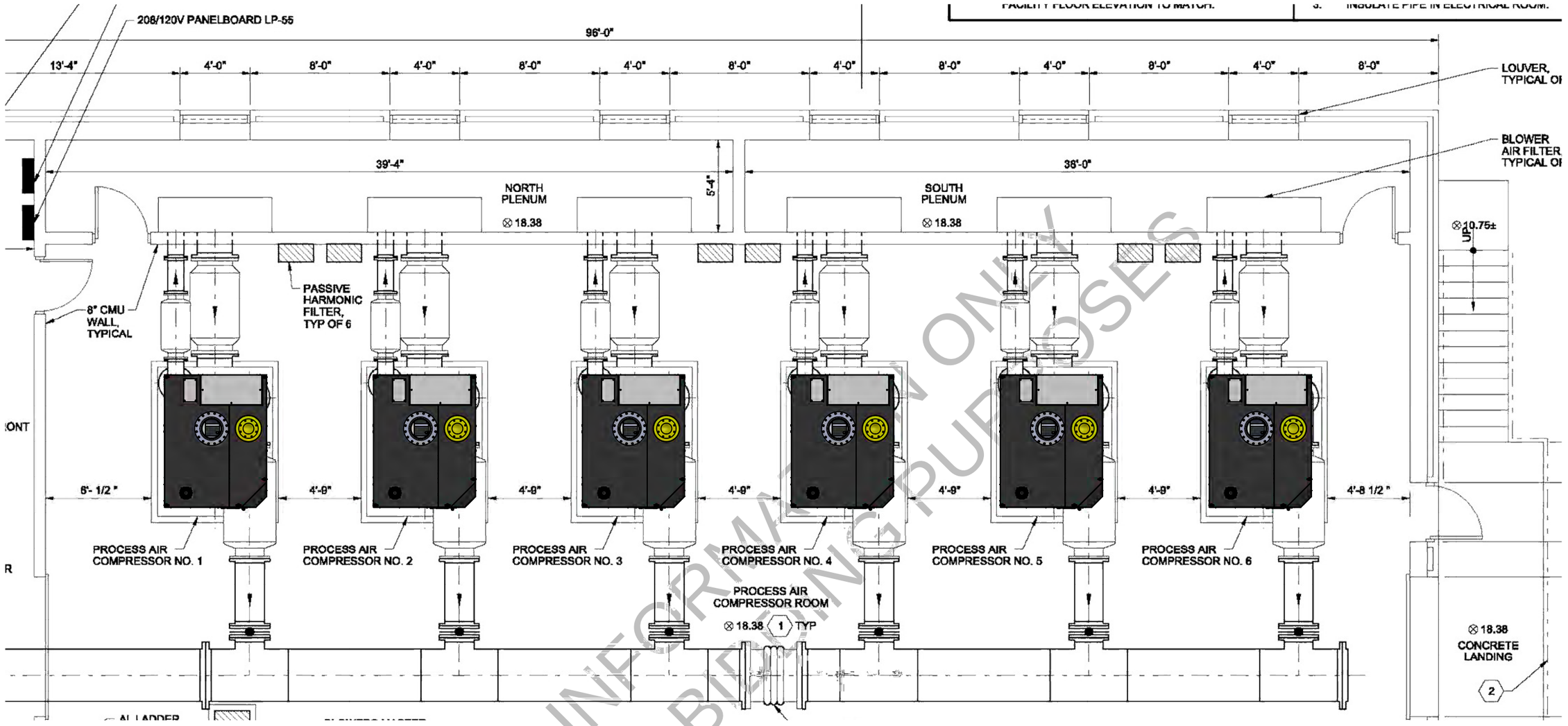

FIND NO	PART OR IDENTIFYING NO	UNITS /ASSY	REV LTR	NOMENCLATURE	MATERIAL	REMARK
U.O.S TOLERANCE			PROJ	BLOWER		
XXXX - ±3 XXX - ±2 XX - ±1.5 X - ±1 X.X - ±0.5	ANGLE ±0.5 SURF ROUGH 3.2µ CORNER C/R 0.5		UNIT	mm		
			SCALE	1:200		
			WGT			
DRAWN	A. BOR		14-01-2022			
CHECKED	L. STURZU		14-01-2022			
CONFIRMED	-		-			
Q.A	-		-			
APPROVED						

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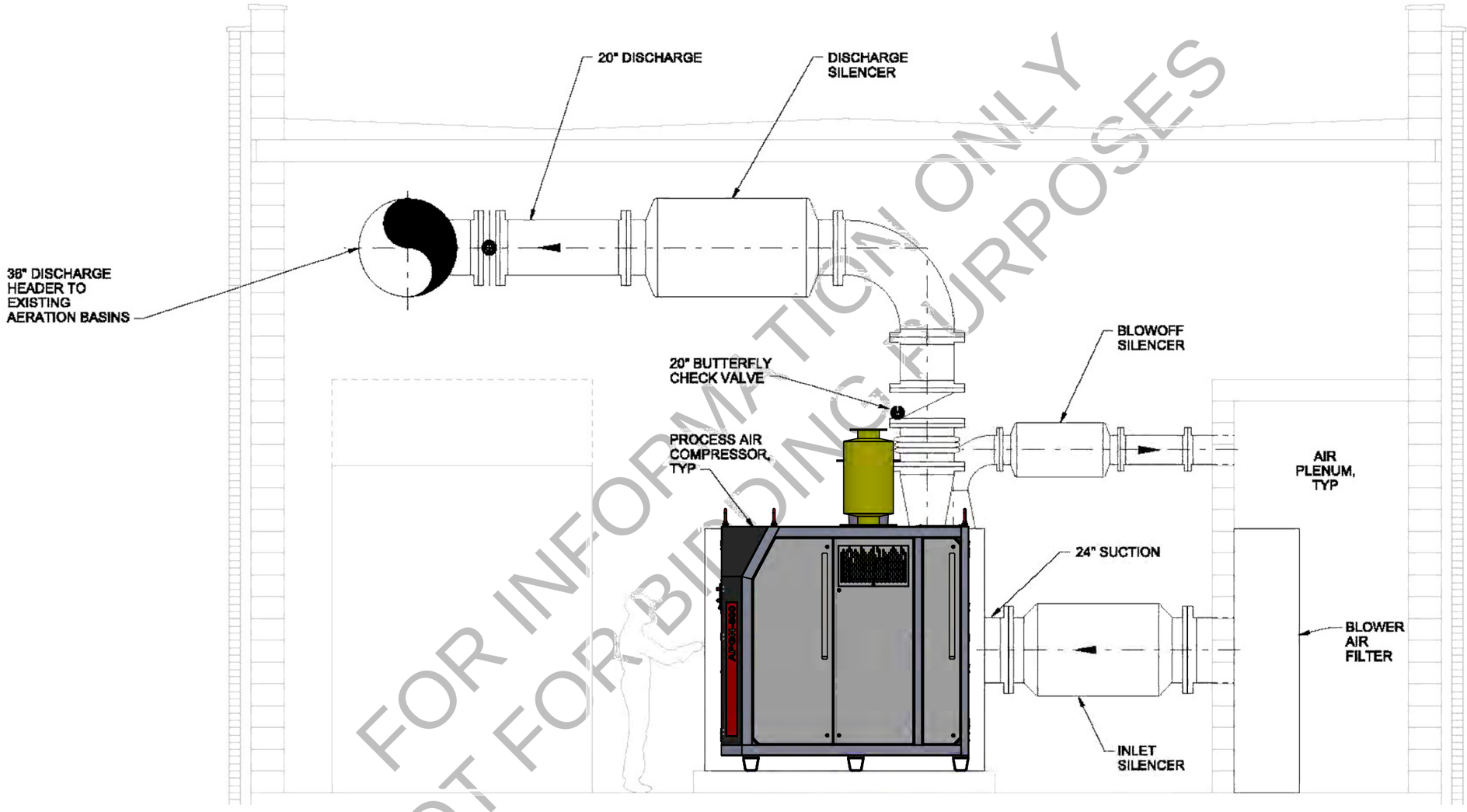
1270, Michèle-Bohec
Blainville, Québec
CANADA J7C 5S4

TITLE

Greater New Haven, CT

DWG NO	DWG SIZE
	A3
REFERENCE APGN500	SHT **1 / 3**



FIND NO	PART OR IDENTIFYING NO	UNITS /ASSY	REV LTR	NOMENCLATURE	MATERIAL	REMARK
U.O.S TOLERANCE			PROJ	BLOWER		
XXXX - ±3 XXX - ±2 XX - ±1.5 X - ±1 X.X - ±0.5	ANGLE ±0.5 SURF ROUGH 3.2µ CORNER C/R 0.5		UNIT	mm		
			SCALE	1:200		
			WGT			
DRAWN	A. BOR		14-01-2022			
CHECKED	L. STURZU		14-01-2022			
CONFIRMED	-		-			
Q.A	-		-			
APPROVED						

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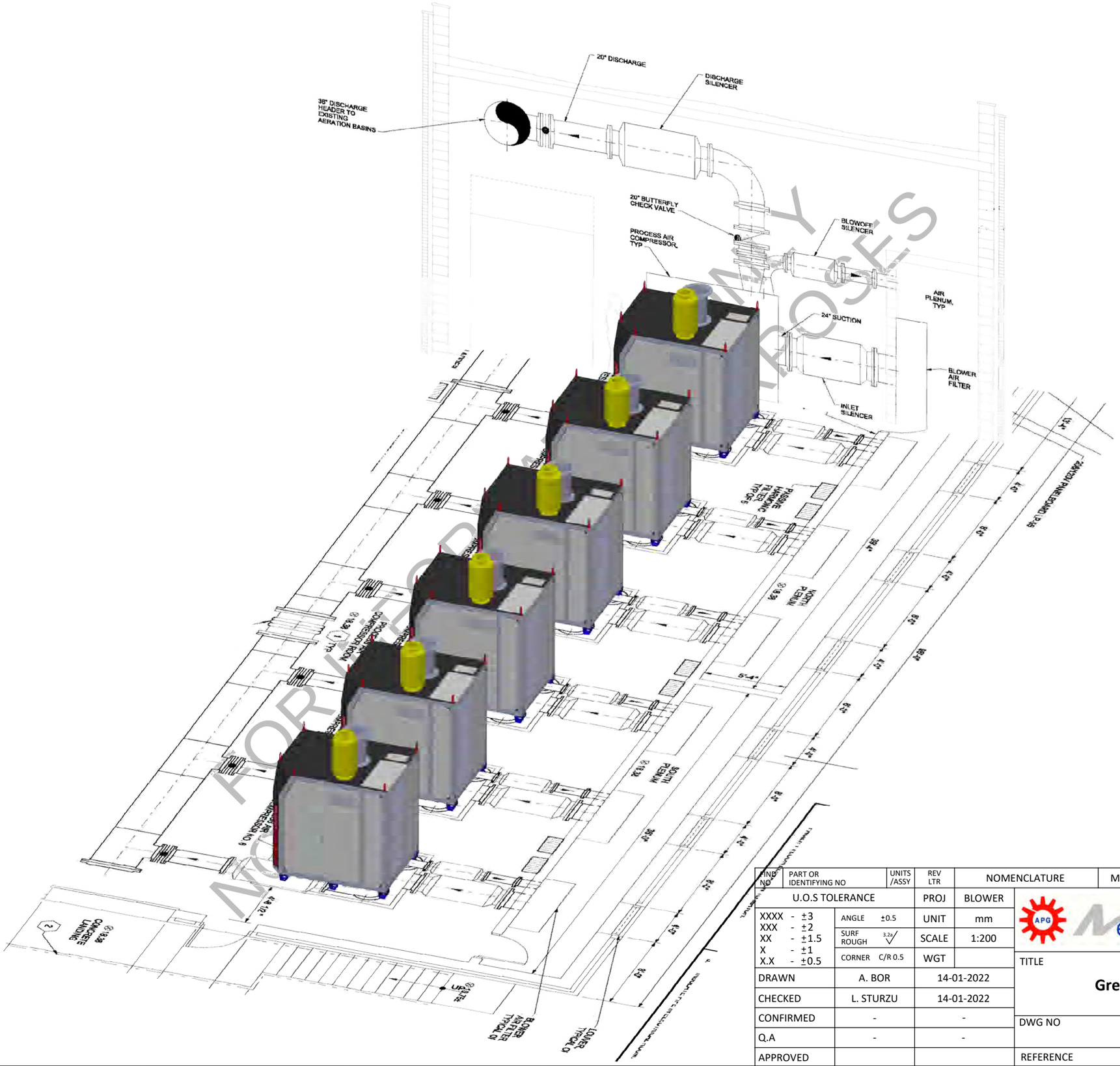
1270, Michèle-Bohec
Blainville, Québec
CANADA J7C 5S4

TITLE

Greater New Haven, CT

DWG NO	DWG SIZE
	A3
REFERENCE APGN500	SHT **2 / 3**



FIND NO	PART OR IDENTIFYING NO	UNITS /ASSY	REV LTR	NOMENCLATURE	MATERIAL	REMARK
U.O.S TOLERANCE			PROJ	BLOWER		
XXXX - ±3 XXX - ±2 XX - ±1.5 X - ±1 X.X - ±0.5	ANGLE ±0.5 SURF ROUGH 3.2a CORNER C/R 0.5		UNIT	mm		
			SCALE	1:200		
			WGT			
DRAWN	A. BOR		14-01-2022			
CHECKED	L. STURZU		14-01-2022			
CONFIRMED	-		-			
Q.A	-		-			
APPROVED						

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1270, Michèle-Bohec
Blainville, Québec
CANADA J7C 5S4

TITLE

Greater New Haven

DWG NO	DWG SIZE
	A3
REFERENCE APGN500	SHT **3 / 3**

1. Preliminary Equipment List

Below is a general technical sheet of the proposed equipment. For more details regarding the material of construction, please refer to Section Proposal Submittal Information – e. Technical – I. Mechanical – c. Catalog Information.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Turbo Blower Data

General Information

Project	Greater New Haven WWTP			Manufacturer	APGN Inc. (www.apg-neuros.com)						
Site Address	345 East Shore Parkway, New Haven, CT 06405			Place of Installation	Indoor						
Site Elevation	19	(feet)		Application	Waste Water Treatment						
Working Gas	AIR			Number of Units Present	Total	6	Working	5	Standby	1	

Mechanical

Model	APGN500 C060					
Bearing	Active Magnetic Bearing			Number of Impellers	1	
Coupling	Direct	Noise	80	Size (W/L/H)[1]	5'11"/7'8"/7'7"	(ft)
Type of VFD	Integrated			PWM Type	Vector	6 Pulse
Inlet Type	Horizontal Flange			Discharge Type	Vertical	
Inlet Flange Size	ANSI 24 inch			Discharge Flange Size	ANSI 16 inch	
Foot Type	Anchor Feet					

Electrical and Controller

Electricity	480V - 60Hz - 3Ph	Power Entry	Bottom
Local Control Panel	CompactLogix	Master Control Panel	CompactLogix
Communication	Ethernet	Mode of Operation	Local/Remote
Room Ventilation	No Separate Fan Required	Lubricants	Not Required
Additional Items	Vibration Sensor		

Note:

1. Blower size without foot

2. Flow Modulation : Speed Control by PLC

3. No Condensation

4. Blow-off Valve and Silencer shall be supplied as default loose item

5. Tolerance of ± 2 dB (A) on noise

APGN Inc.
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Tel: 450 939-0799, Fax: 450 939-2115
www.apg-neuros.com

2. Recommended Lifting height and Horizontal Clearances

APG – Neuros
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Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

APG Neuros recommends to locate the blower at least 42 inches (3.5 ft) from other blowers, walls, vertical pillars, any other obstructions or other machines in order to secure a space for maintenance (large heavy parts are to be removed during maintenance). This also allows for proper air flow.

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Using Lifting Equipment

Lift and transport blower units to the installation site by using a suitable lifting equipment such as a forklift or an eyebolt lifting. Verify that the weight capacity of the lifting equipment will support the weight of the unit before attempting to move. Do not drop the blower unit. Use care to lift and transport the unit.

Using a Forklift

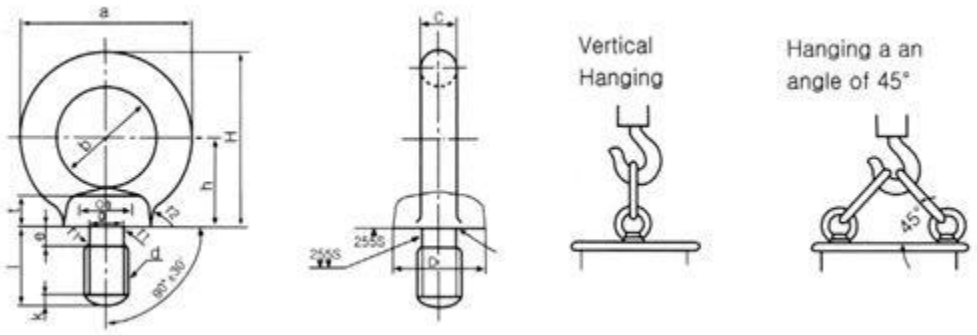
WARNING **DO NOT LIFT the blower unit from the front or back side.**

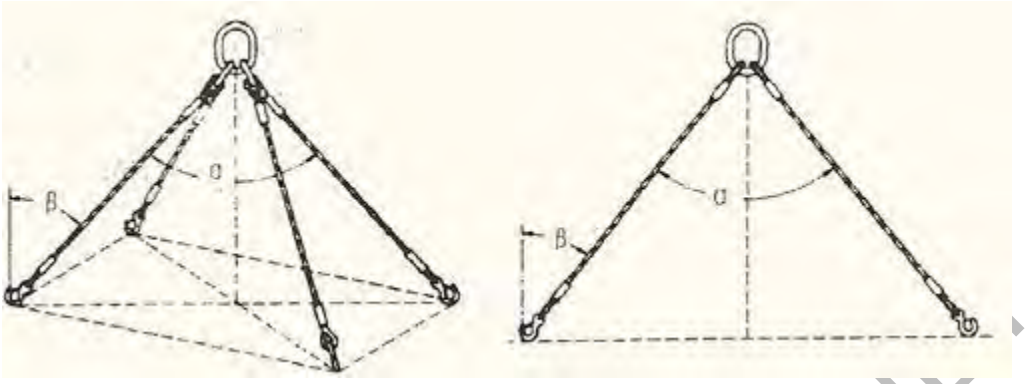
The blower unit must be lifted from its lateral side. If the blower unit has an air conditioning unit installed, the blower unit must be lifted from the opposite side of the air conditioning unit. Carefully place the forks underneath the pallet. Transport the unit on a well-leveled floor using a forklift.

FORKLIFT LIFTING

Using Eyebolts

DANGER **There are four (4) eyebolts installed on each top corner of the blower and all eyebolts must be used when lifting the blower. Do not deform the eyebolts or drop the blower.**





EYEBOLT LIFTING

Verify the weight of the unit before attempting to lift. All ropes, cables and lifting equipment should be able to support the weight of the unit.

When lifting the blower with ropes or cables using the eyebolts, the angle (β) between the rope and the vertical must not exceed 45 degrees. As β = α/2, α must not exceed 90 degrees.

The load capacity of the eyebolt decreases by half at a 45-degree angle.

WARNING **When moving the blower, the tilt angle of the blower unit must not exceed one degree.**

Installing Blower Units with Anchor Feet

Install the blower on a firm, level foundation such as a concrete floor that can support the full weight of the blower. Ensure the anchor feet are touching the base completely, otherwise the blower frame will twist and cause damage when bolting them down. If the foundation is not level, shims may be used as an adjustment to ensure the blower is level within 1/8 of an inch (3.175 mm); the addition of grout may be required.

ANCHOR BOLT INSTALLATION

Installation of anchor bolts are required and should follow the manufacturer's installation recommendations.

Model	Anchor Hole	Anchors (diameter)
APGN500	1 inch (2.54 cm)	7/8 inch (2.22 cm)

Length for each bolt is usually six (6) inches (15.24 cm) but it can vary from site to site.

ANCHOR BOLT RECOMMENDATIONS

f. Compressor Sound Level Data

This is to confirm that in accordance with ASME PTC 36, Measurement of Industrial Sound, and operating at the maximum design capacities, the tested sound values from the blower shall not exceed 80 dB(A) at a distance of 3 feet.

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Tel : (450) 939-0799, www.apg-neuros.com

g. Heat Dissipation

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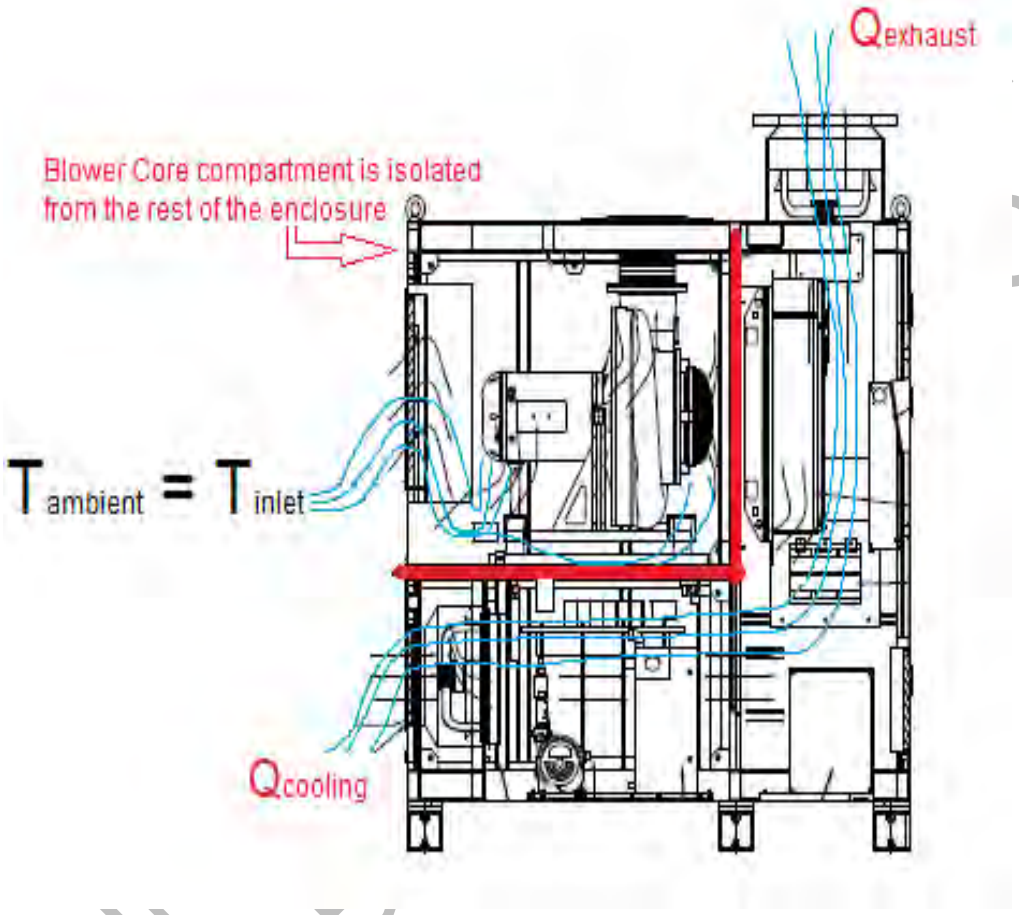
Cooling narrative with heat rejection outside the blower room

Base Bid

No heat rejection to the blower room. Heat is piped outside the blower room.



Base Bid

No heat rejection to the blower room. Heat is piped outside the blower room.

Cooling Process description for blower

- Blower inlet air flow $T_{ambient}$ enters from the rear inlet filter of the blower
- The air is diverted directly into the blower core such that $T_{ambient}$ is equal to T_{inlet}.
- The blower core compartment is completely isolated from the rest of the enclosure. This prevents the air used for cooling from mixing with the intake process air to the blower core.
- $Q_{cooling}$ air is drawn into the bottom rear inlet filter of the blower.
- The heat from the electrical components and heat exchanger is dissipated into the $Q_{cooling}$ intake air and diverted upward towards the VFD.
- $Q_{cooling}$ air is exhausted by a high powerd fan as $Q_{exhaust}$.
- $Q_{exhuast}$ can be ducted outside the blower room to prevent the blower from recylcing the warm air.
- $Q_{cooling}$ does not mix with the blower process intake air. As a result, the inlet air temperature at the blower core is approximately 20-25 deg F cooler than the existing “integrated glycol cooling system” configuration. Since the inlet temperature is reduced, the SCFM flow rate is increased by 4-5% due to the increased air denisity of the cooler intake air. Furthermore, the discharge temperature of the air is subsequently reduced by 30-35 Deg F as a result of the decreased inlet temperature.

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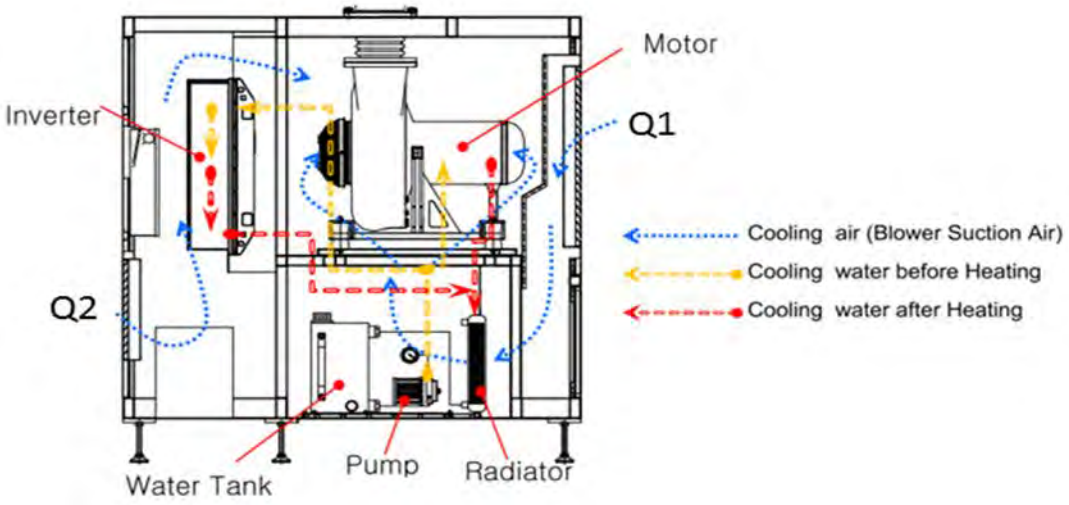
Alternate Bid

No heat rejection to the blower room. Heat is discharged to the processed air.

APG-Neuros Turbo Blower Integrated cooling system: Models APGN500



Cooling Process description for Models APGN500

- Blower inlet Flow Q1 enters from the rear inlet filter of the blower
- The air is diverted downward (decreasing the inlet flow velocity) and passes throgh the heat exchanger. As the air passes through the heat exchanger it cools the glycol/water cooling fluid.
- The heated air from the heat exchanger is diverted upward into the blower core.
- Blower inlet flow Q2 enters the front inlet filter of the blower and passes through the variable frequency drive (VFD).
- The heat from the VFD is dissipated into the fresh intake air and diverted towards the blower core.
- Both air flows Q1 and Q2 are combined as they are diverted into the blower core and discharge as process air.

In conjunction with the forced air convection cooling, the blower is equipped with an internal glycol cooling system.

- Coolant fluid (yellow lines) is sent to the blower core (equipped with a water jacket) and the VFD (equipped with cooling channels).
- The coolant fluid absorbes the heat generated by the blower core and VFD and is diverted to the heat exchanger (red lines).
- The coolant passes trough the heat exchanger and is cooled by the inlet flow Q1.
- No heat is exhausted or dissaped to the blower room. No additional piping is required to exhaust heat away from the blower.

h. Internal and External Heat Exchangers

The proposed equipment does not use any external heat exchangers. For the internal cooling system, APG-Neuros HSTB uses internal forced air convection combined with internal glycol cooling. No external cooling piping or cooling system is needed .

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2) Instrumentation and Control

APG – Neuros
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a. Process and Instrumentation Diagrams

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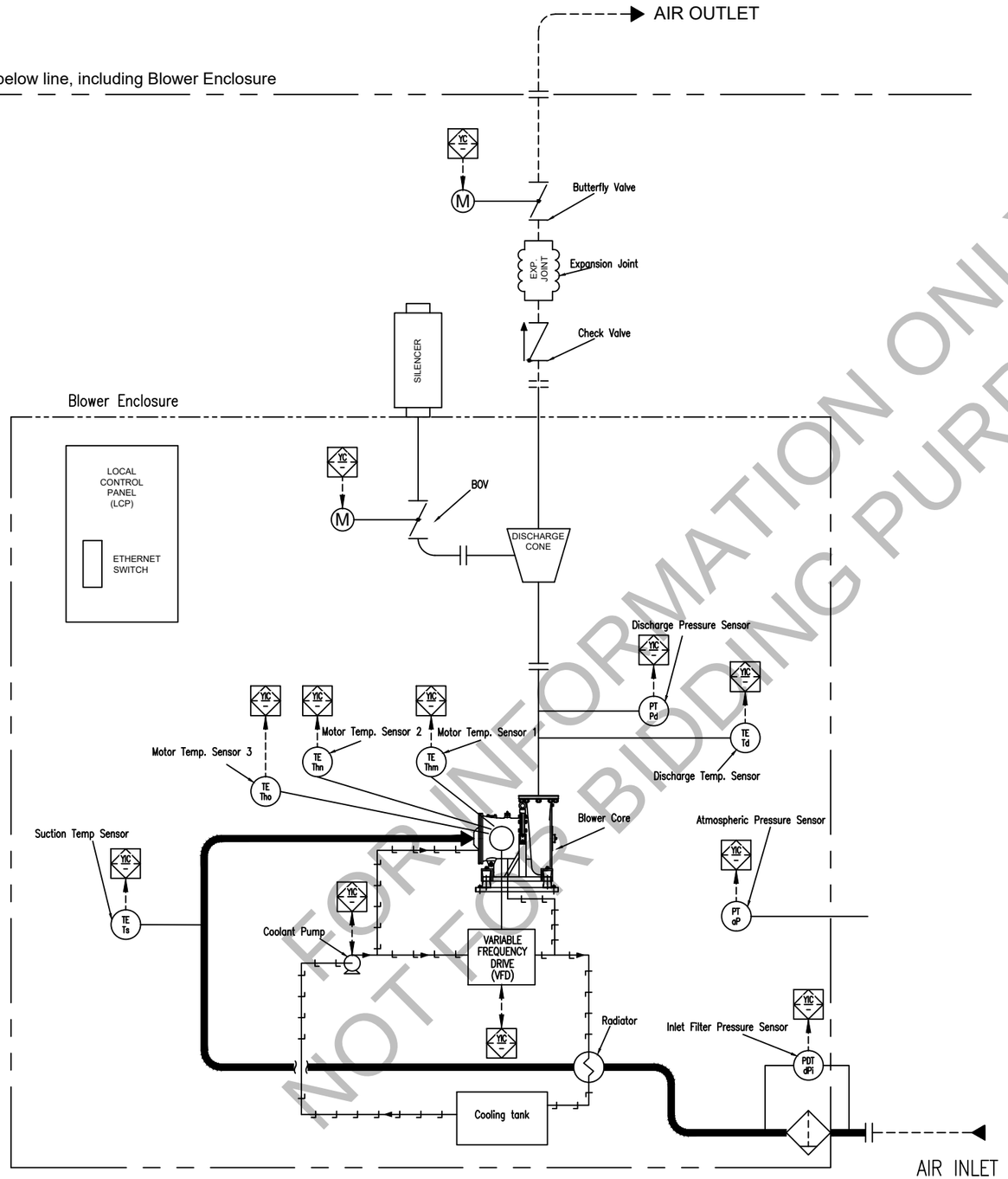


SYMBOLS			
Valve, Gate	Valve, Butterfly	Valve, Check	Valve, Angle
Motor	Solenoid	Radiator	
Silencer	Expansion Joint	Flange	Discharge Cone
Blower Motor	Filter	Pump Motor	

GENERAL INSTRUMENT OR FUNCTION SYMBOLS			
	Primary Location Normally Accessible To Operator	Field Mounted	Auxiliary Location Normally Accessible To Operator
Discrete Instruments			
Shared Display, Shared Control			
Computer Function			
Programmable Logic Control			
			Instruments Sharing Common Housing
	Pilot Light	Undefined Interlock Logic	

Note: Normally inaccessible or behind-the-panel devices or functions are depicted using the same symbol but with dashed horizontal bars:

INSTRUMENT LINE SYMBOLS (All lines to be fine in relation to process piping lines)	
DESCRIPTION	SYMBOL
Instrument Supply or Connection To Process	
Pneumatic Signal	
Electric Signal	
Hydraulic Signal	
Internal System Link (Software or Data Link)	
Mechanical Link	
Supplied by Others	
Open Space Air Flow Within the Enclosure	

DATE	BY	PM	PM	DESCRIPTION	REV.
JAN-20-2022	PAR BY	VER. CHEC.	APP.	ISSUED FOR BIDDING	BID

UNLESS OTHERWISE NOTED:

1. ALL DIMENSIONS ARE IN (INCHES).

2. THIRD ANGLE PROJECTION:

1270, Boulevard Michèle-Bohec,
Blainville, Québec, Canada J7C 5S4
Tel: (450) 939-0799
Fax:(450) 939-2115

FOR: POUR
APGN500 Blower

TITLE: TITRE
PROCESS AND INSTRUMENTATION DIAGRAM

PROJECT No.	DRAWING No. / No. DE DESSIN			
TBD	PID-500xxxxxx			
MSTR No.	SC.	ECH.	SHEET	PAGE / REV
	NONE		1 OF 1	BID

b. Instrumentation

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Controller
Model: AB Single Core
NX Series

Publication: APGN-DO-OM-035-E
Release Date: Monday, December 02, 2019
Version: 6.1
Review Date: November-2019

Carefully read this manual before attempting to operate or perform any maintenance. If you are uncertain about any of the instructions or procedures provided in this manual please contact APG-Neuros or your distributor. We recommend that you retain this manual, and all publications provided with your Turbo Blower, in a location accessible to all personnel who operate and service your Turbo Blower.

Revision History

Date	Version	Description
11-May-2011	v4.0	Rebrand to new template. Revise to resolve grammar and layout issues. Supply missing information. Centralize all information regarding the controller into one document.
14-July-2011	v4.1	Changes to warranty.
09-November-2011	v5.0	Conversion to XML format. Addition of publication number and next review date. Separation of information and creation of new document per model. Update graphics to reflect documentation.
08-April-2014	v5.1	Modifications to reflect new PLC version 3.41 (beta).
20-December-2015	v5.2	Modifications to reflect the updated PLC version (L23E_3.41_07).
13-February-2017	v5.3	Update for the latest PLC program (P_ABL24_3.41_19).
21-March-2018	v5.4	Update for the latest PLC program (P_ABL24_3.41_26).
06-June-2018	v5.5	Update for the latest PLC program (P_ABL24_3.41_30).
07-January-2019	v6.0	Update for the latest PLC program (P_ABL24_3.42_00).
02-December-2019	v6.1	Update for the latest PLC program (P_ABL24_3.42_02).

Contents

Table of Figures

Warranty

APG-Neuros guarantees that this product will be free from defects in materials and workmanship as defined in your proposal and specifically stated in your Certificate of Warranty.

During the warranty period, APG-Neuros will, at its discretion, either repair or replace defective products.

This warranty shall not apply to consumable parts and failure or damage caused by improper usage or unauthorized services or articles of consumption. In such cases, APG-Neuros may refuse to furnish service under the warranty.

Unauthorized modifications and improper installations may void your warranty. APG-Neuros reserves the right to charge for any required repairs.

Conventions

The following conventions are used in this manual:

⚠DANGER	Indicates a hazardous situation which, if not avoided, will result in death or personal injury.
⚠WARNING	Indicates a hazardous situation which, if not avoided, could result in death or personal injury.
⚠CAUTION	Indicates a hazardous situation which, if not avoided could result in minor or personal injury. Caution identifies conditions or practices that could result in damage to the unit or to other equipment.

Graphics

Every effort has been made to use graphics reflective of the typical blower by model and may not be 100% accurate with the blower model you have. Screen shots of many of the touch screen menus are common to all blower models and should not be considered as errors if they reflect a different model as seen in the upper left corner.

Safety Instructions

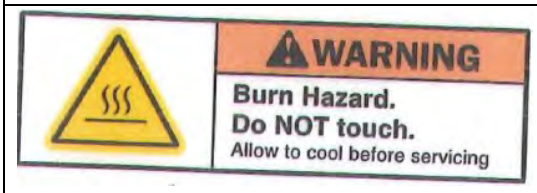
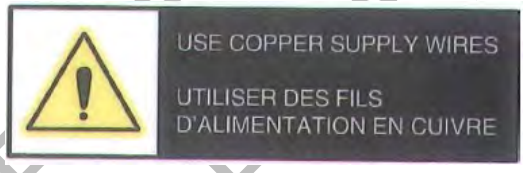
⚠WARNING	Before the operation or the maintenance of this system, carefully read this section and all its contents. General safety regulations and safety precautions must be observed at all times. Noncompliance to safety instructions may be fatal or may result in the breakdown of the system or products.

Safety precautions are included in other sections.

Safety Labels

Safety labels on the blower unit are very important and should never be removed. If they are soiled, illegible, peeled off or lost, replace them with new labels.

The following describes the safety labels identified on the blower unit. Do not operate or perform system maintenance when someone is working in a dangerous area.

	**Risk of Electrical Shock** - Contact with energized or current carrying parts can cause personal injury or death. **Disconnect all remote electric power supplies before servicing.**
 	**Burn Hazard** - Contact with hot surfaces can cause personal injury.
	**Warning** – Use copper supply wires.

	**Arc Flash and Shock Hazard** - Do not operate controls or open covers without appropriate personal protection equipment.
	**Warning** - Do not open it. Moving parts & electric wiring inside. Access limited only to authorized personnel.
	**High Voltage Hazard** - The energized parts are locked by the closed door panel under normal operation to avoid voltage and current hazards. **Keep the door panel closed during operation.**

Emergency Stop Button

The system is fitted with an Emergency Stop button. Pressing it disables the VFD from operating and stops the motor immediately.

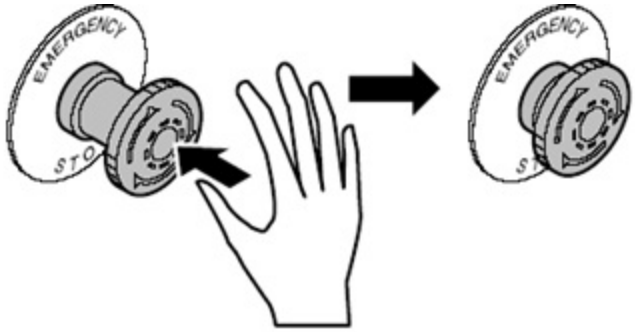
Before operation or maintenance work, verify the position of the Emergency Stop button and verify the AC power is disconnected if working within the energized compartments of the units.

DANGER	In case of an emergency stop, the breaker inside the system will not shut off. The power within the unit will remain energized unless the power source feeding the unit is turned off. Therefore, do not touch the terminals inside the blower.

Verify the Emergency Stop button functions and alarms regularly by pressing the button while the unit is not operating.

To Use the Emergency Stop Button

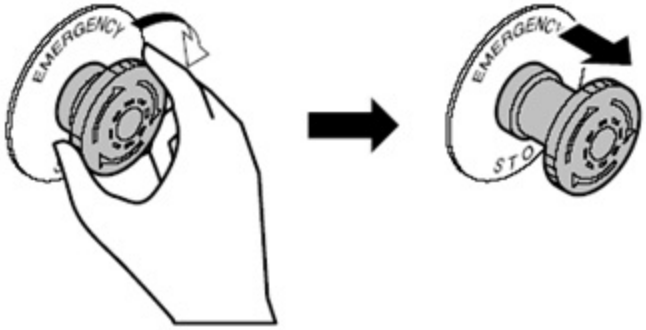
Press the Emergency Stop button to immediately shut off the Turbo Blower.



PRESSING THE EMERGENCY STOP BUTTON

To Reset the Emergency Stop Button

Turn the button clockwise. Once the button is released, the Emergency Stop button is reset.



RESETTING THE EMERGENCY STOP BUTTON

Ensure the unit is clear and operable before resetting the Emergency Stop button.

Danger of Electrical Shock

The blower contains moving and energized parts that can cause serious or deadly injury.

When the blower is powered on, do not touch the inside of the blower under any circumstances.

Turn off power on the Main Circuit Breaker (MCCB) and wait at least five (5) minutes for the capacitors to discharge. Then use a voltmeter or a multimeter to ensure there is no voltage before performing any maintenance work.

Do not wear jewelry or loose clothing when operating or maintaining the blower.

Danger of Short Circuit

Turn off the main power supply upstream of the blower when the circuit breaker trips or the fuses are blown. Troubleshoot and resolve the problem before resetting the breaker to prevent electrical shock due to short circuit.

Switching Power on the Blower

Do not repeatedly switch the Main Circuit Breaker (MCCB) ON and OFF in a short interval. Wait at least five (5) minutes between each switching of MCCB. The capacitors of the VFD need to discharge between power cycles to avoid electrical damage to the equipment and/or injury to personnel.

In case of maintenance on the feeder circuit of the blower, make sure to also switch OFF the Blower MCCB. When power is restored upstream, you may switch the MCCB back ON.

1. Touch Screen Configuration

The turbo blower is controlled by many parameters such as motor speed, discharge pressure and suction flow rate. All parameters have been set at the factory and some of them cannot be changed by the operator. Other parameters have to be set depending on the blower site conditions.

Please note that controller programs are identical but the operational parameters are different from one blower to another.

⚠CAUTION The blower may be damaged if operation parameters are set incorrectly. Only trained and qualified personnel will have access to the internal parameter settings.

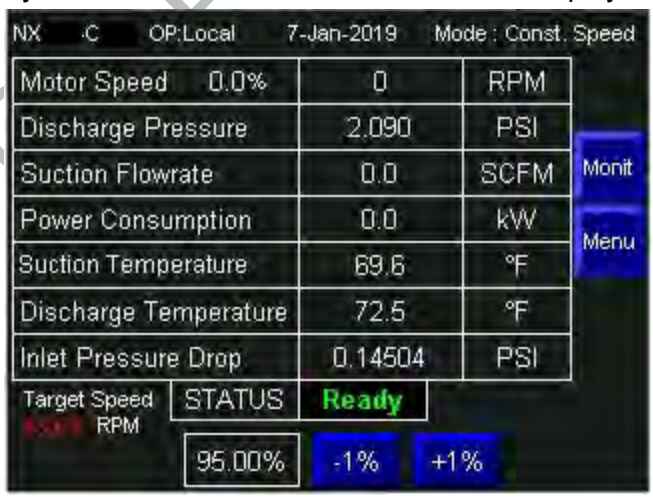
1.1 Main

Main screen is displayed at power up and during normal operation. It displays the principal operation parameters. The banner at the top of the display shows the model name (the first set of numbers determine horsepower and the second set indicates the compressor model based on discharge pressure and flow requirements), operation type (local or remote control), date and the blower operation mode (constant speed, constant flow, constant pressure or DO control).

The following parameters are displayed in the Main screen:

- Motor Speed – The revolution speed of the motor. It is measured in RPM.
- Discharge Pressure – The current discharge pressure.
- Suction Flowrate – The calculated suction flow rate.
- Power Consumption – The output power from the blower package.
- Suction Temperature – The temperature of suction air.
- Discharge Temperature – The temperature of the air being delivered from the blower.
- Inlet Pressure Drop – The differential pressure between the exterior and interior of the blower package.

The middle column displays the current value and the third column displays the measurement units.



MAIN SCREEN

The bottom of the display shows the Command Input Value (Target Percent) corresponding to speed, flow, pressure and DO (dissolved oxygen); two percentage buttons to increase or decrease the command input and the current status. The red number to the left represents the actual value of the target. The corresponding units and description above the display will change according to the control mode.

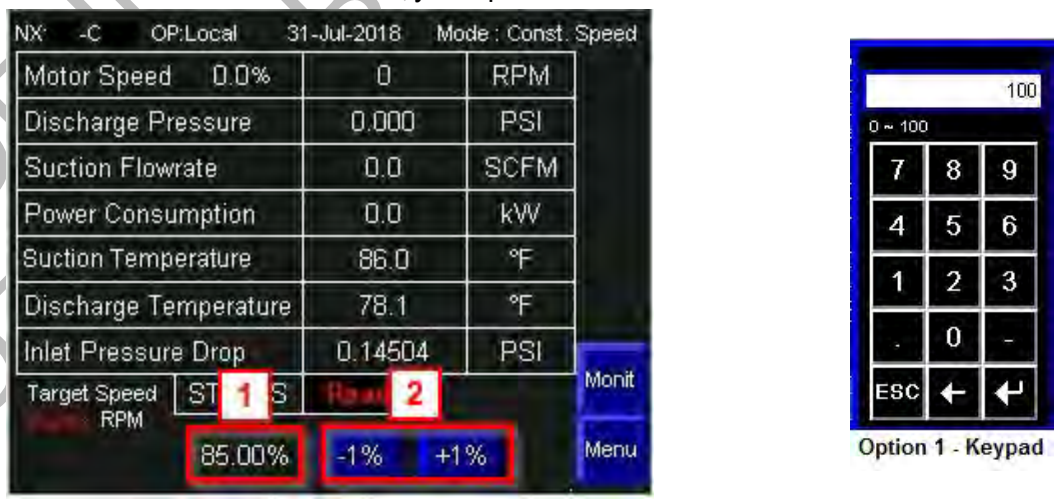
Status is displayed as one of the following:

Status	Description
Checking	The blower is performing a self-check after power has been turned on.
Ready	The blower is ready to run and is waiting for Start command or the Run button to be pressed depending on the operation mode.
Start	The blower is going through the starting cycle after Start command or Run button is pressed.
Run	The blower is running.
Stop	The blower is going through the stopping cycle after Stop command or Stop button is pressed. The status will change to Ready when the cycle is complete.
Fault	The blower stops due to a fault (refer to fault code and message in Reset screen).
Reset	The blower is resetting a fault after Reset procedure and Reset button is pressed. Status will change to Ready if there are no additional faults occurring.
Error	Touch screen communication failure

Changing the Command Input Value

The Command Input can be changed by two methods:

- Method One: Press the Command Input value (option 1) on the touch screen and a keypad will appear on the screen. Input the desired value using the keypad and press the bent arrow button. To correct an invalid character entry, press the left arrow button. To cancel an entry press ESC.
- Method Two: Press (+1%) or (-1%) button (option 2) on the touch screen and the Command Input value will increase or decrease by one percent.



METHODS TO CHANGE THE COMMAND INPUT

Meaning of the Command Input Value (100 %)

The percentage unit (%) is used as an input value to control the blower. This enables users to directly set up the target value relative to normal performance (100%) of the turbo blower, which makes the calibration value for the current inlet temperature unnecessary. Note the performance of the turbo blower is changed according to the intake fluid temperature even though the motor rotates with constant speed.

Depending on the operation mode of the blower (constant speed, flow, pressure or DO control), the target percentage represents:

- In Constant Speed mode, the ratio of the target speed to 100% speed based on the current inlet temperature.
- In Constant Flow mode, the ratio of the target air flow to 100% air flow based on the current inlet temperature.
- In Constant Pressure mode, the ratio of the target pressure to 100% of the predefined rated value of discharge pressure.
- In DO Control mode, 100% corresponds to a predefined upper limit value, and 0% to predefined lower limit.

Flashing Indicators

Under certain operating conditions, the following flashing indicators (NC, NM, NS or WC) will be displayed on the main screen.

- NC: Overrides speed command if it is higher than NC_Max, the dynamic maximum speed based on rated maximum speed and suction temperature. NC_Max is also used to convert speed percent commands to RPM.
- NM: Overrides speed command if it is higher than NM_Max, the maximum physical speed in RPM (N_Max) minus a 100 RPM hysteresis (NS_Hys).
- NS: Dynamic speed override in RPM when in surge protection control mode without BOV_Open mode (N_Surge). This is not the speed at which surge protection control mode will trigger. It is the speed that will be sent to the VFD if in surge protection control mode for an increase in speed.
- WC: Dynamic speed override in RPM when in power protection control mode (N_Power). Occurs when the user defined power limit has been breached and overrides the speed of the blower either in order to protect the VFD or prevent VFD overcurrent faults. While power protection control mode is off, NC_Max is assigned to N_Power.

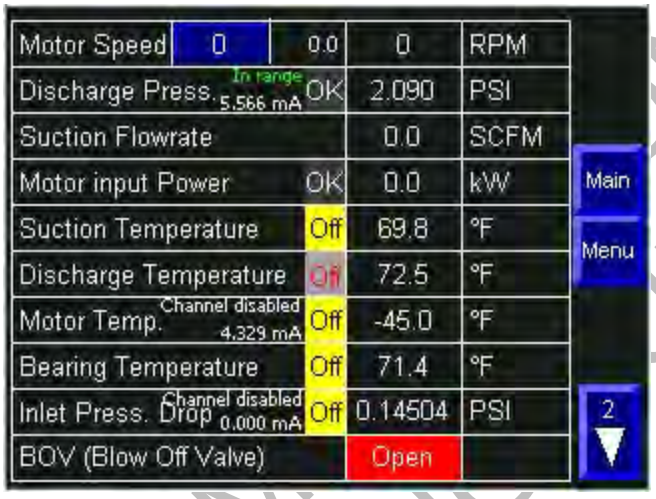
1.2 Monitor

Press Monitor button on the Main screen to access the Monitor screen. The Monitor screen displays the output value of each sensor and its status. "OK" means the sensor measurement value is normal. "Hi" is displayed in red when the parameter value is between 95 - 100% of the normal range and will change to yellow in case of a malfunction. "Off" means the sensor is disabled. "N/A" is displayed in yellow when the signal feedback is not available. In addition to the data displayed on the Main screen, the Monitor screen displays the following parameters.

- Motor Input Power - The input power delivered to the motor (output power from the VFD).
- Motor Temperature - The temperature of motor.
- Bearing Temperature - The temperature of bearing.
- BOV (Blow-Off Valve) - The status of blow-off valve (open/close).

The actual signal feedback in current (mA) from the analog input devices (discharge pressure, motor temperature, inlet pressure drop, rotor vibration, DO, remote input and ambient pressure) is also displayed with the following status.

- "Channel disabled" - The sensor is disabled (in gray text)
- "Wire disconnected" - The sensor is enabled but the wire is disconnected (in red text)
- "In range" - The signal is in range (in green text)
- "Under 4 mA" - The signal is under 4 mA (in red text)
- "Over 20 mA" - The signal is over 20 mA (in red text)
- "High current" - The high current (in red text)
- "Sensor misaligned" - The signal is between 2 and 3 mA (in yellow text)



MONITOR SCREEN

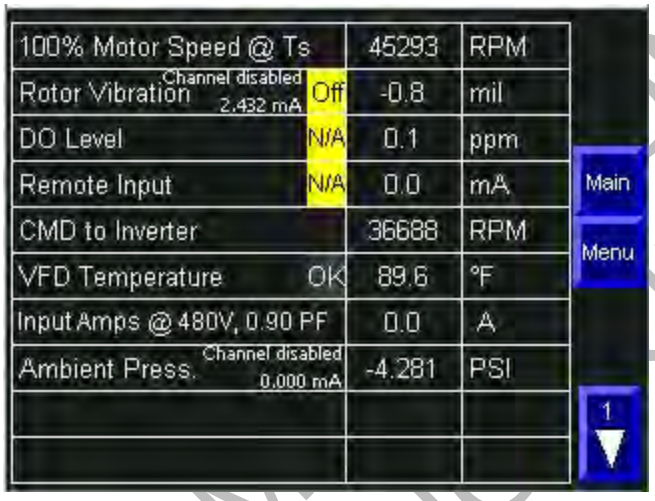
Click the number next to Motor Speed to check the current state of VFD. A pop-up window describing the state of VFD will appear. Close the window by pressing the "X" button on the right upper corner.

MONITOR SCREEN AND VFD STATE WINDOW

Press the down arrow to access Monitor2 screen. This option displays the following parameters.

- 100% Motor Speed @ Ts - The actual maximum speed (in RPM) at the current suction temperature (Ts).

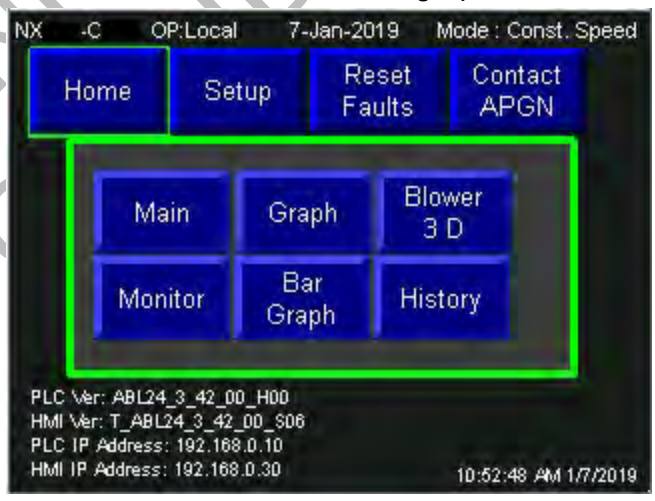
- Rotor Vibration – The vibration value of the shaft.
- DO Level - The actual dissolved oxygen value (in the aeration basin) if a DO probe sourcing a 4-20mA signal is connected to the remote terminals.
- Remote Input - The actual current value (in mA) when the target setpoint is sent through hard-wiring (4-20mA signal).
- CMD to Inverter - The actual speed setpoint sent to the VFD.
- VFD Temperature – The measured heat sink temperature of the VFD.
- Input Amps – The phase (RMS) current at the input of the VFD. This a consolidated view of the volts and PF indication with the amperage reading.
- Ambient Pressure - The relative ambient pressure.



MONITOR2 SCREEN

1.3 Menu - Home

Press Menu button from the Main screen to access the Menu screen. Press Home button then the following screen options can be accessed without entering a password.

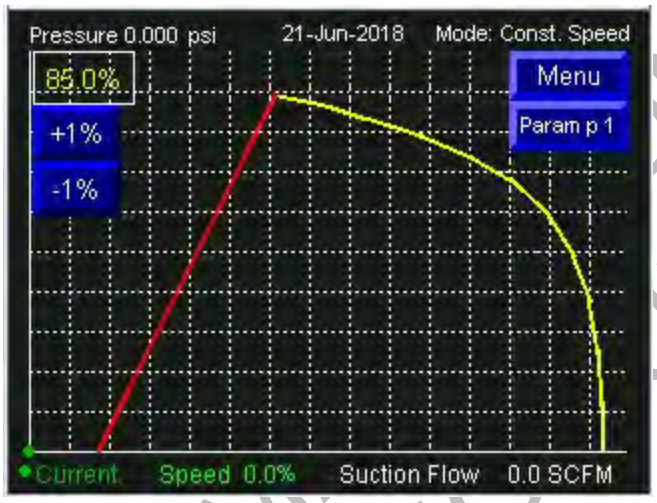


MENU - HOME SCREEN

1.4 Graph

Press Graph button from the Menu - Home screen. The Graph screen displays the approximate current operating point (represented by red dot) of the blower.The discharge pressure is shown on the vertical axis and the suction flow rate is shown on the horizontal axis. The maximum values are shown at the maximum point of the corresponding axis.

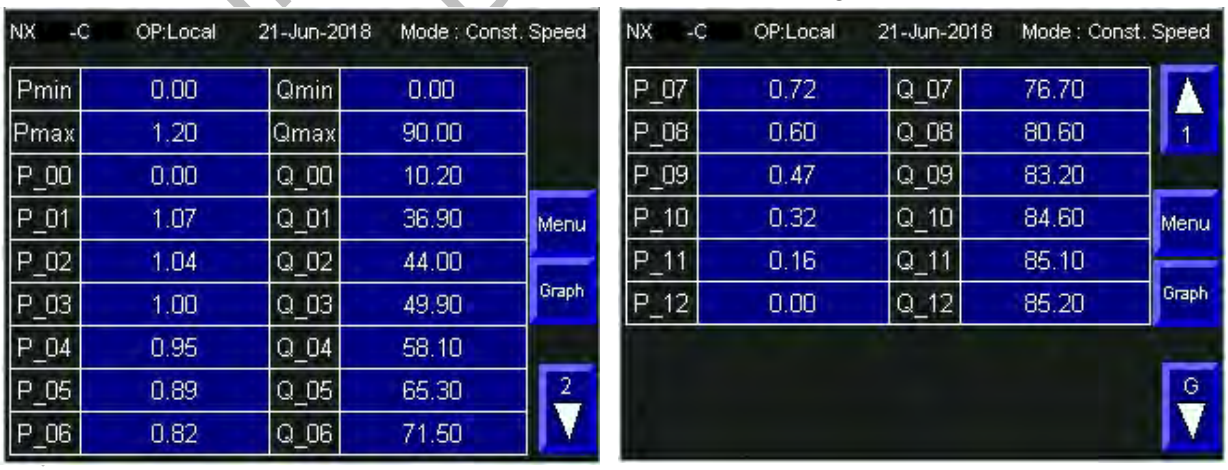
The Graph screen also has increment and decrement buttons for speed control and the target percent input display.



GRAPH SCREEN

Graph parameters can be viewed by pressing the Param p1 button on the upper right corner of Graph screen (a tech level password is required).

- Pmin – The minimum value of discharge pressure (vertical axis)
- Qmin – The minimum value of suction flow rate (horizontal axis)
- Pmax – The maximum value of discharge pressure (vertical axis)
- Qmax – The maximum value of suction flow rate (horizontal axis)
- P_00 – P_12 and Q_00 – Q_12 – The curvilinear value of the graph

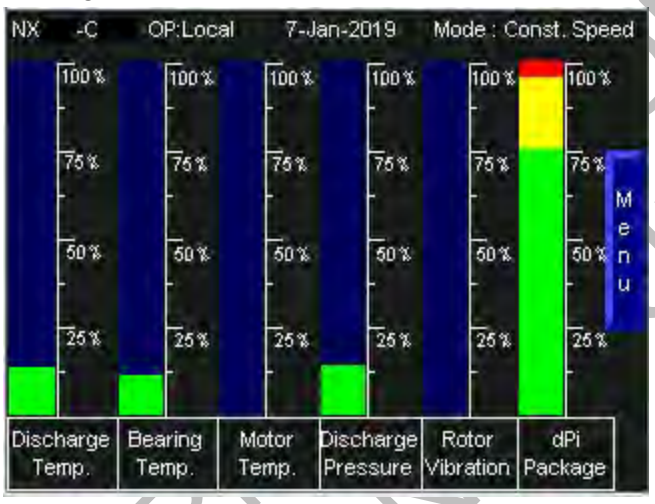


GRAPH PARAMETERS

1.5 Bar Graph

Press Bar Graph button from the Menu - Home screen. The current values of the critical monitoring sensors are displayed as a bar graph. One hundred percent (100%) represents the predefined limitation value of the sensor.

- Discharge Temp. – Percentage of the maximum discharge air temperature.
- Bearing Temp. – Percentage of the maximum bearing temperature.
- Motor Temp. – Percentage of the maximum motor temperature.
- Discharge Pressure – Percentage of the maximum discharge pressure.
- Rotor Vibration – Percentage of the maximum rotor vibration.
- dPi Package - Percentage of the maximum inlet pressure drop.

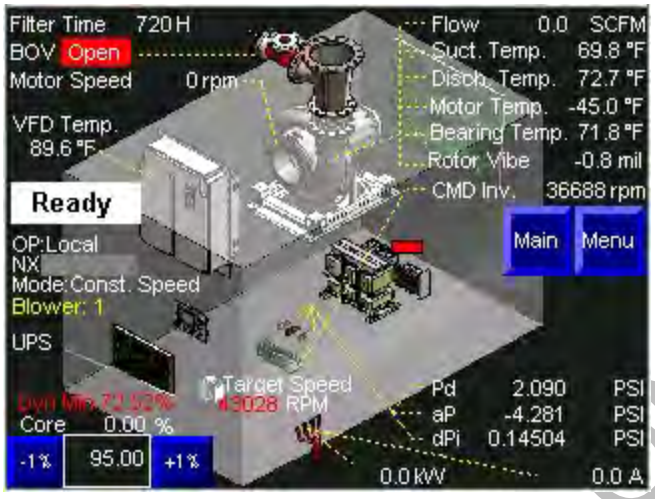


BAR GRAPH SCREEN

The vertical bar displays the permitted maximum value (as a percentage) of a specific sensor. These values can be found on the Limitation Setup screen.

1.6 Blower 3D

Press Blower 3D button from the Menu - Home screen. This screen illustrates the blower, major components and instruments in 3D graphics.



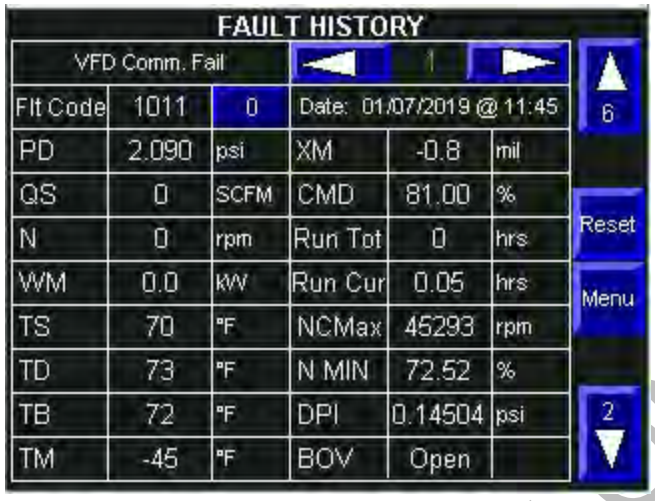
BLOWER 3D SCREEN

The following features are available from the Blower 3D screen.

- Blower model, operation mode, control mode and blower number
- Principal operation parameters such as speed, pressure, temperature, flow, power and vibration
- Status of blower and major components
- Command input button
- Menu button to access the Menu screen
- Monitor button to access the Monitor screen
- Reset button when the blower trips

1.7 History

Press History button from the Menu - Home screen.The History screen displays the recent fault histories in order of occurrence from 1 to 60 (1 = the most recent fault, 60 = the oldest fault). Press the left or right arrows on the screen to scroll through the fault histories. Each fault history represents the fault code, VFD code, blower running time, BOV status, date, time, critical parameter values at the moment of fault occurrence and related fault messages. Reset screen can be accessed from the screen by pressing the Reset button.



HISTORY SCREEN

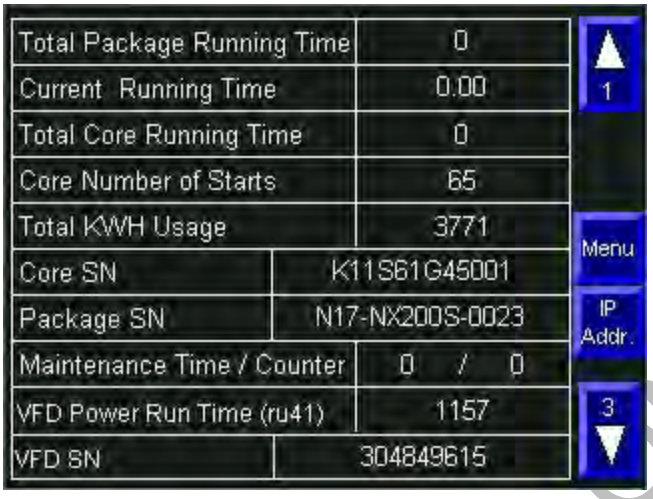
Click the VFD code to check the state of VFD at the moment of fault occurrence. A pop-up window describing the state of VFD will appear. Close the window by pressing the "X" button on the right upper corner.

HISTORY SCREEN AND VFD STATE WINDOW

Press the down arrow to access the History2 screen displaying the following historical data.

- Total Package Running Time - the cumulated running time from the first operation of the blower package.
- Current Running Time - the current running time of this operation.
- Total Core Running Time - the cumulated running time from the first operation of the core.
- Core Number of Starts - the total number of starts and stops of the core.
- Total KWH Usage - the total power consumption of the blower package.

The core and package serial numbers are assigned at the factory, and not accessible by the operator. Only a qualified field service technician can access them when a core or a blower package is changed.



HISTORY2 SCREEN

The maintenance time represents the cumulated running time from the first operation. When the cumulated time reaches pre-defined hours, the following maintenance warning messages will appear on the screen.

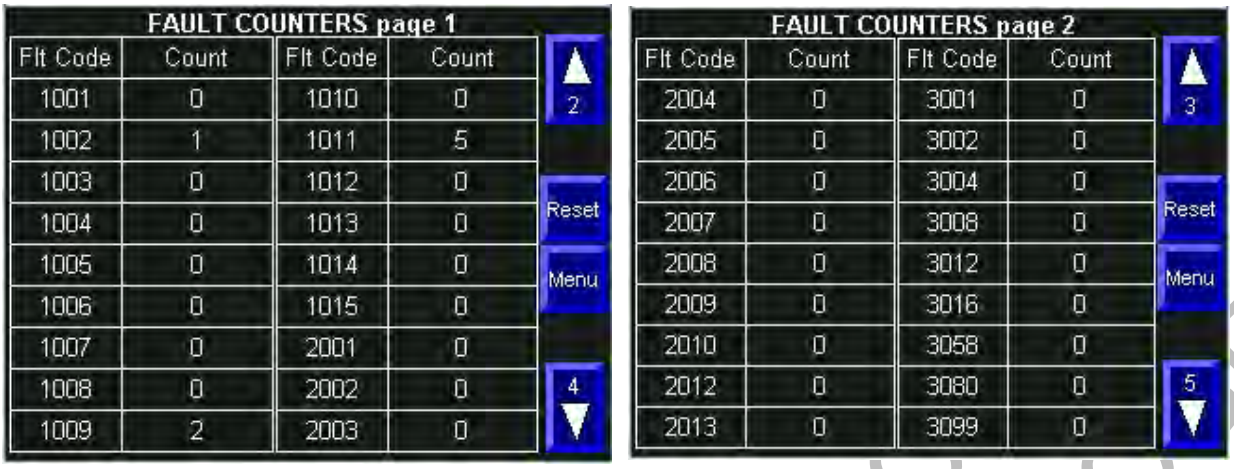
- Factory Maintenance Due (when reaching 10950 hours or 15 months)
- Factory Maintenance Past Due (when reaching 11610 hours or 16 months)
- Factory Maintenance Due Immediately! (when reaching 13140 hours or 18 months)

MAINTENANCE MESSAGE EXAMPLE

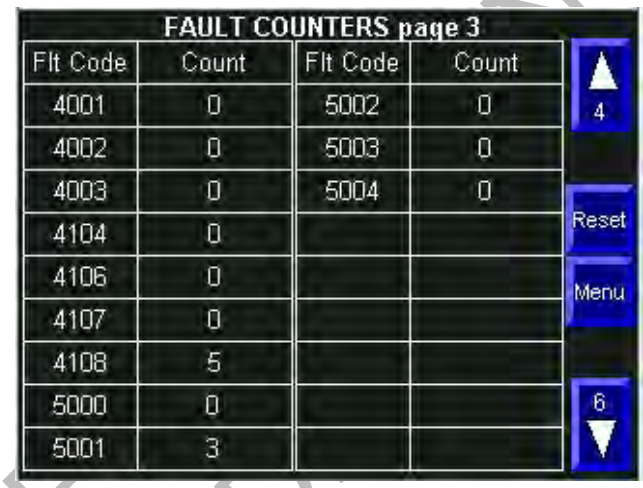
The maintenance time will be reset by a qualified field service technician once the factory maintenance service is performed.

VFD Power Run time and SN are used for VFD troubleshooting. IP addresses for PLC and HMI can be checked by pressing IP Addr. button on the left.

Press the down arrow to access History3, History4 and History5 screens which provide additional fault counter data.



HISTORY3 AND HISTORY4 SCREENS



HISTORY5 SCREEN

The History6 screen displays the history of the recent VFD status changes with a related fault code in order of occurrence (from 1 to 99). Press the left or right arrows on the screen to scroll through the histories. Click the VFD status code to check the description of VFD state. A pop-up window will appear. Close the window by pressing the "X" button on the right upper corner. Additional data on VFD is also displayed for troubleshooting the VFD related problems.

HISTORY6 SCREEN AND VFD STATE WINDOW

1.8 Reset

Press Reset Faults button from the Menu screen to access the Reset screen. When the blower stops with a fault, press the Reset button on this screen to reset the fault after troubleshooting. The Main screen is displayed after the Reset procedure is complete.

Pressing the Lamp Check button will illuminate the Run, Stop and Reset buttons at any time whether the blower running or not.

The Horn Disabled button can be pressed to silence the horn (if equipped) while troubleshooting a fault.

RESET SCREEN

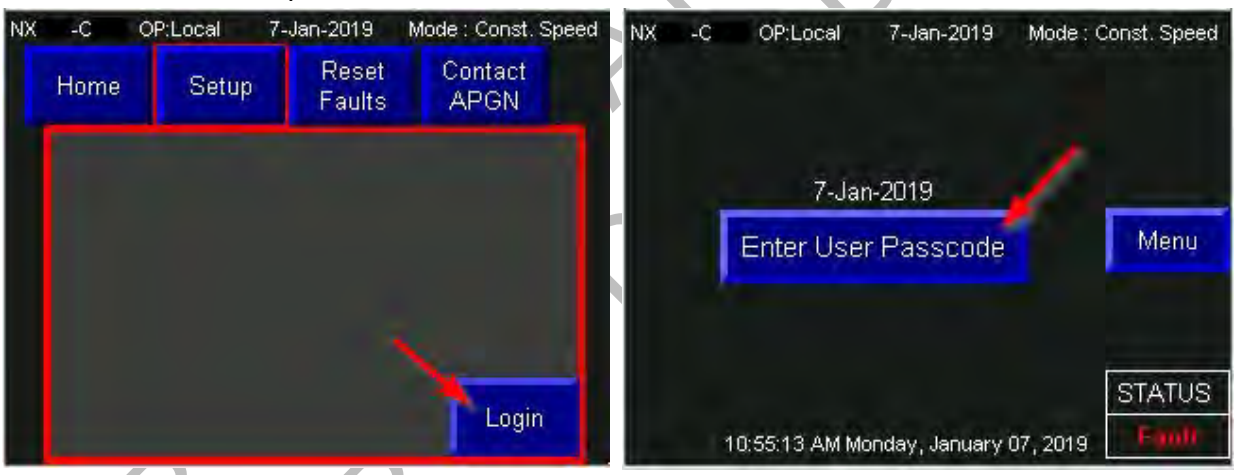
1.9 Contact APGN

Press Contact APGN button from the Menu screen to display the point of contact information for inquiries. Click on the region icon to have contact info for each region (Canada, USA or UK).

CONTACT APGN SCREEN

1.10 Menu - Setup

Press Setup button from the Menu screen then press Login button. Enter a proper password to access the Menu - Setup screen at each level.



ENTERING PASSWORD

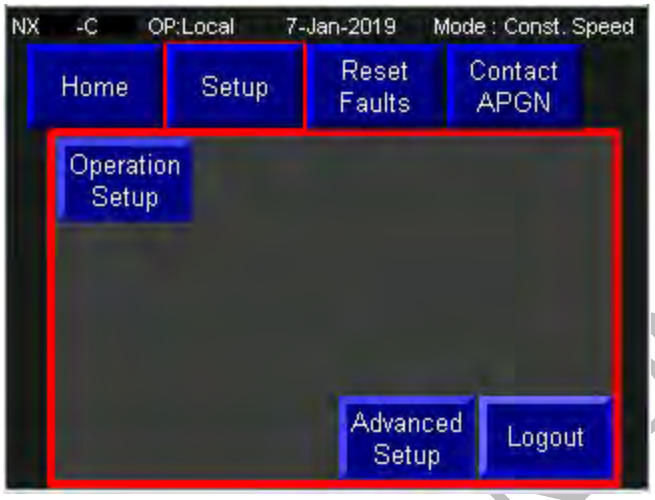
Passwords are entered according to a three-tiered system:

- User password - Allows basic operation and maintenance. This level is set at the factory default of 1234.
- Admin password - Allows higher level user configurations but does not allow operators into Control Setup. This level is set at the factory default of 5678.
- Tech password - Allows full access to all levels including Control Setup. Password is generated based on date and changes each day.

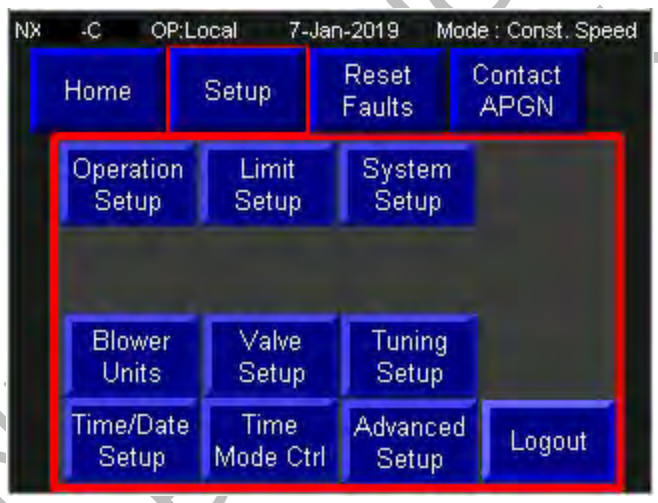
Note: Tech password is for use only by factory certified technicians or under the supervision of factory personnel.

Press Menu button on the screen after entering a password. Menu - Setup screen offers operation, system and control setup options at each blower operating level.

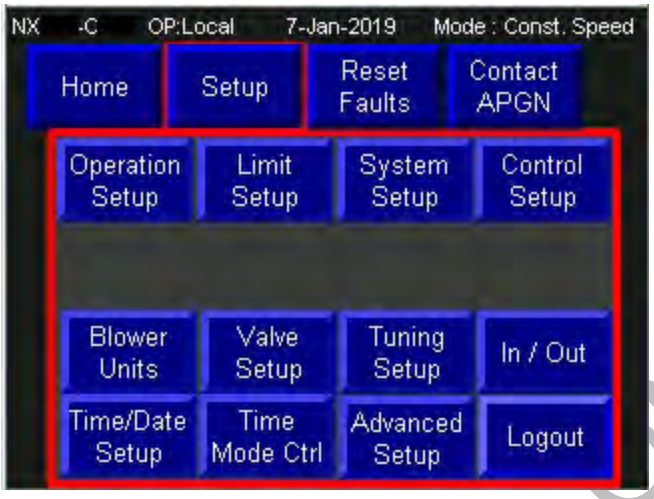
The following screens show the Menu - Setup screen at each password level.



MENU - SETUP SCREEN AT USER LEVEL



MENU - SETUP SCREEN AT ADMIN LEVEL

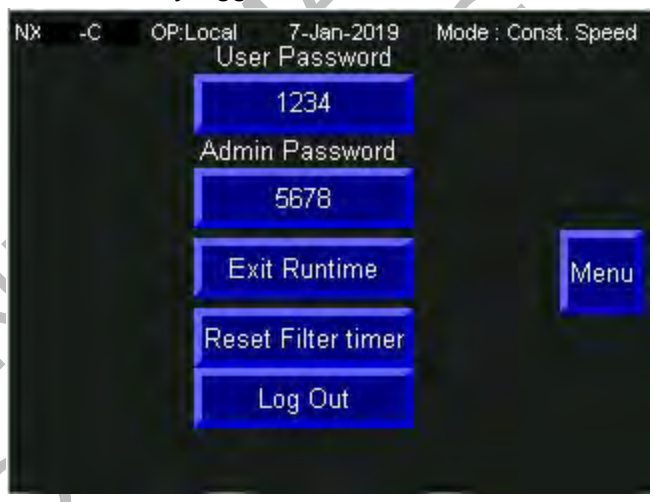


MENU - SETUP SCREEN AT TECH LEVEL

1.11 Advanced Setup

Press Advanced Setup button from the Menu - Setup screen. The Advanced Setup screen offers password control and filter timer reset to an operator when required.

Any level of password can be manually logged out from this screen.



ADVANCED SETUP SCREEN

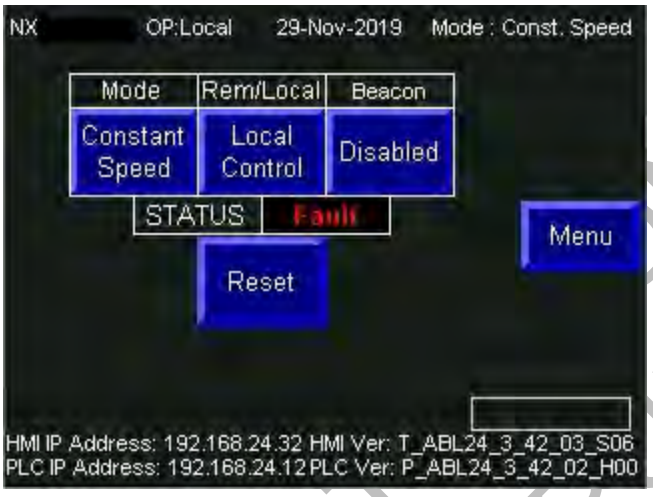
- User Password – Sets the User password.
- Admin Password – Sets the Administrator password.
- Exit Runtime - Changes the touch screen to configuration mode. This option is only available at tech level.
- Reset Filter timer - Allows the operator to reset the filter timer after replacing filters.
- Log Out - Allows the operator to log out after completing tasks.

Note: It is recommended the operator always logs out after completing tasks.

1.12 Operation Setup

The Operation Setup screen is designed to give an operator access to blower operation and control mode. The current IP addresses and program versions are also displayed at the bottom of screen.

Note: Mode and Beacon options are only available at admin level.



OPERATION SETUP SCREEN

Mode selects the operation mode from Constant Speed, Constant Flow, Constant Pressure and DO Control (this parameter cannot be changed while the unit is in operation).

Remote/Local selects the control method. Local Control, Ethernet/IP Control, Remote TB Control, Remote TB/TS SPD Control (TB – Turbo Blower, TS – Touch Screen, SPD - Speed) and Modbus TCP Control are available options. It cannot be changed while the unit is in operation.

- Local Control: blower is fully controlled via the local control panel by entering the percent command on the touch screen and using the Start and Stop buttons.
- Remote Control: blower is controlled from a remote terminal (MCP or SCADA).
  - Ethernet/IP Control (Ethernet TCP/IP communication): local Start/Stop buttons and speed command (on the blower's touch screen) are disabled. Instead, they are issued over the Ethernet network from a remote terminal.
  - Remote TB Control

    START/STOP - remote hardwired signals from remote terminal such as SCADA (digital input - 24 VDC).

    Speed command - remote hardwired signal from remote terminal (analog input - 4-20 mA).
  - Remote TB/TS SPD Control

    START/STOP - remote hardwired signals from remote terminal such as SCADA (digital input - 24 VDC).

    Speed command - specified on the blower's touch screen
  - Modbus TCP Control (Ethernet TCP/IP communication): local Start/Stop buttons and speed command (on the blower's touch screen) are disabled. Instead, they are

issued over the Ethernet network from a remote terminal.

Beacon is used to enable or disable the beacon. If the blower is not equipped with a beacon, select Disabled.

Press Reset button to access the Reset screen.

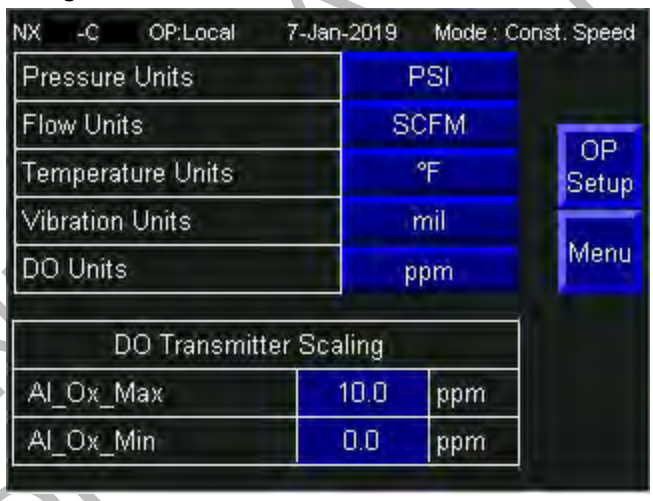
1.12.1 Blower Units

The measurement units for each variable can be selected from this screen. All available unit options for each variable are shown in the following table:

Variable	Unit 1	Unit 2	Unit 3	Unit 4
Pressure	kgf/cm2	kPa	Bar	PSI
Flow	m3/min	Nm3/min	CFM	SCFM
Temperature	°C	°F		
Vibration	um	mil		
DO	ppm	mg/L		

Note: At admin level, the unit can be changed by clicking the measurement unit on Blower 3D, Main and Monitor screens.

The DO input transmitter range is also shown on this screen.

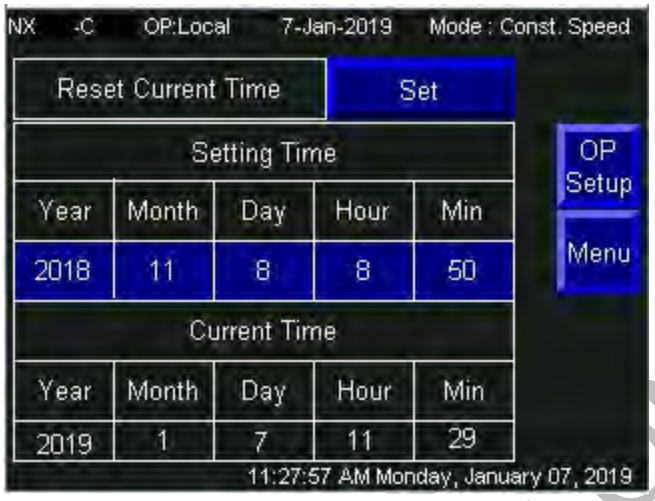


BLOWER UNITS SCREEN

1.12.2 Time/Date Setup

In order to have accurate fault recording data, the PLC internal time clock is synchronized with the touch screen time clock. Both are set simultaneously from this screen.

Enter the new time in the Setting Time inputs. Then Push the "Set" button and the new time and date are loaded into the touch screen and PLC. The Current Time displays the PLC internal clock. It may take up to 15 seconds for the change to take effect. The hours are in 24 hour format and the am/pm notation is not needed.



TIME/DATE SETUP SCREEN

1.12.3 Valve Setup

The discharge or inlet valves equipped with electric actuators can be controlled from this screen. Select a desired valve setup to configure the valve control.

VALVE SETUP SCREEN

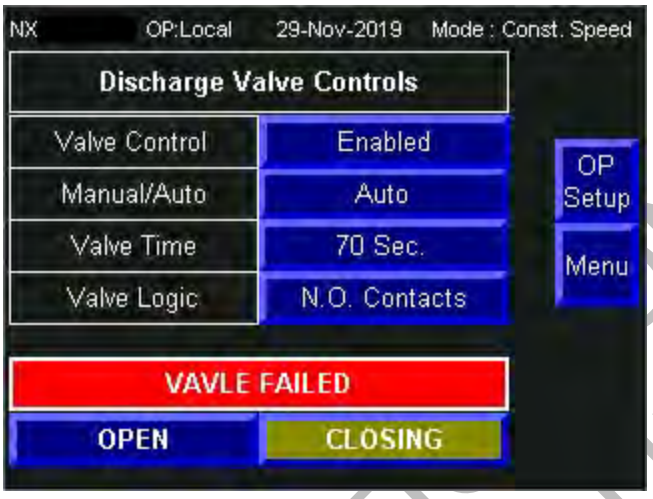
- Valve Control - enable or disable the valve controls.
- Manual/Auto - select Auto or Manual valve controls.
- Valve Time - adjust the time setting on the valve fail logic.
- Valve Logic - select the type of valve control feedback.

The status of valve is displayed in one of three conditions (Fully Open, Fully Closed or In Travel). If the status is not displayed or stays in travel for an extended period of time, a fault will occur.

The Open and Close buttons are used to control the valves manually.

Discharge Valve Controls

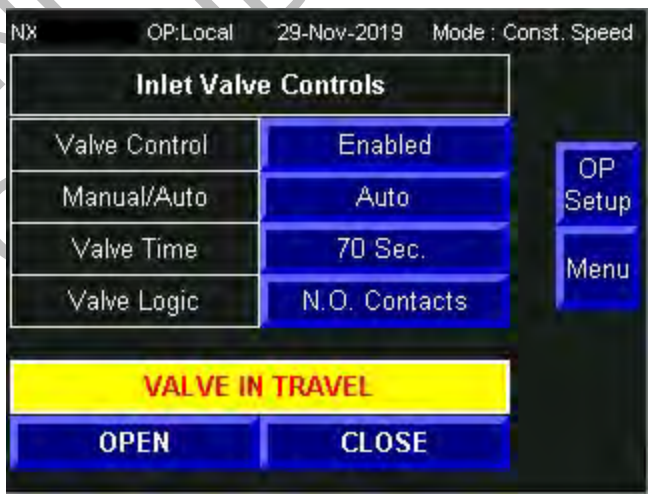
With the valve control Enabled and in Auto - when the blower start command is issued the discharge valve is commanded open. This allows the valve to travel open while the blower is accelerating up to warm speed and the blow-off valve is open. The blow-off valve will not close until the valve is indicating fully open. When the blower stops, a close valve command is issued to close the valve. A fault will occur if the valve is failed to open or close within the specified valve time.



DISCHARGE VALVE CONTROL SCREEN

Inlet Valve Controls

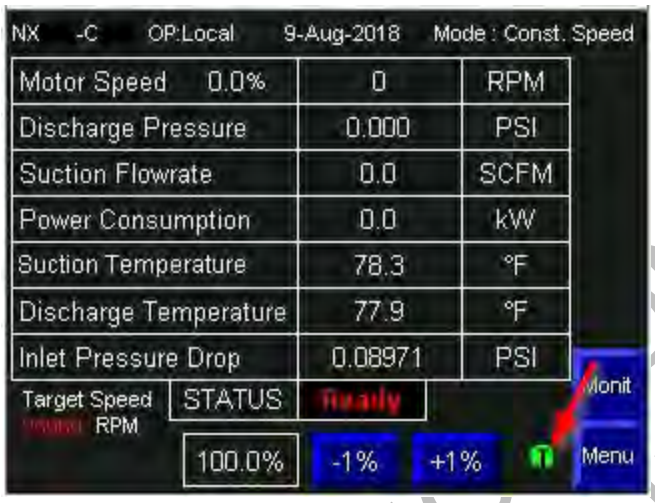
With the valve control Enabled and in Auto - when the blower start command is issued the inlet valve is commanded open. This allows the valve to travel open while the blower is still in Ready status. The blower will not start until the valve is indicating fully open. When the blower stops, a close valve command is issued to close the valve. A fault will occur if the valve is failed to open or close within the specified valve time.



INLET VALVE CONTROL SCREEN

1.12.4 Time Control

Time Control sets the blower operation for a specified running duration. If the blower is running on the Time Control mode, an icon will appear on the next to command input in the Main screen.



MAIN SCREEN SHOWING TIME CONTROL MODE

In the example below, the blower runs during period 1 (at 13:00 hours or 1PM) at 100%, period 2 (at 14:00 hours or 2PM) at 99%, and stops during period 3 (at 15:00 hours or 3PM) and so on. From 8PM as shown in period 8 to 1PM as shown in period 1 (next day), the blower will run for a total of 17 hours at 95%.

- Time Control: enable or disable the time control.
- Period: display the order.
- Time Set: input the time for the operation. The unit is in hours (24h).
- CMD: input the target command (%) of the blower when the blower is running.
- ON/OFF: select the run or the stop of the blower at the assigned time.

TIME CONTROL SCREEN

Note: If the Start button is pressed during the Time Control, a warning message "In processing for Time mode" will be displayed.

TIME CONTROL WARNING

1.12.5 Tuning Setup

When a blower is to be running on the operation modes other than constant speed, Tuning Setup screen can be used for the desired operation mode. It provides access to the tuning parameters without having to go to the Control parameters thereby making tuning easier and more intuitive.

All three tuning screens work the same way - the user enters the setpoint percentage which is used to calculate the target value. The user then enters the deadband (DB) percentage and the PLC calculates the DB low limit and DB high limit. Using the formulas:

- DB Lo Lim = Target Value - DB% * Target Value
- DB Hi Lim = Target Value + DB% * Target Value

The adjustment is how much of a speed change the blower will make if the actual is not within the DB high and low limits. The sample time determines how often the blower will make an adjustment.

In the Flow Control Tuning screen shown below, every 5 seconds the blower will check to see if the actual flow is between the DB Lo Lim and the DB Hi Lim. If it is then it will do nothing. If the flow is lower than the low limit it will increase the blower speed by 100 RPM . If the flow is higher than the DB Hi Lim then it will decrease the blower speed by 100 RPM. It will then repeat this every 5 seconds as long as the blower is in Flow control mode.

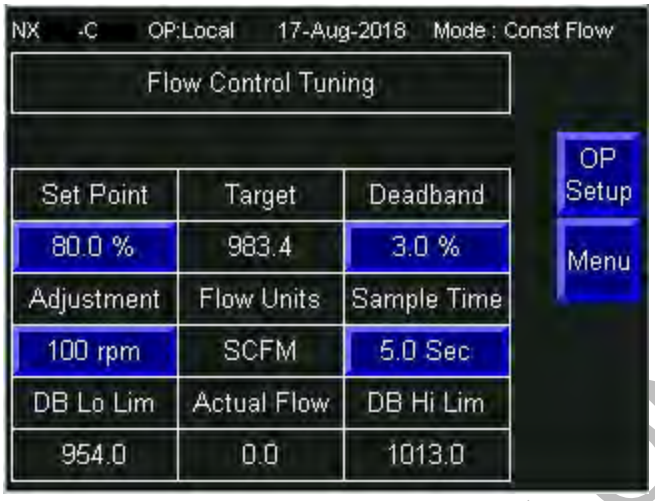
Increasing the adjustment will get a faster return to limits however too much will cause an overshoot and can cause the process to be unstable. Decreasing the sample time will also get a faster return to limits however, if the sample time is faster than the system can change, it will cause an overshoot and can cause the process to be unstable. It works the same way for pressure and DO control.

Flow Control Tuning - The flow control setpoint is in percent of the machine rated flow. The user enters the percentage setpoint (0 to 100) and the PLC calculates the target value using the formula: Target Value = (SP% * QRate * TICR)

- QRate is one of the control parameters
- TICR is a temperature compressibility factor

Thus the maximum flow rate is adjusted for temperature.

To determine the maximum flow rate at any given time, divide target by the setpoint and multiply by 100. Typical flow control sample times vary from 2 to 15 seconds. The adjustment RPM will vary with blower size; larger blowers will need smaller adjustments.

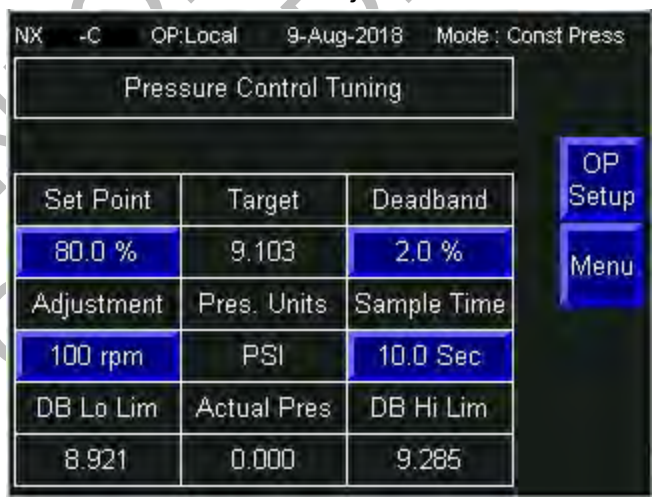


FLOW CONTROL TUNING

Pressure Control Tuning - The pressure control setpoint is in percent of the machine rated output pressure PD Rate. The user enters the percentage setpoint (0 to 100) and the PLC calculates the target value using the formula: Target Value = (SP% * PD_Rate).

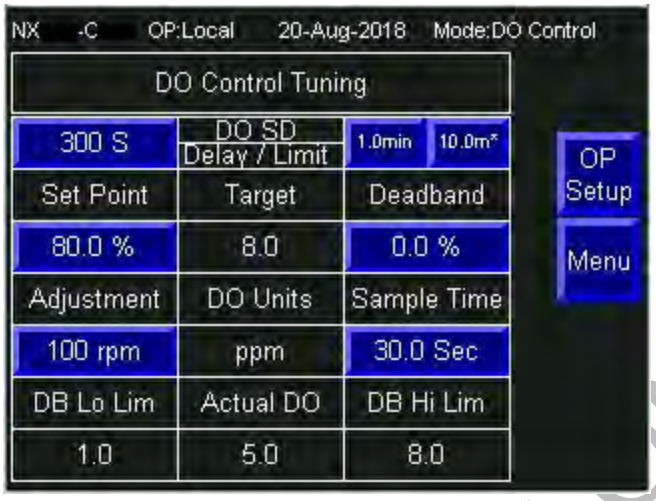
PD Rate is set in the control parameters and is listed in the model number. If the blower is a C060 then PD_Rate is 0.6 kgf/cm2 or 8.534 psi. If the blower is a C070 then PD Rate is 0.7kgf/cm2 or 9.956 psi.

Typical pressure control sample times vary from 5 to 30 seconds depending on the header size and length. Bigger headers will take longer to realize a pressure change. The adjustment RPM will vary with blower size; larger blowers will need smaller adjustments.



PRESSURE CONTROL TUNING

DO Control Tuning - The DO control setpoint is in percent of the range of the DO input signal. The user can set the range of the DO transmitter in this screen or the Units screen. The user enters the percentage setpoint (0 to 100) and the PLC calculates the target value using the formula: Target Value =(SP% * DO_Range).



DO CONTROL TUNING

For example, if the range of the DO transmitter is 0 to 10 ppm and the setpoint is 30% then the target value is 3 ppm. Typical DO control sample times vary from 30 to 900 seconds depending on the size of the basin and how far downstream the DO sensor is. Larger basins will take longer to react and will require longer sample times. The DO control will double the adjustment if the actual DO is out of limits more than twice the deadband.

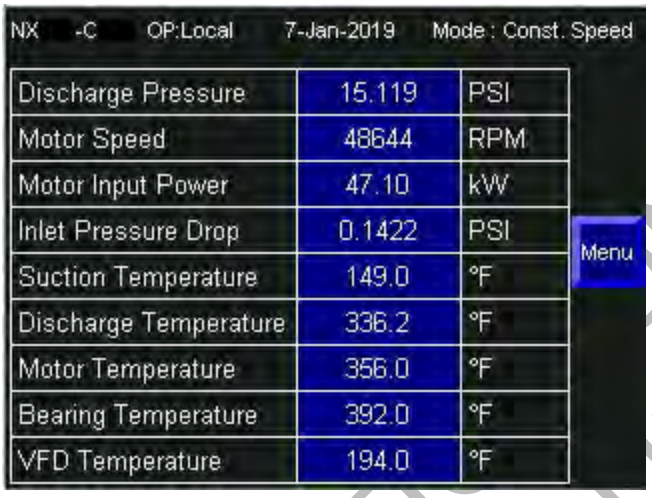
1.13 Limitation Setup

The Limitation Setup sets limits to parameters such as discharge pressure, motor speed, motor input power, inlet pressure drop and temperature. If any of these parameters exceed its predefined limit while the blower is running, the blower will stop with a fault. The corresponding fault code and the message will then be displayed on the Blower 3D and Main screens.

The Limitation Setup screen requires an Admin password to view and a Tech password to make any setpoint changes.

- Discharge Pressure - The limitation value of the discharge pressure. The blower stops with a fault when the discharge pressure is higher than this value.
- Motor Speed - The limitation value of the motor speed. The blower stops with a fault when the motor speed is higher than this value.
- Motor Input Power - The limitation value of the motor input power. The blower stops with a fault when the motor input power is higher than this value.
- Inlet Pressure Drop - The limitation value of the inlet pressure drop. The blower stops with a fault when the differential pressure of the inlet is higher than this value. This fault normally occurs when the filter is blocked with dust or debris.
- Suction Temperature - The limitation value of the temperature of the suctioned air. The blower stops with a fault when the suction temperature is higher than this value. This fault normally occurs when the room temperature (or suction temperature if direct piped) is high.
- Discharge Temperature - The limitation value of the temperature of the discharged air. The blower stops with a fault when the discharge temperature is higher than this value.
- Motor Temperature - The limitation value of the motor temperature. The blower stops with a fault when the motor temperature is higher than this value.

- Bearing Temperature - The limitation value of the bearing temperature. The blower stops with a fault when the bearing temperature is higher than this value. The fault normally occurs when the thrust bearing fails.
- VFD Temperature (Inverter temperature) - The limitation value of the VFD temperature. The blower stops with a fault when the VFD temperature is higher than this value.



LIMITATION SETUP SCREEN

Note:The limitation values are set depending on the blower model and operating condition.

If a site is not using SCADA recording of blowers, the operating log sheet (normally included in blower O&M manual) can be used to track trends of critical parameters. This trend analysis should be set to track trends in blower operations and to set limitation values.

Record the following running values											
Date: Month: Year:	Motor speed (RPM)	Motor temperature (°F)	Suction flow rate (SCFM)	Suction temperature (°F)	Discharge pressure (PSI)	Discharge temperature (°F)	Filter pressure drop (PSI)	Bearing temperature (°F)	Power consumption (kW)	Rotor vibration (mil)	VFD temperature (°F)
1st											
2nd											
3rd											
4th											
5th											
6th											
7th											
8th											
9th											
10th											
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22nd											
23rd											
24th											
25th											
26th											
27th											
28th											
29th											
30th											
31st											

OPERATING LOG SHEET

1.14 System Setup

The System Setup screens are designed to give an operator access to blower system monitoring. System Setup screens require an Admin password to view and a Tech password to make changes.

SYSTEM SETUP SCREEN

- MCP Unit Change – The selection of MCP units. There are two types of units: Metric or English unit systems. The following formulas are applied in unit conversions.

Arguments	Symbols	Metric	English	Conversion Factor	Variables
Suction Pressure	ΔP_i	kPa	PSI	PSI=0.1450377*kPa	
Discharge Pressure	P_d	kgf/cm^2	PSI	PSI=14.22334* kgf/cm^2	
Temperature	T	°C	°F	°F = 1.8 *°C +32	Ti, Ts, Td, Tb, Tm
Suction Flow Rate	Q	m^3/min	CFM	CFM=35.31467* m^3/min	Q0, Qrate, Kq
Rotor Vibration	Xm	µm	mil	mil=0.03937008*µm	
Surge Airflow Gain	Ks	(m^3/min)/(kgf/cm^2)	CFM/PSI	(m^3/min)/(kgf/cm^2)= 2.483008914* (CFM/PSI)	
Motor Input Power	W_m	kW	kW		Wm_Max
Motor Speed	N_1	rpm	rpm		
Time		sec	sec		
Time		hr	hr		
Current		mA	mA		

- Power Mode – The power limitation mode. It is applied when Use is selected and ignored when None is selected.
- Sensor Limit Stop - The display for selecting dPi (inlet pressure drop), Tm (motor temperature), Tb (bearing temperature), Xm (vibration), Ts (suction temperature), Td (discharge temperature) and Ps (ambient pressure) are used to create a fault condition. When On is selected, the unit will trip off and a fault will occur when one of the sensors exceeds its control parameters. Select Off to disable the fault condition.

Press the down arrow on the screen. The following shows the next screen. It is used for Remote Control Setup.

SECOND LEVEL OF SYSTEM SETUP SCREEN

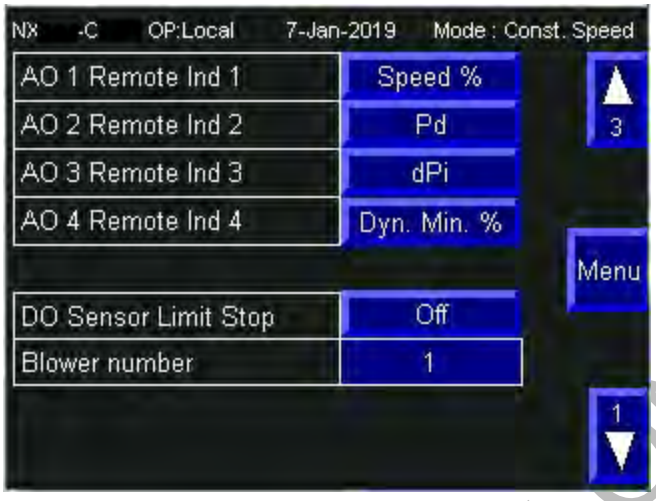
- Run Signal to Remote - Sends the Run signal to the remote terminals from start until stopped when Stable is selected. Sends the Run signal to the remote terminals when the blow-off valve is closed if Start is selected.
- Auto Return to Ready – Enables the PLC to automatically reset the alarms once power is restored after a power failure. The VFD may trip on nuisance alarms during a failure. If the auto reset is successful, the blower will be in Ready status.
- Control Type – Indicates if permanent start (2-wire), momentary start or momentary stop commands are used (3-wire).
- Auto Restart in Local - Enables the PLC to automatically restart the blower once automatic reset is performed. The blower must be controlled in local to use this function.
- MCP Heartbeat Stop – Shuts the blower if the heartbeat signal has not changed for more than five seconds.
- MCP Heartbeat Warning - Allows plants who are not using the MCP Heartbeat to shut off the warning when in TCP control mode.
- MCP Heartbeat Timeout - Allows systems with heavy network traffic and slower master controllers to open up the fault time and avoid nuisance trips. Factory default setting will be five seconds. Recommended range is five to thirty seconds.
- Auto Reset Delay - The amount of time the PLC waits after a power failure before attempting an automatic reset. The default is 60 seconds.

Press the down arrow on the screen. The following is the next screen.

THIRD LEVEL OF SYSTEM SETUP SCREEN

- PMR Monitor – Enables or disables the PMR (phase monitoring relay) monitor alarms and warnings. If the blower is not equipped with a PMR monitor, select Disabled.
- Surge Control - Indicates the surge mode. This parameter cannot be changed while the unit is in operation.
  - No Protection – it does not stop automatically even if the blower runs in a surge condition.
  - Surge Stop – a fault occurs and the blower stops when the blower runs in a surge condition.
  - Surge Boundary – the blower tries to adjust the speed of the blower to keep the unit out of the surge area. If a surge occurs, the blower will stop and a fault will occur.
  - BOV Open – the blower opens the blow-off valve (BOV) for a pre-programmed time then closes the BOV and tries to operate again.
- Horsepower - Select the horsepower of the current model. This parameter cannot be changed while the unit is in operation.
- Compressor Model - Displays the compressor model of the blower.
- NX-NC - Specifies the blower compressor type.
- UPS Monitor - Enables or disables the UPS (uninterrupted power supply) monitor alarms and warnings. If the blower is not equipped with a UPS monitor, select Disabled.
- LVSP Monitor - Enables or disables the LVSP (low voltage surge protection) monitor alarms and warnings. If the blower is not equipped with a LVSP monitor, select Disabled.
- SPD Monitor - Enables or disables the SPD (surge protection device) monitor alarms and warnings. If the blower is not equipped with a SPD monitor, select Disabled.

Press the down arrow on the screen. The following is the next screen.

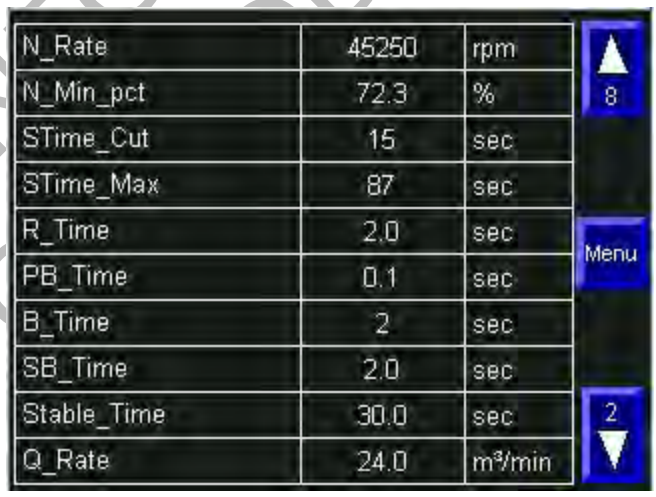


FOURTH LEVEL OF SYSTEM SETUP SCREEN

- AO "x" Remote Ind “x” - Designates the analog output function, i.e. speed, discharge pressure, suction flow rate, motor power, inlet pressure drop, suction temperature or discharge temperature. Each AO is pre-wired to be used if SCADA needs to access the process data through a remote terminal.
- DO Sensor Limit Stop - When On is selected, the warning message about the DO sensor is displayed if there is a connection problem.
- Blower Number - Sets a blower identification number.

1.15 Control Setup

The Control Setup screens are designed to give an operator access to blower control parameters. A Tech password is required to access Control Setup screens.



CONTROL SETUP SCREEN

- N_Rate - Rated motor speed. One hundred percent of motor speed based on the suction temperature of 20°C (68°F).
- N_Min_pct – The minimum value in percentage of the motor speed. To prevent a surge occurrence be careful not to input the motor speed lower than this value.

- STime_Cut – The time limitation to reach 5000 RPM. The blower stops and the fault occurs if the motor does not reach more than 5000 RPM within this time frame after the Run button is pressed.
- STime_Max – The time limitation of overall start operation. The blower stops and the fault occurs if the starting process is not finished within this allowed time after the Run button is pressed.
- R_Time – The time to reset an alarm before returning to Ready status.
- PB_Time – The waiting time before closing the blow-off valve after reaching the value of BOV_pct control parameter.
- B_Time – The waiting time prior to moving towards the target speed after closing the blow-off valve.
- SB_Time – The waiting time until the VFD stops after opening the blow-off valve during a stop.
- Stable_Time - Constant speed duration after closing the blow-off valve at the start.
- Q_Rate - Rated air flow rate in Constant Flow mode.

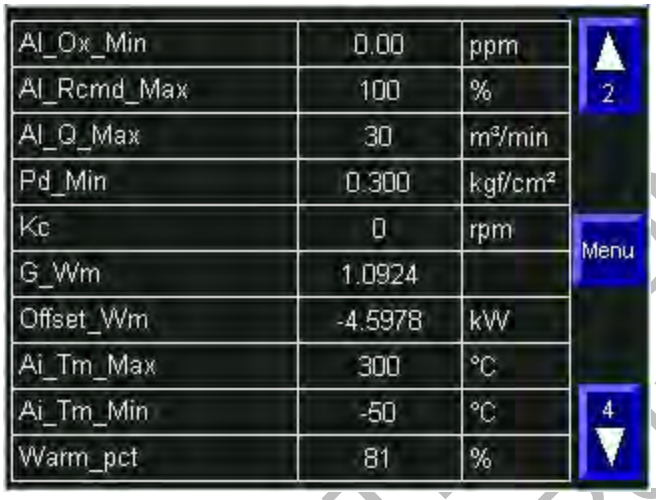
Press the down arrow on the screen. The following is the next screen.

SECOND LEVEL OF CONTROL SETUP SCREEN

- Qo - x-intercept of surge line.
- Ka - Speed modification rate for preventing a surge in Surge Boundary mode. Speed change is fixed as Kc in case Ka is zero.
- Ns_hys – The set speed tolerance. It is typically set at 100 RPM. It is related to the speed of the blow-off valve closure.
- BOV_pct – The speed percentage to close the blow-off valve.
- AI_Pd_Max - The discharge pressure corresponding to 20mA when using the current signal of 4~20mA. It is set to 1 when the maximum value of the sensor is 1 kg_f/cm^2 (14.2233 PSI) or 1.5 in case it is 1.5 kg_f/cm^2 (21.335 PSI).
- AI_Wm_Max - Motor input power corresponding to 20mA when using the current signal of 4~20mA.
- AI_Xm_Max - Shaft vibration corresponding to 20mA when using the current signal of 4~20mA.
- AI_P1_Max - The ambient pressure corresponding to 20mA when using the current signal of 4~20mA.

- AI_Pi_Max - The inlet pressure drop corresponding to 20mA when using the current signal of 4~20mA.
- AI_Ox_Max - Dissolved oxygen (DO) corresponding to 20mA when using the current signal of 4~20mA.

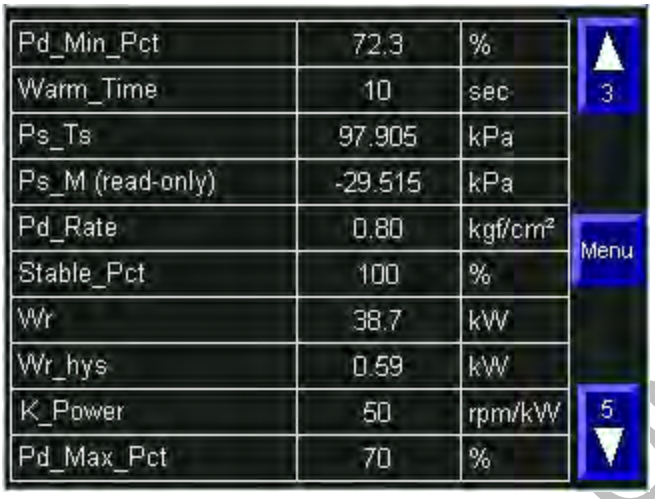
Press the down arrow on the screen. The following is the next screen.



THIRD LEVEL OF CONTROL SETUP SCREEN

- AI_Ox_Min - Dissolved oxygen (DO) corresponding to 4mA when using the current signal of 4~20mA.
- AI_Rcmd_Max - Not used (100 is used in the controller).
- AI_Q_Max - Air flow rate corresponding to 20mA when using the current signal of 4~20mA.
- Pd_Min – The minimum discharge pressure at the motor speed of 100%. The low pressure may result in bearing failure. Normally 0.3 kg_f/cm^2 (4.267 PSI) is set; the minimum pressure for other speed is proportional to the square of the speed.
- Kc - Speed change for preventing a surge when Ka is 0 (Surge Boundary mode).
- G_Wm - Gain for correction of motor input power (Wm).
- Offset_Wm - Offset value for correction of motor input power (Wm).
- Ai_Tm_Max - Motor temperature corresponding to 20mA when using the current signal of 4~20mA.
- Ai_Tm_Min - Motor temperature corresponding to 4mA when using the current signal of 4~20mA.
- Warm_pct - Warm-up speed at the start.

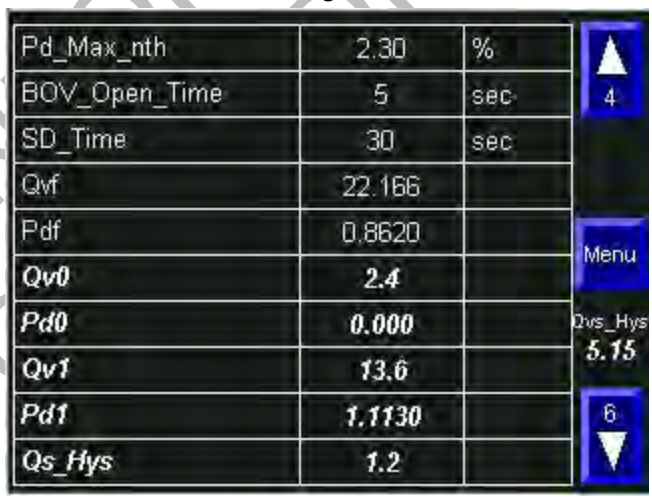
Press the down arrow on the screen. The following is the next screen.



FOURTH LEVEL OF CONTROL SETUP SCREEN

- Pd_Min_Pct - The minimum discharge pressure limit check running percentage value.
- Warm_Time - Warm-up time at the start.
- Ps_Ts - Ambient pressure of operation site.
- Pd_Rate - Rated discharge pressure in Constant Pressure mode.
- Stable_Pct - Stable motor speed after closing the blow-off valve at the start.
- Wr - Base power on Power Limitation mode.
- Wr_hys - Tolerance in base power on Power Limitation mode.
- K_Power - Speed correction factor on Power Limitation mode.
- Pd_Max_Pct - The maximum discharge pressure limit check running percentage value.

Press the down arrow on the screen. The following is the next screen.

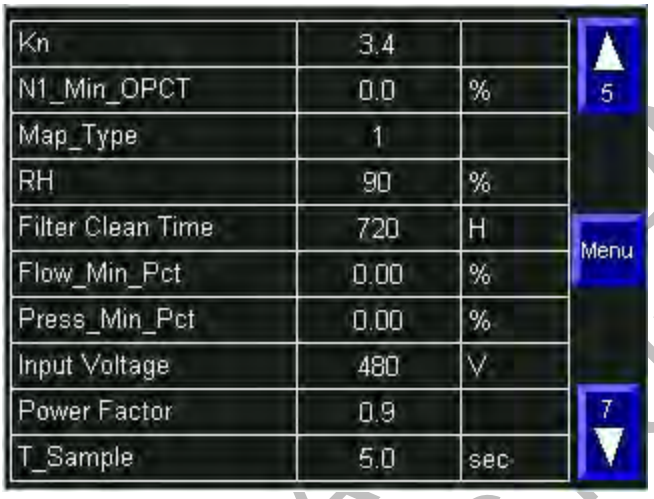


FIFTH LEVEL OF CONTROL SETUP SCREEN

- Pd_Max_nth - The maximum discharge pressure value calculation to be used as nth value.
- BOV_Open_Time - The amount of time the BOV is open in Surge Mode BOV Open.
- SD_Time - The waiting time before a Restart is available after a stop.
- Qvf - The factor of the flow rate on the performance map.
- Pdf - The factor of the discharge pressure on the performance map.

- Qv0 - The flow rate at the low point of the surge line.
- Pd0 - The discharge pressure at the low point of the surge line.
- Qv1 - The flow rate at the high point of the surge line.
- Pd1 - The discharge pressure at the high point of the surge line.
- Qs_Hys - The flow rate offset for the surge boundary, this method uses the flow rate to compare the surge point.

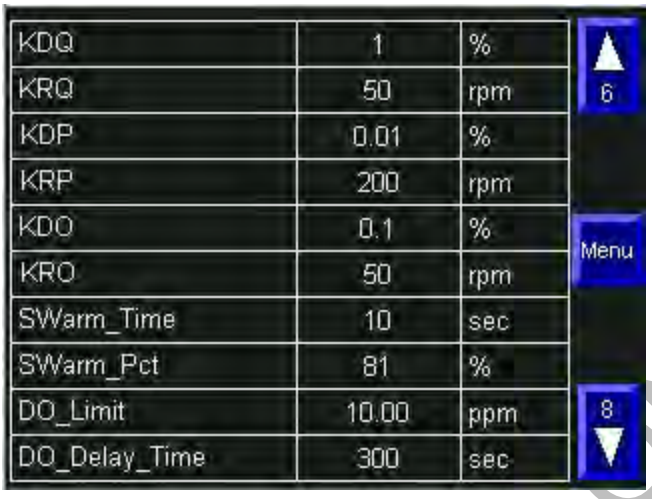
Press the down arrow on the screen. The following is the next screen.



SIXTH LEVEL OF CONTROL SETUP SCREEN

- Kn - The flow rate offset for the real surge line.
- N1_Min_OPCT - The upper offset that is larger than the speed making the BOV Open.
- Map_Type - The model type number (0 - 4) for the performance map.
- RH - Annual average humidity.
- Filter Clean Time – The time elapsed (in hours) before a warning message is displayed to clean the filters. The default is 720 (blower running) hours which is approximately 30 days (1 month) and it can be changed depending on site conditions.
- Flow_Min_Pct – The minimum flow percentage setpoint when the blower is operating in Constant Pressure mode.
- Press_Min_Pct – The minimum discharge pressure setpoint when the blower is operating in Constant Flow mode.
- Input Voltage – The line to line (RMS) input voltage for blower.
- Power Factor – The power factor for calculating the power consumption of the blower.
- T_Sample – The sample time for the step controller. (A step controller can be implemented for Pressure, Flow or DO Control.)

Press the down arrow on the screen. The following is the next screen.



SEVENTH LEVEL OF CONTROL SETUP SCREEN

- KDQ – The flow rate deadband range (in percentage) when the blower is operating in Constant Flow mode.
- KRQ – The speed adjustment (in RPM) when the blower is operating in Constant Flow mode.
- KDP - The discharge pressure deadband range (in percentage) when the blower is operating in Constant Pressure mode.
- KRP - The speed adjustment (in RPM) when the blower is operating in Constant Pressure mode.
- KDO - The dissolved oxygen (DO) deadband range (in percentage) when the blower is operating in DO Control mode.
- KRO - The speed adjustment (in RPM) when the blower is operating in DO Control mode.
- SWarm_Time – The amount of the time the blower is kept running at SWarm_Pct.
- SWarm_Pct – The speed decrease calculated by percentage at which the blower slows down before shutting down.
- DO_Limit – The maximum limit of dissolved oxygen (DO). Once this upper limit is reached, the blower stops.
- DO_Delay_Time – The amount of time the PLC waits before re-starting a blower once the actual DO level in the basin has dropped below the required DO level setpoint.

Press the down arrow on the screen. The following is the next screen.

EIGHTH LEVEL OF CONTROL SETUP SCREEN

- Auto Reset Delay - The amount of time the PLC waits after a power failure before attempting an automatic reset. The default is 60 seconds.
- Auto Reset LO Time - The lock-out (LO) time within which Auto Reset is allowed.
- Auto Reset Retries - The maximum number of auto resets with the lock out time.
- Change_Filter_Count - The number of filter cleaning intervals before the filter change is required.
- HF_Delay - The amount of time the PLC waits to couple the harmonic filter capacitor bank after the blower has reached full speed.
- UPS_Fail_Delay - The amount of time the PLC waits to display a warning message after UPS is on battery mode.
- Ps_Ts_Min - The lower limit for the ambient pressure. (Generally 85 kPa is set.)
- Ps_Ts_Max - The upper limit for the ambient pressure. (Generally 115 kPa is set.)

2. Warning

A warning occurs when the value of the parameter falls between 95% and 100% (condition of fault occurrence) of a sensor limitation value. The warning code with a message is displayed on the top of the screen while the blower is running.

SAMPLE WARNING MESSAGE

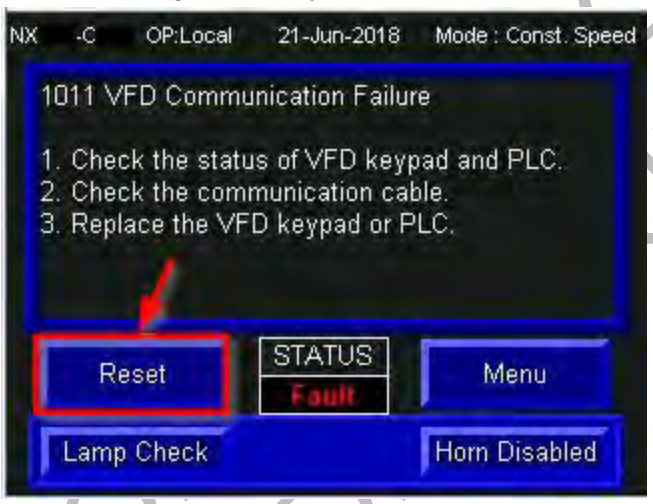
The warning message automatically disappears when the actual sensor value drops below 95% of the set level. The warning needs to be resolved to prevent the blower from stopping with a fault. Refer to Advanced Troubleshooting section in O&M manual for troubleshooting the warning.

3. Fault

The blower stops when a fault occurs, and the fault code with a message is displayed on the Main and Blower 3D screens.

SAMPLE FAULT MESSAGE

The reset screen is displayed when the Reset button is pressed on the Menu or Blower 3D screen. A detailed description of the fault message is displayed.



FAULT MESSAGE IN THE RESET SCREEN

Press the Reset button on the touch screen or the control panel after troubleshooting. The blower is initialized and its status is set Ready after a self-test is performed. The fault must be resolved in order to re-start the blower without any issues. Refer to Advanced Troubleshooting section in O&M manual for troubleshooting the fault.

c. Instrument List

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Greater New Haven APGN500 BOM

No.	General	TAG	ITEM DESCRIPTION	Manufacturer Part No.	Manufacturer	QT'Y	APGN PART No.
			480 VAC - MAINS SIDE				
1	Main	MCCB	MOLDED CASE CIRCUIT BREAKER 800A, P-FRAME, 65kA, Micrologic 5.0 Trip Unit (LSI) WITH EXTENDED ROTARY HANDLE	PJF36080U33A-RE10	Schneider	1	ELE05015-0003.0
2			Set of Lugs	YA600P5	Schneider	6	ELE00027-0221.0
3		HF	Harmonic Filter with 24VDC Contactor Option	N-738-MAPP0636D(C)	MTE	1	TBD
4		VFD	Variable Frequency Drive, 920A Output, 380-500VAC, Alpha-numeric keypad, IP00, No Choke, 6-pulse, water-cooled with Al heatsink, Option board with 6DI, 1 DO, 2AI, 1AO, +10Vref, 2 +24VM, and High-Speed Module	NXP09205A0N0NWGA1A2+BM37	Vacon	1	TBD
5			Dual-Port Ethernet Communication Card	OPTE9-V	Vacon	1	ELE00011-0038.0
6		SF	SINE WAVE FILTER, 840A, Liquid-Cooled, 320Hz	S3L0840A00-0000	CTM Magnetics	1	TBD
7		MTR1	High-Speed Permanent Magnet Synchronous Motor 350kW with Magnetic Bearings	AB350	SKF	1	TBD
8		MBC	Magnetic Bearing Controller with Wide Input Range board, Modbus RTU RS-485 serial interface, Integrated UPS function	150/8-16_M	SKF	1	TBD
9		THD	THD Board with LEM modules for measuring phase currents, voltage to motor	289 PCB	SKF	1	TBD
10		W1 W2	Cable with quick connectors 42-pin to 38-pin, from MBC to Motor, 3m	TBD	SKF	2	TBD
11	Accessories Feeder	FU1	LPJ Time-Delay Fuse Class J, 35A, 600VAC	LPJ35SP	Eaton (Bussman)	3	ELE00018-0068.0
12			Fuse Holder for Class J fuses, Fingersafe	CH60J3I	Eaton (Bussman)	1	ELE00018-0069.0
13		PDB	Power Distribution Block, Fingersafe, 1 Line in range 350-#6 / 2/0-#14, 8 Load Connections #8-#14	FSPDB3C	Mersen	3	ELE00016-0037.0
14		SPD1	LINE VOLTAGE SURGE PROTECTOR (LVSP) VPU AC II 3 R 480V/50kA	2591260000	Weidmuller	1	ELE00019-0037.0
15		PMR1	PHASE MONITORING RELAY	3UG4513-1BR20	Siemens	1	ELE00028-0023.0
16	A/C Unit	FU4	Time-Delay Fuse Class CC, 15A, 600VAC	LP-CC-15	Eaton (Bussman)	3	ELE00018-0066.0
17			Fuse Holder for Class CC fuses, Fingersafe, 30A	CHCC3DIU	Eaton (Bussman)	1	ELE00018-0048.0
18		ACU	Air Conditioning Unit, 480V, 60Hz, NEMA 4X, 18000 BT/hr	K3NA6C18DP53LV	Kooltronic	1	ELE00000-0153.0
19	BOV/DV Actuators	FU2	Time-Delay Fuse Class CC, 5A, 600VAC	LP-CC-5	Eaton (Bussman)	3	ELE00018-0070.0
20			Fuse Holder for Class CC fuses, Fingersafe, 30A	CHCC3DIU	Eaton (Bussman)	1	ELE00018-0048.0
21		FU3	Time-Delay Fuse Class CC, 5A, 600VAC	LP-CC-5	Eaton (Bussman)	3	ELE00018-0070.0
22			Fuse Holder for Class CC fuses, Fingersafe, 30A, with Fuse Blown Indicator	CHCC3DIU	Eaton (Bussman)	1	ELE00018-0048.0
23	Transformer	FU5	Time-Delay Fuse Class CC, 7A, 600VAC	FNQ-R-7	Eaton (Bussman)	2	ELE00018-0047.0
24			Fuse Holder for Class CC fuses, Fingersafe, 30A, with Fuse Blown Indicator	CHCC2DIU	Eaton (Bussman)	1	ELE00018-0049.0
25		FU6	time-Delay Fuse Class CC, 20A, 600VAC	FNQ-R-20	Eaton (Bussman)	1	ELE00018-0019.0
26			Fuse Holder for Class CC fuses with Fuse Blown Indicator	CHCC1DIU	Eaton (Bussman)	1	ELE00018-0055.0
27		T1	Transformer 480V primary to 120VAC secondary, 2 kVA	1497B-A13-M14-0-N	Allen-Bradley	1	ELE03017-0004.0
28	Pump	MS2	Motor Starter TeSys Trip range 2.5-4A, 480Y	GV2P08	Schneider	1	ELE00015-0072.0
29		M2	Motor Contactor TeSys D, 24VDC	LC1D09BD	Schneider	1	ELE00028-0057.0
30		MTR2	Cooling Pump Motor (CRI5-4 A-CA-A-E-HQQE 3x230/460 60HZ)	96084445	GOULDS	1	ELE00038-0007.0
31		TBXX	TB3 for Cooling Pump TERMINAL BLOCK	1492-J3	Allen-Bradley	3	ELE00016-0003.0
32			GROUND BLOCK	1492-JG3	Allen-Bradley	1	ELE00016-0004.0
33			SCREWLESS END ANCHOR	1492-ERL35	Allen-Bradley	LOT As Req.	ELE00016-0012.0
34			END BARRIER	1492-EBJ3	Allen-Bradley	LOT As Req.	ELE00016-0016.0
35		IN-FG	IN-FG BUSBAR	8T*40mm (10mm 6POLES, 6mm 2POLES)	NEUROS	1	ELE03023-0003.0
36		EX-FG	EX-FG BUSBAR	8T*40mm (10mm 3POLES, 6mm 2POLES)	NEUROS	1	ELE03023-0001.0
37		SG	SG BUSBAR SET TO THE BLOWER ENCLOSURE BY THE INSULATION POLES	3T*15 mm (5mm 3POLES)	NEUROS	1	ELE00023-0002.0
38			SG BUSBAR Insulator	DCBH-10	NEUROS	2	ELE00023-0004.0
39		TB2 FG / RTB FG	TB for LVSP & CTRL. Universal Ground Bar System 6-port UGB (L= 4.92")	UGB2/0-414-6	PANDUIT	2	ELE00023-0003.0
			120 VAC - MAINS SIDE				
40		SPD2	SURGE PROTECTIVE DEVICE (SPD) VPU AC II 1 R 150V/50kA	2591660000	Weidmuller	1	ELE00019-0038.0
41	PMSM Cooling Fans	MS3	Motor Starter TeSys Trip range 2.5-4A, 480Y	GV2ME08	Schneider	1	ELE00028-0063.0
42		M3	Motor Contactor TeSys D, 24VDC	LC1D09BD	Schneider	1	ELE00028-0057.0
43		FAN1	EC Centrifugal Fan, Backward curved, single inlet w housing flange 120VAC, 50/60Hz, 3.2A	G1G170-AB05-20 (55600.01011)	EBM Papst	1	ELE00039-0021.0
44		MS4	Motor Starter TeSys Trip range 2.5-4A, 480Y	GV2ME08	Schneider	1	ELE00028-0063.0
45		M4	Motor Contactor TeSys D, 24VDC	LC1D09BD	Schneider	1	ELE00028-0057.0
46		FAN2	EC Centrifugal Fan, Backward curved, single inlet w housing flange 120VAC, 50/60Hz, 3.2A	G1G170-AB05-20 (55600.01011)	EBM Papst	1	ELE00039-0021.0
47	Blow-Off Valve	BOV	Electric Actuator, On/Off Duty, 480VAC Power, 24VDC Control, with External Backup	TBD	Rotork	1	TBD
48			Butterfly Valve, Wafer Style, 8", Ductile Iron Body, CF8M Disc, SS 316 STEM and Viton Seat	BF1-125-080-8667	PRATT	1	TBD
49	120 VAC Distribution Terminals	L,N	Feed-through terminal block for 10AWG wire	1492-J4	Allen-Bradley	LOT As Req.	ELE00016-0019.0
50			Terminal Block Center Jumper	1492-CJJ6-10	Allen-Bradley	LOT As Req.	ELE00000-0154.0
51			End Barrier	1492-EBJ3	Allen-Bradley	LOT As Req.	ELE00016-0016.0
52			SCREW END ANCHOR	1492-EAJ35	Allen-Bradley	LOT As Req.	ELE00016-0001.0
			120 VAC - PLC SIDE				
54	For Lights	CB1	CB for Receptacle Bull. 1489-M Miniature CB, 2A, 1-Pole,Curve D,277 VAC.	1489-M1D020	Allen-Bradley	1	ELE00015-0005.0
55	For Receptacle	CB2	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
56	For PWS2	CB3	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
57	For PWS1	CB4	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
58	Panel Lights	LT1	Panel LED Light 90-250 VAC	855L-NX3	Allen-Bradley	1	ELE00000-0017.0
59	Panel Lights	LT2	Panel LED Light 90-250 VAC	855L-NX3	Allen-Bradley	1	ELE00000-0017.0
60	Panel Lights	LT3	Panel LED Light 90-250 VAC	855L-NX3	Allen-Bradley	1	ELE00000-0017.0
61		EMC	EMC Filter	2856702	PHOENIX CONTACT	1	ELE00019-0040.0
62		RECPT1	Receptacle Duplex Outlet, 120VAC	1492-REC15G	Allen-Bradley	1	ELE00000-0016.0
63		PWS1	TRIO UPS with Integrated Power Supply Unit TRIO-UPS-2G/1AC/24DC/10	2907161	PHOENIX CONTACT	1	TBD
64			UPS Power Storage Device 24VDC; 4Ah	1274117	PHOENIX CONTACT	1	ELE00022-0025.0
65		PWS2	Power Supply, 24VDC, 5A, 120VAC input	1606-XLE120E	Allen-Bradley	1	ELE00020-0007.0
66		RM	Redundancy Module for Power Supplies, for 10A load	1606-XLERED	Allen-Bradley	1	ELE00020-0013.0

Greater New Haven APGN500 BOM

No.	General	TAG	ITEM DESCRIPTION	Manufacturer Part No.	Manufacturer	QT'Y	APGN PART No.
			24 VDC - CONTROLS AND INSTRUMENTS				
67	For DC Branch	CB5	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
68	For PLC Power Supply	FU7	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	1	ELE00018-0008.0
69	For OIT	FU8	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	1	ELE00018-0008.0
70	For Network Switch	FU9	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
71	For NAT/Firewall	FU10	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
72	For DI's	FU11, FU12, FU13, FU14	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	4	ELE00018-0007.0
73	For DO's	FU15, FU16	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	2	ELE00018-0008.0
74	For AI's	FU17	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
75	For HF & BOV	FU18	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
76	For HF & BOV	FU19	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	1	ELE00018-0008.0
77	For Fuses	FUXX	24V DC FUSE BLOCK	1492-H5	Allen-Bradley	13	ELE00018-0010.0
78	For Fuses		FUSE BLOCK END BARRIER	1492-N37	Allen-Bradley	LOT As Req.	ELE00018-0005.0
79	PLC On/Off	CR30	RELAY 24V DC COIL	700-HF32Z24-4	Allen-Bradley	1	ELE00028-0002.0
80			RELAY BASE	700-HN116	Allen-Bradley	1	ELE00028-0003.0
81			CLIP	700-HN114	Allen-Bradley	1	ELE00028-0004.0
82	Output Relays	CR2..CR29	PLC RELAYS	700-HLT1Z24	Allen-Bradley	28	ELE00028-0001.0
83		Pd	DISCHARGE PRESSURE SENSOR 0-1.5kg/cm2	PSCH01.5KCIG	SENSYS	1	ELE00024-0004.0
84		idPf	INTERNAL FILTER PRESSURE DROP SENSOR 0-0.05Bar	PSCH0.05BCIG	SENSYS	1	ELE00024-0005.0
85		tpPd	TOTAL PACKAGE PRESSURE DROP SENSOR 0-0.05Bar	PSCH0.05BCIG	SENSYS	1	ELE00024-0005.0
86		aP	ATMOSPHERIC PRESSURE SENSOR 120kPa	PSCH0120RCIJ	SENSYS	1	ELE00024-0017.0
87		Ts	INLET TEMPERATURE RTD SENSOR	DS 4680 120L	OMEGA	1	ELE00024-0011.0
88		Td	DISCHARGE TEMPERATURE RTD SENSOR	DS 4680 120L	OMEGA	1	ELE00024-0011.0
89		Pd,Pf,Tm Anlg Sens CBL	8761 PAIRED CABLE, 1 PR, 22AWG STRAND (7X30), POLYETHYLENE INSULAT, AUDIO/INSTRUMENT	8761 060500	BELDEN	LOT As Req.	ELE00021-0076.0
90		RTD-CBL	RTD Extension Wire PFA with Shield Insulation	EXTT-3CUI-26S-SB	OMEGA	LOT As Req.	ELE00021-0058.0
91		PLC	COMPACT LOGIX CPU UNIT	1769-L33ER	Allen-Bradley	1	ELE00032-0022.0
92			PLC POWER SUPPLY	1769-PB4	Allen-Bradley	1	ELE00020-0009.0
93			DIGITAL INPUT MODULE	1769-IQ32	Allen-Bradley	1	ELE00041-0040.0
94			DIGITAL OUTPUT MODULE	1769-OB32	Allen-Bradley	1	ELE00032-0009.0
95			ANALOG INPUT MODULE	1769-IF8	Allen-Bradley	1	ELE00032-0018.0
96			RTD INPUT MODULE	1769-IR6	Allen-Bradley	1	ELE00032-0002.0
97			ANALOG OUTPUT MODULE	1769-OF4CI	Allen-Bradley	1	ELE00032-0006.0
98			RIGHT-END CAP	1769-ECR	Allen-Bradley	1	ELE00032-0004.0
99		MBS	Ethernet/IP to Modbus RTU Converter	MV169-MNETC	Prosoft	1	ELE00030-0067.0
100		OIT	PanelView Plus 7 Performance Terminals - 10 inch Touch Interface	2711P-T10C22D9P	Allen-Bradley	1	ELE00030-0044.0
101			16 GB Metal Executive USB Flash Drive	98748	Verbatim	1	ELE00030-0056.0
102		SCBL-1	Comm. System Cable Patch cable, CAT6, pre-assembled, 5.0 m Network Switch to VFD-1	FL CAT6 PATCH 5,0 Order No. 2891783	PHOENIX CONTACT	1	ELE00021-0062.0
103		SCBL-2	Comm. System Cable Patch cable CAT 6 pre-assembled 0.5 m long Network Switch to PLC	FL CAT6 PATCH 0,5 Order No. 2891288	PHOENIX CONTACT	1	ELE00021-0045.0
104		SCBL-3	Comm. System Cable Patch cable CAT 6 pre-assembled 0.5 m long PLC to Ehternet/IP- Modbus RTU Converter	FL CAT6 PATCH 0,5 Order No. 2891288	PHOENIX CONTACT	1	ELE00021-0045.0
105		SCBL-4	Comm. System Cable Patch cable CAT 6 pre-assembled 1.0 m long MBC toEhternet/IP- Modbus RTU Converter	FL CAT6 PATCH 1,0 Order No. 2891385	PHOENIX CONTACT	1	ELE00021-0044.0
106		SCBL-5	Comm. System Cable Patch cable CAT 6 pre-assembled 1.0 m long Network Switch to OIT	FL CAT6 PATCH 1,0 Order No. 2891385	PHOENIX CONTACT	1	ELE00021-0044.0
107		SCBL-6	Comm. System Cable Patch cable CAT 6 pre-assembled 1 m long Network Switch to Ehternet Maintance Port	FL CAT6 PATCH 1,0 Order No. 2891385	PHOENIX CONTACT	1	ELE00021-0044.0
108		SCBL-7	Comm. System Cable Patch cable CAT 6 pre-assembled 0.5 m long Network Switch to NAT/FIREWALL	FL CAT6 PATCH 0,5 Order No. 2891288	PHOENIX CONTACT	1	ELE00021-0045.0
109		NAT/Firewall	Router with Network Address Translation Feature	ICR-3201	BnB ELECTRONICS	1	ELE00026-0052.0
110		NWS	NETWORK SWITCH, 8-PORT	FL SWITCH SFN 8TX	PHOENIX CONTACT	1	ELE00026-0026.0
111		START-PB1	Momentary, Illuminated, Flush Push Button Green.	800FP-LF3	Allen-Bradley	1	ELE00029-0001.0
112			Integrated LED Module; Green, 24V AC/DC Ring Lug	800F-N3G	Allen-Bradley	1	ELE00029-0002.0
113		STOP-PB2	Momentary, Illuminated, Flush Push Button Red.	800FP-LF4	Allen-Bradley	1	ELE00029-0005.0
114			Integrated LED Module; Red, 24V AC/DC Ring Lug	800F-N3R	Allen-Bradley	1	ELE00029-0006.0
115		RESET-PB3	Momentary, Illuminated, Flush Push Button Yellow.	800FP-LF5	Allen-Bradley	1	ELE00029-0009.0
116			Integrated LED Module; White, 24V AC/DC Ring Lug	800F-N3W	Allen-Bradley	1	ELE00029-0020.0
117		E-STOP-PB4	Non-Illuminated Twist-to-Release, Red 30mm.	800FP-MT34	Allen-Bradley	1	ELE00029-0013.0
118			Emergency Stop Legend Plate w/Text - EMERGENCY STOP	800F-15YS-E112	Allen-Bradley	1	ELE00029-0017.0
119		OFF/ON-SS1	2-Position Selector Switch Operator, Illuminated, Red.	800FP-LSM24	Allen-Bradley	1	ELE00029-0018.0
120			Integrated LED Module; Red, 24V AC/DC Ring Lug	800F-N3R	Allen-Bradley	1	ELE00029-0006.0
121		START-PB1; STOP-PB2; RESET-PB3; E-STOP-PB4; OFF/ON-SS1;	Plastic Mounting Latch	800F-ALP	Allen-Bradley	5	ELE00029-0003.0
122		START-PB; STOP-PB; RESET-PB; E-STOP-PB; OFF/ON-SS;	Contact Block N.O.	800F-X10	Allen-Bradley	5	ELE00029-0004.0
123		E-STOP-PB4	Contact Block N.C.	800F-X01	Allen-Bradley	1	ELE00029-0016.0
124		ETH PORT	RJ45, CAT6 Ethernet coupler	09 45 452 1560	HARTING	1	ELE00030-0015.0
125			DUST CAP, har-port PROTECTION COVER IP65/67 TRANSPARENT	09 45 502 0005	HARTING	1	ELE00030-0016.0

3) Electrical

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Project No.: XX-YYYY

Customer: Greater New Haven, CT

Blower Type: APGN500

Date: Jan-21-2022

14						
13	C (CONTROL)	12	REMOTE TERMINAL BOARD	Jan-21-2022	Design	A-00
12	C (CONTROL)	11	NETWORK DIAGRAM	Jan-21-2022	Design	A-00
11	C (CONTROL)	10	RTD INPUT MODULE & ANALOG OUTPUT	Jan-21-2022	Design	A-00
10	C (CONTROL)	09	ANALOG INPUT 2	Jan-21-2022	Design	A-00
9	C (CONTROL)	08	ANALOG INPUT 1	Jan-21-2022	Design	A-00
8	C (CONTROL)	07	DIGITAL OUTPUT	Jan-21-2022	Design	A-00
7	C (CONTROL)	06	DIGITAL INPUT	Jan-21-2022	Design	A-00
6	P (POWER)	05	POWER 5 - DC DISTRIBUTION	Jan-21-2022	Design	A-00
5	P (POWER)	04	POWER 4 - A/C LOW VOLTAGE	Jan-21-2022	Design	A-00
4	P (POWER)	03	POWER 3 - 3 PHASE LOADS	Jan-21-2022	Design	A-00
3	P (POWER)	02	POWER 2 - MBC MOTOR	Jan-21-2022	Design	A-00
2	P (POWER)	01	POWER 1 - VFD	Jan-21-2022	Design	A-00
1	G (GENERAL)	00	FRONT PAGE	Jan-21-2022	Design	A-00
No.	SCHEMATIC TYPE	SHEET No.	SHEET TITLE	REV. DATE	STAGE	REV.

					5	
4					4	
3					3	
2					2	
A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	
REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #

REVISIONS					
REV.	DESCRIPTION	DATE	DRAW	CHECKED	APP'D

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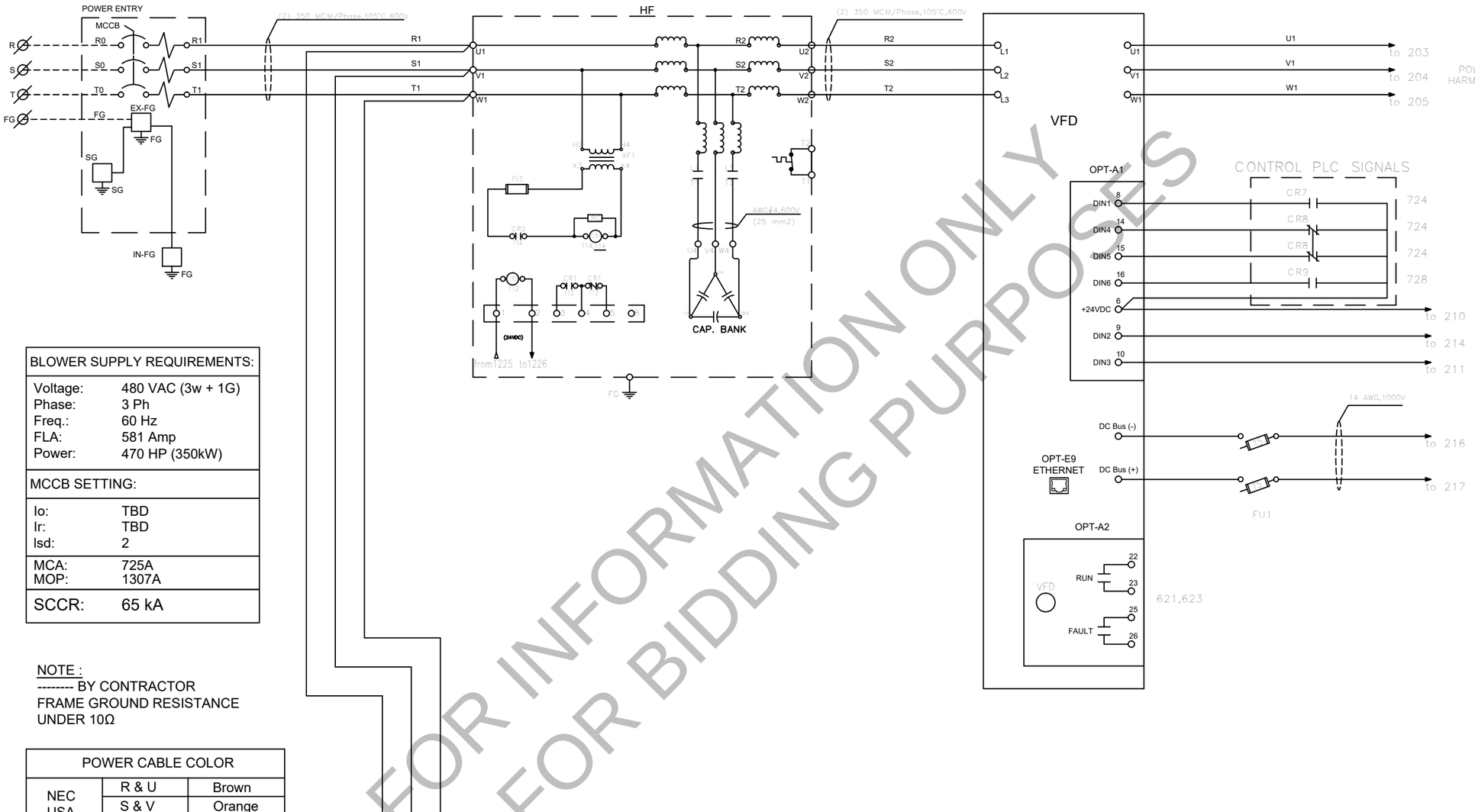
ALL DIMENSIONS ARE IN IN/MM
PROJECTION

PROJECT :	XX-YYYY Greater New Haven, CT APGN500
TITLE :	FRONT PAGE
PROJECT NO: N/A	DRAWING NO: N/A — REV: A-00
DESIGNED/ MODIFIED BY:	P. Mailloux — DATE: Jan-21-2022
CHECKED BY:	P. Mailloux — DATE: Jan-21-2022
DRAWN BY:	A. Khoury — DATE: Jan-21-2022
APPROVED BY:	P. Mailloux — DATE: Jan-21-2022
FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg	PAGE: 00



BLOWER SUPPLY REQUIREMENTS:	
Voltage:	480 VAC (3w + 1G)
Phase:	3 Ph
Freq.:	60 Hz
FLA:	581 Amp
Power:	470 HP (350kW)
MCCB SETTING:	
Io:	TBD
Ir:	TBD
Isd:	2
MCA:	725A
MOP:	1307A
SCCR:	65 kA

NOTE :
-------- BY CONTRACTOR
FRAME GROUND RESISTANCE
UNDER 10Ω

POWER CABLE COLOR		
NEC USA	R & U	Brown
	S & V	Orange
	T & W	Yellow

REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #
					5	
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3					3	
2					2	
A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

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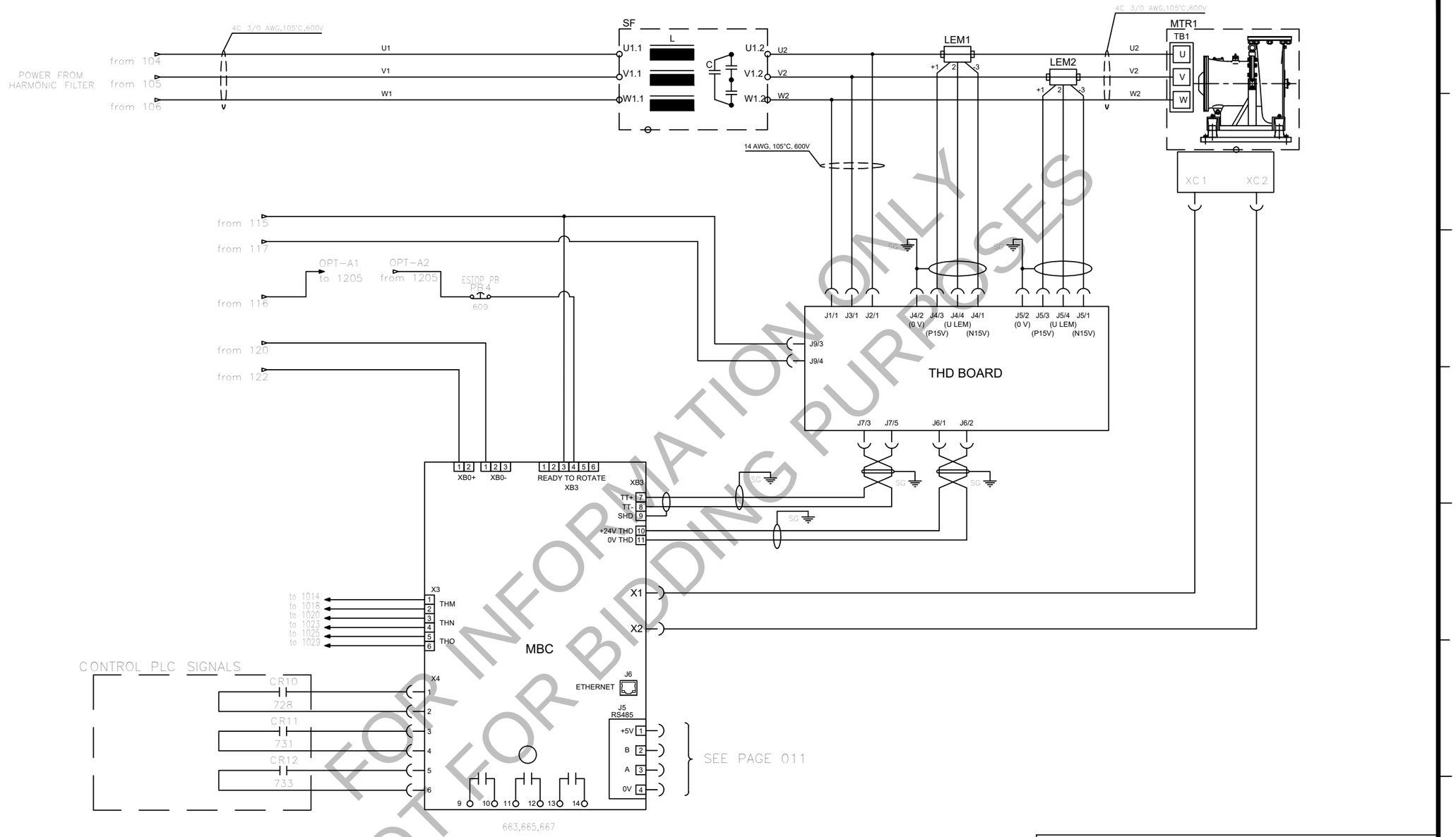
PROJECTION

PROJECT	XX-YYYY Greater New Haven, CT APGN500
TITLE :	POWER 1 - VFD
PROJECT NO.	N/A
DRAWING NO.	N/A
REV:	A-00
DESIGNED/ MODIFIED BY:	P. Mailloux
DATE	Jan-21-2022
CHECKED BY:	P. Mailloux
DATE	Jan-21-2022
DRAWN BY:	A. Khoury
DATE	Jan-21-2022
APPROVED BY:	P. Mailloux
DATE	Jan-21-2022
FILE NAME	XX-YYYY Greater New Haven, CT APGN500.dwg
PAGE:	01



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					2	
A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

REVISIONS					
REV.	DESCRIPTION	DATE	DRAW	CHECKED	APP'D

PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE : POWER 2 - MBC MOTOR

PROJECT NO: N/A | DRAWING NO: N/A | REV: A-00

DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
DRAWN BY:	A. Khoury	DATE	Jan-21-2022
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022

FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg | PAGE: 02

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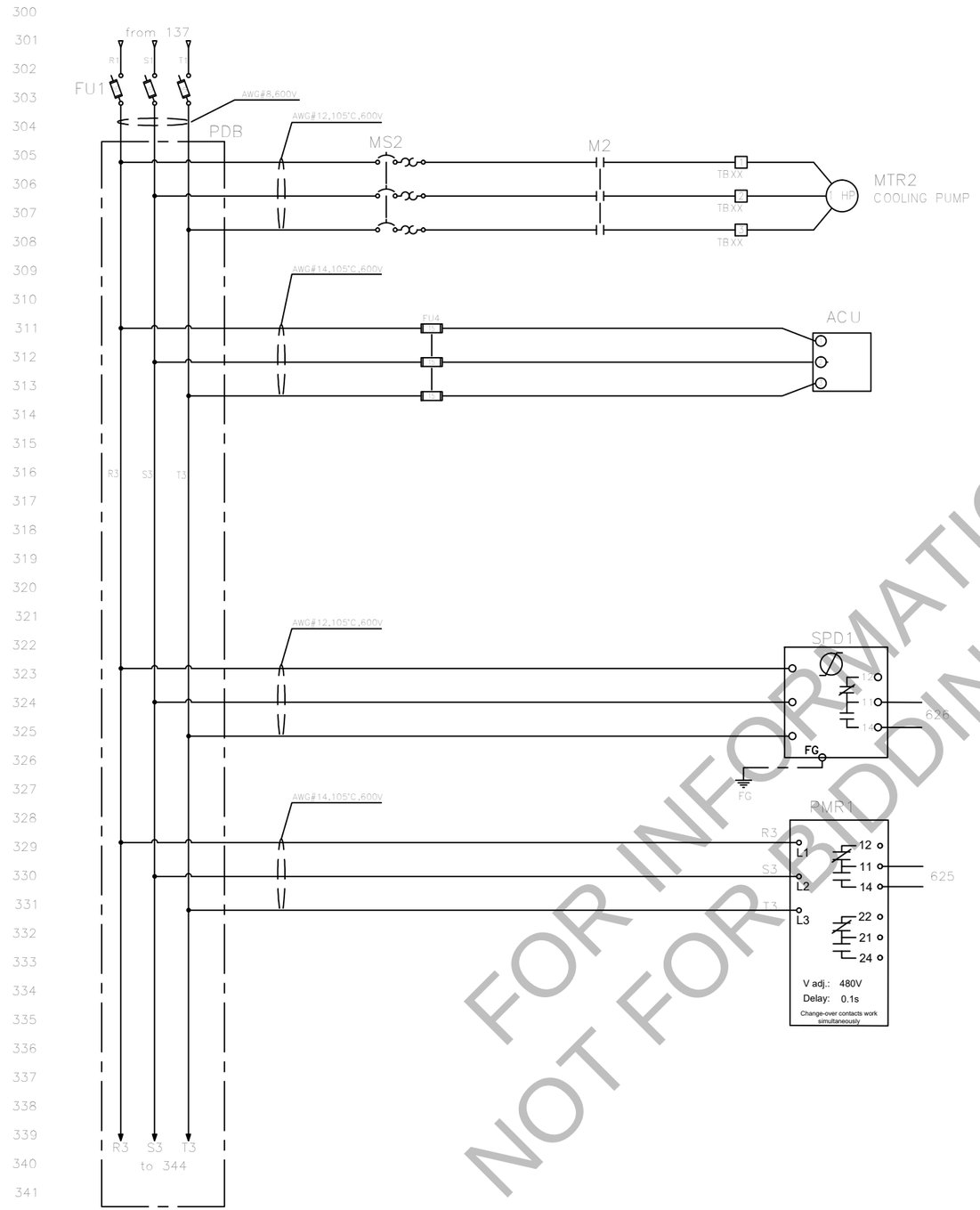
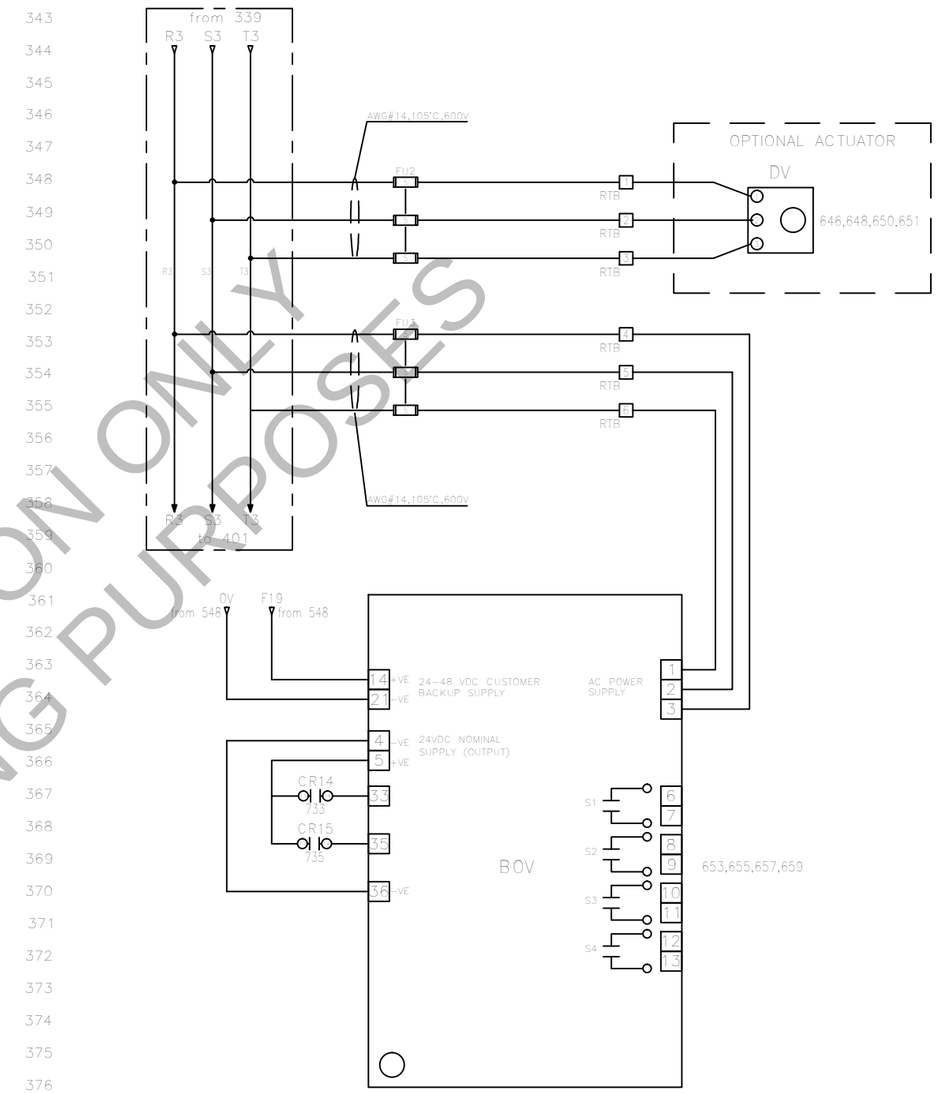
PROJECTION





REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #
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A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

REVISIONS					
REV.	DESCRIPTION	DATE	DRAW.	CHECKED	APP'D

APG Neuros

PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE : POWER 3 - 3 PHASE LOADS

PROJECT NO. N/A	DRAWING NO: N/A	REV: A-00

DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
DRAWN BY:	A. Khoury	DATE	Jan-21-2022
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022

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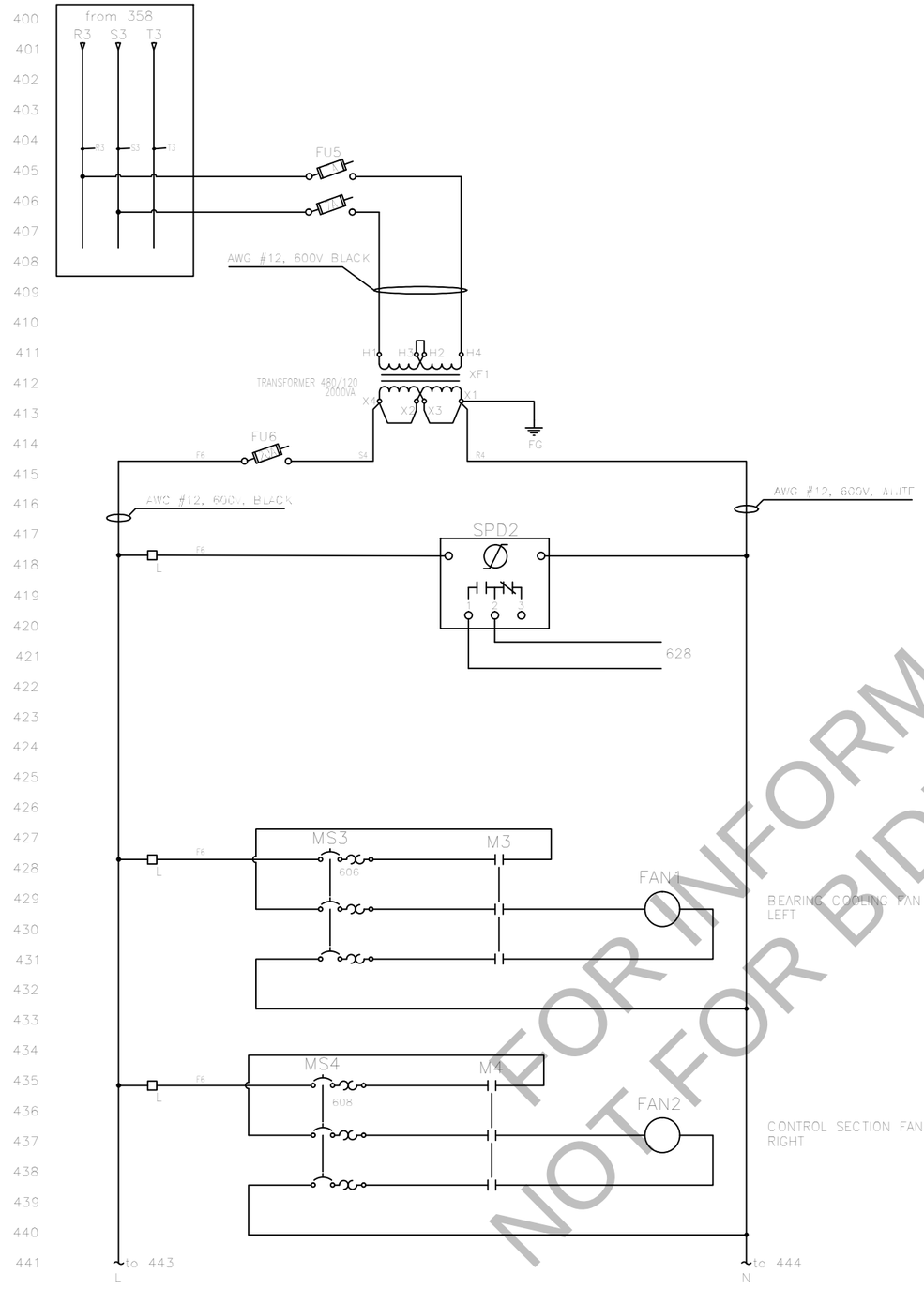
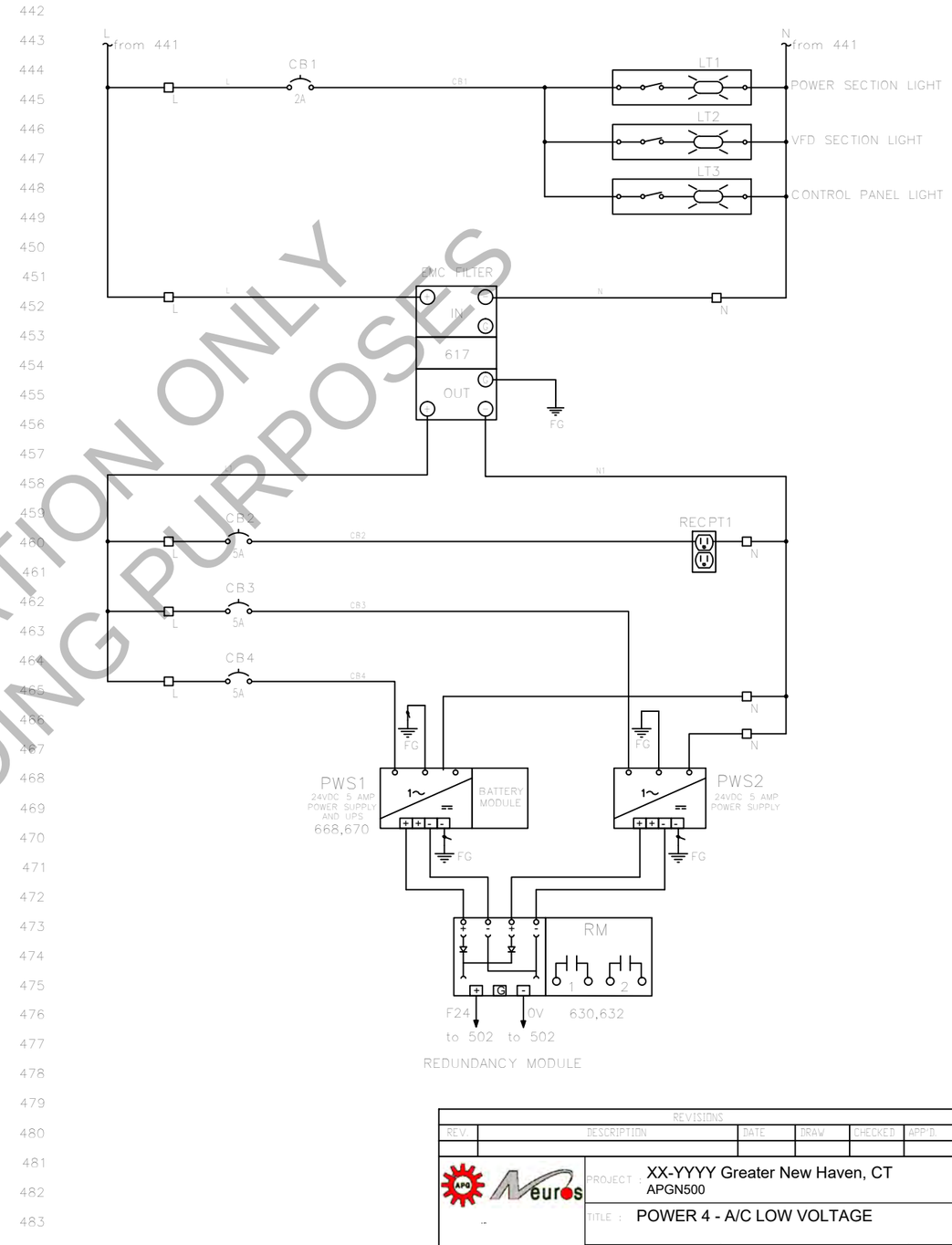
FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg





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A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

REVISIONS					
REV.	DESCRIPTION	DATE	DRAW	CHECKED	APP'D

PROJECT: XX-YYYY Greater New Haven, CT
APGN500

TITLE : POWER 4 - A/C LOW VOLTAGE

PROJECT NO: N/A	DRAWING NO: N/A		REV: A-00
DESIGNED/MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
DRAWN BY:	A. Khoury	DATE	Jan-21-2022
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022
FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg			PAGE: 04

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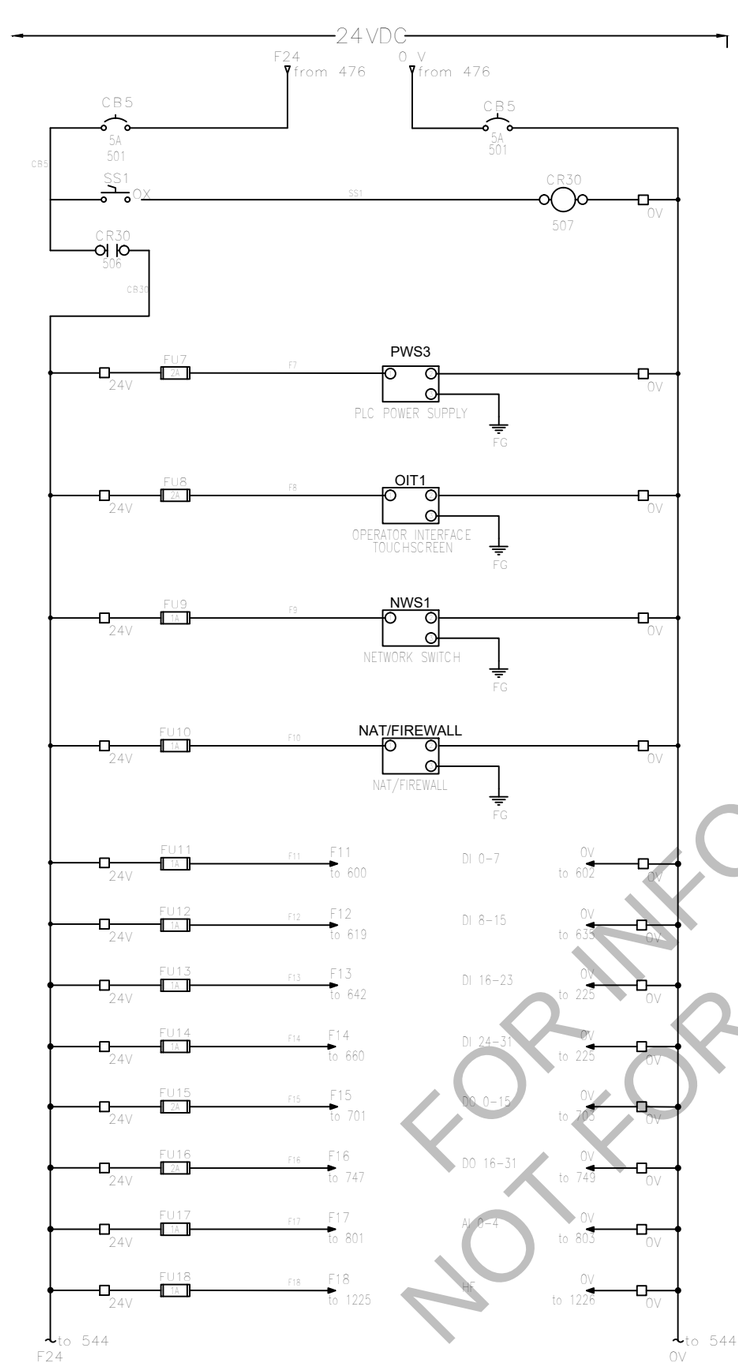

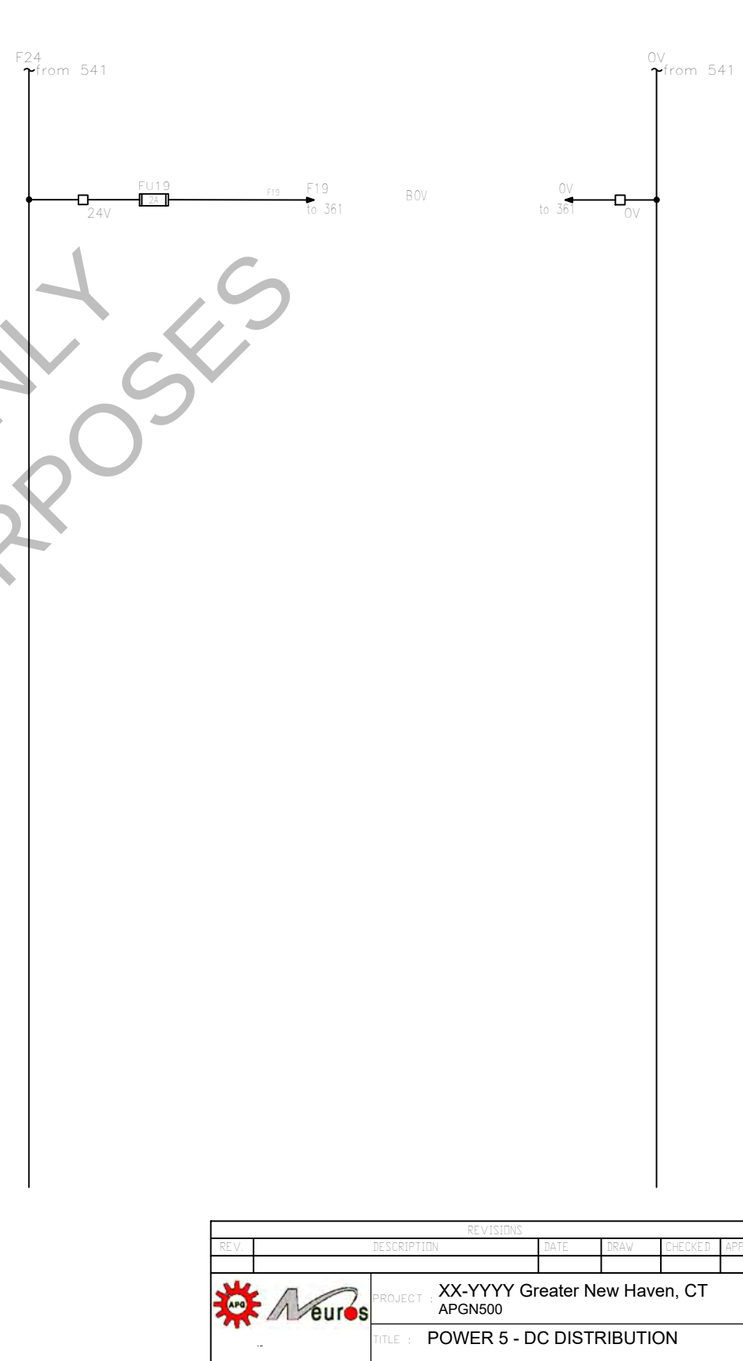

REV.	DESCRIPTION	DATE	DRAW.	CHECKED	APP'D

REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #
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A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

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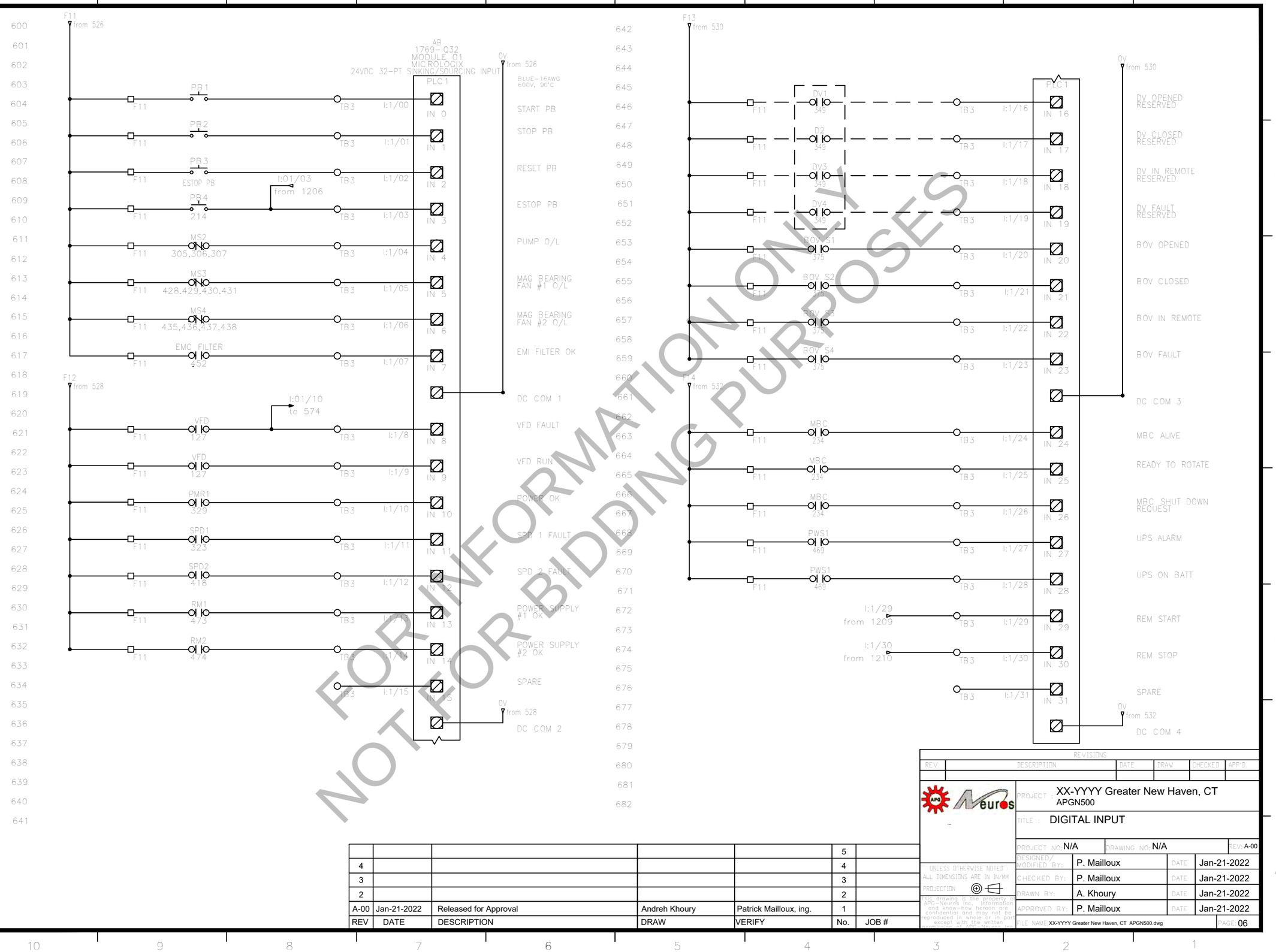
PROJECTION

PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE : POWER 5 - DC DISTRIBUTION

PROJECT NO:	N/A	DRAWING NO:	N/A	REV:	A-00
DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022		
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022		
DRAWN BY:	A. Khoury	DATE	Jan-21-2022		
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022		
FILE NAME:	XX-YYYY Greater New Haven, CT APGN500.dwg			PAGE:	05



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A-00	Released for Approval	Jan-21-2022	Andreh Khoury	Patrick Mailloux, ing.	

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A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

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PROJECTION :

PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE : DIGITAL INPUT

PROJECT NO:	N/A	DRAWING NO:	N/A	REV:	A-00
DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022		
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022		
DRAWN BY:	A. Khoury	DATE	Jan-21-2022		
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022		

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F15
from 534

AB
1769-OB32
MODULE 02
MICROLOGIX
24VDC 32-PT SOURCING OUTPUT
PLC 2

+VDC 1

0V
from 534

OUT 0	0:2/00		BLOWER RUN IND
OUT 1	0:2/01		BLOWER STOP IND
OUT 2	0:2/02		BLOWER FAULT IND
OUT 3	0:2/03	CR 740	RESERVED
OUT 4	0:2/04	CR 1210	REMOTE RUN INDICATION
OUT 5	0:2/05	CR 1211	REMOTE STOP INDICATION
OUT 6	0:2/06	CR 1212	REMOTE FAIL INDICATION NO-FAULT WHEN ON
OUT 7	0:2/07	CR 1213	REMOTE SITE INDICATION BLOWER IN REMOTE
OUT 8	0:2/08	CR 1225	HARMONIC FILTER ENABLE
OUT 9	0:2/09	CR 110	START/STOP VFD
OUT 10	0:2/10	CR 112,113	ENABLE VFD
OUT 11	0:2/11	CR 114	RESET VFD
OUT 12	0:2/12	CR 231	LEVITATION ON / OFF MBC
OUT 13	0:2/13	CR 233	ROTATION ON / OFF MBC
OUT 14	0:2/14	CR 235	RESET MBC
OUT 15	0:2/15	CR	SPARE

DC COM

F16
from 536

PLC 2

+VDC 2

0V
from 536

OUT 16	0:2/16	CR1	BOV CLOSED
OUT 17	0:2/17	CR1	BOV OPENED
OUT 18	0:2/18	CR1	SPARE
OUT 19	0:2/19	CR1	SPARE
OUT 20	0:2/20	CR1	SPARE
OUT 21	0:2/21	CR1	SPARE
OUT 22	0:2/22	CR2	SPARE
OUT 23	0:2/23	CR2	SPARE
OUT 24	0:2/24	CR2	SPARE
OUT 25	0:2/25	CR2	SPARE
OUT 26	0:2/26	CR2	SPARE
OUT 27	0:2/27	CR2	SPARE
OUT 28	0:2/28	CR2	SPARE
OUT 29	0:2/29	CR2	SPARE
OUT 30	0:2/30	CR2	SPARE
OUT 31	0:2/31	CR2	SPARE

DC COM 2

REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #
					5	
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PROJECT: XX-YYYY Greater New Haven, CT
APGN500

TITLE : DIGITAL OUTPUT

PROJECT NO: N/A	DRAWING NO: N/A		REV: A-00
DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
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APPROVED BY:	P. Mailloux	DATE	Jan-21-2022
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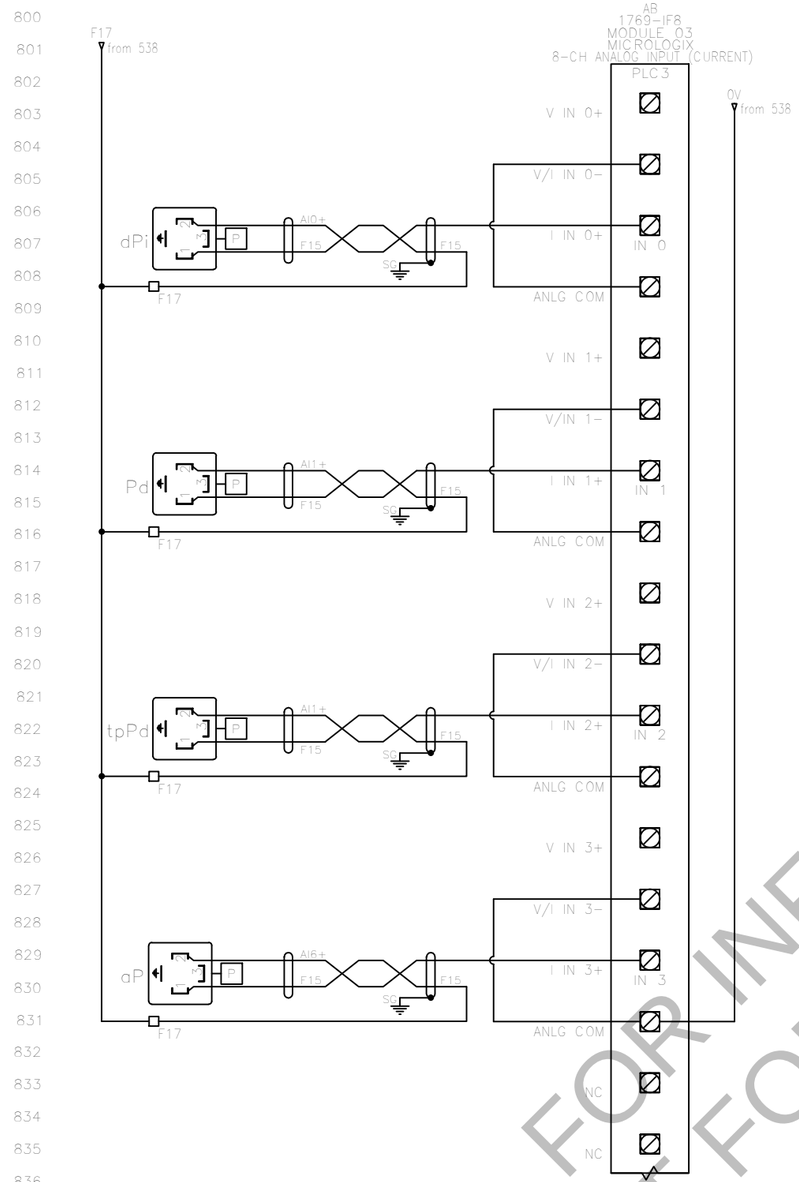

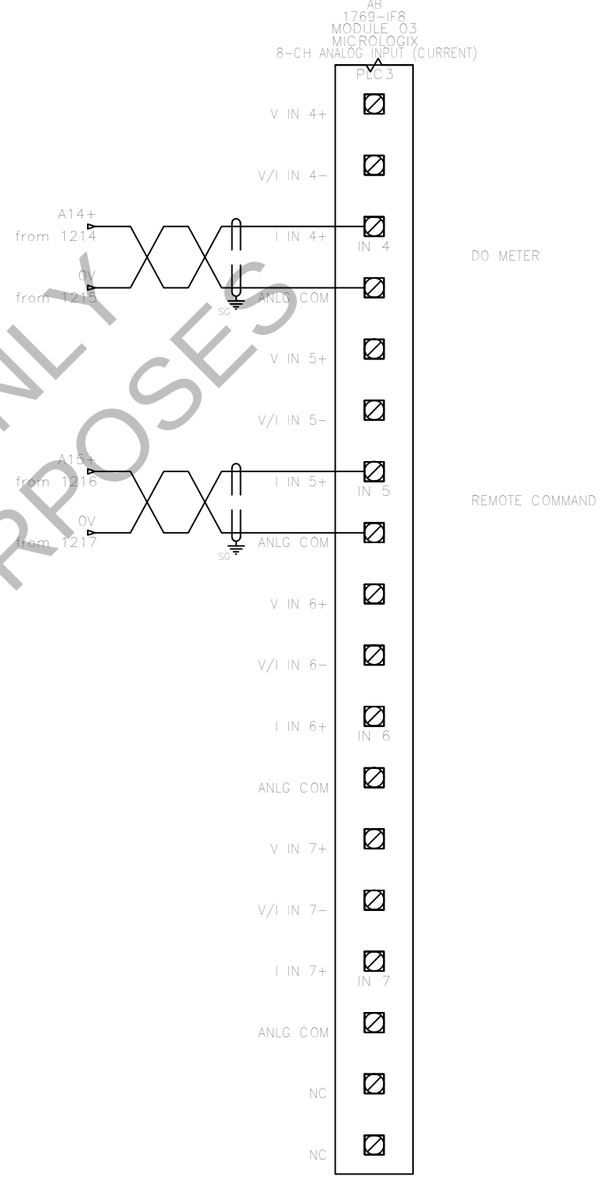

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A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	
REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #

REVISIONS					
REV.	DESCRIPTION	DATE	DRAW.	CHECKED	APP'D

UNLESS OTHERWISE NOTED :
ALL DIMENSIONS ARE IN IN/MM
PROJECTION

PROJECT: XX-YYYY Greater New Haven, CT
APGN500

TITLE : ANALOG INPUT

PROJECT NO: N/A	DRAWING NO: N/A		REV: A-00
DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
DRAWN BY:	A. Khoury	DATE	Jan-21-2022
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022
FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg			PAGE: 08

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3					3	
2					2	
A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN IN/MM
PROJECTION

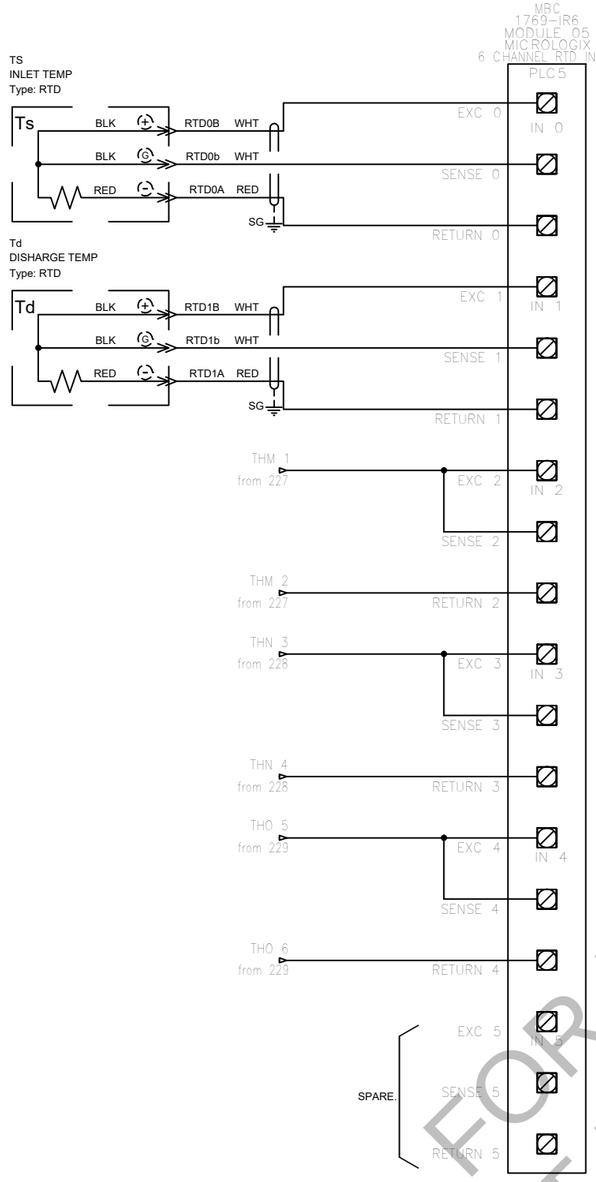
PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE :

PROJECT NO: N/A	DRAWING NO: N/A	REV: A-00

DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
DRAWN BY:	A. Khoury	DATE	Jan-21-2022
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022

FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg PAGE: 09



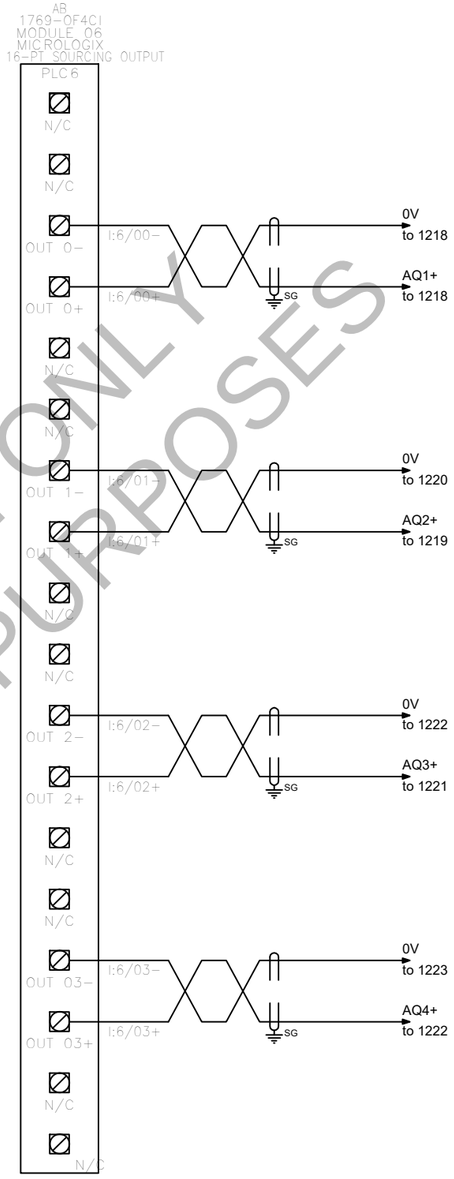
Ts INLET TEMP

Td DISCHARGE TEMP

RTD THM
MBC

RTD THN
MBC

RTD THO
MBC



PREWIRED ANALOG OUTPUTS FOR PROCESS DATA. EACH CONFIGURABLE THROUGH THE HMI BY USER TO SEND ANY OF THE FOLLOWING DATA TO THE SCADA:

–SPEED
–DISCHARGE PRESSURE
–FLOW
–POWER
–FILTER PRESSURE DROP
–SUCTION TEMPERATURE
–DISCHARGE TEMPERATURE
–NONE

THIS DATA ALSO AVAILABLE VIA ETHERNET.

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3					3	
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PROJECTION

PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE : RTD INPUT MODULE & ANALOG OUTPUT

PROJECT NO. N/A	DRAWING NO: N/A		REV: A-00
DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
DRAWN BY:	A. Khoury	DATE	Jan-21-2022
APPROVED BY:	P. Mailloux	DATE	Jan-21-2022
FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg			PAGE: 10

MBC & RTU CONVERTER CABLE

PIN	Signal
1	Shield
2	24 V Return
3	RS-485 Signal B
4	Request-to-Send
5	5 V Return
6	+ 5V
7	+ 24V
8	RS-485 Singal A
9	Not applicable

Serial (RS485)

Male

A from 1138

B from 1137

SG

SCBL-4

Ferrite Beads

RJ45

Male

PIN	Signal
1	RXD
2	TXD
3	RTS
4	D1
5	D0
6	CTS
7	POWER supply
8	Common
9	Shielding

VFD

ETHERNET MAINTENANCE PORT

ETH

SCBL-6

NETWORK SWITCH

NAT/FIREWALL

SCBL-7

TO MCP/PLANT NETWORK SWITCH

OIT

Allen-Bradley

SCBL-5

PLC

1769-MNETC | 1769-IQ32 | 1769-OB32 | 1769-IF8 | 1769-IF8 | 1769-IR6 | 1769-OF4CI

SCBL-1

SCBL-2

SCBL-3

SCBL-4

MAGNETIC BEARING CONTROLLER

ETHERNET J6

J5 RS485

1 2 3 4

B to 1109

A to 1108

RS485

REV	DATE	DESCRIPTION	DRAW	VERIFY	No.	JOB #
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4					4	
3					3	
2					2	
A-00	Jan-21-2022	Released for Approval	Andreh Khoury	Patrick Mailloux, ing.	1	

REVISIONS					
REV.	DESCRIPTION	DATE	DRAW	CHECKED	APP'D

APG Neuros

PROJECT : XX-YYYY Greater New Haven, CT
APGN500

TITLE : NETWORK DIAGRAM

PROJECT NO: N/A	DRAWING NO: N/A	REV: A-00

DESIGNED/ MODIFIED BY:	P. Mailloux	DATE	Jan-21-2022
CHECKED BY:	P. Mailloux	DATE	Jan-21-2022
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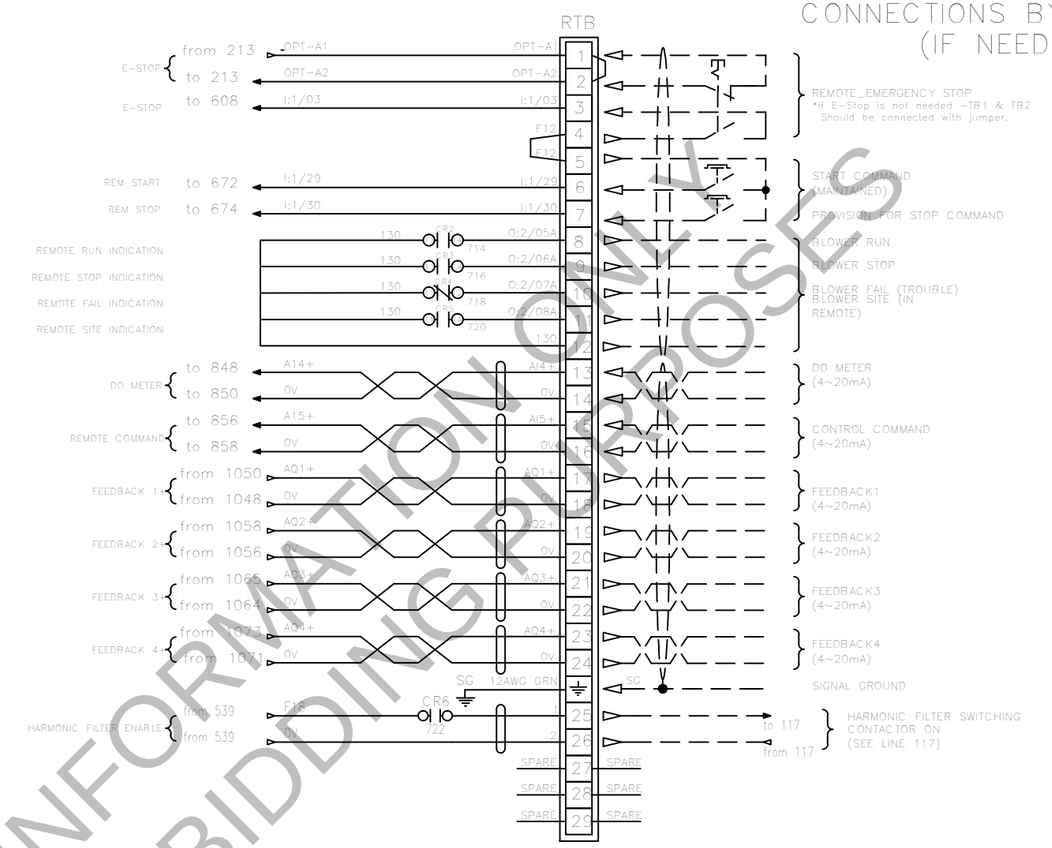
PROJECTION

FILE NAME: XX-YYYY Greater New Haven, CT APGN500.dwg

HARD WIRING PROVIDED FOR
REMOTE SIGNALS
MAY NOT BE USED IF NETWORK
COMMUNICATION IS USED BETWEEN
MASTER CONTROL PANEL AND
BLOWER LOCAL CONTROL PANEL



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PROJECTION

PROJECT	XX-YYYY Greater New Haven, CT APGN500
TITLE :	REMOTE TERMINAL BOARD
PROJECT NO.	N/A
DRAWING NO:	N/A
REV:	A-00
DESIGNED/ MODIFIED BY:	P. Mailloux
DATE	Jan-21-2022
CHECKED BY:	P. Mailloux
DATE	Jan-21-2022
DRAWN BY:	A. Khoury
DATE	Jan-21-2022
APPROVED BY:	P. Mailloux
DATE	Jan-21-2022
FILE NAME	XX-YYYY Greater New Haven, CT APGN500.dwg
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a. Expected Electrical demand at 100% load

Blower electrical demand (input) at 100% load: 435kW/483kVA/583HP/581A.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

b. Components with a separate power supply (Other than 480V)

A 120VAC/15A source is required for the blower Master Control Panel.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

c. Electrical Equipment Details

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

1. Electrical Cut Sheets

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

AFD

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

ENGINEERING
TOMORROW

Selection Guide | VACON® NXP Liquid Cooled | 7.5 kW – 5.3 MW

Robust, silent and **space-saving** control for all drive needs in **demanding applications**

Up to
25%
savings in total life cycle costs compared to air cooled solutions

drives.danfoss.com | VACON®

Quiet. Compact. Cool.

VACON® NXP Liquid Cooled AC drives are the ultimate in space-saving, high power density AC drives. They are well suited for locations where air-cooling is difficult, expensive or impractical such as onboard ships or in locations affected by altitude, or simply where installation space is at a premium. Their robust, modular design makes the VACON® NXP a suitable platform for all drive needs in demanding applications and are available in the power range from 7.5 to 5300 kW at 380-690 VAC supply voltages.

Power packed

As no air ducts are required, liquid cooled drives are extremely compact and suitable for a wide variety of heavy industries with harsh operating conditions such as marine & offshore, pulp & paper, renewable energy and mining & metal.

Thanks to the high degree of protection (IP54) achieved with these drives, they can be installed almost anywhere in the plant or vessel. This eliminates the load on the air-conditioning system in the electrical rooms – an important cost and space consideration in many retrofit applications. And since liquid cooled drives do not require large cooling fans, they are also among the most silent AC drives on the market.

We are committed to providing you with the ultimate in high power density. VACON® NXP liquid cooled products have one of the best power/size ratios on the market. For example, our compact 12 pulse, 1.5MW drive includes a built-in rectifier, inverter and optional brake all in the same package, and all this can be mounted in an 800 mm wide enclosure.

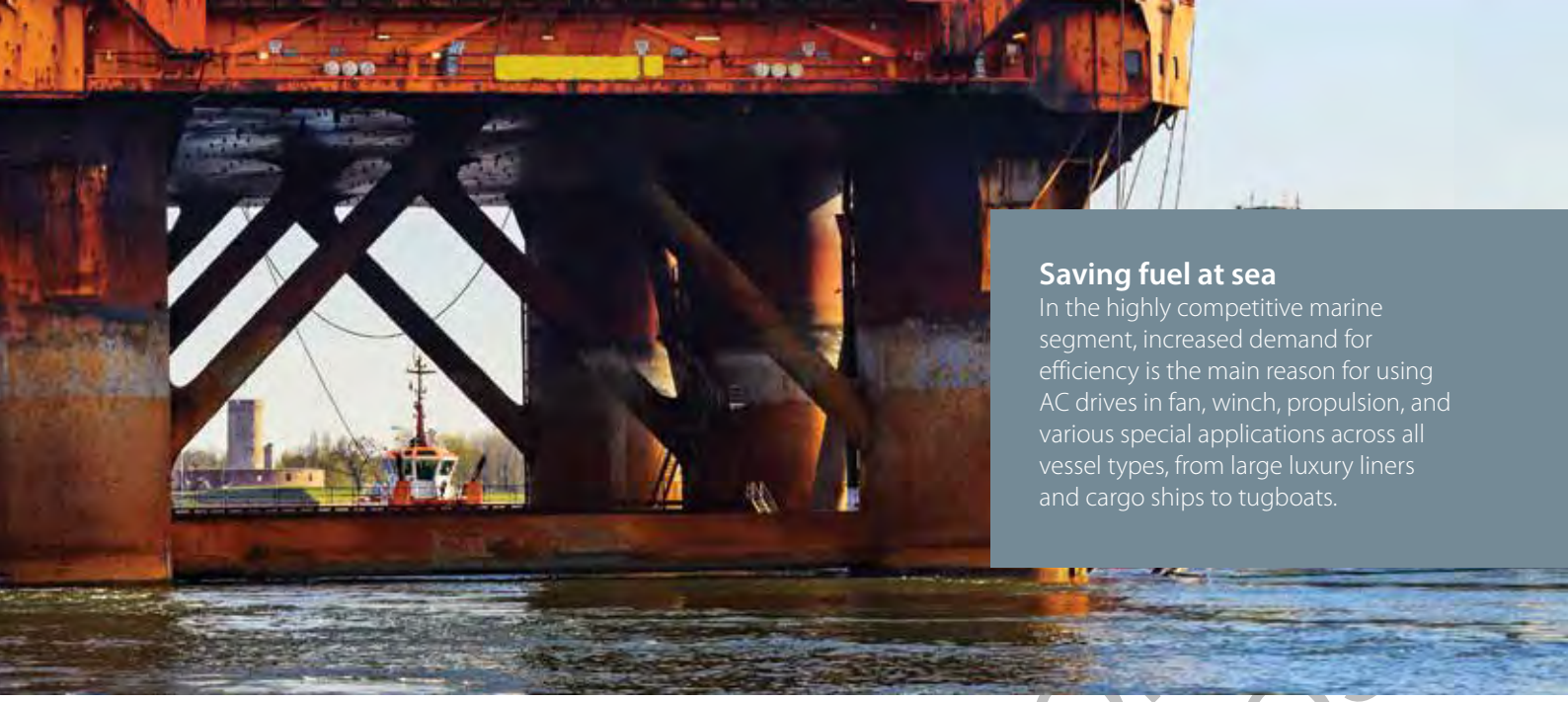
Our liquid cooled range offers the ultimate in motor control, for both induction and permanent magnet motors, gearless drive applications and paralleling solutions for high power motors.

Certification and grid expertize

Our VACON® NXP liquid cooled portfolio fulfills all relevant international standards and global requirements, including marine, safety and EMC & Harmonics approvals. VACON® NXP liquid cooled AC drives can be used in regenerative energy and smart grid applications, which ensures customers can effectively monitor and control energy use and costs.

Typical segments

- Marine and offshore
- Renewable energy
- Mining and metals
- Water and wastewater
- Energy management
- Pulp and paper
- Oil and gas
- Machine building



Saving fuel at sea
In the highly competitive marine segment, increased demand for efficiency is the main reason for using AC drives in fan, winch, propulsion, and various special applications across all vessel types, from large luxury liners and cargo ships to tugboats.

What's in it for you

Minimizes investment and operation costs

Saves floor space and infrastructure needs

Saves time and money

Compact and easy to install

Virtually silent operation

Benefits

- Compact size and high power density
- No large air conditioning systems needed as state-of-the-art liquid cooled AC drive design allows heat loss to be transferred to the most convenient place with no need for vast amounts of filtered air
- Easy to adapt to various uses due to ready-to-use applications
- Flexible and scalable system for additional I/O, fieldbus and f unctional safety boards with five built-in expansion slots
- Silent operation due to eliminated need for large cooling fans

Typical applications

- Propeller and thrusters systems
- Compressors
- Wind turbines
- Extruders
- Pumps and fans
- Test bench systems
- Cranes and winch systems
- Power conversion systems
- Production lines
- Oil rigs
- Crushers
- Conveyors

The liquid way to stay cool

VACON® NXP Liquid Cooled AC drives have been pioneering for more than a decade in demanding industries with a proven track record of highly reliable products. We have succesfully mitigated the common risks of leakage and reliability in our product design.

Climate considerations

When comparing cooling technology solutions, it is important to understand the effects on the infrastructure of the electrical room, and the room's requirements. Additional comparison parameters are the geographical location, relevant industry and process.

In warm climates it is extremely important to observe the amount of heat load transferred to the electrical room because of its indirect effect on electrical energy consumption.

The type-tested switchgears standard EN 60439-1 specifies that the electrical room's 24-hour average temperature should be below +35 °C and the maximum temporary temperature cannot exceed +40 °C. As a result, the cooling system in electrical rooms is typically comprised of air conditioning chillers, which are dimensioned according to the maximum heat load, the temperature inside the electrical room and the maximum temperature outdoors. The typical electrical energy consumption of air conditioning is approx. 25-33% of the cooling power.

The higher the power, the greater the savings

In many cases liquid cooled drives are the most cost-effective option, simply due to the fact that there is no need for additional air conditioning capacity or extra ventilation for the areas in which they are used. The related savings enable shorter payback times and the higher the power, the greater the savings potential.

The continuously growing cost of energy certainly supports a wider use of liquid cooled drives technology, and the number of installations is growing rapidly.

A driving force in wind energy
VACON® AC drives are designed to provide proven performance in demanding environments. Our drives are serving the wind energy industry globally with a combined installed capacity of almost one gigawatt.

Exclusively designed for liquid cooling

Many other liquid cooled drives on the market are based on modifications of an air cooled drive, rather than exclusively designed for the purpose. The VACON® NXP Liquid Cooled dissipates only 0.1 -0.15% of its heat losses to air.* A state-of-the-art cooling heatsink enables the cooling efficiency of the components to be higher than ever.

Cooling technology advantages

Up to **25%** savings in total life cycle costs compared to air cooled solutions

20dBA
less noise than air cooled drive

25% smaller unit can deliver the same or better performance

*400 kW, 690 VAC liquid cooled drive

Extensive portfolio of liquid cooled drive modules

Significant energy savings and optimal performance can be achieved with the right configuration. Liquid cooled AC drives can be used in a multitude of combinations – from a single dedicated frequency converter to large-scale Common DC bus systems.

Dedicated frequency converter

The VACON® NXP Liquid Cooled drives are available as 6- or 12-pulse frequency converters. In addition, our largest unit, the CH74, can also be used as an 18-pulse converter. The AC drive consists of a power unit, control unit and possibly one or more input chokes.

An internal brake chopper is available as standard for our smallest unit CH3. For CH72 (only 6-pulse) and CH74, it is available as internal option while in all other sizes the brake chopper is available as an option and installed externally.

Front-end units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus and, in certain cases, vice versa.

Active front-end (AFE)

The AFE unit is a bi-directional (regenerative) power converter (supply unit) for the front-end of a common liquid cooled DC bus drive line-up. An external LCL filter is used at the input. This unit is suitable for applications where a low level of mains harmonics and high power factor are required. AFE units can operate in parallel to provide increased power and/or redundancy without any drive to drive communication between the units. AFE units can also be connected to the same fieldbus with inverters, and controlled and monitored via fieldbus. Fuses, LCL filters, pre-charging rectifiers and resistors can be specified and ordered separately.

The LCL filter guarantees that harmonics are not an issue in any network. With a power factor > 0.99 and low harmonics, the supply chain transformers, generators, etc. can be sized very accurately without reserving margins for the reactive power. This can mean a saving of 10% in supply chain investments. Likewise the payback time is faster as regenerative energy is fed back to the grid.

Non-regenerative front-end (NFE)

The NFE unit is an unidirectional (motoring) power converter for the front-end of a common DC bus drive line-up. The NFE is a device that operates as a diode bridge. A dedicated external choke is used at the input. This unit is suitable as a 6 or 12 pulse rectifying device when a normal level of harmonics is accepted and no regeneration to the mains is required. NFE units can be paralleled to increase power without any drive to drive communincation between the units.

Inverter unit (INU)

The INU is a bidirectional DC-fed power inverter for the supply and control of AC motors. The INU is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC-side charging circuit is external for inverter types.

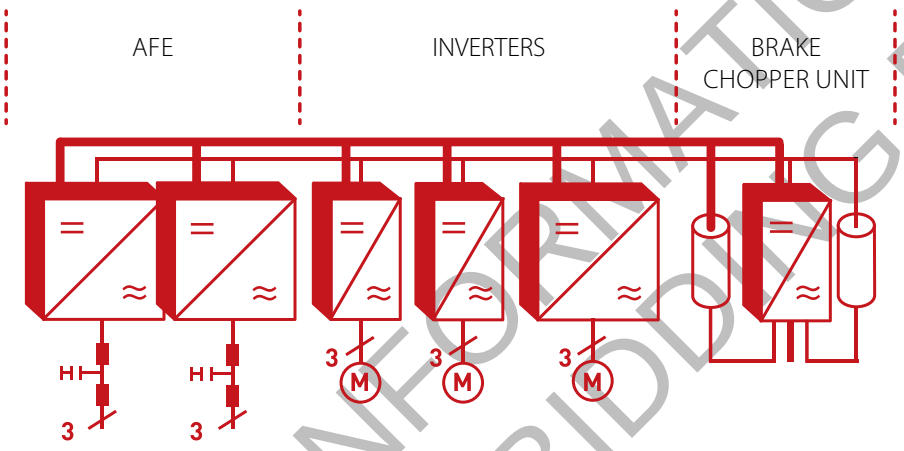
Pre-charging resistors and switches or fuses are not included in an INU delivery and must be specified and ordered separately.

Brake chopper unit (BCU)

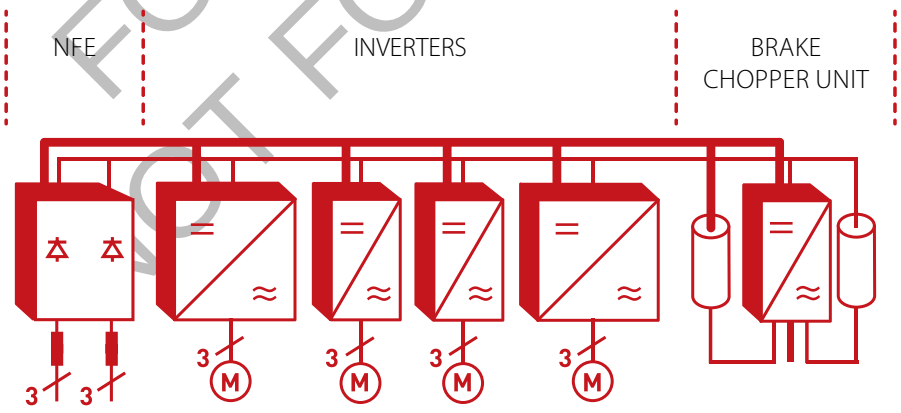
The BCU is a unidirectional power converter for the supply of excessive energy from a common DC bus drive line-up or big AC drive to resistors where the energy is dissipated as heat. External resistors are required. However, resistors or fuses are not included in a BCU delivery and can be specified and ordered separately.

BCU's improve a drive's dynamic performance in a regenerative operating point and protect common DC bus voltage level from overvoltage. In some cases they also reduce the need for AFE investments.

A regenerative Common DC bus system



A non-regenerative common DC bus system



VACON® NXP Liquid Cooled Enclosed drive

The low harmonic and regenerative VACON® NXP Liquid Cooled Enclosed Drives range has been developed especially with ease of use in mind. Packed full of features, these fully standardized, compact and robust AC drives with a full power range help maximize the utilization of space while minimizing overall costs.

These enclosed drives are the ideal solution for applications and locations where space is at a premium. The sturdy cabinet makes it ideal for harsh environments. See technical ratings and dimensions on page 19 for further information.

High power density

VACON® NXP Liquid Cooled Enclosed Drive can be used with AC motors in power sizes from 800–1550 kW. However, using the patented VACON® DriveSynch control concept, four enclosed drives can be run in parallel taking the power range up to an outstanding 5 MW.

Fast installation

VACON® NXP Liquid Cooled Enclosed Drives are pre-designed and engineered. That means they're good to go as soon as you receive them. Simply connect to the cooling system and the power and motor supplies. Being liquid cooled, the product is virtually silent and you'll have greater flexibility with where to put it. You don't have to worry about leaving space for air flow, and you'll save on air-conditioning energy costs.

Packed with cool performance

The enclosed unit comes equipped with the same advantages of efficient and quiet cooling performance as the rest of the VACON® NXP product family. When we say that this product is liquid cooled, we are talking about the entire product. The modules and also all its main components, such as LCL and dU/dt filters, are liquid cooled as standard. The reliable heat exchanger is offered as an option to provide a worry-free life cycle for the product.

You can also enjoy the same fast commissioning with the aid of the easy to use Startup Wizard. The slide-out racks provide easy access for maintenance. Leakage indicators alert the operator to any potential issues in the cooling system.

A solution for all your needs
We provide enclosed solutions to any segment and application. And while we focus on the drives, you can concentrate on your performance.

Eliminate production disturbances

Continuous energy supply is important to ensure your processes are optimized. Distortions in the energy supply, caused by the presence of harmonic currents and voltages, can trigger equipment disturbances and create energy losses. VACON® front-end drives with low harmonic technology maintain a constant energy supply and eliminate the disruption harmonics can cause to production.

Advanced monitoring

The VACON® NXP Liquid Cooled Enclosed Drive's built-in Fieldbus interface communicates effectively with your process automation system. This reduces the need for cabling and gives you increased monitoring and control of process equipment.

Safety is a given

One of the most visible features of the enclosed product is the integrated main breaker switch. This simple on/off switch quickly and easily disconnects and activates the power supply as and when necessary.

Benefits

- Saves floor space and infrastructure needs
- Saves time and money in installation
- Faster and easier servicing
- Improves safety
- Enhances reliability
- Low harmonic input
- Virtually silent operation

Key features

- Optimized design with power range up to 5 MW
- All standard protection components included
- Silent design with no large cooling fans needed
- Slide-out feature
- Leakage detector
- AFE technology
- Pre-engineered solution with all-liquid-cooled design (including filters)
- Cooling system monitoring

Multiple options

VACON® NXP control

High-performance control platform for all demanding drive applications

- Excellent processing and calculation power
- Supports induction and permanent magnet motors
- Maximum utilization of control features over wide power and voltage range
- Built-in PLC functionality
- Integration of customer-specific functionalities
- Bumpless transfer between open loop and closed loop control

Option boards

VACON® NXP control provides exceptional modularity

- 5 plug-in extension slots
- Fieldbus boards
- Encoder boards
- IO boards
- Easy plug-in without need to remove other components

Fieldbus options

Easy integration with plant automation systems

- PROFIBUS DP
- DeviceNet™
- Modbus RTU
- CANopen

Ethernet connectivity

Ethernet connectivity allows remote drive access for monitoring, configuring and troubleshooting

- Modbus/TCP
- PROFINET IO
- EtherNet/IP™
- EtherCAT

Functional safety and reliability

Safe Torque Off (STO)
Available for all VACON® NXP drives
- Prevents drive from generating torque on motor shaft
- Prevents unintentional start-ups
- Corresponds to an uncontrolled stop
- In accordance with stop category 0, EN60204-1

Safe Stop 1 (SS1)
Available for all VACON® NXP drives
- Initiates motor deceleration
- Initiates STO function after application specific time delay
- Corresponds to an uncontrolled stop
- In accordance with stop category 1, EN60204-1

Advanced Safety Options
Support more safety functions

Safe Stop functions::
- STO – Safe Torque Off
- SS1 – Safe Stop 1
- SS2 – Safe Stop 2
- SBC – Safe Brake Control
- SQS – Safe Quick Stop

Safe Speed functions:
- SLS – Safely-limited Speed
- SSM – Safe Speed Monitor
- SSR – Safe Speed Range
- SMS – Safe Maximum Speed

Conformal coating
- Conformal coated circuit boards as standard
- Improved performance
- Increased durability
- Reliable protection against dust and moisture
- Extended lifetime of drive and components

ATEX- certified thermistor input
Especially designed for motor temperature supervision
- Stops feeding energy to motor in case of over-heating
- Certified and compliant with the European ATEX directive 94/9/EC

Commissioning made easy

User-friendly keypad
- Removable panel with plug-in connection
- Graphical and text keypad with multiple language support
- Text display multi-monitoring function
- Parameter backup and copy function with the panel's internal memory
- The startup wizard ensures a hassle-free set up

Software modularity
All-in-One application package
- Seven built-in software applications

Several segment-specific and advanced applications such as:
- System Interface
- Marine
- and much more

For setting, copying, storing, printing, monitoring and controlling parameters

Includes handy Datalogger function
- Track failure modes & perform root cause analysis

Communicates with drive via:
- RS232
- Ethernet TCP/IP
- CAN (fast multiple drive monitoring)
- CAN@Net (remote monitoring)

Independent paralleling
Our patented independent paralleling configuration of front-end (AFE) units:
- Offer high redundancy
- Eliminate need for drive-to-drive communication
- Enables automatic load sharing

Dedicated applications

Intelligent system interfaces for heavy industries

VACON® System Interface Application (SIA) provides a flexible and extensive interface for use in coordinated drives, which have an overriding control system. VACON® SIA utilizes the most advanced functions of our VACON® NXP motor control software and is suitable for demanding drive systems such as those in the pulp & paper and metal industries, processing lines as well as many other standard applications.

Benefits

- Power extension with VACON® DriveSynch
- Master Follower functions for torque sharing
- Freely configurable PLC logic

Dedicated marine application

Our Marine Application provides flexibility and performance across all marine segment applications. VACON® Liquid Cooled drives bring many benefits to this segment in particular such as energy efficiency, improved process availability due to high redundancy, better process quality and control, as well as silent operation and substantially reduced emissions.

Benefits

- Black Out prevention logic
- Cost savings in electric propulsion system
- State-of-the-art load sharing and load trooping

VACON® NXP Grid Converter

The VACON® NXP Grid Converter is a solution that improves energy efficiency and environmental performance in marine industry use. It enables ships to source energy from local grids on shore, allowing for the ship's main generators to be completely switched off.

Benefits

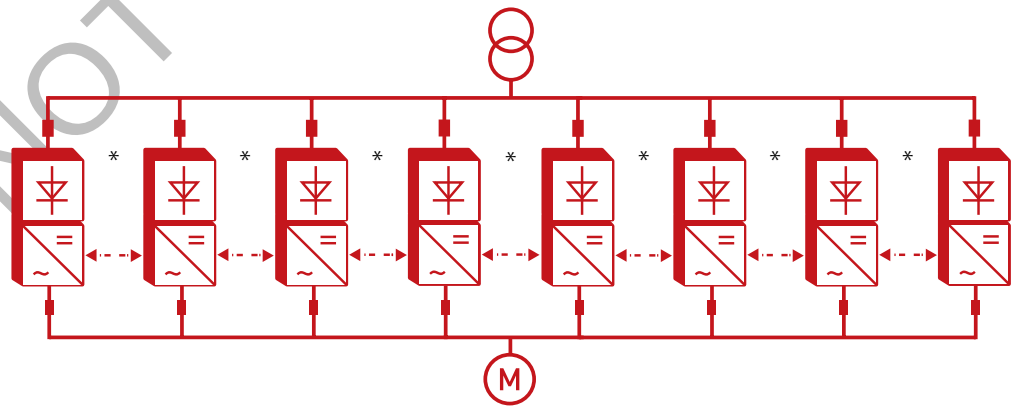
- Reduces fuel consumption and emissions
- Reduces noise and vibrations

High power and improved redundancy

VACON® DriveSynch is a patented control concept for running standard drives in parallel to control high-power AC motors or increase the redundancy of a system. This concept suits high power single or multiple winding motors, typically above 1 MW. High power AC drives above 5 MW can be built using standard drive components.

Benefits

- System redundancy is higher than in a conventional drive because each unit can run independently
- Identical units and standard modules reduce overall costs by reducing need for spares and specialist skills in engineering, installation,commissioning and maintenance



* Fiber optic link

Liquid to liquid heat exchangers

We have a range of cooling units based on liquid-to-liquid heat exchangers (HX), which improve the availability and usability of AC drive systems. The cooling units belong to the liquid cooled VACON® NXP range and offer reliable and cost-effective cooling without ventilation concerns. The heat exchanger is a pre-designed, pre-tested and fully functional package that ensures safety and reliability.

Intelligent system interfaces for heavy industries

- Self-supporting module rack construction
- Cooling circuit equipped with threaded joints or flanges
- Heavy industry, stainless steel
- Industrial water heat exchanger, three-way-valve, pump, AC drive
- Flow and pressure sensors
- Stainless steel AISI piping
- Two-way-valve
- Heat exchanger installed inside a Rittal TS8 or VSG VEDA 5000 cabinet
- Double pumps for marine class requirements, types 120 kW and 300 kW

Ratings and dimensions

VACON® NXP Liquid Cooled AC drives, 6-pulse and 12-pulse, mains voltage 400-500 VAC

AC drive type 6-pulse	AC drive type 12-pulse	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis	Choke type 6-pulse*	Choke type 12-pulse
		Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (400 V) [kW]	Optimum motor at I_{th} (500 V) [kW]				
NXP00165A0N1SWS		16	15	11	7.5	11	0.4/0.2/0.6	CH3	CHK0023N6A0	
NXP00225A0N1SWS		22	20	15	11	15	0.5/0.2/0.7	CH3	CHK0023N6A0	
NXP00315A0N1SWS		31	28	21	15	18.5	0.7/0.2/0.9	CH3	CHK0038N6A0	
NXP00385A0N1SWS		38	35	25	18.5	22	0.8/0.2/1.0	CH3	CHK0038N6A0	
NXP00455A0N1SWS		45	41	30	22	30	1.0/0.3/1.3	CH3	CHK0062N6A0	
NXP00615A0N1SWS		61	55	41	30	37	1.3/0.3/1.5	CH3	CHK0062N6A0	
NXP00725A0N0SWS		72	65	48	37	45	1.2/0.3/1.5	CH4	CHK0087N6A0	
NXP00875A0N0SWS		87	79	58	45	55	1.5/0.3/1.8	CH4	CHK0087N6A0	
NXP01055A0N0SWS		105	95	70	55	75	1.8/0.3/2.1	CH4	CHK0145N6A0	
NXP01405A0N0SWS		140	127	93	75	90	2.3/0.3/2.6	CH4	CHK0145N6A0	
NXP01685A0N0SWS		168	153	112	90	110	4.0/0.4/4.4	CH5	CHK-0261-6-DL	
NXP02055A0N0SWS		205	186	137	110	132	5.0/0.5/5.5	CH5	CHK-0261-6-DL	
NXP02615A0N0SWS		261	237	174	132	160	6.0/0.5/6.5	CH5	CHK-0261-6-DL	
NXP03005A0N0SWF		300	273	200	160	200	4.5/0.5/5.0	CH61	CHK-0400-6-DL	
NXP03855A0N0SWF		385	350	257	200	250	6.0/0.5/6.5	CH61	CHK-0400-6-DL	
NXP04605A0N0SWF	NXP04605A0N0TWF	460	418	307	250	315	6.5/0.5/7.0	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05205A0N0SWF	NXP05205A0N0TWF	520	473	347	250	355	7.5/0.6/8.1	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05905A0N0SWF	NXP05905A0N0TWF	590	536	393	315	400	9.0/0.7/9.7	CH72	CHK-0650-6-DL	2 x CHK-0400-6-DL
NXP06505A0N0SWF	NXP06505A0N0TWF	650	591	433	355	450	10.0/0.7/10.7	CH72	CHK-0650-6-DL	2 x CHK-0400-6-DL
NXP07305A0N0SWF	NXP07305A0N0TWF	730	664	487	400	500	12.0/0.8/12.8	CH72	CHK-0750-6-DL	2 x CHK-0400-6-DL
NXP08205A0N0SWF		820	745	547	450	560	12.5/0.8/13.3	CH63	CHK-0820-6-DL	
NXP09205A0N0SWF		920	836	613	500	600	14.4/0.9/15.3	CH63	CHK-1030-6-DL	
NXP10305A0N0SWF		1030	936	687	560	700	16.5/1.0/17.5	CH63	CHK-1030-6-DL	
NXP11505A0N0SWF		1150	1045	766	600	750	18.5/1.2/19.7	CH63	CHK-1150-6-DL	
NXP13705A0N0SWF	NXP13705A0N0TWF	1370	1245	913	700	900	19.0/1.2/20.2	CH74	3 x CHK-0520-6-DL	2 x CHK-0750-6-DL
NXP16405A0N0SWF	NXP16405A0N0TWF	1640	1491	1093	900	1100	24.0/1.4/25.4	CH74	3 x CHK-0650-6-DL	2 x CHK-0820-6-DL
NXP20605A0N0SWF	NXP20605A0N0TWF	2060	1873	1373	1100	1400	32.5/1.8/34.3	CH74	3 x CHK-0750-6-DL	2 x CHK-1030-6-DL
NXP23005A0N0SWF		2300	2091	1533	1250	1500	36.3/2.0/38.3	CH74	3 x CHK-0820-6-DL	
NXP24705A0N0SWF	NXP24705A0N0TWF	2470	2245	1647	1300	1600	38.8/2.2/41.0	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0650-6-DL
NXP29505A0N0SWF	NXP29505A0N0TWF	2950	2681	1967	1550	1950	46.3/2.6/48.9	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0750-6-DL
NXP37105A0N0SWF	NXP37105A0N0TWF	3710	3372	2473	1950	2450	58.2/3.0/61.2	2 x CH74	6 x CHK-0650-6-DL	4 x CHK-1030-6-DL
NXP41405A0N0SWF	NXP41405A0N0TWF	4140	3763	2760	2150	2700	65.0/3.6/68.6	2 x CH74	6 x CHK-0750-6-DL	4 x CHK-1150-6-DL
2 x NXP24705A0N0SWF	2 x NXP24705A0N0TWF	4700	4300	3100	2450	3050	73.7/4.2/77.9	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0650-6-DL
2 x NXP29505A0N0SWF	2 x NXP29505A0N0TWF	5600	5100	3700	2900	3600	88/5/93	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0750-6-DL
2 x NXP37105A0N0SWF	2 x NXP37105A0N0TWF	7000	6400	4700	3600	4500	110.6/5.7/116.3	4 x CH74	12 x CHK-0650-6-DL	8 x CHK-1030-6-DL
2 x NXP41405A0N0SWF	2 x NXP41405A0N0TWF	7900	7200	5300	4100	5150	123.5/6.9/130.4	4 x CH74	12 x CHK-0750-6-DL	8 x CHK-1150-6-DL

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I_{th} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any load variation or margin for overloadability.

I_L = Low overloadability current. Allows +10% load variation. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% load variation. 50% exceeding can be continuous.

All values with cosφ = 0,83 and efficiency = 97%

***) c** = power loss into coolant; **a** = power loss into air; **T** = total power loss; power losses of input chokes not included. All power losses obtained using max. supply voltage, Ith and switching frequency of 3.6 kHz and Closed Loop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula **P = √3 x Un x In x cosφ x eff%** to calculate the NX Liquid-Cooled drive output power.

The enclosure class for all NX Liquid-Cooled AC drives is IP00.

If the motor is continuously run at frequencies below 5 Hz (besides start and stop ramps), please pay attention to the drive dimensioning for low frequencies, i.e. maximum I = 0.66* I_{th} or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon.

Drive overrating may also be necessary if the process requires high starting torque.

CH3 and CH4 have air cooled choke as standard. CH5 and above have Liquid cooled choke as standard and air cooled choke as option.

VACON® NXP Liquid Cooled AC drives, 6-pulse and 12-pulse, mains voltage 525-690 VAC

AC drive type 6-pulse	AC drive type 12-pulse	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis	Choke type 6-pulse	Choke type 12-pulse
		Ther-mal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Opti-mum motor at I_{th} (525 V) [kW]	Opti-mum motor at I_{th} (690 V) [kW]				
NXP01706A0T0SWF		170	155	113	110	160	4.0/0.2/4.2	CH61	CHK-0261-6-DL	
NXP02086A0T0SWF		208	189	139	132	200	4.8/0.3/5.1	CH61	CHK-0261-6-DL	
NXP02616A0T0SWF		261	237	174	160	250	6.3/0.3/6.6	CH61	CHK-0261-6-DL	
NXP03256A0T0SWF	NXP03256A0T0TWF	325	295	217	200	300	7.2/0.4/7.6	CH72	CHK-0400-6-DL	2 x CHK-0261-6-DL
NXP03856A0T0SWF	NXP03856A0T0TWF	385	350	257	250	355	8.5/0.5/9.0	CH72	CHK-0400-6-DL	2 x CHK-0261-6-DL
NXP04166A0T0SWF	NXP04166A0T0TWF	416	378	277	250	355	9.1/0.5/9.6	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP04606A0T0SWF	NXP04606A0T0TWF	460	418	307	300	400	10.0/0.5/10.5	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05026A0T0SWF	NXP05026A0T0TWF	502	456	335	355	450	11.2/0.6/11.8	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05906A0T0SWF		590	536	393	400	560	12.4/0.7/13.1	CH63	CHK-0650-6-DL	
NXP06506A0T0SWF		650	591	433	450	600	14.2/0.8/15.0	CH63	CHK-0650-6-DL	
NXP07506A0T0SWF		750	682	500	500	700	16.4/0.9/17.3	CH63	CHK-0750-6-DL	
NXP08206A0T0SWF	NXP08206A0T0TWF	820	745	547	560	800	17.3/1.0/18.3	CH74	3 x CHK-0400-6-DL	2 x CHK-0520-6-DL
NXP09206A0T0SWF	NXP09206A0T0TWF	920	836	613	650	850	19.4/1.1/20.5	CH74	3 x CHK-0400-6-DL	2 x CHK-0520-6-DL
NXP10306A0T0SWF	NXP10306A0T0TWF	1030	936	687	700	1000	21.6/1.2/22.8	CH74	3 x CHK-0400-6-DL	2 x CHK-0520-6-DL
NXP11806A0T0SWF	NXP11806A0T0TWF	1180	1073	787	800	1100	25.0/1.3/26.3	CH74	3 x CHK-0400-6-DL	2 x CHK-0650-6-DL
NXP13006A0T0SWF	NXP13006A0T0TWF	1300	1182	867	900	1200	27.3/1.5/28.8	CH74	3 x CHK-0520-6-DL	2 x CHK-0650-6-DL
NXP15006A0T0SWF	NXP15006A0T0TWF	1500	1364	1000	1050	1400	32.1/1.7/33.8	CH74	3 x CHK-0520-6-DL	2 x CHK-0820-6-DL
NXP17006A0T0SWF	NXP17006A0T0TWF	1700	1545	1133	1150	1550	36.5/1.9/38.4	CH74	3 x CHK-0650-6-DL	2 x CHK-1030-6-DL
NXP18506A0T0SWF	NXP18506A0T0TWF	1850	1682	1233	1250	1650	39.0/2.0/41.0	2 x CH74	6 x CHK-0400-6-DL	4 x CHK-0520-6-DL
NXP21206A0T0SWF	NXP21206A0T0TWF	2120	1927	1413	1450	1900	44.9/2.4/47.3	2 x CH74	6 x CHK-0400-6-DL	4 x CHK-0650-6-DL
NXP23406A0T0SWF	NXP23406A0T0TWF	2340	2127	1560	1600	2100	49.2/2.6/51.8	2 x CH74	6 x CHK-0400-6-DL	4 x CHK-0650-6-DL
NXP27006A0T0SWF	NXP27006A0T0TWF	2700	2455	1800	1850	2450	57.7/3.1/60.8	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0750-6-DL
NXP31006A0T0SWF	NXP31006A0T0TWF	3100	2818	2066	2150	2800	65.7/3.4/69.1	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0820-6-DL
2 x NXP18506A0T0SWF	2 x NXP18506A0T0TWF	3500	3200	2300	2400	3150	74,2/3,8/77,9	4 x CH74	12 x CHK-0400-6-DL	8 x CHK-0520-6-DL
2 x NXP21206A0T0SWF	2 x NXP21206A0T0TWF	4000	3600	2700	2750	3600	85,4/4,5/89,9	4 x CH74	12 x CHK-0400-6-DL	8 x CHK-0650-6-DL
2 x NXP23406A0T0SWF	2 x NXP23406A0T0TWF	4400	4000	2900	3050	3950	93,4/5,0/98,4	4 x CH74	12 x CHK-0400-6-DL	8 x CHK-0650-6-DL
2 x NXP27006A0T0SWF	2 x NXP27006A0T0TWF	5100	4600	3400	3500	4600	109,7/5,8/115,5	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0750-6-DL
2 x NXP31006A0T0SWF	2 x NXP31006A0T0TWF	5900	5400	3900	4050	5300	124,8/6,5/131,3	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0820-6-DL

Standard chokes for VACON® NX Liquid Cooled product range

Choke type	Heat losses [W]	Dimensions W x H x D [mm]	Weight [kg]
CHK0023N6A0	145	230 x 179 x 121	10
CHK0038N6A0	170	270 x 209 x 145	15
CHK0062N6A0	210	300 x 214 x 160	20
CHK0087N6A0	250	300 x 233 x 170	26
CHK0145N6A0	380	200 x 292 x 185	37
CHK-0261-6-DL	323	308 x 500 x 270	70
CHK-0400-6-DL	484	308 x 497 x 276	75
CHK-0520-6-DL	574	450 x 502 x 276	104
CHK-0650-6-DL	468	450 x 505 x 284	121
CHK-0750-6-DL	816	450 x 557 x 284	135
CHK-0820-6-DL	731	450 x 506 x 282	118
CHK-1030-6-DL	777	450 x 642 x 274	124
CHK-1150-6-DL	882	450 x 647 x 308	162

VACON® NXP Liquid Cooled inverter units, DC bus voltage 465-800 VDC

AC drive type	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (540 VDC) [kW]	Optimum motor at I_{th} (675 VDC) [kW]		
NXP00165A0T1IWS	16	15	11	7.5	11	0.4/0.2/0.6	CH3
NXP00225A0T1IWS	22	20	15	11	15	0.5/0.2/0.7	CH3
NXP00315A0T1IWS	31	28	21	15	18.5	0.7/0.2/0.9	CH3
NXP00385A0T1IWS	38	35	25	18.5	22	0.8/0.2/1.0	CH3
NXP00455A0T1IWS	45	41	30	22	30	1.0/0.3/1.3	CH3
NXP00615A0T1IWS	61	55	41	30	37	1.3/0.3/1.5	CH3
NXP00725A0T0IWS	72	65	48	37	45	1.2/0.3/1.5	CH4
NXP00875A0T0IWS	87	79	58	45	55	1.5/0.3/1.8	CH4
NXP01055A0T0IWS	105	95	70	55	75	1.8/0.3/2.1	CH4
NXP01405A0T0IWS	140	127	93	75	90	2.3/0.3/2.6	CH4
NXP01685A0T0IWS	168	153	112	90	110	2.5/0.3/2.8	CH5
NXP02055A0T0IWS	205	186	137	110	132	3.0/0.4/3.4	CH5
NXP02615A0T0IWS	261	237	174	132	160	4.0/0.4/4.4	CH5
NXP03005A0T0IWF	300	273	200	160	200	4.5/0.4/4.9	CH61
NXP03855A0T0IWF	385	350	257	200	250	5.5/0.5/6.0	CH61
NXP04605A0T0IWF	460	418	307	250	315	5.5/0.5/6.0	CH62
NXP05205A0T0IWF	520	473	347	250	355	6.5/0.5/7.0	CH62
NXP05905A0T0IWF	590	536	393	315	400	7.5/0.6/8.1	CH62
NXP06505A0T0IWF	650	591	433	355	450	8.5/0.6/9.1	CH62
NXP07305A0T0IWF	730	664	487	400	500	10.0/0.7/10.7	CH62
NXP08205A0T0IWF	820	745	547	450	560	12.5/0.8/13.3	CH63
NXP09205A0T0IWF	920	836	613	500	600	14.4/0.9/15.3	CH63
NXP10305A0T0IWF	1030	936	687	560	700	16.5/1.0/17.5	CH63
NXP11505A0T0IWF	1150	1045	766	600	750	18.4/1.1/19.5	CH63
NXP13705A0T0IWF	1370	1245	913	700	900	15.5/1.0/16.5	CH64
NXP16405A0T0IWF	1640	1491	1093	900	1100	19.5/1.2/20.7	CH64
NXP20605A0T0IWF	2060	1873	1373	1100	1400	26.5/1.5/28.0	CH64
NXP23005A0T0IWF	2300	2091	1533	1250	1500	29.6/1.7/31.3	CH64
NXP24705A0T0IWF	2470	2245	1647	1300	1600	36.0/2.0/38.0	2 x CH64
NXP29505A0T0IWF	2950	2681	1967	1550	1950	39.0/2.4/41.4	2 x CH64
NXP37105A0T0IWF	3710	3372	2473	1950	2450	48.0/2.7/50.7	2 x CH64
NXP41405A0T0IWF	4140	3763	2760	2150	2700	53.0/3.0/56.0	2 x CH64
2 x NXP24705A0T0IWF	4700	4300	3100	2450	3050	69.1/3.9/73	4 x CH64
2 x NXP29505A0T0IWF	5600	5100	3700	2900	3600	74.4/4.6/79	4 x CH64
2 x NXP37105A0T0IWF	7000	6400	4700	3600	4500	90.8/5.2/96	4 x CH64
2 x NXP41405A0T0IWF	7900	7200	5300	4100	5150	101.2/5.8/107	4 x CH64

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 540 VDC = Rectified 400 VAC supply

Input 675 VDC = Rectified 500 VAC supply

VACON® NXP Liquid Cooled inverter units, DC bus voltage 640-1100 VDC [1)]

AC drive type	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (710 VDC) [kW]	Optimum motor at I_{th} (930 VDC) [kW]		
NXP01706A0T0IWF	170	155	113	110	160	3.6/0.2/3.8	CH61
NXP02086A0T0IWF	208	189	139	132	200	4.3/0.3/4.6	CH61
NXP02616A0T0IWF	261	237	174	160	250	5.4/0.3/5.7	CH61
NXP03256A0T0IWF	325	295	217	200	300	6.5/0.3/6.8	CH62
NXP03856A0T0IWF	385	350	257	250	355	7.5/0.4/7.9	CH62
NXP04166A0T0IWF	416	378	277	250	355	8.0/0.4/8.4	CH62
NXP04606A0T0IWF	460	418	307	300	400	8.7/0.4/9.1	CH62
NXP05026A0T0IWF	502	456	335	355	450	9.8/0.5/10.3	CH62
NXP05906A0T0IWF	590	536	393	400	560	10.9/0.6/11.5	CH63
NXP06506A0T0IWF	650	591	433	450	600	12.4/0.7/13.1	CH63
NXP07506A0T0IWF	750	682	500	500	700	14.4/0.8/15.2	CH63
NXP08206A0T0IWF	820	745	547	560	800	15.4/0.8/16.2	CH64
NXP09206A0T0IWF	920	836	613	650	850	17.2/0.9/18.1	CH64
NXP10306A0T0IWF	1030	936	687	700	1000	19.0/1.0/20.0	CH64
NXP11806A0T0IWF	1180	1073	787	800	1100	21.0/1.1/22.1	CH64
NXP13006A0T0IWF	1300	1182	867	900	1200	24.0/1.3/25.3	CH64
NXP15006A0T0IWF	1500	1364	1000	1050	1400	28.0/1.5/29.5	CH64
NXP17006A0T0IWF	1700	1545	1133	1150	1550	32.1/1.7/33.8	CH64
NXP18506A0T0IWF	1850	1682	1233	1250	1650	34.2/1.8/36.0	2 x CH64
NXP21206A0T0IWF	2120	1927	1413	1450	1900	37.8/2.0/39.8	2 x CH64
NXP23406A0T0IWF	2340	2127	1560	1600	2100	43.2/2.3/45.5	2 x CH64
NXP27006A0T0IWF	2700	2455	1800	1850	2450	50.4/2.7/53.1	2 x CH64
NXP31006A0T0IWF	3100	2818	2066	2150	2800	57.7/3.1/60.8	2 x CH64
2 x NXP18506A0T0IWF	3500	3200	2300	2400	3150	64,9/3,5/68,4	4 x CH64
2 x NXP21206A0T0IWF	4000	3600	2700	2750	3600	71,8/3,8/75,6	4 x CH64
2 x NXP23406A0T0IWF	4400	4000	2900	3050	3950	82,1/4,4/86,5	4 x CH64
2 x NXP27006A0T0IWF	5100	4600	3400	3500	4600	95,8/5,1/100,9	4 x CH64
2 x NXP31006A0T0IWF	5900	5400	3900	4050	5300	109,7/5,8/115,5	4 x CH64

[1)] High power 525-690V AFE, INU and BCU units available as wide voltage range version (NX_8 models) with DC bus voltage 640-1200 VDC. The units are ordered with the nominal mains voltage code 8 instead of 6 as for the standard version.

The following additional requirements applies to the wide voltage version:

- output filter with an inductance of at least 0.7% needed
- external 24VDC supply for the control unit

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 710 VDC = Rectified 525 VAC supply
Input 930 VDC = Rectified 690 VAC supply

VACON® NXP Liquid Cooled dimensions: drives consisting of one module

Chassis	Width [mm]	Height [mm]	Depth [mm]	Weight [kg]
CH3	160	431	246	15
CH4	193	493	257	22
CH5	246	553	264	40
CH60	246	673	374	55
CH61/62	246	658	372	55
CH63	505	923	375	120
Ch64	746	923	375	180
CH72	246	1076	372	90
Ch74	746	1175	385	280

One-module drive dimensions (mounting base included). Please note that AC chokes are not included.

VACON® NXN Liquid Cooled non regenerative front-end, DC bus voltage 465-800 V DC, 6/12-pulse

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	400 VAC mains I_{th} [kW]	500 VAC mains I_{th} [kW]	400 VAC mains I_L [kW]	500 VAC mains I_L [kW]		
NXN20006A0T0	2000	1818	1333	1282	1605	1165	1458	5.7/0.5/6.2	CH60

VACON® NXN Liquid Cooled non regenerative front-end, DC bus voltage 640-1100 V DC, 6/12-pulse

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	525 VAC mains I_{th} [kW]	690 VAC mains I_{th} [kW]	525 VAC mains I_L [kW]	690 VAC mains I_L [kW]		
NXN20006A0T0	2000	1818	1333	1685	2336	1531	2014	5.7/0.5/6.2	CH60

VACON® NXN Liquid Cooled non regenerative front-end line filters

Choke type	Suitability	Power loss c/a/T*) [kW]	Dimensions 1 pc W x H x D	Total weight [kg]	Pcs for NXN	Cooling
CHK-1030-6-DL	**NXN20006A0T0WWVA1A2BHB100**	1.18/0.5/1.68	506 x 676 x 302	237	2	Liquid

VACON® NXA Liquid Cooled active front-end, DC bus voltage 465-800 VDC

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	400 VAC mains I_{th} [kW]	500 VAC mains I_{th} [kW]	400 VAC mains I_L [kW]	500 VAC mains I_L [kW]		
NXA01685A0T02WS	168	153	112	113	142	103	129	2.5/0.3/2.8	CH5
NXA02055A0T02WS	205	186	137	138	173	125	157	3.0/0.4/3.4	CH5
NXA02615A0T02WS	261	237	174	176	220	160	200	4.0/0.4/4.4	CH5
NXA03005A0T02WF	300	273	200	202	253	184	230	4.5/0.4/4.9	CH61
NXA03855A0T02WF	385	350	257	259	324	236	295	5.5/0.5/6.0	CH61
NXA04605A0T02WF	460	418	307	310	388	282	352	5.5/0.5/6.0	CH62
NXA05205A0T02WF	520	473	347	350	438	319	398	6.5/0.5/7.0	CH62
NXA05905A0T02WF	590	536	393	398	497	361	452	7.5/0.6/8.1	CH62
NXA06505A0T02WF	650	591	433	438	548	398	498	8.5/0.6/9.1	CH62
NXA07305A0T02WF	730	664	487	492	615	448	559	10.0/0.7/10.7	CH62
NXA08205A0T02WF	820	745	547	553	691	502	628	10.0/0.7/10.7	CH63
NXA09205A0T02WF	920	836	613	620	775	563	704	12.4/0.8/12.4	CH63
NXA10305A0T02WF	1030	936	687	694	868	631	789	13.5/0.9/14.4	CH63
NXA11505A0T02WF	1150	1045	767	775	969	704	880	16.0/1.0/17.0	CH63
NXA13705A0T02WF	1370	1245	913	923	1154	839	1049	15.5/1.0/16.5	CH64
NXA16405A0T02WF	1640	1491	1093	1105	1382	1005	1256	19.5/1.2/20.7	CH64
NXA20605A0T02WF	2060	1873	1373	1388	1736	1262	1578	26.5/1.5/28.0	CH64
NXA23005A0T02WF	2300	2091	1533	1550	1938	1409	1762	29.6/1.7/31.3	CH64

VACON® NXA Liquid Cooled active front-end, DC bus voltage 640-1100 VDC [1)]

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	525 VAC mains I_{th} [kW]	690 VAC mains I_{th} [kW]	525 VAC mains I_L [kW]	690 VAC mains I_L [kW]		
NXA01706A0T02WF	170	155	113	150	198	137	180	3.6/0.2/3.8	CH61
NXA02086A0T02WF	208	189	139	184	242	167	220	4.3/0.3/4.6	CH61
NXA02616A0T02WF	261	237	174	231	303	210	276	5.4/0.3/5.7	CH61
NXA03256A0T02WF	325	295	217	287	378	261	343	6.5/0.3/6.8	CH62
NXA03856A0T02WF	385	350	257	341	448	310	407	7.5/0.4/7.9	CH62
NXA04166A0T02WF	416	378	277	368	484	334	439	8.0/0.4/8.4	CH62
NXA04606A0T02WF	460	418	307	407	535	370	486	8.7/0.4/9.1	CH62
NXA05026A0T02WF	502	456	335	444	584	403	530	9.8/0.5/10.3	CH62
NXA05906A0T02WF	590	536	393	522	686	474	623	10.9/0.6/11.5	CH63
NXA06506A0T02WF	650	591	433	575	756	523	687	12.4/0.7/13.1	CH63
NXA07506A0T02WF	750	682	500	663	872	603	793	14.4/0.8/15.2	CH63
NXA08206A0T02WF	820	745	547	725	953	659	866	15.4/0.8/16.2	CH64
NXA09206A0T02WF	920	836	613	814	1070	740	972	17.2/0.9/18.1	CH64
NXA10306A0T02WF	1030	936	687	911	1197	828	1088	19.0/1.0/20.0	CH64
NXA11806A0T02WF	1180	1073	787	1044	1372	949	1247	21.0/1.1/22.1	CH64
NXA13006A0T02WF	1300	1182	867	1150	1511	1046	1374	24.0/1.3/25.3	CH64
NXA15006A0T02WF	1500	1364	1000	1327	1744	1207	1586	28.0/1.5/29.5	CH64
NXA17006A0T02WF	1700	1545	1133	1504	1976	1367	1796	32.1/1.7/33.8	CH64

[1)] DC bus voltage 640-1200 VDC for wide range voltage version (NX_8).
* C = power loss into coolant, A = power loss into air, T = total power loss

VACON® Liquid Cooled regenerative line filters

LCL filter type	Suitability	Power loss c/a/T*) [kW]	Dimensions L_{net} 1pcs WxHxD [mm]	Dimensions L_{drive} 1pcs (total 3pcs) WxHxD [mm]	Dimensions C_{bank} 1pcs WxHxD [mm]	Total weight [kg]
RLC-0385-6-0	CH62/690VAC: 325A & 385A	2,6/0,8/3,4	580 x 450 x 385	410 x 415 x 385	360 x 265 x 150	458
RLC-0520-6-0	CH62/500-690VAC	2,65/0,65/3,3	580 x 450 x 385	410 x 415 x 385	360 x 265 x 150	481
RLC-0750-6-0	CH62/500VAC, CH63/690VAC	3,7/1/4,7	580 x 450 x 385	410 x 450 x 385	360 x 275 x 335	508
RLC-0920-6-0	CH63/500VAC, CH64/690VAC	4,5/1,4/5,9	580 x 500 x 390	410 x 500 x 400	360 x 275 x 335	577
RLC-1180-6-0	CH63/500VAC, CH64/690VAC	6,35/1,95/8,3	585 x 545 x 385	410 x 545 x 385	350 x 290 x 460	625
RLC-1640-6-0	CH64/500-690VAC	8,2/2,8/11	585 x 645 x 385	420 x 645 x 385	350 x 290 x 460	736
RLC-2300-5-0	CH64/500VAC: 2060A & 2300A	9,5/2,9/12,4	585 x 820 x 370	410 x 820 x 380	580 x 290 x 405	896

The RLC filter contains a 3-phase choke on the mains side, capacitors and 3pcs 1-phase chokes on the AFE side.

VACON® NXB Liquid Cooled external brake chopper, DC bus voltage 460-800 VDC

AC drive type	Current				Braking power		Power loss c/a/T*) [kW]	Chassis
	BCU rated cont. braking current I_{br} [A]	Rated min resistance 800 VDC (Ω)	Rated min resistance 600 VDC (Ω)	Rated max input current (Adc)	Rated cont. braking power 2*R 800 VDC [kW]	Rated cont. braking power 2*R 600 VDC [kW]		
NXB00315A0T08WS	2*31	25.7	19.5	62	49	37	0.7/0.2/0.9	CH3
NXB00615A0T08WS	2*61	13.1	9.9	122	97	73	1.3/0.3/1.5	CH3
NXB00875A0T08WS	2*87	9.2	7.0	174	138	105	1.5/0.3/1.8	CH4
NXB01055A0T08WS	2*105	7.6	5.8	210	167	127	1.8/0.3/2.1	CH4
NXB01405A0T08WS	2*140	5.7	4.3	280	223	169	2.3/0.3/2.6	CH4
NXB01685A0T08WS	2*168	4.7	3.6	336	267	203	2.5/0.3/2.8	CH5
NXB02055A0T08WS	2*205	3.9	3.0	410	326	248	3.0/0.4/3.4	CH5
NXB02615A0T08WS	2*261	3.1	2.3	522	415	316	4.0/0.4/4.4	CH5
NXB03005A0T08WF	2*300	2.7	2.0	600	477	363	4.5/0.4/4.9	CH61
NXB03855A0T08WF	2*385	2.1	1.6	770	613	466	5.5/0.5/6.0	CH61
NXB04605A0T08WF	2*460	1.7	1.3	920	732	556	5.5/0.5/6.0	CH62
NXB05205A0T08WF	2*520	1.5	1.2	1040	828	629	6.5/0.5/7.0	CH62
NXB05905A0T08WF	2*590	1.4	1.1	1180	939	714	7.5/0.6/8.1	CH62
NXB06505A0T08WF	2*650	1.2	1.0	1300	1035	786	8.5/0.6/9.1	CH62
NXB07305A0T08WF	2*730	1.1	0.9	1460	1162	833	10.0/0.7/10.7	CH62

VACON® NXB Liquid Cooled external brake chopper, DC bus voltage 640-1100 VDC [1)]

AC drive type	Current				Braking power		Power loss c/a/T*) [kW]	Chassis
	BCU rated cont. braking current I_{br} [A]	Rated min resistance 1100 VDC (Ω)	Rated min resistance 840 VDC (Ω)	Rated max input current (Adc)	Rated cont. braking power 2*R 1100 VDC [kW]	Rated cont. braking power 2*R 840 VDC [kW]		
NXB01706A0T08WF	2*170	6.5	4.9	340	372	282	4.5/0.2/4.7	CH61
NXB02086A0T08WF	2*208	5.3	4	416	456	346	5.5/0.3/5.8	CH61
NXB02616A0T08WF	2*261	4.2	3.2	522	572	435	5.5/0.3/5.8	CH61
NXB03256A0T08WF	2*325	3.4	2.6	650	713	542	6.5/0.3/6.8	CH62
NXB03856A0T08WF	2*385	2.9	2.2	770	845	643	7.5/0.4/7.9	CH62
NXB04166A0T08WF	2*416	2.6	2	832	913	693	8.1/0.4/8.4	CH62
NXB04606A0T08WF	2*460	2.4	1.8	920	1010	767	8.5/0.4/8.9	CH62
NXB05026A0T08WF	2*502	2.2	1.7	1004	1100	838	10.0/0.5/10.5	CH62

1) DC bus voltage 640-1136 VDC for wide range voltage version (NX_8).
NOTE: The rated currents in given ambient (+50 °C) and coolant (+30 °C) temperatures are achieved only when the switching frequency is equal to or less than the factory default.
NOTE: Braking power: $P_{brake} = 2*U_{brake}^2 / R_{resistor}$ when 2 resistors are used
NOTE: Max input DC current: $I_{in\_max} = P_{brake\_max} / U_{brake}$

VACON® NXP Liquid Cooled AC drive, internal brake chopper unit, braking voltage 460-800 VDC

Converter Type	Loadability	Braking capacity 600 VDC		Braking capacity 800 VDC		Chassis
	Rated min resistance [Ω]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	
NX_460-730 5 [1)]	1.3	276	461	492	615	CH72
NX_1370-2300 5	1.3	276	461	492	615	CH74

1) Only 6 pulse drives

VACON® NXP Liquid Cooled AC drive, internal brake chopper unit, braking voltage 840-1100 VDC

Converter Type	Loadability	Braking capacity 840 VDC		Braking capacity 1100 VDC		Chassis
	Rated min resistance [Ω]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	
NX_325-502 6 [1)]	2.8	252	300	432	392	CH72
NX_820-1700 6	2.8	252	300	432	392	CH74

1) Only 6 pulse drives

The internal brake chopper can also be used in motor application where 2…4 x Ch7x drives are used for a single motor, but in this case the DC connections of the power modules must be connected together.

VACON® external brake resistors for liquid cooled CH72 (CH74) drives – IP20

Product code	Voltage range [VDC]	Maximum brake power [kw]	Maximum average power [kW] (1 puls/2min)	Resistance [Ω]	Maximum energy [kJ] (predefined power pulse)	Dimensions W x H x D [mm]	Weight [kg]
BRW-0730-LD-5 [1]	465…800 VDC	637 [3]	13.3	1.3	1594	480 x 600 x 740	55
BRW-0730-HD-5 [2]	465…800 VDC	637 [3]	34.5	1.3	4145	480 x 1020 x 740	95
BRW-0502-LD-6 [1]	640…1100 VDC	516 [4]	10.8	2.8	1290	480 x 760 x 530	40
BRW-0502-HD-6 [2]	640…1100 VDC	516 [4]	28	2.8	3354	480 x 1020 x 740	85

NOTE: Thermal protection switch included

1) LD = Light Duty: 5s nominal torque braking from nominal speed reduced linearly to zero once per 120s
2) HD = Heavy duty: 3s nominal torque braking at nominal speed + 7s nominal torque braking from nominal speed reduced linearly to zero once per 120s.
3) at 911 VDC
4) at 1200 VDC

Liquid to liquid heat exchangers

	HXL-M/V/R-040-N-P	HXL/M-M/V/R-120-N-P	HXL/M-M/R-300-N-P
Cooling power	0…40 kW	0…120 kW	0…300 kW
Mains supply	380…420 VAC	380…420 VAC	380…500 VAC
Flow	40…120 l/min	120…360 l/min	360…900 l/min
Distribution pressure	0.3 bar / l=10 m, DN32*	HXL: 1 bar / l = 40 m, DN50 HXM: 0.7 bar / l = 30 m, DN50	HXL: 1 bar / l = 40 m, DN80 HXM: 0.7 bar / l = 25 m, DN80
Double pump		HXM	HXM
Cabinets	VEDA, Rittal	VEDA, Rittal	Rittal
Dimensions W x H x D [mm] (without cabinet)	305 (506) x 1910 x 566	705 (982) x 1885 x 603	1100 x 1900 x 750

* l = maximum distribution distance with specific DN diameter

VACON® NXP Liquid Cooled Enclosed drive

AC drive type	Rated current			Electrical output power		Chassis	Dimensions W x H x D W/O Cooling unit [in]
	Thermal ITH [A]	Cont. I_L [A]	Cont. I_H [A]	Motor at I_{th} (400 VAC) [kW]	Motor at I_{th} (500 VAC) [kW]		
NXP13705A5T0RWN-LIQC	1370	1245	913	700	900	CH64	2000 x 2100 x 900
NXP16405A5T0RWN-LIQC	1640	1491	1093	900	1100	CH64	2000 x 2100 x 900

AC drive type	Rated current			Electrical output power		Chassis	Dimensions W x H x D W/O Cooling unit [in]
	Thermal ITH [A]	Cont. I_L [A]	Cont. I_H [A]	Motor at I_{th} (525 VAC) [kW]	Motor at I_{th} (690 VAC) [kW]		
NXP08206A5T0RWN-LIQC	820	745	547	560	800	CH64	2000 x 2100 x 900
NXP09206A5T0RWN-LIQC	920	836	613	650	850	CH64	2000 x 2100 x 900
NXP10306A5T0RWN-LIQC	1030	936	687	700	1000	CH64	2000 x 2100 x 900
NXP11806A5T0RWN-LIQC	1180	1073	787	800	1100	CH64	2000 x 2100 x 900
NXP13006A5T0RWN-LIQC	1300	1182	867	900	1200	CH64	2000 x 2100 x 900
NXP15006A5T0RWN-LIQC	1500	1364	1000	1000	1400	CH64	2000 x 2100 x 900
NXP17006A5T0RWN-LIQC	1700	1545	1133	1150	1550	CH64	2000 x 2100 x 900

Technical data

Mains connection	Input voltage U_{in}	NX_5: 400…500 VAC (–10%…+10%); 465…800 VDC (–0%…+0%) NX_6: 525…690 VAC (–10%…+10%); 640…1100 VDC (–0%…+0%) NX_8: 525…690 VAC (–10%…+10%); 640…1136 VDC (–0%…+0%)[1)] NX_8: 525…690 VAC (–10%…+10%); 640…1200 VDC (–0%…+0%)[2)]
	Input frequency	45…66 Hz
Motor connections	Output voltage	0-U_{in}
	Output frequency	0…320 Hz
	Output filter	VACON® liquid cooled NX_8 unit must be equipped with a output filter with an inductance of at least 0.7%.
Control characteristics	Control method	Frequency control U/f Open loop vector control (5-150% of base speed): speed control 0.5%, dynamic 0.3%sec, torque lin. <2%, torque rise time ~5 ms Closed loop vector control (entire speed range): speed control 0.01%, dynamic 0.2% sec, torque lin. <2%, torque rise time ~2 ms
	Switching frequency	NX_5: Up to and including NX_0061: 1…16 kHz; Factory default 10 kHz From NX_0072: 1…6 kHz; Factory default 3.6 kHz (1…10 kHz with special application) NX_6/NX_8: 1…6 kHz; Factory default 1.5 kHz
	Field weakening point	8…320 Hz
	Acceleration time	0…3000 sec
	Deceleration time	0…3000 sec
	Braking	DC brake: 30% of TN (without brake resistor), flux braking
Ambient conditions	Ambient operating temperature	–10 °C (no frost)…+50 °C (at I_{th}); The NX liquid cooled drives must be used in an heated indoor controlled environment.
	Installation temperature	0…+70 °C
	Storage temperature	–40 °C…+70 °C; no liquid in heatsink under 0 °C
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality - chemical vapours - mechanical particles"	No corrosive gases IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2 (no conductive dust allowed)
	Altitude	NX_5: (380…500 V): 3000 m ASL; in case network is not corner grounded NX_6/NX_8: (525…690 V) max. 2000 m ASL. For further requirements, contact factory 100% load capacity (no derating) up to 1,000 m; above 1,000 m derating of maximum ambient operating temperature by 0,5 °C per each 100 m is required.
	Vibration	5…150 Hz
	EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3…31 Hz Max acceleration amplitude 1 G at 31…150 Hz
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP00 / standard in entire kW/HP range
EMC	Immunity	Fulfils all EMC immunity requirements
	Emissions	EMC level N, T (IT networks)
Safety		EN 50178, EN 60204-1, IEC 61800-5-1, CE, UL, CUL; (see unit nameplate for more details)
Functional safety *)	STO	EN/IEC 61800-5-2 Safe Torque Off (STO) SIL2, EN ISO 13849-1 PL"d" Category 3, EN 62061: SILCL2, IEC 61508: SIL2.
	SS1	EN /IEC 61800-5-2 Safe Stop 1 (SS1) SIL2, EN ISO 13849-1 PL"d" Category 3, EN /IEC62061: SILCL2, IEC 61508: SIL2.
	ATEX Thermistor input	94/9/EC, CE 0537 Ex 11 (2) GD
	Advance safety option	STO (+SBC),SS1,SS2, SOS,SLS,SMS,SSM,SSR
Approvals	Type tested	SGS Fimko CE, UL
	Type approval	DNV, BV, Lloyd's Register (other marine societies delivery based approvals)
	Approvals our partners have	Ex, SIRA
Liquid cooling	Allowed cooling agents	Drinking water Water-glycol mixture
	Temperature of cooling agent	0…35 °C (I_{th})(input); 35…55 °C, please see manual for further details Temperature rise during circulation max. 5 °C No condensation allowed
	System max. working pressure	6 bar/ 30 bar peak
	Pressure loss (at nominal flow)	Varies according to size, please see manual for further details
Protections		Overvoltage, undervoltage, earth fault, mains supervision, motor phase supervision, overcurrent, unitover-temperature, motor overload, motor stall, motor underload, short-circuit of +24 V and +10 V reference voltages.

*) with OPT-AF board (SS1 requires external safety relay)
1) NX_8 drives only available as Ch6x NXB units.
2) NX_8 drives only available as Ch6x NXA/NXP units.

Typecode key

VACON® NXP Liquid Cooled drives

NXP	0000	5	A	0	N	1	S	W	V	A1 A2 00 00 C3	-LIQC	+HXC1

NXP — **Product Range**
NXP = AC drive or inverter unit
NXA = Active front-end unit
NXB = Brake-chopper unit
NXN = Non Regenerative Front End (NFE)

0000 — **Nominal current**
0007 = 7 A
0022 = 22 A
0205 = 205 A etc.
0920 = 920 A

5 — **Nominal mains voltage**
5 = 380-500 VAC
6 = 525-690 VAC

A — **Control keypad**
A = standard alpha-numeric
B = no local control keypad
F = dummy panel
G = graphical keypad

0 — **Enclosure class**
0 = IP00
5 = IP54

N — **EMC emission levels**
N = No EMC emission protection; to be installed on enclosures
T = Fulfills standard 61800-3 for IT-networks

1 — **Brake chopper**
0 = no brake chopper
1 = integrated brake chopper (CH3, CH72 (6-pulse) & CH74 only)

S — **Hardware modifications: supply**
I = Inverter unit; DC-supply
2 = Active front-end unit
S = 6-pulse **with A/C chokes**
Y = 6-pulse **with L/C chokes**
N = 6-pulse, **no chokes**
T = 12-pulse **with A/C chokes**
U = 12-pulse, **no chokes**
W = 12-pulse **with L/C chokes**
R = Low harmonic

W — **Hardware modifications: cooling**
W = Liquid-cooled module with aluminium heatsink
P = Liquid-cooled module with nickel-coated aluminium heatsink

V — **Hardware modifications: boards**
F = Fiber connection, standard (from CH61)
G = Fiber connection, varnished (from CH61)
S = Direct connection, standard
V = Direct connection, varnished

If OPT-AF option board is used
N = IP54 control box, fiber connection, standard boards, (from CH61)
O = IP54 control box, fiber connection, varnished boards, (from CH61)

A1, **A2** — **Option boards; each slot is represented by two characters:**
A = basic I/O boards,
B = expander I/O boards
C = fieldbus boards
D = special boards

00
00
C3

-LIQC — **Liquid Cooled Enclosed Drive**

+HXC1 — **Heat Exchanger option for enclosed drive**
+HXC1 = Stainless steel piping, 1-pump
+HXC2 = Stainless steel piping, 2-pumps

*) Note, the control unit of NX_8 drives need to be supplied with a external 24 Vdc power source.

Marine approvals

Type approvals

Delivery based approvals

Option boards

Type	Description	Card slot					I / O signal																					
		A	B	C	D	E	DI	DO	DI DO	AI (mA/V/±V)	AI (mA) isolated	AO (mA/V)	AO (mA) isolated	RO (NO/NC)	RO (NO)	+10Vref	Therm	+24V/ EXT +24 V	pt100	KTY84	42-240 VAC input	DI/DO (10...24 V)	DI/DO (RS422)	DI ~ 1Vp-p	Resolver	Out +5 V/+15 V/+24 V	Out +15 V/+24 V	Out +5 V/+12 V/+15 V
Basic I/O cards (OPTA)																												
OPTA1	DI/DO/AI/AO/ 10V/ 24V	■					6	1		2		1				1		2										
OPTA2	Relay output (NO/NC)		■											2														
OPTA3	Relay output + Thermistor input		■											1	1		1											
OPTA4	Encoder TTL type			■			2																3/0			1		
OPTA5	Encoder HTL type			■			2															3/0					1	
OPTA7	Double encoder HTL type			■																		6/2					1	
OPTA8	"OPTA1 + Analogue signals galvanically isolated as a group"	■					6	1		2		1				1		2										
OPTA9	OPTA1 + 2,5mm2 connectors	■					6	1		2		1				1		2										
OPTAE	Encoder HTL type (Divider + direction)			■				2														3/0					1	
OPTAF	STO, ATEX therm		■				2							1	1		1											
OPTAK	Sin/Cos encoder interface			■																				3			1	
OPTAN	DI/AI/AO	■					6			2		2																
I/O expander cards (OPTB)																												
OPTB1	Programmable I/O		■	■	■	■			6									1										
OPTB2	Relay output + Thermistor input		■	■	■	■								1	1		1											
OPTB4	"Analog input/output Analogue signals galvanically isolated separately"		■	■	■	■					1		2					1										
OPTB5	Relay output		■	■	■	■									3													
OPTB8	"Temperature Measurement option PT100"		■	■	■	■												1	3									
OPTB9	DI + Relay output		■	■	■	■	2								1						5							
OPTBH	"Temperature Measurement option pt100, pt1000, Ni1000, KTY84"		■	■	■	■													3	3								
OPTBB	EnDat + Sin/Cos 1 Vp-p			■	■	■	2																0/2	2				1
OPTBC	Resolver, 3xDO (Wide range)			■	■	■																3/3			1			
OPTBE	EnDat/SSI/BiSS C		■	■	■	■																						
OPTBL	Advanced safety option			■	■	■	4	2										1										
OPTBM	OPTBL+ HTL/TTL encoder			■	■	■	4	2										1										
OPTBN	OPTBL+ Sin/Cos encoder			■	■	■	4	2										1										
Fieldbus cards (OPTC and OPTE)*																												
OPTE2	RS485 with screw terminal				■	■	RS485 with screw terminal																					
OPTE3	PROFIBUS DP with screw terminal				■	■	PROFIBUS DP with screw terminal																					
OPTE5	PROFIBUS DP with D9-connector				■	■	PROFIBUS DP with D9-connector																					
OPTE6	CANopen				■	■	CANopen																					
OPTE7	DeviceNet				■	■	DeviceNet																					
OPTE8	RS485 with D9-connector				■	■	RS485 with D9-connector																					
OPTE9	Dual-port Ethernet				■	■	Dual-port Ethernet																					
OPTEA	Advanced Dual-port Ethernet				■	■	Advanced Dual-port Ethernet																					
OPTC2	RS485 with screw terminal				■	■	RS485 with screw terminal																					
OPTC3	PROFIBUS DP with screw terminal				■	■	PROFIBUS DP with screw terminal																					
OPTC4	LonWorks				■	■	LonWorks																					
OPTC5	PROFIBUS DP with D9-connector					■	PROFIBUS DP with D9-connector																					
OPTC6	CANopen				■	■	CANopen																					
OPTC7	DeviceNet				■	■	DeviceNet																					
OPTC8	RS485 with D9-connector				■	■	RS485 with D9-connector																					
OPTCI	Modbus/TCP				■	■	Modbus TCP																					
OPTCJ	BACnet MS/TP				■	■	BACnet MS/TP																					
OPTCP	PROFINET IO				■	■	PROFINET IO																					
OPTCQ	EtherNet/IP				■	■	EtherNet/IP																					
Communication cards (OPTD)																												
OPT-D1	SystemBus adapt, 2xfibre-optic				■	■	System Bus adapter (2 x fiber optic pairs)																					
OPT-D2	SystemBus (1xfiber), isol. CAN				■	■	System Bus adapter (1 x fiber optic pair) & CAN-bus adapter (galvanically decoupled)																					
OPT-D3	RS232 adapter (no galv.isol.)				■	■	RS232 adapter card (galvanically decoupled), used mainly for application engineering to connect another keypad																					
OPT-D6	CAN-Bus (galv. decoupled)		■		■	■	CAN-bus adapter (galvanically decoupled)																					
OPT-D7	Line voltage measurement			■			Line voltage measurement																					

**) OPTE series fieldbus cards provide most recent features on market and they are recommended for new installation*

1) Analogue signals galvanically isolated as a group
2) Analogue signals galvanically isolated separately

DrivePro® Life Cycle services
Delivering a customized service experience!

We understand that every application is different. Having the ability to build a customized service package to suit your specific needs is essential.

DrivePro® Life Cycle Services is a collection of tailormade products designed around you. Each one engineered to support your business through the different stages of your AC drive's life cycle.

From optimized spare-part packages to condition-monitoring solutions, our products can be customized to help you achieve your business goals.

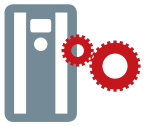
With the help of these products, we add value to your application by ensuring you get the most out of your AC drive.

When you deal with us, we also offer you access to training, as well as the application knowledge to help you in planning and preparation. Our experts are at your service.

You're covered
with DrivePro® Life Cycle service products

DrivePro® Retrofit
Minimize the impact and maximize the benefit

Manage the end of product lifecycle efficiently, with professional help to replace your legacy drives.
The DrivePro® Retrofit service ensures optimal uptime and productivity during the smooth replacement process.



DrivePro® Spare Parts
Plan ahead with your spare part package

In critical situations, you want no delays. With DrivePro® Spare Parts you always have the right parts on hand, on time. Keep your drives running at top efficiency, and optimize system performance.

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You obtain the fastest, most cost-efficient alternative to repair, when time is critical. You increase uptime, thanks to quick and correct replacement of the drive.

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You can rely on us every step of the way

DrivePro® Remote Expert Support offers speedy resolution of on-site issues thanks to timely access to accurate information. With the secure connection, our drives experts analyze issues remotely reducing the time and cost involved in unnecessary service visits.

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It collects all the relevant data and analyzes it so that you can resolve issues before they affect your processes.

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http://drives.danfoss.com/danfoss-drives/local-contacts/

ENGINEERING
TOMORROW

A better tomorrow is **driven by drives**

Danfoss Drives is a world leader in variable speed control of electric motors.
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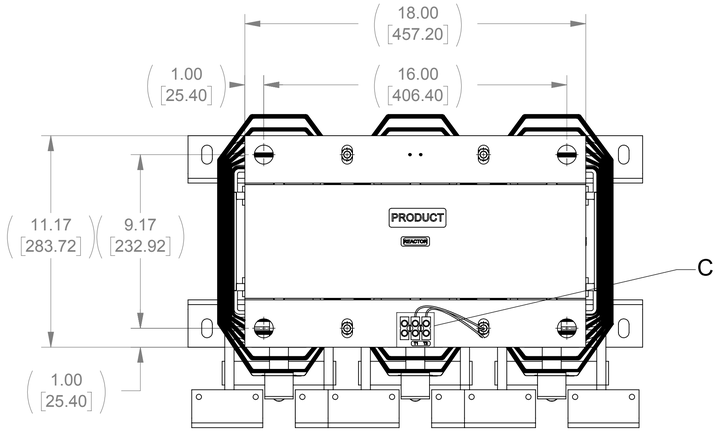
DKDD.PB.909.A5.02

Harmonic Filter

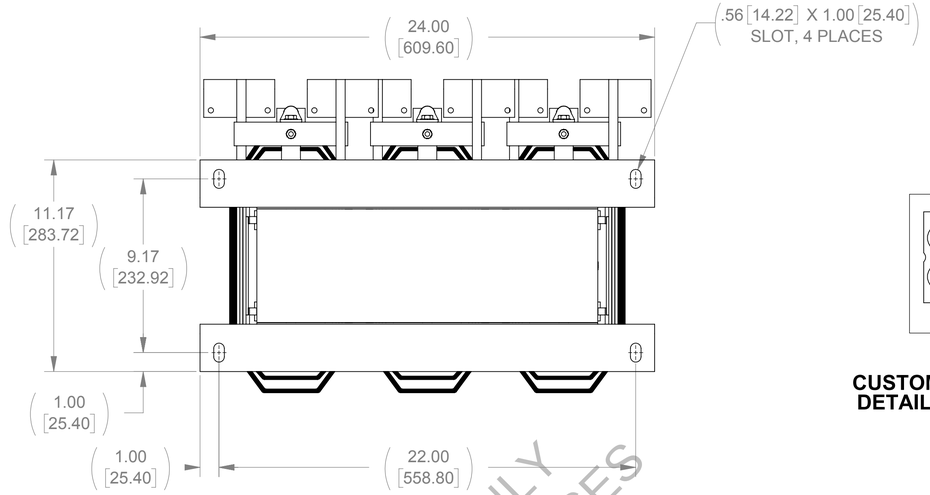
APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

APPROX. WEIGHT (LBS)
668

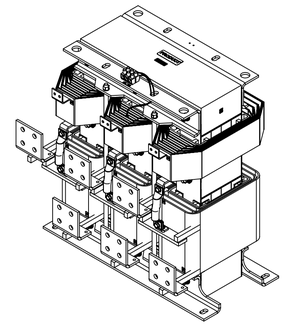
ECO No	DESCRIPTION	REV BY	DATE
M9783	CHANGED CAPPANEL-543 TO 543C	MN	02/26/16

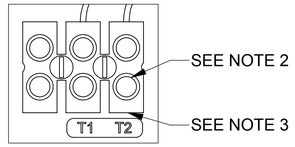


TOP VIEW

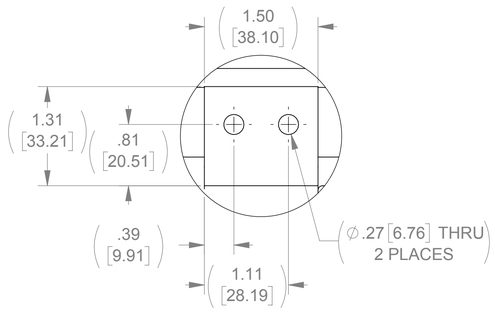


BOTTOM VIEW

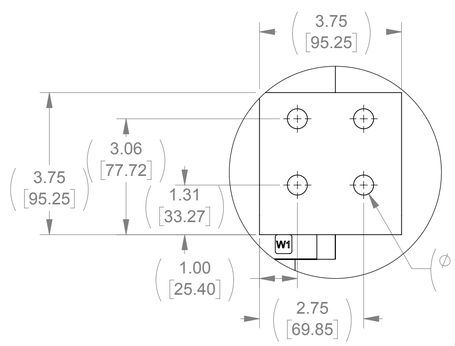




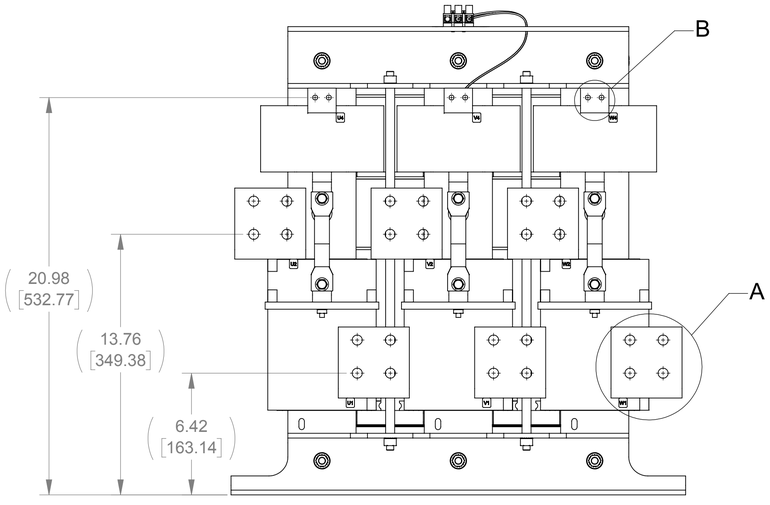
DETAIL C
CUSTOMER CONNECTION
DETAIL VIEW (THERMAL)



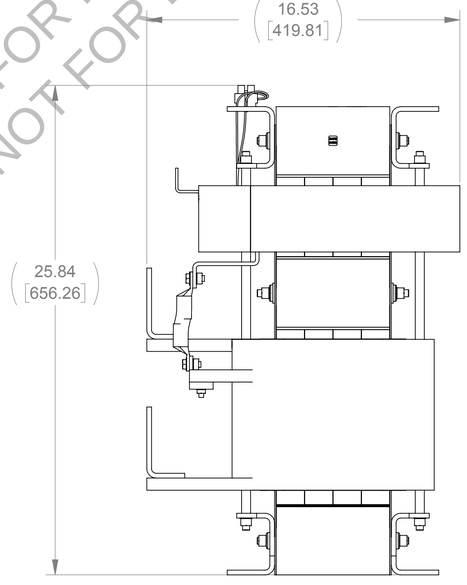
DETAIL B
(3 PLACES)



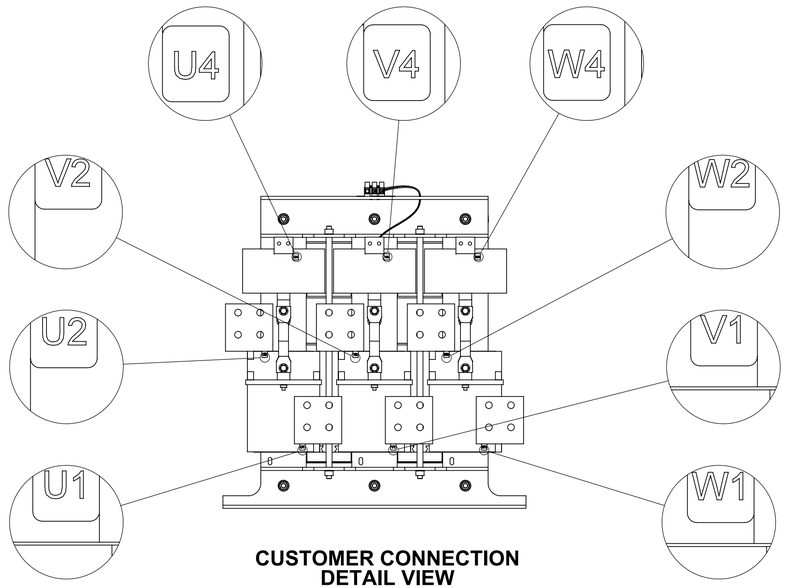
DETAIL A
(6 PLACES)



FRONT VIEW



RIGHT SIDE VIEW



CUSTOMER CONNECTION
DETAIL VIEW

NOTES:

1. **FILTER INCLUDES CAPPANEL-543C (QTY. 2)**
2. **TERMINAL SCREW TIGHTENING TORQUE: 16 IN/LBS.**
3. **WIRE RANGE: 4-14 AWG.**

THE COMPONENT, PART OR ASSEMBLY DESCRIBED IN THIS DOCUMENT MUST COMPLY WITH THE EU(EUROPEAN UNION) DIRECTIVE RoHS

CONTAINS <0.1% OF ANY SVHC BY WEIGHT PER REACH REGULATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM] TOLERANCES ARE:

ANGLES: ± **1** °

1 PLACE .X: ± **.1 [2.5]**

2 PLACE .XX: ± **.03 [0.76]**

3 PLACE .XXX: ± **.010 [0.254]**

MTE
AN SL POWER ELECTRONICS COMPANY
N83 W13330 Leon Road
Menomonee Falls, WI 53051 USA
800.455.4683
262.253.8200

MATERIAL

DRAWN JS	DATE 8/05/12
CHECKED JM	DATE 03/21/16
APPROVED JM	DATE 03/21/16

DESCRIPTION

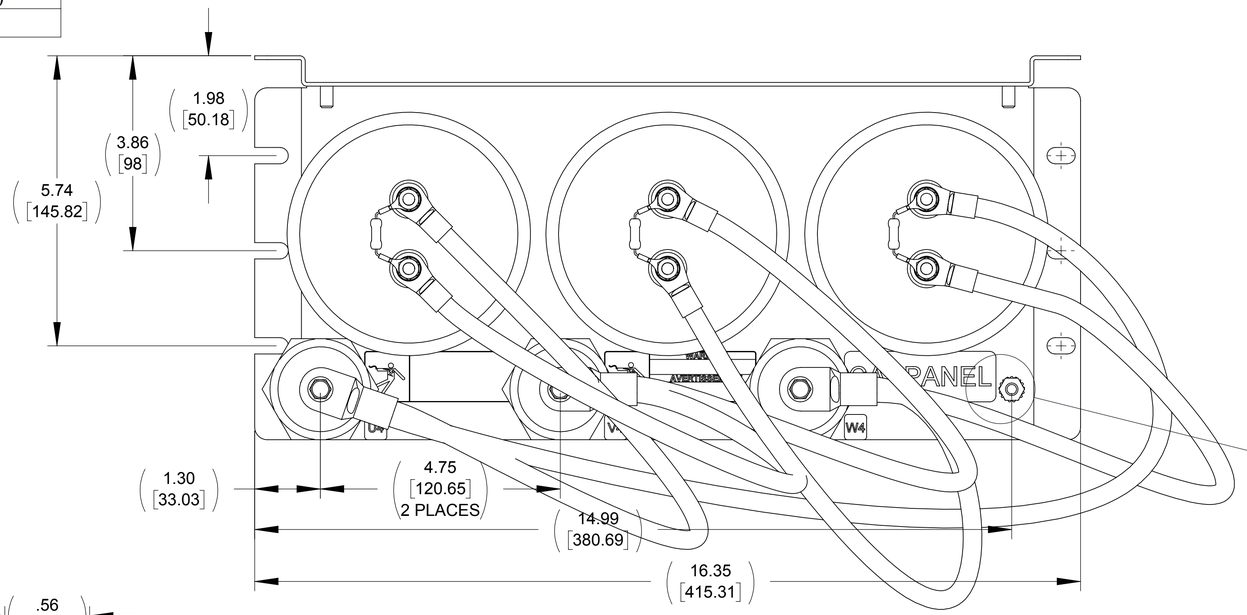
MATRIX AP 636A 480V 60HZ
OPEN PANEL

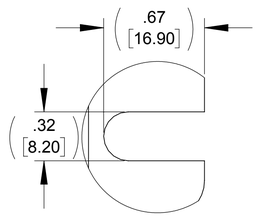
SIZE	DWG No.	REV
D	CD MAPP0636D	08

SCALE 1:4 SHEET 1 OF 1

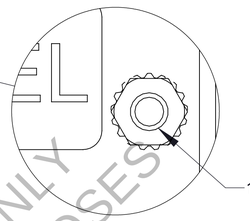
APPROX WEIGHT (LBS.)
20

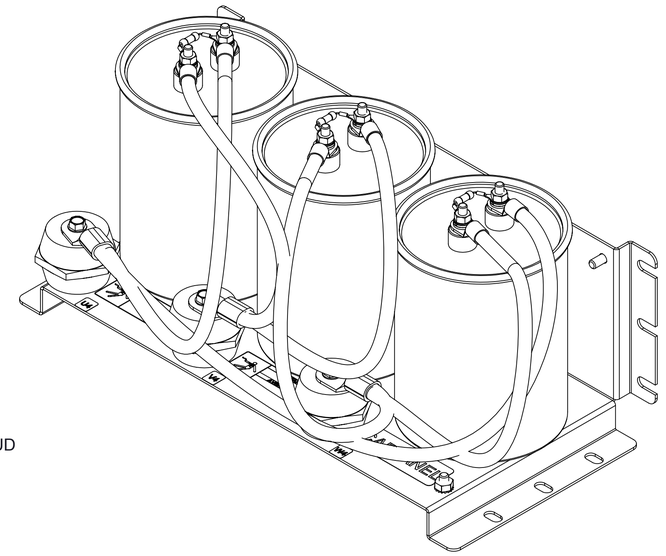
ECO No	DESCRIPTION	REV BY	DATE
M9725	UPDATED TO NEW DRAWING STANDARD AND REMOVED GRND LABLE	KV	11/12/15

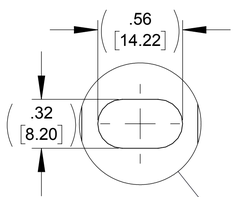




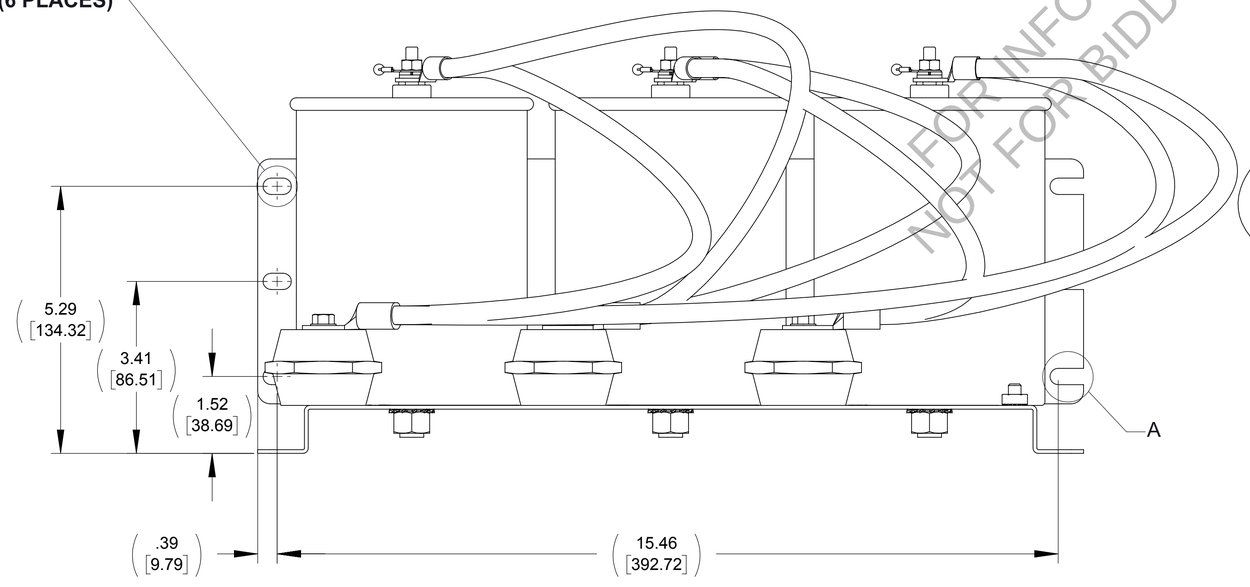
DETAIL A
(6 PLACES)

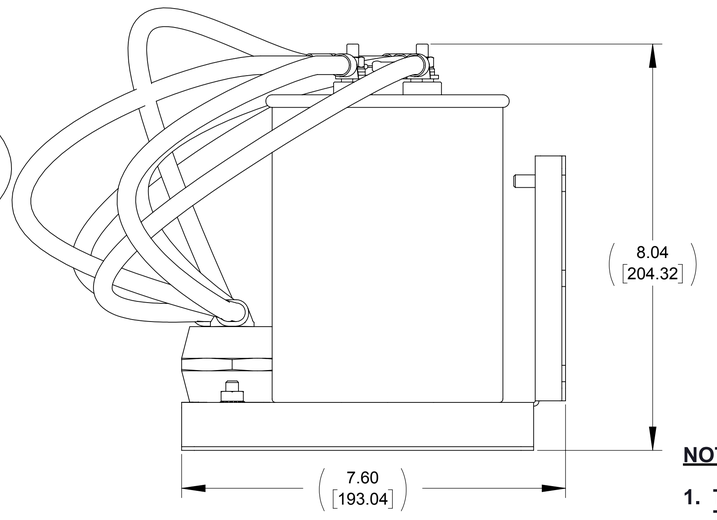






(6 PLACES)





NOTE:

1. **TIGHTEN STANDOFF SCREWS TO 58 IN/LBS. TORQUE, MAX.**

THE COMPONENT, PART OR ASSEMBLY DESCRIBED IN THIS DOCUMENT MUST COMPLY WITH THE EU(EUROPEAN UNION) DIRECTIVE RoHS2

CONTAINS <0.1% OF ANY SVHC BY WEIGHT PER REACH REGULATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM] TOLERANCES ARE:

ANGLES: ± 1 °

1 PLACE .X: ± .1 [2.5]

2 PLACE .XX: ± .01 [0.25]

3 PLACE .XXX: ± .005 [0.127]

MTE
AN SL INDUSTRIES COMPANY

N83 W13330 Leon Road
Menomonee Falls, WI 53051 USA
800.455-4683
262.253.8200

MATERIAL

DRAWN	DATE
MN	08/03/15
CHECKED	DATE
JM	11/13/15
APPROVED	DATE
JM	11/13/15

DESCRIPTION

3 CAP ASSEMBLY 450uF
DELTA CONFIGURATION

SIZE	DWG No.	REV
D	CD CAPPANEL-543C	01

SCALE 2:3 SHEET 1 OF 1

Compressor Motor

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Introduction :

SKF Magnetic Mechatronics is pleased to present in this document the main technical characteristics of the SKF high speed AB350 motor for direct and variable-speed drive of centrifugal air blower and /or compressor, along with the main characteristics of the magnetic bearings.

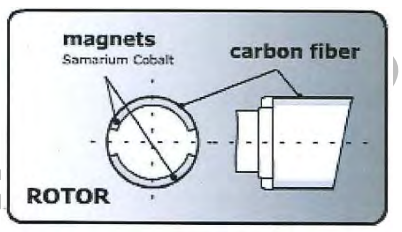
1.1 MOTOR DESIGN (ROTOR AND STATOR)

Type

HSPMSM (High Speed Permanent Magnet Synchronous Motor)

2 pole motor

Surface mount rare earth permanent magnet type



Typical rotor construction

Motor torque

Service factor 1.0
Maximum mechanical torque at shaft end : 180 Nm
The motor can deliver its rated torque from 4,000 rpm to 21,000 rpm

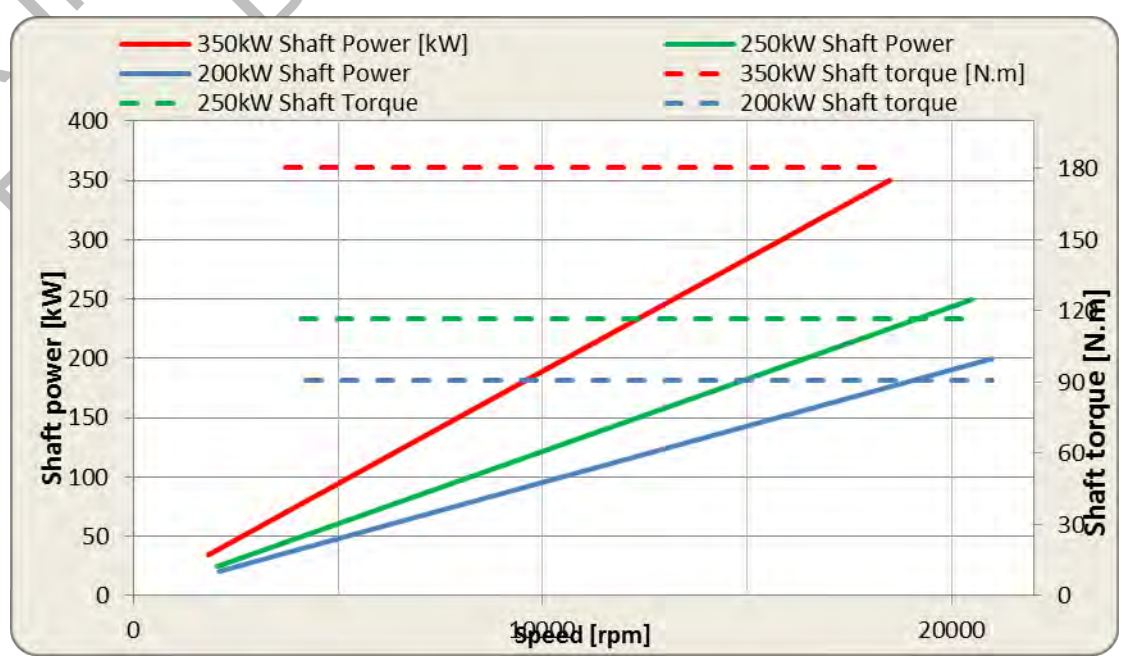
Motor power range

For 380V/50Hz market

Motor power range	200 to 350kW	
Preselected operating points	Power and Speed	Mechanical torque at shaft end
AB350	350 kW @ 18,500 rpm	180 N.m
AB350-bis	250 kW @ 20,500 rpm	116 N.m
AB350-ter	200 kW @ 21,000 rpm	91 N.m

Other different combinations of power levels and speed are possible depending on cooling conditions and possible inverter current or voltage limitation.

Power and Torque versus speed

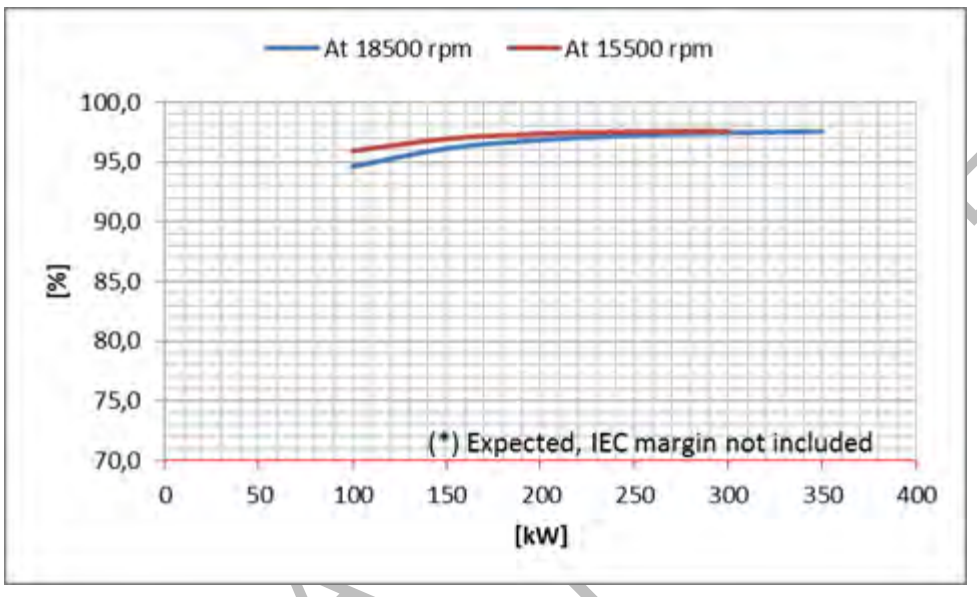


Speed range

Motor operating speed range : 4,000 rpm to 21,000 rpm

Across the 20 to 100% range of the speed, the motor can deliver up to its rated torque.

In the very low speed range (0 to 20%), the torque capability is limited by the VFD control algorithm and synchronization scheme due to the sensorless operation. For application with a high starting torque, please contact SKF.

Over speed capability	The rotor mechanical components and the rotor assembly without impeller is designed to withstand 10% overspeed with respect to 21 000 rpm. The system (when considering the addition of the impeller on the rotor, the electrical components such as motor and filters) withstands as a minimum over speed up to +5% of the maximum operating speed without any damage to the motor and electrical component.
Motor losses	Motor losses and motor efficiency : • consists in iron core losses, copper losses, magnet losses, Magnetic bearing losses, windage losses (typically in air at 1 bara) • vary with speed and torque (or power) operating points As an example, below is the efficiency at different power levels for the 350kW/18500rpm motor, plotted for 2 speeds: 

Motor rated voltage and current Versus power/speed level

GRID NOMINAL VOLTAGE (Vrms) : 460												
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Max. Motor current THD (THDi in %)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Motor power factor	0.92	0.88	0.84	0.8	0.93	0.9	0.86	0.82	0.94	0.9	0.87	0.84
Defluxing (yes/no)	No	No	No	No	No	No	No	No	No	No	No	No

GRID NOMINAL VOLTAGE (Vrms) : 400												
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Max. Motor current THD (THDi in %)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Motor power factor	0.92	0.88	0.84	0.8	0.93	0.9	0.86	0.82	0.94	0.9	0.87	0.84
Defluxing (yes/no)	No	No	No	No	No	No	No	No	No	No	No	No

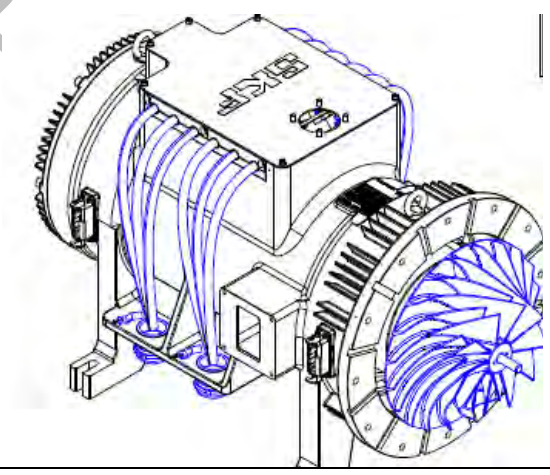
GRID NOMINAL VOLTAGE (Vrms) : 380												
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Motor input voltage ph-ph (Vrmsph-ph)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input current (Arms)	286	299	313	322	306	318	331	325	320	331	338	332
Max. Motor current THD (THDi in %)	445	555	665	776	412	514	615	725	393	490	590	695
Max. Motor current THD (THDi in %)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Motor power factor	0.92	0.88	0.84	0.82	0.93	0.9	0.86	0.87	0.94	0.9	0.88	0.89
Defluxing (yes/no)	No	No	No	Yes	No	No	No	Yes	No	No	Yes	Yes

Motor to be operated with a VFD equipped with a control strategy and algorithm that (in conjunction most of the time with the use of a sine filter), allow meeting the motor input current distortion as specified below :

- Current total harmonic distortion < 5%
- DC component ≤ 3% max
- Sum of harmonics below 11th ≤ 3%,
- Sum of harmonics 11th and above ≤ 1%

All values are in percentage of the RMS fundamental (i.e. first harmonic) component of motor rated current, the motor rated current being defined for operation at rated speed, rated torque and at motor rated power factor

Note : By experience, such low level of motor current distortion is required to reliably stay within the maximum allowable temperature indicated below.

Motor Housing	IP 00 Non magnetic alloy (aluminum) housing : ➢ with lifting eyebolts ➢ Built-in water jacket ➢ Designed for installation in horizontal position. *(Can be mounted vertically as well)* 
Motor stator	The motor stator is assembled into the housing with an interference fit between the stator outer diameter and housing bore. Equipped with 3 RTD devices (PT100 temperature probes) embedded in the winding heads to allow winding temperature monitoring.
Motor power connection and Motor cable	The motor is equipped with an integrated junction box, in order to connect the power cables (supplied by the customer). Cross section of power cable to be defined by customer according to rating of motor phase current (see table in section § 1.5) and cable characteristics (cable amperage capacity). Shielding of the power cables is required to comply with EMC regulations (the conductors of the 3 phases shall be inside the same shield).
Maximum operating temperature	The motor part shall not be operated at higher continuous temperature than indicated hereafter: • Rotor less than 140°C • Motor stator less than 150°C Motor cooling consists in: • Liquid cooling over the outer diameter of the motor stator lamination stack (water jacket) • Gas cooling in the motor cavity along rotor airgap and over stator winding heads

Cooling details	Forced cooling air (in rotor airgap and stator winding heads): • Flow: 380 Nm³/h minimum • Pressure drop : 3.5 kPa Liquid cooling in water jacket : • Water (or Water – Glycol mix (~20%)) • Flow : 18 – 20 l/min (temperature rise less than 5°C) • Max pressure : 4 barg Interfaces for air cooling please refer to interface drawing. Interfaces for water cooling inlet/outlet connections: please refer to interface drawing. The complete (air & water) cooling system is in the Customer scope of supply, based on the SKF cooling requirement and specification to be provided during the course of the project. A solution with EBM Papst air cooling fans has been identified and qualified by SKF (Part number of EBM Papst cooling fan available upon request).
Air quality	• Filtered (98% of filtration of 2 µm particles) • Dry
Motor Cavity Pressure	Nominal Atmospheric Pressure (1 bar abs)
Motor weight	Approx. 350 kg
Motor electrical data	

Motor back-EMF constant Vrms ph-ph/Hz	0,9
No load Back EMF Voltage Vrms ph-ph at rated speed (21krpm)	315
Motor synchronous inductance Ls=Lq=Ld (µH)	75
Motor phase resistance (mOhm)	1
Motor phase connection (Star or delta)	Star
Motor shaft spin inertia (kg.m²)	0.09

1.2 IMPELLER AND SEAL (CUSTOMER SUPPLIED)

ROTORDYNAMIC Characteristics **Impeller size, Mass, Spin and transverse inertia, center of mass, material**	A sufficient separation margin (25% minimum) must be maintained between the shaft 1st bending frequency and the rotating frequency to guarantee sub-critical operation in all its operation range and up to the maximum operation speed The design of the impeller, seal and impeller attachment (which have direct impact on the rotor dynamic) must be jointly optimized between customer and SKF to achieve sub-critical operation. A rotor dynamic modeling and calculation done by SKF is required with impeller and seal characteristics (weight, spin and transverse inertia, location of center of gravity, materials) to be communicated to SKF prior to the project for approval. The design and definition of the impeller and seal is under the customer responsibility. As a guide line, for a single stage configuration with a single impeller, the typical maximum impeller can be up to 9 kg
Impeller attachment and shaft end outer diameter	The shaft end diameter on impeller side is maximized to improve stiffness and allow a wide range of impellers. Impeller is axially held in place thanks to a tension bolt. Impeller is centered in shaft spacer thanks to pilot outer diameter (*STD Diameter 44 h6 ; extendable with added spacer (See example in Appendix 1*). Transmission of torque to the spacer by a key and from the spacer to the impeller by friction. Please refer to the appendix 1: Mechanical Interfaces.

Tension bolt (Customer Supplied)	Impeller is pressed and kept into contact with SKF shaft spacer by a tension bolt, installed with a hydraulic tensioner tool. Please refer to the shaft end figure in Appendix 1 : Mechanical Interfaces
Impeller clearance	Shall be compatible with the clearance of the auxiliary bearings as defined in section 1.3
Axial and radial load	Balanced equally in both directions and to be minimized. Characteristics to be communicated to SKF prior to the project for approval. General guideline: steady state loads should not exceed 50% of the bearing design capacity as outlined in section 1.3
Seals (Customer Supplied)	To be defined by the Customer including axial load balancing and leakage venting. Hot air leakage into the motor must be minimized. Seal clearance shall be compatible with the clearance of the auxiliary bearings as defined in section 1.3
MECHANICAL BALANCING OF ROTATING PARTS	Rotor and impeller to be balanced independently to G2.5 level (as per ISO 1940 definition). Final balancing of the rotor with its impeller and seals is not required.

1.3 ACTIVE MAGNETIC BEARINGS (AMB)

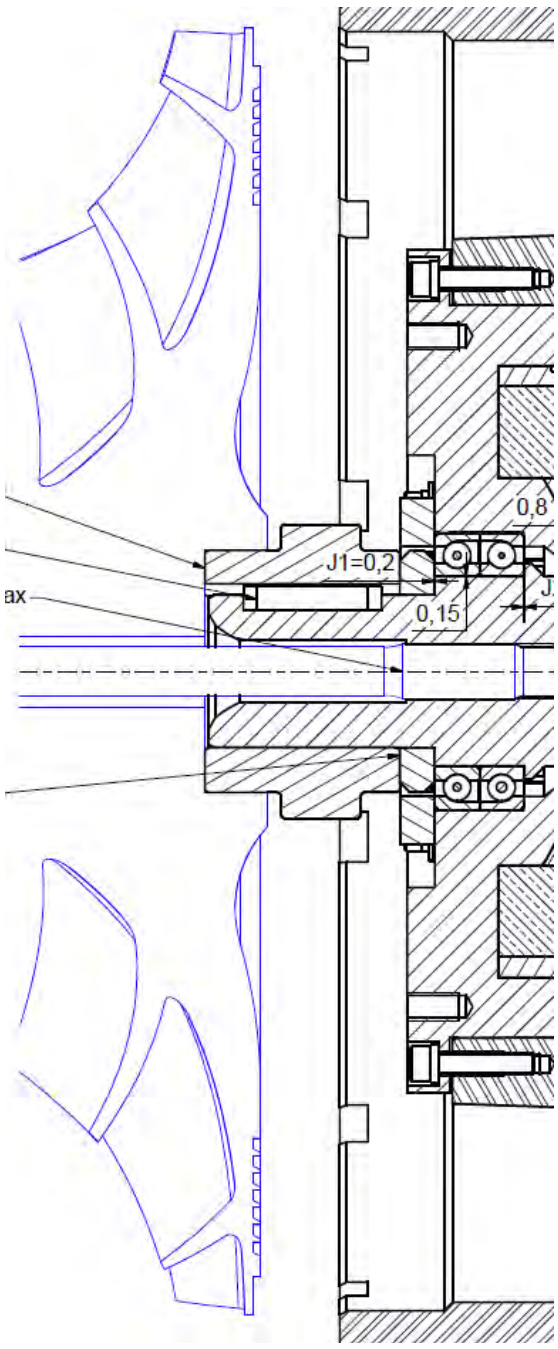
Radial bearing	Bearing coil rated for 150V and 4 Amp Temperature class of Isolation material : class F
Radial load capacity	900 N per axis
Displacement and monitoring sensor	SKF-S2M inductive type sensor with built-in harmonics rejection For a G2.5 quality level of balancing, rotor vibration (orbit) during steady state operation is typically less than 20 µm peak-peak in radial direction and less than 10 µm peak-peak in axial direction.

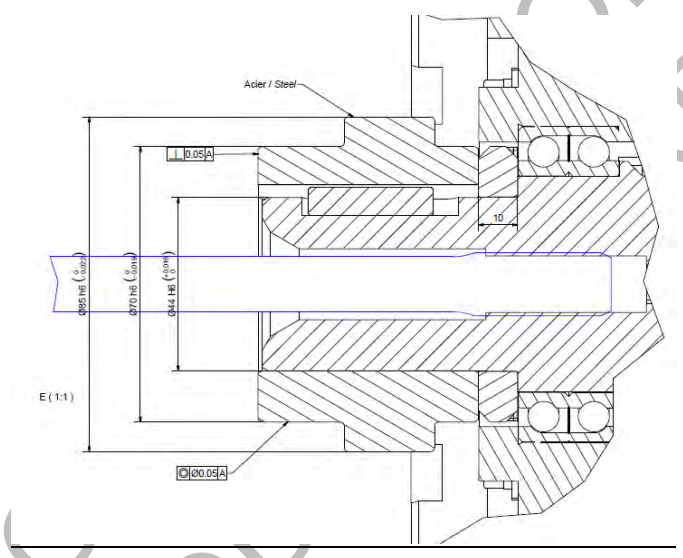
Axial bearing	Bearing coil rated for 150V and 16 Amp Temperature class of Isolation material : class F
Type	The axial bearing is designed for optimum dynamic response in an effort to cope with operation close to the surge line.
Axial peak load capacity	2,700 N for side 1 = impeller side axial bearing (at 0.5mm nominal airgap) 3,200 for side 2 = axial bearing on impeller opposite side (*) Axial bearings of AB350 are slightly different between side and side 2, which explains the difference in load capacity.
Displacement and monitoring sensor	The axial position sensor is located close to the impeller so to better control its axial position (minimum impact on impeller clearance) Rotor side 1 (at impeller side) acts as positioning end during motor rotation and rotor elongation at non-impeller side due to heat and float does not affect rotor end at impeller side. SKF inductive type position sensor, rotor elongation sensor, Temperature sensor integrated in each thrust bearing side (KTY 84) used for internal monitoring

Auxiliary bearings	Integrated in the magnetic bearing cartridge with the axial bearing acting as the auxiliary bearing carrier.
Type	Angular contact ball bearings, soft mounted and axially preloaded with damping devices. Dry lubrication. Minimum maintenance
Clearances	± 0.15 mm radial + floating ring tolerance 0.07mm → Total diametrical clearance = 2x(0.15+0.07)=0.44mm ± 0.20 mm axial → 0.4 mm total axial float
	The auxiliary bearings are at standstill and not spinning during normal operation. They are only (and rarely) used in case of gross overload of the magnetic bearing and in case of major electronic failure of the bearing controller. Note : During a black-out (loss of AC mains voltage) event, the UPS function built-in the controller maintains the levitation active during the deceleration of the rotating motor and consequently the rotor only safely drops on the auxiliary bearing below a low speed threshold with no induced wear. The auxiliary bearing are designed to withstand : • Several hundredth of high speed contact of short duration (less than 0.5sec) between the rotating shaft and aux. bearing • Several dozens of high speed contact of longer duration (0.5 to 2 sec) between the rotating shaft and aux. bearing • Five (5) to ten (10) 'full speed complete coast down' landings Assessment of the health of the Auxiliary bearings is facilitated with 2 features built-in the monitoring software of the bearing controller : ➢ Automated rotor to bearing clearances measurements ➢ Counters of high speed 'Rotor Landing' (with a soft-landing counter and a hard-landing one)

Bearing cables	1 cable for the front end bearing / 1 cable for the rear end bearing Multi conductors and shielded conductor pairs with overall shield Length : typical 3m (25m maximum) The cables are in the customer scope of supply. On specific request from the Customer, the cables can be supplied by SKF as an option.

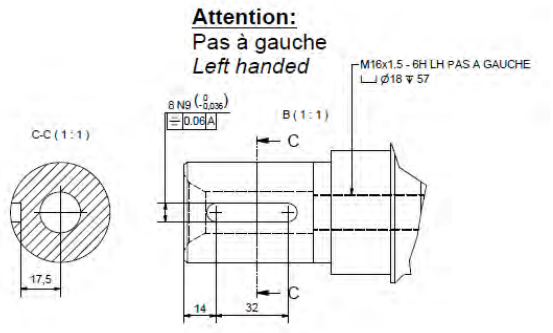
Appendix 1 : Rotor mechanical Interfaces



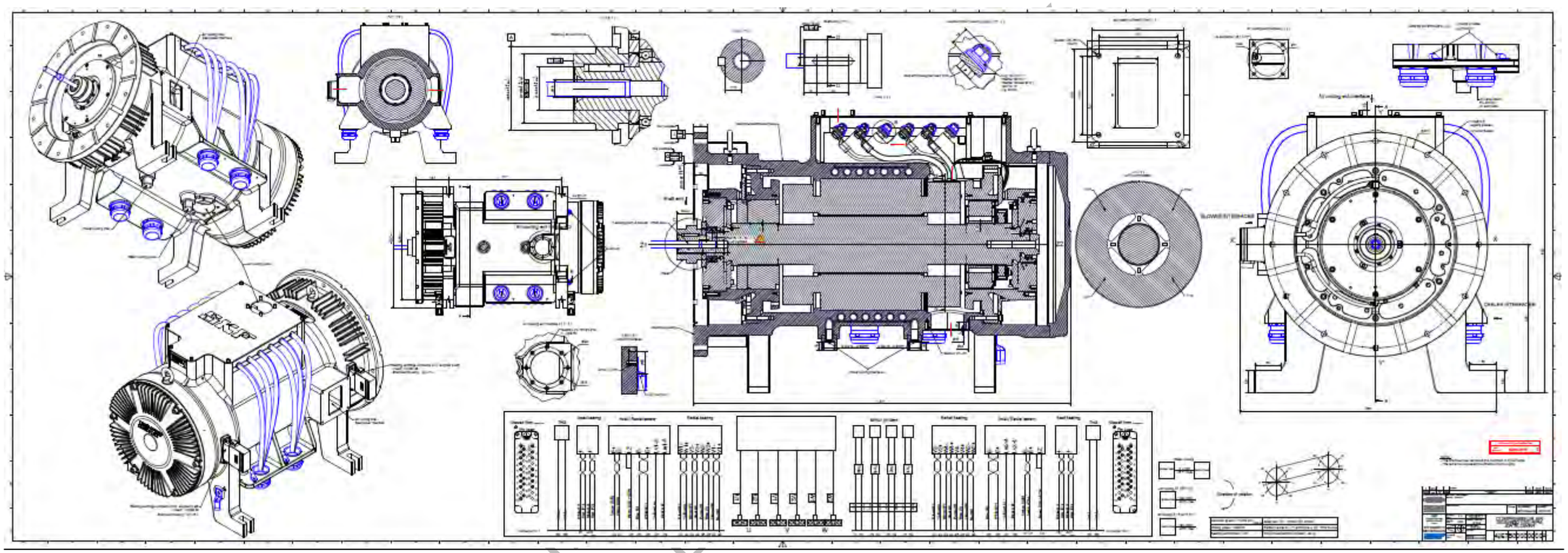


Impeller attachment with a central M16x1.5 stretch bolt

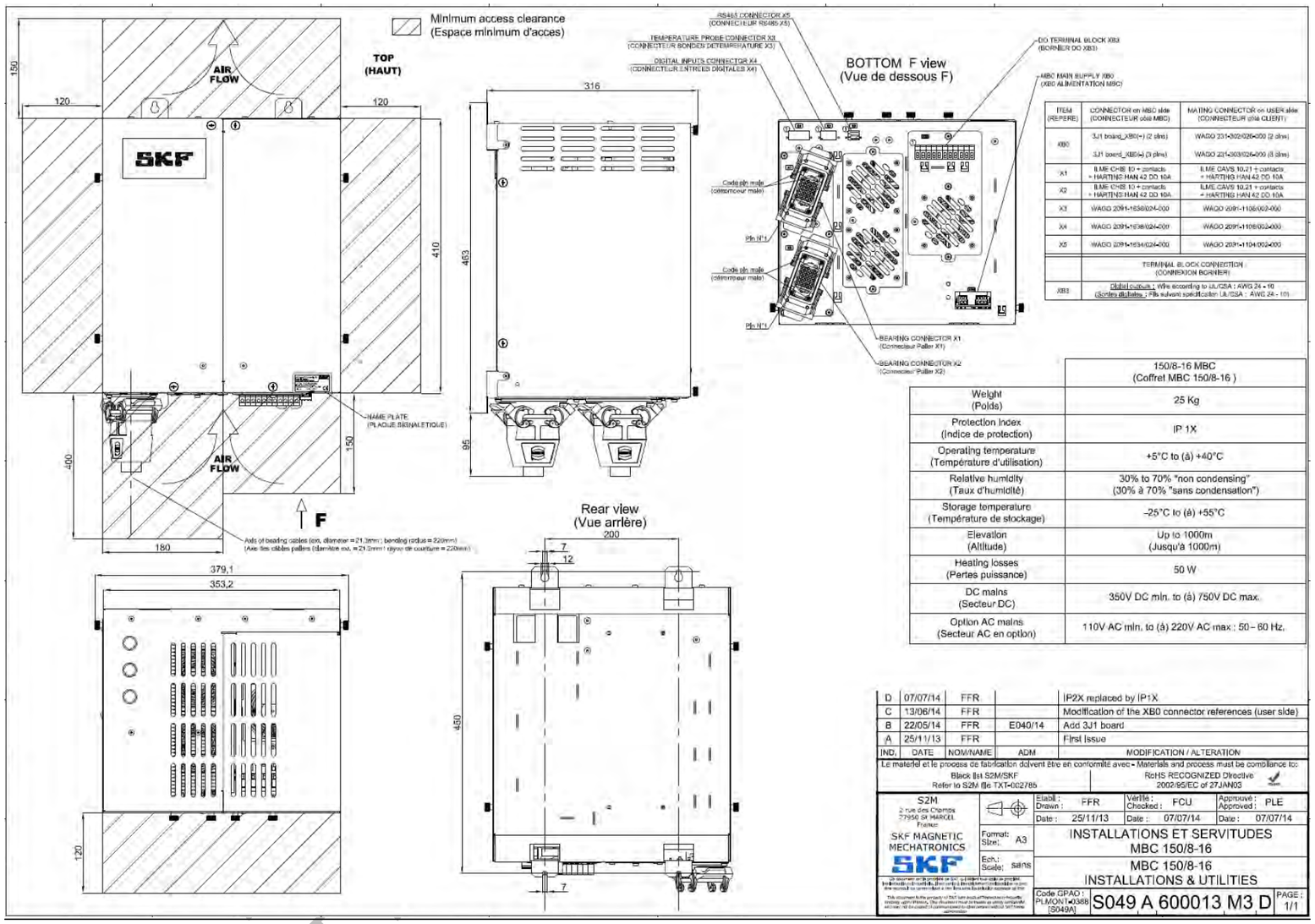
(105kN max pre-stretch load)



Appendix 2 : Motor interface drawing



Appendix 3 : 150/4-16 Bearing controller interface



ITEM (REPERE)	CONNECTOR on MBC side (CONNECTEUR côté MBC)	MATING CONNECTOR on USER side (CONNECTEUR côté CLIENT)
XB0	3J1 board_XB0(+) (2 slins)	WAGO 231-302/026-000 (2 slins)
	3J1 board_XB0(-) (3 plins)	WAGO 231-303/026-000 (3 slins)
X1	ILME CHE 10 + contacts + HARTING HAN 42 DD 10A	ILME CAVS 10,21 + contacts + HARTING HAN 42 DD 10A
X2	ILME CHE 10 + contacts + HARTING HAN 42 DD 10A	ILME CAVS 10,21 + contacts + HARTING HAN 42 DD 10A
X3	WAGO 2091-1638/024-000	WAGO 2091-1108/002-000
X4	WAGO 2091-1638/024-000	WAGO 2091-1108/002-000
X5	WAGO 2091-1634/024-000	WAGO 2091-1104/002-000
	TERMINAL BLOCK CONNECTION (CONNEXION BORNIER)	
XB3	Digital outputs : Wire according to UL/CSA : AWG 24 - 16 (Sorties digitales : Fils suivant spécification UL/CSA : AWG 24 - 16)	

	150/8-16 MBC (Coffret MBC 150/8-16)
Weight (Poids)	25 Kg
Protection index (Indice de protection)	IP 1X
Operating temperature (Température d'utilisation)	+5°C to (à) +40°C
Relative humidity (Taux d'humidité)	30% to 70% "non condensing" (30% à 70% "sans condensation")
Storage temperature (Température de stockage)	-25°C to (à) +55°C
Elevation (Altitude)	Up to 1000m (Jusqu'à 1000m)
Heating losses (Pertes puissance)	50 W
DC mains (Secteur DC)	350V DC min. to (à) 750V DC max.
Option AC mains (Secteur AC en option)	110V AC min. to (à) 220V AC max ; 50 - 60 Hz.

IND.	DATE	NOM/NAME	ADM	MODIFICATION / ALTERATION
D	07/07/14	FFR		IP2X replaced by IP1X
C	13/06/14	FFR		Modification of the XB0 connector references (user side)
B	22/05/14	FFR	E040/14	Add 3J1 board
A	25/11/13	FFR		First issue

Le matériel et le process de fabrication doivent être en conformité avec - Materials and process must be comblance to:
Black list S2M/SKF
Refer to S2M file TXT-002785
RoHS RECOGNIZED Directive 2002/95/EC of 27/JAN/03

S2M
2 rue des Champs
27950 St MAGEL
France
SKF MAGNETIC MECHATRONICS

Etabli : Drawn :	FFR	Vérifié : Checked :	FCU	Approuvé : Approved :	PLE
Date :	25/11/13	Date :	07/07/14	Date :	07/07/14

Format: A3 Size:
Ech.: sans Scale:

INSTALLATIONS ET SERVITUDES
MBC 150/8-16
MBC 150/8-16
INSTALLATIONS & UTILITIES

Code GPAO : PLMONT-0388 [S049A] | S049 A 600013 M3 D | PAGE : 1/1

Appendix 4 : Sine filter and VFD data

GRID NOMINAL VOLTAGE (Vrms)	460											
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Rated torque (Nm)	103,2	129,0	154,9	180,7	95,5	119,4	143,2	167,1	90,9	113,7	136,4	159,2
Number of pair of pole	1	1	1	1	1	1	1	1	1	1	1	1
Rated frequency (Hz)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Recommended Sine filter data												
Filter 'L' component (µH)	30				30				30			
Filter 'C' component (µF) - Delta connection	250	250	300	300	200	200	250	250	150	200	250	250
Capacitor current at rated frequency (Arms)	139	144	145	190	128	133	173	173	106	145	190	197
Capacitor current with 10% margin (Arms)	153	158	160	209	141	146	190	190	117	160	209	217
Capacitor max voltage (Vrms)	335				354				410			
Filter resonance 1 (Hz)	670	670	611	611	750	750	670	670	865	750	670	670
Filter resonance 2 (Hz)	1255	1255	1145	1145	1403	1403	1255	1255	1620	1403	1255	1255
VFD requirements (when used with above mentioned sine filter)												
Output voltage ph-ph (Vrms ph-ph)	283	303	322	347	302	321	337	362	317	330	344	368
Output current at rated frequency (Arms)	415	490	562	636	390	461	531	600	370	446	513	573
Output current with 10% margin for harmonics (Arms)	457	539	618	700	429	507	584	660	407	491	564	630
Min switching frequency (kHz)	3,4	3,4	3,4	3,4	3,7	3,7	3,7	3,7	3,9	3,9	3,9	3,9
Recommended practical min switching frequency (kHz)	4	4	4	4	5	5	5	5	5	5	5	5
DC bus voltage (Vdc) min value under load	620											
VFD max output voltage assumption	410											

GRID NOMINAL VOLTAGE (Vrms)	400											
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Rated torque (Nm)	103,2	129,0	154,9	180,7	95,5	119,4	143,2	167,1	90,9	113,7	136,4	159,2
Number of pair of pole	1	1	1	1	1	1	1	1	1	1	1	1
Rated frequency (Hz)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Recommended Sine filter data												
Filter 'L' component (µH)	30				30				30			
Filter 'C' component (µF) - Delta connection	250	250	300	300	200	200	250	250	150	200	250	250
Capacitor current at rated frequency (Arms)	139	144	145	190	128	133	173	173	106	145	190	197
Capacitor current with 10% margin (Arms)	153	158	160	209	141	146	190	190	117	160	209	217
Capacitor max voltage (Vrms)	335				354				410			
Filter resonance 1 (Hz)	670	670	611	611	750	750	670	670	865	750	670	670
Filter resonance 2 (Hz)	1255	1255	1145	1145	1403	1403	1255	1255	1620	1403	1255	1255
VFD requirements (when used with above mentioned sine filter)												
Output voltage ph-ph (Vrms ph-ph)	283	303	322	347	302	321	337	360	317	330	344	368
Output current at rated frequency (Arms)	415	490	562	636	390	461	531	600	370	446	513	573
Output current with 10% margin for harmonics (Arms)	457	539	618	700	429	507	584	660	407	491	564	630
Min switching frequency (kHz)	3,4	3,4	3,4	3,4	3,7	3,7	3,7	3,7	3,9	3,9	3,9	3,9
Recommended practical min switching frequency (kHz)	4	4	4	4	5	5	5	5	5	5	5	5
DC bus voltage (Vdc) min value under load	523											
VFD max output voltage assumption	350											

GRID NOMINAL VOLTAGE (Vrms)	380											
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Rated torque (Nm)	103,2	129,0	154,9	180,7	95,5	119,4	143,2	167,1	90,9	113,7	136,4	159,2
Number of pair of pole	1	1	1	1	1	1	1	1	1	1	1	1
Rated frequency (Hz)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	322	306	318	331	325	320	331	338	332
Motor input current (Arms)	445	555	665	776	412	514	615	725	393	490	590	695
Recommended Sine filter data												
Filter 'L' component (µH)	30				30				30			
Filter 'C' component (µF) - Delta connection	250	250	300	300	200	200	250	250	150	200	250	250
Capacitor current at rated frequency (Arms)	139	144	145	186	128	133	173	170	106	145	185	185
Capacitor current with 10% margin (Arms)	153	158	160	205	141	146	190	187	117	160	204	204
Capacitor max voltage (Vrms)	355				354		380		410			
Filter resonance 1 (Hz)	670	670	611	611	750	750	670	670	865	750	670	670
Filter resonance 2 (Hz)	1255	1255	1145	1145	1403	1403	1255	1255	1620	1403	1255	1255
VFD requirements (when used with above mentioned sine filter)												
Output voltage ph-ph (Vrms ph-ph)	283	303	322	340	302	321	337	340	317	330	340	340
Output current at rated frequency (Arms)	415	490	562	650	390	461	531	632	370	446	521	618
Output current with 10% margin for harmonics (Arms)	457	539	618	715	429	507	584	695	407	491	573	680
Min switching frequency (kHz)	3,4	3,4	3,4	3,4	3,7	3,7	3,7	3,7	3,9	3,9	3,9	3,9
Recommended practical min switching frequency (kHz)	4	4	4	4	5	5	5	5	5	5	5	5
DC bus voltage (Vdc) min value under load	500											
VFD max output voltage assumption	340											

Enclosure Disconnecting means

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Product data sheet

Specifications

Circuit breaker, PowerPacT P, unit mount, Micrologic 5.0, 800A, 3 pole, 25kA, 600VAC, 80% rated

PJF36080U33A

Main

Range	PowerPact
Product name	PowerPact P
Product or Component Type	Circuit breaker
Device Application	Distribution

Complementary

Line Rated Current	800 A
Number of Poles	3P
Control Type	Toggle
Breaking capacity code	J
Breaking capacity	AIR 100 kA 240 V AC 50/60 Hz UL 489 AIR 65 kA 480 V AC 50/60 Hz UL 489 AIR 25 kA 600 V AC 50/60 Hz UL 489 Icu 65 kA 240 V AC 50/60 Hz IEC 60947-2 Icu 50 kA 380/415 V AC 50/60 Hz IEC 60947-2
[Ue] rated operational voltage	600 V AC 50/60 Hz UL 489
Network Frequency	50/60 Hz
[Ics] rated service breaking capacity	35 kA 240 V AC 50/60 Hz IEC 60947-2 25 kA 380/415 V AC 50/60 Hz IEC 60947-2
[Uimp] rated impulse withstand voltage	8 kV IEC 60947-2
Trip unit technology	Electronic, standard, Micrologic 5.0, LSI
Continuous current rating	80 %
[Ui] rated insulation voltage	750 V IEC 60947-2
Trip unit name	Micrologic 5.0
AWG gauge	3 x AWG 3/0...3 x 500 kcmil aluminium/copper
Local signalling	Overload 1 trip indicator green) 1 trip indicator green)
Mounting mode	Unit mount busbar)
Mounting Support	Busbar
Electrical connection	Busbar connection line Busbar connection load

* Price is “List Price” and may be subject to a trade discount – check with your local distributor or retailer for actual price.

Terminal identifier	AL800M23K
Long time pick-up adjustment range	0.4...1 x Ir
Tightening torque	442.54 lbf.in (50 N.m) 0.15…0.37 in² (95…240 mm²) (3 x AWG 3/0...3 x 500 kcmil) 8.85…11.51 lbf.in (1.0…1.3 N.m)
Number of slots	2 auxiliary switch OF plug-in) 1 alarm switch SD plug-in) 1 overcurrent trip switch SDE plug-in) 1 voltage release MN or MX plug-in)
Power wire stripping length	0.98 in (25 mm)
Height	12.86 in (326.64 mm)
Width	8.27 in (210.06 mm)
Depth	8.05 in (204.47 mm)
Net Weight	32 lb(US) (14.51 kg)
Quantity per Set	1

Environment

Quality labels	CE
Standards	UL CSA NEMA NOM-003-SCFI-2000 IEC 60947-2
Product certifications	UL CSA NOM
IP degree of protection	Front cover IP40
Pollution degree	3 IEC 60947-1
Ambient air temperature for operation	28…158 °F (-2…70 °C)
Ambient Air Temperature for Storage	-58…185 °F (-50…85 °C)
Operating altitude	< 6561.68 ft (2000 m) without derating 13123.36 ft (4000 m) with derating

Ordering and shipping details

Category	01215 - PG,H,J,K,L,N UNIT MT BREAKERS
Discount Schedule	DE2
GTIN	NULL
Nbr. of units in pkg.	1
Package weight(Lbs)	32.00 lb(US) (14.515 kg)
Returnability	Yes
Country of origin	US

Packing Units

Unit Type of Package 1	PCE
Package 1 Height	11.75 in (29.845 cm)
Package 1 width	11.63 in (29.528 cm)
Package 1 Length	20.25 in (51.435 cm)

Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: This product can expose you to chemicals including: DINP, which is known to the State of California to cause cancer, and DIDP, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
REACh Regulation	REACh Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information.
Environmental Disclosure	Product Environmental Profile
Circularity Profile	End of Life Information
PVC free	Yes

Contractual warranty

Warranty	18 months

Product data sheet
Characteristics

YA600P5
PowerPact M/P-FRAME MOULDED CASE CIRCUIT BREAKER 600A AL COMPRESSION LUG KIT

Main

Range of Product	PowerPact M PowerPact P
Product or Component Type	Mechanical lug
Accessory / separate part category	Connection accessory
Quantity per Set	Set of 2
Circuit breaker type	M-frame P-frame

Complementary

Product compatibility	PowerPact PowerPact PowerPact P PowerPact
Line Rated Current	600 A
Material	Aluminium
Mounting Mode	Compression Unit mount
AWG gauge	AWG 4/0...500 kcmil aluminium/copper
Tightening torque	247.82 Lbf.In (28 N.m) 0.15…0.37 in² (95…240 mm²) (AWG 4/0...500 kcmil)

Environment

Product Certifications	CSA UL

Ordering and shipping details

Category	01250-M,P,R FRAME ACCESSORIES ONLY
Discount Schedule	DE2
Package weight(Lbs)	32.00 Oz (907.185 g)
Returnability	Yes
Country of origin	US

Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov
REACh Regulation	REACh Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS Declaration
Environmental Disclosure	Product Environmental Profile
Circularity Profile	End Of Life Information
PVC free	Yes

Contractual warranty

Warranty	18 months

Product Life Status : Commercialised

Electrical Equipment

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Low-Peak™ Class J

LPJ — 600Vac/300Vdc, 1-60A, Dual Element, Time-Delay Fuses

Available with easyID™ open fuse indication

Description: Ultimate protection Class J dual element, current-limiting, time-delay fuses available with optional open fuse indication. Time-delay – 10 seconds (minimum) at 500% of rated current.

Catalog Symbol: LPJ-(amp)SP (non-indicating)
LPJ-(amp)SPI (indicating)

Ratings:

Volts — 600Vac, 300Vdc

Amps — 1-60A

IR — 300kA Vac RMS Sym.

— 100kA Vdc

Agency Information:

CE, UL Listed, Guide JDDZ, File E4273

CSA Certified, Class 1422-02, File 53787, Class J per CSA 22.2 No. 248.

Catalog Numbers (amps) – Non-indicating Fuses

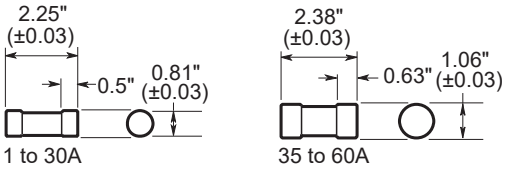
LPJ-1SP	LPJ-3SP	LPJ-7SP*	LPJ-25SP*
LPJ-1¼SP	LPJ-3⁹⁄₁₀SP	LPJ-8SP*	LPJ-30SP*
LPJ-1⁹⁄₁₀SP	LPJ-3½SP	LPJ-9SP*	LPJ-35SP*
LPJ-1⁹⁄₁₀SP	LPJ-4SP	LPJ-10SP*	LPJ-40SP*
LPJ-2SP	LPJ-4½SP	LPJ-12SP*	LPJ-45SP*
LPJ-2¼SP	LPJ-5SP	LPJ-15SP*	LPJ-50SP*
LPJ-2½SP	LPJ-5⁹⁄₁₀SP	LPJ-17½SP*	LPJ-60SP*
LPJ-2⁹⁄₁₀SP	LPJ-6SP*	LPJ-20SP*	

* Open fuse indication available by inserting the suffix "I," e.g., LPJ-15SPI. Requires 75Vac minimum voltage.

Carton Quantity:

Amp Rating	Carton Qty.
1–60	10

Dimensions - in



Features:

- Industry's only UL Listed and CSA Certified fuse with a 300kA interrupting rating that allows for simple, worry-free installation in virtually any application.
- Fast short-circuit protection and dual-element, time-delay performance provide ultimate protection.
- Reduces existing fuse inventory by up to 33% when upgrading to Low-Peak fuses.
- Consistent 2:1 ampacity ratios for all Low-Peak fuses make selective coordination easy.
- Long time-delay minimizes needless fuse openings due to temporary overloads and transient surges.
- Current-limitation protects downstream components against damaging thermal and magnetic effects of short-circuit currents.
- Dual-element fuses have lower resistance than ordinary fuses so they run cooler. Can often be sized for back-up protection against motor burnout from overload or single-phasing if other overload protective devices fail.
- Proper sizing can provide "no damage" Type 2 coordinated protection for NEMA and IEC motor controllers.
- Space-saving package for equipment downsizing.

Recommended Fuse Blocks and Holders

Fuse Amps	1-Pole	2-Pole	3-Pole
Open Blocks			
0-30	J60030-1_	J60030-2_	J60030-3_
35-60	J60060-1_	J60060-2_	J60060-3_
"Pyramid" Blocks			
0-30	—	—	JP60030-3_
CH Series Holders			
0-30	CH30J1_	CH30J2_	CH30J3_
35-60	CH60J1_	CH60J2_	CH60J3_
Safety J™ Holders			
0-30	JT60030_	—	—
35-60	JT60060_	—	—

For additional information on the Class J fuse blocks and holders, see data sheets # 1114 (open blocks), #1108 (pyramid blocks), # 2144 (CH Series) and # 1152 (Safety J).

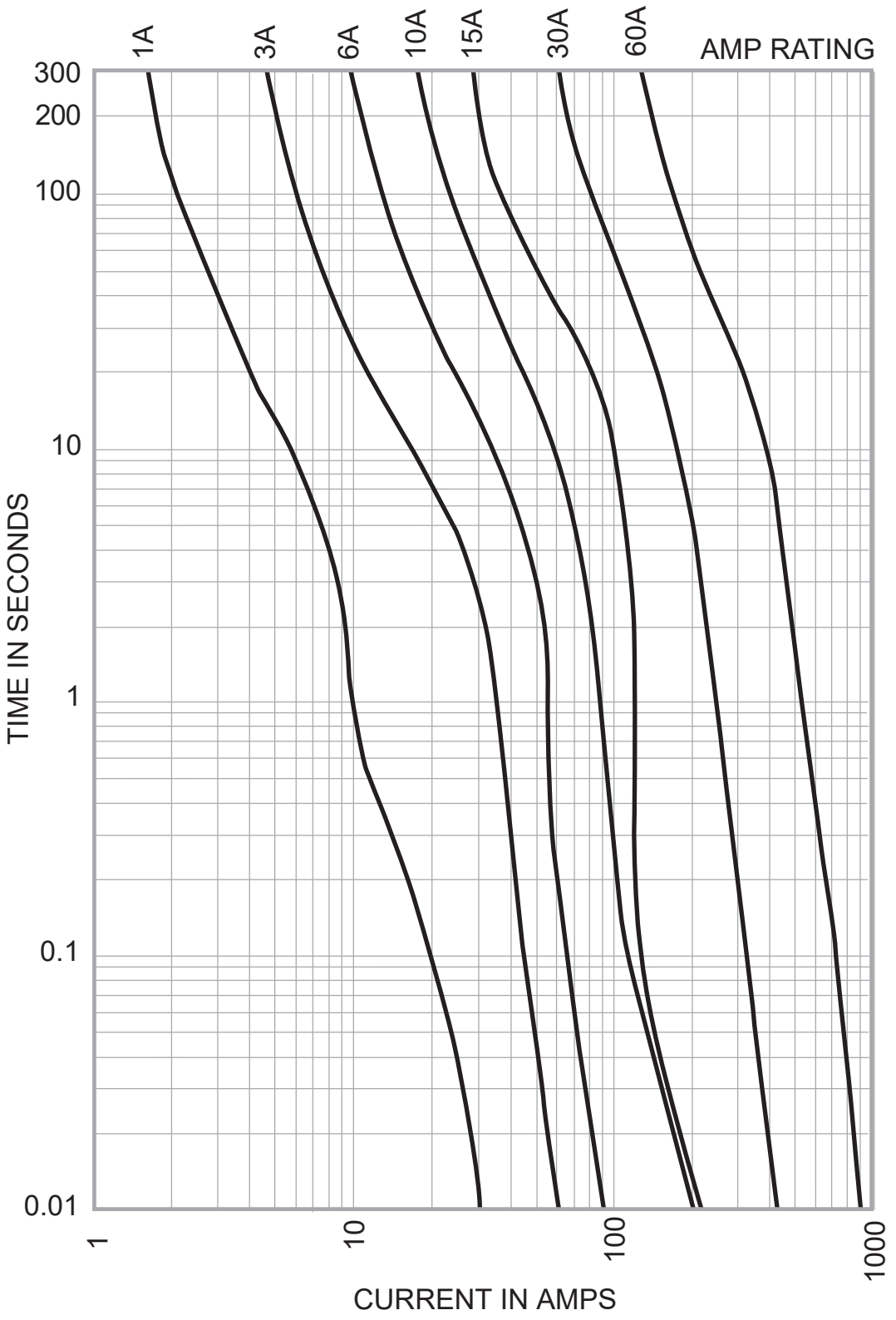
Fuse Reducers For Class J Fuses

Equipment Fuse Clips	Desired Fuse (Case) Size	Catalog Numbers (Pairs)
60A	30A	J-63
100A	30A	J-13
	60A	J-16
200A	60A	J-26†

† Not for bolt-in applications.

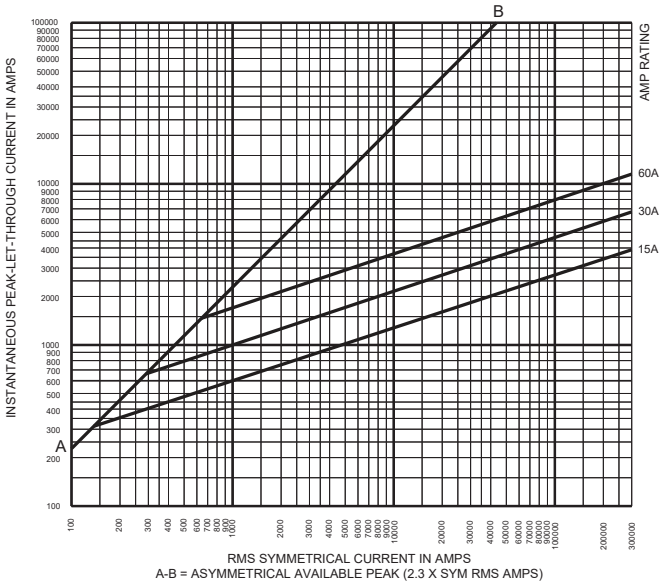
LPJ — 600Vac/300Vdc, 1-60A, Dual Element, Time-Delay Fuses

Time-Current Curves - Average Melt



LPJ — 600Vac/300Vdc, 1-60A, Dual Element, Time-Delay Fuses

Current-Limitation Curves



Current-Limiting Effects

Prosp. S.C.C.	Let-Through Current (Apparent RMS Symmetrical Vs. Fuse Rating)		
—	15A	30A	60A
1000	1000	1000	1000
3000	1000	1000	1000
5000	1000	1000	1000
10,000	1000	1000	2000
15,000	1000	1000	2000
20,000	1000	1000	2000
25,000	1000	1000	2000
30,000	1000	1000	2000
35,000	1000	1000	2000
40,000	1000	2000	3000
50,000	1000	2000	3000
60,000	1000	2000	3000
80,000	1000	2000	3000
100,000	1000	2000	4000
150,000	1000	2000	4000
200,000	2000	3000	4000
250,000	2000	3000	5000
300,000	2000	3000	5000

FSPDB

Finger-Safe Power Distribution Blocks

POWER DISTRIBUTION BLOCKS

SAFETY EVOLVING

Mersen FSPDBs introduce a new level of safety and ease for installing power distribution blocks. An IP20 level of finger-safe protection is achieved using FSPDBs, eliminating the need for special covers or custom plexiglass sheets to protect your panels. FSPDBs (sizes 1 to 4) simply snap onto 35mm DIN rail to provide the quickest installation. Modular design also allows for multi pole applications by use of assembly pins. FSPDBs provide a safe, convenient way of splicing cables, splitting primary power into a variety of secondary circuits or providing a fixed junction tap-off point.

FEATURES/BENEFITS:

- **Finger-safe protection:** Fully insulated block ensures touch safe isolation of live parts. Recessed termination screws and wire openings provide IP20 grade protection and qualify as “finger-safe” per IEC 529.
- **Compact modularity:** Single or multiple pole configurations in the most compact footprint. Allows users to build smaller or higher density panels.
- **Snap on DIN-rail mounting:** Sizes 1 to 4 feature integral DIN rail adaptors allowing for quick and easy installations on 35mm DIN rail yielding lower installed costs.
- **Captive termination screws:** Unique channel design ensures captive metric wire termination screws. Screws can never be lost.
- **Available accessories:** For multi-pole panel mounting, simply snap in pins for rigid fit. Cap plugs provide the ability to maintain touch safety on unused openings. Circuit identification markers simply snap into blocks to ID circuits. End anchors provide rigid end stops. (Continued on next page.)

RATINGS:

- **Volts:** FSPDB1,2,3—1500VAC/DC; FSPDB4,5—600VAC/DC
- **Amps:** 175 to 840A
- **SCCR:** 600V or less, 100kA with proper fuse; Over 600V, 10kA

Contact Technical Services for instruction sheet.

APPROVALS:

- UL Recognized Component Guide XCFR2, File E73571
- CSA Certified: Class 6228, File 69363
- IEC-947-7-1, 529, 68-2-6, CE Marked

Mersen
Expertise, our source of energy

FEATURES/BENEFITS (CONTINUED):

- **Multiple wire ratings:** Provide users more versatility by offering capability of using multiple conductors in #2 and 2/0 openings.
- **AC & DC ratings:** FSPDB1, 2, and 3 have been evaluated for use at 1500V (AC or DC) provided they are installed on DIN-rails only and with proper barriers and spacing between poles of opposite polarity.

CATALOG NUMBERS

Catalog Number		Ampere Rating	Line			Load			
			Wire Range			Wire Range			
Aluminum (Connector rated for 90° C Cu/AL wire)	Copper (Connector rated for 75° C Cu wire only)	(Based on NEC Table 310-16 for 75° C Cu wire only)	AWG/	mm²	Openings	AWG/ kcmil	mm²	Openings Per Pole	Short Circuit Current Rating
FSPDB1A	FSPDB1C	175	2/0-#14	70-2.5	1	2/0-#14	70-2.5	1	100kA*
FSPDB2A	FSPDB2C	175	2/0-#14	70-2.5	1	#2-#14	35-2.5	4	100kA*
FSPDB3A	FSPDB3C	310	350-#6	185-16	1	#2-#14	35-2.5	8	100kA*
			2/0-#14	70-2.5					
FSPDB4A	FSPDB4C	335	400-#6	185-16	1	400-#6	185-16	1	100kA*
FSPDB5A**	FSPDB5C	840	600-#4	300-25	2	600-#4	300-25	2	100kA*

**Contact Mersen Technical Services at technicalservices.nby@mersen.com for fuse type and maximum ampere required.*
*** FSPDB5A is not DIN-rail mountable.*

Multiple Wire Ratings (Same Size & Type Wires Only)					
2/0 Openings			#2 Openings		
(2) #4 AWG	(2) #8 AWG	(2) #12 AWG	(2) #6 AWG	(2-4) #10 AWG	(2-4) #14 AWG
(2) #6 AWG	(2) #10 AWG	(2) #14 AWG	(2) #8 AWG	(2-4) #12 AWG	

DIMENSIONS

Dimension	FSPDB1A FSPDB1C Figure 1		FSPDB2A FSPDB2C Figure 1		FSPDB3A FSPDB3C Figure 2		FSPDB4A FSPDB4C Figure 1		FSPDB5A FSPDB5C Figure 2	
	mm	in	mm	in	mm	in	mm	in	mm	in
A	25.4	1.00	28.4	1.12	46.9	1.85	39	1.54	72	2.84
B	43.3	1.70	57.8	2.28	64.3	2.53	108	4.25	91	3.58
C	49.5	1.95	56.0	2.21	64.3	2.53	80	3.15	80	3.15
D	45.1	1.78	51.6	2.03	59.8	2.36	75.5	2.97	-	-
E	39.4	1.55	39.4	1.55	51.5	2.03	50.1	1.97	50.1	1.97
F	72.6	2.86	87.7	3.45	100.8	3.97	145.5	5.73	145	5.71
G	59.6	2.35	74.6	2.94	82.4	3.24	120.6	4.75	127.5	5.02
H	5.3	0.21	5.1	0.20	6.5	0.26	7	0.28	3	0.12
I	-	-	-	-	31.5	1.24	-	-	52	2.04
J	5.3	0.21	6.4	0.25	6.5	0.26	6.5	0.26	6.5	0.26
K	10	0.40	11.7	0.46	8.9	0.35	16	0.63	8.5	0.34

ACCESSORIES

Catalog No.	Description
FSPIN1	Accessory pin to form multiple pole block
FSCIM1	Circuit identification marker for 2/0 & #2 max. conductors (80 per card)
FSCIM2	Circuit identification marker for 350, 400 & 600 kcmil max. conductors (56 per card)
FSCAP1	Cap plug for spare 2/0 openings
FSCAP2	Cap plug for spare 350 kcmil openings
FSCAP3	Cap plug for spare 600 kcmil opening
FSEA	Pair of end anchors

Figure 1

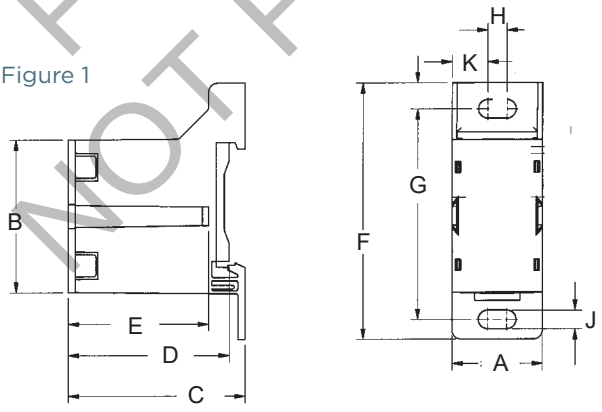
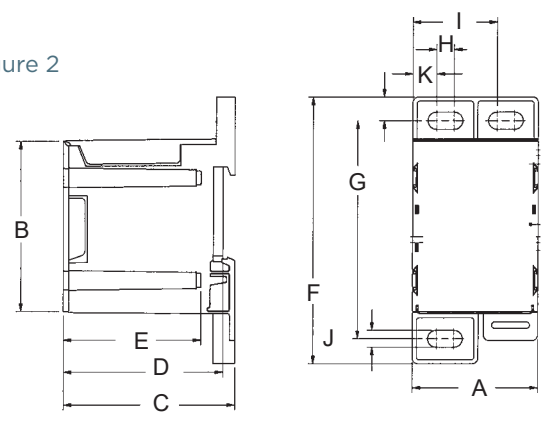


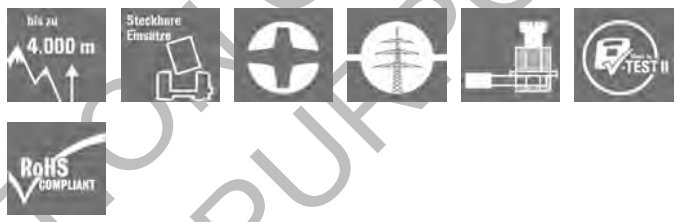
Figure 2



PD

VPU series
VPU AC II 3 R 480/50

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 26
D-32758 Detmold
Germany
Fon: +49 5231 14-0
Fax: +49 5231 14-292083
www.weidmueller.com



Weidmüller VPU I (Type I), VPU II (Type II) and VPU III (Type III) surge protection products effectively reduce the interference coupling that can occur due to transient surge voltages, even significantly below the limits prescribed by insulation co-ordination according to EN 60664-3 / DIN VDE 0110-3. This means that the whole installation is exposed to fewer malfunctions. The arresters are co-ordinated using technical means. This means that decoupling between Types I, II and III is unnecessary. The arresters are tested according to product standard IEC 61643-11 / DIN EN 61643-11 and can be installed in systems according to IEC 61643-12 / VDE V0675-6-12 and IEC 62305-4 / VDE 0185-4. This lightning and surge protection device is suited for installation in power supply systems. Weidmüller offers different products depending on the particular mains network type and voltage level. A special Type I and Type II protective device is even available for photovoltaic applications.

General ordering data

Type	VPU AC II 3 R 480/50
Order No.	2591260000
Version	Surge voltage arrester, Low voltage, Surge protection, with remote contact, TN-C, U_P(L/N-PE) ≤ 2.3 kV
GTIN (EAN)	4050118599671
Qty.	1 pc(s).

VPU series
VPU AC II 3 R 480/50

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 26
D-32758 Detmold
Germany
Fon: +49 5231 14-0
Fax: +49 5231 14-292083
www.weidmueller.com

Technical data

Dimensions and weights

Width	54 mm	Width (inches)	2.126 inch
Height	95 mm	Height (inches)	3.74 inch
Depth	68 mm	Depth (inches)	2.677 inch
Depth including DIN rail	76 mm	Net weight	410 g

Temperatures

Humidity	5 - 95% rel. humidity	Operating temperature, max.	85 °C
Operating temperature, min.	-40 °C	Storage temperature, max.	85 °C
Storage temperature, min.	-40 °C	Operating temperature	-40 °C...85 °C
Storage temperature	-40 °C...85 °C		

Rated data UL

Voltage type	AC	Certificate No. (cURus)	E354261
Rated Voltage U_N	400 V	VPR (L/N-PE)	2,500 V
MCOV (L/N-PE)	960 Vac	SCCR	200 kA
I_n	20 kA	Category	SPD TYPE 1CA

Connection data, remote alert

Connection type	PUSH IN	Stripping length	8 mm
Cross-section for connected wire, solid core, min.	0.14 mm²	Cross-section for connected wire, solid core, max.	1.5 mm²

General data

Altitude	≤ 4000 m	Colour	orange, black
Design	Installation housing; 3TE, Insta IP 20	Optical function display	green = OK; red = arrester is defective - replace
Protection degree	IP20 in installed state	Rail	TS 35
Segment	Power distribution	UL 94 flammability rating	V-0
Version	Surge protection, with remote contact		

Insulation coordination acc. to EN 50178

Pollution severity	2	Surge voltage category	III

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Technical data

Rated data IEC / EN

Discharge current I_{max} (8/20µs) wire-PE	50 kA	Discharge current I_n (8/20µs) wire-PE	20 kA
Energy coordination (≤10 m)	Type II, Type III	Follow-on current extinguishing capability I_{fi}	Follow current need not be taken into account
Frequency range, max.	60 Hz	Frequency range, min.	50 Hz
Fuse	250 gG @50 kA Isccr, 315 gG @25 kA Isccr	Leakage current at U_n	0.7 mA
Low voltage network	TN-C	Max. continuous voltage, Uc (AC)	480 V
Number of poles	3	Protection level U_P (typ.)	≤ 2.3 kV
Rated voltage (AC)	400 V	Requirements category acc. to IEC 61643-11	Type II
Requirements class, acc. to EN 61643-11	T2	Response time	≤ 25 ns
SPD type	T2	Short-circuit current rating I_{SCCR}	50 kA
Signalling contact	250 V 1A 1CO	Standards	IEC61643-11, EN61643-11
Temporary surge voltage (over-voltage) - TOV	581 V	Voltage type	AC

Connection data

Wire connection method	Screw connection	Type of connection	Screw connection
Stripping length, rated connection	15 mm	Tightening torque, min.	2 Nm
Tightening torque, max.	4.5 Nm	Clamping range, rated connection	16 mm²
Clamping range, min.	4 mm²	Clamping range, max.	35 mm²
Wire cross-section, solid, min.	2.5 mm²	Wire cross-section, solid, max.	35 mm²
Wire connection cross-section, finely stranded, min.	4 mm²	Wire connection cross section, finely stranded, max.	35 mm²
Conductor cross-section, flexible, AEH (DIN 46228-1), min.	2.5 mm²	Conductor cross-section, flexible, AEH (DIN 46228-1), max.	35 mm²
Connection cross-section, stranded, min.	2.5 mm²	Connection cross-section, stranded, max.	35 mm²

Classifications

ETIM 6.0	EC000941	ETIM 7.0	EC000941
eClass 9.0	27-13-08-05	eClass 9.1	27-13-08-05
eClass 10.0	27-13-08-05	UNSPSC	30-21-19-21

Approvals

Approvals	
ROHS	Conform

Downloads

Approval/Certificate/Document of Conformity	EAC VPU SERIES Declaration of Conformity
Engineering Data	STEP
User Documentation	Instruction sheet

VPU series
VPU AC II 3 R 480/50

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Klingenbergstraße 26
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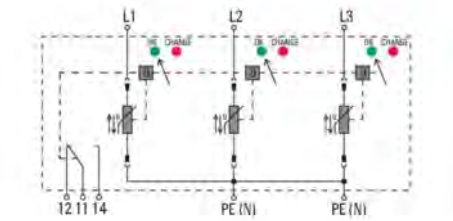
Drawings

Electric symbol



Schematic circuit diagram

SIEMENS

Data sheet 3UG4513-1BR20

ANALOG MONITORING RELAY PHASE FAILURE AND -SEQUENCE ADJUSTABLE UNDERVOLTAGE UNBALANCE 20% FIXED 3X 160 TO 690V AC 50 TO 60 HZ HYSTERESIS 5% FIXED DELAY TIME 0-20S 2 CHANGEOVER CONTACTS SCREW TERMINAL REPLACEMENT PRODUCT FOR 3UG3013-1B...

Product function		Phase monitoring relay
Measuring circuit:		
Type of voltage for monitoring		AC
Number of poles for main current circuit		3
Measurable voltage at AC	V	160 ... 690
Adjustable voltage range	V	200 ... 690
Relative metering precision	%	5
Relative repeat accuracy	%	1
General technical data:		
Display version LED		Yes
Product function		
• undervoltage detection		Yes
• Overvoltage detection		No
• phase sequence recognition		Yes
• Phase failure detection		Yes
• Phase unbalance		Yes
• Overvoltage detection 3 phase		No
• undervoltage detection 3 phases		Yes

• Voltage window recognition 3 phase		No
• Auto-reset		Yes
• Adjustable open/closed-circuit current principle		No
Starting time after the control supply voltage has been applied	ms	1 000
Response time maximum	ms	450
Type of voltage of the control supply voltage		AC
Control supply voltage		
• at AC		
— at 50 Hz rated value	V	160 ... 690
— at 60 Hz rated value	V	160 ... 690
Operating range factor control supply voltage rated value		
• at AC		
— at 50 Hz		1 ... 1
— at 60 Hz		1 ... 1
Surge voltage resistance rated value	kV	6
Consumed active power	W	2
Protection class IP		IP20
Electromagnetic compatibility		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
Shock resistance acc. to IEC 60068-2-27		sinusoidal half-wave 15g / 11 ms
Installation altitude at height above sea level maximum	m	2 000
Conducted interference due to burst acc. to IEC 61000-4-4		2 kV
Conducted interference due to conductor-earth surge acc. to IEC 61000-4-5		2 kV
Conducted interference due to conductor-conductor surge acc. to IEC 61000-4-5		1 kV
Electrostatic discharge acc. to IEC 61000-4-2		6 kV contact discharge / 8 kV air discharge
Field-bound parasitic coupling acc. to IEC 61000-4-3		10 V/m
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690
Degree of pollution		3
Ambient temperature		
• during operation	°C	-25 ... +60
• during storage	°C	-40 ... +85
• during transport	°C	-40 ... +85
Galvanic isolation		
• between entrance and outlet		Yes
• between the outputs		Yes
• between the voltage supply and other circuits		Yes

Mechanical data:		
Width	mm	22.5
Height	mm	92
Depth	mm	91
Mounting position		any
Required spacing for grounded parts		
• forwards	mm	0
• Backwards	mm	0
• at the side	mm	0
• upwards	mm	0
• downwards	mm	0
Required spacing with side-by-side mounting		
• forwards	mm	0
• Backwards	mm	0
• at the side	mm	0
• upwards	mm	0
• downwards	mm	0
Required spacing for live parts		
• forwards	mm	0
• Backwards	mm	0
• at the side	mm	0
• upwards	mm	0
• downwards	mm	0
Mounting type		snap-on mounting
Product function removable terminal for auxiliary and control circuit		Yes
Type of electrical connection		screw-type terminals
Type of connectable conductor cross-sections		
• solid		1x (0.5 ... 4 mm2), 2x (0.5 ... 2.5 mm2)
• finely stranded		
— with core end processing		1x (0.5 ... 2.5 mm2), 2x (0.5 ... 1.5 mm2)
• at AWG conductors		
— solid		2x (20 ... 14)
— stranded		2x (20 ... 14)
Tightening torque with screw-type terminals	N·m	0.8 ... 1.2

Outputs:		
Number of NO contacts delayed switching		0
Number of NC contacts delayed switching		0
Number of CO contacts delayed switching		2
Ampacity of the output relay		
• at AC-15		

— at 250 V at 50/60 Hz	A	3
— at 400 V at 50/60 Hz	A	3
• at DC-13		
— at 24 V	A	1
— at 125 V	A	0.2
— at 250 V	A	0.1
Thermal current of the switching element with contacts maximum	A	5
Operating current at 17 V minimum	mA	5
Continuous current of the DIAZED fuse link of the output relay	A	4
Mechanical service life (switching cycles) typical		10 000 000
Electrical endurance (switching cycles) at AC-15 at 230 V typical		100 000
Operating frequency with 3RT2 contactor maximum	1/h	5 000

Certificates/ approvals:

General Product Approval			EMC	Declaration of Conformity	Test Certificates
CCC	UL	EAC	C-Tick	EG-Konf.	Type Test Certificates/Test Report

Test Certificates	Shipping Approval	other	Railway
Special Test Certificate	LRS	Confirmation	Vibration and Shock

Further information

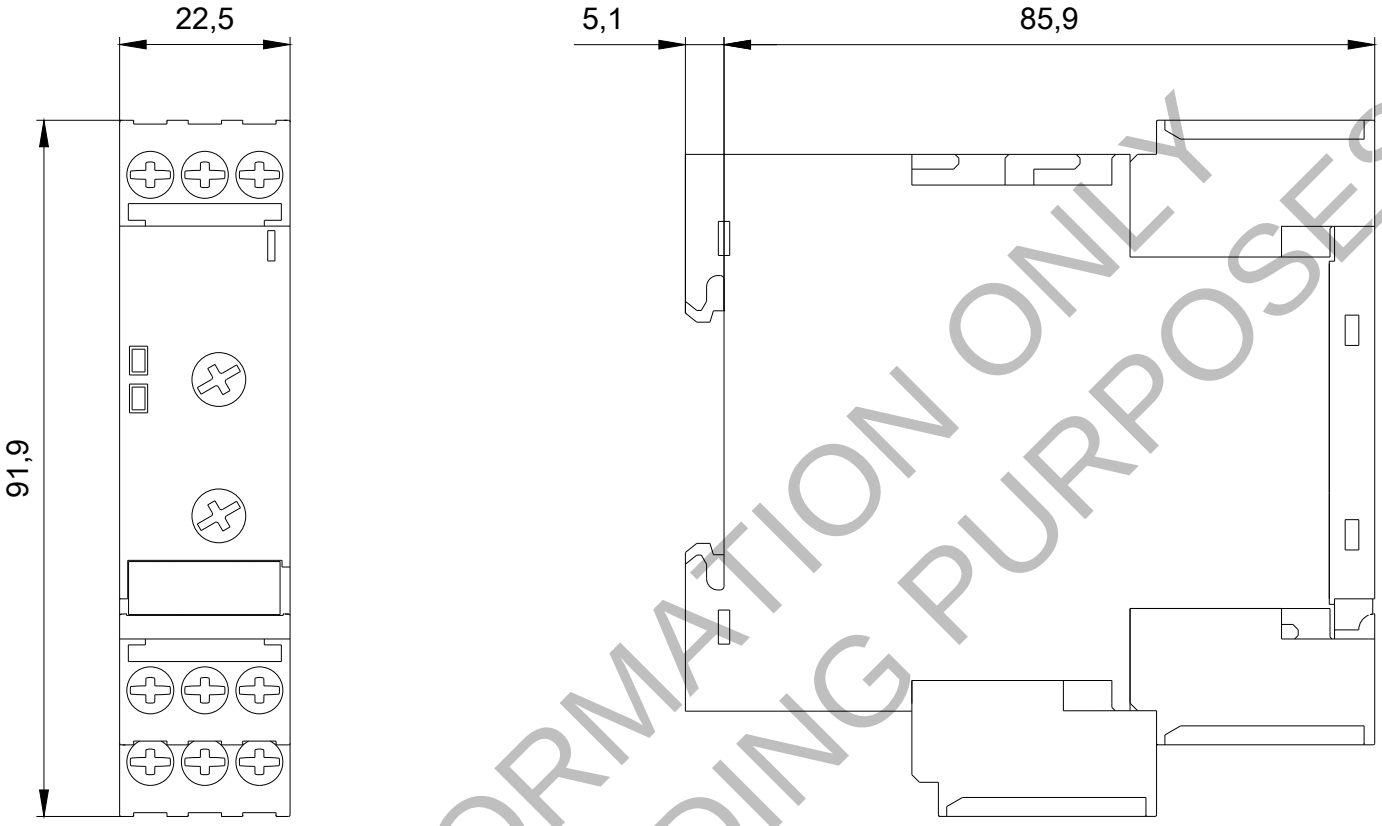
Information- and Downloadcenter (Catalogs, Brochures,…)
http://www.siemens.com/industrial-controls/catalogs

Industry Mall (Online ordering system)
http://www.siemens.com/industrymall

Cax online generator
http://support.automation.siemens.com/WW/CAXorder/default.aspx?lang=en&mlfb=3UG4513-1BR20

Service&Support (Manuals, Certificates, Characteristics, FAQs,...)
https://support.industry.siemens.com/cs/ww/en/ps/3UG4513-1BR20

Image database (product images, 2D dimension drawings, 3D models, device circuit diagrams, EPLAN macros, ...)
http://www.automation.siemens.com/bilddb/cax_de.aspx?mlfb=3UG4513-1BR20&lang=en



last modified: 08/12/2017

Low-Peak™ LP-CC Class CC 600 Vac/300 Vdc, 1/2-30 A time-delay fuses

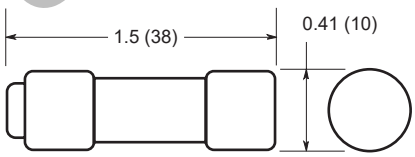
RoHS

Catalog numbers (amps)				
LP-CC-1/2	LP-CC-1-1/2	LP-CC-3	LP-CC-6	LP-CC-12
LP-CC-6/10	LP-CC-1-6/10	LP-CC-3-2/10	LP-CC-6-1/4	LP-CC-15
LP-CC-8/10	LP-CC-1-8/10	LP-CC-3-1/2	LP-CC-7	LP-CC-20
LP-CC-1	LP-CC-2	LP-CC-4	LP-CC-7-1/2	LP-CC-25
LP-CC-1-1/8	LP-CC-2-1/4	LP-CC-4-1/2	LP-CC-8	LP-CC-30
LP-CC-1-1/4	LP-CC-2-1/2	LP-CC-5	LP-CC-9	
LP-CC-1-4/10	LP-CC-2-8/10	LP-CC-5-6/10	LP-CC-10	

Carton quantity:

Amp rating	Carton qty.
1/2-30	10

Dimensions - in (mm)



Catalog symbol:

- LP-CC-(amp)

Description:

Bussmann™ series Ultimate protection Low-Peak Class CC current-limiting, time-delay fuses. Time-delay – 12 seconds (minimum) at 200% of rated current.

Specifications:

Ratings

- Volts
  - 600 Vac
  - 300 Vdc (1/2 to 2-8/10 A, 20-30 A)
  - 150 Vdc (3-15 A)
- Amps 1/2-30 A
- IR
  - 200 kA Vac RMS Sym.
  - 20 kA Vdc

Agency information

- UL® Listed Class CC, Std. 248-4, Guide JDDZ, File E4273
- CSA® Certified; Class 1422-02, File 53787
- CE
- RoHS compliant (20-30A)

Features:

- 200kA interrupting rating complies with NEC® Section 110.9 for today's large capacity systems.
- Fast short-circuit protection and dual-element, time-delay performance provide ultimate protection.
- Reduces existing fuse inventory by up to 33% when upgrading to Low-Peak fuses.
- Consistent 2:1 amp rating ratios for all Low-Peak fuses make selective coordination easy.
- Time-delay characteristic avoids unwanted fuse openings from surge currents while fast response speed under fault conditions provides a high degree of current limitation.
- Current-limitation protects downstream components against damaging thermal and magnetic effects of fault currents.
- A superior, all-purpose, space-saving branch circuit fuse that meets most protection requirements up to 30 A.
- Very compact physical size that's only 13/32" x 1-1/2" (10 x 38mm) with rejction tip.
- Proper sizing can provide "No Damage" Type 2 coordinated protection for NEMA and IEC motor controllers.
- Can be used where either a time-delay or a fast-acting fuse is needed, making selection easier and reducing spare fuse inventories for substantial cost reduction.
- Superior protection for small horsepower motor circuits.

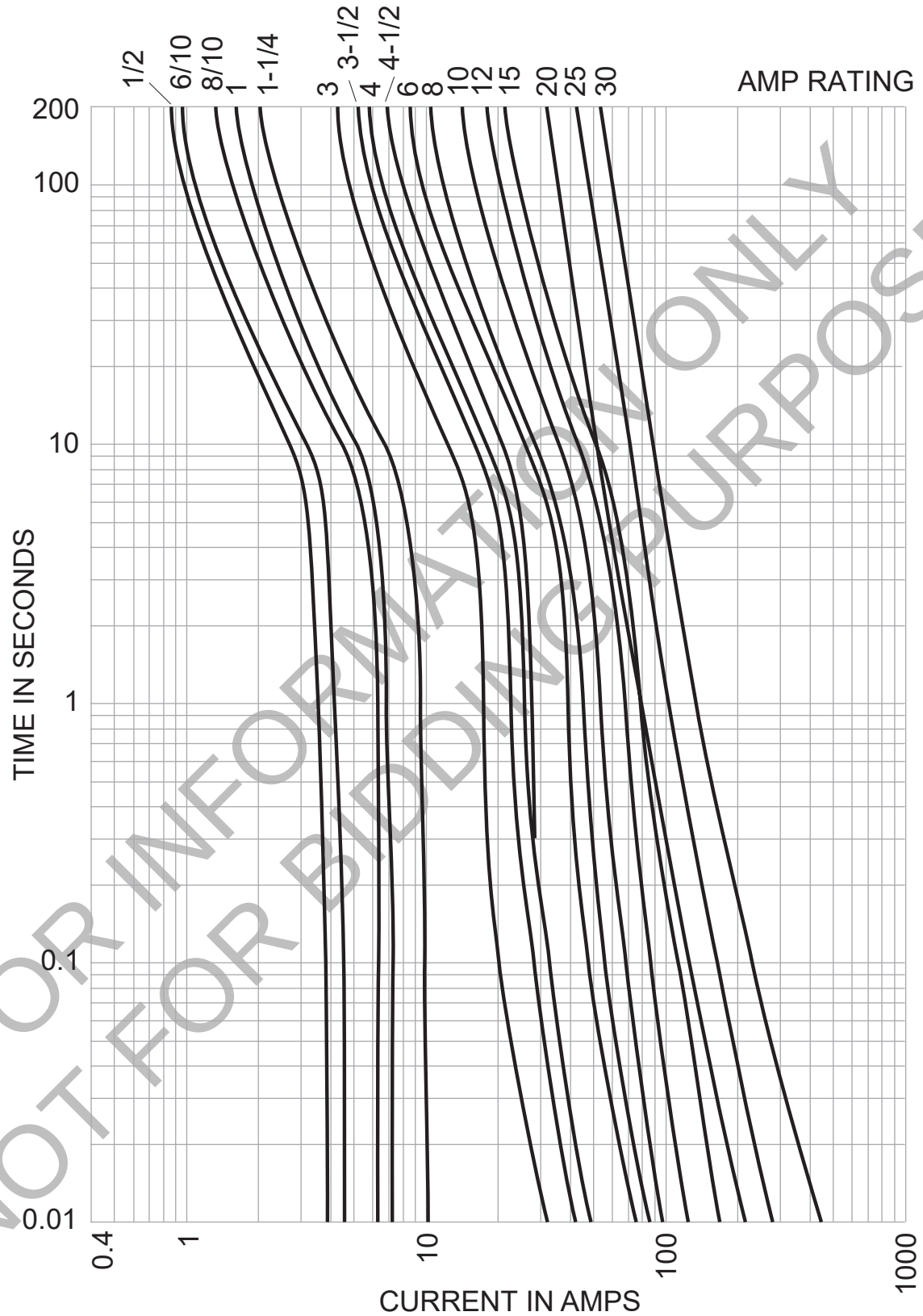
Recommended fuse blocks and holders:

Fuse amps	1-pole	2-pole	3-pole
Modular open blocks			
up to 30	BCM603-1_	BCM603-2_	BCM603-3_
DIN-Rail holders			
Up to 30	CHCC1D_	CHCC2D_	CHCC3D_
	—	—	OPM-NG-_
	—	—	OPM-1038_
	—	—	OPM-1038_SW
Panel mount holders			
Up to 30	HPS-RR	—	—
	HPF-RR	—	—
In-line holders			
Up to 30	—	HEY	—
	HEZ	—	—

For additional information on Class CC fuse blocks and holders, see data sheets:

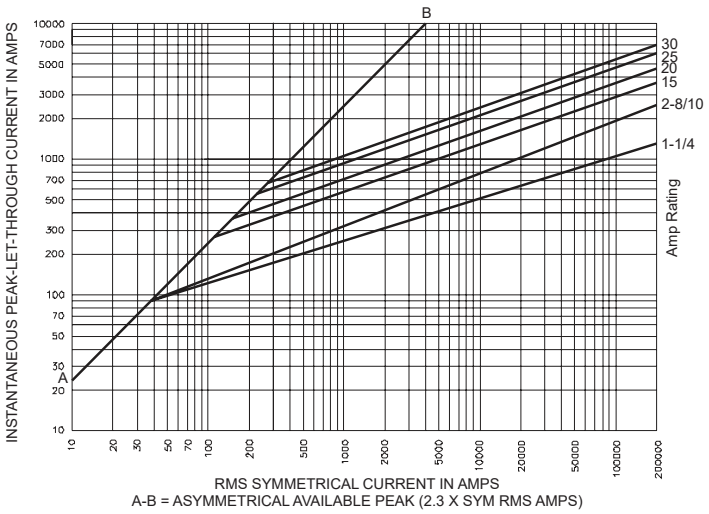
- Modular open blocks no. 10241 (BCM)
- DIN-Rail holders No. 10430 (CHCC), No. 1109 (OPM-NG), No. 1102 (OPM-1038), No. 1103 (OPM-1038_SW)
- Panel mount holders No. 2113 (HPS), No. 2114 (HPF)
- In-line holders No. 2126 (HEY), No. 2130 (HEZ)

Time-current curves - average melt:



Low-Peak™ LP-CC Class CC 600 Vac/300 Vdc, 1/2-30 A time-delay fuses

Current-limitation curves:



A-B = ASYMMETRICAL AVAILABLE PEAK (2.3 X SYM RMS AMPS)

Current-limiting effects:

Prospective S.C.C.	Let-through current (apparent RMS symmetrical vs. fuse rating)					
	1-1/4 A	2-8/10 A	15 A	20 A	25 A	30 A
1000	100	135	240	305	380	435
3000	140	210	350	440	575	580
5000	165	255	420	570	690	710
10,000	210	340	540	700	870	1000
20,000	260	435	680	870	1090	1305
30,000	290	525	800	1030	1300	1520
40,000	315	610	870	1150	1390	1700
50,000	340	650	915	1215	1520	1820
60,000	350	735	1050	1300	1650	1980
80,000	390	785	1130	1500	1780	2180
100,000	420	830	1210	1600	2000	2400
200,000	525	1100	1600	2000	2520	3050

NOTE: To calculate I_p (I_{peak}) multiply I_{RMS} value by 2.3.

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For Eaton's Bussmann series product information, call **1-855-287-7626** or visit: **Eaton.com/bussmannseries**

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Powering Business Worldwide

GUARDIAN/GUARDIANX SERIES DP53 480 VOLT 3-PHASE NEMA 4 or 4X AIR CONDITIONERS

Model	NEMA Rating	UL/CUL Listed or Recognized	BTU/H Rating	95/95 Rating	Ambient Temp. °F Max.	°F Min.	°C Max.	°C Min.	Volts	Hz	* Running Amps	Weight lbs	Weight kg
K3NA6C18DP53L	4	Listed	18000	15800	125	-20	52	-29	480	60	5.7	224	102
K3NA6C18DP53LV	4X	Listed	18000	15800	125	-20	52	-29	480	60	5.7	224	102

* Rating shown is for operation at maximum ambient temperature.

STANDARD FEATURES

Baked Powder Finish (NEMA 4 models)
Closed-Loop Cooling
Condenser Blower Controller
Epoxy-Coated Condenser Coils
External junction box for permanent wiring connections
Filters (2)
Heavy-duty Steel Shell
Internal Corrosion Protection (NEMA 4X models)
Low Temperature Control Thermostat
NEMA 4 or 4X Rating Maintained (UL50)
Stainless Steel Shell (NEMA 4X models)
UL/CUL Listed
Zero ODP Refrigerant

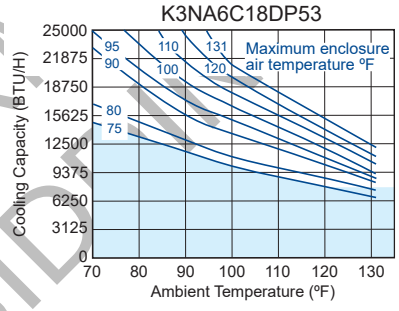
ACCESSORIES AND OPTIONS

Compressor Short Cycle Protector*
Enclosure Heater
Filter Recoating Adhesive
Lead-Lag Controller
Programmable Temperature Alarm
Programmable Thermostat Available
Remote Thermostat Relay
Replacement Filters
Special materials or finishes
Special motors, line cords or connectors
Temperature Alarm

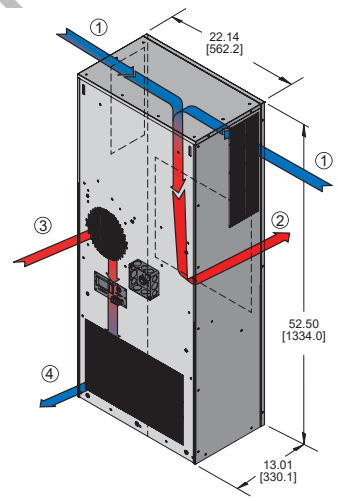
* Standard Feature on models with a Programmable Thermostat

c UL us
NEMA
TYPE 4 OR 4X
MAINTAINED

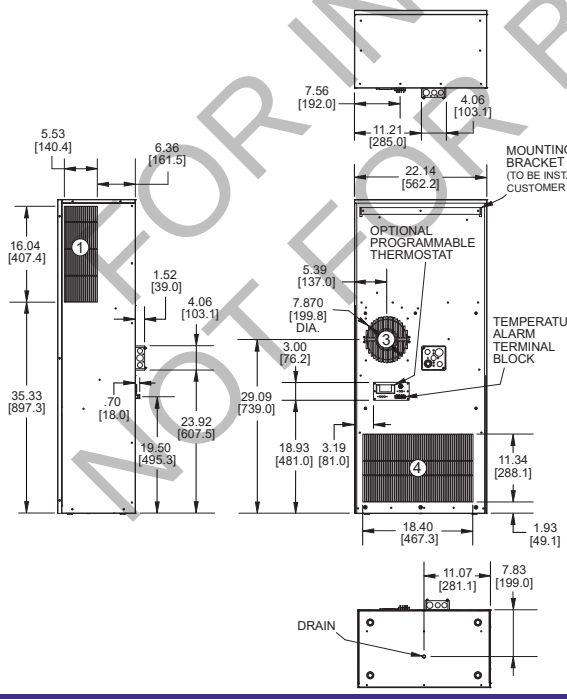
PERFORMANCE

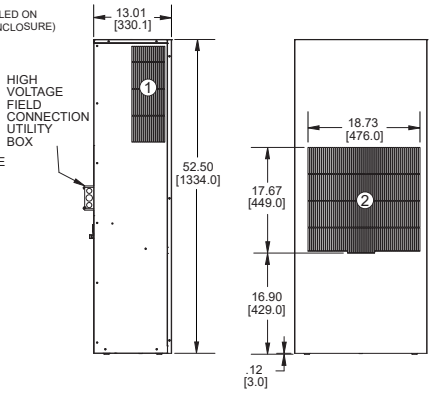


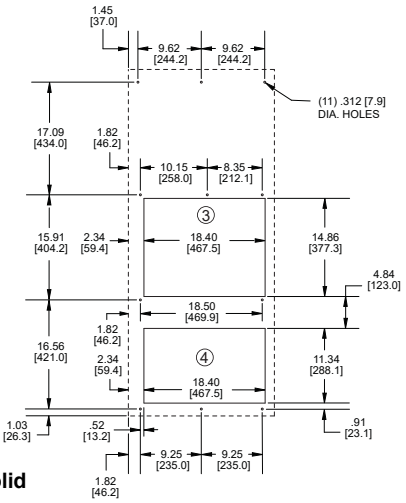
Operation within shaded area not recommended.



① CONDENSER AIR INLET (Ambient Air In)
② CONDENSER OUTLET (Warm Ambient Air Out)
③ WARM AIR RETURN FROM ENCLOSURE
④ COOL AIR OUTLET TO ENCLOSURE







MOUNTING PLAN

Many popular units are available as 3D solid models for customer system integration. Please contact Kooltronic for details.

Dimensions, inches [mm], are for reference only and are subject to change.

GUARDIAN/GUARDIANX SERIES DP53 480 VOLT 3-PHASE NEMA 4 or 4X AIR CONDITIONERS

DESCRIPTION

The ***Guardian/GuardianX*** Indoor/Outdoor Air Conditioners are designed specifically for **NEMA 4** and **4X** enclosure applications that require washdown or are subject to outdoor storm conditions. All ***Guardian*** models have a **NEMA 4** Rating, offering protection against the hazards of unwanted environmental penetration. The ***GuardianX***, with the ***NEMA 4X*** Rating, is offered with a Stainless Steel Shell and Internal Corrosion Protection.

With Epoxy-coated condenser coils and a closed-loop cooling system, the ***Guardian Series*** offers added security by providing an operating environment safe from harsh ambient conditions.

The features engineered into all of the ***Guardian Series*** models make them a tamper-resistant choice for external applications. Combined with a NEMA 4 Rating, with all models UL/CUL Listed, the ***Guardian Series*** is an excellent choice for telecommunications or other outdoor cabinet applications.

FEATURES AND BENEFITS (STANDARD)

All models UL and cUL Listed, a standard of safety.

CFC-free refrigerant provides a zero ozone depletion potential.

Condenser blower controller installed in the refrigerant liquid line, controlling the condenser fan.

Closed-loop cooling provides stable temperature control while excluding dust and humidity from the electrical enclosure.

Condenser impeller cycling provides stable capacity and temperature control.

Condenser filtration to maintain peak thermal performance extends compressor life.

Internal corrosion protection to increase reliability in hostile environments.

Low Temperature Control Thermostat provides energy-efficient operations.

NEMA 12, 3R & 4 ratings for compatibililty with listed electrical enclosures.

Stainless steel shell for NEMA 4X corrosive environments (NEMA 4X models).

Both evaporator and condenser coils are epoxy coated, prolonging unit life.

FEATURES AND BENEFITS (OPTIONAL)*

Compressor short-cycling protection extends compressor life. (Standard Feature on models with a Programmable Thermostat).

Enclosure heater eliminates damaging condensation, increasing reliability of electrical enclosure components.

Lead-lag control for two air conditioners provides for capacity control, and alternates usage, increasing reliability.

Mounting adapter plates are offered to replace another manufacturer's unit.

Programmable thermostat capable of remote monitoring and control is available.

Programmable temperature alarm to alert if early action required.

Remote monitoring provides temperature data for warning of early action required.

Remote thermostat relay for control by a user-supplied control system.

Special paint finishes*

*Contact KOOLTRONIC for more information.

REPLACEMENT FILTERS

The DP53L-LV filter Part No. 6382F (16.88″ x 6.38″ x 0.34″ [428.7mm x 162.0mm x 8.6mm]). The DP53L-LV uses two filters.

LIMITRON™ FNQ-R Class CC 600Vac, 1/4-30A, time-delay fuses

RoHS

Catalog numbers (amps)			
FNQ-R-1/4	FNQ-R-1-3/10	FNQ-R-3-2/10	FNQ-R-8
FNQ-R-3/10	FNQ-R-1-4/10	FNQ-R-3-1/2	FNQ-R-9
FNQ-R-4/10	FNQ-R-1-1/2	FNQ-R-4	FNQ-R-10
FNQ-R-1/2	FNQ-R-1-6/10	FNQ-R-4-1/2	FNQ-R-12
FNQ-R-6/10	FNQ-R-1-8/10	FNQ-R-5	FNQ-R-15
FNQ-R-3/4	FNQ-R-2	FNQ-R-5-6/10	FNQ-R-17-1/2
FNQ-R-8/10	FNQ-R-2-1/4	FNQ-R-6	FNQ-R-20
FNQ-R-1	FNQ-R-2-1/2	FNQ-R-6-1/4	FNQ-R-25
FNQ-R-1-1/8	FNQ-R-2-8/10	FNQ-R-7	FNQ-R-30
FNQ-R-1-1/4	FNQ-R-3	FNQ-R-7-1/2	

Catalog symbol:

- FNQ-R-(amp)

Description:

Advanced protection Class CC current-limiting, time-delay fuses.

Specifications:

Ratings

- Volts
  - 600Vac
  - 300Vdc (15 & 20A)
- Amps 1/4-30A
- IR
  - 200kA Vac RMS Sym.
  - 20kA Vdc (15 & 20A)

Agency information

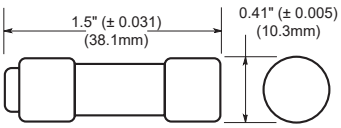
- UL® Listed, Std. 248-4, Class CC, Guide JDDZ, File E4273
- CSA® Certified, Class CC CSA, Class 1422-01, File 53787–HRC-MISC
- CE
- RoHS compliant*

* FNQ-R-1/4 not RoHS complaint.

Carton quantity:

Amp rating	Carton qty.
1/4-30	10

Dimensions - in:



Features:

- Provides 10X better current limitation to help prevent equipment damage caused by short-circuit events.
- 200kA interrupting rating complies with NEC® Section 110.9 for today's large capacity systems.
- Fast-acting fuse helps prevent equipment damage caused by short-circuit events.
- Rejection type fuse fits both standard and rejection-style holders.
- The Class CC FNQ-R Limitron fuse meets the needs of control circuit transformer protection.
- FNQ-R fuses can be sized according to NEC® and UL requirements and still allow the high inrush currents, with significantly more time-delay than the UL minimum value of 12 seconds at 200% for Class CC fuses.
- Ideal for critical industrial or commercial applications that have specific current limitation requirements.

Applications:

- Branch circuits
- Line protection
- Small control transformers
- Industrial control

Recommended fuse blocks and holders:

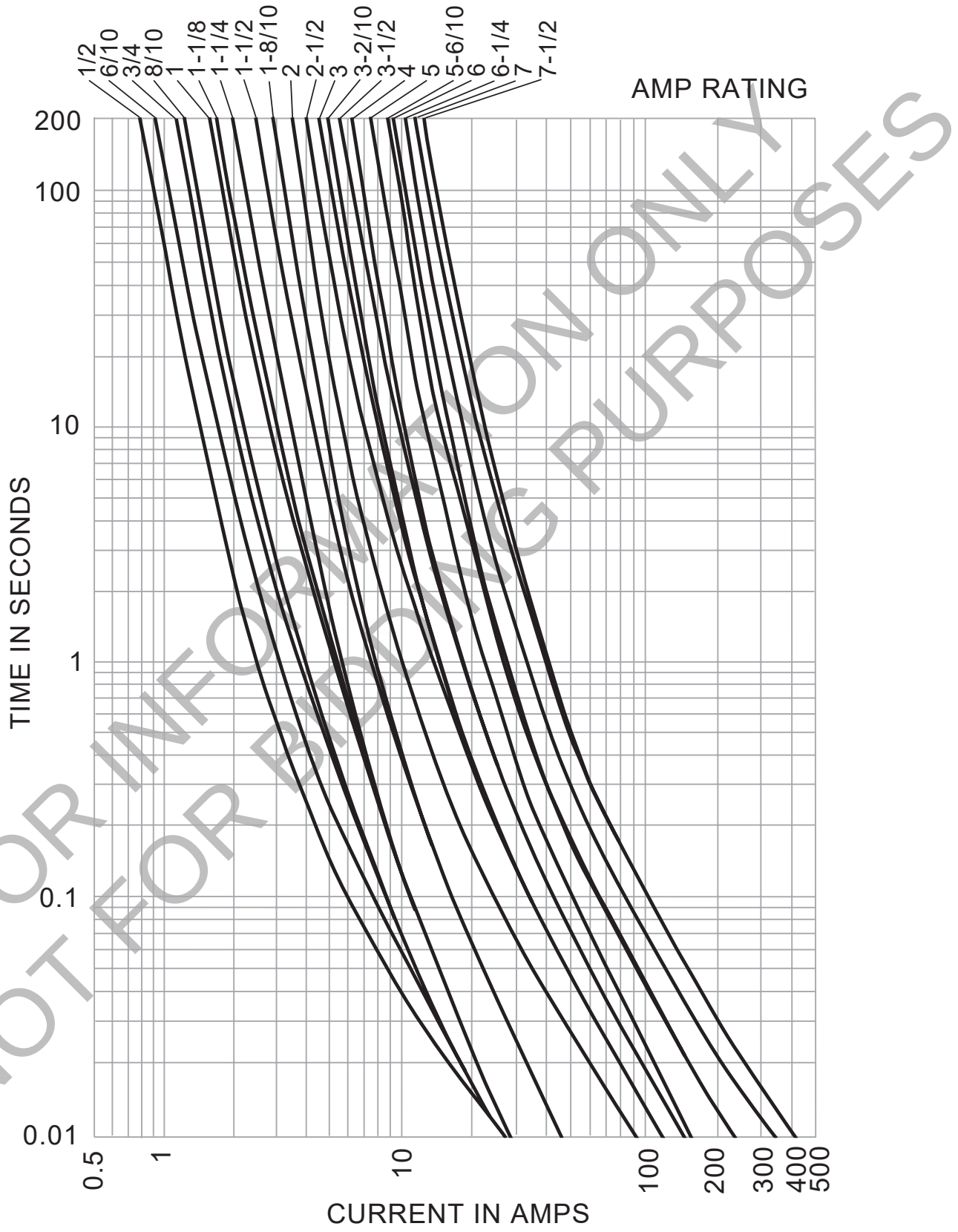
Fuse amps	1-Pole	2-Pole	3-Pole
Modular open blocks			
0-30	BCM603-1_	BCM603-2_	BCM603-3_
DIN-Rail holders			
	CHCC1D_	CHCC2D_	CHCC3D_
0-30	—	—	OPM-NG-_
	—	—	OPM-1038_
	—	—	OPM-1038_SW
Panel mount holders			
0-30	HPS	—	—
	HPF	—	—
In-line holders			
0-30	—	HEY	—
	HEZ	—	—

For additional information on Class CC fuse blocks and holders, see data sheets:

- Modular open blocks # 10241 (BCM)
- DIN-Rail holders No. 3185 (CHCC), No. 1109 (OPM), No. 1102 (OPM-1038), No. 1103 (OPM-1038_SW)
- Panel mount holders No. 2113 (HPS), No. 2114 (HPF)
- In-line holders No. 2126 (HEY), No. 2130 (HEZ)

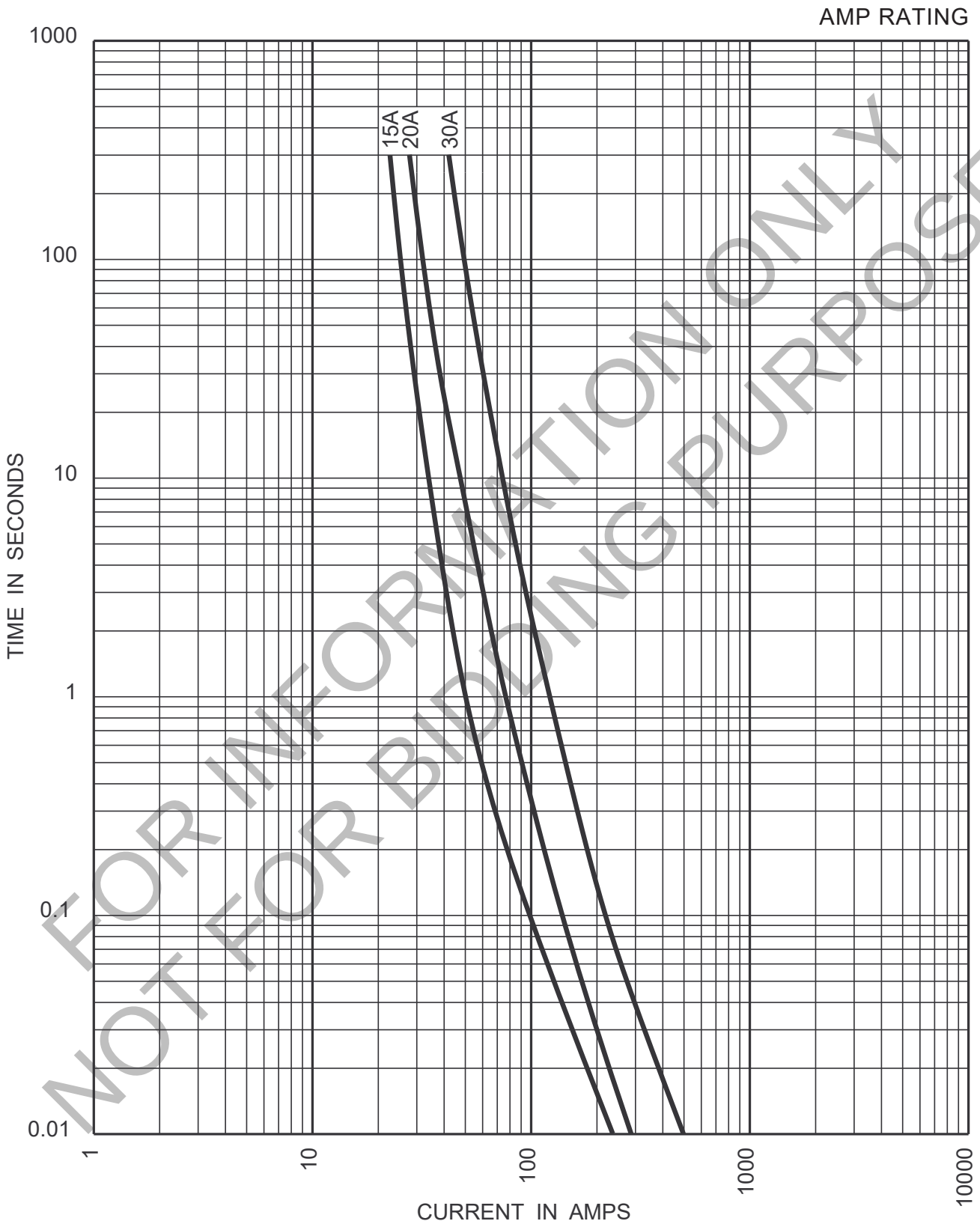
Time-current curves - average melt:

1⁄2 to 71⁄2 amps



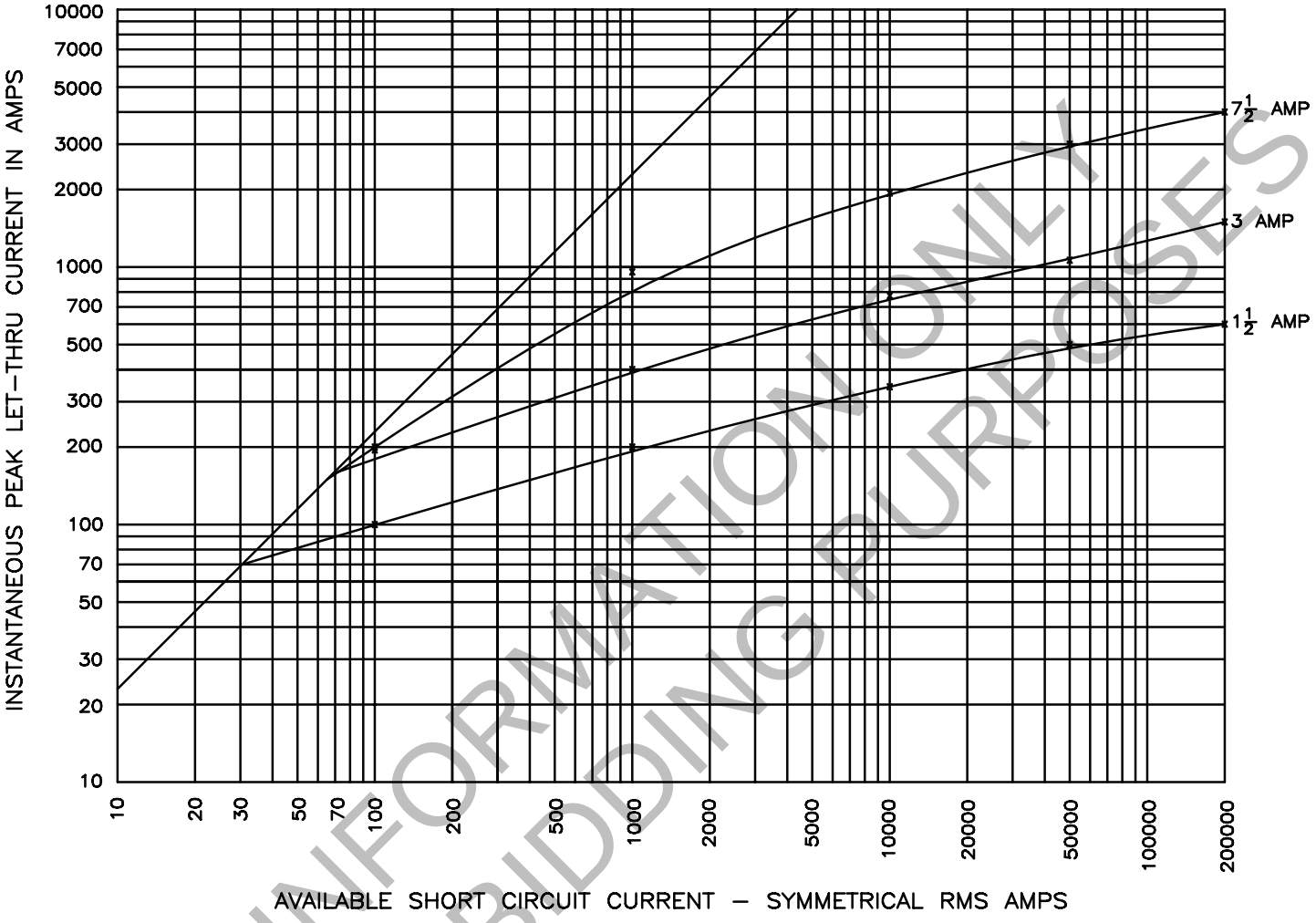
Time-current curves - average melt:

15 to 30 Amps



Current-limitation curves:

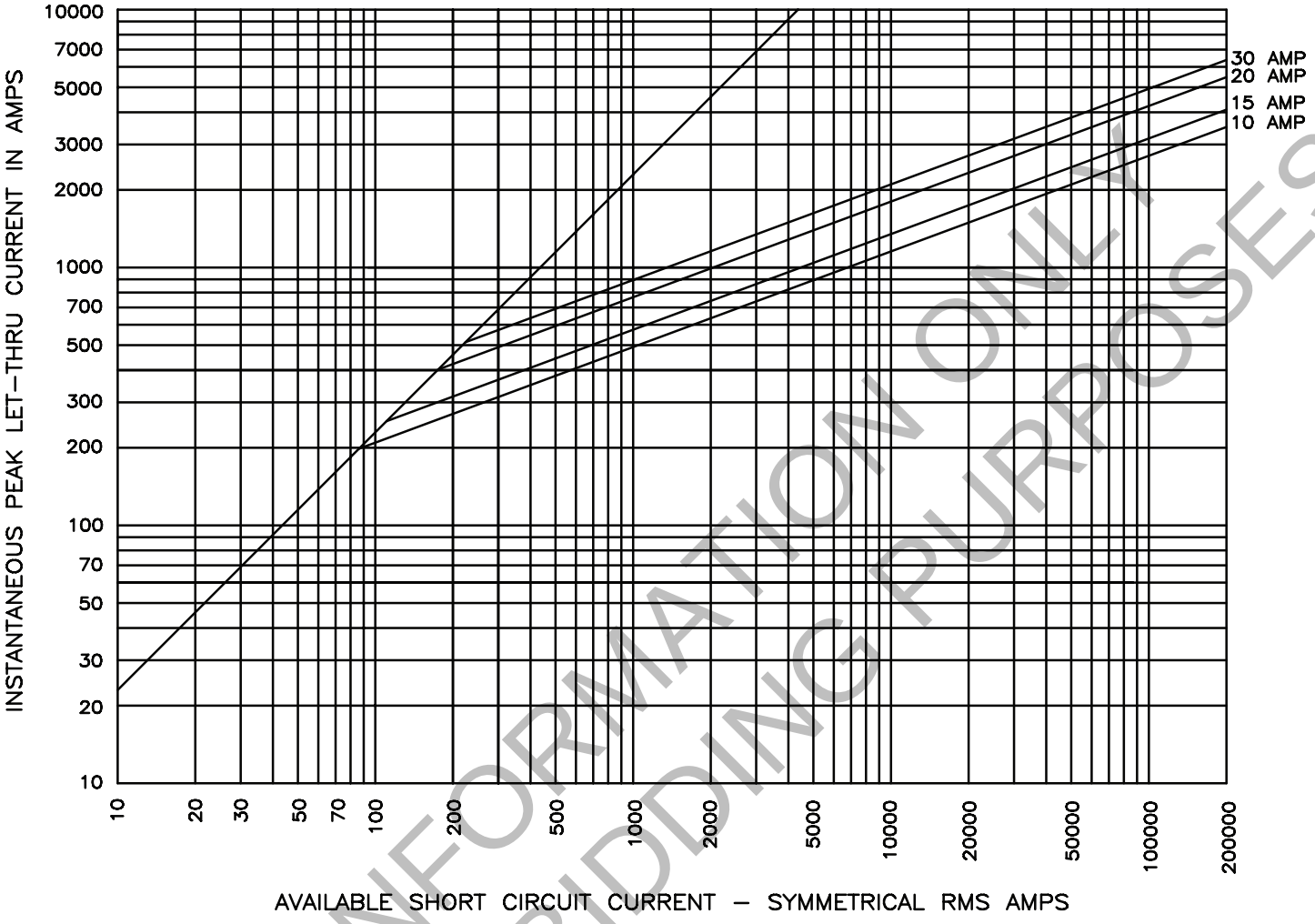
1-1⁄2 to 7-1⁄2 amps



LIMITRON™ FNQ-R Class CC 600Vac, 1⁄4-30A, time-delay fuses

Current-limitation curves:

10 to 30 amps



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Powering Business Worldwide

Transformers

				
Bulletin	1497	1497A	1497B	1497D
Type	**Control Circuit Transformer**	**Machine Tool Transformer**	**Control Power Transformer**	**General Purpose Transformer**
Features	• Single, dual, and multi-tap primary voltages • Single phase • EN 60-529 finger-safe protection • RoHS compliant • 50/60 Hz, 50 Hz, or 60 Hz • Optional Fusing	• Dual/Multi-tap • RoHS compliant • Single phase • 50/60 Hz • Optional Fusing	• Dual/Multi-tap • RoHS compliant • Single phase • 60 Hz only • Optional Fusing	• Indoor/outdoor non-ventilated enclosure • Single phase • Exceeds requirements of the Uniform Building Code (UBC) and California Code Title 24 • Copper windings provided for all transformers rated 2 kVA and below • Aluminum windings provided for all transformers rated 2 kVA and above • NEMA Type 3R rated enclosures • 50/60 HZ or 60 Hz
Output Power	63…2000VA	50…3000VA	50…3000VA	0.05…25 kVA
Input Voltage/ Primary Voltage	208…600V 220…550 (50 Hz)	208…575V (50/60 Hz)	120…600V	208…600V
Output Voltage/ Secondary Voltage	24…120V 24…230V (50 Hz)	24…120V (50/60 Hz)	24…240V	120…240V
Insulation	63…2000VA — Class 130 °C (55…80 °C temp. rise)	50…150VA — Class 105 °C (55 °C temp. rise) 200…1500VA — Class 130 °C (80 °C temp. rise) 2000…3000VA — Class 180 °C (100 °C temp. rise)		Class 180 °C (115 °C temp. rise)
Certifications	cULus, CE	cULus	cULus	UL, CSA
Standards	CSA C22.2 No. 66.1, EN 61558, UL 5085-1, 5085-2	CSA C22.2 No. 66.1, UL 5085-1, 5085-2	CSA C22.2 No. 66.1, UL 5085-1, 5085-2	CSA C22.2 No. 47 — M90, UL 1561
Page	**Page 4**	**Page 9**	**Page 14**	**Page 19**

Bulletin 1497B — Control Power Transformers

Bulletin 1497B Control Power Transformers are designed to reduce supply voltages to control circuits. The complete line of transformers is available with optional factory-installed or panel-mount primary and secondary fuse block.

- 50…3000VA (60 Hz)
- RoHS compliant
- Single phase
- Epoxy encapsulated

Standards Compliance

UL 5085-1, UL 5085-2

CSA C22.2 No. 66.1

Certifications

cULus Listed (File No. E52057; Guide No. XPTQ, XPTQ7)

Catalog Number Explanation

Bulletin 1497B Control Power Transformers

1497B – A3 – M11 – 0 – N
a *b* *c* *d*

a

VA Rating	
Code	Description [VA]
A1	50
A2	75
A3	100
A4	150
A5	200
A6	250
A7	300
A9	500
A10	750
A11	1000
A12	1500
A13	2000
A14	3000

b

Primary and Secondary Voltage		
Code	Primary	Secondary
M11	600/575/550V	120X240V (60 Hz)
M12	120X240V	120X240V (60 Hz)
M13	120X240V	24V (60 Hz)
M14	240X480V	120X240V (60 Hz)
M15	380/400/416V	115X230V (60 Hz)
M16	240X480V	24V (60 Hz)
M17	208/240V	24V (60 Hz)

c

Fuse Block Options❄	
Code	Block Options
0	0 Primary, 0 Secondary
1	0 Primary, 1 Secondary
2	2 Primary, 0 Secondary
3	2 Primary, 1 Secondary

d

Factory Installed Options	
Code	Description
N	No Taps

Note: For complete list of valid transformer configurations, see Product Selection.
❄ Transformers rated 350VA and below use secondary fuse clips. Transformers rated 500VA and above use secondary fuse blocks.

Selecting a Control Power Transformer

For proper transformer selection, three characteristics of the load circuit must be determined in addition to the minimum voltage required to operate the circuit. These are total steady-state (sealed) VA, total inrush VA, and inrush load power factor.

- Total steady-state (sealed) VA is the volt-amperes that the transformer must deliver to the load circuit for an extended period of time — the amount of current required to hold the contact in the circuit.
- Total inrush VA is the volt amperes that the transformer must deliver upon initial energization of the control circuit. Energization of electromagnetic devices takes 30…50 milliseconds. During this inrush period, the electromagnetic control devices draw many times normal current — 3…10 times normal is typical.
- Inrush load power factor is difficult to determine without detailed vector analysis of all the load components. Such an analysis is generally not feasible. Therefore, a safe assumption is 40% power factor.

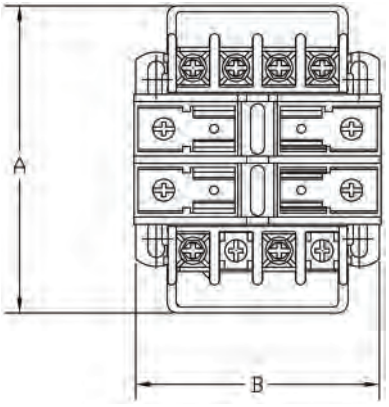
Selection Process

1. Determine the total inrush VA of the control circuits from the table below, *Typical Magnetic Motor Starter and Contactor Data 60 Hz, 120 Volt, 3-Pole*. Do not neglect the current requirements of indicating lights and other devices that do not have an inrush VA but are re-energized at the same time as the other components in the circuit. Their total VA should be added to the total inrush VA.
2. Refer to the table below, *Regulation Data — Inrush VA*. If the supply circuit voltage (Step 1) is reasonably stable and fluctuates not more than ± 5%, refer to the 90% secondary voltage column. If it fluctuates as much as ± 10%, refer to the 95% secondary voltage column. Go down the column selected until at the inrush VA closest to, but not less than, the inrush VA of the control circuit.
3. Read to the far left side of the chart. The transformer's continuous nominal VA rating is now selected. The secondary voltage that will be delivered under inrush conditions will be either 85%, 90%, or 95% of the rated secondary voltage, depending on the column selected from the table below, *Regulation Data — Inrush VA*. The total sealed VA of the control circuit must not exceed the nominal VA rating of the transformer selected from the table below, *Typical Magnetic Motor Starter and Contactor Data 60 Hz, 120 Volt, 3-Pole*.
4. Refer to the specification tables on the following pages to select a transformer according to the required continuous nominal VA, and primary and secondary voltage combinations.

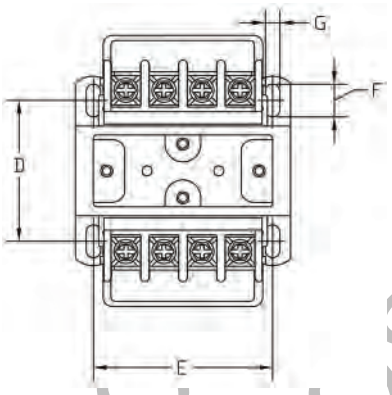
Regulation Data — Inrush VA

Inrush VA at 40% Power Factor				Power Factor Adjustments	
Nominal VA Rating	85%	90%	95%	Power Factor	Multiply By
50	158	139	116	100%	0.63
75	242	213	177	90%	0.65
100	346	302	249	80%	0.70
150	528	461	379	70%	0.75
200	869	743	585	60%	0.82
250	1057	904	719	50%	0.90
300	1418	1200	937	40%	1.00
500	2681	2221	1648	20%	1.27
750	4560	3718	2700	10%	1.45
1000	7568	6118	4185	—	—
1500	15724	12423	8203	—	—
2000	16941	13660	9484	—	—
3000	25680	20180	13797	—	—

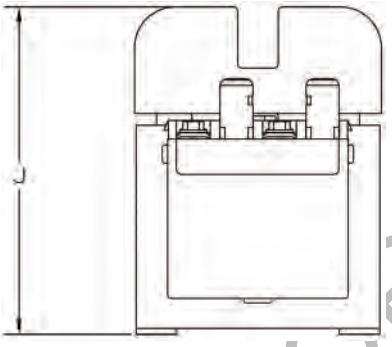
Dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.



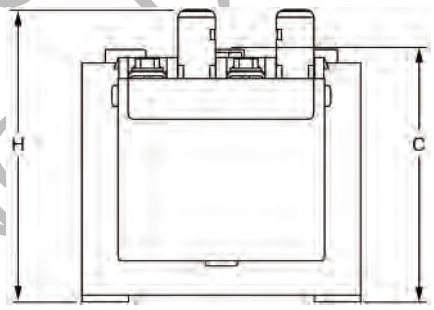
Transformer with 2 Primary Fuse Blocks and 0 or 1 Secondary Fuse Block/Clip
(Top View)



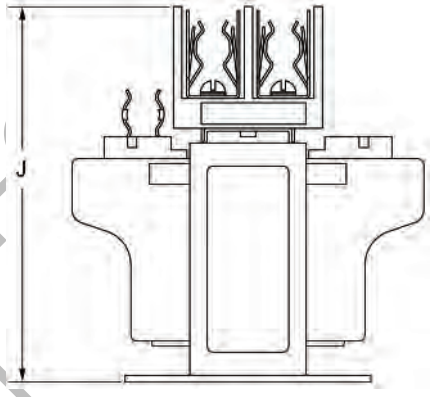
Transformer with 0 Primary Fuse Blocks and 0 or 1 Secondary Fuse Block/Clip
(Top View)



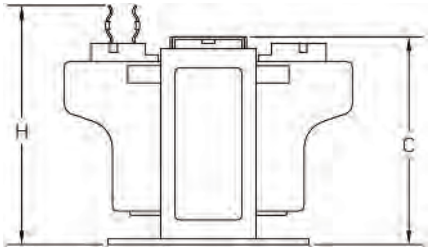
Transformer with 2 Primary Fuse Blocks and 1 Secondary Fuse Block/Clip
(Side View)



Transformer with 0 Primary Fuse Block and 1 Secondary Fuse Block/Clip
(Side View)



Transformer with 2 Primary Fuse Blocks and 1 Secondary Fuse Block/Clip
(Side View)



Transformer with 0 Primary Fuse Blocks and 1 Secondary Fuse Clip
(Side View)

VA	Cat. No.	A	B	C	D	E	F	G	H	J	Approx. Shipping Wt. lb (kg)
50	**1497B-A1-M13-0-N**	3-25/32 (96)	3 (76)	2-23/32 (69)	1-31/32 (50)	2-1/2 (64)	15/32 (12)	1/5 (5)	3-9/64 (80)	4-1/32 (102)	3 (1.4)
	1497B-A1-M16-0-N										
	1497B-A1-M17-0-N										
75	1497B-A2-M13-0-N	4-1/32 (102)	3 (76)	2-23/32 (69)	2-27/64 (61)	2-1/2 (64)	15/32 (12)	1/5 (5)	3-9/64 (80)	4-1/32 (102)	4 (1.8)
100	1497B-A3-M11-0-N	4-1/16 (103)	3-3/4 (95)	3-23/64 (85)	2-13/32 (61)	3-1/8 (80)	15/32 (12)	1/5 (5)	3-49/64 (96)	4-21/32 (118)	5 (2.3)
	1497B-A3-M12-0-N	4 (102)	3-3/8 (86)	3-3/64 (77)	2-27/64 (61)	2-13/16 (71)			3-15/32 (88)	4-23/64 (110)	
	1497B-A3-M13-0-N										
	1497B-A3-M14-0-N										
	1497B-A3-M16-0-N										
	1497B-A3-M17-0-N										
150	1497B-A4-M13-0-N	4-1/16 (103)	3-3/4 (95)	3-23/64 (85)	2-13/16 (71)	3-5/16 (80)	15/32 (12)	1/5 (5)	3-49/64 (96)	4-21/32 (118)	6 (2.7)
	1497B-A4-M14-0-N										
	1497B-A4-M16-0-N										
	1497B-A4-M17-0-N										
200	1497B-A5-M11-0-N	4-3/8 (111)	4-1/2 (114)	3-31/32 (101)	2-5/8 (67)	3-3/4 (95)	15/32 (12)	1/5 (5)	4-2/5 (112)	5-9/32 (134)	10 (4.5)
	1497B-A5-M12-0-N										
	1497B-A5-M13-0-N										
250	1497B-A6-M13-0-N	4-3/8 (111)	4-1/2 (114)	3-31/32 (101)	2-53/64 (72)	3-3/4 (95)	15/32 (12)	1/5 (5)	4-2/5 (112)	5-9/32 (134)	10 (4.5)
	1497B-A6-M14-0-N										
	1497B-A6-M16-0-N										
	1497B-A6-M17-0-N										
300	1497B-A7-M11-0-N	4-3/4 (120)	4-1/2 (114)	3-31/32 (101)	3-3/16 (81)	3-3/4 (95)	15/32 (12)	1/5 (5)	4-2/5 (112)	5-9/32 (134)	12 (5.4)
	1497B-A7-M12-0-N										
	1497B-A7-M13-0-N										
500	**1497B-A9-M11-0-N**	6-7/64 (155)	5-1/4 (133)	4-5/8 (118)	3-7/8 (98)	4-3/8 (111)	1-1/16 (27)	5/16 (8)	—	5-15/16 (151)	18 (8.2)
	1497B-A9-M12-0-N										
	1497B-A9-M14-0-N										
	1497B-A9-M15-0-N										
750	1497B-A10-M12-0-N	7-39/64 (193)	5-1/4 (133)	4-5/8 (118)	5-7/8 (149)	4-3/8 (111)	1-1/16 (27)	5/16 (8)	—	5-15/16 (151)	28 (12.7)
	1497B-A10-M14-0-N										
	1497B-A10-M15-0-N										
1000	1497B-A11-M11-0-N	7-7/64 (181)	6-3/4 (171)	5-55/64 (149)	4-31/32 (126)	6-1/8 (155)	9/10 (23)	5/16 (8)	—	7-3/16 (183)	40 (18.1)
	1497B-A11-M12-0-N										
	1497B-A11-M14-0-N										
	1497B-A11-M15-0-N										41 (18.6)
1500	1497B-A12-M14-0-N	8-7/64 (206)	6-3/4 (171)	5-55/64 (149)	6-1/8 (155)	6-1/8 (155)	7/8 (22)	5/16 (8)	—	7-3/16 (183)	53 (24)
	1497B-A12-M15-0-N										
2000	1497B-A13-M11-0-N	8-7/64 (206)	6-3/4 (171)	5-55/64 (149)	6-1/8 (155)	6-1/8 (155)	7/8 (22)	5/16 (8)	—	7-3/16 (183)	61 (27.7)
	1497B-A13-M12-0-N										
	1497B-A13-M14-0-N	9 (229)									53 (24)
	1497B-A13-M15-0-N	8-7/64 (206)									
3000	1497B-A14-M11-0-N	8-9/16 (217)	9 (229)	7-41/64 (194)	5-13/16 (148)	7-1/2 (191)	9/10 (23)	7/16 (11)	—	8-61/64 (227)	78 (35.4)
	1497B-A14-M12-0-N										
	1497B-A14-M14-0-N										
	1497B-A14-M15-0-N										

Product data sheet
Characteristics

GV2P08
Motor circuit breaker, TeSys GV2, 3P, 2.5-4 A, thermal magnetic, screw clamp terminals

Main

Range	TeSys
Product name	TeSys GV2
Product or component type	Circuit breaker
Device short name	GV2P
Device application	Motor
Trip unit technology	Thermal-magnetic

Complementary

Poles description	3P
Network type	AC
Utilisation category	AC-3 conforming to IEC 60947-4-1 Category A conforming to IEC 60947-2
Network frequency	50/60 Hz conforming to IEC 60947-4-1
Fixing mode	35 mm symmetrical DIN rail: clipped Panel: screwed (with 2 x M4 screws)
Operating position	Any position
Motor power kW	1.1 kW at 400/415 V AC 50/60 Hz 1.5 kW at 500 V AC 50/60 Hz 2.2 kW at 690 V AC 50/60 Hz
Breaking capacity	100 kA Icu at 230/240 V AC 50/60 Hz conforming to IEC 60947-2 100 kA Icu at 400/415 V AC 50/60 Hz conforming to IEC 60947-2 100 kA Icu at 440 V AC 50/60 Hz conforming to IEC 60947-2 100 kA Icu at 500 V AC 50/60 Hz conforming to IEC 60947-2 8 kA Icu 690 V AC 50/60 Hz IEC 60947-2
[Ics] rated service short-circuit breaking capacity	100 % at 690 V AC 50/60 Hz conforming to IEC 60947-2 100 % at 500 V AC 50/60 Hz conforming to IEC 60947-2 100 % at 230/240 V AC 50/60 Hz conforming to IEC 60947-2 100 % at 440 V AC 50/60 Hz conforming to IEC 60947-2 100 % at 400/415 V AC 50/60 Hz conforming to IEC 60947-2
Control type	Rotary knob

[In] rated current	4 A
Thermal protection adjustment range	2.5…4 A
Magnetic tripping current	51 A
[Ue] rated operational voltage	690 V AC 50/60 Hz conforming to IEC 60947-2
[Ui] rated insulation voltage	690 V AC 50/60 Hz conforming to IEC 60947-2
[Ith] conventional free air thermal current	4 A conforming to IEC 60947-4-1
[Uimp] rated impulse withstand voltage	IEC 60947-2 6 kV
Power dissipation per pole	2.5 W
Mechanical durability	100000 cycles
Electrical durability	100000 cycles for AC-3 at 440 V
Maximum operating rate	25 cyc/h
Rated duty	Continuous conforming to IEC 60947-4-1
Tightening torque	1.7 N.m on screw clamp terminals
Suitability for isolation	Yes conforming to IEC 60947-1
Phase failure sensitivity	Yes conforming to IEC 60947-4-1
Height	3.50 in (89 mm)
Width	1.77 in (45 mm)
Depth	3.82 in (97 mm)

Environment

Standards	EN/IEC 60947-2 EN/IEC 60947-4-1 UL 60947-4-1 CSA C22.2 No 60947-4-1
Product certifications	IECEE CB Scheme UL CSA CCC EAC ATEX BV LROS (Lloyds register of shipping) DNV-GL RINA
Protective treatment	TH
IP degree of protection	IP20 conforming to IEC 60529
IK degree of protection	IK04
Ambient air temperature for operation	-4…140 °F (-20…60 °C)
Ambient air temperature for storage	-40…176 °F (-40…80 °C)
Fire resistance	960 °C conforming to IEC 60695-2-1
Operating altitude	2000 m

Packing Units

Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Weight	11.46 oz (325 g)
Package 1 Height	1.81 in (4.6 cm)
Package 1 width	3.66 in (9.3 cm)
Package 1 Length	3.94 in (10 cm)
Unit Type of Package 2	S02
Number of Units in Package 2	20
Package 2 Weight	15.01 lb(US) (6.808 kg)
Package 2 Height	5.91 in (15 cm)
Package 2 width	11.81 in (30 cm)
Package 2 Length	15.75 in (40 cm)

Unit Type of Package 3	P06
Number of Units in Package 3	320
Package 3 Weight	264.07 lb(US) (119.78 kg)
Package 3 Height	31.50 in (80 cm)
Package 3 width	31.50 in (80 cm)
Package 3 Length	23.62 in (60 cm)

Offer Sustainability

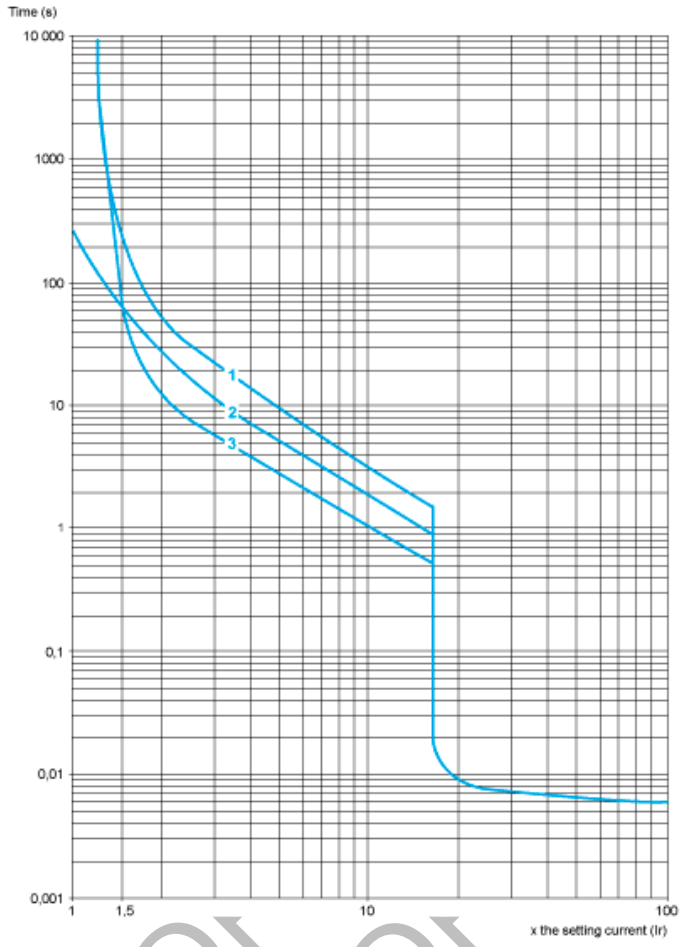
Sustainable offer status	Green Premium product
REACh Regulation	REACh Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information
Environmental Disclosure	Product Environmental Profile
WEEE	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins

Contractual warranty

Warranty	18 months

Thermal-Magnetic Tripping Curves for GV2ME and GV2P

Average Operating Times at 20 °C Related to Multiples of the Setting Current

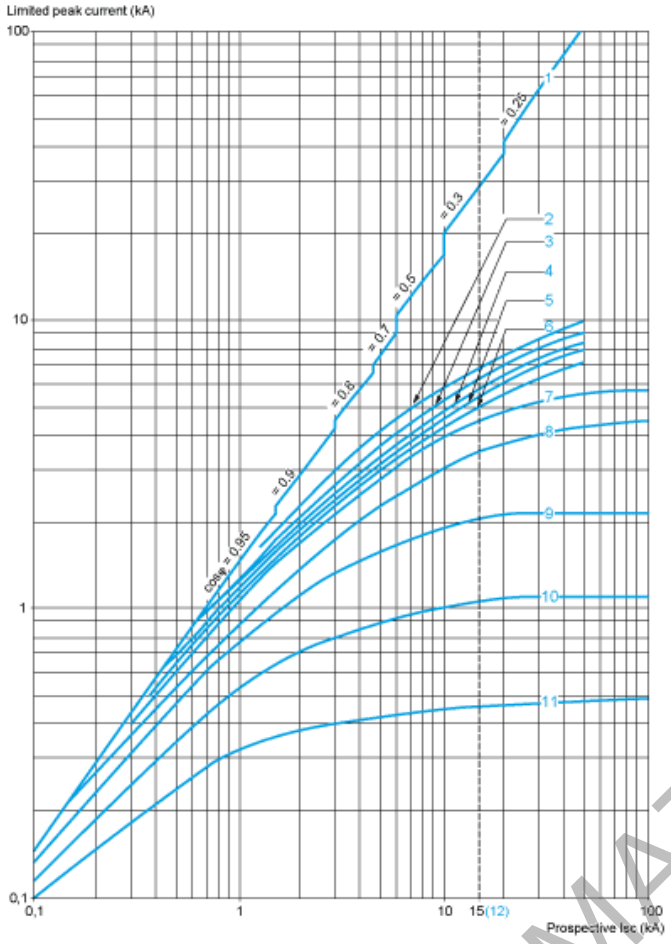


1 3 poles from cold state
2 2 poles from cold state
3 3 poles from hot state

Current Limitation on Short-Circuit for GV2ME and GV2P (3-Phase 400/415 V))

Dynamic Stress

I peak = f (prospective Isc) at 1.05 Ue = 435 V

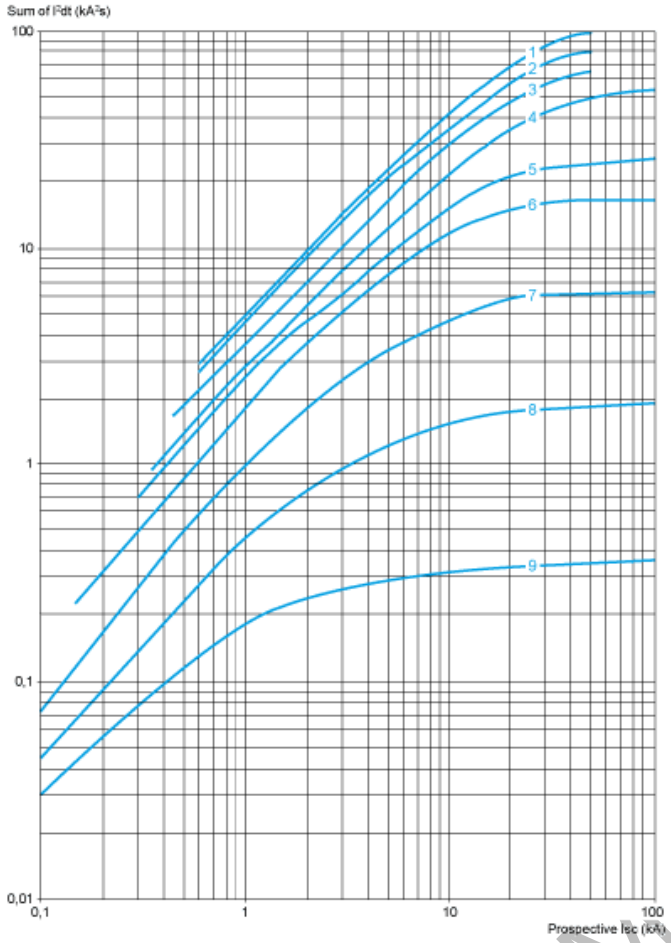


1	Maximum peak current
2	24-32 A
3	20-25 A
4	17-23 A
5	13-18 A
6	9-14 A
7	6-10 A
8	4-6.3 A
9	2.5-4 A
10	1.6-2.5 A
11	1-1.6 A
12	Limit of rated ultimate breaking capacity on short-circuit of GV2ME (14, 18, 23, and 25 A ratings).

Thermal Limit on Short-Circuit for GV2P

Thermal Limit in kA^2s in the Magnetic Operating Zone

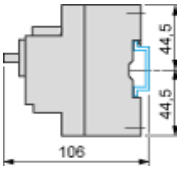
Sum of I^2dt = f (prospective Isc) at 1.05 Ue = 435 V



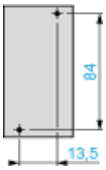
1	24-32 A
2	20-25 A
3	17-23 A
4	13-18 A
5	9-14 A
6	6-10 A
7	4-6.3 A
8	2.5-4 A
9	1.6-2.5 A
10	1-1.6 A

GV2P

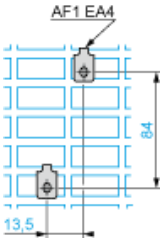
On rail AM1 DE200, ED200 (35 x 15)



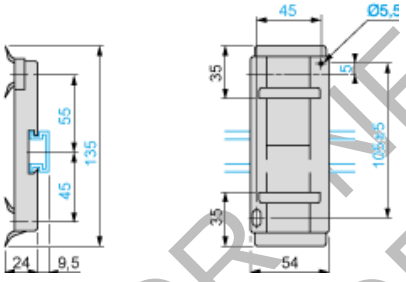
Panel mounted



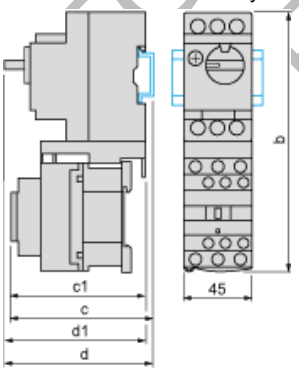
On pre-slotted plate AM1 PA



Adapter plate GK2AF01



Combination GV2P + TeSys d contactor

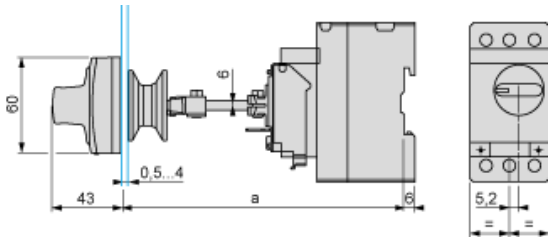


GV2P +	LC1D09…D18	LC1D25 and D32
b	176.4	186.8
c1	100.1	106.4

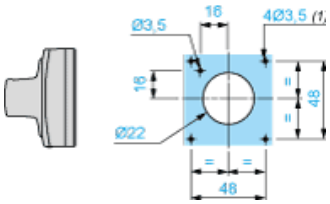
GV2P +	LC1D09…D18	LC1D25 and D32
c	105.6	111.9
d1	95	95
d	100.5	100.5

Mounting

Mounting of External Operator GV2APN01, GV2APN02 or GV2APN04 for Motor Circuit Breakers GV2P

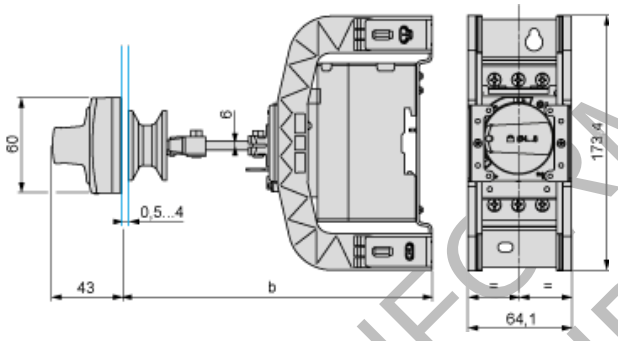


Door cut-out



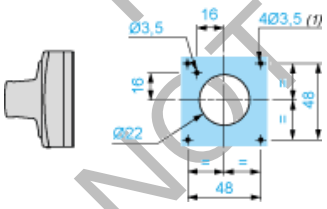
(1) For IP65 only.

Mounting of External Operator GVAPH02 for Motor Circuit Breakers GV2P



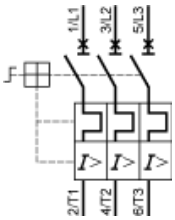
	a		b	
	Minimum	Maximum	Minimum	Maximum
GV2APN••	140	250	–	–
GV2APN•• + GVAPH02	–	–	151	250
GV2APN•• + GVAPK11	250	434	–	–
GV2APN•• + GVAPH02 + GVAPK11	–	–	250	445

Door cut-out



(1) For IP65 only.

GV2P••



Product data sheet
Characteristics

LC1D09BD
TeSys D contactor - 3P(3 NO) - AC-3 - <= 440 V
9 A - 24 V DC coil

Main

Range	TeSys
Product name	TeSys D
Product or component type	Contactor
Device short name	LC1D
Contactor application	Motor control Resistive load
Utilisation category	AC-4 AC-1 AC-3
Poles description	3P
Power pole contact composition	3 NO
[Ue] rated operational voltage	Power circuit <= 690 V AC 25...400 Hz Power circuit <= 300 V DC
[Ie] rated operational current	9 A (at <60 °C) at <= 440 V AC AC-3 for power circuit 25 A (at <60 °C) at <= 440 V AC AC-1 for power circuit
Motor power kW	2.2 kW at 220...230 V AC 50/60 Hz (AC-3) 4 kW at 380...400 V AC 50/60 Hz (AC-3) 4 kW at 415...440 V AC 50/60 Hz (AC-3) 5.5 kW at 500 V AC 50/60 Hz (AC-3) 5.5 kW at 660...690 V AC 50/60 Hz (AC-3) 2.2 kW at 400 V AC 50/60 Hz (AC-4)
Motor power HP (UL / CSA)	1 hp at 230/240 V AC 50/60 Hz for 1 phase motors 2 hp at 200/208 V AC 50/60 Hz for 3 phases motors 2 hp at 230/240 V AC 50/60 Hz for 3 phases motors 5 hp at 460/480 V AC 50/60 Hz for 3 phases motors 7.5 hp at 575/600 V AC 50/60 Hz for 3 phases motors 0.33 hp at 115 V AC 50/60 Hz for 1 phase motors
Control circuit type	DC standard
[Uc] control circuit voltage	24 V DC
Auxiliary contact composition	1 NO + 1 NC
[Uimp] rated impulse withstand voltage	6 kV IEC 60947

Overvoltage category	III
[Ith] conventional free air thermal current	25 A 140 °F (60 °C) power circuit 10 A 140 °F (60 °C) signalling circuit
Irms rated making capacity	250 A 440 V power circuit IEC 60947 140 A AC signalling circuit IEC 60947-5-1 250 A DC signalling circuit IEC 60947-5-1
Rated breaking capacity	250 A 440 V power circuit IEC 60947
[Icw] rated short-time withstand current	105 A 104 °F (40 °C) - 10 s power circuit 210 A 104 °F (40 °C) - 1 s power circuit 30 A 104 °F (40 °C) - 10 min power circuit 61 A 104 °F (40 °C) - 1 min power circuit 100 A - 1 s signalling circuit 120 A - 500 ms signalling circuit 140 A - 100 ms signalling circuit
Associated fuse rating	10 A gG signalling circuit IEC 60947-5-1 25 A gG <= 690 V type 1 power circuit 20 A gG <= 690 V type 2 power circuit
Average impedance	2.5 mOhm - Ith 25 A 50 Hz power circuit
[Ui] rated insulation voltage	Power circuit 690 V IEC 60947-4-1 Power circuit 600 V CSA Power circuit 600 V UL Signalling circuit 690 V IEC 60947-1 Signalling circuit 600 V CSA Signalling circuit 600 V UL
Electrical durability	0.6 Mcycles 25 A AC-1 at Ue <= 440 V 2 Mcycles 9 A AC-3 at Ue <= 440 V
Power dissipation per pole	1.56 W AC-1 0.2 W AC-3
Front cover	With
Mounting support	Plate Rail
Standards	CSA C22.2 No 14 EN 60947-4-1 EN 60947-5-1 IEC 60947-4-1 IEC 60947-5-1 UL 508
Product certifications	LROS (Lloyds register of shipping) CSA UL GOST DNV CCC GL BV RINA
Connections - terminals	Power circuit screw clamp terminals 1 0.00…0.01 in² (1…4 mm²)flexible without cable end Power circuit screw clamp terminals 2 0.00…0.01 in² (1…4 mm²)flexible without cable end Power circuit screw clamp terminals 1 0.00…0.01 in² (1…4 mm²)flexible with cable end Power circuit screw clamp terminals 2 0.00…0.00 in² (1…2.5 mm²)flexible with cable end Power circuit: screw clamp terminals 1 cable(s) 1…4 mm²solid without cable end Power circuit: screw clamp terminals 2 cable(s) 1…4 mm²solid without cable end Control circuit screw clamp terminals 1 0.00…0.01 in² (1…4 mm²)flexible without cable end Control circuit screw clamp terminals 2 0.00…0.01 in² (1…4 mm²)flexible without cable end Control circuit screw clamp terminals 1 0.00…0.01 in² (1…4 mm²)flexible with cable end Control circuit screw clamp terminals 2 0.00…0.00 in² (1…2.5 mm²)flexible with cable end Control circuit screw clamp terminals 1 0.00…0.01 in² (1…4 mm²)solid without cable end Control circuit screw clamp terminals 2 0.00…0.01 in² (1…4 mm²)solid without cable end
Tightening torque	Power circuit 15.05 lbf.in (1.7 N.m) screw clamp terminals flat Ø 6 mm Power circuit 15.05 lbf.in (1.7 N.m) screw clamp terminals Philips No 2 Control circuit 15.05 lbf.in (1.7 N.m) screw clamp terminals flat Ø 6 mm Control circuit 15.05 lbf.in (1.7 N.m) screw clamp terminals Philips No 2
Operating time	53.55...72.45 ms closing 16...24 ms opening
Safety reliability level	B10d = 1369863 cycles contactor with nominal load EN/ISO 13849-1 B10d = 20000000 cycles contactor with mechanical load EN/ISO 13849-1
Mechanical durability	30 Mcycles

Maximum operating rate	3600 cyc/h 140 °F (60 °C)

Complementary

Coil technology	Built-in bidirectional peak limiting diode suppressor
Control circuit voltage limits	0.1...0.25 Uc (-40…70 °C):drop-out DC 0.7...1.25 Uc (-40…60 °C):operational DC 1...1.25 Uc (60…70 °C):operational DC
Time constant	28 ms
Inrush power in W	5.4 W (at 20 °C)
Hold-in power consumption in W	5.4 W at 20 °C
Auxiliary contacts type	Mechanically linked 1 NO + 1 NC IEC 60947-5-1 Mirror contact 1 NC IEC 60947-4-1
Signalling circuit frequency	25...400 Hz
Minimum switching current	5 mA signalling circuit
Minimum switching voltage	17 V signalling circuit
Non-overlap time	1.5 ms on de-energisation between NC and NO contact 1.5 ms on energisation between NC and NO contact
Insulation resistance	> 10 MOhm signalling circuit
Contact compatibility	M4
Compatibility code	LC1D
Motor power range	1.1…2 kW 200…240 V 3 phases 2.2…3 kW 380…440 V 3 phases 4…6 kW 380…440 V 3 phases 4…6 kW 480…500 V 3 phases
Motor starter type	Direct on-line contactor
Contactor coil voltage	24 V DC standard

Environment

IP degree of protection	IP20 front face IEC 60529
Protective treatment	TH IEC 60068-2-30
Pollution degree	3
Ambient air temperature for operation	-40…140 °F (-40…60 °C) 140…158 °F (60…70 °C) with derating
Ambient air temperature for storage	-76…176 °F (-60…80 °C)
Operating altitude	0...3000 m
Fire resistance	1562 °F (850 °C) IEC 60695-2-1
Flame retardance	V1 UL 94
Mechanical robustness	Vibrations contactor open2 Gn, 5...300 Hz Vibrations contactor closed4 Gn, 5...300 Hz Shocks contactor open10 Gn for 11 ms Shocks contactor closed15 Gn for 11 ms
Height	3.03 in (77 mm)
Width	1.77 in (45 mm)
Depth	3.74 in (95 mm)
Net weight	1.06 lb(US) (0.48 kg)

Packing Units

Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Weight	18.77 oz (532 g)
Package 1 Height	1.97 in (5 cm)
Package 1 width	3.62 in (9.2 cm)
Package 1 Length	4.41 in (11.2 cm)

Offer Sustainability

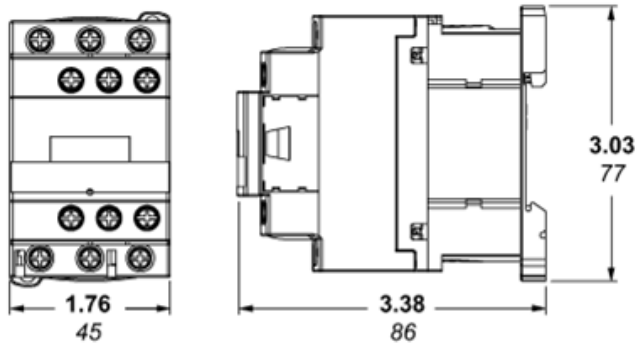
Sustainable offer status	Green Premium product
REACh Regulation	REACh Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information
Environmental Disclosure	Product Environmental Profile
Circularity Profile	End of Life Information
WEEE	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins
PVC free	Yes

Contractual warranty

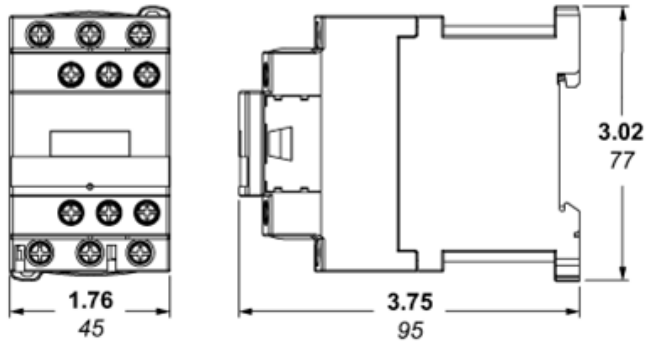
Warranty	18 months

Approximate Dimensions

CONTACTOR WITH AC COIL



CONTACTOR WITH DC COIL

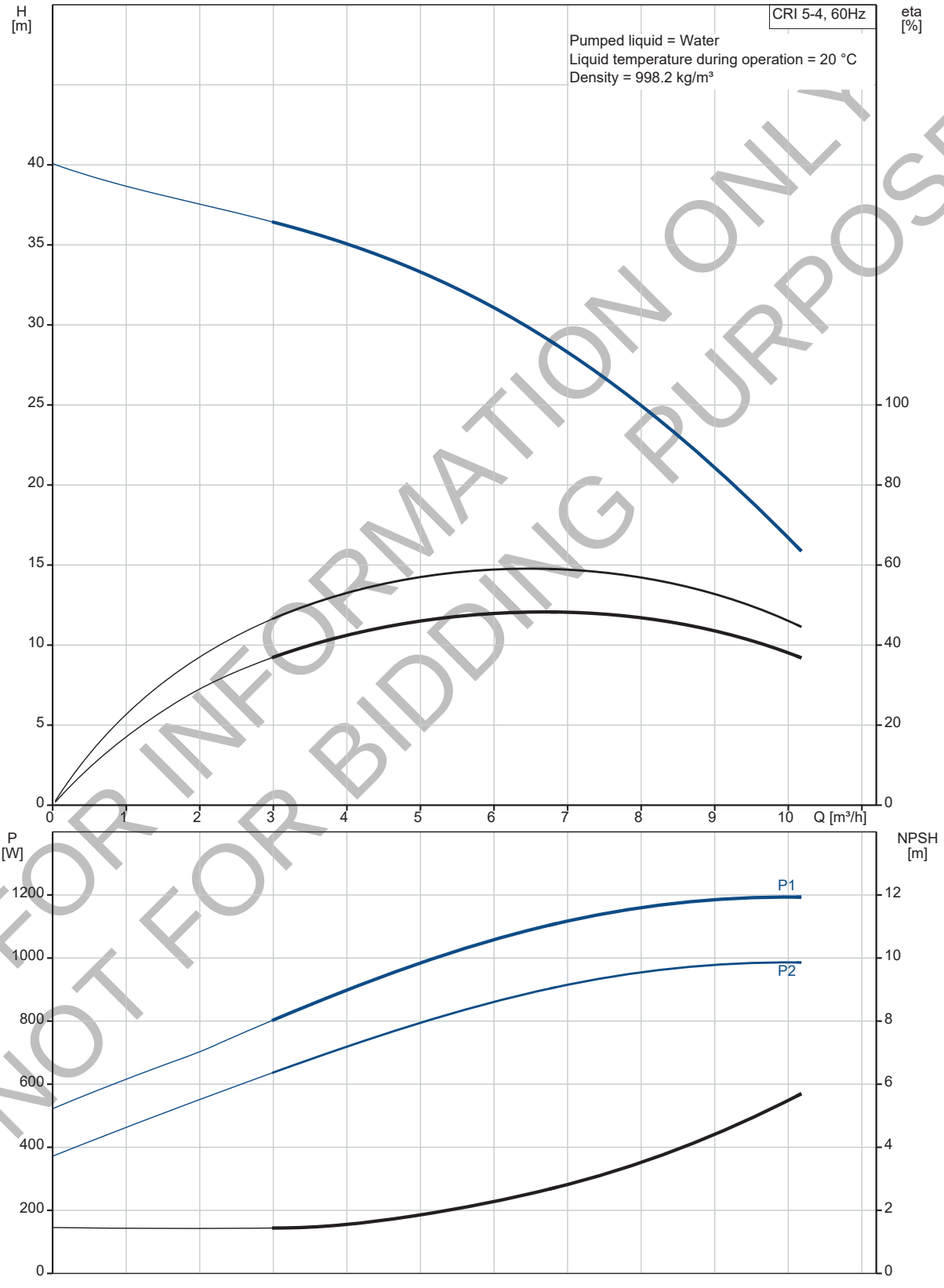


GRUNDFOS

Company name:
Created by:
Phone:

Date: 26/08/2021

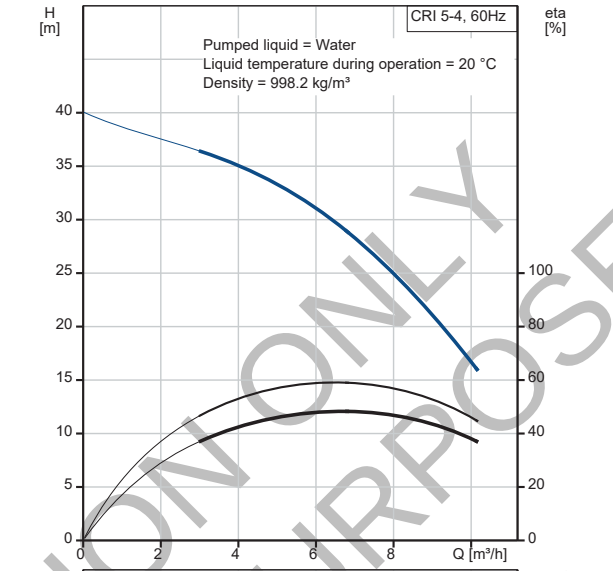
96084445 CRI 5-4 A-CA-A-E-HQQE 60 Hz

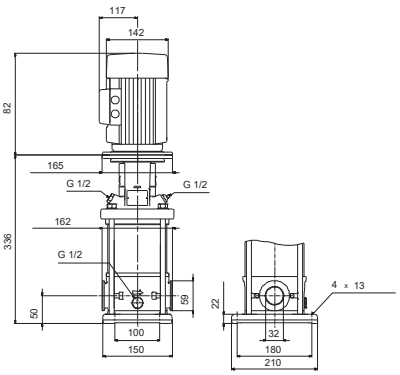


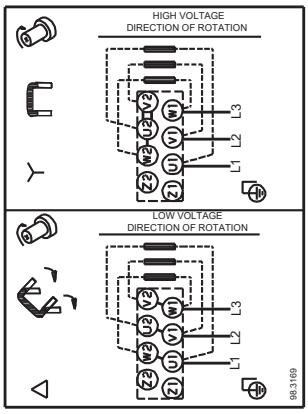
Company name:
Created by:
Phone:

Date: 26/08/2021

Description	Value
General information:	
Product name:	CRI 5-4 A-CA-A-E-HQQE
Product No:	96084445
EAN number:	5700395192834
Price:	
Technical:	
Pump speed on which pump data are based:	3466 rpm
Rated flow:	6.9 m³/h
Rated head:	28.9 m
Maximum head:	41.7 m
Actual impeller diameter:	73.2 mm
Stages:	4
Impellers:	4
Number of reduced-diameter impellers:	0
Low NPSH:	N
Pump orientation:	Vertical
Shaft seal arrangement:	Single
Code for shaft seal:	HQQE
Approvals:	CURUS
Approvals for drinking water:	NSF/ANSI 61
Curve tolerance:	ISO9906:2012 3B
Pump version:	A
Model:	A
Cooling:	TEFC
Materials:	
Base:	Stainless steel
Base:	EN 1.4408
Base:	AISI 316
Impeller:	Stainless steel
Impeller:	EN 1.4301
Impeller:	AISI 304
Material code:	A
Code for rubber:	E
Bearing:	SIC
Installation:	
Maximum ambient temperature:	60 °C
Maximum operating pressure:	25 bar
Max pressure at stated temp:	25 bar / 120 °C
Max pressure at stated temp:	25 bar / -20 °C
Type of connection:	FlexiClamp
Size of inlet connection:	DN 32
Size of outlet connection:	DN 32
Pressure rating for connection:	PN 25
Flange size for motor:	56C
Connect code:	CA
Liquid:	
Pumped liquid:	Water
Liquid temperature range:	-20 .. 120 °C
Selected liquid temperature:	20 °C
Density:	998.2 kg/m³
Electrical data:	
Motor standard:	NEMA
Motor type:	80CA
IE Efficiency class:	NEMA Premium / IE3 60Hz
Rated power - P2:	1.1 kW
Power (P2) required by pump:	1.1 kW







GRUNDFOS

Company name:
Created by:
Phone:

Date: 26/08/2021

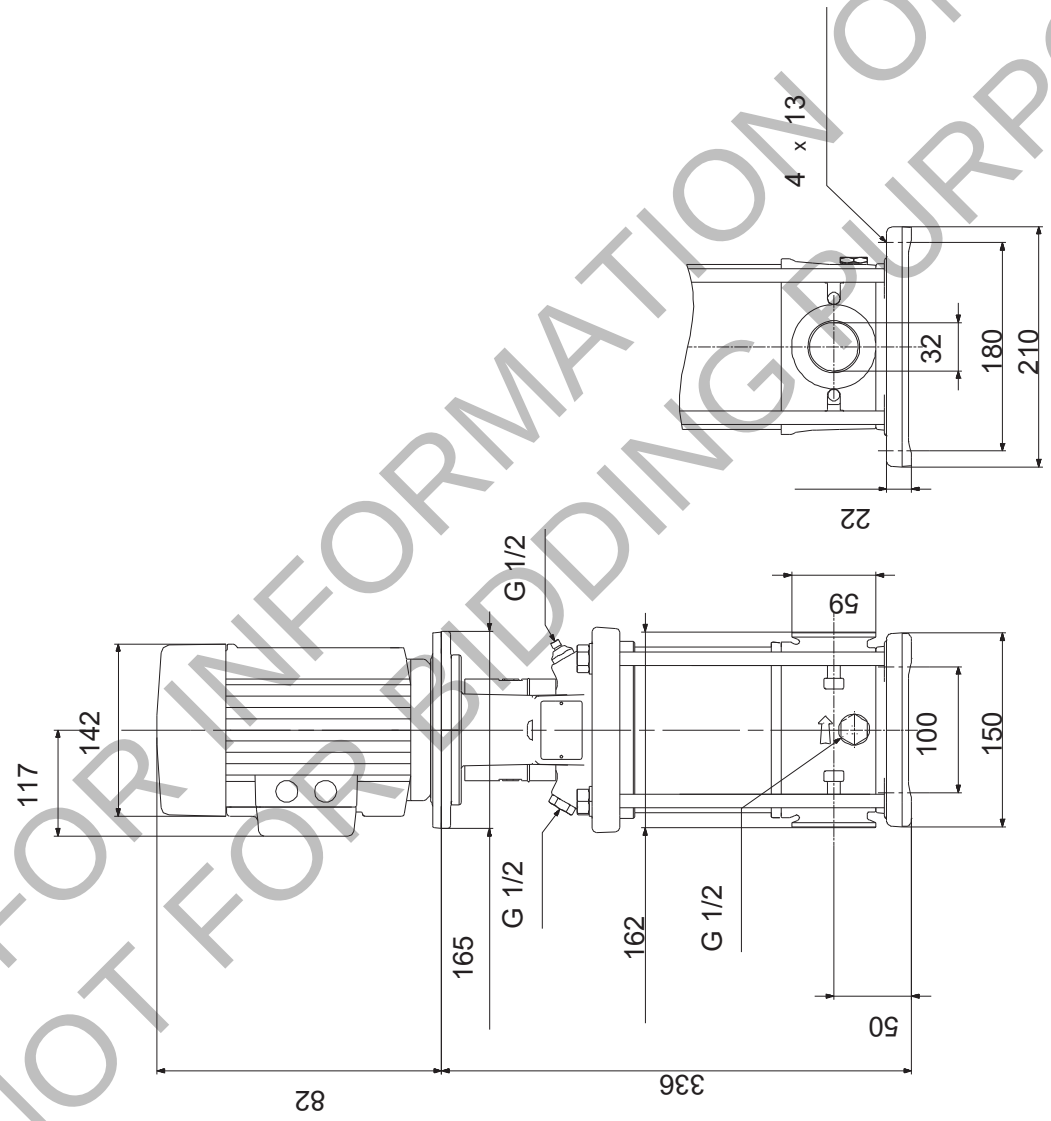
Description	Value
Mains frequency:	60 Hz
Rated voltage:	3 x 208-230YY/460Y V
Service factor:	1.15
Rated current:	4,45-4,3/2,16 A
Starting current:	720 %
Full load SF current:	5,1-4,95/2,48 A
Cos phi - power factor:	0.84-0.78
Rated speed:	3440-3480 rpm
Efficiency:	IE3 84,1%
Motor efficiency at full load:	84.1-83.5 %
Motor efficiency at 3/4 load:	81.0 %
Motor efficiency at 1/2 load:	78.5 %
Number of poles:	2
Enclosure class (IEC 34-5):	55 Dust/Jetting
Insulation class (IEC 85):	F
Built-in motor protection:	NONE
Motor No:	98976607
Controls:	
Frequency converter:	NONE
Others:	
DOE Pump Energy Index CL:	0.89
Net weight:	20.7 kg
Gross weight:	25.7 kg
Shipping volume:	0.14 m³

GRUNDFOS

Company name:
Created by:
Phone:

Date: 26/08/2021

96084445 CRI 5-4 A-CA-A-E-HQQE 60 Hz

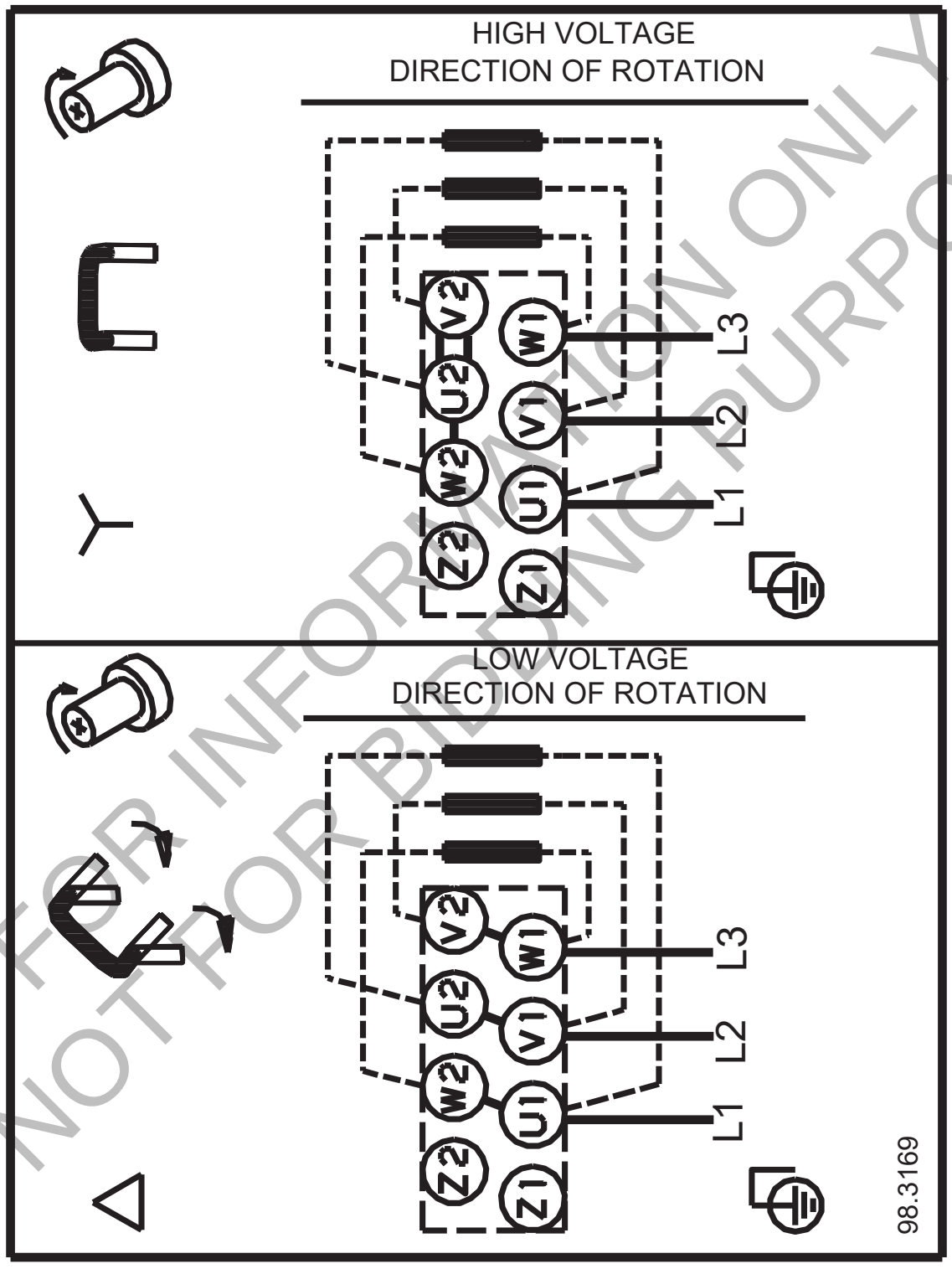


Note! All units are in [mm] unless others are stated.
Disclaimer: This simplified dimensional drawing does not show all details.

Company name:
Created by:
Phone:

Date: 26/08/2021

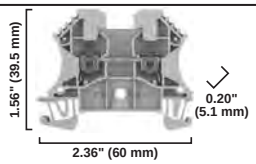
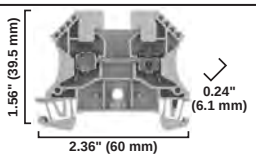
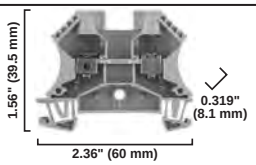
96084445 CRI 5-4 A-CA-A-E-HQQE 60 Hz



Note! All units are in [mm] unless others are stated.

Screw Connection Terminal Blocks

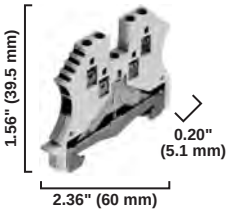
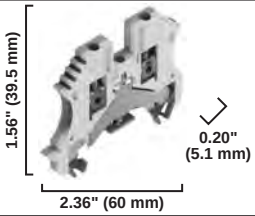
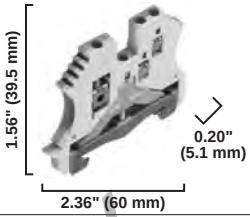
Standard Feed-Though Blocks

	1492-J3				1492-J4				1492-J6			
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.												
Specifications	*Feed-Through Terminal Block*				*Feed-Through Terminal Block*				*Feed-Through Terminal Block*			
Certifications	cULus	CSA	IEC	ATEX	cULus	CSA	IEC	ATEX	cULus	CSA	IEC	ATEX
Voltage Rating	600V AC/DC		800V AC/DC	550V AC/DC	600V AC/DC		800V AC/DC	690V AC/DC	600V AC/DC		800V AC/DC	550V AC/DC
Maximum Current	65 A	50 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A		41 A	36 A
Wire Range (Rated Cross Section)	#22… 12 AWG	#26… 12 AWG	2.5 mm²	2.5 mm² (#20… 14 AWG)	#22… 10 AWG	#26… 10 AWG	4 mm²	4 mm² (#20… 12 AWG)	#22…8 AWG		6 mm²	6 mm² (#20… 10 AWG)
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in (12 mm)			
Recommended Tightening Torque	4.5…7.1 lb•in. (0.5…0.8 N•m)				9.0 lb•in. (1.0 N•m)				14.2 lb•in (1.6 N•m)			
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)			
Housing Temperature Range	–58…+248 °F (–50…+120 °C)				–58…+248 °F (–50…+120 °C)				–58…+248 °F (–50…+120 °C)			
Short-Circuit Current Rating	See page 12-43											

Terminal Blocks		**Cat. No.**	**Pkg Qty.**	**Cat. No.**	**Pkg Qty.**	**Cat. No.**	**Pkg Qty.**
Color:	Grey	**1492-J3**	100	**1492-J4**	100	**1492-J6**	100
	Red	**1492-J3-RE**	100	**1492-J4-RE**	100	**1492-J6-RE**	100
	Blue	**1492-J3-B**	100	**1492-J4-B**	100	**1492-J6-B**	100
	Black	**1492-J3-BL**	100	**1492-J4-BL**	100	**1492-J6-BL**	100
	Green	**1492-J3-G**	100	**1492-J4-G**	100	**1492-J6-G**	100
	Yellow	**1492-J3-Y**	100	**1492-J4-Y**	100	**1492-J6-Y**	100
	Orange	**1492-J3-OR**	100	**1492-J4-OR**	100	**1492-J6-OR**	100
	Brown	**1492-J3-BR**	100	**1492-J4-BR**	100	**1492-J6-BR**	100
	White	**1492-J3-W**	100	**1492-J4-W**	100	**1492-J6-W**	100

Accessories	**Cat. No.**	**Pkg Qty.**	**Cat. No.**	**Pkg Qty.**	**Cat. No.**	**Pkg Qty.**
Mounting Rails: 1 m Symmetrical DIN (Steel)	**199-DR1**	10	**199-DR1**	10	**199-DR1**	10
1 m Symmetrical DIN (Aluminum)	**1492-DR5**	10	**1492-DR5**	10	**1492-DR5**	10
1 m Hi-Rise Sym. DIN (Aluminum)	**1492-DR6**	2	**1492-DR6**	2	**1492-DR6**	2
1 m Angled Hi-Rise Sym. DIN (Steel)	**1492-DR7**	2	**1492-DR7**	2	**1492-DR7**	2
End Barriers Grey	**1492-EBJ3**	50	**1492-EBJ3**	50	**1492-EBJ3**	50
Blue	**1492-EBJ3-B**	50	**1492-EBJ3-B**	50	**1492-EBJ3-B**	50
Yellow	**1492-EBJ3-Y**	50	**1492-EBJ3-Y**	50	**1492-EBJ3-Y**	50
End Anchors and Retainers: Screwless End Retainer	**1492-ERL35**	20	**1492-ERL35**	20	**1492-ERL35**	20
DIN Rail — Normal Duty	**1492-EAJ35**	100	**1492-EAJ35**	100	**1492-EAJ35**	100
DIN Rail — Heavy Duty	**1492-EAHJ35**	50	**1492-EAHJ35**	50	**1492-EAHJ35**	50
Jumpers:* Screw Center Jumper — 10-pole	**1492-CJJ5-10**	20	**1492-CJJ6-10**	20	**1492-CJJ8-10**	20
Screw Center Jumper — 4-pole	**1492-CJJ5-4**	50	**1492-CJJ6-4**	50	**1492-CJJ8-4**	50
Screw Center Jumper — 3-pole	**1492-CJJ5-3**	50	**1492-CJJ6-3**	50	**1492-CJJ8-3**	50
Screw Center Jumper — 2-pole	**1492-CJJ5-2**	50	**1492-CJJ6-2**	50	**1492-CJJ8-2**	50
Plug-in Center Jumper — 50-Pole	**1492-CJLJ5-50**	10	**1492-CJLJ6-41** (41-pole)	10	—	—
Plug-in Center Jumper — 10-Pole	**1492-CJLJ5-10**	20	**1492-CJLJ6-10**	20	—	—
Plug-in Center Jumper — 9-Pole	**1492-CJLJ5-9**	20	—	—	—	—
Plug-in Center Jumper — 8-Pole	**1492-CJLJ5-8**	20	—	—	—	—
Plug-in Center Jumper — 7-Pole	**1492-CJLJ5-7**	20	—	—	—	—
Plug-in Center Jumper — 6-Pole	**1492-CJLJ5-6**	20	—	—	—	—
Plug-in Center Jumper — 5-Pole	**1492-CJLJ5-5**	20	—	—	—	—
Plug-in Center Jumper — 4-Pole	**1492-CJLJ5-4**	60	**1492-CJLJ6-4**	60	—	—
Plug-in Center Jumper — 3-Pole	**1492-CJLJ5-3**	60	**1492-CJLJ6-3**	60	—	—
Plug-in Center Jumper — 2-Pole	**1492-CJLJ5-2**	60	**1492-CJLJ6-2**	60	—	—
Insulated Side Jumper — 24-Pole	**1492-SJ5B-24**	50	—	—	—	—
Insulated Side Jumper — 10-Pole	**1492-SJ5B-10**	50	—	—	—	—
Screw Type Jumper Notching Tool	**1492-T1**	1	**1492-T1**	1	**1492-T1**	1
Other Accessories: Partition Plate	**1492-EBJ16**	20	**1492-EBJ16**	20	**1492-EBJ16**	20
Test Plug Socket	**1492-TPS23**	20	**1492-TPS23L**	50	**1492-TPS23L**	50
Test Plug	**1492-TP23**	20	**1492-TP23**	20	**1492-TP23**	20
Test Plug (Stackable)	**1492-TPJ5**	25	**1492-TPJ6**	25	—	—
Electrical Warning Plate	**1492-EWPJ5**	25	**1492-EWPJ5**	25	**1492-EWPJ8**	50
Group Marking Carrier	**1492-GM35**	25	**1492-GM35**	25	**1492-GM35**	25
Marking Systems: Snap-in Marker Cards	**1492-M5X12** (144/card)	5	**1492-M6X12** (120/card)	5	**1492-MR8X12** (84/card)	5
	1492-M5X5 (200/card)	5	**1492-M6X5** (200/card)	5	**1492-M8X5** (160/card)	5

* Use of center jumpers may affect spacings, requiring derating of terminal blocks. See page 12-78 for details.

	1492-JG2Q			1492-JG3				1492-JG3TW			
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.											
Specifications	*Feed-Through Ground Block with 2 connection points on each side*			*Feed-Through Ground Block*				*Feed-Through Ground Block with 2 connection points on one side*			
Certifications		CSA	IEC		CSA	IEC	ATEX		CSA	IEC	ATEX
Voltage Rating	—	—	—	—	—	—	—	—	—	—	—
Maximum Current	Grounding			Grounding				Grounding			
Wire Range (Rated Cross Section)	#22…14 AWG		1.5 mm²	#22…12 AWG		2.5 mm²	2.5 mm² (#20…14 AWG)	—			
Wire Range (Single Side for JG3TW)	—			—				#22…12 AWG	2.5 mm²		2.5 mm² (#20…14 AWG)
Wire Range (Twin Side for JG3TW)	—			—				#26…12 AWG	1.5 mm²		1.5 mm² (#20…16 AWG)
Wire Strip Length/Tightening Torque	0.28 in. (7 mm)			0.39 in. (10 mm)				Single Side: 0.39 in. (10 mm)/ 7.1 lb-in. (0.8 N•m) Twin Side: 0.28 in. (7 mm)/ 4.5 lb-in. (0.5 N•m)			
Recommended Tightening Torque	5.0 lb•in. (0.6 N•m)			7.1 lb•in. (0.8 N•m)				—			
Mounting Torque — Center Screw	3.5…5.3 lb•in. (0.4…0.6 N•m)			3.5…6.2 lb•in. (0.4…0.6 N•m)				3.5…5.3 lb•in. (0.4…0.6 N•m)			
Density	59 pcs/ft (196 pcs/m)			59 pcs/ft (196 pcs/m)				59 pcs/ft (196 pcs/m)			
Housing Temperature Range	–58…+248 °F (–50…+120 °C)			–58…+248 °F (–50…+120 °C)				–58…+248 °F (–50…+120 °C)			
Short-Circuit Current Rating	See page 12-43										
Terminal Blocks	**Cat. No.**		**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**
Color: Green/Yellow	**1492-JG2Q**		100	**1492-JG3**			100	**1492-JG3TW**			100
Accessories	**Cat. No.**		**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**
Mounting Rails: 1 m Symmetrical DIN (Steel)	**199-DR1**		10	**199-DR1**			10	**199-DR1**			10
1 m Symmetrical DIN (Aluminum)	**1492-DR5**		10	**1492-DR5**			10	**1492-DR5**			10
1 m Hi-Rise Sym. DIN (Aluminum)	**1492-DR6**		2	**1492-DR6**			2	**1492-DR6**			2
1 m Angled Hi-Rise Sym. DIN (Steel)	**1492-DR7**		2	**1492-DR7**			2	**1492-DR7**			2
End Barrier Yellow	**1492-EBJ3-Y**		50	**1492-EBJ3-Y**			50	**1492-EBJ3-Y**			50
End Anchors and End Retainers: Screwless End Retainer	**1492-ERL35**		20	**1492-ERL35**			20	**1492-ERL35**			20
DIN Rail — Normal Duty	**1492-EAJ35**		100	**1492-EAJ35**			100	**1492-EAJ35**			100
DIN Rail — Heavy Duty	**1492-EAHJ35**		50	**1492-EAHJ35**			50	**1492-EAHJ35**			50
Other Accessories: Group Marking Carrier	**1492-GM35**		25	**1492-GM35**			25	**1492-GM35**			25
Marking Systems: Snap-in marker cards	**1492-M5X12** (144/card)		5	**1492-M5X12** (144/card)			5	**1492-M5X12** (144/card)			5
Snap-in marker cards	**1492-M5X5** (200/card)		5	**1492-M5X5** (200/card)			5	**1492-M5X5** (200/card)			5

StructuredGround™ Universal Ground Bar System

PANDUIT®

SPECIFICATION SHEET

specifications

Provide a field wiring terminal for the connection of an equipment grounding conductor in each control panel and enclosure. The terminal shall be UL 467 Listed or CSA 22.2 certified. The equipment grounding conductor shall have electrical continuity with the enclosure or sub-panel. The field wiring terminal may also provide multiple locations or ports for terminating equipment ground conductors from devices inside the panel or enclosure, functioning as the ground bar within the panel or enclosure. The ground bar shall provide a means to attach and to identify the main equipment grounding conductor.

PATENT PENDING

technical information

Performance level:	UL 467 Listed and CSA 22.2 Certified for grounding and bonding an equipment grounding conductor up to 2/0 AWG; meets UL 508A requirements
Main:	Provides a location for the main equipment grounding conductor using a compression or mechanical connector
Wire ports:	Accept bare stripped copper wire from #14 to #4 AWG Accept wire ferrules from #14 AWG to #6 AWG Top of ground bar accepts ring terminals, compression connectors or mechanical connectors with a ¼" stud hole size and maximum width of 0.55"
Materials:	Ground bars and bonding stand-offs precision machined from 110 electrolytic copper with a 99.9% copper content and then tin-plated for additional corrosion resistance
Packaging:	Each part is provided with all fasteners required for terminating wires and for each mounting option

key features and benefits

Flexible design	Works with all types of wire termination methods including stripped wire, ferrules, terminals, and compression or mechanical connectors; compatible with over 140 Panduit connectors
Multiple mounting options	In addition to surface mounting, two mounting stand-off options are available, one that bonds to the mounting surface and one that isolates from the mounting surface; both options provide additional finger wiring space in tight places
Unique geometry	The unique shape of the universal ground bar allows more surface contact between the wire connectors and the ground bar

applications

The StructuredGround™ Universal Ground Bar System (UGB) offers multiple termination methods and mounting options making it ideal for any control panel or enclosure application. The UGB enables the end user to choose the method in which to terminate conductors with connectors of their choice or simply cut and strip the wires. The UGB system will help reduce the types of ground bars that a panel shop or distributor needs to keep in stock to meet the various applications and customer requirements.

Universal Ground Bar System

6-port ground bar:	UGB2/0-414-6
12-port ground bar:	UGB2/0-414-12
18-port ground bar:	UGB2/0-414-18
Isolation standoffs:	UGB-IN-SO
Bonding standoffs:	UGB-B-SO

Recommended Connectors for Main Equipment Ground Conductor, Maximum 2/0 AWG

Copper Mechanical with Anti-Rotation

#14 – 2/0 AWG:	CLMAR2/0-14-Q

Two-Hole Copper Compression, 1/4" Stud Hole with 5/8" Spacing; #14 to 2/0 AWG

#14 – 10 AWG:	LCA10-14A-L
#8 AWG:	LCD8-14A-L
#6 AWG:	LCD6-14A-L
#4 AWG:	LCD4-14A-L
#2 AWG:	LCD2-14A-Q
#1 AWG:	LCD1-14A-E
1/0 AWG:	LCD1/0-14A-X
2/0 AWG:	LCD2/0-14A-X

One-Hole Copper Compression, 1/4" Stud Hole; #14 to 2/0 AWG

#14 – 10 AWG:	LCA10-14-L
#8 AWG:	LCAS8-14-L
#6 AWG:	LCAS6-14-L
#4 AWG:	LCAS4-14-L
#2 AWG:	LCAS2-14-Q
#1 AWG:	LCAS1-14-E
1/0 AWG:	LCAS1/0-14-X
2/0 AWG:	LCAS2/0-14-X

One and two-hole copper compression connectors available for both code and flex conductors, with narrow tongue and bent tongue configurations.

Recommended Connectors for Port Connections

Ring Terminals, ¼" Stud Hole, Maximum Width of 0.55"; #22 to #4 AWG

Ring terminals available with vinyl, nylon, KYNAR*, high-temp, or heavy duty insulation or non-insulated.

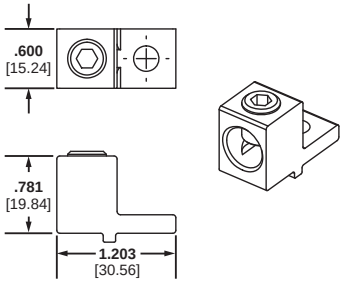
Compression Connectors, Maximum Width of 0.55"; up to #4 AWG Typical

Ferrules, Minimum Pin Depth of 12mm; #14 to #6 AWG

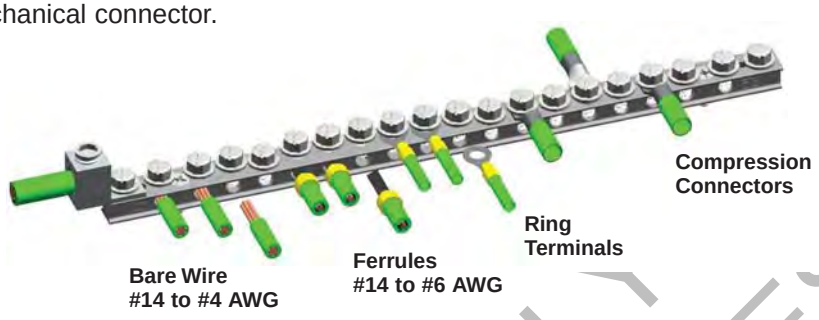
*KYNAR is a registered trademark of Atofina Chemicals, Inc.

StructuredGround™ Universal Ground Bar System

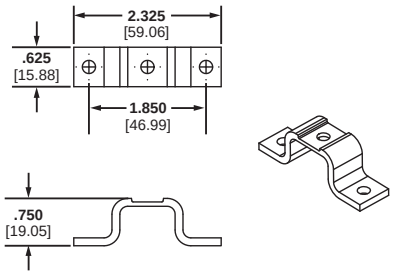
CLMAR2/0-14-Q: Tin-plated copper connector with anti-rotational feature.



UGB2/0-414-18: 18-port UGB mounted directly to surface with the equipment grounding conductor terminated in an anti-rotational, copper mechanical connector.

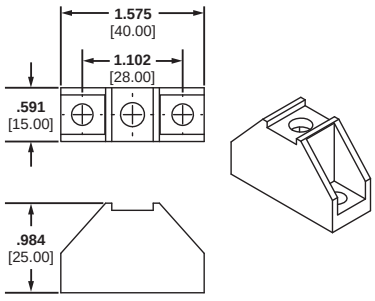


UGB-B-SO: Bonding stand-off.

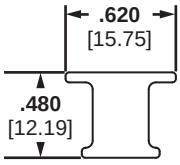


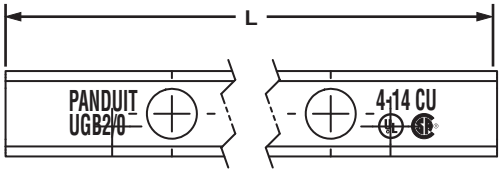
UGB2/0-414-12: 12-port UGB mounted on bonding stand-offs with the equipment grounding conductor terminated in a two-hole compression lug.

UGB-IN-SO: Isolation stand-off.



UGB2/0-414-6: 6-port UGB mounted on isolation stand-offs with the equipment grounding conductor terminated in an anti-rotational, copper mechanical connector.





Part Number	"L" Dim.
UGB2/0-414-6	4.92" (125mm)
UGB2/0-414-12	8.28" (210mm)
UGB2/0-414-18	11.64" (295mm)

WORLDWIDE SUBSIDIARIES AND SALES OFFICES

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cs-aus@panduit.com
Phone: 61.3.9794.9020

For a copy of Panduit product warranties, log on to www.panduit.com/warranty

For more information

Visit us at www.panduit.com

Contact Customer Service by email: cs@panduit.com or by phone: 800.777.3300 and reference GRSP08

SA-GRSP08
5/2011

VPU AC II 1 R 150/50

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 26
D-32758 Detmold
Germany

www.weidmueller.com

Weidmüller VPU I (Type I), VPU II (Type II) and VPU III (Type III) surge protection products effectively reduce the interference coupling that can occur due to transient surge voltages, even significantly below the limits prescribed by insulation co-ordination according to EN 60664-3 / DIN VDE 0110-3. This means that the whole installation is exposed to fewer malfunctions. The arresters are co-ordinated using technical means. This means that decoupling between Types I, II and III is unnecessary. The arresters are tested according to product standard IEC 61643-11 / DIN EN 61643-11 and can be installed in systems according to IEC 61643-12 / VDE 0675-6-12 and IEC 62305-4 / VDE 0185-4.
This lightning and surge protection device is suited for installation in power supply systems. Weidmüller offers different products depending on the particular mains network type and voltage level. A special Type I and Type II protective device is even available for photovoltaic applications.

General ordering data

Version	Surge voltage arrester, Low voltage, Surge protection, with remote contact, Single-phase, U_P(L/N-PE) ≤ 1.25 kV
Order No.	2591660000
Type	VPU AC II 1 R 150/50
GTIN (EAN)	4050118599282
Qty.	1 pc(s).

VPU AC II 1 R 150/50

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 26
D-32758 Detmold
Germany

www.weidmueller.com

Technical data

Dimensions and weights

Depth	68 mm	Depth (inches)	2.677 inch
Depth including DIN rail	76 mm	Height	111.6 mm
Height (inches)	4.394 inch	Net weight	152 g
Width	18 mm	Width (inches)	0.709 inch

Temperatures

Storage temperature	-40 °C...85 °C	Operating temperature	-40 °C...85 °C
Humidity	5 - 95% rel. humidity		

Rated data UL

Operating altitude	≤ 4000 m	Ambient temperature (operational), max.	85 °C
Rated Voltage U_N	120 V	VPR (N-PE)	600 V
SCCR	200 kA	I_n	20 kA
Category	SPD TYPE 1CA	Ambient temperature (operational), min.	-40 °C
Certificate No. (cURus)	E354261	MODE	all modes
VPR (L-PE)	600 V	Voltage type	AC

Connection data, remote alert

Connection type	PUSH IN	Cross-section for connected wire, solid core, max.	1.5 mm²
Cross-section for connected wire, solid core, min.	0.14 mm²	Stripping length	8 mm

General data

Colour	orange, black	Design	Installation housing; 1TE, Insta IP 20
Operating altitude	≤ 4000 m	Optical function display	green = OK; red = arrester is defective - replace
Protection degree	IP20 in installed state	Rail	TS 35
Segment	Power distribution	UL 94 flammability rating	V-0
Version	Surge protection, with remote contact		

Insulation coordination acc. to EN 50178

Operating altitude	≤ 4000 m	Pollution severity	2
Surge voltage category	III		

VPU AC II 1 R 150/50

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Germany

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Technical data

Rated data IEC / EN

Discharge current I_{max} (8/20µs) wire-PE	50 kA	Discharge current I_n (8/20µs) wire-PE	20 kA
Energy coordination (≤10 m)	Type II, Type III	Follow-on current extinguishing capability I_{fi}	Follow current need not be taken into account
Frequency range, max.	60 Hz	Frequency range, min.	50 Hz
Fuse	No Fuse neccessary ≤315 A gG, 250 A gG @50 kA Isccr, 315 A gG @25 kA Isccr	Leakage current at U_n	0.3 mA
Low voltage network	Single-phase	Max. continuous voltage, Uc (AC)	150 V
Number of poles	1	Protection level U_P (typ.)	≤ 1.25 kV
Rated voltage (AC)	120 V	Requirements category acc. to IEC 61643-11	Type II
Requirements class, acc. to EN 61643-11	T2	Response time	≤ 25 ns
SPD type	T2	Short-circuit current rating I_{SCCR}	50 kA
Signalling contact	250 V 1A 1CO	Standards	IEC61643-11, EN61643-11, UL 1449 Ed.4
Temporary surge voltage (over-voltage) - TOV	229 V	Voltage type	AC

Connection data

Wire connection method	Screw connection	Type of connection	Screw connection
Stripping length, rated connection	15 mm	Tightening torque, min.	2 Nm
Tightening torque, max.	4.5 Nm	Clamping range, rated connection	16 mm²
Clamping range, min.	4 mm²	Clamping range, max.	35 mm²
Wire cross-section, solid, min.	2.5 mm²	Wire cross-section, solid, max.	35 mm²
Wire connection cross-section, finely stranded, min.	4 mm²	Wire connection cross section, finely stranded, max.	35 mm²
Conductor cross-section, flexible, AEH (DIN 46228-1), min.	2.5 mm²	Conductor cross-section, flexible, AEH (DIN 46228-1), max.	35 mm²
Connection cross-section, stranded, min.	2.5 mm²	Connection cross-section, stranded, max.	35 mm²

Ratings IECEx/ATEX/cUL

Certificate no. (cULus)	E354261

Guarantee

Time interval	5 years

Classifications

ETIM 6.0	EC000941	ETIM 7.0	EC000941
eClass 9.0	27-13-08-05	eClass 9.1	27-13-08-05
eClass 10.0	27-13-08-05	eClass 11.0	27130805

Important note

Product information	For use in DC applications, please use the fuse of SIBA Type NH2XL aR/aSF DC 1500 V

VPU AC II 1 R 150/50

Weidmüller Interface GmbH & Co. KG
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D-32758 Detmold
Germany

www.weidmueller.com

Technical data

Approvals

Approvals	
ROHS	Conform
UL File Number Search	E354261

Downloads

Approval/Certificate/Document of Conformity	EAC VPU SERIES Declaration of Conformity
Engineering Data	STEP
User Documentation	Instruction sheet

VPU AC II 1 R 150/50

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Germany

www.weidmueller.com

Drawings

Electric symbol

Schematic circuit diagram

Product data sheet

Specifications

Motor circuit breaker, TeSys Deca, 3P, 2.5-4 A, thermal magnetic, screw clamp terminals

GV2ME08

Main

Range of product	TeSys GV2
Range	TeSys TeSys Deca
Device short name	GV2ME
Product name	TeSys GV2 TeSys Deca
Product or component type	Circuit breaker
Device application	Motor
Trip unit technology	Thermal-magnetic

Complementary

Poles description	3P
Network type	AC
Utilisation category	AC-3 IEC 60947-4-1 Category A IEC 60947-2
Network frequency	50/60 Hz IEC 60947-4-1
Fixing mode	35 mm symmetrical DIN rail clipped Panel screwed with adaptor plate)
Operating position	Any position
Motor power kW	1.1 kW 400/415 V AC 50/60 Hz 1.5 kW 400/415 V AC 50/60 Hz 1.5 kW 500 V AC 50/60 Hz 3 kW 690 V AC 50/60 Hz 2.2 kW 500 V AC 50/60 Hz 2.2 kW 690 V AC 50/60 Hz
Breaking capacity	100 kA Icu 230/240 V AC 50/60 Hz IEC 60947-2 100 kA Icu 400/415 V AC 50/60 Hz IEC 60947-2 100 kA Icu 440 V AC 50/60 Hz IEC 60947-2 100 kA Icu 500 V AC 50/60 Hz IEC 60947-2 3 kA Icu 690 V AC 50/60 Hz IEC 60947-2
[Ics] rated service short-circuit breaking capacity	100 % 500 V AC 50/60 Hz IEC 60947-2 100 % 230/240 V AC 50/60 Hz IEC 60947-2 100 % 440 V AC 50/60 Hz IEC 60947-2 100 % 400/415 V AC 50/60 Hz IEC 60947-2 75 % 690 V AC 50/60 Hz IEC 60947-2
Control type	Push-button
[In] rated current	4 A
Thermal protection adjustment range	2.5…4 A

Magnetic tripping current	51 A
[Ue] rated operational voltage	690 V AC 50/60 Hz IEC 60947-2
[Ui] rated insulation voltage	690 V AC 50/60 Hz IEC 60947-2
[Ith] conventional free air thermal current	4 A IEC 60947-4-1
[Uimp] rated impulse withstand voltage	6 kV IEC 60947-2
Power dissipation per pole	2.5 W
Mechanical durability	100000 cycles
Electrical durability	100000 cycles AC-3 440 V
Maximum operating rate	25 cyc/h
Rated duty	Continuous IEC 60947-4-1
Tightening torque	15.05 lbf.in (1.7 N.m) screw clamp terminals
Suitability for isolation	Yes IEC 60947-1
Phase failure sensitivity	Yes IEC 60947-4-1
Height	3.50 in (89 mm)
Width	1.77 in (45 mm)
Depth	3.09 in (78.5 mm)
Net weight	0.57 lb(US) (0.26 kg)
Colour	Dark grey

Environment

Standards	EN/IEC 60947-2 EN/IEC 60947-4-1 CSA C22.2 No 60947-4-1 UL 60947-4-1
Product certifications	IECEE CB Scheme UL CSA CCC EAC ATEX BV LROS (Lloyds register of shipping) DNV-GL RINA UKCA
Protective treatment	TH
IP degree of protection	IP20 IEC 60529
IK degree of protection	IK04
Ambient air temperature for operation	-4…140 °F (-20…60 °C)
Ambient air temperature for storage	-40…176 °F (-40…80 °C)
Fire resistance	1760 °F (960 °C) IEC 60695-2-1
Operating altitude	2000 m

Packing Units

Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Weight	9.14 oz (259 g)
Package 1 Height	1.77 in (4.5 cm)

Package 1 width	3.35 in (8.5 cm)
Package 1 Length	3.54 in (9 cm)
Unit Type of Package 2	S02
Number of Units in Package 2	24
Package 2 Weight	14.25 lb(US) (6.465 kg)
Package 2 Height	5.91 in (15 cm)
Package 2 width	11.81 in (30 cm)
Package 2 Length	15.75 in (40 cm)
Unit Type of Package 3	P06
Number of Units in Package 3	384
Package 3 Weight	245.68 lb(US) (111.44 kg)
Package 3 Height	29.53 in (75 cm)
Package 3 width	31.50 in (80 cm)
Package 3 Length	23.62 in (60 cm)

Offer Sustainability

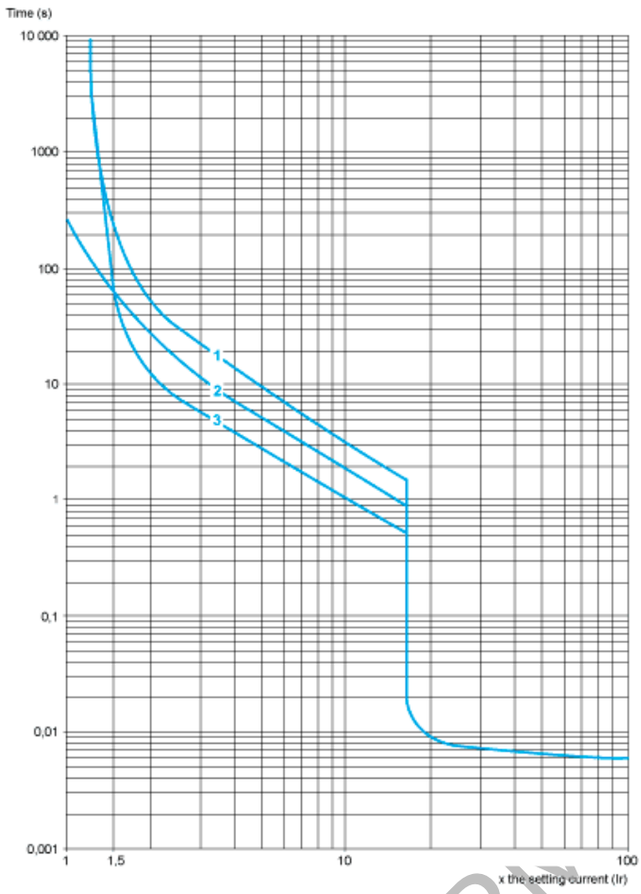
Sustainable offer status	Green Premium product
REACh Regulation	REACh Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information
Environmental Disclosure	Product Environmental Profile
WEEE	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins

Contractual warranty

Warranty	18 months

Thermal-Magnetic Tripping Curves for GV2ME and GV2P

Average Operating Times at 20 °C Related to Multiples of the Setting Current

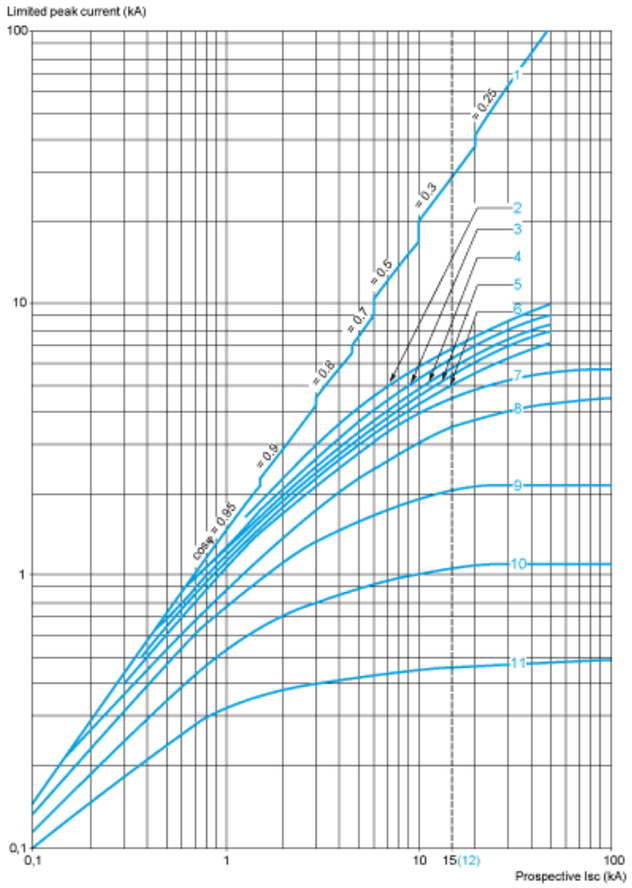


1 3 poles from cold state
2 2 poles from cold state
3 3 poles from hot state

Current Limitation on Short-Circuit for GV2ME and GV2P (3-Phase 400/415 V))

Dynamic Stress

I peak = f (prospective Isc) at 1.05 Ue = 435 V

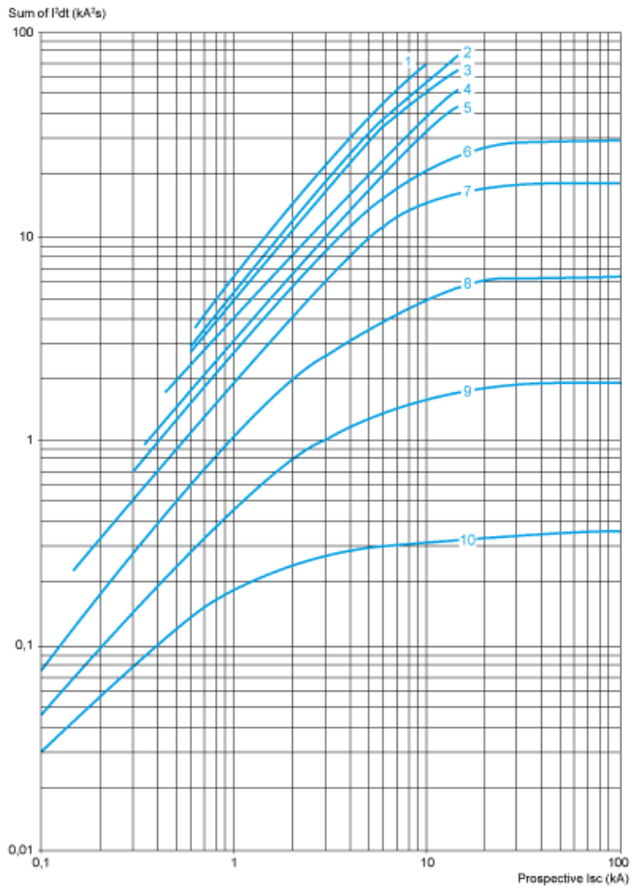


1	Maximum peak current
2	24-32 A
3	20-25 A
4	17-23 A
5	13-18 A
6	9-14 A
7	6-10 A
8	4-6.3 A
9	2.5-4 A
10	1.6-2.5 A
11	1-1.6 A
12	Limit of rated ultimate breaking capacity on short-circuit of GV2ME (14, 18, 23, and 25 A ratings).

Thermal Limit on Short-Circuit for GV2ME

Thermal Limit in kA^2s in the Magnetic Operating Zone

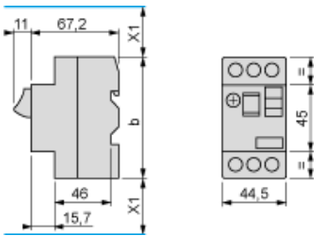
Sum of I^2dt = f (prospective Isc) at 1.05 Ue = 435 V



1 24-32 A
2 20-25 A
3 17-23 A
4 13-18 A
5 9-14 A
6 6-10 A
7 4-6.3 A
8 2.5-4 A
9 1.6-2.5 A
10 1-1.6 A

Dimension

GV2ME



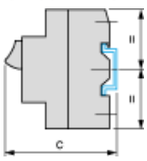
(1) Maximum
X1 Electrical clearance = 40 mm for Ue ≤ 690 V

	b
GV2ME••	89
GV2ME••3	101

Mounting

GV2ME

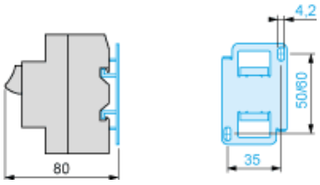
On 35 mm rail



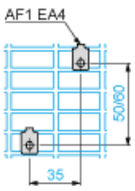
c = 78.5 on AM1 DP200 (35 x 7.5)

c = 86 on AM1 DE200, ED200 (35 x 15)

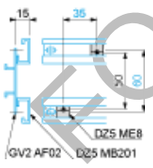
On panel with adapter plate GV2AF02



On pre-slotted plate AM1 PA

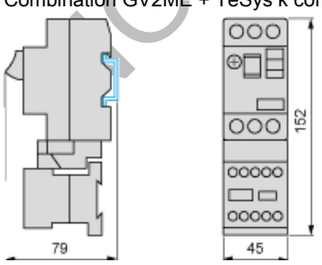


On rails DZ5 MB201



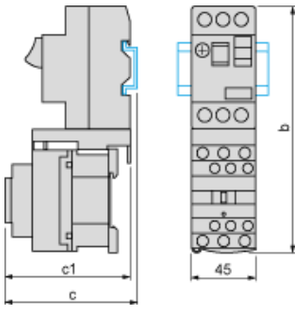
GV2AF01

Combination GV2ME + TeSys k contactor



GV2AF3

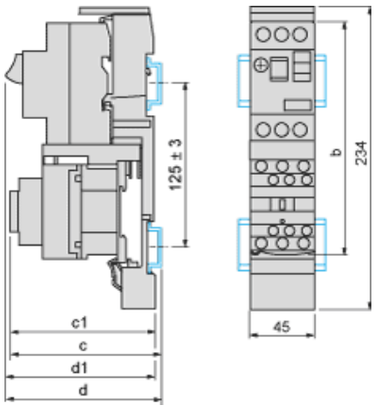
Combination GV2ME + TeSys d contactor



GV2ME +	LC1D09…D18	LC1D25 and D32
b	176.4	186.8
c1	94.1	100.4
c	99.6	105.9

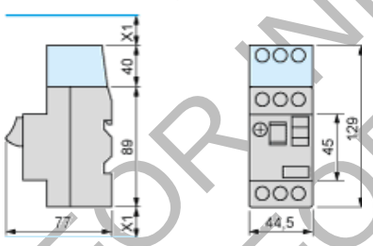
GV2AF4 + LAD311

Combination GV2ME + TeSys d contactor



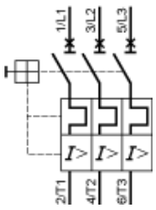
GV2ME +	LC1D09…D18	LC1D25 and D32
b	176.4	186.8
c1	103.1	136.4
c	135.6	141.9
d1	107	107
d	112.5	112.5

GV2ME + GV1L3 (Current Limiter)

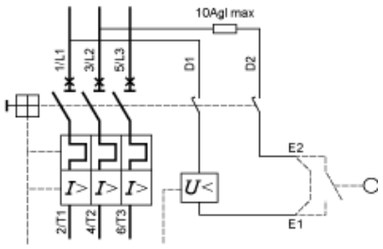


X1 = 10 mm for Ue = 230 V or 30 mm for 230 V < Ue ≤ 690 V

GV2ME•• and GV2RT



Connection of Undervoltage Trip for Dangerous Machines (Conforming to INRS) on GV2ME Only



G1G170-AB05-20

EC centrifugal fan

backward curved, single inlet

with housing (flange), Gas blower for gas-condensing heating

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D-74673 Mulfingen
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info1@de.ebmpapst.com
www.ebmpapst.com

Nominal data

Type	G1G170-AB05-20
Motor	M1G074-CF

Phase		1~
Nominal voltage	VAC	115
Frequency	Hz	50/60
Type of data definition		rfa
Speed	min^{-1}	5730
Power input	W	345
Current draw	A	4.0
Min. ambient temperature	°C	- 25
Max. ambient temperature	°C	+ 55
Min. temp. of flow medium	°C	-25
Max. temp. of flow medium	°C	+80

ml = max. load · me = max. efficiency · rfa = running at free air · cs = customer specs · cu = customer unit
Subject to alterations

EC centrifugal fan

backward curved, single inlet

with housing (flange), Gas blower for gas-condensing heating

Technical features

Leackage current	<= 3.5 mA
Size	170 mm
Direction of rotation	Clockwise, seen on rotor
Mounting position	Any
Electrical leads	With plug
EMC interference emission	Acc. to EN 61000-6-3 (household environment)
EMC interference immunity	Acc. to EN 61000-6-2
Insulation class	"B"
Cooling bore / aperture	Rotor-side
Motor bearing	Ball bearing
Mass	4.35 kg
Material of protective cover	Polyflam RPP 374-ND CS1 (UL 97-V0)
Housing material	Die-cast aluminium
Material of impeller	Aluminium sheet
Motor protection	Thermal overload protector (TOP) wired internally
Surface of rotor	Coated in black
Type of protection	IP 20
Technical features	- Control input PWM - Motor current limit - Tach output - Overtemperature-protected motor
Max. permissible ambient motor temp. (transp./ storage)	+80 °C
Min. permissible ambient motor temp. (transp./storage)	-40 °C
Approval	CSA C22.2 Nr.113; UL 507

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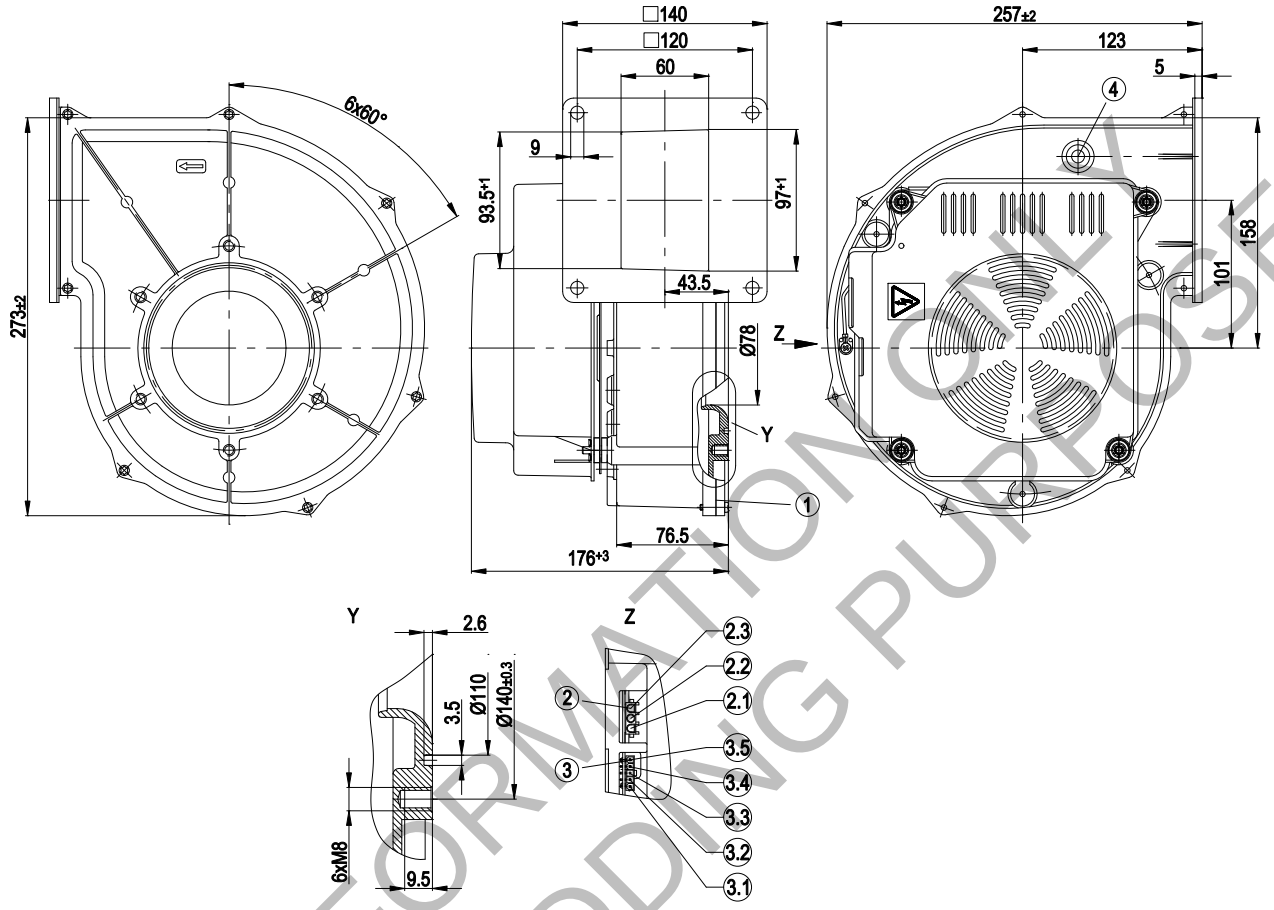
EC centrifugal fan

backward curved, single inlet

with housing (flange), Gas blower for gas-condensing heating

Product drawing



1	Housing side parts sealed with NBR round cord (pentane-resistant)
Z	View Z
2	3-pole strip; mating connector (not included in delivery): tyco No. 350 766-1; female connector: No. 926 884-1
2.1	L
2.2	N
2.3	PE
3	5-pole strip; mating connector (not included in delivery) Molex No. 39-01-4050, female connector Molex No. 39-00-0059
3.1	(+)
3.2	Speed monitoring
3.3	Not assigned
3.4	PWM input
3.5	(-)
4	Bleeder connection for pressure relief possible

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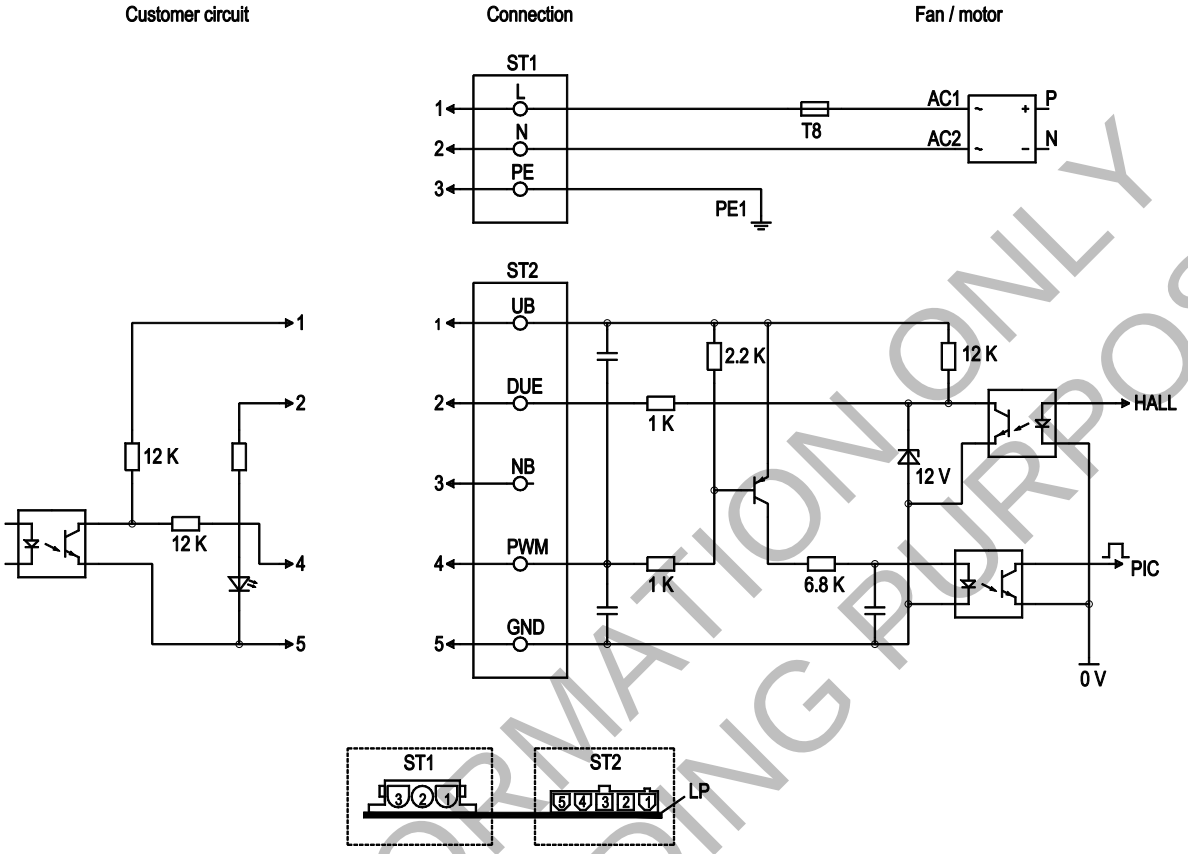
EC centrifugal fan

backward curved, single inlet

with housing (flange), Gas blower for gas-condensing heating

Connection screen



No.	Pin	Signal	Function / assignment
ST1	1, 2, 3	L, N, PE	Power supply 115 VAC, 50-60 Hz, neutral conductor, protective earth
ST2	1	UB	External voltage 24-45 VDC
ST2	2	DUE	Speed monitoring output connection, monitoring circuit output, 3 pulses per revolution, current source 1 mA
ST2	3	N.C.	Not assigned
ST2	4	PWM	PWM - 2-6 kHz control input, PWM on n = 100%, PWM low n = 0%
ST2	5	GND	GND - Connection for control interface

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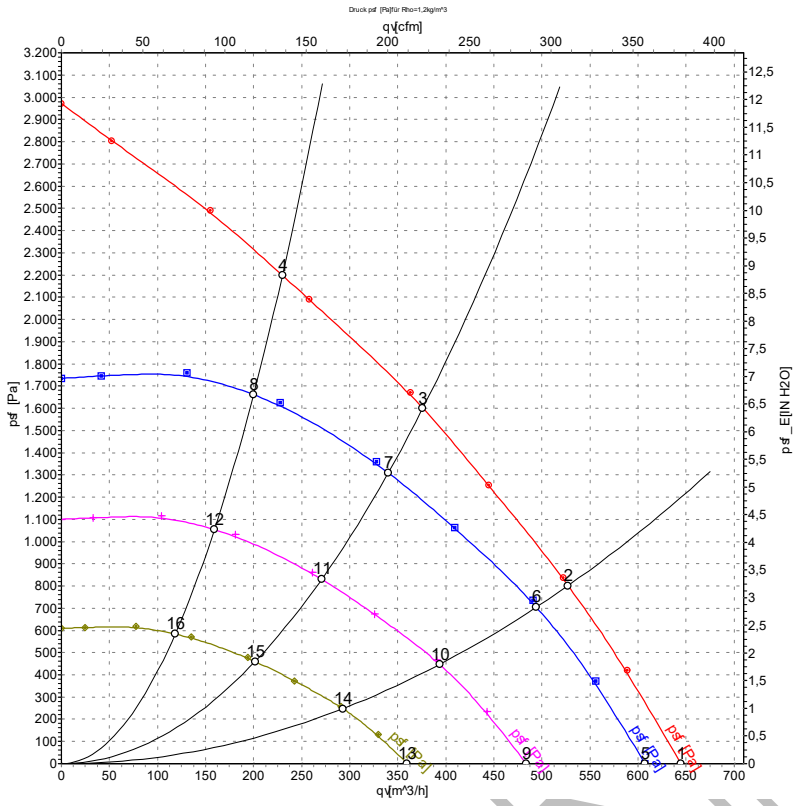
G1G170-AB05-20

EC centrifugal fan

backward curved, single inlet

with housing (flange), Gas blower for gas-condensing heating

Charts: Air flow 50 Hz



Measurement: LU-48962

Air performance measured as per ISO 5801 Installation Category A. For detailed information on the measuring set-up, please contact ebm-papst. Suction-side noise levels: LwA measured as per ISO 13347 / LpA measured with 1m distance to fan axis. The values given are valid under the measuring conditions mentioned above and may vary according to the actual installation situation. With any deviation from the standard set-up, the specific values have to be checked and reviewed with the unit installed.

Measured values

	U	f	n	P_1	I	qv	p_{sf}
	V	Hz	min^{-1}	W	A	m^3/h	Pa
1	115	50	5730	345	4.00	645	0
2	115	50	5750	342	3.97	525	800
3	115	50	5970	317	3.70	375	1600
4	115	50	6205	292	3.42	230	2200
5	115	50	5400	288	3.33	605	0
6	115	50	5400	283	3.28	495	715
7	115	50	5400	235	2.75	340	1314
8	115	50	5400	193	2.26	200	1664
9	115	50	4300	145	1.68	485	0
10	115	50	4300	143	1.66	395	454
11	115	50	4300	119	1.39	270	834
12	115	50	4300	98	1.14	160	1055
13	115	50	3200	60	0.69	360	0
14	115	50	3200	59	0.68	295	251
15	115	50	3200	49	0.57	200	462
16	115	50	3200	40	0.47	120	584

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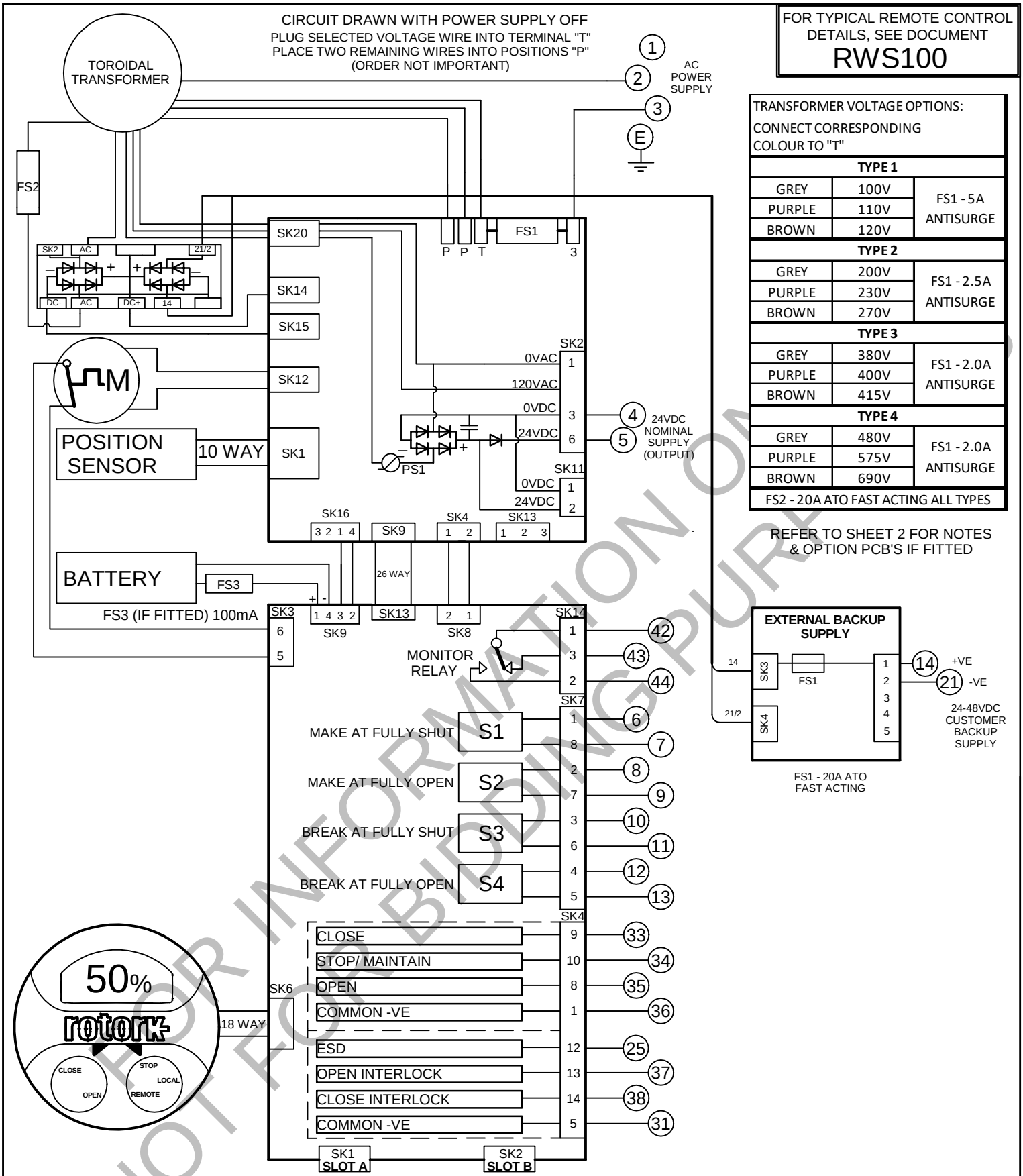
CIRCUIT DRAWN WITH POWER SUPPLY OFF

PLUG SELECTED VOLTAGE WIRE INTO TERMINAL "T"
PLACE TWO REMAINING WIRES INTO POSITIONS "P"
(ORDER NOT IMPORTANT)

FOR TYPICAL REMOTE CONTROL DETAILS, SEE DOCUMENT
RWS100



TRANSFORMER VOLTAGE OPTIONS: CONNECT CORRESPONDING COLOUR TO "T"		
TYPE 1		
GREY	100V	FS1 - 5A ANTISURGE
PURPLE	110V	
BROWN	120V	
TYPE 2		
GREY	200V	FS1 - 2.5A ANTISURGE
PURPLE	230V	
BROWN	270V	
TYPE 3		
GREY	380V	FS1 - 2.0A ANTISURGE
PURPLE	400V	
BROWN	415V	
TYPE 4		
GREY	480V	FS1 - 2.0A ANTISURGE
PURPLE	575V	
BROWN	690V	
FS2 - 20A ATO FAST ACTING ALL TYPES		

REFER TO SHEET 2 FOR NOTES & OPTION PCB'S IF FITTED

Iss	Date	Chkd	Revision Details
1	070416	PMJ	First Issue.
2	270619	PMJ	PUB002-065 WAS -039

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BATH, BA1 3JQ
ENGLAND
Tel:01225-733200

ROTORK CONTROLS INC
ROCHESTER
NY 14624, USA
Tel:585-247-2304

IQT EXTERNAL BATTERY BATTERY BACKUP

Drawn by: PMJ
Date : 070416
Base WD: ????????
Job No : - -
MI No : - -

Circuit Diagram Number
380B0000
B1 C1 B2 C2

Issue No 2

Sheet 1 of 2

NO OPTIONS FITTED

NOTES

1.FUSES:
-PS1 is a self-resetting fuse.
-Refer to publication PUB002-065 for approved fuses FS1 and FS2.
-Actuator rated voltage specified on nameplate. Voltage tolerance +/-10% applies for rated torque performance; duty cycle is not guaranteed.

2.REMOTE CONTROL:
-For typical remote control circuits refer to:
  -RWS indicated or PUB002-041.
-For DC and AC control, connect –ve/0V to terminal 36.
-(For negative switch / positive common, refer to RWS indicated).
-Control signal threshold voltages:
  -DC: “on” ≥16Vdc / “off” ≤8Vdc, max 60Vdc.
  -AC: “on” ≥60Vac / “off” ≤40Vac, max 120Vac.
-Control signal duration to be 300ms minimum.
-Maximum current drawn from remote control signals is:
  -8mA at 24Vdc or 12mA at 120Vac.
-Supply provided on terminals 4 & 5:
  -Intended for remote control.
  -Max external load 5W at 24Vdc / 5VA at 120Vac

3.INDICATION:
-For typical position, status and alarm indication see PUB002-041.
-“S” contacts are user configurable and are shown in their default setting.
-Refer to PUB002-040 for functions and configuration instructions.
-Monitor Relay indicates actuator availability for remote control (shown “unavailable”). It can be configured to exclude local/remote selection.
-Refer to PUB002-040 for monitored functions and configuration instructions.
-Voltage applied to indication contacts must not exceed 150Vac
-Individual Switch current must not exceed 3.5A inductive, 5A resistive and no more than 8A in total for all 4 contacts.

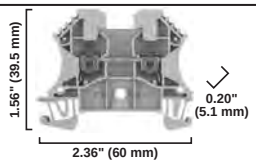
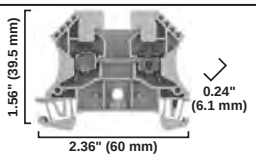
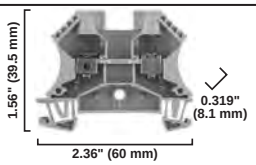
4.BATTERY:
-Battery maintains local and remote “S” contact indication only.
-Refer to installation manual for approved replacement battery types.

See Sheet 1 for all Revision details/information

Circuit Diagram Number	Issue No	Sheet
380B0000	2	2 of 2

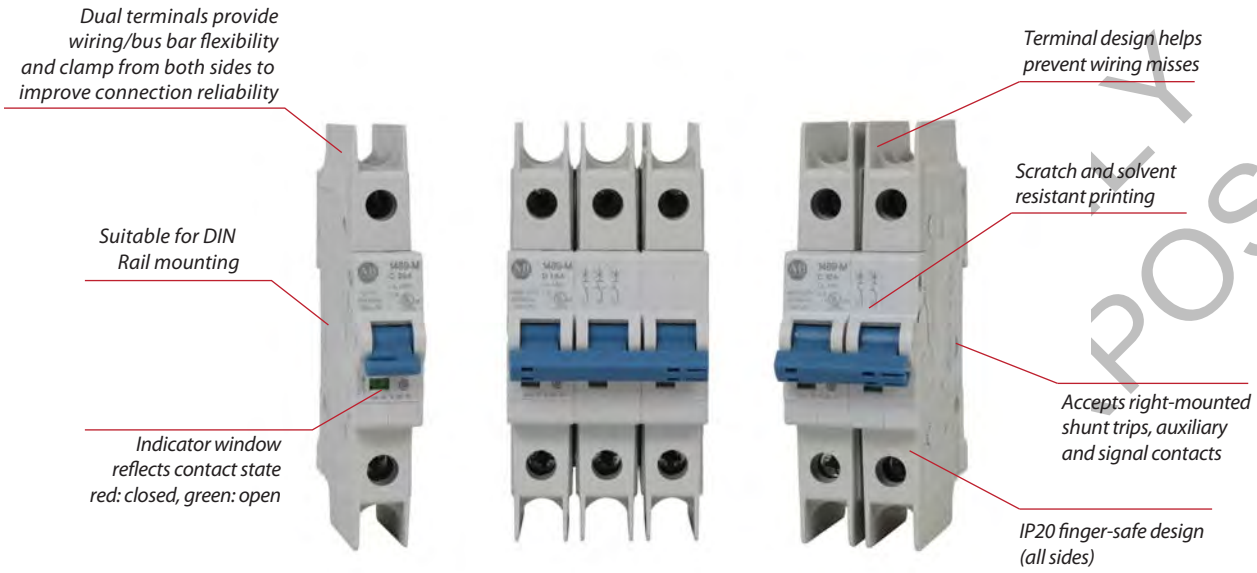
Screw Connection Terminal Blocks

Standard Feed-Though Blocks

	1492-J3				1492-J4				1492-J6			
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.												
Specifications	*Feed-Through Terminal Block*				*Feed-Through Terminal Block*				*Feed-Through Terminal Block*			
Certifications	cULus	CSA	IEC	ATEX	cULus	CSA	IEC	ATEX	cULus	CSA	IEC	ATEX
Voltage Rating	600V AC/DC		800V AC/DC	550V AC/DC	600V AC/DC		800V AC/DC	690V AC/DC	600V AC/DC		800V AC/DC	550V AC/DC
Maximum Current	65 A	50 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A		41 A	36 A
Wire Range (Rated Cross Section)	#22… 12 AWG	#26… 12 AWG	2.5 mm²	2.5 mm² (#20… 14 AWG	#22… 10 AWG	#26… 10 AWG	4 mm²	4 mm² (#20… 12 AWG)	#22…8 AWG		6 mm²	6 mm² (#20… 10 AWG)
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in (12 mm)			
Recommended Tightening Torque	4.5…7.1 lb•in. (0.5…0.8 N•m)				9.0 lb•in. (1.0 N•m)				14.2 lb•in (1.6 N•m)			
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)			
Housing Temperature Range	–58…+248 °F (–50…+120 °C)				–58…+248 °F (–50…+120 °C)				–58…+248 °F (–50…+120 °C)			
Short-Circuit Current Rating					See page 12-43							
Terminal Blocks	**Cat. No.**			**Pkg Qty**	**Cat. No.**			**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**
Color: Grey	**1492-J3**			100	**1492-J4**			100	**1492-J6**			100
Red	**1492-J3-RE**			100	**1492-J4-RE**			100	**1492-J6-RE**			100
Blue	**1492-J3-B**			100	**1492-J4-B**			100	**1492-J6-B**			100
Black	**1492-J3-BL**			100	**1492-J4-BL**			100	**1492-J6-BL**			100
Green	**1492-J3-G**			100	**1492-J4-G**			100	**1492-J6-G**			100
Yellow	**1492-J3-Y**			100	**1492-J4-Y**			100	**1492-J6-Y**			100
Orange	**1492-J3-OR**			100	**1492-J4-OR**			100	**1492-J6-OR**			100
Brown	**1492-J3-BR**			100	**1492-J4-BR**			100	**1492-J6-BR**			100
White	**1492-J3-W**			100	**1492-J4-W**			100	**1492-J6-W**			100
Accessories	**Cat. No.**			**Pkg Qty**	**Cat. No.**			**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**
Mounting Rails: 1 m Symmetrical DIN (Steel)	**199-DR1**			10	**199-DR1**			10	**199-DR1**			10
1 m Symmetrical DIN (Aluminum)	**1492-DR5**			10	**1492-DR5**			10	**1492-DR5**			10
1 m Hi-Rise Sym. DIN (Aluminum)	**1492-DR6**			2	**1492-DR6**			2	**1492-DR6**			2
1 m Angled Hi-Rise Sym. DIN (Steel)	**1492-DR7**			2	**1492-DR7**			2	**1492-DR7**			2
End Barriers Grey	**1492-EBJ3**			50	**1492-EBJ3**			50	**1492-EBJ3**			50
Blue	**1492-EBJ3-B**			50	**1492-EBJ3-B**			50	**1492-EBJ3-B**			50
Yellow	**1492-EBJ3-Y**			50	**1492-EBJ3-Y**			50	**1492-EBJ3-Y**			50
End Anchors and Retainers: Screwless End Retainer	**1492-ERL35**			20	**1492-ERL35**			20	**1492-ERL35**			20
DIN Rail — Normal Duty	**1492-EAJ35**			100	**1492-EAJ35**			100	**1492-EAJ35**			100
DIN Rail — Heavy Duty	**1492-EAHJ35**			50	**1492-EAHJ35**			50	**1492-EAHJ35**			50
Jumpers:* Screw Center Jumper — 10-pole	**1492-CJJ5-10**			20	**1492-CJJ6-10**			20	**1492-CJJ8-10**			20
Screw Center Jumper — 4-pole	**1492-CJJ5-4**			50	**1492-CJJ6-4**			50	**1492-CJJ8-4**			50
Screw Center Jumper — 3-pole	**1492-CJJ5-3**			50	**1492-CJJ6-3**			50	**1492-CJJ8-3**			50
Screw Center Jumper — 2-pole	**1492-CJJ5-2**			50	**1492-CJJ6-2**			50	**1492-CJJ8-2**			50
Plug-in Center Jumper — 50-Pole	**1492-CJLJ5-50**			10	**1492-CJLJ6-41** (41-pole)			10	—			—
Plug-in Center Jumper — 10-Pole	**1492-CJLJ5-10**			20	**1492-CJLJ6-10**			20	—			—
Plug-in Center Jumper — 9-Pole	**1492-CJLJ5-9**			20	—			—	—			—
Plug-in Center Jumper — 8-Pole	**1492-CJLJ5-8**			20	—			—	—			—
Plug-in Center Jumper — 7-Pole	**1492-CJLJ5-7**			20	—			—	—			—
Plug-in Center Jumper — 6-Pole	**1492-CJLJ5-6**			20	—			—	—			—
Plug-in Center Jumper — 5-Pole	**1492-CJLJ5-5**			20	—			—	—			—
Plug-in Center Jumper — 4-Pole	**1492-CJLJ5-4**			60	**1492-CJLJ6-4**			60	—			—
Plug-in Center Jumper — 3-Pole	**1492-CJLJ5-3**			60	**1492-CJLJ6-3**			60	—			—
Plug-in Center Jumper — 2-Pole	**1492-CJLJ5-2**			60	**1492-CJLJ6-2**			60	—			—
Insulated Side Jumper — 24-Pole	**1492-SJ5B-24**			50	—			—	—			—
Insulated Side Jumper — 10-Pole	**1492-SJ5B-10**			50	—			—	—			—
Screw Type Jumper Notching Tool	**1492-T1**			1	**1492-T1**			1	**1492-T1**			1
Other Accessories: Partition Plate	**1492-EBJ16**			20	**1492-EBJ16**			20	**1492-EBJ16**			20
Test Plug Socket	**1492-TPS23**			20	**1492-TPS23L**			50	**1492-TPS23L**			50
Test Plug	**1492-TP23**			20	**1492-TP23**			20	**1492-TP23**			20
Test Plug (Stackable)	**1492-TPJ5**			25	**1492-TPJ6**			25	—			—
Electrical Warning Plate	**1492-EWPJ5**			25	**1492-EWPJ5**			25	**1492-EWPJ8**			50
Group Marking Carrier	**1492-GM35**			25	**1492-GM35**			25	**1492-GM35**			25
Marking Systems: Snap-in Marker Cards	**1492-M5X12** (144/card)			5	**1492-M6X12** (120/card)			5	**1492-MR8X12** (84/card)			5
	1492-M5X5 (200/card)			5	**1492-M6X5** (200/card)			5	**1492-M8X5** (160/card)			5

* Use of center jumpers may affect spacings, requiring derating of terminal blocks. See page 12-78 for details.

1489-M Circuit Breakers



Bulletin 1489-M thermal-magnetic Circuit Breakers are approved for branch circuit protection in the United States and Canada, and are certified as Miniature Circuit Breakers for IEC applications.

These branch protectors are compatible with many accessories to meet diverse application needs, including UL 508 Listed bus bars for convenience in panel assembly, auxiliary contacts, signal contacts and shunt trips for versatility, and lockout attachments for safety during maintenance.

Features

- Current limiting
- Fast breaking time
- High rated voltage
- Superior shock and vibration resistance to help prevent nuisance tripping
- Dual terminals allow a more secure connection of two wires, or both a wire and bus bar
- Terminal design helps prevent wiring misses by directing wires into the terminal openings, even while tightening
- Reversible line and load connections
- Single and multi-pole toggle mount lock out attachments available for Lockout/Tagout (LOTO)
- RoHS compliant and fully recyclable device
- Suitable for extreme ambient conditions

1489-M Circuit Breakers	
Rated Voltage	UL/CSA: Max. 480Y/277V AC IEC: U_e 230/400V AC
Interrupting Capacity	UL/CSA: 10 kA IEC: 15 kA
Current Ratings	0.5...63 A
Poles	1, 2, 3
Trip Curves	C, D
Standards Compliance	UL 489 CSA C22.2 No. 5.1 EN 60947-2 GB 14048.2
Certifications	UL Listed, File No. E197878 CSA Certified, File No. 259391 CE Marked VDE Certified CCC Certified RoHS Compliant

Catalog Number Explanation

Note: Examples given in this section are for reference purposes. This basic explanation should not be used for product selection; some combinations may not produce a valid catalog number.

1489	-	M	1	C	005
		a	*b*	*c*	*d*

a

Voltage Type	
Code	**Description**
M	AC Circuit Breaker

b

Poles	
Code	**Description**
1	1-Pole
2	2-Pole
3	3-Pole

c

Trip Curve	
Code	**Trip Curve**
C	Trip Curve C
D	Trip Curve D

d

Rated Current (I_n)	
Code	**Current [A]**
005	0.5
010	1
016	1.6
020	2
030	3
040	4
050	5
060	6
070	7
080	8
100	10
130	13
150	15
160	16
200	20
250	25
300	30
320	32
350	35
400	40
500	50
600	60
630	63

Product Selection

1-Pole Circuit Breakers

Photo/Wiring Diagram	UL/CSA Max. Voltage	IEC/EN Max. Voltage	Continuous Current Rating (I_n) [A]	Trip Curve C Inductive 5...10 I_n Cat. No.	Trip Curve D Highly Inductive 10...20 I_n Cat. No.
  1-pole	277V AC, 48V DC	230V AC	0.5	1489-M1C005	1489-M1D005
			1	1489-M1C010	1489-M1D010
			1.6	1489-M1C016	1489-M1D016
			2	1489-M1C020	1489-M1D020
			3	1489-M1C030	1489-M1D030
			4	1489-M1C040	1489-M1D040
			5	1489-M1C050	1489-M1D050
			6	1489-M1C060	1489-M1D060
			7	1489-M1C070	1489-M1D070
			8	1489-M1C080	1489-M1D080
			10	1489-M1C100	1489-M1D100
			13	1489-M1C130	1489-M1D130
			15	1489-M1C150	1489-M1D150
			16	1489-M1C160	1489-M1D160
			20	1489-M1C200	1489-M1D200
			25	1489-M1C250	1489-M1D250
			30	1489-M1C300	1489-M1D300
			32	1489-M1C320	1489-M1D320
			35	1489-M1C350	1489-M1D350
	C Curve: 277V AC, 48V DC D Curve: 240V AC, 48V DC		40	1489-M1C400	1489-M1D400
	240V AC, 48V DC		50	1489-M1C500	1489-M1D500
			60	1489-M1C600	1489-M1D600
			63	1489-M1C630	1489-M1D630

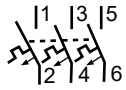
Product Selection

2-Pole Circuit Breakers

Photo/Wiring Diagram	UL/CSA Max. Voltage	IEC/EN Max. Voltage	Continuous Current Rating (I_n) [A]	Trip Curve C Inductive 5...10 I_n Cat. No.	Trip Curve D Highly Inductive 10...20 I_n Cat. No.
  2-pole	480Y/277V AC, 96V DC	400V AC	0.5	1489-M2C005	1489-M2D005
			1	1489-M2C010	1489-M2D010
			1.6	1489-M2C016	1489-M2D016
			2	1489-M2C020	1489-M2D020
			3	1489-M2C030	1489-M2D030
			4	1489-M2C040	1489-M2D040
			5	1489-M2C050	1489-M2D050
			6	1489-M2C060	1489-M2D060
			7	1489-M2C070	1489-M2D070
			8	1489-M2C080	1489-M2D080
			10	1489-M2C100	1489-M2D100
			13	1489-M2C130	1489-M2D130
			15	1489-M2C150	1489-M2D150
			16	1489-M2C160	1489-M2D160
			20	1489-M2C200	1489-M2D200
			25	1489-M2C250	1489-M2D250
			30	1489-M2C300	1489-M2D300
			32	1489-M2C320	1489-M2D320
			35	1489-M2C350	1489-M2D350
	C Curve: 480Y/277V AC, 96V DC D Curve: 240V AC, 96V DC		40	1489-M2C400	1489-M2D400
	240V AC, 96V DC		50	1489-M2C500	1489-M2D500
			60	1489-M2C600	1489-M2D600
			63	1489-M2C630	1489-M2D630

Product Selection

3-Pole Circuit Breakers

Photo/Wiring Diagram	UL/CSA Max. Voltage	IEC/EN Max. Voltage	Continuous Current Rating (I_n) [A]	Trip Curve C Inductive 5...10 I_n Cat. No.	Trip Curve D Highly Inductive 10...20 I_n Cat. No.
  3-pole	480Y/277V AC	400V AC	0.5	1489-M3C005	1489-M3D005
			1	1489-M3C010	1489-M3D010
			1.6	1489-M3C016	1489-M3D016
			2	1489-M3C020	1489-M3D020
			3	1489-M3C030	1489-M3D030
			4	1489-M3C040	1489-M3D040
			5	1489-M3C050	1489-M3D050
			6	1489-M3C060	1489-M3D060
			7	1489-M3C070	1489-M3D070
			8	1489-M3C080	1489-M3D080
			10	1489-M3C100	1489-M3D100
			13	1489-M3C130	1489-M3D130
			15	1489-M3C150	1489-M3D150
			16	1489-M3C160	1489-M3D160
			20	1489-M3C200	1489-M3D200
			25	1489-M3C250	1489-M3D250
			30	1489-M3C300	1489-M3D300
			32	1489-M3C320	1489-M3D320
			35	1489-M3C350	1489-M3D350
	C Curve: 480Y/277V AC D Curve: 240V AC		40	1489-M3C400	1489-M3D400
	240V AC		50	1489-M3C500	1489-M3D500
			60	1489-M3C600	1489-M3D600
			63	1489-M3C630	1489-M3D630

Specifications

Electrical Ratings					
Poles					1, 2, 3
Tripping characteristics					C, D
Rated current (I_n)					0.5...63 A
Rated frequency [f]					50/60 Hz
Rated insulation voltage U_i per IEC/EN 60664-1					250V AC (phase to ground) 440V AC (phase to phase)
Overvoltage category					III
Pollution degree					3
Data per UL/CSA					
Rated voltage	AC	1-pole	C Curve	0.5...40 A	277V AC
				50...63 A	240V AC
			D Curve	0.5...35 A	277V AC
				40...63 A	240V AC
		2-, 3-pole	C Curve	0.5...40 A	480Y/277V AC
				50...63 A	240V AC
			D Curve	0.5...35 A	480Y/277V AC
				40...63 A	240V AC
	DC	1-pole			48V DC
		2-pole			96V DC (2-pole in series)
Rated interrupting capacity per UL 489					10 kA
Reference temperature for tripping characteristics					40 °C
Electrical endurance					6,000 operations (AC and DC); 1 cycle (1s - ON, 9s - OFF)
Data per IEC/EN 60947-2					
Rated operational voltage (U_e)	1-pole				230V AC
	2-, 3-pole				400 V AC
Highest supply or utilization voltage (U_{max})	AC	1-pole			253/440V AC
		2-, 3-pole			440V AC
	DC ★	1-pole			48V DC
		2-pole			96V DC
Min. operating voltage					12V AC, 12V DC
Rated ultimate short-circuit breaking capacity (I_{cu})					15 kA
Rated service short-circuit breaking capacity (I_{cs})					≤40 A: 11.25 kA >40 A: 7.5 kA
Rated impulse withstand voltage Uimp. (1.2/50µs)					4 kV (test voltage 6.2kV at sea level, 5kV at 2,000m)
Dielectric test voltage					2 kV (50/60Hz, 1 min.)
Reference temperature for tripping characteristics					30 °C
Electrical endurance 1 cycle (2s - ON, 13s - OFF, $I_n \leq 32A$), 1 cycle (2s - ON, 28s - OFF, $I_n > 32A$)					$I_n < 30A$:20,000 ops.(AC) $I_n \geq 30A$:10,000 ops. (AC) 1,000 ops. (DC)

★ Self-declared IEC DC ratings.

Mechanical Data		
Housing		Insulation group II, RAL 7035
Indicator window		red ON/green OFF
Protection degree per EN 60529		IP20, IP40 in enclosure with cover
Mechanical endurance		20,000 operations
Shock resistance per IEC/EN 60068-2-27		25 g - 2 shocks - 13 ms
Vibration resistance per IEC/EN 60068-2-6		5g - 20 cycles at 5...150...5 Hz with load 0.8 In
Environmental		
Environmental conditions (damp heat) per IEC/EN 60068-2-30		28 cycles with 55°C/90-96% and 25°C/95-100%
Ambient temperature★		-25...+55 °C
Storage temperature		-40...+70 °C
Installation		
Terminal		Dual terminal
Cross-section of conductors♣ – solid, stranded (front/back terminal slot)	mm^2	35/35 mm^2
	AWG	18...4/18...10 AWG
Cross-section of conductors – flexible	mm^2	25/10 mm^2
Multi-wire rating per UL, CSA	AWG	1 wire, 18...4 AWG
	AWG	2 wires‡, 18...10 AWG
Cross-section of bus bars (back terminal slot)	mm^2	10 mm^2
Tightening torque	N•m	2.8 N•m
	in•lb	AWG 18...16: 8.85 in•lb, AWG 14...10: 17.7 in•lb, AWG 8...4:39.8 in•lb
Screwdriver		No. 2 Pozidrive
Mounting		DIN Rail (EN 60715, 35 mm) with fast clip
Mounting position		Any
Supply		Optional
Approximate Dimensions and Weight		
Pole dimensions (H x D x W)		111 x 69 x 17.5 mm (4.37 x 2.72 x .69")
Pole weight		125 g (4.4 oz.)
Combination with Auxiliary Elements		
Auxiliary contact		Yes
Signal contact		Yes
Shunt trip		Yes

♣ 35 mm self-declared, not included in IEC/EN approval.

★ Refer to the ambient temperature derating tables.

‡ Wires must be of like size and stranding. Only one wire per terminal slot.

Power Loss Due to Current

Rated Current [A]	Power Loss Per Pole [W]		Rated Current [A]	Power Loss Per Pole [W]
0.5	1.4		15	2.4
1	1.4		16	2.5
1.6	1.8		20	2.5
2	1.8		25	3.2
3	1.6		30	3.5
4	1.8		32	3.7
5	1.9		35	4.1
6	2.0		40	4.5
7	1.1		50	4.5
8	1.5		60	4.9
10	2.1		63	5.4
13	2.3		—	—

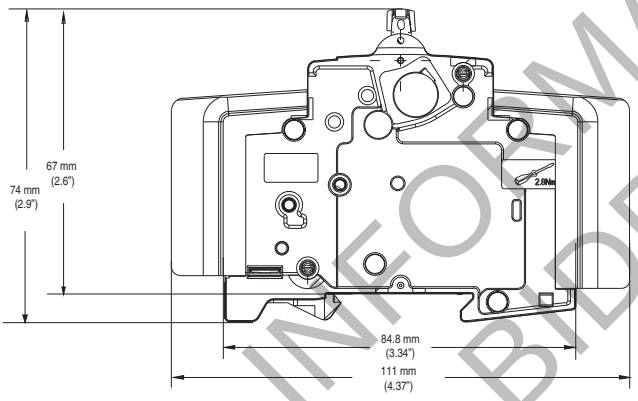
Zero-stack Derating

The installation of several miniature circuit breaker side by side with rated current on all poles requires a correction factor to the rated current (not required if spacers are used).

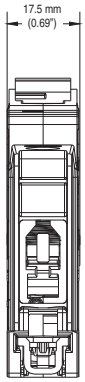
No. of Adjacent Devices	Factor
1	1
2,3	0.9
4,5	0.8
≥ 6	0.75

Approximate Dimensions

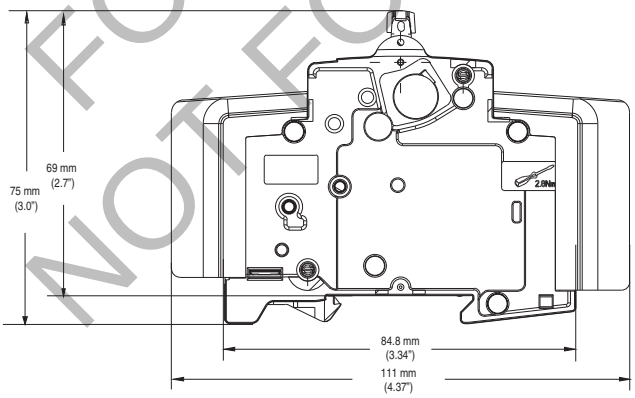
Note: Dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.



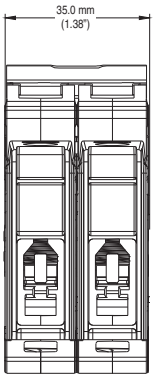
1-Pole



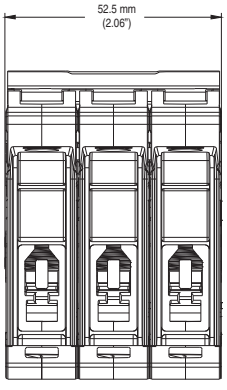
1-Pole



2-, 3-Pole



2-Pole



3-Pole

Cat. No. 855L-NX1

Cat. No. 855L-NX2

Bulletin 855L — Panel Light Bars

- Long LED life unlike fluorescent lights
- Energy savings, minimum impact on power supply size
- Ideal for environments with high shock and vibration
- No transformer required
- Low weight due to absence of heavy ballast
- No electrical noise unlike fluorescent fixtures
- Low heat output
- Solid light without flicker
- No need to ship separate components once the panel is assembled
- No glass or hazardous waste

Standards Compliance

EN61000-6-2

EN61000-6-3

EN60947-5-1

Certifications

CE Marked

Product Selection

	Description	Supply Voltage	Cat. No.
	With On/Off switch	24…48V AC/DC 50/60 Hz	**855L-NX1**
		110/120…230/240V AC/DC 50/60 Hz	**855L-NX3**
	Without On/Off switch	24…48V AC/DC 50/60 Hz	**855L-NX2**
		110/120…230/240V AC/DC 50/60 Hz	**855L-NX4**

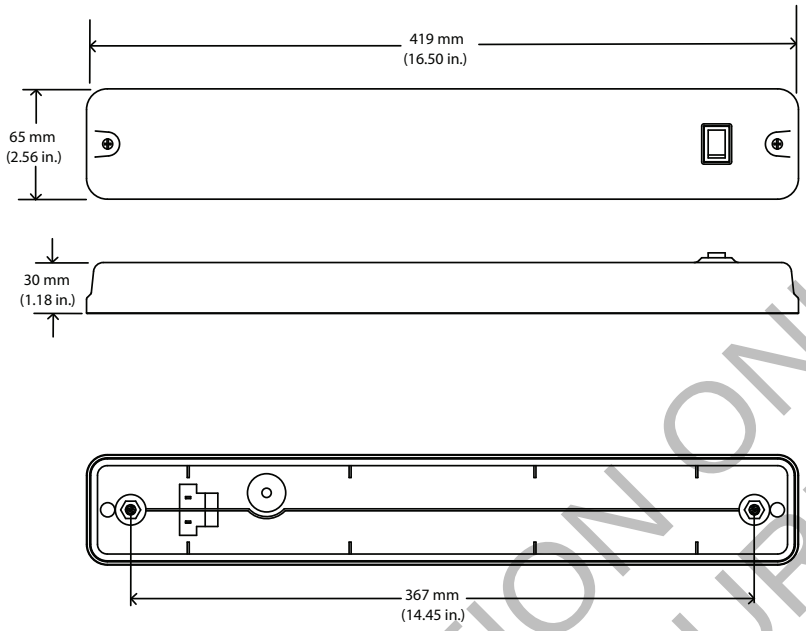
Specifications

	855L-NX1 (24…48V with ON/OFF switch) 855L-NX2 (24…48V - no switch)	855L-NX3 (110…240V with ON/OFF switch) 855L-NX4 (110…240V - no switch)
Nominal Input Voltage	24…48V AC/DC 50/60 Hz	110…240V AC/DC 50/60 Hz
Input Voltage Limits	17…63V DC 17…53V AC 50/60 Hz	90…320V DC 90…250V AC 50/60 Hz
Nominal Current	~300 mA @ 24V DC/ ~150 mA @ 48V DC	<70 mA @ 120V AC/ <55 mA @ 240V AC
Inrush Current	~4 A @ 48V DC, +25 °C	~1.7 A @ 120V AC/ ~3.4 A @ 240V AC
Leakage Current Immunity	>8 mA DC	>3 mA AC/~1 mA DC
Ingress Protection	855L-NX1: NEMA 1, IP40 855L-NX2: NEMA 1, IP44	855L-NX3: NEMA 1, IP40 855L-NX4: NEMA 1, IP44
Operating Temperature Range	-31…+122 °F (-35…+50 °C)	
Storage Temperature Range	-31…+185 °F (-35…+85 °C)	
Wire Size	22…14 AWG (0.5…2.5 mm²)	
Light Beam Angle	~70°	
LED Color	White	
Light Output	≥410 lumens	
Lens Material	Polycarbonate (clear)	
Base Material	Polycarbonate (light grey)	
Mounting Orientation	No restrictions	
Mounting Screws*	2 X 1/4 in. (M5/ M6)	
Weight	<1 lb (380 g)	
Standards Compliance	EN61000-6-2, EN61000-6-3, EN60947-5-1	
Certifications	CE Marked	
LED MTFB	100 000 hr	

* Not provided.

Approximate Dimensions

Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.



EMC filter surge protection device - SFP 1-20/120AC - 2856702

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Device protection, according to type 3/class III, with network interference suppression filter to prevent high-frequency interference voltages, for 1-phase power supply networks with separate N and PE (3-conductor system: L1, N, PE), with remote indication contact.

Product Description

Device protection with interference filter

Why buy this product

- Can be installed in industrial environments
- Thermal monitoring of the protective circuit
- Combined protective circuit for absorbing transient surge voltages and high-frequency interference voltages
- Disconnection status signaled via floating remote indication contact
- Integrated power display switches off automatically when there is a malfunction due to overload.

Key Commercial Data

Packing unit	1 STK
Weight per Piece (excluding packing)	615.2 g
Custom tariff number	85363010
Country of origin	Germany

Technical data

Dimensions

Height	93 mm
Width	112 mm
Depth	79 mm

Ambient conditions

Degree of protection	IP20

EMC filter surge protection device - SFP 1-20/120AC - 2856702

Technical data

Ambient conditions

Ambient temperature (operation)	-25 °C ... 70 °C
Ambient temperature (storage/transport)	-25 °C ... 70 °C
Permissible humidity (operation)	5 % ... 95 %

General

IEC test classification	III
	T3
EN type	T3
Number of ports	Two
SPD design	Voltage-limiting type
Mode of protection	L-N
	L-PE
	N-PE
Mounting type	DIN rail: 35 mm
Color	black
	silver
Housing material	Aluminum
Degree of pollution	2
Flammability rating according to UL 94	V-0
Type	Rail-mountable module, one-piece
Number of positions	2
Surge protection fault message	Optical, remote indicator contact
For country-specific use in	USA, CN, BR

Protective circuit

Nominal voltage U_N	120 V AC (TN)
	120 V AC (TT - only in use with RCD)
	120 V AC (IT - only in use with RCD)
Nominal frequency f_N	50 Hz (60 Hz)
Maximum continuous voltage U_C	150 V AC
Rated load current I_L	20 A (40°C)
Residual current I_{PE}	≤ 0.6 mA
Nominal discharge current I_n (8/20) µs	3 kA
Standby power consumption P_C	≤ 7.5 VA (at U_{REF})
	≤ 10 VA (at U_C)
Reference test voltage U_{REF}	132 V AC
Combination wave U_{OC}	6 kV (3 kA)
Voltage protection level U_p	≤ 0.5 kV

EMC filter surge protection device - SFP 1-20/120AC - 2856702

Technical data

Protective circuit

TOV behavior at U_T (L-N)	175 V AC (5 s / withstand mode)
	240 V AC (5 s / safe failure mode)
	208 V AC (120 min / safe failure mode)
TOV behavior at U_T (L-PE)	208 V AC (5 s / withstand mode)
	175 V AC (120 min / withstand mode)
	1332 V AC (200 ms / safe failure mode)
TOV behavior at U_T (N-PE)	1200 V AC (200 ms / safe failure mode)
Response time t_A	≤ 25 ns
Capacity (L-N)	1 µF ±10 %
	10 nF ±10 % (X2-275 V)
Capacity (L-PE)	2.2 nF ±20 % (Y2-250 V)
Capacity (L-PEN)	2.2 nF ±20 % (Y2-250 V)
Max. required back-up fuse	20 A (MCB B/general purpose)
	16 A (IT - MCB B/general purpose)
Input attenuation aE, sym.	20 dB (≥ 100 kHz / 50 Ω)
Input attenuation aE, asym.	30 dB (≥ 1 MHz / 50 Ω)
Short-circuit current rating I_{SCCR}	5 kA AC (TN/TT)
	1 kA AC (IT)

Indicator/remote signaling

Connection name	Remote fault indicator contact
Switching function	PDT contact
Operating voltage	12 V AC ... 250 V AC
	250 V DC (250 mA DC)
Operating current	100 mA AC ... 1 A
	1 A (48 V DC)
Connection method	Pluggable screw connection
Conductor cross section flexible	0.14 mm² ... 1.5 mm²
Conductor cross section solid	0.14 mm² ... 1.5 mm²
Conductor cross section AWG	26 ... 16
Screw thread	M2
Tightening torque	0.25 Nm
Stripping length	7 mm

Connection data

Connection method	Screw terminal blocks
Conductor cross section flexible	2.5 mm² ... 4 mm²
Conductor cross section solid	2.5 mm² ... 6 mm²

EMC filter surge protection device - SFP 1-20/120AC - 2856702

Technical data

Connection data

Conductor cross section AWG	14 ... 10
Screw thread	M3
Tightening torque	0.5 Nm ... 0.6 Nm
	4.5 lb_f-in. ... 5.5 lb_f-in.
Stripping length	8 mm

UL specifications

SPD Type	2CA
Maximum continuous operating voltage MCOV (L-N)	150 V AC
Maximum continuous operating voltage MCOV (L-G)	150 V AC
Maximum continuous operating voltage MCOV (N-G)	150 V AC
Mode of protection	L-N
	L-G
	N-G
Power distribution system	1
Nominal frequency	50/60 Hz
Voltage protection rating VPR (L-N)	500 V
Voltage protection rating VPR (L-G)	500 V
Voltage protection rating VPR (N-G)	500 V
Nominal discharge current I_n	3 kA
Short-circuit current rating (SCCR)	5 kA

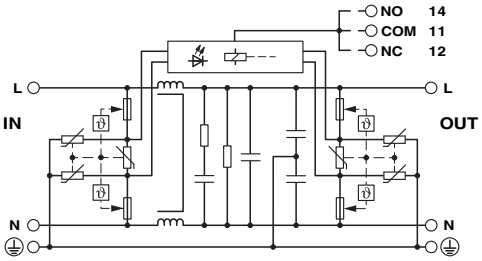
Protective circuit, filter

Discharge resistance	820 kΩ
Clamping voltage ringwave (L-N)	100 V (category A 100 kHz 6 kV/200 A)
	195 V (category B 100 kHz 6 kV/500 A)
Clamping voltage ringwave (L-PE)	390 V (category A 100 kHz 6 kV/200 A)
	390 V (category B 100 kHz 6 kV/500 A)

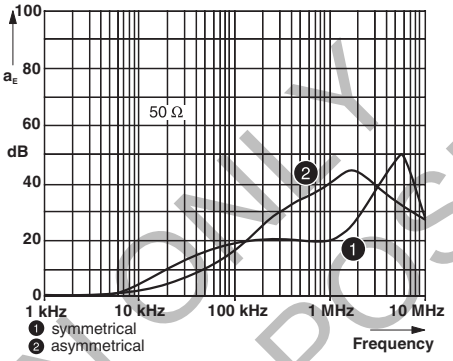
Drawings

EMC filter surge protection device - SFP 1-20/120AC - 2856702

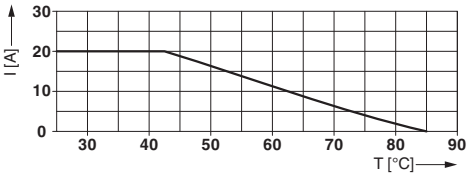
Circuit diagram



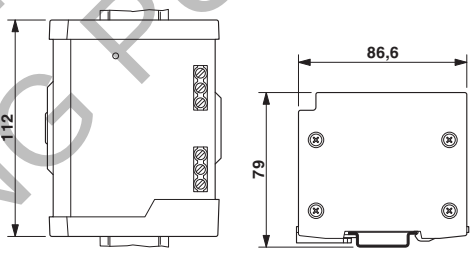
Diagram



Diagram



Dimensional drawing



Classifications

eCl@ss

eCl@ss 4.0	27140201
eCl@ss 4.1	27130801
eCl@ss 5.0	27130801
eCl@ss 5.1	27130801
eCl@ss 6.0	27130806
eCl@ss 7.0	27130806
eCl@ss 8.0	27130806
eCl@ss 9.0	27130806

ETIM

ETIM 2.0	EC000942
ETIM 3.0	EC000942
ETIM 4.0	EC000942
ETIM 5.0	EC000942

EMC filter surge protection device - SFP 1-20/120AC - 2856702

Classifications

UNSPSC

UNSPSC 6.01	30212010
UNSPSC 7.0901	39121610
UNSPSC 11	39121610
UNSPSC 12.01	39121610
UNSPSC 13.2	39121620

Approvals

Approvals

Approvals

UL Recognized / cUL Recognized / EAC / cULus Recognized

Ex Approvals

Approvals submitted

Approval details

UL Recognized

cUL Recognized

EAC

cULus Recognized

Bulletin 1492 DIN Rail Receptacle

Advantages

- Quick to snap on 35 mm DIN rail and easy to wire
- Available with ground fault circuit interrupter (GFCI) or standard duplex outlets
- Feature of visual indication of power included with GFCI receptacle

1492-REC15G
GFCI Receptacle

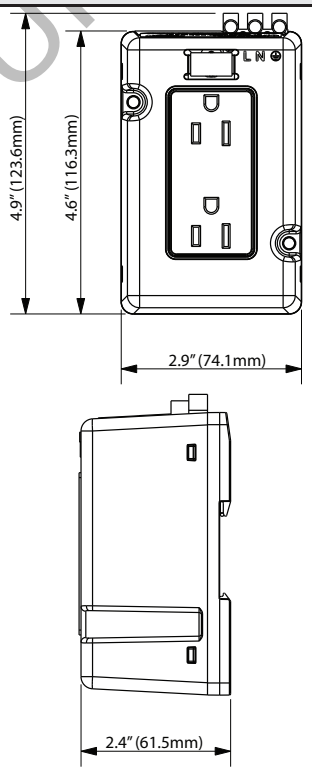
1492-REC15
Standard Duplex Receptacle

Overview

The Bulletin 1492 DIN rail receptacle is a convenient power outlet which is simple to snap onto DIN rail or mount on a panel. The receptacle is available in 15 A or 20 A versions and is an easy way to provide access to power in a panel.

Technical Specifications for the DIN Rail Receptacle				
	1492-REC15	1492-REC20	1492-REC15G	1492-REC20G
Mechanical Ratings				
	15 A Duplex	20 A Duplex	15 A GFCI	20 A GFCI
Operating Temperatures	-13°F to 140°F (-25°C to 60°C)			
Storage Temperatures, Short Term	-31°F to 176°F (-35°C to 80°C)			
Terminal Wire Sizes	#20 - #10 AWG solid or stranded			
Terminal Torque	7 lb.-in. (.79 Nm)			
Electrical Ratings				
Device Ratings	15 A, 125V	20 A, 125V	15 A, 125V	
Operating Frequency	50 - 60 Hz			
Dielectric Voltage	Withstands 2000V per UL498		Withstands 1500V per UL498	
Current Interrupting	N/A		10 kA	
Short-Circuit Current Rating	1492-REC15	1492-REC20	1492-REC15G	1492-REC20G
	10 kA		2 kA	
Trip Level	N/A		5±1 mA	
Material Listing				
Enclosure Cover, Flammability	PBT/polycarbonate blend, UL94 rating V0 @ .63mm			
Enclosure Base, Flammability	Polyamide 6/6 30% GF, UL94 rating V0 @ .63mm			
Spring	Stainless Steel			
Standards and Certifications				
	UL 508A (file # E54866)			
	cULus			
	UL498		UL 498, UL 943	
	NEMA WD-6			
	NEMA 5-15R			

Dimensions



	Cat. No.	Pkg. Qty.
Marking Systems Marker Card*:	1492-MS10x17 (40/card)	5

* A single marker is included with each DIN Rail Receptacle

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Allen-Bradley • Rockwell Software

Rockwell Automation

Publication 1492-PP023C-EN-E – April 2010

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

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Uninterruptible power supply with integrated power supply unit. For lead AGM energy storage with 1.3 Ah to 38 Ah nominal capacity. Input: 1-phase, output: 24 V DC/10 A. Push-in connection technology

Product Description

Supply DC loads reliably and save space with the TRIO uninterruptible power supplies. An input grid is no longer necessary for startup. Connected industrial PCs can be shut down easily via the integrated USB interface.

Your advantages

- Space saving: Combination of UPS module and power supply in the same housing
- Long buffer times, thanks to large selection of VRLA energy storage systems
- USB interface for connection to higher-level controllers such as industrial PCs
- Startup from energy storage possible, even without mains input
- Universal range of possible applications, thanks to a comprehensive package of approvals and an extended temperature range
- Easy installation, thanks to push-in connection technology

RoHS

Key Commercial Data

Packing unit	1 pc
GTIN	4 055626 166582
GTIN	4055626166582

Technical data

Dimensions

Width	68 mm
Height	130 mm
Depth	160 mm
Width with alternative assembly	160 mm
Height with alternative assembly	130 mm
Depth with alternative assembly	68 mm
Installation distance right/left	0 mm / 0 mm
Installation distance top/bottom	50 mm / 50 mm

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Technical data

Ambient conditions

Degree of protection	IP20
Inflammability class in acc. with UL 94 (housing / terminal blocks)	V0
Ambient temperature (operation)	-25 °C ... 70 °C (> 60 °C Derating: 2.5 %/K)
Ambient temperature (start-up type tested)	-40 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	≤ 93 % (At +25°C, non-condensing)
Climatic class	3K3 (in acc. with EN 60721)
Degree of pollution	2
Installation height	≤ 4000 m (> 2000 m, observe derating)

Input data

AC input voltage range	100 V AC ... 240 V AC -15 % ... +10 %
Inrush current limiting/I²t	< 0.2 A^2s
Mains buffering time	≥ 25 ms (120 V AC)
Typical response time	200 ms
Input fuse, integrated	6.3 A (slow-blow, internal)

Output data

Nominal output voltage	24 V DC
Setting range of the output voltage (U_{Set})	24 V DC ... 28 V DC (> 24 V constant capacity)
Nominal output current (I_N)	10 A
Dynamic Boost ($I_{Dyn.Boost}$)	15 A
Derating	> 60 °C (2.5%/K of P_{Out} nom.)
Control deviation	< 0.55 % (Static load change 10 % ... 90 %)
Maximum power dissipation in no-load condition	< 3 W (230 V AC)
Efficiency	typ. 90 % (120 V AC)
	typ. 91 % (230 V AC)
	typ. 96 % (Battery operation)
Residual ripple	< 20 mV
Connection in parallel	yes, with diode module uncoupled
Surge protection against internal surge voltages	< 30 V DC
Feedback voltage resistance	≤ 35 V DC

General

Net weight	1.34 kg
Insulation voltage input/output	4 kV AC (type test)
	2 kV AC (routine test)
Protection class	I
MTBF (IEC 61709, SN 29500)	> 2007013 h (230 V AC, at 25 °C)
	> 1210518 h (230 V AC, at 40 °C)
	> 575978 h (230 V AC, at 60 °C)
Mounting position	horizontal DIN rail NS 35, EN 60715

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Technical data

General

Assembly instructions	alignable: horizontally 0 mm, vertically 50 mm

Connection data, input

Connection method	Push-in connection
Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	4 mm²
Conductor cross section flexible min.	0.2 mm²
Conductor cross section flexible max.	2.5 mm²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	12
Stripping length	10 mm

Connection data, output

Connection method	Push-in connection
Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	4 mm²
Conductor cross section flexible min.	0.2 mm²
Conductor cross section flexible max.	2.5 mm²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	12
Stripping length	10 mm

Connection data for signaling

Connection method	Push-in connection
Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	1.5 mm²
Conductor cross section flexible min.	0.2 mm²
Conductor cross section flexible max.	1.5 mm²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	16
Stripping length	8 mm

Charging process

Charge characteristic curve	IU_0U
Charge current	0.2 A ... 3 A (-25 °C ... 60 °C)

Standards

EMC requirements for noise immunity	EN 61000-6-1
	EN 61000-6-2
EMC requirements for noise emission	EN 61000-6-3
	EN 61000-6-4
Standard - safety for equipment for measurement, control, and laboratory use	IEC 61010-1
Standard – Safety extra-low voltage	IEC 61010 (SELV) / (PELV)

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Technical data

Standards

Standard - Safe isolation	DIN VDE 0100-410
Standard - power supply devices for low voltage with DC output	EN 61204-3

Conformance/approvals

UL approvals	UL Listed UL 61010
	UL/C-UL Listed ANSI/ISA-12.12.01 Class I, Division 2, Groups A, B, C

EMC data

Electromagnetic compatibility	Conformance with EMC Directive 2014/30/EU
Low Voltage Directive	Conformance with Low Voltage Directive 2014/35/EC
Conducted noise emission	EN 61000-6-3 (Class B)
Noise emission	EN 61000-6-3 (Class B)
DNV GL conducted interference	Class B
Additional text	Area power distribution
DNV GL noise radiation	Class B
Additional text	Bridge and deck area
Electrostatic discharge	EN 61000-4-2
Contact discharge	6 kV (Test Level 4)
Discharge in air	8 kV (Test Level 4)
Electromagnetic HF field	EN 61000-4-3
Frequency range	80 MHz ... 6 GHz
Test field strength	10 V/m (Test Level 3)
Comments	Criterion A
Fast transients (burst)	EN 61000-4-4
Input	4 kV (Test Level 4 - asymmetrical)
Output	2 kV (Test Level 3 - asymmetrical)
Signal	2 kV (Test Level 4 - asymmetrical)
Comments	Criterion A
Surge voltage load (surge)	EN 61000-4-5
Input	2 kV (Test Level 3 - symmetrical)
	4 kV (Test Level 4 - asymmetrical)
Output	1 kV (Test Level 1 - symmetrical)
	2 kV (Test Level 3 - asymmetrical)
Signal	1 kV (Test Level 2 - asymmetrical)
Comments	Criterion A
Conducted interference	EN 61000-4-6
I/O/S	asymmetrical
Frequency range	0.15 MHz ... 80 MHz
Voltage	10 V (Test Level 3)
Comments	Criterion A
Attenuated sinusoidal oscillations (ring wave)	EN 61000-4-12
Comments	Criterion A

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Technical data

EMC data

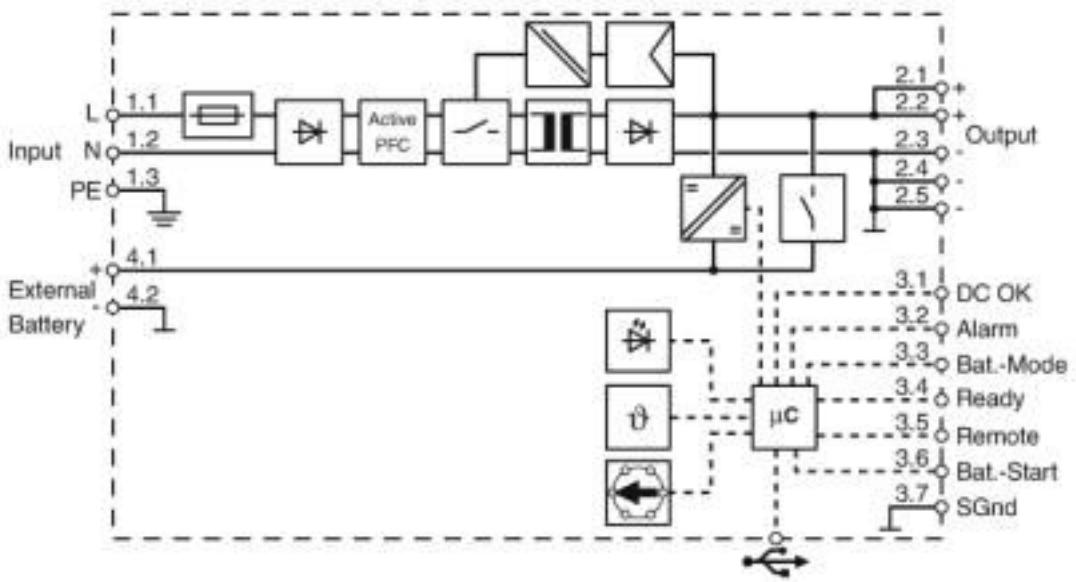
Criterion A	Normal operating behavior within the specified limits.
Criterion B	Temporary impairment to operational behavior that is corrected by the device itself.

Environmental Product Compliance

REACh SVHC	Lead 7439-92-1

Drawings

Block diagram



Classifications

eCl@ss

eCl@ss 10.0.1	27040705
eCl@ss 9.0	27040705

ETIM

ETIM 6.0	EC000382
ETIM 7.0	EC000382

Approvals

Approvals

Approvals

DNV GL / BSH / UL Listed / cUL Listed / EAC / IECEE CB Scheme / LR / cULus Listed

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Approvals

Ex Approvals

UL Listed / cUL Listed / cULus Listed

Approval details

DNV GL	https://approvalfinder.dnvgl.com/	TAA00002DW
BSH		1025a
UL Listed	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 123528
cUL Listed	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 123528
EAC		RU*DE*08.B.01873/19
IECEE CB Scheme	http://www.iecee.org/	DK-67494-UL
LR	http://www.lr.org/en	LR2002877TA
cULus Listed		

Accessories

Accessories

Assembly adapter

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Accessories

Assembly adapters - UWA 130 - 2901664

2-piece universal wall adapter for securely mounting the device in the event of strong vibrations. The profiles that are screwed onto the side of the device are screwed directly onto the mounting surface. The universal wall adapter is attached on the left/right.

Battery unit

Energy storage - UPS-BAT/VRLA/24DC/1.3AH - 2320296

Energy storage device, lead AGM, VRLA technology, 24 V DC, 1.3 Ah, tool-free battery replacement, automatic detection, and communication with QUINT UPS-IQ

Energy storage - UPS-BAT/VRLA/24DC/3.4AH - 2320306

Energy storage device, lead AGM, VRLA technology, 24 V DC, 3.4 Ah, tool-free battery replacement, automatic detection, and communication with QUINT UPS-IQ

Energy storage - UPS-BAT/VRLA/24DC/7.2AH - 2320319

Energy storage device, lead AGM, VRLA technology, 24 V DC, 7.2 Ah, tool-free battery replacement, automatic detection, and communication with QUINT UPS-IQ

Energy storage - UPS-BAT/VRLA/24DC/12AH - 2320322

Energy storage device, lead AGM, VRLA technology, 24 V DC, 12 Ah, tool-free battery replacement, automatic detection, and communication with QUINT UPS-IQ

Uninterruptible power supply - TRIO-UPS-2G/1AC/24DC/10 - 2907161

Accessories

Energy storage - UPS-BAT/VRLA/24DC/38AH - 2320335

Energy storage device, lead AGM, VRLA technology, 24 V DC, 38 Ah, automatic detection, and communication with QUINT UPS-IQ

Data cable preassembled

Data cable - MINI-SCREW-USB-DATACABLE - 2908217

Used for communication between an industrial PC and Phoenix Contact devices with USB-Mini-B connection.

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2907161

Energy storage - UPS-BAT/PB/24DC/4AH - 1274117

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Energy storage, VRLA-AGM, 24 V DC, 4 Ah, automatic detection and communication with QUINT UPS-IQ

Product Description

For continuous monitoring and intelligent management, there is constant communication with the QUINT UPS. Thanks to automatic detection of the energy storage, and tool-free switching during operation, quick installation is possible. The QUINT UPS with IQ technology energy storage leaves the warehouse fully charged.

C1
D2

Key Commercial Data

Packing unit	1 pc
Weight per Piece (excluding packing)	3,300.000 g
Country of origin	China
Note	Made to Order (non-returnable)

Technical data

Dimensions

Width	85 mm
Height	191 mm
Depth	110 mm
Installation distance right/left	0 mm / 0 mm
Installation distance top/bottom	50 mm / 50 mm

Ambient conditions

Degree of protection	IP20
Ambient temperature (operation)	0 °C ... 40 °C
Ambient temperature (storage/transport)	-20 °C ... 40 °C
Ambient temperature (charge)	0 °C ... 40 °C
Ambient temperature (discharge)	-20 °C ... 50 °C
Max. permissible relative humidity (operation)	≤ 95 %
Degree of pollution	2

Protection class	III

Energy storage - UPS-BAT/PB/24DC/4AH - 1274117

Technical data

Degree of protection	IP20
Degree of pollution	2
Weight	3.3 kg
Disposal	Used batteries must not be thrown away with household waste, they should instead be disposed of in accordance with applicable national regulations.
Connection in parallel	yes
	max. 5
Connection in series	No
Battery type	BB Battery HR4.2-12FR
Battery technology	VRLA-AGM
IQ-Technology	yes
Temperature sensor	yes
Latest startup date (battery only)	6 Months (0 °C ... 20 °C)
Latest startup (battery only) - range	3 Months ... 6 Months (20 °C ... 30 °C)
	1 Months ... 3 Months (30 °C ... 40 °C)
Accumulator module service life (according to Eurobat)	6 (20 °C)
Storage medium	VRLA-AGM
Size designation	Block

Input data

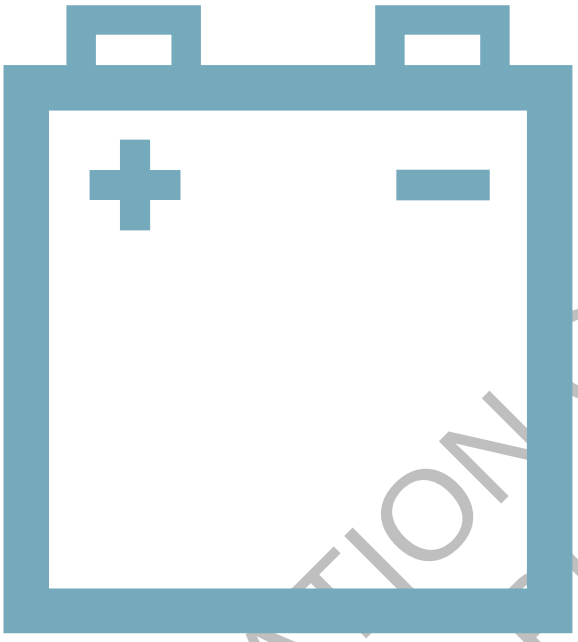
Input voltage	24 V DC (SELV)
Nominal capacity	4 Ah
Charge current	1.2 A
End-of-charge voltage	27.6 V DC (20 °C)

Output voltage	24 V DC
Output current I_{max}	25 A
Output fuse	1x 25 A
Buffer time	4.5 min. (20 A)
	3 min. (25 A)

Drawings

Energy storage - UPS-BAT/PB/24DC/4AH - 1274117

Pictogram



Classifications

eCl@ss

eCl@ss 11.0	27050403
eCl@ss 9.0	27050403

ETIM

ETIM 7.0	EC000357

1606-XLE120E & 1606-XLE120EC 24V, 5A; Single Phase Input

1606-XLE120E & 1606-XLE120EC

24V,5A Single Phase Input

POWER SUPPLY

- Ultra-small size
- Extra-low inrush current
- Active power factor correction
- Wide range AC/DC input
- Superior efficiency and temperature rating
- DC-OK

1. GENERAL DESCRIPTION

The 1606-XLE supplies are cost optimized power supplies without compromising quality, reliability and performance. The 1606-XLE120E is part of the XLE power supply family, existing alongside the high featured XLS family.

The 1606-XLE includes all the essential basic functions and the devices have a power reserve of 20%. This extra current may even be used continuously at temperatures up to +45°C. The most important features are the small size, the high efficiency and the wide temperature range.

The Auto-select input makes worldwide installation and usage very simple. Defects or system failures caused by wrongly set switches can not occur.

2. SPECIFICATION QUICK REFERENCE

Output voltage	DC 24V	
Adjustment range	24 - 28V	
Output current	5 – 4.3A	ambient <60°C
	6 – 5,1A	ambient <45°C
Output power	120W	ambient <60°C
	144W	ambient <45°C
Output ripple	< 50mVpp	20Hz to 20MHz
Input voltage	AC 100-120 / 200-240V	Auto-select Input
Line frequency	50-60Hz	±6%
AC Input current	typ. 2.05 / 1.23A	at 120 / 230Vac
Power factor	typ. 0.56 / 0.47	at 120 / 230Vac
AC Inrush current	typ. 3A peak	
DC Input	not allowed	
Efficiency	typ. 89.4 / 90.2%	at 120 / 230Vac
Losses	typ. 14.5 / 13.2W	at 120 / 230Vac
Temperature range	-25°C to +70°C	operational
Derating	3W/°C	+60 to +70°C
Hold-up time	typ. 80 / 78ms	at 120 / 230Vac
Dimensions	32x124x117mm	WxHxD

3. AGENCY APPROVALS

c UL US LISTED IND. CONT. EQ. UL 508	c TÜV US UL 60950-1
CE EMC, LVD	

4. RELATED PRODUCTS

1606-XLB	Wall mount bracket
1606-XLSRED	Redundancy Module
1606-XLBUFFER	Buffer unit

Bulletin 1606 Redundant Power Supplies

	N+1 Redundancy	N+1 Redundancy	N+1 Redundancy
	1606-XL60DR	1606-XL120DR	1606-XL240DR
Output Volts/Watts	24V/60 W	24V/120 W	24V/240 W
Input Voltage (47...63 Hz)	100...120V/200...240V AC manual select; 160...375V DC	100...120/200...240V AC manual select; 210...375V DC	AC 100...120/200...240V manual select; DC 240...375V
Operational Range	—	85...132/176...264V AC	85...132/176...264 V AC
Hold-up Time	>20 ms (AC 196V)	>37 ms (AC 196V)	>25 ms (AC 196V)
Rated Input Current	<1.3 A (115V)/<0.7 A (230V)	<2.6 A (115V)/<1.4 A (230V)	<6 A (115V)/<2.8 A (230V)
Efficiency	typ. 86.5%	typ. 89%	typ. 89%
Output Voltage	24V	24V	24V
Rated Output Current	2.5 A	5 A	10 A
Power Boost	—	6 A	12 A
Ripple/Noise	<30 mV_{PP}	<30 mV_{PP}	<30 mV_{PP}
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C with derating	-10...+70 °C >60 °C with derating	0...+70 °C >60 °C with derating
Non-Operating Temperature Range	-10 °C...+70 °C >60 °C with derating	-40...+85 °C	-40...+85 °C
MTBF∆	700 000 hours	480.000 hours	390.000 hours
Dimensions (W x H x D)	49 x 124 x 102 mm	64 x 124 x 102 mm	120 x 124 x 102 mm
Weight	470 g	620 g	980 g
Certifications/Standards ★	1, 2, 3, 5, 6	1, 2, 3, 5, 6, 7	1, 2, 3, 5, 6
Special Features	RDY relay contact; N+1 redundancy; plug connectors; NEC Class 2 power supply	RDY relay contact; N+1 redundancy; plug connectors	RDY relay contact; N+1 redundancy; plug connectors

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1
∆ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606 Redundancy Module

	N+1 Redundancy	N+1 Redundancy	N+1 Redundancy	N+1 Redundancy		N+1 Redundancy	N+1 Redundancy
	1606-XLRED20-30	1606-XLRED40	1606-XLPRED	1606-XLSRED	1606-XLERED	1606-XLSRED40	1606-XLSRED80
Output Volts/Watts	30 A Dual redundancy module	40 A Single redundancy module	8 A Dual redundancy	10 A Dual redundancy		20 A Dual redundancy	40 A Dual redundancy
Input Voltage (47...63 Hz)	DC 24V (max. 35V)		DC 10...60V	DC 10...60V		24...28 V DC	24...28 V DC
Operational Range	18...36 V DC		10...60V DC	10...60V DC		24...28 V DC	24...28 V DC
Rated Input Current	20...30 A (max. 35 A)	0...40 A (max. 50 A)	Single input: 8 A max. Dual input: 16 A max. total	Single input: 10 A max. Dual input: 20 A max. total		Single input: 20 A max. Dual input: 40 A max. total	Single input: 40 A max. Dual input: 80 A max. total
Output Voltage	Vin -0.5V typ.	Vin -0.6V typ.	Vin -0.9V typ.	Vin -0.9V typ.		Vin -2.15V typ.	Vin -2.7V typ.
Rated Output Current	20...30 A (max. 35 A)	0...40 A (max. 50 A)	0...10 A	0...20 A		0...40 A	0...80 A
Operating Temperature Range (T_{amb})	-10 °C...+70 °C		-40 °C...+70 °C >60 °C with derating	-25 °C...+70 °C >60 °C with derating		-25 °C...+70 °C >60 °C with derating	-25 °C...+70 °C >60 °C with derating
Dimensions (W x H x D)	48 x 124 x 102 mm	48 x 124 x 117 mm	45 x 75 x 91 mm	32 x 124 x 102 mm	32 x 124 x 117 mm	36 x 124 x 127 mm	46 x 124 x 127 mm
Weight	625 g	646 g	136 g	290 g	350 g	340 g	440 g
Certifications/Standards ★	1, 2, 3, 6		1, 2, 3, 6	1, 2, 3, 6		1, 2, 3, 6	1, 2, 3, 6
Special Features	Dual redundancy module for 2x35 A; N+1 redundancy	Single redundancy module for 2.5-50 A; N+1 redundancy	Redundancy for DC 10...60V applications; ABS/GL/RINA (Marine); Class 1 Div. 2	Redundancy for DC 10...60V applications; Class 1 Div. 2	Redundancy for DC 10...60V applications; Class 1 Div. 2; DC OK	Redundancy for DC 24...28V applications; Class 1 Div. 2	Redundancy for DC 24...28V applications; Class 1 Div. 2

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1
∆ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

312/318 Series Lead-Free 3AG, Fast-Acting Fuse

Agency Approvals

Agency	Agency File Number	Ampere Range
UL	E10480	312 Series: 0.062A - 25A 318 Series: 0.062A - 25A
CSA	29862	312 Series: 0.062A - 30A 318 Series: 0.062A - 10A
PSE	NBK040205-E10480B/F NBK040205-E10480D/H	312/318 Series 1A-5A 312/318 Series 6A-10A
cULus	E10480	318 Series: 12A - 30A
KC	SU05001-6008 SU05001-5005 SU05001-5006	312/318 Series: 1-2A 312/318 Series: 3-6A 312/318 Series: 7-10A
CE	N/A	312 Series: 0.062A - 10A 318 Series: 0.062A - 10A

Description

The 3AG Fast-Acting Fuse solves a broad range of application requirements while offering reliable performance and cost-effective circuit protection.

Features

- In accordance with UL Standard 248-14
- Available in cartridge and axial lead format and with various forming dimensions
- RoHS compliant and Lead-free

Applications

Used as supplementary protection in appliance or utilization equipment to provide individual protection for components or internal circuits.

Electrical Characteristics for Series

% of Ampere Rating	Ampere Rating	Opening Time
100%	0.062A – 35A	4 hours, Minimum
135%	0.062A – 35A	1 hour, Maximum
200%	0.062A – 10A	5 sec., Maximum
	12A – 30A	10 sec., Maximum
	35A	20 sec., Maximum

Additional Information

Datasheet 312 Series | **Resources 312 Series** | **Samples 312 Series** | **Accessories 312 & 318 Series**

Datasheet 318 Series | **Resources 318 Series** | **Samples 318 Series**

For recommended fuse accessories for this product series, see 'Recommended Accessories' section.

Revised: 03/22/17

Electrical Characteristic Specifications by Item

Amp Code	Ampere Rating (A)	Voltage Rating (V)	Interrupting Rating	Nominal Cold Resistance (Ohms)	Nominal Melting I^2t (A^2 sec)	Agency Approvals					
						UL	cULus	KC	PSE	SP	CE
.062	0.062	250	35A@250Vac 10KA@125Vac	24.7000	0.000249	x				x	x
.100	0.1	250		11.2800	0.00171	x				x	x
.125	0.125	250		7.1450	0.00289	x				x	x
.150	0.15	250		5.1300	0.00550	x				x	x
.175	0.175	250		3.8750	0.00960	x				x	x
.187	0.187	250		3.4200	0.0128	x				x	x
.200	0.2	250		3.0200	0.0165	x				x	x
.250	0.25	250		2.0100	0.0355	x				x	x
.300	0.3	250		1.4050	0.0689	x				x	x
.375	0.375	250		0.8250	0.185	x				x	x
.500	0.5	250		0.4980	0.483	x				x	x
.600	.6	250		0.3620	0.880	x				x	x
.750	0.75	250		0.2445	1.84	x				x	x
001.	1	250		0.1900	0.760	x		x	x	x	x
1.25	1.25	250	100A@250Vac 10KA@125Vac	0.1385	1.45	x		x	x	x	x
01.5	1.5	250		0.1036	2.35	x			x	x	x
01.6	1.6	250		0.0934	2.80	x		x	x	x	x
1.75	1.75	250		0.0856	3.60	x			x	x	x
01.8	1.8	250		0.0825	3.85	x			x	x	x
002.	2	250		0.0704	5.20	x		x	x	x	x
2.25	2.25	250		0.0594	7.20	x			x	x	x
02.5	2.5	250		0.0513	9.54	x			x	x	x
003.	3	250		0.0427	14.0	x		x	x	x	x
004.	4	250	200A@250Vac 10KA@125Vac	0.0293	28.5	x		x	x	x	x
005.	5	250		0.0224	50.0	x		x	x	x	x
006.	6	250		0.0178	118.0	x		x	x	x	x
007.	7	250		0.0146	81.0	x		x	x	x	x
008.	8	250		0.0122	166.0	x		x	x	x	x
010.	10	250		0.0093	298.0	x		x	x	x	x
012.*	12	32	300A@32 Vac	0.0072	234.6	x	x**			x	
015.*	15	32		0.0052	490.5	x	x**			x	
020.*	20	32		0.0035	1414	x	x**			x	
025.*	25	32		0.0024	2041	x	x**			x	
030.*	30	32		0.0019	3717	x	x**			x	
035.	35	32		0.0013	7531						

NOTES:

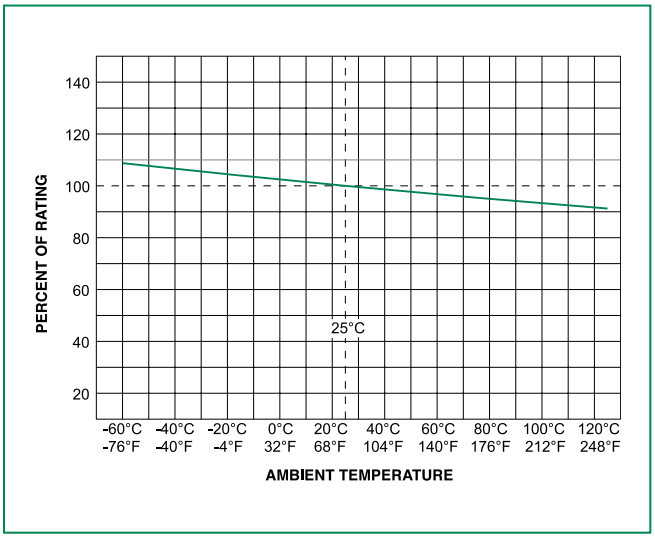
** For 318 Series 12A to 30A, the agency approval is only cURus.

Revised: 03/22/17

Axial Lead & Cartridge Fuses

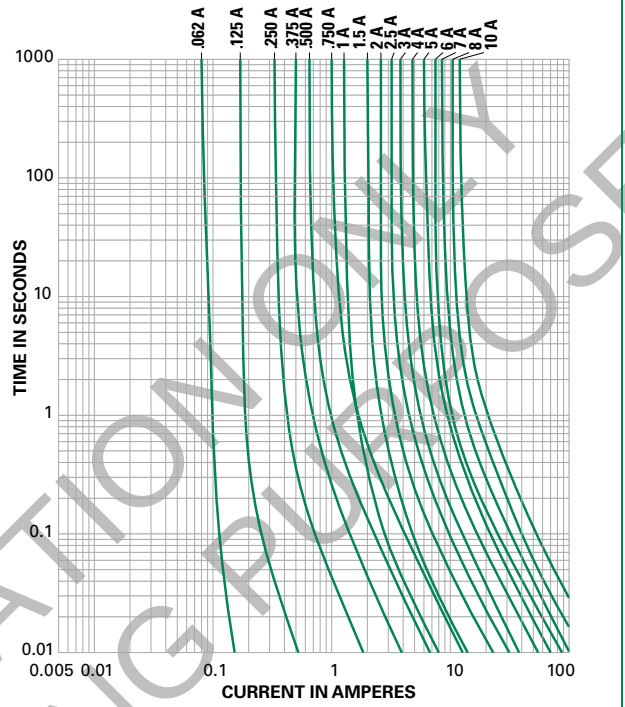
3AG > Fast Acting > 312/318 Series

Temperature Re-rating Curve



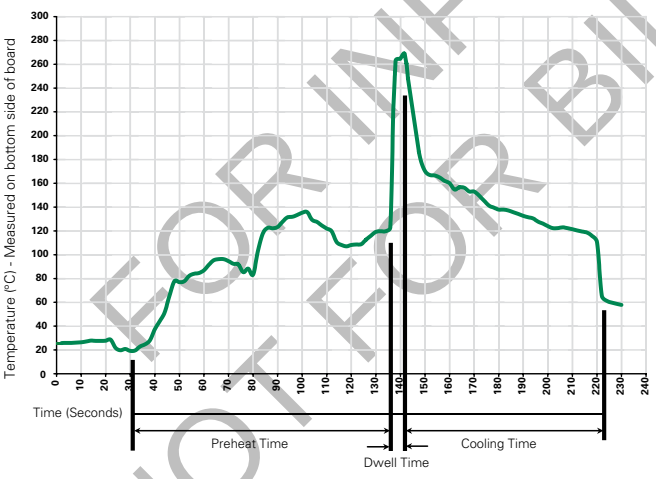
Note:
Rerating depicted in this curve is in addition to the industry practice derating of 25% for continuous operation.

Average Time Current Curves



Please contact Littelfuse for more details on those T-C Curves of other ampere ratings which are not published.

Soldering Parameters - Wave Soldering



Recommended Process Parameters:

Wave Parameter	Lead-Free Recommendation
Preheat: (Depends on Flux Activation Temperature)	(Typical Industry Recommendation)
Temperature Minimum:	100°C
Temperature Maximum:	150°C
Preheat Time:	60-180 seconds
Solder Pot Temperature:	260°C Maximum
Solder Dwell Time:	2-5 seconds

Recommended Hand-Solder Parameters:

Solder Iron Temperature: 350°C +/- 5°C
Heating Time: 5 seconds max.

Note: These devices are not recommended for IR or Convection Reflow process.

Revised: 03/22/17

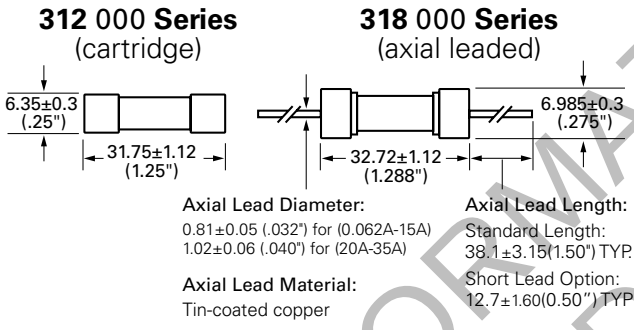
Product Characteristics

Materials	Body: Glass Cap: Nickel–plated brass Leads: Tin–plated Copper
Terminal Strength	MIL-STD-202, Method 211, Test Condition A
Solderability	MIL-STD-202 method 208
Product Marking	Cap1: Brand logo, current and voltage ratings Cap2: Series and agency approval marks

Operating Temperature	–55°C to +125°C
Thermal Shock	MIL-STD-202, Method 107, Test Condition B: (5 cycles -65°C to +125°C)
Vibration	MIL-STD-202, Method 201
Humidity	MIL-STD-202, Method 103, Test Condition A: High RH (95%), and Elevated temperature (40°C) for 240 hours
Salt Spray	MIL-STD-202, Method 101, Test Condition B

Dimensions

Measurements displayed in millimeters (inches)



Axial Lead Diameter:
0.81±0.05 (.032") for (0.062A-15A)
1.02±0.06 (.040") for (20A-35A)

Axial Lead Material:
Tin-coated copper

Axial Lead Length:
Standard Length:
38.1±3.15(1.50") TYP.
Short Lead Option:
12.7±1.60(0.50") TYP

Part Numbering System

0312 xxxx M X P

Series

Amp Code
Refer to Amp Code column of Electrical Characteristics Table

Quantity Code
M = 1000

Packaging Code
X = Filler

Lead-free

Packaging

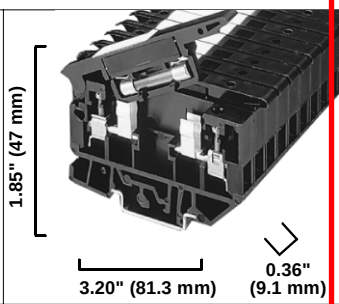
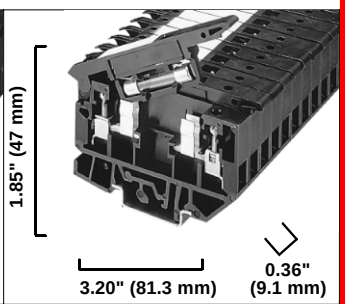
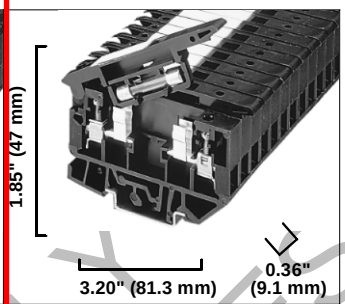
Packaging Option	Packaging Specification	Quantity	Quantity & Packaging Code	Taping Width
312 Series				
Bulk	N/A	1000	MX	N/A
Bulk	N/A	100	HX	N/A
318 Series				
Bulk	N/A	1000	MX	N/A
Bulk	N/A	100	HX	N/A
Bulk	N/A	1000	MXB	N/A

Revised: 03/22/17

Recommended Accessories

Accessory Type	Series	Description	Max Application Voltage	Max Application Amperage
Holder	155100	Twist-Lock In-Line Fuseholder	32	20
	342	Traditional Panel Mount Fuseholder	250	20
	346	Panel Mount Flip-Top Shock-Safe Fuseholder	250	15
	345	Shock-Safe Fuseholder with PC Mount, Solder Mount and Panel Mount options	250	20
Block	354	Low Profile OMNI-BLOK® Fuse Block	600	30
	359	High Current Screw Terminal Fuse Block		30
Clip	122	High Current Traditional PC Board Fuse Clip	1000	30
	101	Rivet/Eyelet Type Fuse Clip	1000	15

Notes:
1. Do not use in applications above rating.
2. Please refer to fuseholder data sheet for specific re-rating information.
3. Please contact factory for applications greater than the max voltage and amperage shown.

	1492-H4			1492-H5			1492-H6		
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.									
Specifications	*Single-circuit fusible terminal block with neon blown fuse indicator.*			*Single-circuit fusible terminal block with LED blown fuse indicator.*			*Single-circuit fusible terminal block without a blown fuse indicator.*		
Approvals	cULus	CSA	IEC	cULus	CSA	IEC	cULus	CSA	IEC
Voltage Rating	300V AC/DC	300V AC/DC	500V AC/DC	300V AC/DC	300V AC/DC	500V AC/DC	300V AC/DC	300V AC/DC	500V AC/DC
Maximum Current	12 A	12 A	12 A	12 A	12 A	12 A	12 A	12 A	12 A
Wire Range (Rated Cross Section)	#30… #12 AWG	#30… #12 AWG	0.05… 4 mm²	#30… #12 AWG	#30… #12 AWG	0.05… 4 mm²	#30… #12 AWG	#30… #12 AWG	0.05… 4 mm²
Indicator Type	Neon			LED			Non-Indicating		
Leakage Current	2 mA @ 300V			2 mA @ 24V			—		
Working Voltage	100…300V AC			10…57V AC/DC			Per Fuse Rating		
Fuse Size (Not Supplied)	1/4" x 1-1/4"			1/4" x 1-1/4"			1/4" x 1-1/4"		
Wire Strip Length	0.38" (9.7 mm)			0.38" (9.7 mm)			0.38" (9.7 mm)		
Recommended Tightening Torque	3…7 lb-in. (0.3…0.8 Nm)			3…7 lb-in. (0.3…0.8 Nm)			3…7 lb-in. (0.3…0.8 Nm)		
Density	33 pcs./ft (109/m)			33 pcs./ft (109/m)			33 pcs./ft (109/m)		
Insulation Temperature Range	–40…+221°F (–40…+105°C)			–40…+221°F (–40…+105°C)			–40…+221°F (–40…+105°C)		
Terminal Blocks	**Cat. No.**		**Pcs./ Pkg.**	**Cat. No.**		**Pcs./ Pkg.**	**Cat. No.**		**Pcs./ Pkg.**
Terminal Block	1492-H4		25	1492-H5		25	1492-H6		25
Accessories (page 185)	**Cat. No.**		**Pcs./ Pkg.**	**Cat. No.**		**Pcs./ Pkg.**	**Cat. No.**		**Pcs./ Pkg.**
Mounting Rails: 1 m Symmetrical DIN (Steel)	199-DR1		10	199-DR1		10	199-DR1		10
1 m Symmetrical DIN (Aluminum)	1492-DR5		10	1492-DR5		10	1492-DR5		10
1 m Hi-Rise Sym. DIN (Aluminum)	1492-DR6		2	1492-DR6		2	1492-DR6		2
1 m Angled Hi-Rise Sym. DIN (Steel)	1492-DR7		2	1492-DR7		2	1492-DR7		2
End Barrier	1492-N37		50	1492-N37		50	1492-N37		50
End Anchors: DIN Rail — Normal Duty	1492-EA35		50	1492-EA35		50	1492-EA35		50
DIN Rail — Heavy Duty	1492-EAH35		10	1492-EAH35		10	1492-EAH35		10
Jumpers: Side Jumper — 10-pole Uninsulated	1492-N49		10	1492-N49		10	1492-N49		10
Side Jumper — Insulating Sleeve	1492-SJS		10	1492-SJS		10	1492-SJS		10
Other Accessories: Group Marking Carrier	1492-GM35		10	1492-GM35		10	1492-GM35		10
Marking Systems: Snap-in Marker Card	1492-SM8X12		5	1492-SM8X12		5	1492-SM8X12		5

Accessories — Page 185

Bulletin 700-HF

Allen-Bradley

Miniature Square Base Ice-Cube Relay

Features

These small relays—used in industrial applications—are available from Rockwell Automation in two- and four-pole versions. Two styles of sockets are available, as well.

Clear cover

Allows visual inspection of terminals.

Plug-in terminals

Secure connections, yet easy to install or remove relays.

What's New

Color coding

Tabs and coil covers indicate coil voltage type: orange for AC and blue for DC.

Push-to-test with manual override

Manual override feature enables changing contact state, even when coils are not energized. This upgrade changes all catalog numbers that had the (-1) option to the new (-3) option.

Increased contact ratings

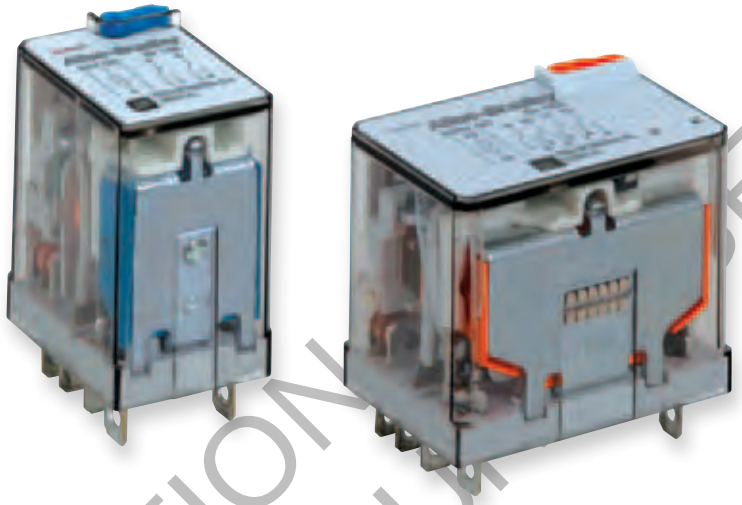
Relays are now rated for 12 amps.

Visual

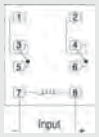
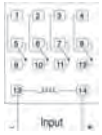
- Wiring diagram on top faceplate
- Mechanical indicator

Sockets

Available in two styles for each contact configuration, one that is compatible with Allen-Bradley general purpose relay accessories such as surge suppressors and timing units and the second with traditional open style terminals.



Product Selection

Description	Wiring Diagrams		Coil Voltage	Cat. No. ‡ ∂
	U.S./Canada	International		
DPDT 2-pole 2 Form C AgCdO Contacts			6V AC	700-HF32A06
			12V AC	700-HF32A12
			24V AC	700-HF32A24
			120V AC	700-HF32A1
			240V AC	700-HF32A2
			6V DC	700-HF32Z06
			12V DC	700-HF32Z12
			24V DC	700-HF32Z24
			48V DC	700-HF32Z48
Socket	700-HN116 700-HN262	700-HN116 700-HN262	110V DC	700-HF32Z1
4PDT 4-pole 4 Form C AgCdO Contact			6V AC	700-HF34A06
			12V AC	700-HF34A12
			24V AC	700-HF34A24
			120V AC	700-HF34A1
			240V AC	700-HF34A2
			6V DC	700-HF34Z06
			12V DC	700-HF34Z12
			24V DC	700-HF34Z24
			48V DC	700-HF34Z48
Socket	700-HN139 700-HN264	700-HN139 700-HN264	110V DC	700-HF34Z1

Note: Three pole-option is no longer available.

LED Option: Add suffix (-4) to the selected bulletin 700-HF relay Cat. No. except for the 240V AC units, add (-4L).

‡ Push-to-Test Manual Override and LED Option: Add suffix (-3-4) to the selected bulletin 700-HF Cat. No. except for the 240V AC units, add (-3-4L).

∂ Push-to-Test and Manual Override Option: Add suffix (-3) to the selected bulletin 700-HF relay.

Product Specifications

Electrical Ratings			700-HF 2 Pole	700-HF 4 Pole
Contacts	Inductive V AC	230V AC	AC 15 @ 700 VA / AC-1 @ 3000 VA / 1 Hp @ 240V AC	
		120V AC	1/2 Hp @ 120V AC	
	VDC	DC-1	12 A @ 30V DC / 0.5 A @ 110V DC / 0.25 A @ 220V DC	
	Resistive	AC	12 A @ 250 V AC (per pole)	
		DC	12 A @ 30 V DC (per pole)	
Operating Range		AC	80...110% Nominal Voltage	
		DC	80...110% Nominal Voltage	85...110% Nominal Voltage
Rated Power		AC (50 Hz)	1.5 VA	2 VA
		DC	1 W	1.3 W
Holding Voltage		AC	80% Nominal Voltage	
		DC	60% Nominal Voltage	
Must Drop Out Voltage		AC	20% Nominal Voltage	
		DC	10% Nominal Voltage	
Insulation Voltage			250V AC	
Design Specification/Test Requirements				
Dielectric Withstand Voltage		Pole-to-Pole	2500V AC	
		Contact to Pole	2500V AC	
Mechanical				
Degree of Protection			Open Type (Sockets)	
Mechanical Life Operations			20 x 10^6	
Switching Frequency Operations			3600/hr	
Operating Time at Nominal Voltage at 20 °C		Pickup	8 ms	10 ms
		Dropout	3 ms	4 ms
Maximum Operating Rate			4 Ops/s	
Vibration & Shock			15 G	
Environmental				
Temperature		Operating	–40…+70 °C (–40…+268 °F)	
		Storage	–50…+80 °C (–89…+176 °F)	
Construction				
Insulating Material			Molded High-Dielectric Material	
Enclosure			Transparent Dust Cover	
Contact Material			Silver Cad. Oxide	
Terminal Markings on Socket			In accordance with EN 500005	
Sockets			8-Blade Socket (DPDT) Cat. No. 700-HN116 & 700-HN262 14-Blade Socket (4PDT) Cat. No. 700-HN139 & 700-HN264	
Certifications			CSA Certified (File No. 229473), UL Recognized (File No. E3125, Guide NLDX2/NLDX8), CE Marked, UL Listed when used with sockets shown above, (File No. E3125, Guide NLDX/NLDX 7), LR Certified, RINA Certified, IMQ Certified	
Standards			UL 508, CSA 22.2 No. 14, EN-61810-1, EN 60998-1, EN 60998-2-1	

www.rockwellautomation.com

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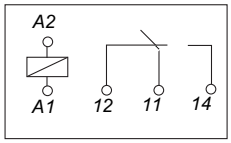
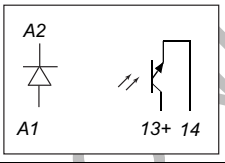
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 700-PP030A-EN-P – October 2012

Interposing/Isolation Relays

Product Selection

Standard built-in Features: • LED • Reverse Polarity Protection for DC Inputs • Surge Protection	 *Cat. No. 700-HLT1Z24*	 *Cat. No. 700-HLS1Z24*
Specifications		 ❶
Output Type	SPDT (1 C/O); I_{th} = 6A	1 N.O. solid-state; I_{th} = 2 A
Recommended Tightening Torque	0.5 Nm max. (4.4 lb.–in.)	0.5 Nm max (4.4 lb.–in.)
Wire Range	0.14 mm²…2.5 mm² (#26…#14 AWG)	0.14 mm²…2.5 mm² (#26…#14 AWG)
Approvals	cULus, cURus, ABS, CE	cULus, cURus, ABS, CE

Assembled Devices	Cat. No.	Pkg Qty.	Factory-stocked Item	Cat. No.	Pkg Qty.	Factory-stocked Item
Input Voltages:						
12V DC	700-HLT1Z12 ❷	10	✔	—	–	
24V DC	700-HLT1Z24 ❷	10	✔	700-HLS1Z24 ❷	10	✔
48V DC	700-HLT12Z48 ❷	10		700-HLS1Z48 ❷	10	
12V AC/DC	700-HLT1U12	10		—	—	
24V AC/DC	700-HLT1U24	10	✔	—	10	
48V AC/DC	700-HLT1U48	10		—	10	
110/125V AC/DC	700-HLT1U1	10	✔	700-HLS1U1 ❷	10	✔
220-240V AC/DC	700-HLT1U2	10	✔	700-HLS1U2 ❷	10	
Built-in LCSC (leakage current suppression circuit) 120V AC and 125V DC	700-HLT1L1 ❷ (Available in November 2001)	10		700-HLS1L1 ❷ (Available in November 2001)	10	
Built-in LCSC (leakage current suppression circuit) 240V AC	700-HLT1L2 ❷ (Available in November 2001)	10		700-HLS1L2 ❷ (Available in November 2001)	10	

❶ Reverse polarity on the output terminals of the solid-state relay will result in the output being "ON" regardless of the state of the input voltage.
❷ Electromechanical relay to solid-state relay interchangeability possible.

Interposing/Isolation Relays

Specifications ❶

Cat. No. 700-HLT… (Relay Output)			
Electrical Ratings			
Rated Thermal Current (I_{th})	1-Pole — 6 A		
Rated Insulation Voltage (U_i)	250V IEC, 300V UL/CSA		
Contacts	Inductive	1-Pole	
	24V AC, 1-phase 120V AC, 1-phase 240V AC, 1-phase	30 A ►][◄ 30 A 15 A	5 A ◄][► 3 A 1.5 A
	Make, Break, & Continuous V DC	24V DC 120V DC 240V DC	1.0 A 0.2 A 0.1 A
Min. Permissible Contact Ratings	12V, 6 mA (72 mW)		
Permissible Coil Voltage Variation	85…110% of Nominal Voltage at 50 Hz 85…110% of Nominal Voltage at 60 Hz 80…110% of Nominal Voltage at DC		
Power Consumption ±10%	AC	0.3 VA	
	DC	0.2 W	
Design Specification/Test Requirements			
Dielectric Withstand Voltage	Pole to Pole (VRMS)	1500 VA	
	Contact to Coil (VRMS)	4000 VA	
Mechanical			
Degree of Protection	IP20		
Mechanical Life Operations	1 x 10^7		
Switching Frequency Operations (no-load)	10 cycles/sec		
Coil Voltages	See Product Selection		
Operating Time at Nominal Voltage at 20°C (ms)	Pickup Dropout	7 ms 3 ms	
Maximum Operating Rate (full load = 6 A)	6 cycles/min.		
Environmental			
Temperature	Operating	–40…+55°C	
	Storage	-40…100°C	
Altitude	2000 m (6560 ft)		
Construction			
Insulating Material	Molded High Dielectric Material		
Enclosure	Relay IP67		
Contact Material	Silver Cad. Ox., AgSnO		
Terminal Markings on Socket	In accordance with EN50 0005		
Certifications	cULus, cURus, ABS, CE		

❶ Performance Data – See page Important-2, publication A113.

Model PSC

Car, Building Purpose High Performance Pressure Transducer

Description

PSC is compact size to vehicles and heavy machinery. It is also suitable for low pressure measurement and precise measurement. It builds an amplifier to interface with various kinds of controllers.

Features

- CE Certified
- VDC, mA output
- Measuring range 0~70MPa
- 0.25%FS accuracy
- IP55 protection(Cable type)
- Gauge and absolute measurement
- Piezoresistive silicon cell
- Stainless steel media-wetted materials

Applications

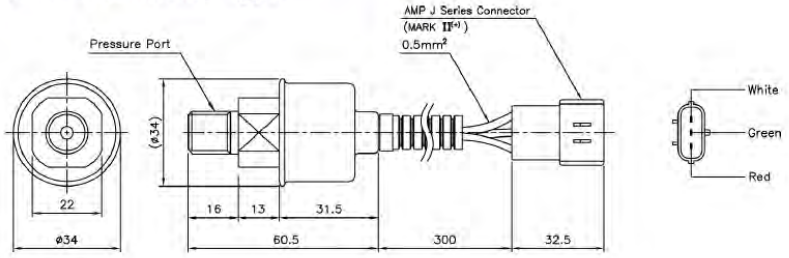
- Off road equipment
- Hydraulics & Pneumatic
- Compressor control
- Industrial engines
- Pump pressure control

Specifications

Range	
	0 ~ 5kPa ... 70MPa(Gauge)
	-100kPa ~ 0 ... 70MPa (Gauge)
	0 ~ 35kPa ... 70MPa (Absolute)
Performance	
Accuracy	±0.25%FS(RSS)
Thermal Effect on Zero	±0.05%FS/℃
Thermal Effect on Span	±0.05%FS/℃
Compensated Temperature Range	-10 ~ 70℃
Operating Temperature Range	-20 ~ 100℃ (Optional -30~120℃)
Electrical	
Excitation	11 ~ 28VDC
Output	0~5VDC, 1~5VDC, 0~10VDC, 4~20mA(2Wire)
Electrical Connection	Connector, Cable, AMP Connector(1~5VDC 3Wire Only), Head, Din Connector
Physical	
Proof Pressure	X3 or 140MPa, Whichever is less.
Burst Pressure	X4 or 210MPa, Whichever is less.
Vibration	49.1m/s2{5G}, 10~500Hz
Shock	490m/s2{50G}
Pressure port	R(PT)1/8", G(PF)1/8", R(PT)1/4", G(PF)1/4", R(PT)3/8", G(PF)3/8"
Media-Wetted Materials	Stainless Steel 304, 316L, VITON
Weight	Approx. 130g (AMP Connector Type)

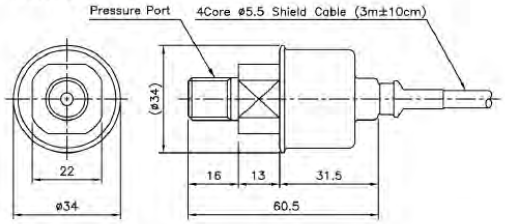
Dimension

▶ AMP Connector Type



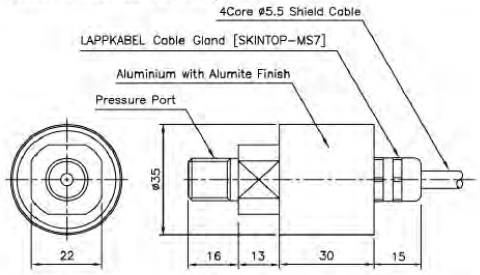
Wire Color	Connections
Red	Input ⊕
White	Common ⊖
Green	Output ⊕

▶ Cable Type



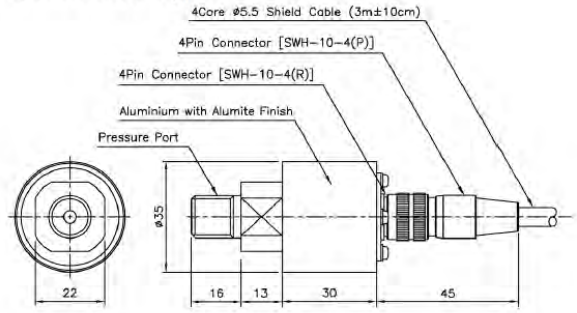
Wire Color	Connections		
	4Wire	3Wire	2Wire
Red	Input ⊕	Input ⊕	Input ⊕
White	Output ⊖	Common⊖	×
Black	Input ⊖	×	Output ⊕
Green	Output ⊕	Output ⊕	×
Shield	Earth	Earth	Earth

▶ Cable Gland Type



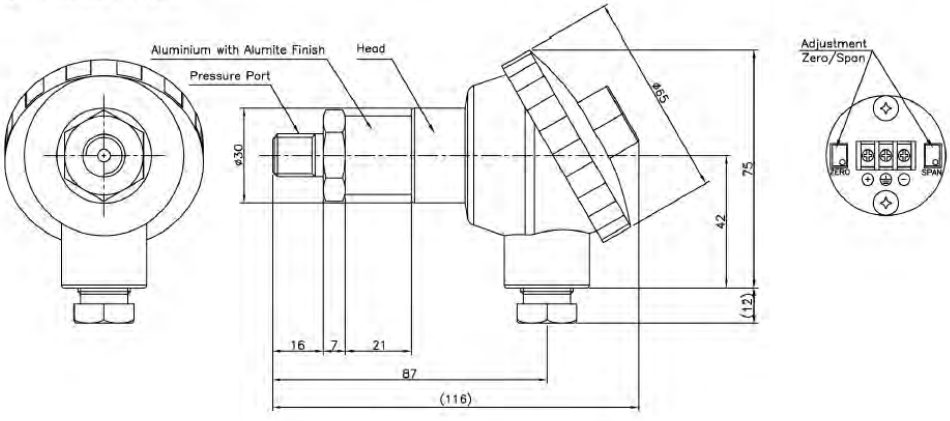
Wire Color	Connections		
	4Wire	3Wire	2Wire
Red	Input ⊕	Input ⊕	Input ⊕
White	Output ⊖	Common⊖	×
Black	Input ⊖	×	Output ⊕
Green	Output ⊕	Output ⊕	×
Shield	Earth	Earth	Earth

▶ Connector Type



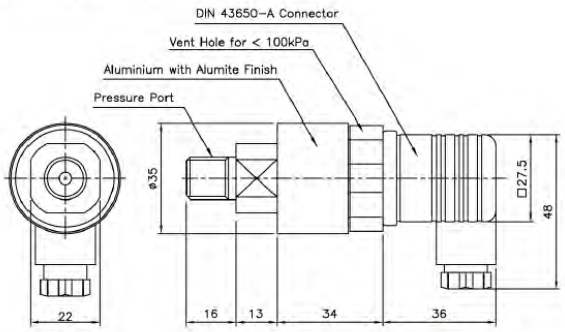
Pin No.	Wire Color	Connections		
		4Wire	3Wire	2Wire
1	Red	Input ⊕	Input ⊕	Input ⊕
2	White	Output ⊖	Common⊖	×
3	Black	Input ⊖	×	Output ⊕
4	Green	Output ⊕	Output ⊕	×
5	Shield	Earth	Earth	Earth

▶ Head Type



No.	Connections
	2Wire
+	Input ⊕
⏚	Earth
−	Output ⊕

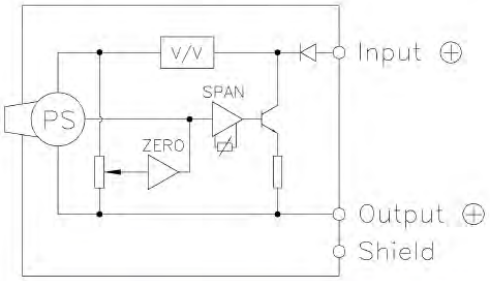
▶ Din connector Type



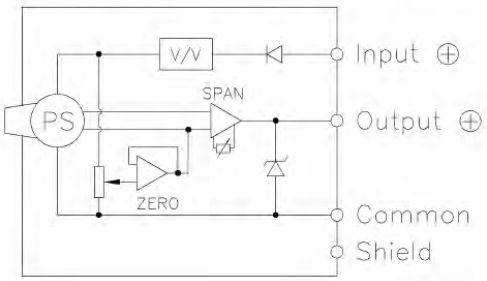
Pin No.	Connections	
	3Wire	2Wire
1	Input ⊕	Input ⊕
2	Common⊖	Output ⊕
3	Output ⊕	×
⏚	Earth	Earth

Internal Circuit Diagram

▶ 2Wire mA Output Type



▶ 3, 4Wire mA, VDC Output Type



Ordering Information

DISCHARGE PRESSURE SENSOR: PSCH0-1.5KCIG
PACKAGE & FILTER PRESSURE DROP SENSOR: PSCH0-0.05BCIG
ATMOSPHERIC PRESSURE SENSOR: PSCH0-120RCIJ

PSC E 0005 R A P G-□

Model Name

Output
- B : 4Wire 0~5V
- C : 3Wire 0~5V
- D : 4Wire 1~5V
- E : 3Wire 1~5V
- H : 2Wire 4~20mA
- J : 3Wire 0~10V
- K : 4Wire 0~10V

Pressure Range
- XXXX : Pressure
- CXXX : Compound Pressure

Pressure Unit
- R : kPa
- B : bar
- P : psi
- C : cmH_2O
- M : MPa
- K : kgf/cm^2
- H : mmHg

Option
- B : Termperature Range -30~120℃

Type of Pressure Measurement
- G : Gauge
- J : Absolute

Connecting Methods
- P : Connector
- C : Cable
- F : AMP Connector
- H : Head
- I : Din 43650-A connector
- S : Cable Gland

Pressure port
- A : R(PT)3/8"
- B : G(PF)3/8"
- C : R(PT)1/4"
- D : G(PF)1/4"
- G : R(PT)1/8"
- H : G(PF)1/8"

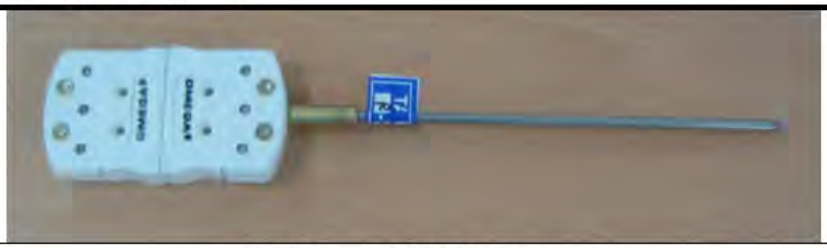
Sensys SENSOR SYSTEM TECHNOLOGY CO., LTD.
ADD : RM5010, Ansan Digital Park, 1123 Singil-Dong, Danwon-Gu, Ansan-Si, Geyonggi-Do, Korea
TEL : 82-31-310-8910~9
FAX : 82-31-310-8920
http://www.sensys.co.kr
e-mail : master@sensys.co.kr

· Specifications are subject to change without notice.

동양센서
ORIENTAL TEMP SENSOR

RTD and Thermocouple Sensors Specification

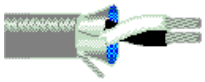
■ RTD(Resistance Temperature Detector) P/N: DS 4680 120L

Appearance		Note
Type	PT100, α=0.00385, 3-Wire	
Sheath Outer Dia.	Φ3.2 mm	
Wire Insulation	Teflon	
Accuracy	Class B (0±0.3 ℃, 100±0.8 ℃)	
Upper Temperature Limit	260 ℃	

Detailed Specifications & Technical Data

ENGLISH MEASUREMENT VERSION

8761 Multi-Conductor - Single-Pair Cable



For more Information please call

1-800-Belden1

General Description:

22 AWG stranded (7x30) TC conductors, polyethylene insulation, twisted pair, overall Beldfoil® shield (100% coverage), 22 AWG stranded TC drain wire, PVC jacket.

Physical Characteristics (Overall)

Conductor

AWG:

# Pairs	AWG	Stranding	Conductor Material
1	22	7x30	TC - Tinned Copper

Total Number of Conductors:	2

Insulation

Insulation Material:

Insulation Material	Wall Thickness (in.)
PE - Polyethylene	0.017

Outer Shield

Outer Shield Material:

Outer Shield Trade Name	Type	Outer Shield Material	Coverage (%)
Beldfoil®	Tape	Aluminum Foil-Polyester Tape w/shorting fold	100.000

Outer Shield Drain Wire AWG:

AWG	Stranding	Drain Wire Conductor Material
22	Stranded	TC - Tinned Copper

Outer Jacket

Outer Jacket Material:

Outer Jacket Material	Nom. Wall Thickness (in.)
PVC - Polyvinyl Chloride	.025

Overall Cable

Overall Cabling Lay Length & Direction:

Length (in.)	Direction	Twists (twist/ft)
2.000	Left Hand	6.000

Overall Nominal Diameter:	0.175 in.

Pair

Pair Color Code Chart:

Number	Color
1	Black & Clear

Mechanical Characteristics (Overall)

Operating Temperature Range:	-20°C To +60°C
UL Temperature Rating:	60°C (UL AWM Style 2092)
Bulk Cable Weight:	16 lbs/1000 ft.
Max. Recommended Pulling Tension:	27 lbs.
Min. Bend Radius/Minor Axis:	1.750 in.

Applicable Specifications and Agency Compliance (Overall)

Applicable Standards & Environmental Programs

NEC/(UL) Specification:	CM
NEC Articles:	800
CEC/C(UL) Specification:	CM
AWM Specification:	UL Style 2092 (300 V 60°C)
EU Directive 2011/65/EU (ROHS II):	Yes
EU CE Mark:	Yes

EU Directive 2000/53/EC (ELV):	Yes
EU Directive 2002/95/EC (RoHS):	Yes
EU RoHS Compliance Date (mm/dd/yyyy):	01/01/2004
EU Directive 2002/96/EC (WEEE):	Yes
EU Directive 2003/11/EC (BFR):	Yes
CA Prop 65 (CJ for Wire & Cable):	Yes
MII Order #39 (China RoHS):	Yes

Flame Test

UL Flame Test:	UL1685 UL Loading
CSA Flame Test:	FT1

Suitability

Suitability - Indoor:	Yes

Plenum/Non-Plenum

Plenum (Y/N):	No
Plenum Number:	88761, 87761, 82761

Electrical Characteristics (Overall)

Nom. Characteristic Impedance:

Impedance (Ohm)
64

Nom. Inductance:

Inductance (µH/ft)
0.2

Nom. Capacitance Conductor to Conductor:

Capacitance (pF/ft)
24

Nom. Capacitance Cond. to Other Conductor & Shield:

Capacitance (pF/ft)
47

Nom. Conductor DC Resistance:

DCR @ 20°C (Ohm/1000 ft)
16

Max. Operating Voltage - UL:

Voltage
300 V RMS (UL AWM Style 2092)

Max. Recommended Current:

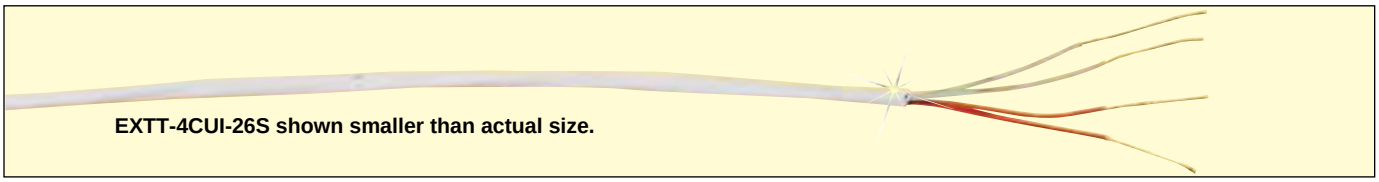
Description	Current
10C temperature rise	2.9 Amps per conductor @ 25°C ambient

Put Ups and Colors:

Item #	Putup	Ship Weight	Color	Notes	Item Desc
8761 060U1000	1,000 FT	17.000 LB	CHROME		2 #22 PE FS PVC
8761 060U500	500 FT	9.000 LB	CHROME		2 #22 PE FS PVC
8761 0601000	1,000 FT	18.000 LB	CHROME	C	2 #22 PE FS PVC
8761 06010000	10,000 FT	170.000 LB	CHROME	C Y	2 #22 PE FS PVC
8761 06010001	10,000 FT	170.000 LB	CHROME	C Z	2 #22 PE FS PVC
8761 06015000	15,000 FT	270.000 LB	CHROME	C Y	2 #22 PE FS PVC
8761 0602000	2,000 FT	36.000 LB	CHROME		2 #22 PE FS PVC
8761 060500	500 FT	9.000 LB	CHROME		2 #22 PE FS PVC
8761 0605000	5,000 FT	90.000 LB	CHROME	C	2 #22 PE FS PVC

Notes:
C = CRATE REEL PUT-UP.
Y = FINAL PUT-UP LENGTH MAY VARY -10% TO +20% FROM LENGTH SHOWN.MAY CONTAIN 2 PIECES. MINIMUM LENGTH OF ANY ONE PIECE IS 1500'.
Z = FINAL PUT-UP LENGTH MAY VARY (+ OR -) 10% FOR SPOOLS OR REELS AND(+ OR -) 5% FOR UNREEL CARTONS FROM LENGTH SHOWN.

RTD and Thermistor Extension Wire



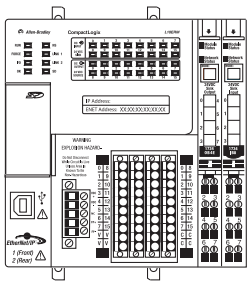
EXTT-4CUI-26S shown smaller than actual size.

AWG No.	Model Number	# of Con.	Wire Type	Conductor Material	Conductor	Overall	Braid	°C*	°F*	Nominal Size: mm (in)	Wt. kg/300 m (lb/1000')†	Color Code	Outer Jacket Color
Glass Insulation													
20	**EXGG-2CU-20**	2	Solid	NPC	Glass braid	Glass braid	None	482	900	1.5 x 2.4 (0.060 x 0.095)	4 (9)	1 Red 1 Black	White
26	**EXGG-2CU-26S**	2	7 x 34	NPC			None	482	900	1.5 x 1.3 (0.060 x 0.052)	2 (5)	1 Red 1 Black	White
26	**EXGG-3CU-26S**	3	7 x 34	NPC			None	482	900	1.5 x 1.6 (0.060 x 0.064)	3 (7)	1 Red 2 Black	White
26	**EXGG-4CU-26S**	4	7 x 34	NPC			None	482	900	1.5 x 1.7 (0.060 x 0.066)	4 (9)	2 Red 2 Black	White
26	**EXGG-2CUI-26S**	2	7 x 34	NPC			None	482	900	2.1 Ø (0.083 dia.)	2.2 (5)	1 Red 1 White	White
26	**EXGG-3CUI-26S**	3	7 x 34	NPC			None	482	900	2.2 Ø (0.087 dia.)	3.2 (7)	2 Red 1 White	White
26	**EXGG-4CUI-26S**	4	7 x 34	NPC			None	482	900	2.4 Ø (0.095 dia.)	4.2 (9.3)	2 Red 2 White	White
Glass with Outer Braid Insulation													
26	**EXGG-2CUI-26S-SB**	2	7 x 34	NPC	Glass braid	Glass braid	SST	482	900	2.8 Ø (0.110 dia.)	5.2 (11.5)	1 Red 1 White	SST braid
26	**EXGG-3CUI-26S-SB**	3	7 x 34	NPC			SST	482	900	2.9 Ø (0.114 dia.)	6.2 (13.7)	2 Red 1 White	SST braid
26	**EXGG-4CUI-26S-SB**	4	7 x 34	NPC			SST	482	900	3.1 Ø (0.122 dia.)	7.2 (15.9)	2 Red 2 White	SST braid
Neoflon® PFA Insulation													
26	**EXTT-2CU-26S**	2	7 x 34	NPC	PFA	PFA	None	260	500	1.1 x 1.7 (0.042 x 0.068	2 (5)	1 Red 1 Black	White
26	**EXTT-3CU-26S**	3	7 x 34	NPC			None	260	500	11.8 Ø (0.072 dia.)	4 (9)	1 Red 2 Black	White
26	**EXTT-4CU-26S**	4	7 x 34	NPC			None	260	500	2.1 Ø (0.082 dia.)	5 (11.5)	2 Red 2 Black	White
26	**EXTT-2CUI-26S**	2	7 x 34	NPC			None	260	500	2.1 Ø (0.083 dia.)	2.2 (5)	1 Red 1 White	White
26	**EXTT-3CUI-26S**	3	7 x 34	NPC			None	260	500	2.2 Ø (0.087 dia.)	4.2 (9.3)	2 Red 1 White	White
26	**EXTT-4CUI-26S**	4	7 x 34	NPC			None	260	500	2.4 Ø (0.095 dia.)	5.2 (11.5)	2 Red 2 White	White
PFA with Shield Insulation													
26	**EXTT-2CUI-26S-SB**	2	7 x 34	NPC	PFA	PFA	SST	260	500	2.8 Ø (0.110 dia.)	5.2 (11.5)	1 Red 1 White	SST braid
26	**EXTT-3CUI-26S-SB**	3	7 x 34	NPC			SST	260	500	2.9 Ø (0.114 dia.)	7.2 (15.9)	2 Red 1 White	SST braid
26	**EXTT-4CUI-26S-SB**	4	7 x 34	NPC			SST	260	500	3.1 Ø (0.122 dia.)	8.2 (18.1)	2 Red 2 White	SST braid
Polyvinyl (PVC) Insulation													
24	**EXPP-2CU-24S**	2	7 x 32	NPC	Polyvinyl	Polyvinyl	None	105	221	2.1 x 3.4 (0.082 x 0.134)	5 (10)	1 Red 1 Black	White
24	**EXPP-3CU-24S**	3	7 x 32	NPC			None	105	221	4.22 Ø (0.166 dia.)	6 (14)	1 Red 2 Black	White
24	**EXPP-4CU-24S**	4	7 x 32	NPC			None	105	221	4.3 Ø (0.169 dia.)	7 (15.5)	2 Red 2 Black	White
24	**EXPP-2CUI-24S**	2	7 x 32	NPC			None	105	221	2.1 x 3.4 (0.082 x 0.134)	5 (10)	1 Red 1 White	White
24	**EXPP-3CUI-24S**	3	7 x 32	NPC			None	105	221	4.22 Ø (0.166 dia.)	6 (14)	2 Red 1 White	White
24	**EXPP-4CUI-24S**	4	7 x 32	NPC			None	105	221	4.3 Ø (0.169 dia.)	7 (15.5)	2 Red 2 White	White
Polyvinyl (PVC) with Shield Insulation													
24	**EXPP-2CUI-24S-TCB-P**	2	7 x 32	NPC	Polyvinyl	Polyvinyl	Tinned copper	105	221	2.8 x 4.0 (0.110 x .157)	8 (17.7)	1 Red 1 White	White
24	**EXPP-3CUI-24S-TCB-P**	3	7 x 32	NPC			Tinned copper	105	221	4.9 Ø (0.193 dia.)	9 (19.9)	2 Red 1 White	White
24	**EXPP-4CUI-24S-TCB-P**	4	7 x 32	NPC			Tinned copper	105	221	5.0 Ø (0.197 dia.)	10 (22)	2 Red 2 White	White

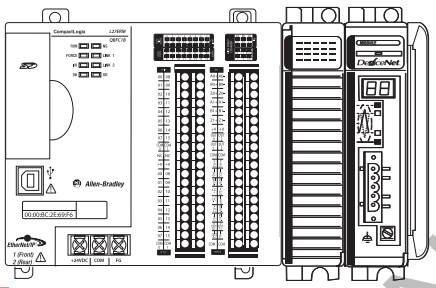
** Maximum temperature is for wire or insulation, whichever is lower.*
† Weight of spool and wire rounded to the next highest kilogram (lb); does not include packing material.
Conductors can be welded (spliced) within spool.
***Ordering Example: EXTT-3CU-26S-1000,** 1000' of #26 AWG PFA insulated wire with 3 conductors.*

CompactLogix 5370 Controllers

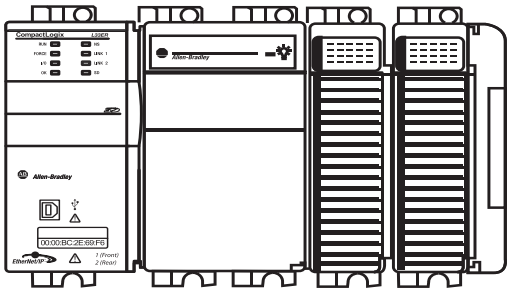
CompactLogix 5370 L1 Control System



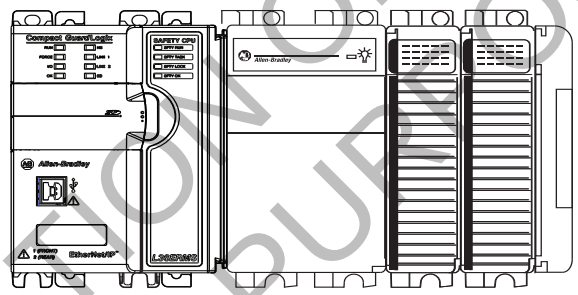
CompactLogix 5370 L2 Control System



CompactLogix 5370 L3 Control System



Compact GuardLogix® 5370 Control System



CompactLogix 5370 controllers provide scalable controller solutions to address a wide variety of applications. All CompactLogix 5370 controllers provide the following functionality:

- Two EtherNet™/IP ports
- One USB port
- Support for local expansion modules
- Control of local and distributed I/O modules
- Use of 1784-SD1 or 1784-SD2 Secure Digital (SD) card for nonvolatile memory
- A battery is no longer necessary because of the internal energy-storage solution

Some CompactLogix 5370 controllers provide the following functionality:

- Built-in power supply
- Some combination of embedded digital, analog, and high-speed counter modules
- Support for Integrated Motion over an EtherNet/IP network
- Access to DeviceNet™ networks

The Compact GuardLogix controller is a 1769-L3 CompactLogix controller that provides safety control to achieve SIL CL3 according to EN62061 / EN 61511-1 / IEC 61508 and PLe according to EN ISO 13849-1. A major benefit of this system is that it is still one project, safety and standard together.

Application	Description
SIL 1, 2, 3	The Compact GuardLogix controller system is type-approved and certified for use in safety applications up to and including SIL 3 according to IEC 61508, and applications up to and including PLe/Cat.4 according to ISO 13849-1. For more information, see the following: • GuardLogix 5570 and Compact GuardLogix 5370 Controllers Systems Safety Reference Manual, publication 1756-RM099 • Compact GuardLogix 5370 Controllers User Manual, publication 1769-UM002 • GuardLogix Safety Application Instruction Set Reference Manual, publication 1756-RM095

During development, safety and standard have the same rules. The following are allowed:

- Multiple programmers
- Online editing
- Forcing

Once the project is tested and ready for final validation, you apply the safety application signature and safety-lock the application. This process sets the safety task to a SIL 3 integrity level. The Compact GuardLogix enforces the SIL 3 integrity level. When safety memory is locked and protected, the safety logic cannot be modified and all safety functions operate with SIL 3 integrity. On the standard side of the Compact GuardLogix controller, all functions operate like a regular Logix controller. Thus online editing, forcing, and other activities are all allowed.

Standard logic and external devices, like HMIs or other controllers, can read safety memory with this level of integration. This level of integration removes the need to condition safety memory for use elsewhere. The result is easy system-wide integration and the ability to display safety status on displays or marquees. Use Guard I/O™ modules for field device connectivity. For safety interlocking between Compact GuardLogix controllers, use Ethernet or ControlNet™ networks. Multiple Compact GuardLogix controllers can share safety data for zone to zone interlocking, or one Compact GuardLogix controller can use remote distributed safety I/O between different cells/areas.

Features - CompactLogix 5370 Controllers and Compact GuardLogix 5370 Controllers

Feature	1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B, 1769-L19ER-BB1B	1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B	1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM	1769-L30ERMS, 1769-L33ERMS, 1769-L36ERMS
Controller tasks: • Continuous • Periodic	• 32 tasks • 100 programs/task			
Built-in communication ports	• Two EtherNet/IP ports - CompactLogix 5370 controllers have two EtherNet/IP ports to connect to an EtherNet/IP network. The ports carry the same network traffic as part of the embedded switch of the controller. However, the controller uses only one IP address. • One USB port (only for temporary connection)			
Communication options	EtherNet/IP	• EtherNet/IP • DeviceNet via 1769-SDN scanner		
EtherNet/IP node, max	• 1769-L16ER-BB1B: Up to four nodes • 1769-L18ER-BB1B, 1769-L18ERM-BB1B, 1769-L19ER-BB1B: Up to 8 nodes	• 1769-L24ER-QB1B, 1769-L24ER-QBFC1B: Up to 8 nodes • 1769-L27ERM-QBFC1B: Up to 16 nodes	• 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L30ERMS: Up to 16 nodes • 1769-L33ER, 1769-L33ERM, 1769-L33ERMS: Up to 32 nodes • 1769-L36ERM, 1769-L36ERMS: Up to 48 nodes	
Controller connections	256			
Embedded I/O modules	• 16 DC digital inputs • 16 DC digital outputs	All controllers: • 16 DC digital inputs • 16 DC digital outputs Only 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B: • 4 high-speed counters • 4 high-speed counter outputs • 4 universal analog inputs • 2 analog output points	–	
Sockets, max	32			
Integrated Motion over an EtherNet/IP network	1769-L18ERM-BB1B - 1 or 2 axes	1769-L27ERM-QBFC1B - As many as 4 axes	• 1769-L30ERM, 1769-L30ERMS - As many as 4 axes • 1769-L33ERM, 1769-L33ERMS - As many as 8 axes • 1769-L36ERM, 1769-L36ERMS - As many as 16 axes	
Programming languages	• Relay ladder(1) • Structured Text • Function block • SFC			
Integrated safety	–			Yes

(1) The Compact GuardLogix 5370 controllers support only the relay ladder programming language in the safety task. The Compact GuardLogix 5370 controllers support all listed programming languages in the standard task.

Technical Specifications - CompactLogix 5370 Controllers and Compact GuardLogix 5370 Controllers

Attribute	1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B, 1769-L19ER-BB1B	1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B	1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM	1769-L30ERMS, 1769-L33ERMS, 1769-L36ERMS
User memory	• 1769-L16ER: 384 KB • 1769-L18ER, 1769-L18ERM: 512 KB • 1769-L19ER-BB1B: 1 MB	• 1769-L24ER-QB1B, 1769-L24ER-QBFC1B: 750 KB • 1769-L27ERM-QBFC1B: 1 MB	• 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM: 1 MB • 1769-L33ER, 1769-L33ERM: 2 MB • 1769-L36ERM: 3 MB	• 1769-L30ERMS: 1 MB standard + 0.5 MB safety • 1769-L33ERMS: 2 MB standard + 1 MB safety • 1769-L36ERMS: 3 MB standard + 1.5 MB safety
Optional nonvolatile memory	1784-SD1 card with 1 Gb of available memory (shipped with controller) 1784-SD2 card with 2 Gb of available memory (available for separate ordering)			
Number of local expansion modules, max[1]	• 1769-L16ER-BB1B: Six 1734 POINT I/O™ modules • 1769-L18ER-BB1B, 1769-L18ERM-BB1B, 1769-L19ER-BB1B: Eight 1734 POINT I/O modules	Four 1769 Compact I/O™ modules	• 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L30ERMS: Eight 1769 Compact I/O modules • 1769-L33ER, 1769-L33ERM, 1769-L33ERMS: Sixteen 1769 Compact I/O modules • 1769-L36ERM, 1769-L36ERMS: Thirty 1769 Compact I/O modules	
Number of I/O module banks, max	–	1	3	
Current draw @ 5V DC, controller power	1 A	• 1769-L24ER-QB1B: 1.54 A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F). • 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B: 1 A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F).	500 mA	850 mA
Current draw @ 24V DC, controller power	–	• 1769-L24ER-QB1B: 0.95A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F). • 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B: 0.8 A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F).	225 mA	700 mA
Current draw @ 24V DC, field power, max	3 A - Combined total for all devices that draw current from field power connections Input: 5 mA Output: 500 mA	–		
Power dissipation, max	11.5 W	• 1769-L24ER-QB1B: 12 W • 1769-L24ER-QBFC1B, L27ERM-QBFC1B: 21 W	4.5 W	6.5 W
Isolation voltage	50V (continuous), Basic Insulation Type Tested at 500V AC for 60 s, System to Field	30V (continuous), Basic Insulation Type, USB to system, Ethernet to system and Ethernet to Ethernet Type tested at 500V AC for 60 s		50V, Basic Insulation Type Tested at 500V AC for 60 s, System to Communication ports.
Short circuit protection, field power	Internal fuse, Non-replaceable	–		
Recommended external short circuit protection, field power	User-provided 4…5 A @ 3.15…5.5 A^2t fuse	–		
Weight, approx	0.66 kg (1.5 lb)	• 1769-L24ER-QB1B = 0.63 kg (1.39 lb) • 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B = 0.9 kg (1.9 lb)	0.31 kg (0.68 lb)	0.54 kg (1.18 lb)

Technical Specifications - CompactLogix 5370 Controllers and Compact GuardLogix 5370 Controllers (continued)

Attribute	1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B, 1769-L19ER-BB1B	1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B	1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM	1769-L30ERMS, 1769-L33ERMS, 1769-L36ERMS
Module width	100.00 mm (3.94 in.)	1769-L24ER-QB1B = 115.00 mm (4.53 in.) 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B = 140 mm (5.51 in.)	55.00 mm (2.17 in.)	89.00 mm (3.50 in.)
Module location	DIN rail mount	DIN rail or panel mount		
Panel-mounting screw torque	N/A	1.1…1.8 N•m (10…16 lb•in) - use M4 or #8 screws		
Embedded power supply	24V DC input, isolated	24V DC Input, isolated	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4	
Power supply distance rating	–		• Controller and 1769-SDN: 4 • 1769 Compact I/O modules: 4…8, depending on module	4 (3 I/O modules between controller and power supply)
Wire category(2)	1 - signal ports 1 - power ports 2 - communication ports		2 - communication ports	
Wire type, Ethernet	RJ45 connector according to IEC 60603-7, 2 or 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702			
Wire type, power terminals and embedded I/O connections	Copper		–	
Wire size, power terminals(3)	0.051…3.31 mm^2 (30…12 AWG) solid or stranded copper wire rated at 75 °C (167 °F), or greater, 1.2 mm (3/64 in.) insulation, max Each terminal accepts 1 or 2 wires	0.25…2.50 mm^2 (22…14 AWG) solid copper wire rated at 75 °C (167 °F), or greater 1.2 mm (3/64 in.) insulation, max Each terminal accepts only 1 wire	–	
Wire stripping length, power terminals(3)	10 mm (0.39 in)	8 mm (0.31 in)	–	
Screw torque, power terminals(3)	0.5…0.6 N•m (4.4…5.3 lb•in)	1.0…1.2 N•m (8.9…10.6 lb•in)	–	
Wire size, embedded I/O connections	0.205…1.31 mm^2 (24…16 AWG) solid or stranded copper wire rated at 75 °C (167 °F), or greater 1.2 mm (3/64 in.) insulation, max or 90 °C (194 °F) Each terminal accepts only 1 wire		–	
Wire stripping length, embedded I/O connections	10 mm (0.39 in)		–	
North American temperature code	T4A	T3C	T5	
IEC temperature code	T4		T5	
Enclosure type rating	None (open-style)			

(1) You can use up to the maximum number of local expansion modules with the CompactLogix 5370 L1 controllers that are listed. This condition applies if only the total current drawn by the embedded I/O and local expansion modules does not exceed both the available POINTBus™ backplane current of 1 A and the field power current of 3 A. For more information on POINTBus backplane current and field-power current considerations when installing local expansion modules, see page 12.

(2) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 and the appropriate system-level installation manual.

(3) In regard to the CompactLogix 5370 L1 controllers, this specification applies to connecting wires to the power connector that is inserted in the controller. In regard to the CompactLogix 5370 L2 controllers, this specification applies to connecting wires to power terminals built into the controller.

1769 Compact I/O Power Supplies

Each 1769-L3*x* controller and additional bank of I/O modules requires a 1769 power supply. Place 1769 I/O modules to the left or right of the 1769 power supply. As many as eight I/O modules can be placed on each side of the power supply.

Each 1769 module also has a power supply distance rating (the number of modules from the power supply). Each module must be located within its distance rating. See the specifications for the module to determine its distance rating.

Technical Specifications - 1769 Compact I/O Power Supplies

Attribute	1769-PA2	1769-PB2	1769-PA4	1769-PB4
Input voltage range	85…265V AC	19.2...31.2V DC	85…265V AC or 170...265V AC, switch selectable	19.2...31.2V DC
Input voltage, nom	120V/220V AC	24V DC	120V/220V AC	24V DC
Power consumption	100 VA @ 120V AC 130 VA @ 240V AC	50 VA @ 24V DC	200 VA @ 120V AC 240 VA @ 240V AC	100 VA @ 24V DC
Power dissipation	8 W @ 60° C (140° F)	7.5 W @ 60° C (140° F)	18 W @ 60° C (140° F)	14.5 W @ 60° C (140° F)
Current capacity @ 5V	2.0 A	2.0 A	4.0 A	4.0 A
Current capacity @ 24V	0.8 A	0.8 A	2.0 A	2.0 A
Inrush current, max	25 A @ 132V AC	30 A @ 31.2V DC	25 A @ 132V AC	30 A @ 31.2V DC
Isolation voltage	265V (continuous), reinforced insulation type (IEC Class 1 grounding required) Routine tested @ 2596V DC for 1 s, AC power input to system and AC power input to 24V DC user power	75V (continuous), reinforced insulation type (IEC Class 1 grounding required) Routine tested at 1697V DC for 1 s, DC power input to system	265V (continuous), reinforced insulation type (IEC Class 1 grounding required) Routine tested at 2596V DC for 1 s, AC power input to system	75V (continuous), reinforced insulation type (IEC Class 1 grounding required) Routine tested at 1697V DC for 1 s, DC power input to system
Fuse type	Wickmann 19195-3.15A Littelfuse 02183.15MXP	Wickmann 19193-6.3A Littelfuse 021706.3MXP	Wickmann 19195-3.15A Littelfuse 02183.15MXP	Wickmann 19193-6.3A Littelfuse 021706.3MXP
Weight, approx.	525 g (1.16 lb)		630 g (1.39 lb)	
Dimensions (HxWxD), approx.	118 x 70 x 87 mm (4.65 x 2.76 x 3.43 in.)			
Module location	DIN rail or panel mount			
Mounting screw torque	1.16 N•m (10 lb•in) - use M4 or #8 screws			
Power supply distance rating	8 8 I/O modules can be connected on either side of the power supply for a maximum of 16 modules			
Wire category[1]	1 - on power ports	2 - on power ports	1 - on power ports	2 - on power ports
Wire size	14 AWG (2.5 mm^2) solid copper wire rated at 90 °C (194 °F) or greater, 1.2 mm (3/64 in.) insulation max			
North American temperature code	T3C			
IEC temperature code	—	T4	—	T4
Enclosure type rating	None (open-style)			

[1] Use this conductor category information for planning conductor routing as described in the system level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Certifications - 1769 Compact Power Supplies

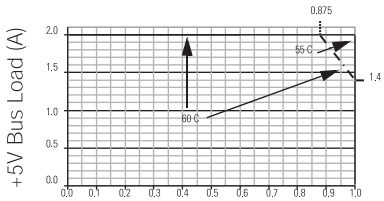
Certification[1]	1769-PA2, 1769-PA4	1769-PB2, 1769-PB4
c-UL-us	UL Listed for Class 1, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E10314	
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions	
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions	
	—	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" (Zone 2) • EN 60079-0; General Requirements (Zone 2)

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

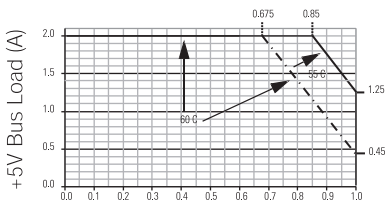
Power Requirements and Transformer Sizing - 1769 CompactLogix Power Supplies

1769-PA2 Output Derating

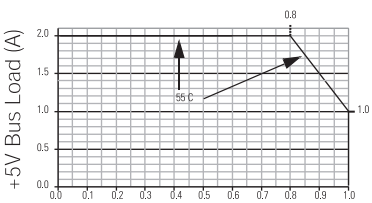
User +24V Current Draw at 0 A



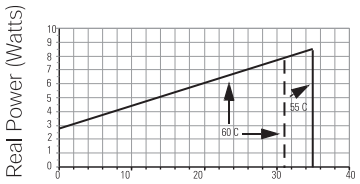
User +24V Current Draw at 0.2 A



User +24V Current Draw at 0.25 A

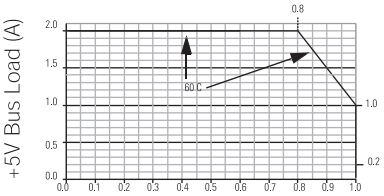


1769-PA2 Power Disspation

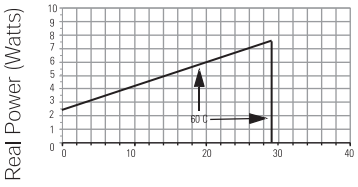


Bus +5V, +24V, and User Load (Watts)

1769-PB2 Output Derating



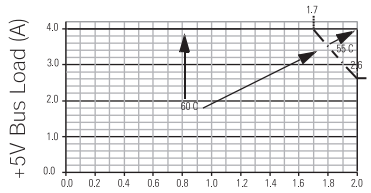
1769-PB2 Power Dissipation



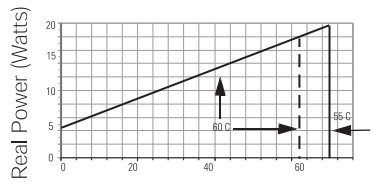
Bus +5V, +24V, and User Load (Watts)

1769-PA4 Output Derating

Total Output: 68 W @ 55 °C (131 °F) or below
61 W @ 60 °C (140 °F) or below



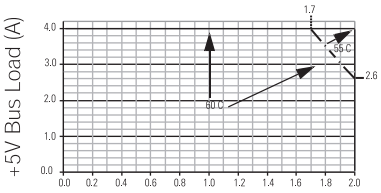
1769-PA4 Power Disspation



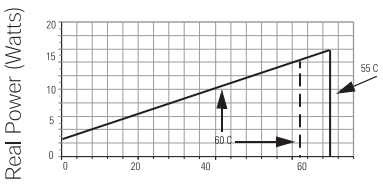
Bus +5V, +24V, and User Load (Watts)

1769-PB4 Output Derating

Total Output: 68 W @ 55 °C (131 °F) or below
61 W @ 60 °C (140 °F) or below

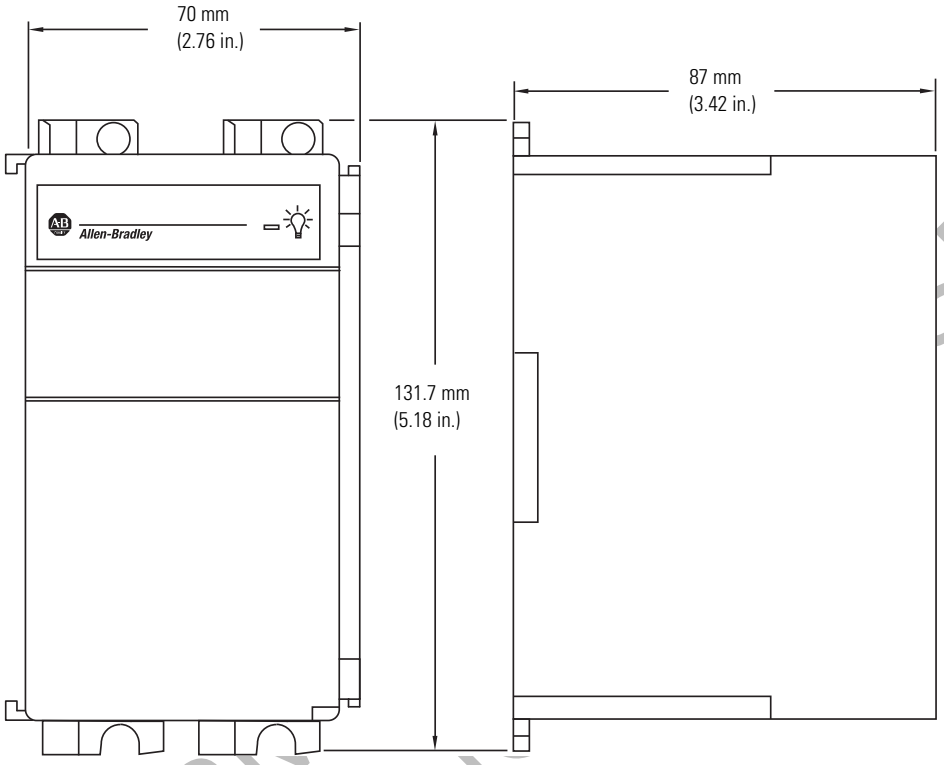


1769-PB4 Power Disspation



Bus +5V, +24V, and User Load (Watts)

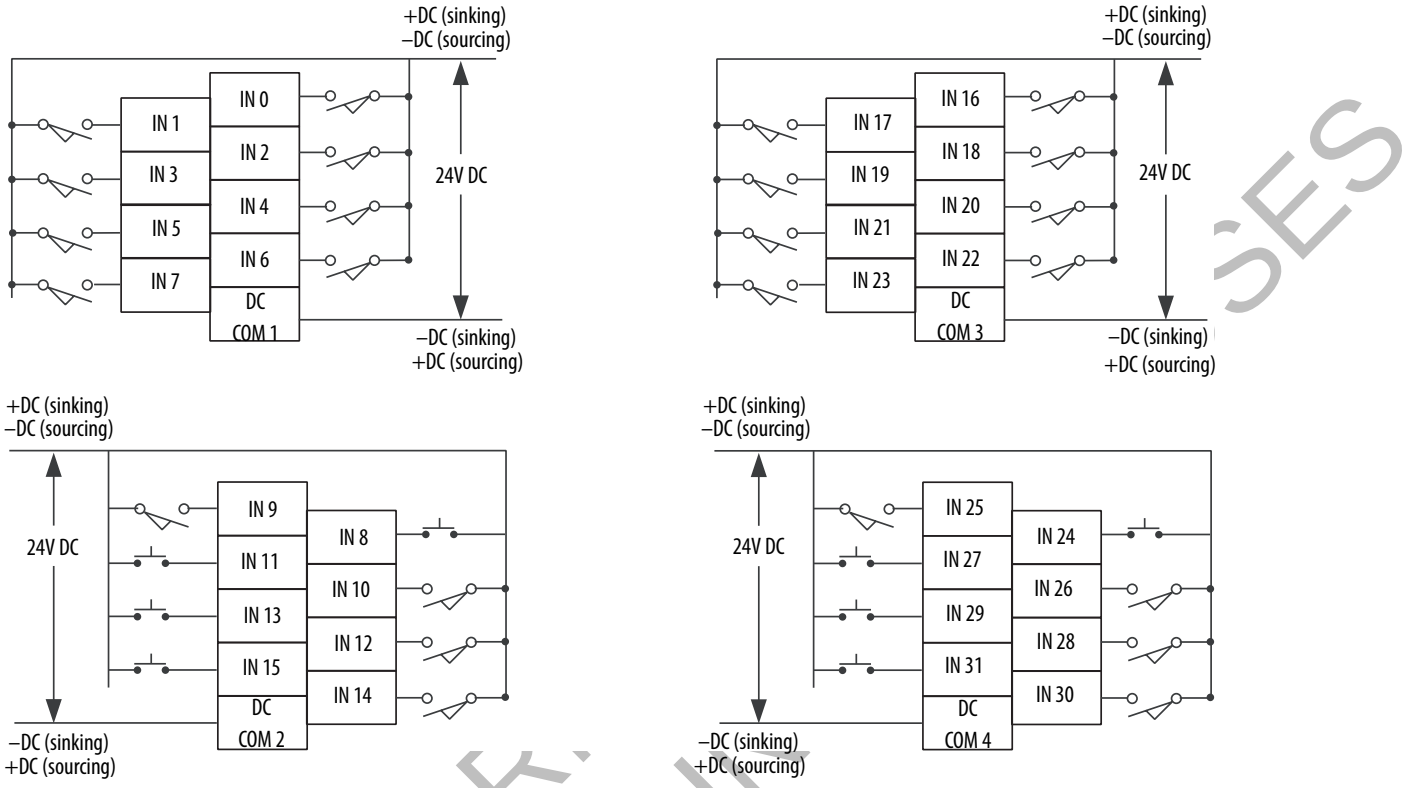
Mounting Dimensions - 1769 CompactLogix Power Supplies



1769-IQ32

Compact 24V DC sink/source input module

1769-IQ32



Technical Specifications - 1769-IQ32

Attribute	1769-IQ32
Inputs	32 (8 points/group)
Voltage category	24V DC sink/source
Operating voltage range	10…30V DC @ 30 °C (86 °F) 10…26.4V DC @ 60 °C (140 °F)
Input delay, on	8 ms
Input delay, off	8 ms
Current draw @ 5.1V	170 mA
Heat dissipation, max	4.6 W
Off-state voltage, max	5V DC
Off-state current, max	1.5 mA
On-state voltage, min	10V DC
On-state current, min	2 mA
Inrush current, max	250 mA
Input impedance, nominal	5.2 kΩ @ 24V DC 6.1 kΩ @ 30V DC
Isolation voltage	Verified by one of these dielectric tests: 1200V AC for 1 s or 1697V DC for 1 s, input point to bus and group to group 75V DC working voltage (IEC Class II reinforced insulation)
Weight, approx	440 g (0.97 lb)

Technical Specifications - 1769-IQ32

Attribute	1769-IQ32
Dimensions (HxWxD), approx	118 x 52.5 x 87 mm (4.65 x 2.07 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)
Slot width	1.5
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	8 modules
Terminal screw torque	0.68 N•m (6 lb•in)
Retaining screw torque	0.46 N•m (4.1 lb•in)
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
IEC input compatibility	Type 1+
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door	Not available
Vendor ID code	1
Product type code	7
Product code	68
Enclosure type rating	None (open-style)

See Environmental Specifications - 1769 Compact I/O Modules on page 3.

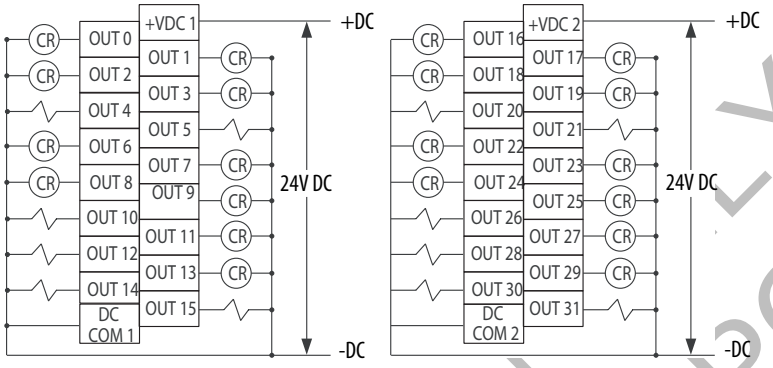
Certifications - 1769-IQ32

Certification(1)	1769-IQ32
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E10314. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E10314.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation

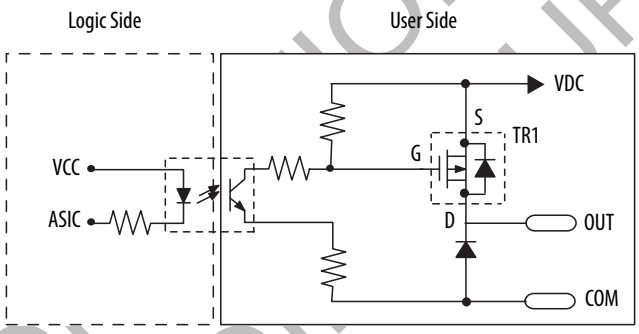
(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

1769-OB32

Compact solid-state 24V DC source output module



Simplified Output Circuit Diagram



Technical Specifications - 1769-OB32

Attribute	1769-OB32
Outputs	32 (16 points/group)
Voltage category	24V DC source
Operating voltage range	20.4…26.4V DC
Output delay, on	0.1 ms
Output delay, off	1.0 ms
Current draw @ 5.1V	300 mA
Heat dissipation, max	4.5 W
Off-state leakage current, max(1)	1.0 mA @ 26.4V DC
On-state current, min	1.0 mA
On-state voltage drop, max	1.0V DC @ 1 A
Current per point, max	0.5 A @ 60 °C (140 °F) 1.0 A @ 30 °C (86 °F)
Current per module, max	4.0 A @ 60 °C (140 °F) 8.0 A @ 30 °C (86 °F)
Surge current(2)	2.0 A for 10 ms, repeatable every 2 s
Isolation voltage	Verified by one of these dielectric tests: 1200V AC for 1 s or 1697V DC for 1 s, output point to bus 75V DC working voltage (IEC Class II reinforced insulation)
Weight, approx	450 g (0.992 lb)
Dimensions (HxWxD), approx	118 x 52.5 x 87 mm (4.65 x 2.07 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)

Technical Specifications - 1769-0B32

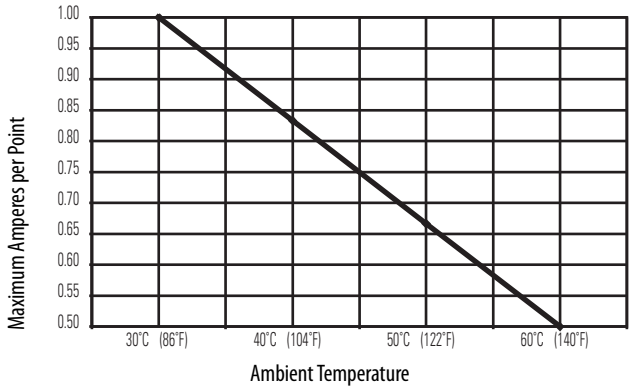
Attribute	1769-0B32
Slot width	1.5
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	6 modules
Terminal screw torque	0.68 N•m (6 lb•in)
Retaining screw torque	0.46 N•m (4.1 lb•in)
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door	Not available
Vendor ID code	1
Product type code	7
Product code	73
Enclosure type rating	None (open style)

(1) To limit the effects of leakage current through solid-state outputs, a loading resistor can be connected in parallel with your load. Use a 5.6 kΩ, 1/2 W resistor for transistor outputs, 24V DC operation.
(2) Use a 1N4004 diode reverse-wired across the load for transistor outputs switching 24V DC inductive loads.

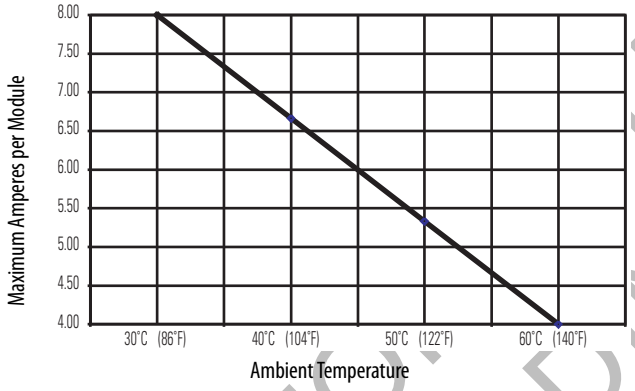
See Environmental Specifications - 1769 Compact I/O Modules on page 3.

Temperature Derating - 1769-OB32

1769-OB32 Maximum Amperes per Point Versus Temperature



1769-OB32 Maximum Amperes per Module Versus Temperature



Certifications - 1769-OB32

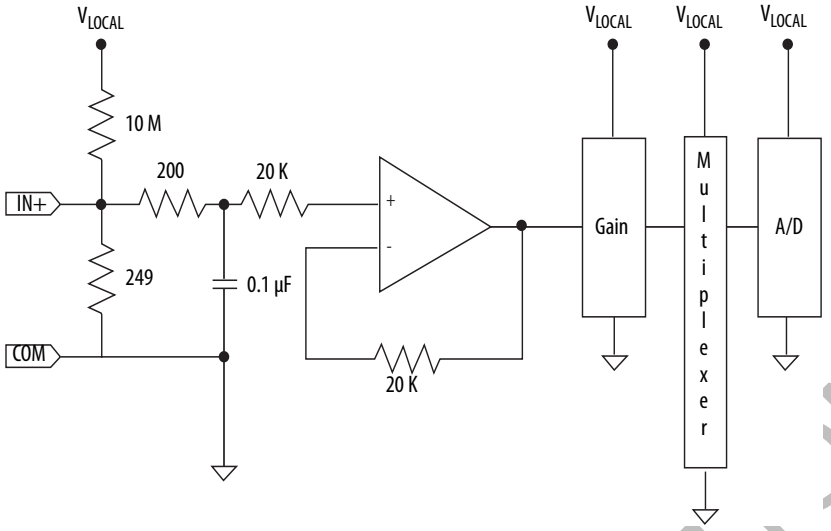
Certification[1]	1769-OB32
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E10314. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E10314.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation

(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

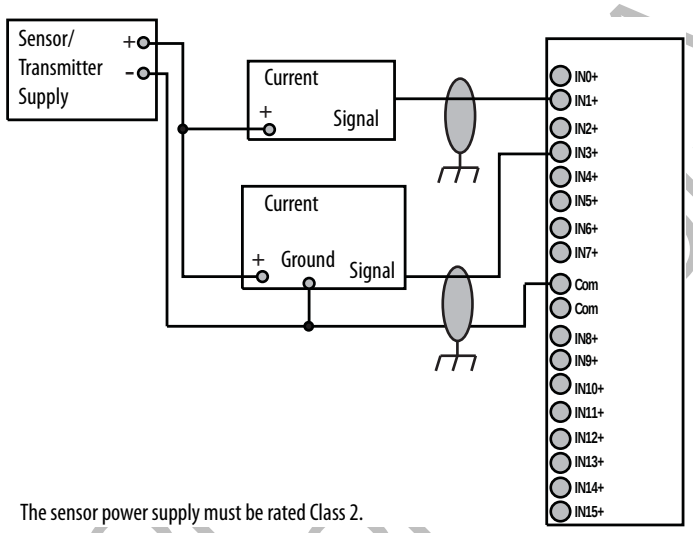
1769-IF16C

Compact current analog input module

Simplified Input Circuit Diagram



1769-IF16C Sensor/Transmitter Inputs



The sensor power supply must be rated Class 2.

Technical Specifications - 1769-IF16C

Attribute	1769-IF16C
Inputs	16 single-ended
Input range	0…20 mA 4…20 mA
Full scale range(1)	0…21 mA 3.2…21 mA
Current draw @ 5.1V	190 mA
Current draw @ 24V	70 mA
Heat dissipation, max	4.0 W
Converter type	Sigma Delta
Resolution (2)	16 bits (unipolar) 15 bits plus sign (bipolar)
Rated working voltage(3)	30V AC/30V DC

Technical Specifications - 1769-IF16C

Attribute	1769-IF16C
Common mode voltage range[4]	±10V DC max per channel
Common mode rejection	> 60 dB @ 50 and 60 Hz with the 16 Hz filter selected
Input impedance	249 Ω
Accuracy[5]	±0.5% full scale @ 25 °C (77 °F)
Accuracy drift with temperature	±0.0045% per °C
Nonlinearity	±0.03%
Repeatability[6]	±0.03%
Module error	1.25%
Overload at input terminals, max[7]	±28 mA continuous, ±7.6V DC
Isolation voltage	500V AC or 710V DC for 1 minute (qualification test), group to bus 30V AC/30V DC working voltage (IEC Class II reinforced insulation)
Weight, approx	281 g (0.62 lb)
Dimensions (HxWxD), approx	118 x 35 x 87 mm (4.65 x 1.38 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)
Slot width	1
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	8 modules
Terminal screw torque	0.68 N•m (6 lb•in)
Retaining screw torque	0.46 N•m (4.1 lb•in)
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door label	1769-RL2 series B (2 per kit)
Replacement door	1769-RD (2 per kit)
Vendor ID code	1
Product type code	10
Product code	47
Input words	22
Output words	2
Configuration words	98
Enclosure type rating	None (open-style)

(1) The over- or under-range flag comes on when the normal operating range (over/under) is exceeded. The module continues to convert the analog input up to the maximum full scale range. The flag automatically resets when within the normal operating range.
(2) Resolution is dependent upon your filter selection. The maximum resolution is achieved with either the 50 or 60 Hz filter selected.
(3) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential. For example, a 10V DC input signal and 20V DC potential above ground at the input terminal.
(4) For proper operation, both the plus and minus input terminals must be within ±10V DC of analog common.
(5) Includes offset, gain, nonlinearity, and repeatability error terms.
(6) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.
(7) Damage can occur to the input circuit if this value is exceeded.

See Environmental Specifications - 1769 Compact I/O Modules on page 3.

Response Speed - 1769-IF16C

Filter Frequency	Step Response	Update per Input Point	Update per Module
16 Hz	1550 ms	200 ms	1600 ms
50 Hz	500 ms	70 ms	560 ms
60 Hz	420 ms	60 ms	480 ms
315 Hz	90 ms	15 ms	120 ms
1365 Hz	35 ms	5 ms	40 ms

Certifications - 1769-IF16C

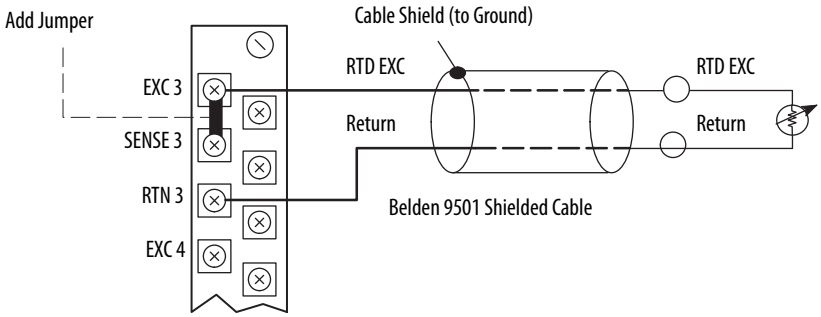
Certification[1]	1769-IF16C
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E10314. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E10314.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation

(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

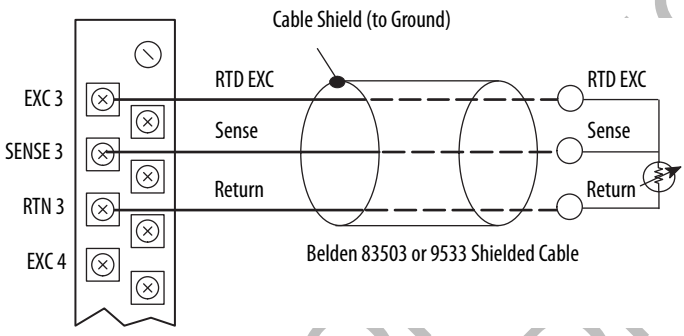
1769-IR6

Compact RTD/resistance input module

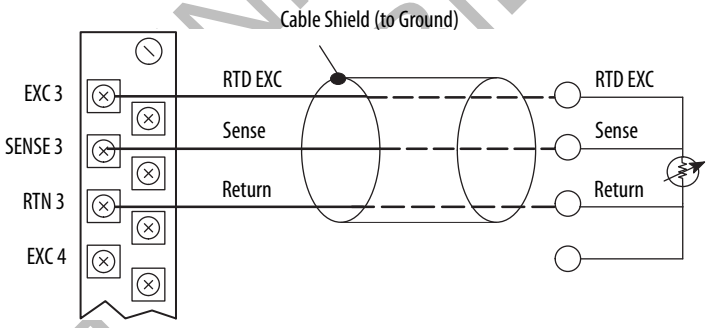
Two Wire RTD Configuration



Three Wire RTD Configuration

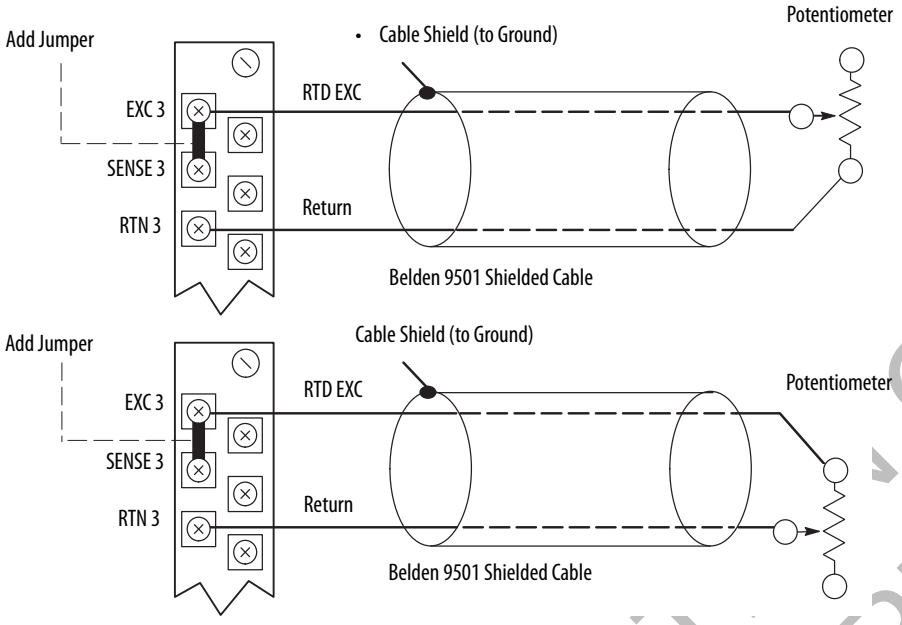


Four Wire RTD Configuration

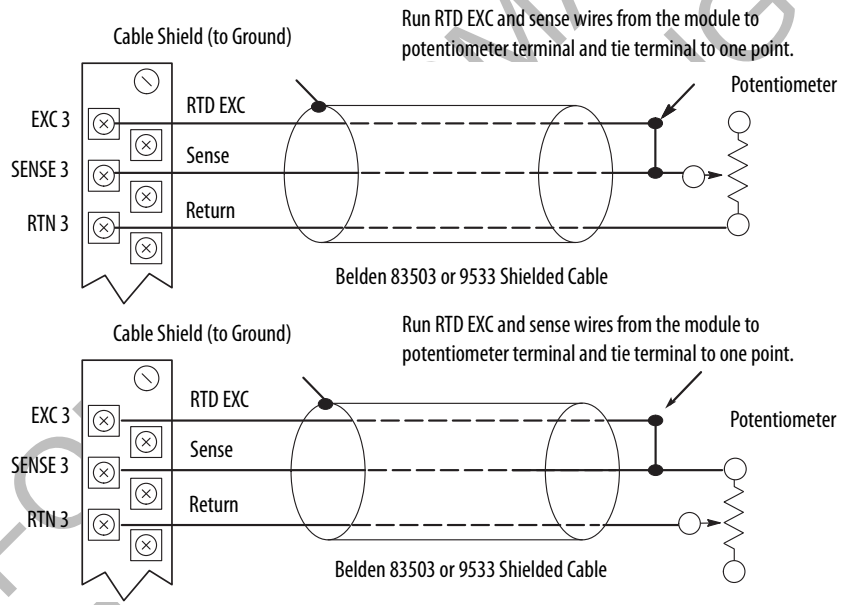


Belden 83503 or 9533 Shielded Cable
Leave one sensor wire open.

Two Wire Potentiometer Configuration



Three Wire Potentiometer Configuration



Data Formats for RTD Temperature Ranges for 0.5 mA and 1.0 mA Excitation Current

RTD Input Type	Engineering Units x1		Engineering Units x10		Scaled-for-PID	Proportional Counts
	0.1 °C	0.1 °F	1.0 °C	1.0 °F		
100 Ω Platinum 385	-2000…+8500	-3280…+15620	-200…+850	-328…+1562	0…16383	-32768…+32767
200 Ω Platinum 385	-2000…+8500	-3280…+15620	-200…+850	-328…+1562	0…16383	-32768…+32767
500 Ω Platinum 385	-2000…+8500	-3280…+15620	-200…+850	-328…+1562	0…16383	-32768…+32767
1000 Ω Platinum 385	-2000…+8500	-3280…+15620	-200…+850	-328…+1562	0…16383	-32768…+32767
100 Ω Platinum 3916	-2000…+6300	-3280…+11660	-200…+630	-328…+1166	0…16383	-32768…+32767
200 Ω Platinum 3916	-2000…+6300	-3280…+11660	-200…+630	328…+1166	0…16383	-32768…+32767
500 Ω Platinum 3916	-2000…+6300	-3280…+11660	-200…+630	328…+1166	0…16383	-32768…+32767
1000 Ω Platinum 3916	-2000…+6300	-3280…+11660	-200…+630	328…+1166	0…16383	-32768…+32767
10 Ω Copper 426	-1000…+2600	-1480…+5000	+100…+260	-148…+500	0…16383	-32768…+32767
120 Ω Nickel 618	-1000…+2600	-1480…+5000	-100…+260	-148…+500	0…16383	-32768…+32767
120 Ω Nickel 672	-800…+2600	-1120…+5000	-80…+260	-112…+500	0…16383	-32768…+32767
604 Ω Nickel Iron 518	-1000…+2600	-3280…+1560	-100…+200	-328…+156	0…16383	-32768…+32767

Temperature Range - 1769-IR6

RTD Type[1]		Temperature Range Using 0.5 mA Excitation	Temperature Range Using 1.0 mA Excitation
Platinum 385	100 Ω	-200…850 °C (-328…1562 °F)	-200…850 °C (-328…1562 °F)
	200 Ω	-200…850 °C (-328…1562 °F)	-200…850 °C (-328…1562 °F)
	500 Ω	-200…850 °C (-328…1562 °F)	-200…850 °C (-328…1562 °F)
	1000 Ω	-200…850 °C (-328…1562 °F)	N/A
Platinum 3916	100 Ω	-200C…630 °C (-328…1166 °F)	-200…630 °C (-328…1166 °F)
	200 Ω	-200C…630 °C (-328…1166 °F)	-200…630 °C (-328…1166 °F)
	500 Ω	-200C…630 °C (-328…1166 °F)	-200…630 °C (-328…1166 °F)
	1000 Ω	-200C…630 °C (-328…1166 °F)	N/A
Copper 426	10 Ω	N/A	-100…260 °C (-148…500 °F)
Nickel 618[2]	120 Ω	-100…260 °C (-148…500 °F)	-100…260 °C (-148…500 °F)
Nickel 672	120 Ω	-80…260 °C (-112…500 °F)	-80…260 °C (-112…500 °F)
Nickel-Iron 518	604 Ω	-200…180 °C (-328…338 °F)	-100…+200 °C (-148…392 °F)

(1) Digits following the RTD type represent the temperature coefficient of resistance (α), which is defined as the resistance change per Ω per °C. For instance, Platinum 385 refers to a Platinum RTD with $\alpha = 0.00385\ \Omega/\Omega$ -°C, or simply 0.00385/°C.

(2) Actual value at 0 °C is 100 Ω per DIN standard.

Resistance Device Compatibility - 1769-IR6

Resistance Device Type	Resistance Range (0.5 mA Excitation)	Resistance Range (1.0 mA Excitation)
150 Ω	0…150 Ω	0…150 Ω
500 Ω	0…500 Ω	0…500 Ω
1000 Ω	0…1000 Ω	0…1000 Ω
3000 Ω	0…3000 Ω	N/A

Technical Specifications - 1769-IR6

Attribute	1769-IR6
Inputs	6 RTD inputs
Input range	0…150 Ω 0…500 Ω 0…1000 Ω 0…3000 Ω
Resolution	Input filter and configuration dependent
Sensors supported	100, 200, 500, 1000 Ω Platinum 385 100, 200, 500, 1000 Ω Platinum 3916 120 Ω Nickel 672 120 Ω Nickel 618 10 Ω Nickel-iron 518
Current draw @ 5.1V	100 mA
Current draw @ 24V	35 mA
Heat dissipation, max	1.5 W
Converter type	Sigma Delta
Common mode voltage range	±10V DC max
Common mode rejection	110 dB @ 50 Hz with the 10 or 50 Hz filter selected 110 dB @ 60 Hz with the 10 or 60 Hz filter selected
Normal mode rejection ratio	70 dB @ 50 Hz with the 10 or 50 Hz filter selected 70 dB @ 60 Hz with the 10 or 60 Hz filter selected
Cable impedance, max	25 Ω
Input impedance	> 10 MΩ
Accuracy @ 25 °C (77 °F) (1) (50/60 Hz filter)	±0.5 °C (0.9 °F) for Pt 385 ±0.4 °C (0.72 °F) for Pt 3916 ±0.3 °C (0.54 °F) for Ni ±0.3 °C (0.54 °F) for NiFe ±0.8 °C (1.44 °F) for Cu ±0.15 Ω for 150 Ω range ±0.5 Ω for 500 Ω range ±1.0 Ω for 1000 Ω range ±1.5 Ω for 3000 Ω range
Accuracy @ 0…60 °C (32…140 °F) (1) (50/60 Hz filter)	±0.9 °C (1.62 °F) for Pt 385 ±0.8 °C (1.44 °F) for Pt 3916 ±0.5 °C (0.9 °F) for Ni ±0.5 °C (0.9 °F) for NiFe ±1.1 °C (1.98 °F) for Cu ±0.25 Ω for 150 Ω range ±0.8 Ω for 500 Ω range ±1.5 Ω for 1000 Ω range ±2.5 Ω for 3000 Ω range
Accuracy drift @ 0…60 °C (32…140 °F) (1)	±0.026 °C/°C (0.026 °F/°F) for Pt 385 ±0.023 °C/°C (0.023 °F/°F) for Pt 3916 ±0.012 °C/°C (0.012 °F/°F) for Ni\ ±0.015 °C/°C (0.015 °F/°F) for NiFe ±0.032 °C/°C (0.032 °F/°F) for Cu ±0.007 Ω/°C (±0.013Ω/°F) for 150 Ω ±0.023 Ω/°C (±0.041Ω/°F) for 500 Ω ±0.043 Ω/°C (±0.077Ω/°F) for 1000 Ω ±0.072 Ω/°C (±0.130Ω/°F) for 3000 Ω
Nonlinearity	±0.05%
Repeatability(2) (50/60 Hz filter)	±0.01 °C (0.018 °F) for Ni and NiFe ±0.2 °C (0.36 °F) for other RTD inputs ±0.04 Ω for 150 Ω resistances ±0.2 Ω for other resistances
Open circuit detection time(3)	6 ms…303 s
Isolation voltage	720V DC for 1 minute, optical and magnetic (qualification), channel to bus 30V AC/30V DC working voltage (IEC Class II reinforced insulation)
Weight, approx	276 g (0.61 lb)

Technical Specifications - 1769-IR6

Attribute	1769-IR6
Dimensions (HxWxD), approx	118 x 35 x 87 mm (4.65 x 1.38 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)
Slot width	1
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	8 modules
Terminal screw torque	0.68 N•m (6 lb•in)
Retaining screw torque	0.46 N•m (4.1 lb•in)
Recommended cable	2-wire configuration: Belden 9501 or equivalent 3-wire configuration: Belden 9533 or equivalent 4-wire configuration: Belden 83503 or equivalent
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
IEC input compatibility	Type 1+
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door label	1769-RL2 series B (2 per kit)
Replacement door	1769-RD (2 per kit)
Vendor ID code	1
Product type code	10
Product code	37
Enclosure type rating	None (open-style)

(1) Accuracy is dependent upon the Analog/Digital converter output rate selection, excitation current selection, data format, and input noise.
(2) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.
(3) Open-circuit detection time is equal to channel update time.

See Environmental Specifications - 1769 Compact I/O Modules on page 3.

RTD Accuracy and Temperature Drift - 1769-IR6

RTD Type		Scaled Accuracy Max 25 °C (77 °F) with Calibration	Scaled Accuracy Max 0…60 °C (32…140 °F) with Calibration)	Temperature Drift Max from 25 °C (77 °F) without Calibration
Copper 426	10 Ω	±0.6 °C (1.08 °F)	±1.1 °C (1.98 °F)	±0.032 °C/°C (0.032 °F/°F)
Nickel 618	120 Ω	±0.2 °C (±0.36 °F)	±0.4 °C (±0.72 °F)	±0.012 °C/°C (±0.012 °F/°F)
Nickel 672	120 Ω	±0.2 °C (±0.36 °F)	±0.4 °C (±0.72 °F)	±0.012 °C/°C (±0.012 °F/°F)
Nickel-Iron 518	604 Ω	±0.3 °C (±0.54 °F)	±0.5 °C (±0.9 °F)	±0.015 °C/°C (±0.015 °F/°F)
Platinum 385	100 Ω	±0.5 °C (±0.9 °F)	±0.9 °C (±1.62 °F)	±0.026 °C/°C (±0.026 °F/°F)
	200 Ω	±0.5 °C (±0.9 °F)	±0.9 °C (±1.62 °F)	±0.026 °C/°C (±0.026 °F/°F)
	500 Ω	±0.5 °C (±0.9 °F)	±0.9 °C (±1.62 °F)	±0.026 °C/°C (±0.026 °F/°F)
	1000 Ω	±0.5 °C (±0.9 °F)	±0.9 °C (±1.62 °F)	±0.026 °C/°C (±0.026 °F/°F)
Platinum 3916	100 Ω	±0.4 °C (±0.7 2°F)	±0.8 °C (±1.44 °F)	±0.023 °C/°C (±0.023 °F/°F)
	200 Ω	±0.4 °C (±0.72 °F)	±0.8 °C (±1.44 °F)	±0.023 °C/°C (±0.023 °F/°F)
	500 Ω	±0.4 °C (±0.72 °F)	±0.8 °C (±1.44 °F)	±0.023 °C/°C (±0.023 °F/°F)
	1000 Ω	±0.4 °C (±0.72 °F)	±0.8 °C (±1.44 °F)	±0.023 °C/°C (±0.023 °F/°F)

RTD Standards - 1769-IR6

RTD Type	α[3]	IEC-751 1983, Amend. 2 1995	DIN 43760 1987	SAMA[4] Standard RC21-4-1966	Japanese Industrial Standard JIS C1604-1989	Japanese Industrial Standard JIS C1604-1997	Minco[5]
100 Ω Pt	0.00385	X	X			X	
200 Ω Pt	0.00385	X	X			X	
500 Ω Pt	0.00385	X	X			X	
1000 Ω Pt	0.00385	X	X			X	
100 Ω Pt	0.03916				X		
200 Ω Pt	0.03916				X		
500 Ω Pt	0.03916				X		
1000 Ω Pt	0.03916				X		
10 Ω Cu[1]	0.00426			X			
120 Ω Ni[2]	0.00618		X				
120 Ω Ni	0.00372						X
604 Ω NiFe	0.00518						X

(1) Actual value at 0 °C (32 °F) is 9.04 2 Ω per SAMA standard RC21-4-1966.
(2) Actual value at 0 °C (32 °F) is100 Ω per SAMA standard RC21-4-1966.
(3) α is the temperature coefficient of resistance, which is defined as the resistance change per ohm per °C.
(4) Scientific Apparatus Makers Association
(5) Minco Type "NA" (Nickel) and Minco Type "FA" (Nickel-Iron)

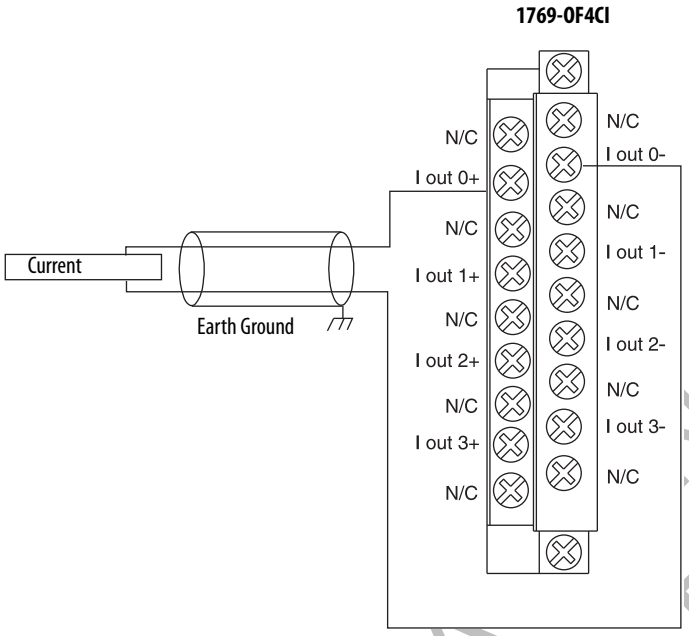
Certifications - 1769-IR6

Certification[1]	1769-IR6
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation

(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

1769-0F4CI

Compact current output, individually isolated analog module



Technical Specifications - 1769-0F4CI

Attribute	1769-0F4CI
Outputs	4 differential, individually isolated
Output range	0…20 mA 4…20 mA
Full scale range[1]	0…21 mA 3.2…21 mA
Resolution	16 bits (unipolar) 0…20 mA: 15.91 bits, 0.323 µA/bit 4…20 mA: 15.59 bits, 0.323 µA/bit
Bus current draw	5V DC, 145 mA 24V DC, 120 mA
Heat dissipation, max	2.68 W
Conversion rate (all channels), max	110 ms
Limited voltage/current[2]	< 2.9 ms
Resistive load on current output	0…500 Ω (includes wire resistance)
Inductive load (current outputs), max	0.1 mH
Field calibration	None required
Accuracy[3]	±0.35% full scale @ 25 °C (77 °F)
Accuracy drift with temperature	±0.0058% FS per °C
Output ripple[4]	±0.05% @ 0…50 kHz
Nonlinearity	±0.05%
Repeatability[5]	±0.05%
Module error	±0.55%
Output impedance	>1 MΩ
Open and short-circuit protection	Yes

Technical Specifications - 1769-0F4CI

Attribute	1769-0F4CI
Short-circuit protection, max	21 mA
Output overvoltage protection	Yes
Output response at system powerup and power down	No current glitch
Rated working voltage(6)	30V AC/30V DC
Isolation voltage	500V AC or 710V DC for 1 min (qualification test), output group to bus 30V AC/30V DC working voltage (IEC Class II reinforced insulation)
Weight, approx	270 g (0.60 lb)
Dimensions (HxWxD), approx	118 x 35 x 87 mm (4.65 x 1.38 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)
Slot width	1
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	8 modules
Terminal screw torque	0.68 N•m (6 lb•in)
Retaining screw torque	0.46 N•m (4.1 lb•in)
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
Recommended cable	Belden 8761 (shielded)
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door label	1769-RL2 (2 per kit)
Replacement door	1769-RD (2 per kit)
Vendor ID code	1
Product type code	10
Product code	45
Input words	6
Output words	5
Configuration words	32
Enclosure type rating	None (open style)

(1) The over- or under-range flag comes on when the normal operating range (over/under) is exceeded. The module continues to convert the analog input up to the maximum full scale range. The flag automatically resets when within the normal operating range.
(2) Step response is the time between when the D/A converter was instructed to go from minimum to full range until the device is at 63% of full range.
(3) Includes offset, gain, nonlinearity, and repeatability error terms.
(4) Output ripple is the amount that a fixed output varies with time, which assumes a constant load and temperature.
(5) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.
(6) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential. For example, a 10V DC input signal and 20V DC potential above ground at the input terminal.

Certifications - 1769-0F4CI

Certification[1]	1769-0F4CI
c-UL	UL Listed Industrial Control Equipment, certified for US and Canada. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation

(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

Compact I/O Accessories

Category	Cat. No.	Description
End cap	1769-ECL	Left-end cap for Compact I/O system
	1769-ECR	Right-end cap for Compact I/O system
Expansion cable	1769-CLL1	Left bank-to-left bank expansion 305 mm (1 ft)
	1769-CLL3	Left bank-to-left bank expansion 1 m (3.28 ft)
	1769-CRR1	Right bank-to-right bank expansion 305 mm (1 ft)
	1769-CRR3	Right bank-to-right bank expansion 1 m (3.28 ft)
	1769-CRL1	Right bank-to-left bank expansion 305 mm (1 ft)
	1769-CRL3	Right bank-to-left bank expansion 1 m (3.28 ft)
Replacement terminal block	1769-RTBN10	10-pin NEMA terminal block
	1769-RTBN18	18-pin NEMA terminal block
Replacement door labels	1769-RL1	Replacement door labels for digital I/O, 2 per kit
	1769-RL2	Replacement door labels for analog and specialty I/O, 2 per kit
Replacement doors	1769-RD	Door replacement kit, 2 per kit
Replacement connector kit	1746-N3	Connector kit to terminate a cable, which connects field I/O devices to 32-point I/O modules, 1 connector and 40 terminals

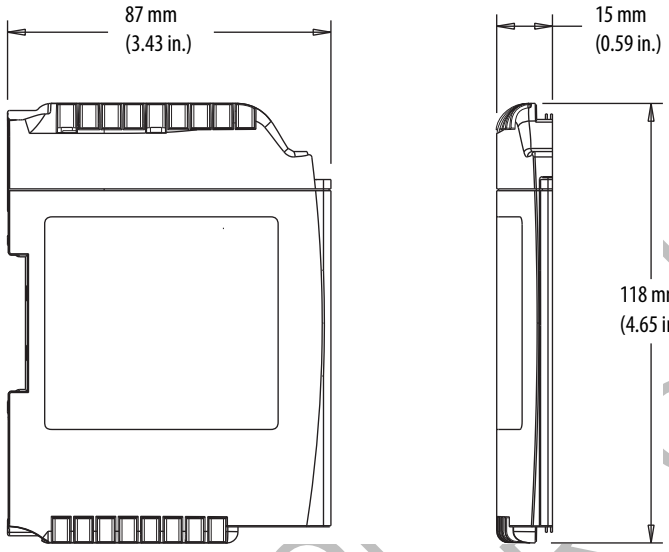
End Caps

The final I/O bank in Compact system needs an end cap on the end without the expansion cable. The 1769-L23*x* controller comes with a right-end cap, so you do not need to order one separately.

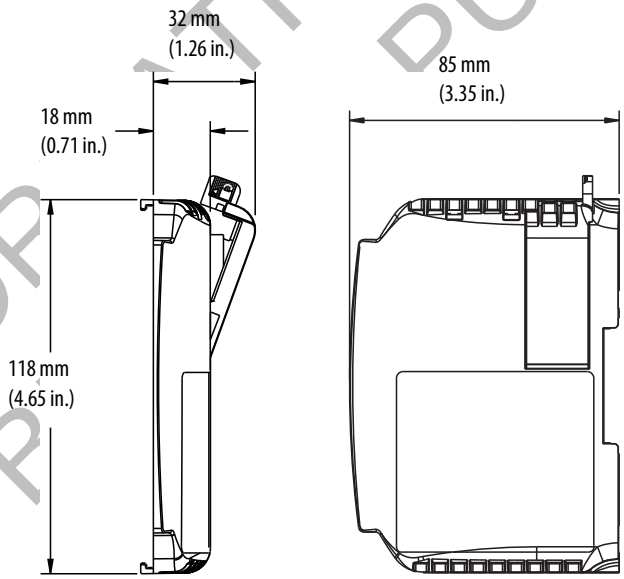
Technical Specifications - 1769-ECL, 1769-ECR

Attribute	1769-ECL	1769-ECR
Current draw @ 5.1V	5 mA	
Current draw @ 24V	0 mA	
Weight, approx	130 g (0.286 lb)	
Location	Left end	Right end
North American temperature code	T3C	
IEC temperature code	N/A	T4
Enclosure type rating	None (open-style)	None (open-style)

Mounting Dimensions - 1769-ECL



Mounting Dimensions - 1769-ECR



Certifications - 1769-ECL, 1769-ECR

Certification[1]	1769-ECL	1769-ECR
c-UL-us	UL Listed for Class I, Division 2 Group A, B, C, D Hazardous Locations, certified for U.S. and Canada. See UL File E10314	
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions	CE
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure	—
ATEX	—	European Union 2014/34/EU ATEX Directive, compliant with: EN 60079-0; General Requirements EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc

(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

DATASHEET

Modbus TCP/IP Client Communication Module

MVI69-MNETC

The MVI69-MNETC Modbus TCP/IP Client Communication Module allows Rockwell Automation® CompactLogix / MicroLogix® processors to interface easily with Modbus TCP/IP server devices.

Compatible devices include Modicon PACs, as well as a wide variety of instruments and devices. The module acts as an input/output module between the Modbus network and the Rockwell Automation backplane.

The data transfer from the processor is asynchronous from the actions on the Modbus Client-controlled network. A 5000-word register space in the module exchanges data between the processor and the Modbus network.

Features

- Single-slot - 1769 backplane compatible
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module
- Ladder Logic is used for data transfer between module memory and processor controller tags. A sample ladder file with AOI is included
- Configuration data obtained from configuration text file downloaded to module. A sample configuration file is included.
- Supports CompactLogix and MicroLogix 1500 LRP Controllers except 1769-QBFC1B, 1769-L16x, and 1769-L18x

Functional Specifications

- Support for the storage and transfer of up to 5000 registers to/from the processor's controller tags
- User-definable module memory usage
- 10/100 Base-T Ethernet compatible interface

Client Specifications

The MVI69-MNETC will operate on a local or remote rack. This module was created to improve performance when controlling multiple servers on a Modbus TCP/IP network.

- Offers 30 Client connections with up to 16 commands per Client to talk to multiple servers
- Easily enable or disable the commands from the ladder logic
- A Client configured as a virtual Modbus master device on the MVI69-MNETC module will actively issue Modbus TCP/IP commands to other nodes on the Modbus TCP/IP network
- Actively reads data from and writes data to Modbus TCP/IP devices, using MBAP or Encapsulated Modbus message formats
- Transmits Modbus Function Codes 1, 2, 3, 4, 5, 6, 7, 15, and 16
- .CompactLogix / MicroLogix processor can be programmed to use special functions to control the activity on the Client by actively selecting commands to execute from the command list (Command Control) or issuing commands directly from the ladder logic (Event Commands)
- Configurable parameters for the Client include:
  - Minimum Command Delay
  - User-defined commands (read/write)

Hardware Specifications

Specification	Description
Dimensions	Standard 1769 single-slot module
Current Load	800 mA max @ 5 VDC Power supply distance rating of 2 (L43 and L45 installations on first 2 slots of 1769 bus)
Operating Temp.	0°C to 60°C (32°F to 140°F)
Storage Temp.	-40°C to 85°C (-40°F to 185°F)
Relative Humidity	5% to 95% (with no condensation)
LED Indicators	Power and Module Status Application Status CFG Port Activity Ethernet Port Activity Error Status
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) RS-232 only No hardware handshaking
App Port (Ethernet modules)	10/100 Base-T Ethernet compatible interface Electrical Isolation 1500 Vrms at 50 Hz to 60 Hz for 60 s, applied as specified in section 5.3.2 of IEC 60950: 1991 Ethernet Broadcast Storm Resiliency = less than or equal to 5000 [ARP] frames-per-second and less than or equal to 5 minutes duration
Shipped with Unit	RJ45 to DB-9M cables for each port 6-foot RS-232 configuration cable

Agency Approvals and Certifications

Agency
ATEX
DNV
CE
CB Safety
GOST-R
CSA
cULus

Additional Products

ProSoft Technology® offers a full complement of hardware and software solutions for a wide variety of industrial communication platforms. For a complete list of products, visit our web site at:

www.prosoft-technology.com

Ordering Information

To order this product, please use the following:

Modbus TCP/IP Client Communication Module

MVI69-MNETC

To place an order, please contact your local ProSoft Technology distributor. For a list of ProSoft Technology distributors near you, go to:

www.prosoft technology.com

and select *Where to Buy* from the menu.

PanelView Plus 7 Performance 10-in and 12-in Terminals

Attribute	10.4-in. Touch 2711P-T10C22D9P, 2711P-T10C22D9P-B [1] 2711P-T10C22A9P, 2711P-T10C22A9P-B 2711P-T10C22D9PK[2]	10.4-in. Touch with Keypad 2711P-B10C22D9P, 2711P-B10C22D9P-B [1] 2711P-B10C22A9P, 2711P-B10C22A9P-B	12.1-in. Touch 2711P-T12W22D9P, 2711P-T12W22D9P-B [1] 2711P-T12W22A9P, 2711P-T12W22A9P-B 2711P-T12W22D9PK[2]
Operator input	Touch	Touch with keypad	Touch
Conformal-coated	Yes	—	Yes
Display type	TFT Color		
Display size, diagonal	10.4-in.		12.1-in. wide screen
Viewing area (W x H)	211 x 158 mm (8.3 x 6.2 in.)		261 x 163 mm (10.3 x 6.4 in.)
Display resolution	800 x 600 SVGA, 18-bit color graphics		1280 x 800 WXGA, 18-bit color graphics
Aspect ratio	4:3		16:10
Brightness, typical	300 cd/m^2 (Nits)		
Backlight life	White light-emitting diode, solid state Life: 50,000 h min at 40 °C (104 °F) to half-brightness, backlight is not replaceable		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: ±2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell		
Memory: • System • User	• 512 MB RAM and 512 MB storage • 80 MB, approx, nonvolatile storage for applications		
Secure Digital (SD) card slot	One SD card slot for external storage; supports cat. no. 1784-SDx cards		
USB ports: • Host • Device	• Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage • One high-speed 2.0 device port (type B) that will be functional in a future release		
Operating system	Windows CE with Extended Features and MS Office Viewers (includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)		
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support Device Level Ring (DLR), linear, or star network topologies		
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.6 or later		
Electrical			
Input voltage	24V DC nom (18…30V DC) / 100…240V AC	24V DC nom (18…30V DC) / 100…240V AC	24V DC nom (18…30V DC) / 100…240V AC
Power consumption	50 W max (2.1 A at 24V DC) / 105VA	50 W max (2.1 A at 24V DC) / 105VA	50 W max (2.1 A at 24V DC) / 105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies[3] / —	Supports (SELV) and (PELV) 24V DC supplies[3] / —	Supports (SELV) and (PELV) 24V DC supplies[3] / —
Mechanical			
Weight, approx	2.28 kg (5.03 lb)	2.58 kg (5.69 lb)	2.54 kg (5.60 lb)
Dimensions, approx (H x W x D)	252 x 297 x 69.6 mm 9.92 x 11.69 x 2.74 in.	252 x 385 x 69.6 mm 9.92 x 15.16 x 2.74 in.	240 x 340 x 69.6 mm 9.69 x 13.39 x 2.74 in.
Cutout dimensions, approx (H x W)	224 x 269 mm 8.82 x 10.59 in.	224 x 335 mm 8.82 x 13.19 in.	218 x 312 mm 8.58 x 12.28 in.

(1) Catalog numbers with a -B extension denote terminals that exclude the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.
(2) Catalog numbers that end with a K denote terminals that are conformal coated.
(3) DC-powered terminals support safety extra low voltage (SELV) and protective extra low voltage (PELV) 24V DC power supplies such as cat. nos. 1606-XLP95E, 1606-XLP100E, 2711P-RSACDIN.

Typical Configuration

Traditional DLR, linear, and star network topologies are supported. See these topics for examples:

- Device Level Ring Network Topology on page 45
- Linear Network Topology on page 46
- Star Network Topology on page 47

P/N: 2711P-T10C22D9P

Catalog Number Explanation

This section provides an explanation of the catalog numbers.

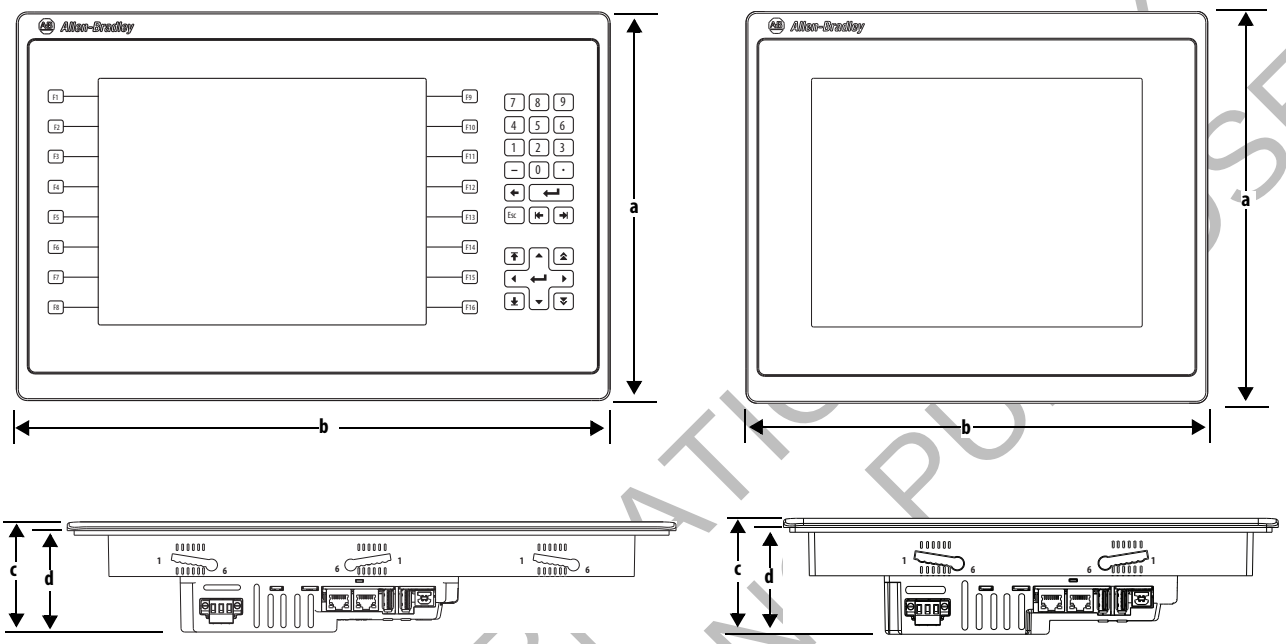
Bulletin	Input Type	Display Size	Display Type	Network	Power	Operating System	Model[1]	-	Option
2711P-	**T** = Touch	**7** = 6.5-in.	**C** = Color	**22** = Ethernet DLR ports	**A** = AC	**9** = Windows CE	**P** = Performance	-	**B** = No brand identity
	B = Key and Touch	**9** = 9-in.	**W** = Wide aspect ratio color		**D** = DC			-	**BSHK**[2] = No brand identity, stainless steel, hygienic, conformal coated
		10 = 10.4-in.							**K** = Conformal coated
		12 = 12.1-in.							**BM001– BM016**[3] = ArmorView Plus 7 terminal
		15 = 15-in.							
		19 = 19-in.							

(1) Performance model s support Windows CE 6.0 operating system with extended features: web browser, remote desktop connection, media player, Microsoft office file viewers, Word Pad text editor.
(2) The -BSHK terminals are available in 9-in. and 12.1-in. touch screen terminals, with DC power, and without the Allen-Bradley logo.
(3) The ArmorView Plus 7 product includes a 12.1-in. PanelView Plus 7 Performance terminal and a 1732E ArmorBlock® EtherNet/IP I/O module. Both products are enclosed in a cast aluminum assembly that can be mounted on a machine, an arm mount system, a VESA-compatible bracket (with the optional VESA kit), or a pedestal. To order an ArmorView Plus 7 terminal, add BM001…BM016 to the 12.1-in. PanelView Plus 7 Performance touch terminal, 2711P-T12W22D9P. For explanations of the ArmorView Plus 7 catalog numbers, see the ArmorView Plus 7 Installation Instructions, publication 2711P-IN013.

Product Dimensions

This section provides product dimensions. The PanelView Plus 7 Performance 10.4-inch touch and combination keypad with touch devices are shown for illustrative purposes. Stainless steel terminals use different mounting clips, but the dimensions are the same. All other terminal sizes look similar.

PanelView Plus 7 Performance Terminal Dimensions - 10.4-in. Model



PanelView Plus 7 Performance Terminal Dimensions

Terminal Size	Input Type	Height (a) mm (in.)	Width (b) mm (in.)	Overall Depth (c) mm (in.)	Mounted Depth (d) mm (in.)
6.5-in.	Key/touch	179 (7.05)	285 (11.22)		
	Touch	170 (6.69)	212 (8.35)		
9-in.	Touch	190 (7.48)	280 (11.02)		
10.4-in.	Key/touch	252 (9.92)	385 (15.16)		
	Touch	252 (9.92)	297 (11.69)	69.6 (2.74)	63.6 (2.50)
12.1-in.	Touch	246 (9.69)	340 (13.39)		
15-in.	Key/touch	329 (12.95)	484 (19.06)		
	Touch	318 (12.52)	381 (15.00)		
19-in.	Touch	411 (16.18)	485 (19.09)		

TIP When mounted in a panel, the front of the bezel extends less than 6.36 mm (0.25 in.) from the front of the panel.

Verbatim Metal Executive USB flash drive 16 GB USB Type-A 2.0 Silver

Brand : Verbatim

Product code: 98748

Product name : Metal Executive - USB Drive 16 GB - Silver

Metal Executive USB 2.0 Drive 16GB

Verbatim Metal Executive USB flash drive 16 GB USB Type-A 2.0 Silver:

- Ultra small metal housing
- Tough, waterproof & dustproof design
- Includes a convenient metal key ring
- Capacities avaliable: 16GB, 32GB & 64GB
- Stylish Silver colour

The Metal Executive USB 2.0 Drive has a small, sleek metal casing which makes it incredibly tough and able to withstand the demands of everyday life.
Verbatim Metal Executive. Capacity: 16 GB, Device interface: USB Type-A, USB version: 2.0. Form factor: Capless, Product colour: Silver

Performance	
Capacity *	16 GB
Device interface *	USB Type-A
USB version *	2.0
Windows operating systems supported	Windows 10 Education,Windows 10 Education x64,Windows 10 Enterprise,Windows 10 Enterprise x64,Windows 10 Home,Windows 10 Home x64,Windows 10 Pro,Windows 10 Pro x64,Windows 7 Enterprise,Windows 7 Enterprise x64,Windows 7 Home Basic,Windows 7 Home Basic x64,Windows 7 Home Premium,Windows 7 Home Premium x64,Windows 7 Professional,Windows 7 Professional x64,Windows 7 Starter,Windows 7 Starter x64,Windows 7 Ultimate,Windows 7 Ultimate x64,Windows 8,Windows 8.1,Windows Vista Business,Windows Vista Business x64,Windows Vista Enterprise,Windows Vista Enterprise x64,Windows Vista Home Basic,Windows Vista Home Basic x64,Windows Vista Home Premium,Windows Vista Home Premium x64,Windows Vista Ultimate,Windows Vista Ultimate x64,Windows XP Home,Windows XP Home x64,Windows XP Professional,Windows XP Professional x64
Mac operating systems supported	Mac OS X 10.1 Puma, Mac OS X 10.10 Yosemite, Mac OS X 10.11 El Capitan, Mac OS X 10.2 Jaguar, Mac OS X 10.3 Panther, Mac OS X 10.4 Tiger, Mac OS X 10.5 Leopard, Mac OS X 10.6 Snow Leopard, Mac OS X 10.7 Lion, Mac OS X 10.8 Mountain Lion, Mac OS X 10.9 Mavericks

Performance	
Linux operating systems supported	✓

Design	
Form factor *	Capless
Product colour *	Silver
Housing material	Metal
Protection features	Water resistant
Key ring	✓

Packaging Content	
Quantity per pack	1 pc(s)

Patch cable - FL CAT6 PATCH 5,0 - 2891783

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Patch cable, CAT6, pre-assembled, 5.0 m

Ethernet

Key Commercial Data

Packing unit	10 pc
GTIN	4 046356 167574
Weight per Piece (excluding packing)	199.906 g
Weight per piece (including packing)	212.98 g
Custom tariff number	85444210
Country of origin	Poland

Technical data

Ambient conditions

Ambient temperature (operation)	-10 °C ... 60 °C

External sheath

Outer sheath, material	LSFROH
External diameter	5.5 mm
External diameter max.	6.2 mm

Single wire

Individual wires per module	8
Single wire, material	Cu litz wire
Single wire, cross section	0.14 mm²

Mechanical properties

Smallest bending radius, fixed installation	30 mm

General

Conductor length	5 m
Nominal voltage U_N	150 V_{rms}

Patch cable - FL CAT6 PATCH 5,0 - 2891783

Technical data

General

Transmission characteristics (category)	CAT6

Behavior in fire

Flame resistance	According to IEC 60332-3C
Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1

Standards and Regulations

Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1
Flame resistance	According to IEC 60332-3C

Classifications

eCl@ss

eCl@ss 4.0	27250591
eCl@ss 4.1	27240409
eCl@ss 5.0	27259207
eCl@ss 5.1	27061801
eCl@ss 6.0	27259207
eCl@ss 7.0	27259207
eCl@ss 8.0	27060308
eCl@ss 9.0	27060308

ETIM

ETIM 2.0	EC001262
ETIM 3.0	EC001262
ETIM 4.0	EC001262
ETIM 5.0	EC002599

UNSPSC

UNSPSC 6.01	26121609
UNSPSC 7.0901	26121609
UNSPSC 11	26121609
UNSPSC 12.01	26121609
UNSPSC 13.2	26121609

Approvals

Approvals

Patch cable - FL CAT6 PATCH 5,0 - 2891783

Approvals

Approvals

EAC

Ex Approvals

Approvals submitted

Approval details

EAC

Patch cable - FL CAT6 PATCH 0,5 - 2891288

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Patch cable, CAT6, pre-assembled, 0.5 m

RoHS

Ethernet

Key Commercial Data

Packing unit	1 STK
GTIN	4 046356 167529
GTIN	4046356167529
Weight per Piece (excluding packing)	36.820 g
Custom tariff number	85444210
Country of origin	Poland

Technical data

Ambient conditions

Ambient temperature (operation)	-10 °C ... 60 °C

External sheath

Outer sheath, material	LSFROH
External diameter	5.5 mm
External diameter max.	6.2 mm

Single wire

Individual wires per module	8
Single wire, material	Cu litz wire
Single wire, cross section	0.14 mm²

Mechanical properties

Patch cable - FL CAT6 PATCH 0,5 - 2891288

Technical data

Mechanical properties

Smallest bending radius, fixed installation	30 mm

General

Conductor length	0.5 m
Nominal voltage U_N	150 V_{rms}
Transmission characteristics (category)	CAT6

Behavior in fire

Flame resistance	according to IEC 60332-3C
Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1

Standards and Regulations

Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1
Flame resistance	according to IEC 60332-3C

Environmental Product Compliance

China RoHS	Environmentally Friendly Use Period = 50
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Classifications

eCl@ss

eCl@ss 4.0	27250591
eCl@ss 4.1	27240409
eCl@ss 5.0	27259207
eCl@ss 5.1	27061801
eCl@ss 6.0	27259207
eCl@ss 7.0	27259207
eCl@ss 8.0	27060308
eCl@ss 9.0	27060308

ETIM

ETIM 2.0	EC001262
ETIM 3.0	EC001262
ETIM 4.0	EC001262
ETIM 5.0	EC002599

Patch cable - FL CAT6 PATCH 0,5 - 2891288

Classifications

UNSPSC

UNSPSC 6.01	26121609
UNSPSC 7.0901	26121609
UNSPSC 11	26121609
UNSPSC 12.01	26121609
UNSPSC 13.2	26121604

Approvals

Approvals

Approvals

EAC

Ex Approvals

Approval details

EAC	EAC	EAC-Zulassung

Patch cable - FL CAT6 PATCH 1,0 - 2891385

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Patch cable, CAT6, pre-assembled, 1.0 m

RoHS

Ethernet

Key Commercial Data

Packing unit	10 STK
Minimum order quantity	10 STK
GTIN	4 046356 167536
GTIN	4046356167536
Weight per Piece (excluding packing)	50.900 g
Custom tariff number	85444210
Country of origin	Poland

Technical data

Ambient conditions

Ambient temperature (operation)	-10 °C ... 60 °C

External sheath

Outer sheath, material	LSFROH
External diameter	5.5 mm
External diameter max.	6.2 mm

Single wire

Individual wires per module	8
Single wire, material	Cu litz wire
Single wire, cross section	0.14 mm²

Mechanical properties

Smallest bending radius, fixed installation	30 mm

General

Patch cable - FL CAT6 PATCH 1,0 - 2891385

Technical data

General

Conductor length	1 m
Nominal voltage U_N	150 V_{rms}
Transmission characteristics (category)	CAT6

Behavior in fire

Flame resistance	according to IEC 60332-3C
Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1

Standards and Regulations

Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1
Flame resistance	according to IEC 60332-3C

Environmental Product Compliance

China RoHS	Environmentally Friendly Use Period = 50
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Classifications

eCl@ss

eCl@ss 4.0	27250591
eCl@ss 4.1	27240409
eCl@ss 5.0	27259207
eCl@ss 5.1	27061801
eCl@ss 6.0	27259207
eCl@ss 7.0	27259207
eCl@ss 8.0	27060308
eCl@ss 9.0	27060308

ETIM

ETIM 2.0	EC001262
ETIM 3.0	EC001262
ETIM 4.0	EC001262
ETIM 5.0	EC002599

UNSPSC

UNSPSC 6.01	26121609
UNSPSC 7.0901	26121609
UNSPSC 11	26121609
UNSPSC 12.01	26121609
UNSPSC 13.2	26121604

Patch cable - FL CAT6 PATCH 1,0 - 2891385

Approvals

Approvals

Approvals

EAC

Ex Approvals

Approval details

EAC	EAC	EAC-Zulassung

Patch cable - FL CAT6 PATCH 3,0 - 2891686

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Patch cable, CAT6, pre-assembled, 3.0 m

RoHS

Ethernet

Key Commercial Data

Packing unit	1 STK
GTIN	4 046356 167567
GTIN	4046356167567
Weight per Piece (excluding packing)	130.200 g
Custom tariff number	85444210
Country of origin	Poland

Technical data

Ambient conditions

Ambient temperature (operation)	-10 °C ... 60 °C

External sheath

Outer sheath, material	LSFROH
External diameter	5.5 mm
External diameter max.	6.2 mm

Single wire

Individual wires per module	8
Single wire, material	Cu litz wire
Single wire, cross section	0.14 mm²

Mechanical properties

Patch cable - FL CAT6 PATCH 3,0 - 2891686

Technical data

Mechanical properties

Smallest bending radius, fixed installation	30 mm

General

Conductor length	3 m
Nominal voltage U_N	150 V_{rms}
Transmission characteristics (category)	CAT6

Behavior in fire

Flame resistance	according to IEC 60332-3C
Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1

Standards and Regulations

Concentration of fumes	in accordance with IEC 61034
Halogen-free	According to IEC 60754-1
Flame resistance	according to IEC 60332-3C

Environmental Product Compliance

China RoHS	Environmentally Friendly Use Period = 50
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Classifications

eCl@ss

eCl@ss 4.0	27250591
eCl@ss 4.1	27240409
eCl@ss 5.0	27259207
eCl@ss 5.1	27061801
eCl@ss 6.0	27259207
eCl@ss 7.0	27259207
eCl@ss 8.0	27060308
eCl@ss 9.0	27060308

ETIM

ETIM 2.0	EC001262
ETIM 3.0	EC001262
ETIM 4.0	EC001262
ETIM 5.0	EC002599

Patch cable - FL CAT6 PATCH 3,0 - 2891686

Classifications

UNSPSC

UNSPSC 6.01	26121609
UNSPSC 7.0901	26121609
UNSPSC 11	26121609
UNSPSC 12.01	26121609
UNSPSC 13.2	26121604

Approvals

Approvals

Approvals

EAC

Ex Approvals

Approval details

EAC	EAC	EAC-Zulassung

ICR-3201, ICR-3201W

INDUSTRIAL IoT LAN ROUTER & GATEWAY

+ LAN VPN Gateway for Industrial IoT applications
+ Powerful CPU with 1.3 GB storage to host customer SW applications
+ 2× Ethernet 10/100, 1x RS232, 1x RS485 and I/O
+ Optional Wi-Fi 802.11ac using MU-MIMO technology, Bluetooth v5.1 (class 1)
+ Robust metal cover with DIN and Wall mount options
+ Operational temperature range from -40 °C to +75 °C
+ Backup real time clock
+ Sleep mode & Power ignition

The ICR-3201 gateway is the perfect way to connect IP or serial devices to a LAN network via WAN interface. Industrial M2M and IoT applications include kiosks, industrial PCs, HMIs, traffic controllers, meters, UPS systems, and much more.

With upload speeds of up to 100 Mbit/s and download speeds of up to 100 Mbps, the ICR-3201 provides ample bandwidth high data demand applications such as CCTV or public Wi-Fi hotspots.

In addition to its two independent or switched Ethernet ports, serial ports RS232 and RS485, ICR-3201 has built-in digital I/O connectivity, backup real-time clock and sleep mode support. Optional built-in Wi-Fi and Bluetooth v5.1 (class 1) modules are available (ICR-3201W). WiFi with 802.11a,b,g,n,ac modes, and MO-MIMO support is appropriate for Wi-Fi applications.

The router supports VPN tunnel creation using various protocols to ensure safe communications. The router provides diagnostic functions which include automatic monitoring of the wireless and wired connections, automatic restart in case of connection losses, and a hardware watchdog that monitors the router status.

The ICR-3201 places intelligence at the network edge with an extremely powerful Cortex A8 CPU at 1GHz, 512 MB RAM and 4 GB EMMC FLASH memory in pSLC mode for a long-lifetime and critical industrial applications. 1.3 GB of memory space is allocated for customer SW applications and data. With open Linux platform and wide posibilities of programming customer SW applications in Python, C/C++ or browser-based flow editor Node-RED the ICR-3201 offers a real open development platform for Industrial IoT applications.

The Advantech existing app library (User modules) with apps already developed to enhance specific router functionality including industrial protocol conversions and support of IoT platforms such as MS Azure, Cumulocity, ThingWorx and others are supported on the router.

ICR-3201 is easy to install using WebAccess/DMP, a full featured configuration and monitoring tool for mass deployment. The router also supports additional traffic and health monitoring software R-SeeNet.

Bluetooth 5 ready

python™ C++ Node-RED

ORDERING INFORMATION – Antennas & Power Supplies Sold Separately

MODEL NO. - ORDER CODES		REGION	2× ETHERNET	RS232 RS485	I/O	WI-FI 802ac	2x MIMO	Bluetooth v5.1 (class1)
	ICR-3201	Global	✓	✓	✓			
	ICR-3201W	Global	✓	✓	✓	✓	✓	✓

* Check availability of another models for various world regions at our corporate website or with your local distributor.

ICR-3201, ICR-3201W
INDUSTRIAL IoT LAN ROUTER & GATEWAY

ACCESSORIES - INCLUDED

DESCRIPTION	
Wall mount kit	WALL-ICR32
DIN clip	BB-DIN-ICR32
Serial / IO connector	BB-CON-ICR32-10
PWR connector	BB-CON-WR2
Quick Start Guide	

ACCESSORIES - SOLD SEPARATELY

ORDER CODE	DESCRIPTION
BB-AW-A2458G-FSRPK	Antenna Wi-Fi 2.4 & 5.8 GHz
BB-RPS-v2-WR2-AUS	Wall mount Power Supply 12V/1A, AUS plug
BB-RPS-v2-WR2-EU	Wall mount Power Supply 12V/1A, EU plug
BB-RPS-v2-WR2-UK	Wall mount Power Supply 12V/1A, UK plug
BB-RPS-v2-WR2-US	Wall mount Power Supply 12V/1A, US plug

SPECIFICATIONS

NETWORKING	
Network and Routing	DHCP Server, NAT/PAT, VRRP, Dynamic DNS client, DNS proxy, VLAN, QoS, DMVPN, NTP Client/ Server, IGMP, BGP, OSPF, RIP, SMTP, SMTPS, SNMP v1/ v2c/ v3, Backup Routers, PPP, PPPoE, SSL, Port Forwarding, Host Port Routing, Ethernet Bridging, Load Balancing, IPv6 Dual Stack
Security	HTTPS, SSH, VPN tunnels, SFTP, DMZ, Firewall (IP Filtering, MAC address filtering, Inbound and outbound Port filtering)
VPN Tunnelling	Open VPN client and server and P2P, L2TP, PPTP, GRE, EasyVPN, IPSec with IKEv1 and IKEv2
Configuration	Web server, SSH, Four configuration switchable profiles, Automatic configuration update from server, Backup configuration, Restore configuration
Firmware Management	Automatic firmware updates from the server, locally via LAN or remotely via WAN (HTTP, HTTPS)
Diagnostic	One CLICK report - current configuration / factory identification / system log / kernel log / reboot log / routing table, Remote diagnostics possible via SSH
Status	Network Status, DHCP Status, IPSec Status, Statistics history for last 60days
Log	System Log, Reboot Log, Kernel Log
Controlling and Diagnostic	SMS, SNMP v1/v2c/v3, Statuses
Event Engine	StartUp script & Up/Down script (Bash, Python), Digital Input, Network Parameters, Data Usage, Timer, Power, Device Temperature. Report Types: SMS, email, SNMP Trap
Industrial Protocols	Modbus RTU/TCP gateway, IEC 60870-5-101 to 104 gateway, DF1, DNP3
Applications Development	Open Linux, Python, BASH, C/C++, Node-RED

PORTS, LED, ANTENNAS	
2× Ethernet	RJ45, 10/100 Mbps
LED indicators	PWR, USR
2× MIMO WiFi antenna - *optional	R-SMA connector
1× RS232, 1× RS485	(10-Way Terminal block)
I/O	1x Digital Input (On Voltage: 2.7V to 36VDC) 1x Binary Output (10-Way Terminal block)

CPU, MEMORY	
CPU	Cortex-A8, 1000 MHz
RAM	512 MB
Flash memory	eMMC - 4096 MB (838 MB for Router Apps, 512 MB for customer data)

MECHANICAL	
Metal case, Metal DIN rail, Wall mount kit	Metal
Enclosure Dimensions	31.2 × 94 × 129 mm
Weight - ICR-3201	457 g
Weight - ICR-3201W	477 g

ICR-3201, ICR-3201W
INDUSTRIAL IoT LAN ROUTER & GATEWAY

SPECIFICATIONS - CONTINUED

POWER, CONSUMPTION, ENVIRONMENTAL, IP COVER	
Power Supply	9–36VDC (2-Way Terminal block)
Power Consumption with WiFi - Idle / Average / Peak / Sleep Mode	2.5 / 4 W / 11 W / 10 mW
Temperature Range – Operating / Storage	-40 to +75 °C / -40 to +85 °C
Humidity – Operating / Storage (noncondensing)	0 to 95 % / 0 to 95 %
Cold Start	-40 °C
Operating Altitude	2000 m / 70 kPa
Enclosure Rating	IP30
Grounding screw	

WI-FI *	
Antenna Connector	2× R-SMA – 50 Ohms (MU-MIMO)
Supported WiFi Band	2.4 GHz to 2.495, 5.15 GHz to 5.825 GHz
Standards	IEEE 802.11ac Wave 2, 802.11d, 802.11e, 802.11h, 802.11i
Security - Standards	WEP, WPA, WPA2
Security - Encryption	WEP, TKIP, AES
Security - EAP Types	EAP-FAST, EAP-TLS, EAP-TTLS, PEAP-GTC, PEAP-MSCHAPv2, PEAP-TLS, LEAP
WiFi Standards	802.11a, 802.11b, 802.11g, 802.11n, 802.11ac Wave 2 WPA Enterprise, WPA2 Enterprise
Type of Device	Access point, Station

STANDARDS AND REGULATIONS	
Radio	EN 301 893, EN 300 328
EMC	EN 301 489-1, EN 301 489-17, AS/NZS CISPR 32, FCC Part 15 Subpart B, ICES-003 Issue 6, EN 61000-6-2
Safety	UL/EN/AS/NZS 62368-1
Climatic	EN 60068-2-1, EN 60068-2-2, EN 60068-2-14, EN 60068-2-30, MIL-STD-810G, SAE J1455
Mechanical	EN 60068-2-27, EN 60068-2-31, EN 60529, MIL-STD-810G, SAE J1455
Transportation	E-Mark E8 homologation number: 10R – 05 10350
National	CE, FCC, IC, RCM compliant
Environmental	REACH, RoHS3 and WEEE compliant

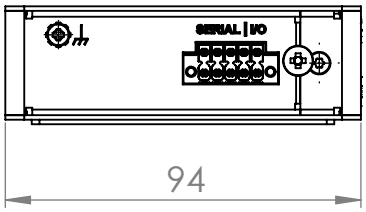
Bluetooth specifications *	
Version	Bluetooth 5.1, class 1
Support data rate	1 Mbps (GFSK), 2 Mbps (π/4-DQPSK), 3 Mbps (8-DPSK)
	Bluetooth®SIG Qualification

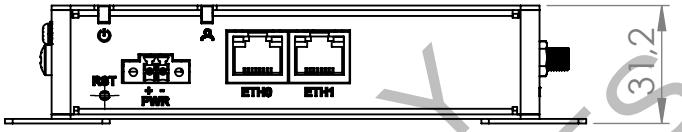
* Available only in "W" variant of the cellular router.

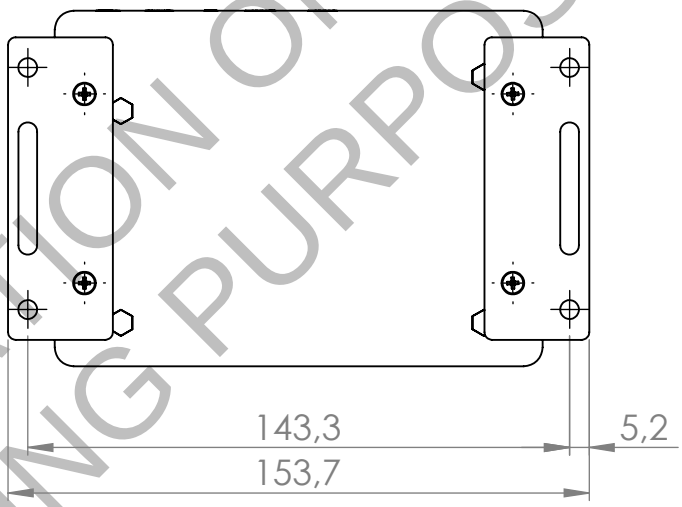
ICR-3201, ICR-3201W

INDUSTRIAL IoT LTE ROUTER & GATEWAY

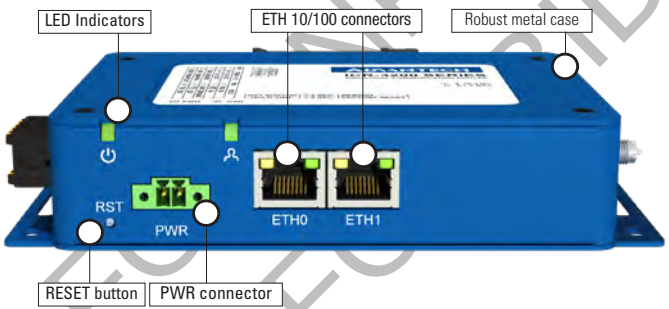
MECHANICAL DRAWING



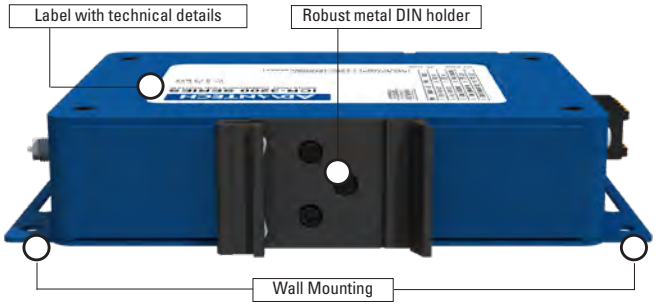




FRONT VIEW



REAR VIEW



LEFT SIDE VIEW

RIGHT SIDE VIEW

Industrial Ethernet Switch - FL SWITCH SFN 8TX - 2891929

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Ethernet switch, 8 TP RJ45 ports, automatic detection of data transmission speed of 10/100 Mbps (RJ45), autocrossing function

Why buy this product

- Auto negotiation and autocrossing detection simplifies installation and setup
- Local diagnostic indicators with LEDs
- The switch also offers cable locking and port blocking
- QoS-prioritized (Quality of Service) messages
- RJ45 ports support a transmission speed of 10/100 Mbps; fiber optic ports support 100 Mbps

RoHS

Ethernet

Key Commercial Data

Packing unit	1 STK
GTIN	4 046356 100823
GTIN	4046356100823
Weight per Piece (excluding packing)	444.440 g
Custom tariff number	85176200
Country of origin	Taiwan

Technical data

Note

Utilization restriction	EMC: class A product, see manufacturer's declaration in the download area

Dimensions

Width	50 mm
Height	120 mm
Depth	70 mm

Ambient conditions

Degree of protection	IP20

Industrial Ethernet Switch - FL SWITCH SFN 8TX - 2891929

Technical data

Ambient conditions

Ambient temperature (operation)	0 °C ... 60 °C
Ambient temperature (storage/transport)	-20 °C ... 70 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	86 kPa ... 108 kPa (up to 1500 m above mean sea level)
Air pressure (storage/transport)	66 kPa ... 108 kPa (up to 3500 m above mean sea level)

Interfaces

Interface 1	Ethernet (RJ45)
No. of ports	8 (RJ45 ports)
Connection method	RJ45
Note on connection method	Auto negotiation and autocrossing
Transmission physics	Ethernet in RJ45 twisted pair
Transmission speed	10/100 MBit/s

Function

Basic functions	Unmanaged switch / auto negotiation, complies with IEEE 802.3, store and forward switching mode
Status and diagnostic indicators	LEDs: U_{S1}, link and activity per port

Network expansion parameters

Cascading depth	Network, linear, and star structure: any
Maximum conductor length (twisted pair)	100 m

Supply voltage

Supply voltage	24 V DC
Residual ripple	3.6 V_{PP} (within the permitted voltage range)
Supply voltage range	9 V DC ... 32 V DC
Typical current consumption	typ. 140 mA (at U_S = 24 V DC)

General

Mounting type	DIN rail
Type AX	Block design
Net weight	512 g
Housing material	Aluminum

Standards and Regulations

Electromagnetic compatibility	Conformance with EMC Directive 2004/108/EC
Noise emission	EN 61000-6-4
Noise immunity	EN 61000-6-2:2005
Vibration (storage/transport)	5g, 150 Hz, in acc. with IEC 60068-2-6
Vibration (operation)	In acc. with IEC 60068-2-6: 5g, 150 Hz

Industrial Ethernet Switch - FL SWITCH SFN 8TX - 2891929

Classifications

eCl@ss

eCl@ss 4.0	27250501
eCl@ss 4.1	27250501
eCl@ss 5.0	27250501
eCl@ss 5.1	27250501
eCl@ss 6.0	19170106
eCl@ss 7.0	19170106
eCl@ss 8.0	19170106
eCl@ss 9.0	19170106

ETIM

ETIM 2.0	EC000734
ETIM 3.0	EC000734
ETIM 4.0	EC000734
ETIM 5.0	EC000734

UNSPSC

UNSPSC 6.01	43172015
UNSPSC 7.0901	43201404
UNSPSC 11	43172015
UNSPSC 12.01	43201410
UNSPSC 13.2	43201410

Approvals

Approvals

Approvals

UL Listed / cUL Listed / EAC / EAC / KC / cULus Listed

Ex Approvals

UL Listed / cUL Listed / cULus Listed

Approval details

UL Listed http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm FILE E 140324

cUL Listed http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm FILE E 140324

Industrial Ethernet Switch - FL SWITCH SFN 8TX - 2891929

Approvals

EAC EAC-Zulassung

EAC RU *-DE.A*30.B.01735

KC http://rra.go.kr/eng2/index.jsp KCC-REI-PCK- FL28919

cULus Listed

Overview, Continued

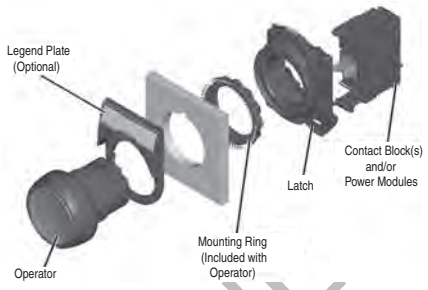
3-Across x 2-Deep Back-of-Panel (6 Circuits Max.)

- Rugged snap-fit design for plastic or metal latch
- Stackable contact blocks
- Rotating collar for easy one-hand latch removal
- Color-coded contact block plungers for contact identification

Plastic Latch with Contact Block

Metal Latch with Contact Block

Assembly Overview



Specifications*

Front-of-Panel (Operators)

Description		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Mechanical Ratings			
Vibration (assembled to panel)		Tested at 10…2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. for 3 hr duration, no damage	
Shock		Tested at 1/2 cycle sine wave for 11 ms; no damage at 100 G	
Degree of protection❄		IP65/66 (Type 3/3R/4/4X/12/13)	IP65/66 (Type 3/3R/4/12/13)
Mechanical durability per EN 60947-5-1 (Annex C)	10 000 000 Cycles	Momentary push buttons, momentary mushroom	
	1 000 000 Cycles	Multi-function, selector switch, key selector switch, selector jog, SensEject™ key selector switch	
	500 000 Cycles	Non-illuminated push-pull E-stop‡	
	300 000 Cycles	Twist-to-release E-stop, illuminated push-pull E-stop‡, alternate action push buttons	
	100 000 Cycles	Potentiometer, toggle switch	
Operating forces (typical with one contact block)		Flush/extended = 5 N, E-stop = 36 N Mushroom = 9 N	
Operating torque (typical application with one contact block)		Selector switch = 0.25 N•m (2.2 lb•in)	
Mounting torque	Plastic	1.7 N•m (15 lb•in)	
	Metal	4.4 N•m (40 lb•in)	
Environmental			
Temperature range (operating)		-25…+70 °C (-13…+158 °F)§	
Temperature range (short term storage)		-40…+85 °C (-40…+185 °F)	
Humidity		50…95% RH from 25…60 °C (77…140 °F)	

* Performance Data — see page Important-3 of the Industrial Controls catalog.
❄ Momentary mushroom operators are IP65. Plastic keyed operators are IP66, Type 4/13; not Type 4X.
‡ Limit of four contact blocks max. for these devices.
§ Operating temperatures below 0 °C (32 °F) are based on the absence of freezing moisture and liquids, UL Recognized to 55 °C (131 °F) - Incandescent module max. 40 °C (104 °F).

Product Certifications

Certifications	UR/UL, CSA, CCC, CE
Standards Compliance — CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5
Terminal Identification	EN/IEC 60947-1
Shipping Approvals	ABS
RoHS	✓

Back-of-Panel Components*

Electrical Ratings				
Standard contact block ratings		A600, Q600 600V AC AC 15, DC 13 to IEC/EN 60947-5-1 and UL 508, 17V, 5 mA min.		
Low voltage contact block ratings❄		5V, 1 mA DC min. C300, R150, AC 15, DC 13 to EN 60947-5-1 and UL 508		
	Nominal Voltage	**Range**	**Current Draw**	**Frequency**
LED Module Ratings	24…120V AC/DC 24V AC 24V DC 120V AC 240V AC	20…132V AC/DC 10…29V AC 10…30V DC 102…132V AC 204…264V AC	15 mA (AC), 12 mA (DC) 31 mA 24 mA 6 mA 6 mA	50/60 Hz, DC 50/60 Hz DC 50/60 Hz 50/60 Hz
Thermal current		10 A max. enclosed (40 °C ambient) to UL508, EN 60947-5-1		
Insulation voltage (U_i)		Screw terminal = 690V, spring-clamp = 300V		
Wire capacity (screw terminal)‡		#18…12 AWG (0.75…2.5 mm²) Max. (2) #14 AWG or (1) #12 AWG		
Wire capacity (spring-clamp terminal)		#18…14 AWG (0.75…1.5 mm²) One per spring clamp, two spring clamps per terminal		
Recommended tightening torque on screw terminals		0.7…0.9 N•m (6…8 lb•in)		
Dielectric strength (minimum)		2500V for one minute		
External short circuit protection	Standard blocks	10 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 248-4)		
	Low voltage contact blocks	6 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 248-4)		
Electrical shock protection		Finger-safe conforming to IP2X		
Mechanical Ratings				
Vibration (assembled to panel)		Tested at 10…2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. 6 hr		
Shock		Tested at 1/2 cycle sine wave for 11 ms and no damage at 100 G max.		
Contact durability per EN 60947-5-1 (Annex C)		10 000 000 cycles		
Contact operation	N.O.	Slow double make and break		
	N.C. & S.M.C.B.	Slow double make and break — positive opening ⊖		
	N.O.E.M.	Double break / double make, early make		
	N.C.L.B.	Double break / double make, late break — positive opening ⊖		
	N.C.E.B.	Double break / double make, early break — positive opening ⊖		
Push button travel to change electrical state		N.C. and N.O.E.M.	1.5 mm (0.060 in.)	
		N.O. and N.C.L.B.	2.5 mm (0.1 in.)	
Operating forces (typical)	Single circuit contact block	3.4 N		
	Dual circuit contact block	5…6.5 N		
Illumination				
LED Dominant Wavelength	Green Red Yellow Blue White	525 nm 629 nm 590 nm 470 nm —		
LED Luminous Intensity	Green Red Yellow Blue White	780 mcd 780 mcd 600 mcd 168 mcd 360 mcd		
Incandescent maximum wattage		2.6 W		
Materials				
Springs		Stainless steel and zinc coated music wire		
Electrical contacts	Standard	Silver-nickel		
	Low voltage	Gold-plated over silver		
Terminals	Screw	Brass		
	Spring-clamp	Silver-plated brass		

* Performance Data — see page Important-3 of the Industrial Controls catalog.
❄ Low voltage contacts are recommended for applications below 17V, 5 mA.
‡ Wires less than #18 AWG (0.75 mm²) may not hold in terminal securely.

Material Listing

Component	For Use with	Material Used
Panel gasket	All operators	Nitrile, TPE
Diaphragm seal	Illuminated push button, non-illuminated push button	Automotive industry acceptable silicone
K-seal	Selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Nitrile
Diaphragm retainer, return spring I	Illuminated push button, non-illuminated push button, momentary mushroom	Stainless steel
Return spring II	Reset, selector switch, key selector switch, alternate action, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Zinc-coated music wire
Button cap/mushroom head	Non-illuminated push button, momentary mushroom, reset, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function	PBT/polycarbonate blend
2-color molded button cap	Non-illuminated push button	PBT/polycarbonate blend
Lens	Multi-function	Acetal
Lens, knob	Illuminated push button, illuminated momentary mushroom, illuminated selector switch	Polyamide
Knob	Non-illuminated selector switch	Glass-filled polyamide
Plastic bezel/bushing I	Non-illuminated push button, illuminated push button, momentary mushroom, selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function, reset	Glass-filled polyamide
Plastic bezel/bushing II, jam nut	Pilot light, reset jam nut, reset pushers	Glass-filled PBT
Metal bezel/bushing	All metal operators	Zinc
Diffuser	Illuminated push button, pilot light	Polycarbonate
Legend frames	—	Glass-filled polyamide
Plastic mounting ring	All plastic operators	Glass-filled polyamide
Metal mounting ring	All metal operators	Chromated zinc
Plastic latch	—	Glass-filled polyamide
Metal latch	—	Chromated zinc + stainless steel
Plastic enclosure	—	PBT/polycarbonate blend
Metal enclosure	—	Aluminum
Terminal screws	LED module, incandescent module, contact blocks	Zinc-plated steel with chromate
Terminals	LED module, incandescent module, contact blocks	Brass with silver-nickel contacts
Spring clamps	LED module, incandescent module, contact blocks	Stainless steel
Lamp socket	Incandescent module	Brass
Housing	Incandescent module, LED module	Glass-filled polyamide
Low-voltage terminals	Contact blocks	Gold-plated silver-nickel contacts
Low-voltage spanner	Contact blocks	Gold-plated silver-nickel contacts
Spanner	Contact blocks	Brass with silver-nickel contacts
Boot	Toggle Switch, illuminated push button, non-illuminated push button, multi-function illuminated and non-illuminated	Automotive industry acceptable silicone

Momentary Push Button Operators, Illuminated — Flush, Extended, Guarded

Flush Operator
Cat. No. 800FM-LF4

Extended Operator
Cat. No. 800FP-LE3

Guarded Operator
Cat. No. 800FP-LG3

Color	Pkg. Quantity	Flush		Extended	
		Plastic	Metal	Plastic	Metal
		Cat. No.	Cat. No.	Cat. No.	Cat. No.
Green	1	**800FP-LF3**	**800FM-LF3**	**800FP-LE3**	**800FM-LE3**
Red		**800FP-LF4**	**800FM-LF4**	**800FP-LE4**	**800FM-LE4**
Yellow		**800FP-LF5**	**800FM-LF5**	**800FP-LE5**	**800FM-LE5**
Clear		**800FP-LF7**	**800FM-LF7**	**800FP-LE7**	**800FM-LE7**

800F P – LE 3 –
a b c d

a

Operator Construction	
Code	Description
P	Round plastic operator (IP66, Type 4/4X/13)
M	Round metal operator (IP66, Type 4/13)

b

Operator Type	
Code	Description
LF	Flush
LE	Extended
LG	Guarded

c

Color Cap ∗	
Code	Color
0	Amber❄
3	Green
4	Red
5	Yellow❄
6	Blue❄
7	Clear
9	No cap

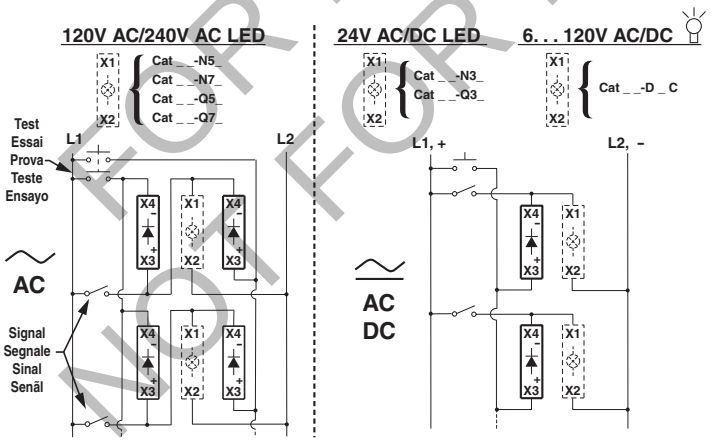
d

Packaging	
Code	Description
Blank	1 per package
BP	10 per package‡

∗ For custom laser-engraved operator, order operator with applicable lens cap color plus custom laser-engraved diffuser; see page 10-115.
❄ When using LED for illumination, a white LED is recommended.
‡ Only available with no color cap (**9** from Table c).

Push-to-Test Push Button Device Schematic

Illuminated push buttons may be wired as a push-to-test device by using the following schematic and Cat. No. 800F-XD7 Diode module from page 10-111.



10

Back of Panel Components, Continued

Other

	Description	Volts	Pkg. Quantity		Cat. No.
 *Cat. No. 800F-D3C*	**Incandescent Module** For use with pilot lights, push buttons, and momentary mushroom operators. **Note:** Sold in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.	No bulb	10		**800F-D0C**
		6V AC/DC			**800F-D1C**
		12V AC/DC			**800F-D2C**
		24V AC/DC			**800F-D3C**
		48V AC/DC			**800F-D4C**
		120V AC/DC			**800F-D5C**
 *Cat. No. 800F-N3G*	**Integrated LED Module** For use with all illuminated devices. For best results, LED should match lens color. For amber operators, use yellow LED. **Note:** Sold in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.	24…120V AC/DC	10	✶	**800F-NUx**
		24V AC/DC		✶	**800F-N3x**
		120V AC		✶	**800F-N5x**
		240V AC		✶	**800F-N7x**
		24V AC/DC spring-clamp		✶	800F-Q3x
		120V AC spring-clamp		✶	800F-Q5x
		240V AC spring-clamp		✶	800F-Q7x
		24V AC/DC ring lug		❄‡	800F-R3x

	Description	Contact Material	Pkg. Quantity	Cat. No.
 *Cat. No. 800F-BX01*	**Base Mounted Contact Block** Base mounted contact blocks can be used in plastic or metal enclosures. **Note:** Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.	N.O.	10	**800F-BX10**
		N.C.		**800F-BX01**
		N.O. low voltage — QuadConnect™		800F-BX10V
		N.C. low voltage — QuadConnect™		**800F-BX01V**
		N.O.E.M.		**800F-BX10E**
		N.C.L.B.		**800F-BX01L**
		N.O. spring-clamp		**800F-BQ10**
		N.C. spring-clamp		**800F-BQ01**

	Description	Volts	Pkg. Quantity		Cat. No.
 *Cat. No. 800F-BN3R*	**Base Mounted Integrated LED Module** Base mounted modules can be used in plastic or metal enclosures. For best illumination results, LED should match lens color. **Note:** Sold in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.	24V AC/DC	10	✶	**800F-BN3x**
		120V AC		✶	**800F-BN5x**
		240V AC		✶	**800F-BN7x**

✶ To complete the cat. no., replace the **x** with one of the following letters for the desired color: **Y** = Amber, **R** = Red, **G** = Green, **B** = Blue, **W** = White.
❄ Cannot be used in a composite catalog number.
‡ Replacement screws are available (Cat. No. 800F-ARS1)

Back-of-Panel Components, Continued

Other

	Description	Pkg. Quantity	Cat. No.
 *Cat. No. 800F-ALM*	**Metal Mounting Latch** These are zinc-plated, metal die cast mounting latches. **Note:** Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.	10	**800F-ALM**
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces.	100	**800F-ALM-BP**
 *Cat. No. 800F-ALP*	**Plastic Mounting Latch** **Note:** Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.	10	**800F-ALP**
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces.	100	**800F-ALP-BP**

	Description	Contact Type	Pkg. Quantity	Cat. No.
 *Cat. No. 800F-X10*	**Contact Block** **Note:** Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.	N.O.	10	**800F-X10**
		N.C.		**800F-X01**
		N.O. low voltage — QuadCONNECT™		**800F-X10V**
		N.C. low voltage — QuadCONNECT™		**800F-X01V**
		N.O.L.M.		♣ **800F-X10N**
		N.O.E.M.		**800F-X10E**
		N.O.E.E.M.		➢ 800F-X10M
		N.C.L.B.		**800F-X01L**
		N.C.E.B.		✶ **800F-X01B**
		Self-Monitoring		❄ **800F-X01S**
		Dual circuit of 2 N.O.		❄ **800F-X20D**
		Dual circuit of 2 N.C.		❄ **800F-X02D**
		Dual circuit of 1 N.O.-1 N.C.		❄ **800F-X11D**
		N.O. with stab terminals		800F-X10T
		N.C. with stab terminals		800F-X01T
		N.O. spring-clamp		**800F-Q10**
		N.C. spring-clamp		**800F-Q01**
		N.O. spring-clamp low-voltage — QuadConnect™		**800F-Q10V**
		N.C. spring-clamp low-voltage — QuadConnect™		**800F-Q01V**
		N.O.E.M. spring-clamp		**800F-Q10E**
		N.C.L.B. spring clamp		**800F-Q01L**
		N.C.E.B. spring-clamp		✶ **800F-Q01B**
		Ring lug N.O.		‡§ **800F-R10**
		Ring lug N.C.		‡§ **800F-R01**
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces. Latch not included.	N.O.	100	**800F-X10-BP**
		N.C.		**800F-X01-BP**

♣ For use with **Cat. No. 800FP-CB_** and **Cat. No. 800FP-CC_** operators.
➢ For use with **Cat. No. 800FP-CC_** operators.
✶ Only for use with 4-position selector switch, 4-position toggle switch, or 3-position push-pull operator.
❄ Cannot stack.
‡ Cannot be used in a composite catalog number.
§ Replacement screws are available (Cat. No. 800F-ARS1)

Emergency Stop Operators*

Non-Illuminated Twist-to-Release, Push-Pull

60 mm Non-Illuminated Twist-to-Release
Cat. No. 800FP-MT64

40 mm Non-Illuminated Push-Pull
Cat. No. 800FP-MP44

Color	Size	Pkg. Quantity	Twist-to-Release (Trigger Action)		Push-Pull (Trigger Action)	
			Plastic	Metal	Plastic	Metal
			Cat. No.	Cat. No.	Cat. No.	Cat. No.
Red	30	1	**800FP-MT34**	**800FM-MT34**	—	—
	40		**800FP-MT44**	**800FM-MT44**	**800FP-MP44**	**800FM-MP44**
	60		**800FP-MT64**	**800FM-MT64**	—	—

Illuminated — Twist-to-Release, Push-Pull‡

40 mm Illuminated Twist-to-Release
Cat. No. 800FP-LMT44

40 mm Mushroom Push/Pull
Cat. No. 800FM-LMP44

Color	Size	Pkg. Quantity	Twist-to-Release (Trigger Action)		Push-Pull (Trigger Action)	
			Plastic	Metal	Plastic	Metal
			Cat. No.	Cat. No.	Cat. No.	Cat. No.
Red	30	1	—	—	**800FP-LMP34**	**800FM-LMP34**
	40		**800FP-LMT44**	**800FM-LMT44**	**800FP-LMP44**	**800FM-LMP44**
	60		**800FP-LMT64**	**800FM-LMT64**	**800FP-LMP64**	**800FM-LMP64**

Key Release Mushroom Operator

40 mm Non-Illuminated Key Release
Cat. No. 800FP-MK44

Color	Size	Pkg. Quantity	Ronis Key Lock (Trigger Action)❄	
			Plastic	Metal
			Cat. No.	Cat. No.
Red	40 mm	1	**800FP-MK44**	**800FM-MK44**

* All emergency stop operators are EN ISO 13850 compliant with standard NC, NCLB, or self-monitoring contact blocks.
‡ LED module required for illumination, can not use incandescent module.
❄ For key options, see page 10-88.

2-Position Push-Pull Operators, Non-Illuminated — Twist-to-Release (Trigger Action), Push-Pull (Trigger Action)⁎⌘

40 mm Trigger Action
Twist-to-Release Mushroom
Cat. No. 800FP-MT44

40 mm Trigger Action
Push-Pull Mushroom
Cat. No. 800FP-MP44

90 mm Half-Dome
Cat. No. 800FP-MP94

		40 mm Mushroom (Trigger Action) Twist-to-Release		40 mm Mushroom (Trigger Action) Push-Pull	
		Plastic	Metal	Plastic	Metal
Color	Pkg. Quantity	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Red	1	**800FP-MT44**	**800FM-MT44**	**800FP-MP44**	**800FM-MP44**

800F P – MT4 4 ____
a b c d

a

Operator Construction	
Code	Description
P	Round plastic operator (IP66, Type 4/4X/13)
M	Round metal operator (IP66, Type 4/13)

b

Operator Type	
Push, Twist-to-Release➢	
Code	Type
MT3	30 mm color cap
MT4	40 mm color cap
MT6	60 mm color cap
Push-Pull✦	
Code	Type
MP4	40 mm color cap
Half-Dome Push-Pull✦	
Code	Type
MP9	90 mm color cap❄

c

Color Cap	
Code	Color
2	Black
3	Green
4	Red
5	Yellow
6	Blue

d‡§♣

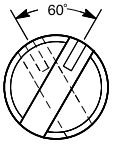
Engraving	
Code	Description
Blank	No engraving on cap
LE	EMO laser engraved
E	EMO printed

⁎ All emergency stop operators are EN ISO 13850 compliant with standard NC, NCLB, or self-monitoring contact blocks.
⌘ E-Stop operators, latch, and contact block combinations have been third-party tested for B10d values. B10d values can be found in publication SAFETY-SR001_-EN-E.
➢ Only available with red color cap.
‡ For EMO guards, see page 10-109.
§ Only available on 40 mm color cap.
♣ Only available on red, 40 mm push, twist-to-release operator type (MT44).
❄ Half-dome operators only available with black, red, and yellow color caps.
✦ Limit of four contact blocks max. for these devices.

2-Position Selector Switch Operators, Illuminated §

Standard Knob
Cat. No. 800FP-LSM26

Switching Angle



Contact Type➢	Target Table and Operator Position✶	
N.O.	O	X
N.C.	X	O

Note: X = Closed/O = Open
➢ Contact selection is limited to the following options, consult your local Rockwell Automation sales office or Allen-Bradley distributor for other options.

Color	Operator Type	Pkg. Quantity	Standard Knob	
			Plastic	Metal
			Cat. No.	Cat. No.
Green		1	**800FP-LSM23**	**800FM-LSM23**
Red			**800FP-LSM24**	**800FM-LSM24**
Yellow			**800FP-LSM25**	**800FM-LSM25**

✶ Target table for spring return from left is reversed from what is shown in the table.

800F P – LS M2 3
a b c d e

a

Operator Construction	
Code	Description❄
P	Round plastic operator (IP66, Type 4/4X/13)
M	Round metal operator (IP66, Type 4/13)

b

Operator Type	
Code	Description
LS	Standard knob
LH	Knob lever♣

c

Operator Function	
Code	Type
M2	Maintained (60° switching angle)
L2	Spring return from left (60° switching angle)
R2	Spring return from right (60° switching angle)

d

Knob/Insert Color		
Code	Knob Color	Insert Color
0	Amber➢	White
3	Green	White
4	Red	White
5	Yellow➢	Black
6	Blue➢	White
7	Clear	Black

e

Orientation	
Code	Description
Blank	Standard
N	90° offset‡

❄ LED module required for illumination, can not use incandescent module.
‡ For use in vertical mount enclosures.
§ Crevices may exist on product that may be unsuitable for certain applications. Please consult your local Rockwell Automation sales office or Allen-Bradley distributor.
♣ Only available in clear.
➢ Use of a white LED is recommended.

Two-Color Molded Legend Caps — Non-Illuminated Push Buttons

800F – AF 3 01
a b c

Cat. No. 800F-15YSE112

a

Button Cap Type	
Code	Description
AF	Flush
AE	Extended

b

Color Cap	
Code	Description
1	White
2	Black
3	Green
4	Red
5	Yellow
6	Blue

c

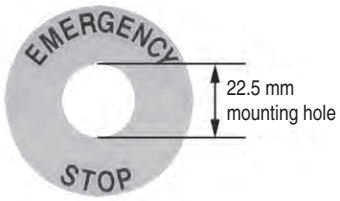
Legend Text❄‡	
English	
Code	Description
01	START
02	STOP
05	O
06	I
08	→
09	FORWARD✶
10	REVERSE✶
11	R

✶ Available in flush only.
❄ White and yellow caps have black text. All other color caps have white text.
‡ Valid color cap text codes include:

Color	Text	
	Flush Caps	Extended Caps
White	FORWARD, REVERSE, START, I, →, R	→, R
Black	FORWARD, REVERSE, →, R	STOP, O, →, R
Green	FORWARD, REVERSE, START, I, →	→
Red	FORWARD, REVERSE, STOP, O, →	STOP, O, →
Yellow	FORWARD, REVERSE, →	→
Blue	FORWARD, REVERSE, →, R	→, R

Emergency Stop Legend Plates§

800F – 15YS
a b



a

Size/Color (Yellow)	
Code	Description
15Y	60 mm round (30.5 mm mounting hole)
15YS	60 mm round (22.5 mm mounting hole)➢
16Y	90 mm round (22.5 mm mounting hole)➢

b

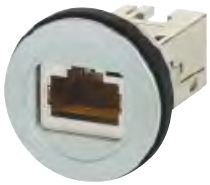
Text	
Code	Description
Blank	No text
E112	EMERGENCY STOP
F112	ARRÊT D'URGENCE⌘
S112	PARADA DE EMERGENCIA
G112	NOT HALT
T112	ARRESTO EMERGENZA
N112	NÖDSTOPP, EMERGENCY STOP⌘

b (cont'd)

Text	
Code	Description
W112	NØDSTOPP, EMERGENCY STOP⌘
A112	NØDSTOP
B112	EMERGENCY STOP, ARRÊT D'URGENCE, PARADA DE EMERGENCIA⌘
D112	NOODSTOP⌘
M112	NOT HALT, ARRESTO EMERGENZA, ARRÊT D'URGENCE✦
	EMERGENCY STOP, ARRÊT D'URGENCE, NOT HALT❖
L112	NEYÐARSTOPP, NEYÐARSTOPP⌘
H112	NÖD-STOP, HÄTÄ-SEIS, NÖD-STOP⌘

§ Sold only multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.
➢ Not for use with base mounted contact blocks.
⌘ Not available on 15YS version.
✦ Text printed on the 15Y version only.
❖ Text printed on the 15YS & 16Y versions only.

har-port coupler



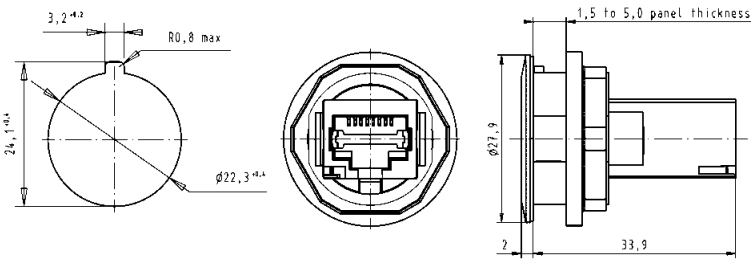
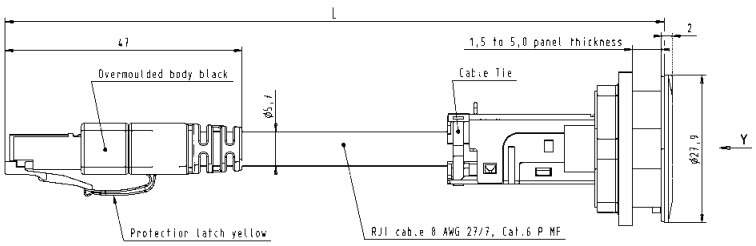
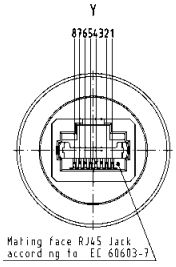
har-port RJ45 coupler

Advantages

- Compact and well-shaped service interface in a timeless attractive design
- Easy mounting
- Transmission category 6, performance class E_A, suitable for 1/10 Gigabit Ethernet
- Compact and robust design
- Practical accessories

Technical characteristics

Number of ports	2x RJ45
Transmission performance	Category 6 / class E_A acc. to ISO/IEC 11 801:2002, EN 50 173-1
Transmission rate	10/100 Mbit/s and 1/10 Gbit/s
Shielding	Fully shielded, 360° shielding contact
Mounting	Screwable in cover plates
Degree of protection	IP 20
Mating cycles	min. 750
Temperature range	-25 °C ... +70 °C
Housing material	Polyamide

Identi cation	Part No.	Drawing	Dimensions in mm
har-port RJ45 Cat. 6 coupler	09 45 452 1560		
c/w protection cover: 09 45 502 0005			
har-port RJ45 Cat. 6 coupler with cable			
Length: 0.2 m	09 45 452 1501		
0.5 m	09 45 452 1504		
1.0 m	09 45 452 1509		
1.5 m	09 45 452 1510		
2.0 m	09 45 452 1511		
3.0 m	09 45 452 1513		
5.0 m	09 45 452 1516		
			
har-port HIFF coupler housing (for all HIFF compatible modules)	09 45 452 0000		

2. Voltage and Amperage Ratings

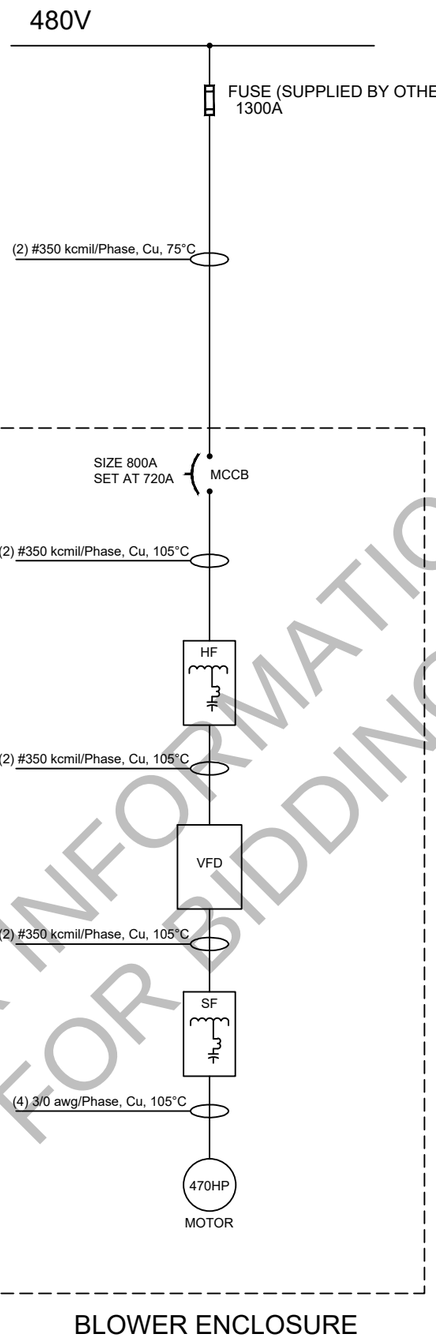
AFD: 500V - 920A

Harmonic Filter : 480V - 636A

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

3. One Line Diagram

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com



APGN INC.
1270, Michèle-Bohec, Blainville,
Québec, CANADA, J7C 5S4
Tel: (450) 939-0799
Fax : (450) 939-2115

UNLESS OTHERWISE NOTED :
ALL DIMENSIONS ARE IN IN/MM
PROJECTION

PROJECT :	XX-YYYY Greater New Haven		
TITLE :	ONE-LINE DIAGRAM FOR APGN500		
PROJECT NO: XX-YYYY	DRAWING NO: SLD-500220304		REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-20-2022
CHECKED BY:	P. Mailloux	DATE	Jan-20-2022
DRAWN BY:	B. Yu	DATE	Jan-20-2022
APPROVED BY:	P. Mailloux	DATE	Jan-20-2022
FILE NAME: XX-YYYY Greater New Haven APGN500 One-Line Diagram Rev Bid			PAGE: 01

4. Minimum Short Circuit Ratings

The short circuit rating for each applicable equipment can be found in the associated datasheet. Please refer to Section 3. Electrical - c. Electrical Equipment Details - 1. Cut Sheets.

All AFDs and associated equipment provided are provided with a minimum short circuit ratings of 65KA rms symmetrical

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

5. Calculations for the proposed Harmonic

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

MTE IEEE519 harmonic study title

Client Name : Greater New Haven

Report submitted to: Mohamed Saleh

Report by: Billy Yu

Project notes: For Bidding

Disclaimer:
The information contained here is an estimation without warranty of any kind and does not constitute a guarantee of filter performance, measurement or any standard of conformity. Numerous outside factors can influence the harmonics present on a power system, including other equipment in close proximity within the plant and other neighboring plants. This can include, but is not limited to, frequency converters, nonlinear loads and/or other equipment. The calculated current and voltage harmonics shown in this Report may contain inaccuracies and is for estimation purposes only.

IEEE519:
The following calculations in this report are based on the guidelines set forth in IEEE519- 2014 namely THVD voltage distortion limits of table 1 and TDD current distortion limits in Table 2.
Within the IEEE519 document Section 5 recommendations state : " The recommended limits in this clause only apply at the point of common coupling and should not be applied to either individual pieces of equipment or at locations within a users facility."

Loading and harmonic calculation
Load calculations for harmonic currents are based on motor HP or KW and use standard PF and effiency at the nominal line voltage to determine a value for fundamental drive current. Typical tabular harmonic THID % are used to model harmonic current which normally could be measured at the input of a six pulse drive. Again these are estimates based on typical lab data at various drive inputs

Report Summary of IEEE519 -2014 compliance		Original		Added Filter	
TDD	PCC is at the transformer secondary	**FAIL**	**90.14**	**4.08**	**PASS**
THVD	PCC is at the transformer secondary	**FAIL**	**15.08**	**1.12**	**PASS**

Utility provided frequency in Hertz	60	Hz
Utility voltage Primary	40000	volts
Utility SSC amps	3000	amps

Transformer Size KVA	3600	KVA
Secondary Voltage	480	voltage
Impedance %	5	%
Calculated XMR Full load Amps	4330	Amps
Calc Short circuit amps	86603	Amps
calc ohms impedance	0.0032	Ohms

Generator Size KVA
Sub transient reactance typical 0.15
Calculated Generator Full load Amps
Calc Short circuit amps
generator impedance %
calc ohms impedance

Load Summary of nonlinear loads

Ref	Load notes	Quantity	HP	% load	Original	Filter proposed	Qty	Gen
A	APGN500	5	470	100	No link or reactor	MAPP0636D	5	
B								
C								
D								
E								
F								
G								

Linear loads summary on soft start or across line make up
Total all linear loads that are typically running across the line = 0HP .8 pf

Linear load 0 % of total load with 0Amps

Results:

Calculation PCC data summary at secondary of transformer

		Original	Filtered	
total transformer load in KW		**1948**	**1947**	
total transformer load in KVA apparent power		**2622**	**1949**	
total RMS load current in Amps		3157.72	2347.45	
total RMS fundamental current in AMPS		2345.50	2345.50	
total harmonic current in amps		2114.20	95.59	
% transformer loading		72.9	54.2	
Short circuit ratio Isc/Il IEEE		36.9	36.9	
required IEEE 519 TDD % for Isc/Il		**8**	**8**	
% TDD per IEEE needs to be less than 8%	**FAIL**	**90.14**	**4.08**	**PASS**
THVD % at PCC transformer less than 8%	**FAIL**	**15.08**	**1.12**	**PASS**
distortion power factor		0.74	1.00	
true power factor		0.743	0.999	
Active filter corrective amps to comply		2004	0	

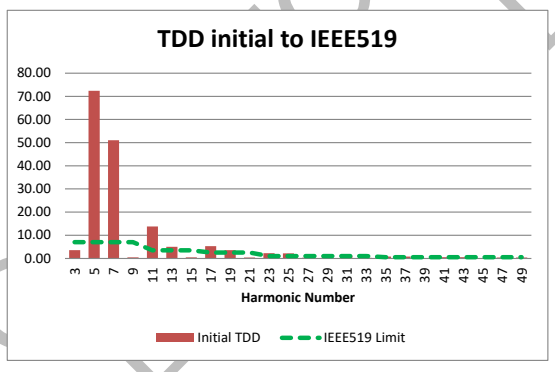
Calculation PCC data summary primary of transformer high voltage **NO**

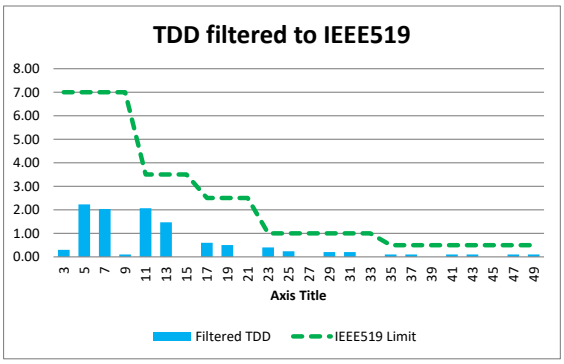
Utility load current Amps
total RMS fundamental current in AMPS
total harmonic current in amps
Short circuit ratio Isc/Il IEEE
required IEEE 519 TDD % for Isc/Il
% TDD per IEEE needs to be less than 20%

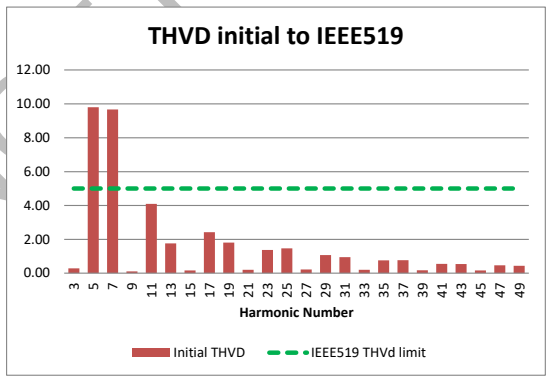
Calculation Generator summary of selected loads **NO**

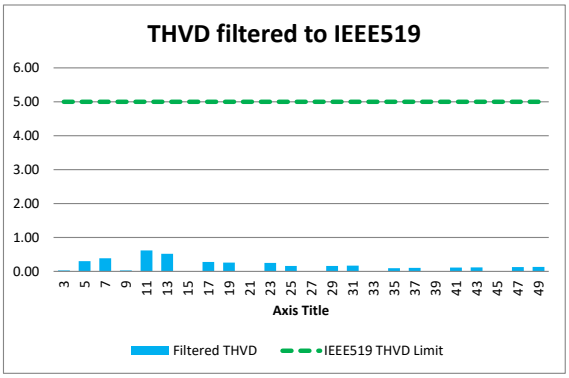
Specified Generator None KVA
total generator KW load
total generator KVA load
total RMS load current in Amps
total RMS fundamental current in AMPS
total harmonic current in amps
% Generator loading
required IEEE 519 TDD % for Isc/Il
% TDD per IEEE needs to be less than 5%
THVD % at generator output less than 8%
distortion power factor
true power factor

Spectrum results at Transformer PCC overall facility based on listed loading

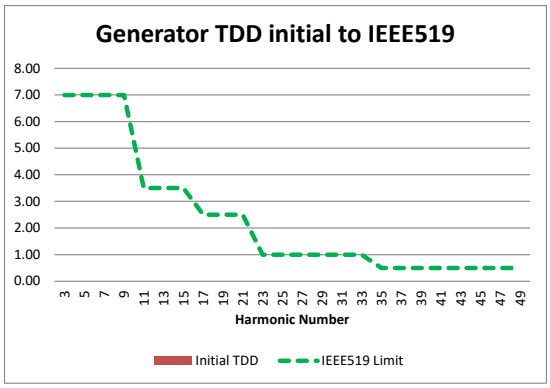


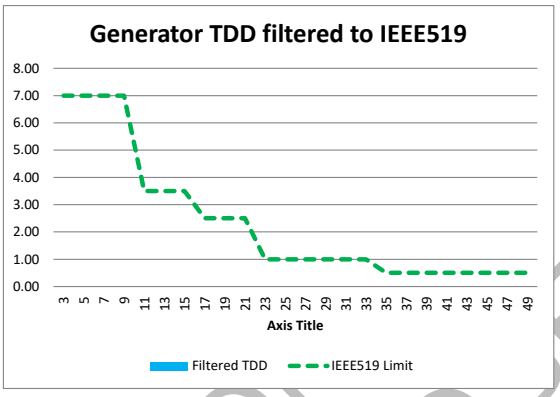


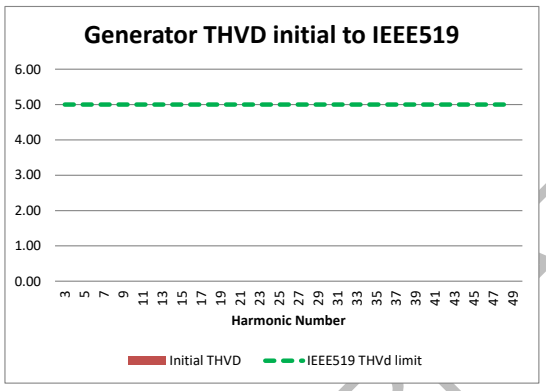


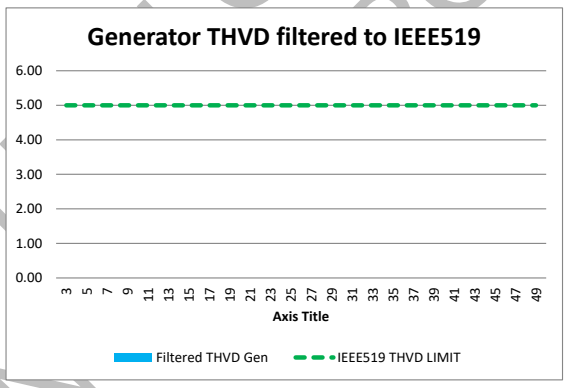


Spectrum results at generator for listed loading









A Drive type characteristics

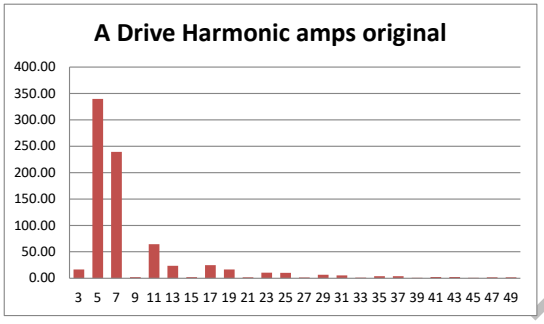
Data summary each drive input

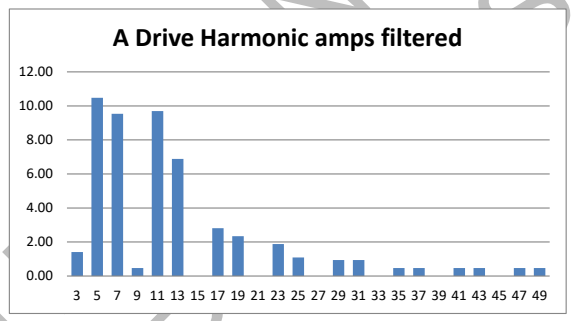
Load notes **APGN500: Drive for each is 470 HP 100% loaded**

Original **No link or reactor**

Added **MAPP0636D**

	Original	Filtered
THID % present at filter input	90.14%	4.08%
RMS harmonic Current amps	422.84	19.12
AMPS RMS total Drive load current	631.54	469.49
Effective THID added to total load	18.03	0.82
Power factor contribution	0.74	1.00





B Drive type characteristics

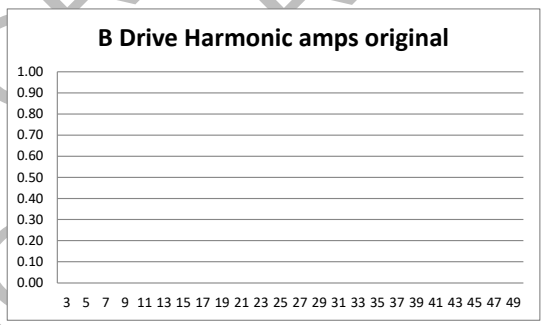
Data summary each drive input

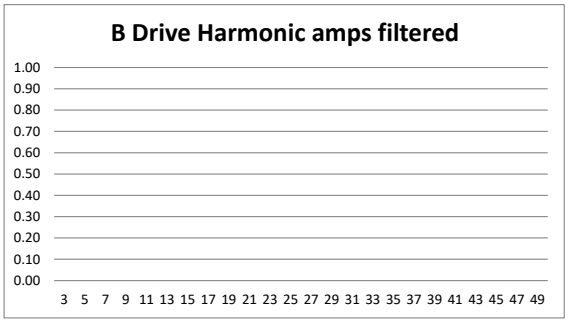
Load notes -

Original -

Added

	Original	Filtered
THID % present at drives input	-	-
RMS harmonic Current amps	-	-
AMPS RMS total Drive load current	-	-
Effective THID added to total load	-	-
Power factor contribution	-	-



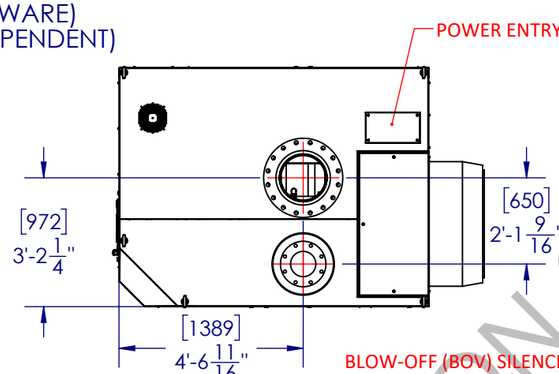


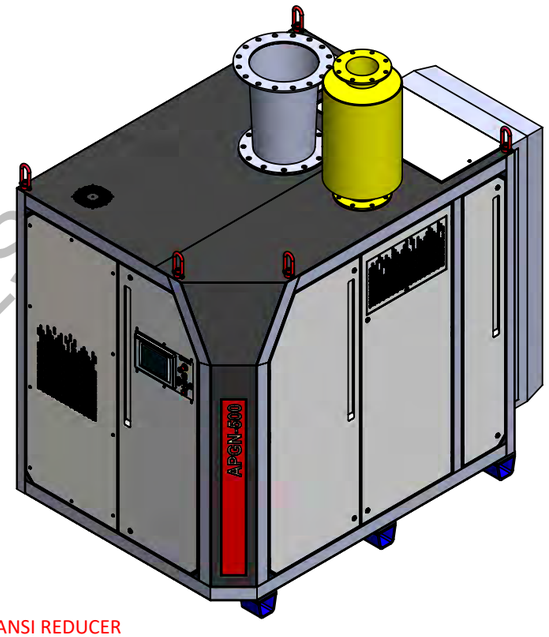
6. Enclosure Proposed

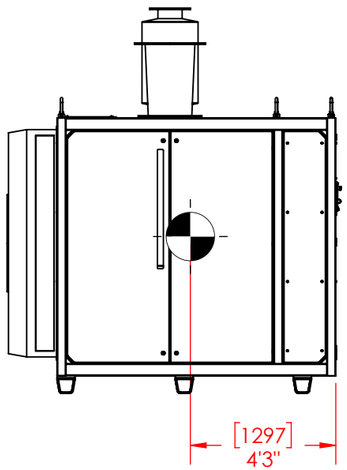
All the electrical equipment are situated inside the blower enclosure.

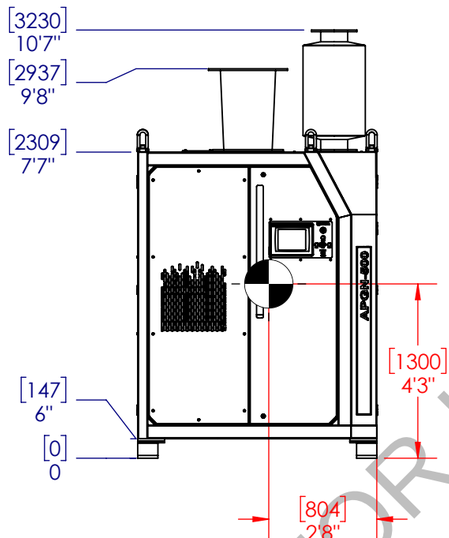
APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

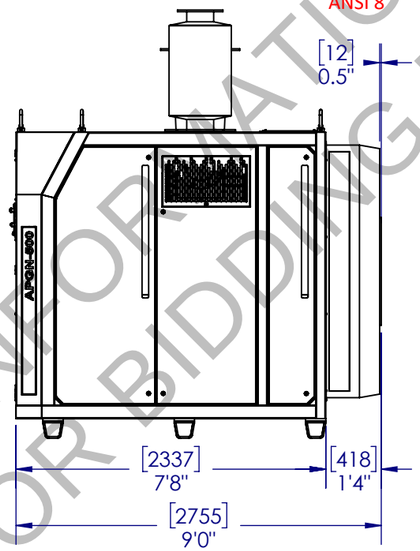
NOTE 1
1. MATERIAL: CARBON STEEL.
2. PAINT: POWLAC EY ZINC PRIMER, AND GREY COLOR, FILM THINKNESS EACH 60µ (101~106g/m²)
3. LIFTING INSTRUCTIONS : FROM LATERAL SIDE OR TOP
4. MINIMUM CLEARANCE REQUIRED FOR FILTER REMOVAL AND MAINTENANCE : 42 INCHES
5. COOLING SYSTEM: CLOSED LOOP WATER-GLYCOL AND AIR CONVECTION
6. FOR CABLING, REFER TO ELECTRICAL RATING SHOWN ON BLOWER NAMEPLATE
7. WEIGHT APPROX.: 6735 Lbs. (DEPENDING ON INSTALLED HARDWARE)
8. DISCHARGE CONE NOT SHOWN (CAN BE 16" OR 18" FLOW DEPENDENT)

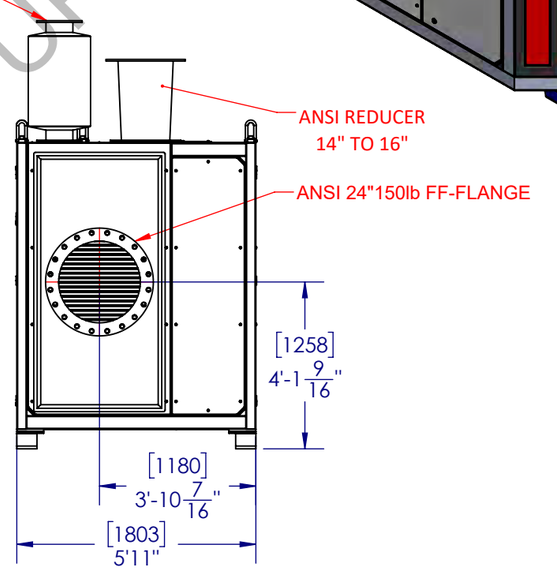


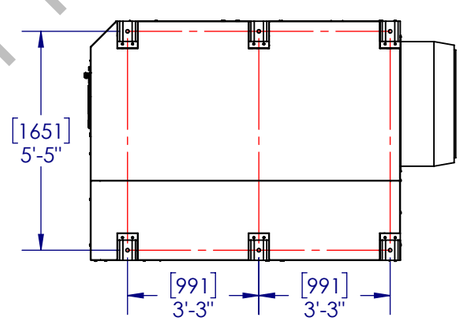












NOTE 2

1. ISOMETRIC VIEW IS NOT TO SCALE
2. ALL DIMENSIONS ARE IN FEET&INCHES
3. DUAL DIMENSIONS ARE IN MILLIMETERS

APGN INC.
1270, Michèle-Bohec, Blainville,
Québec, CANADA, J7C 5S4
Tel: (450) 939-0799
Fax : (450) 939-2115

UNLESS OTHERWISE NOTED :
ALL DIMENSIONS ARE IN INCHES
PROJECTION

FOR : GENERAL ARRANGEMENT
TITLE : APGN500 TURBO BLOWER
ANCHORING FEET - FLANGE INLET

PROJECT NO.	DRAWING NO. G-500220226-A	REV : 00	
DRAWN BY. A. BOR	14-01-2022	MASTER No. -	
CHECKED BY. L.STURZU	14-01-2022	REFERENCE No. -	
APPR. BY.		SCALE : 1:40	DWG SIZE : B
FILE NAME : APGN500-AF-IFH24-DC16-A			SHEET 1 OF 1

7. Documentation for UL Certification

APG-Neuros provides high-quality electrical and mechanical components that are UL listed.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Greater New Haven APGN500 BOM

No.	General	TAG	ITEM DESCRIPTION	Manufacturer Part No.	Manufacturer	QT'Y	APGN PART No.
			480 VAC - MAINS SIDE				
1	Main	MCCB	MOLDED CASE CIRCUIT BREAKER 800A, P-FRAME, 65kA, Micrologic 5.0 Trip Unit (LSI) WITH EXTENDED ROTARY HANDLE	PJF36080U33A-RE10	Schneider	1	ELE05015-0003.0
2			Set of Lugs	YA600P5	Schneider	6	ELE00027-0221.0
3		HF	Harmonic Filter with 24VDC Contactor Option	N-738-MAPP0636D(C)	MTE	1	TBD
4		VFD	Variable Frequency Drive, 920A Output, 380-500VAC, Alpha-numeric keypad, IP00, No Choke, 6-pulse, water-cooled with Al heatsink, Option board with 6DI, 1 DO, 2AI, 1AO, +10Vref, 2 +24VM, and High-Speed Module	NXP09205A0N0NWGA1A2+BM37	Vacon	1	TBD
5			Dual-Port Ethernet Communication Card	OPTE9-V	Vacon	1	ELE00011-0038.0
6		SF	SINE WAVE FILTER, 840A, Liquid-Cooled, 320Hz	S3L0840A00-0000	CTM Magnetics	1	TBD
7		MTR1	High-Speed Permanent Magnet Synchronous Motor 350kW with Magnetic Bearings	AB350	SKF	1	TBD
8		MBC	Magnetic Bearing Controller with Wide Input Range board, Modbus RTU RS-485 serial interface, Integrated UPS function	150/8-16_M	SKF	1	TBD
9		THD	THD Board with LEM modules for measuring phase currents, voltage to motor	289 PCB	SKF	1	TBD
10		W1 W2	Cable with quick connectors 42-pin to 38-pin, from MBC to Motor, 3m	TBD	SKF	2	TBD
11	Accessories Feeder	FU1	LPJ Time-Delay Fuse Class J, 35A, 600VAC	LPJ35SP	Eaton (Bussman)	3	ELE00018-0068.0
12			Fuse Holder for Class J fuses, Fingersafe	CH60J3I	Eaton (Bussman)	1	ELE00018-0069.0
13		PDB	Power Distribution Block, Fingersafe, 1 Line in range 350-#6 / 2/0-#14, 8 Load Connections #8-#14	FSPDB3C	Mersen	3	ELE00016-0037.0
14		SPD1	LINE VOLTAGE SURGE PROTECTOR (LVSP) VPU AC II 3 R 480V/50kA	2591260000	Weidmuller	1	ELE00019-0037.0
15		PMR1	PHASE MONITORING RELAY	3UG4513-1BR20	Siemens	1	ELE00028-0023.0
16	A/C Unit	FU4	Time-Delay Fuse Class CC, 15A, 600VAC	LP-CC-15	Eaton (Bussman)	3	ELE00018-0066.0
17			Fuse Holder for Class CC fuses, Fingersafe, 30A	CHCC3DIU	Eaton (Bussman)	1	ELE00018-0048.0
18		ACU	Air Conditioning Unit, 480V, 60Hz, NEMA 4X, 18000 BT/hr	K3NA6C18DP53LV	Kooltronic	1	ELE00000-0153.0
19	BOV/DV Actuators	FU2	Time-Delay Fuse Class CC, 5A, 600VAC	LP-CC-5	Eaton (Bussman)	3	ELE00018-0070.0
20			Fuse Holder for Class CC fuses, Fingersafe, 30A	CHCC3DIU	Eaton (Bussman)	1	ELE00018-0048.0
21		FU3	Time-Delay Fuse Class CC, 5A, 600VAC	LP-CC-5	Eaton (Bussman)	3	ELE00018-0070.0
22			Fuse Holder for Class CC fuses, Fingersafe, 30A, with Fuse Blown Indicator	CHCC3DIU	Eaton (Bussman)	1	ELE00018-0048.0
23	Transformer	FU5	Time-Delay Fuse Class CC, 7A, 600VAC	FNQ-R-7	Eaton (Bussman)	2	ELE00018-0047.0
24			Fuse Holder for Class CC fuses, Fingersafe, 30A, with Fuse Blown Indicator	CHCC2DIU	Eaton (Bussman)	1	ELE00018-0049.0
25		FU6	time-Delay Fuse Class CC, 20A, 600VAC	FNQ-R-20	Eaton (Bussman)	1	ELE00018-0019.0
26			Fuse Holder for Class CC fuses with Fuse Blown Indicator	CHCC1DIU	Eaton (Bussman)	1	ELE00018-0055.0
27		T1	Transformer 480V primary to 120VAC secondary, 2 kVA	1497B-A13-M14-0-N	Allen-Bradley	1	ELE03017-0004.0
28	Pump	MS2	Motor Starter TeSys Trip range 2.5-4A, 480Y	GV2P08	Schneider	1	ELE00015-0072.0
29		M2	Motor Contactor TeSys D, 24VDC	LC1D09BD	Schneider	1	ELE00028-0057.0
30		MTR2	Cooling Pump Motor (CRI5-4 A-CA-A-E-HQQE 3x230/460 60HZ)	96084445	GOULDS	1	ELE00038-0007.0
31		TBXX	TB3 for Cooling Pump TERMINAL BLOCK	1492-J3	Allen-Bradley	3	ELE00016-0003.0
32			GROUND BLOCK	1492-JG3	Allen-Bradley	1	ELE00016-0004.0
33			SCREWLESS END ANCHOR	1492-ERL35	Allen-Bradley	LOT As Req.	ELE00016-0012.0
34			END BARRIER	1492-EBJ3	Allen-Bradley	LOT As Req.	ELE00016-0016.0
35		IN-FG	IN-FG BUSBAR	8T*40mm (10mm 6POLES, 6mm 2POLES)	NEUROS	1	ELE03023-0003.0
36		EX-FG	EX-FG BUSBAR	8T*40mm (10mm 3POLES, 6mm 2POLES)	NEUROS	1	ELE03023-0001.0
37		SG	SG BUSBAR SET TO THE BLOWER ENCLOSURE BY THE INSULATION POLES	3T*15 mm (5mm 3POLES)	NEUROS	1	ELE00023-0002.0
38			SG BUSBAR Insulator	DCBH-10	NEUROS	2	ELE00023-0004.0
39		TB2 FG / RTB FG	TB for LVSP & CTRL. Universal Ground Bar System 6-port UGB (L= 4.92")	UGB2/0-414-6	PANDUIT	2	ELE00023-0003.0
			120 VAC - MAINS SIDE				
40		SPD2	SURGE PROTECTIVE DEVICE (SPD) VPU AC II 1 R 150V/50kA	2591660000	Weidmuller	1	ELE00019-0038.0
41	PMSM Cooling Fans	MS3	Motor Starter TeSys Trip range 2.5-4A, 480Y	GV2ME08	Schneider	1	ELE00028-0063.0
42		M3	Motor Contactor TeSys D, 24VDC	LC1D09BD	Schneider	1	ELE00028-0057.0
43		FAN1	EC Centrifugal Fan, Backward curved, single inlet w housing flange 120VAC, 50/60Hz, 3.2A	G1G170-AB05-20 (55600.01011)	EBM Papst	1	ELE00039-0021.0
44		MS4	Motor Starter TeSys Trip range 2.5-4A, 480Y	GV2ME08	Schneider	1	ELE00028-0063.0
45		M4	Motor Contactor TeSys D, 24VDC	LC1D09BD	Schneider	1	ELE00028-0057.0
46		FAN2	EC Centrifugal Fan, Backward curved, single inlet w housing flange 120VAC, 50/60Hz, 3.2A	G1G170-AB05-20 (55600.01011)	EBM Papst	1	ELE00039-0021.0
47	Blow-Off Valve	BOV	Electric Actuator, On/Off Duty, 480VAC Power, 24VDC Control, with External Backup	TBD	Rotork	1	TBD
48			Butterfly Valve, Wafer Style, 8", Ductile Iron Body, CF8M Disc, SS 316 STEM and Viton Seat	BF1-125-080-8667	PRATT	1	TBD
49	120 VAC Distribution Terminals	L,N	Feed-through terminal block for 10AWG wire	1492-J4	Allen-Bradley	LOT As Req.	ELE00016-0019.0
50			Terminal Block Center Jumper	1492-CJJ6-10	Allen-Bradley	LOT As Req.	ELE00000-0154.0
51			End Barrier	1492-EBJ3	Allen-Bradley	LOT As Req.	ELE00016-0016.0
52			SCREW END ANCHOR	1492-EAJ35	Allen-Bradley	LOT As Req.	ELE00016-0001.0
			120 VAC - PLC SIDE				
54	For Lights	CB1	CB for Receptacle Bull. 1489-M Miniature CB, 2A, 1-Pole,Curve D,277 VAC.	1489-M1D020	Allen-Bradley	1	ELE00015-0005.0
55	For Receptacle	CB2	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
56	For PWS2	CB3	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
57	For PWS1	CB4	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
58	Panel Lights	LT1	Panel LED Light 90-250 VAC	855L-NX3	Allen-Bradley	1	ELE00000-0017.0
59	Panel Lights	LT2	Panel LED Light 90-250 VAC	855L-NX3	Allen-Bradley	1	ELE00000-0017.0
60	Panel Lights	LT3	Panel LED Light 90-250 VAC	855L-NX3	Allen-Bradley	1	ELE00000-0017.0
61		EMC	EMC Filter	2856702	PHOENIX CONTACT	1	ELE00019-0040.0
62		RECPT1	Receptacle Duplex Outlet, 120VAC	1492-REC15G	Allen-Bradley	1	ELE00000-0016.0
63		PWS1	TRIO UPS with Integrated Power Supply Unit TRIO-UPS-2G/1AC/24DC/10	2907161	PHOENIX CONTACT	1	TBD
64			UPS Power Storage Device 24VDC; 4Ah	1274117	PHOENIX CONTACT	1	ELE00022-0025.0
65		PWS2	Power Supply, 24VDC, 5A, 120VAC input	1606-XLE120E	Allen-Bradley	1	ELE00020-0007.0
66		RM	Redundancy Module for Power Supplies, for 10A load	1606-XLERED	Allen-Bradley	1	ELE00020-0013.0

Greater New Haven APGN500 BOM

No.	General	TAG	ITEM DESCRIPTION	Manufacturer Part No.	Manufacturer	QT'Y	APGN PART No.
			24 VDC - CONTROLS AND INSTRUMENTS				
67	For DC Branch	CB5	CB for Receptacle Bull. 1489-M Miniature CB, 5A, 1-Pole,Curve D,277 VAC.	1489-M1D050	Allen-Bradley	1	ELE00015-0036.0
68	For PLC Power Supply	FU7	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	1	ELE00018-0008.0
69	For OIT	FU8	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	1	ELE00018-0008.0
70	For Network Switch	FU9	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
71	For NAT/Firewall	FU10	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
72	For DI's	FU11, FU12, FU13, FU14	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	4	ELE00018-0007.0
73	For DO's	FU15, FU16	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	2	ELE00018-0008.0
74	For AI's	FU17	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
75	For HF & BOV	FU18	1/4x1-1/4'' GLASS FUSE 1 AMP FAST ACTING	0312001	LITTELFUSE	1	ELE00018-0007.0
76	For HF & BOV	FU19	1/4x1-1/4'' GLASS FUSE 2 AMP FAST ACTING	0312002	LITTELFUSE	1	ELE00018-0008.0
77	For Fuses	FUXX	24V DC FUSE BLOCK	1492-H5	Allen-Bradley	13	ELE00018-0010.0
78	For Fuses		FUSE BLOCK END BARRIER	1492-N37	Allen-Bradley	LOT As Req.	ELE00018-0005.0
79	PLC On/Off	CR30	RELAY 24V DC COIL	700-HF32Z24-4	Allen-Bradley	1	ELE00028-0002.0
80			RELAY BASE	700-HN116	Allen-Bradley	1	ELE00028-0003.0
81			CLIP	700-HN114	Allen-Bradley	1	ELE00028-0004.0
82	Output Relays	CR2..CR29	PLC RELAYS	700-HLT1Z24	Allen-Bradley	28	ELE00028-0001.0
83		Pd	DISCHARGE PRESSURE SENSOR 0-1.5kg/cm2	PSCH01.5KCIG	SENSYS	1	ELE00024-0004.0
84		idPf	INTERNAL FILTER PRESSURE DROP SENSOR 0-0.05Bar	PSCH0.05BCIG	SENSYS	1	ELE00024-0005.0
85		tpPd	TOTAL PACKAGE PRESSURE DROP SENSOR 0-0.05Bar	PSCH0.05BCIG	SENSYS	1	ELE00024-0005.0
86		aP	ATMOSPHERIC PRESSURE SENSOR 120kPa	PSCH0120RCIJ	SENSYS	1	ELE00024-0017.0
87		Ts	INLET TEMPERATURE RTD SENSOR	DS 4680 120L	OMEGA	1	ELE00024-0011.0
88		Td	DISCHARGE TEMPERATURE RTD SENSOR	DS 4680 120L	OMEGA	1	ELE00024-0011.0
89		Pd,Pf,Tm Anlg Sens CBL	8761 PAIRED CABLE, 1 PR, 22AWG STRAND (7X30), POLYETHYLENE INSULAT, AUDIO/INSTRUMENT	8761 060500	BELDEN	LOT As Req.	ELE00021-0076.0
90		RTD-CBL	RTD Extension Wire PFA with Shield Insulation	EXTT-3CUI-26S-SB	OMEGA	LOT As Req.	ELE00021-0058.0
91		PLC	COMPACT LOGIX CPU UNIT	1769-L33ER	Allen-Bradley	1	ELE00032-0022.0
92			PLC POWER SUPPLY	1769-PB4	Allen-Bradley	1	ELE00020-0009.0
93			DIGITAL INPUT MODULE	1769-IQ32	Allen-Bradley	1	ELE00041-0040.0
94			DIGITAL OUTPUT MODULE	1769-OB32	Allen-Bradley	1	ELE00032-0009.0
95			ANALOG INPUT MODULE	1769-IF8	Allen-Bradley	1	ELE00032-0018.0
96			RTD INPUT MODULE	1769-IR6	Allen-Bradley	1	ELE00032-0002.0
97			ANALOG OUTPUT MODULE	1769-OF4CI	Allen-Bradley	1	ELE00032-0006.0
98			RIGHT-END CAP	1769-ECR	Allen-Bradley	1	ELE00032-0004.0
99		MBS	Ethernet/IP to Modbus RTU Converter	MV169-MNETC	Prosoft	1	ELE00030-0067.0
100		OIT	PanelView Plus 7 Performance Terminals - 10 inch Touch Interface	2711P-T10C22D9P	Allen-Bradley	1	ELE00030-0044.0
101			16 GB Metal Executive USB Flash Drive	98748	Verbatim	1	ELE00030-0056.0
102		SCBL-1	Comm. System Cable Patch cable, CAT6, pre-assembled, 5.0 m Network Switch to VFD-1	FL CAT6 PATCH 5,0 Order No. 2891783	PHOENIX CONTACT	1	ELE00021-0062.0
103		SCBL-2	Comm. System Cable Patch cable CAT 6 pre-assembled 0.5 m long Network Switch to PLC	FL CAT6 PATCH 0,5 Order No. 2891288	PHOENIX CONTACT	1	ELE00021-0045.0
104		SCBL-3	Comm. System Cable Patch cable CAT 6 pre-assembled 0.5 m long PLC to Ehternet/IP- Modbus RTU Converter	FL CAT6 PATCH 0,5 Order No. 2891288	PHOENIX CONTACT	1	ELE00021-0045.0
105		SCBL-4	Comm. System Cable Patch cable CAT 6 pre-assembled 1.0 m long MBC toEhternet/IP- Modbus RTU Converter	FL CAT6 PATCH 1,0 Order No. 2891385	PHOENIX CONTACT	1	ELE00021-0044.0
106		SCBL-5	Comm. System Cable Patch cable CAT 6 pre-assembled 1.0 m long Network Switch to OIT	FL CAT6 PATCH 1,0 Order No. 2891385	PHOENIX CONTACT	1	ELE00021-0044.0
107		SCBL-6	Comm. System Cable Patch cable CAT 6 pre-assembled 1 m long Network Switch to Ehternet Maintance Port	FL CAT6 PATCH 1,0 Order No. 2891385	PHOENIX CONTACT	1	ELE00021-0044.0
108		SCBL-7	Comm. System Cable Patch cable CAT 6 pre-assembled 0.5 m long Network Switch to NAT/FIREWALL	FL CAT6 PATCH 0,5 Order No. 2891288	PHOENIX CONTACT	1	ELE00021-0045.0
109		NAT/Firewall	Router with Network Address Translation Feature	ICR-3201	BnB ELECTRONICS	1	ELE00026-0052.0
110		NWS	NETWORK SWITCH, 8-PORT	FL SWITCH SFN 8TX	PHOENIX CONTACT	1	ELE00026-0026.0
111		START-PB1	Momentary, Illuminated, Flush Push Button Green.	800FP-LF3	Allen-Bradley	1	ELE00029-0001.0
112			Integrated LED Module; Green, 24V AC/DC Ring Lug	800F-N3G	Allen-Bradley	1	ELE00029-0002.0
113		STOP-PB2	Momentary, Illuminated, Flush Push Button Red.	800FP-LF4	Allen-Bradley	1	ELE00029-0005.0
114			Integrated LED Module; Red, 24V AC/DC Ring Lug	800F-N3R	Allen-Bradley	1	ELE00029-0006.0
115		RESET-PB3	Momentary, Illuminated, Flush Push Button Yellow.	800FP-LF5	Allen-Bradley	1	ELE00029-0009.0
116			Integrated LED Module; White, 24V AC/DC Ring Lug	800F-N3W	Allen-Bradley	1	ELE00029-0020.0
117		E-STOP-PB4	Non-Illuminated Twist-to-Release, Red 30mm.	800FP-MT34	Allen-Bradley	1	ELE00029-0013.0
118			Emergency Stop Legend Plate w/Text - EMERGENCY STOP	800F-15YS-E112	Allen-Bradley	1	ELE00029-0017.0
119		OFF/ON-SS1	2-Position Selector Switch Operator, Illuminated, Red.	800FP-LSM24	Allen-Bradley	1	ELE00029-0018.0
120			Integrated LED Module; Red, 24V AC/DC Ring Lug	800F-N3R	Allen-Bradley	1	ELE00029-0006.0
121		START-PB1; STOP-PB2; RESET-PB3; E-STOP-PB4; OFF/ON-SS1;	Plastic Mounting Latch	800F-ALP	Allen-Bradley	5	ELE00029-0003.0
122		START-PB; STOP-PB; RESET-PB; E-STOP-PB; OFF/ON-SS;	Contact Block N.O.	800F-X10	Allen-Bradley	5	ELE00029-0004.0
123		E-STOP-PB4	Contact Block N.C.	800F-X01	Allen-Bradley	1	ELE00029-0016.0
124		ETH PORT	RJ45, CAT6 Ethernet coupler	09 45 452 1560	HARTING	1	ELE00030-0015.0
125			DUST CAP, har-port PROTECTION COVER IP65/67 TRANSPARENT	09 45 502 0005	HARTING	1	ELE00030-0016.0

8. MCP Detailed Drawing

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Project No.: XX-YYYY

Customer: Greater New Haven

Panel Type: CompactLogix L24ER

Date: Jan-18-2022

PAGE No.	SHEET TITLE	REV. DATE	STAGE	REV.
11	NAMEPLATES & STICKERS	Jan-18-2022	For Approval	A-00
10	BACK PANEL DETAILS 2	Jan-18-2022	For Approval	A-00
09	BACK PANEL DETAILS 1	Jan-18-2022	For Approval	A-00
08	PLC ANALOG OUTPUT	Jan-18-2022	For Approval	A-00
07	PLC ANALOG INPUT	Jan-18-2022	For Approval	A-00
06	PLC OUTPUT INPUT	Jan-18-2022	For Approval	A-00
05	PLC DIGITAL INPUT	Jan-18-2022	For Approval	A-00
04	PANEL POWER	Jan-18-2022	For Approval	A-00
03	NETWORK DIAGRAM	Jan-18-2022	For Approval	A-00
02	BILL OF MATERIAL	Jan-18-2022	For Approval	A-00
01	PANEL LAYOUT	Jan-18-2022	For Approval	A-00
00	FRONT PAGE	Jan-18-2022	For Approval	A-00

REVISIONS					
REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
Bid	Released for Bidding	Jan-18-2022	B.Yu	P. Mailloux	P. Mailloux

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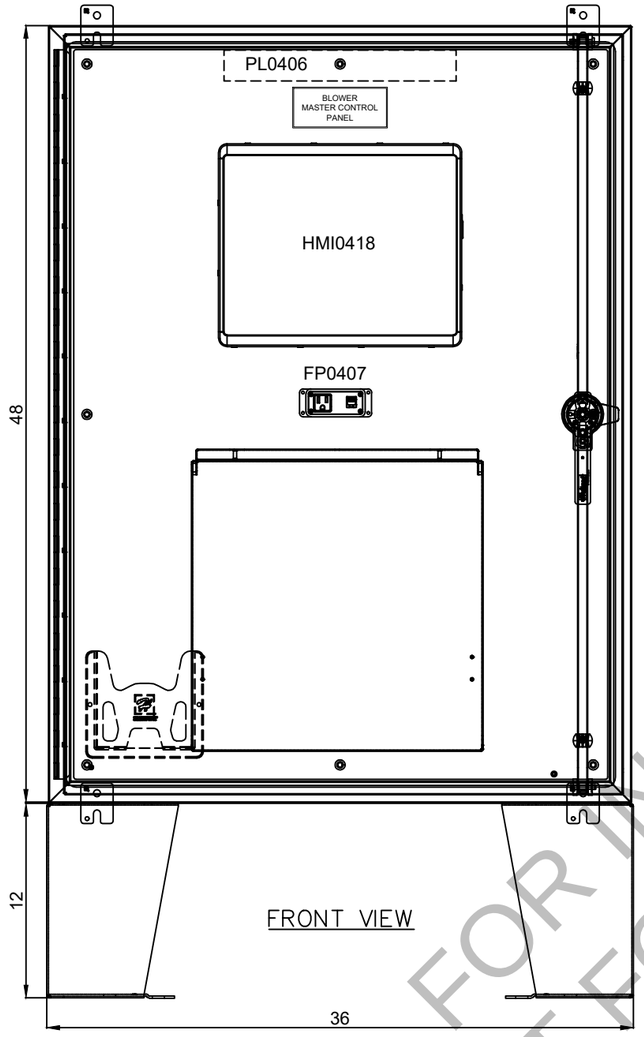
PROJECTION

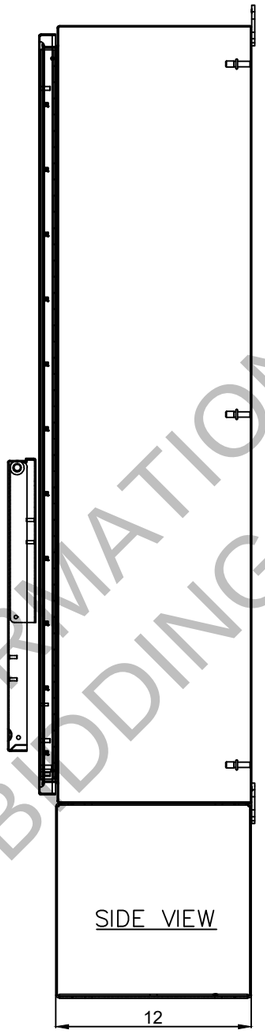
PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

TITLE : FRONT PAGE

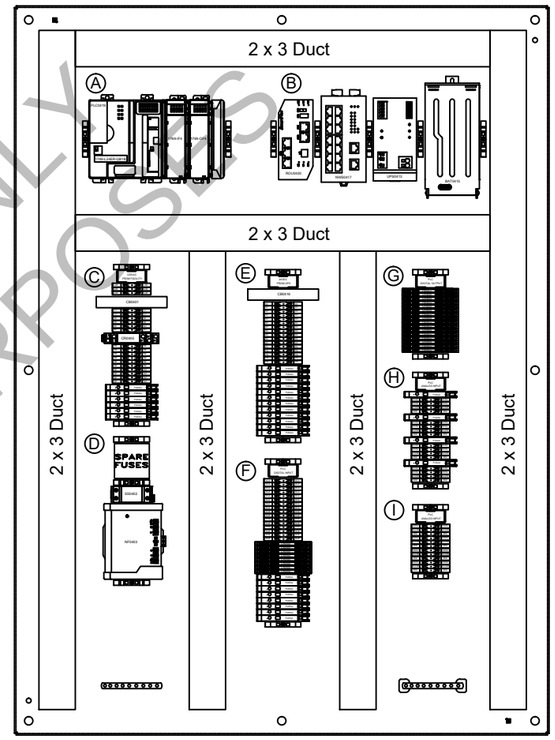
PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301		REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
DRAWN BY:	B. Yu	DATE	Jan-18-2022
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022
FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid			PAGE: 00



FRONT VIEW



SIDE VIEW



BACK PANEL

REVISIONS					
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PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

TITLE : PANEL LAYOUT

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301		REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
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APPROVED BY:	P. Mailloux	DATE	Jan-18-2022
FILE NAME:XX-YYYY Greater New Haven - MCP Rev Bid			PAGE: 01

MCP BOM

No	Tag	Item Description	Part Number	Manufacturer	Quantity	Comments
1	PLC0419	CompactLogix L24ER Controller	1769-L24ER-QB1B	Allen Bradley	1	16-PT 24VDC Sinking Input / Sourcing Output
2		Analog Input Module	1769-IF4	Allen Bradley	1	4-CH Current/Voltage Input
3		Analog Output Module	1769-OF4	Allen Bradley	1	4-CH Current/Voltage Output
4	HMI0418	PanelView Plus 7 Standard Interface	2711P-T15C21D8S	Allen Bradley	1	15" Touch Screen Interface, 24VDC
5		USB Drive 16GB	98748	Verbatim	1	
6	NWS0417	Unmanaged Network Switch	2891933	Phoenix Contact	1	16 x RJ45 Ports
7	ROU0420	Firewall with NAT	SR30010125	B&B Electronic	1	10-30VDC Power, 5 Ports
8		WIFI Antenna	BB-AW-A2458G-FSRPK	B&B Electronic	1	2.4/5.8GHz, SMA-RP Connector
9	SS0402	Surge Suppressor	2905348	Phoenix Contact	1	Type 2/Class II
10	EF0403	EMI Filter Surge Protection Device	2856702	Phoenix Contact	1	SFP 1-20/120AC (20A)
11	PL0406	LED Panel Light	EL900D	Hoffman	1	120VAC
12	FP0407	Grace-Port, 1 Ethernet Port & 1 Plug	P-R2-F3R0	Grace Eng.	1	120VAC/3A
13	UPS0413	UPS with Integrated Power Supply	2907161	Phoenix Contact	1	24VDC Output, 10A
14	BAT0415	Energy Storage Device for UPS	1274117	Phoenix Contact	1	24VDC,4Ah
15	CB0401, CB0413	Miniature Circuit Breaker, 1 Pole	1489-M1Cxxx	Allen Bradley	2	See Drawing for Ratings
16	FUxxxx	120VAC Fused Terminal Block	1492-H4	Allen Bradley	6	
17		24VC Fused Terminal Block	1492-H5	Allen Bradley	24	
18		Fuse Block End Barrier	1492-N37	Allen Bradley	Lot	As needed
19		1/4x1-1/4" Glass Fuse	0312xxx	Littelfuse	Lot	See Drawing for Ratings
20		Fuse Holder Drawer	7914760001	Weidmuller	1	1 Spare Fuse per Rating
21	CR0405	Power Fail Relay	700-HK36A1-4	Allen Bradley	1	16A Contact, SPDT,120VAC Coil
22		Relay Base	700-HN121	Allen Bradley	1	
23	CR05xx, CR06xx	PLC Interposing Relay	700-HLT1Z24	Allen Bradley	24	6A Contact SPDT, 24VDC Coil
24	ENC	Wall Mount Enclosure	A48H36DLP3PT	Hoffman	1	48 x 36 x 12
25		Back Panel	A48P36	Hoffman	1	48 x 36
26		Flood Stand Legs	AFK1212	Hoffman	1	12 x 12
27		Folding Shelf	AA61SHLF1818	Hoffman	1	18 x18
28	MISC	Feed-Through Terminal Block	1492-J3	Allen Bradley	Lot	See Drawing for Tags
29		Ground Terminal Block	1492-JG3	Allen Bradley	Lot	See Drawing for Tags
30		Terminal Block End Barrier	1492-EBJ3	Allen Bradley	Lot	As needed
31		Screw End Anchor	1492-EAJ35	Allen Bradley	Lot	As needed
32		Group Maker	1492-GM35	Allen Bradley	Lot	As needed
33		Grounding Bus Bar	-	Panduit	2	1x Non-Isolated & 1x Isolated
34		Grey Wire Duct and Cover	-	Panduit	Lot	As needed

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PROJECTION

PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

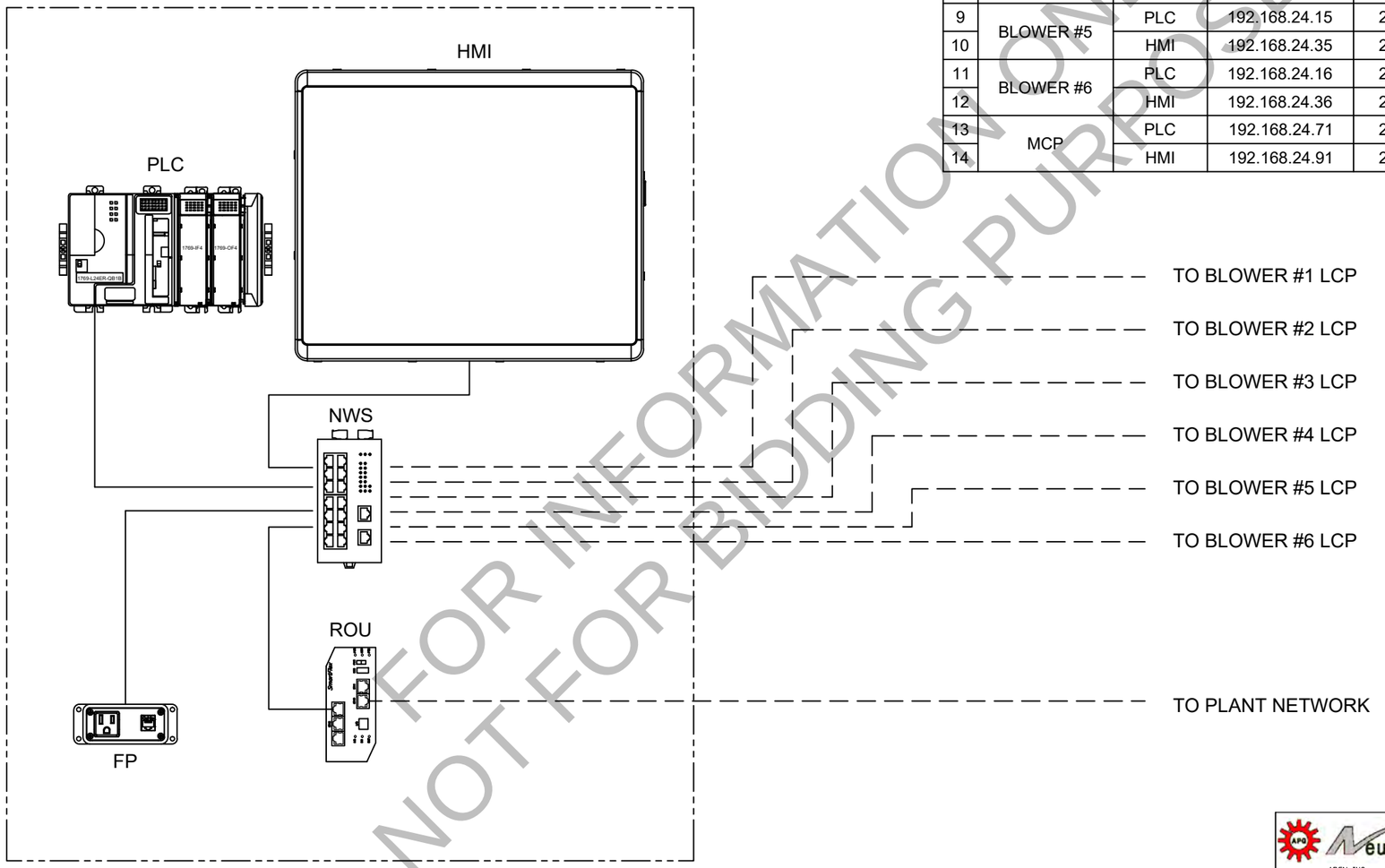
TITLE : BILL OF MATERIAL

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301		REV: Bid
DESIGNED/MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
DRAWN BY:	B. Yu	DATE	Jan-18-2022
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022
FILE NAME:XX-YYYY Greater New Haven - MCP Rev Bid			PAGE: 02

CABLE LEGEND		
LINETYPE	CABLE TYPE	PROVIDED BY
———————	CAT6 Ethernet	APG-Neuros
— — — — — — —	CAT6 Ethernet	Contractor

IP ADDRESSES					
NO.	DEVICE		IP	SUBNET MASK	GATEWAY
1	BLOWER #1	PLC	192.168.24.11	255.255.255.0	192.168.24.1
2		HMI	192.168.24.31	255.255.255.0	192.168.24.1
3	BLOWER #2	PLC	192.168.24.12	255.255.255.0	192.168.24.1
4		HMI	192.168.24.32	255.255.255.0	192.168.24.1
5	BLOWER #3	PLC	192.168.24.13	255.255.255.0	192.168.24.1
6		HMI	192.168.24.33	255.255.255.0	192.168.24.1
7	BLOWER #4	PLC	192.168.24.14	255.255.255.0	192.168.24.1
8		HMI	192.168.24.34	255.255.255.0	192.168.24.1
9	BLOWER #5	PLC	192.168.24.15	255.255.255.0	192.168.24.1
10		HMI	192.168.24.35	255.255.255.0	192.168.24.1
11	BLOWER #6	PLC	192.168.24.16	255.255.255.0	192.168.24.1
12		HMI	192.168.24.36	255.255.255.0	192.168.24.1
13	MCP	PLC	192.168.24.71	255.255.255.0	192.168.24.1
14		HMI	192.168.24.91	255.255.255.0	192.168.24.1

BLOWER MASTER CONTROL PANEL



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PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

TITLE : NETWORK DIAGRAM

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301		REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022
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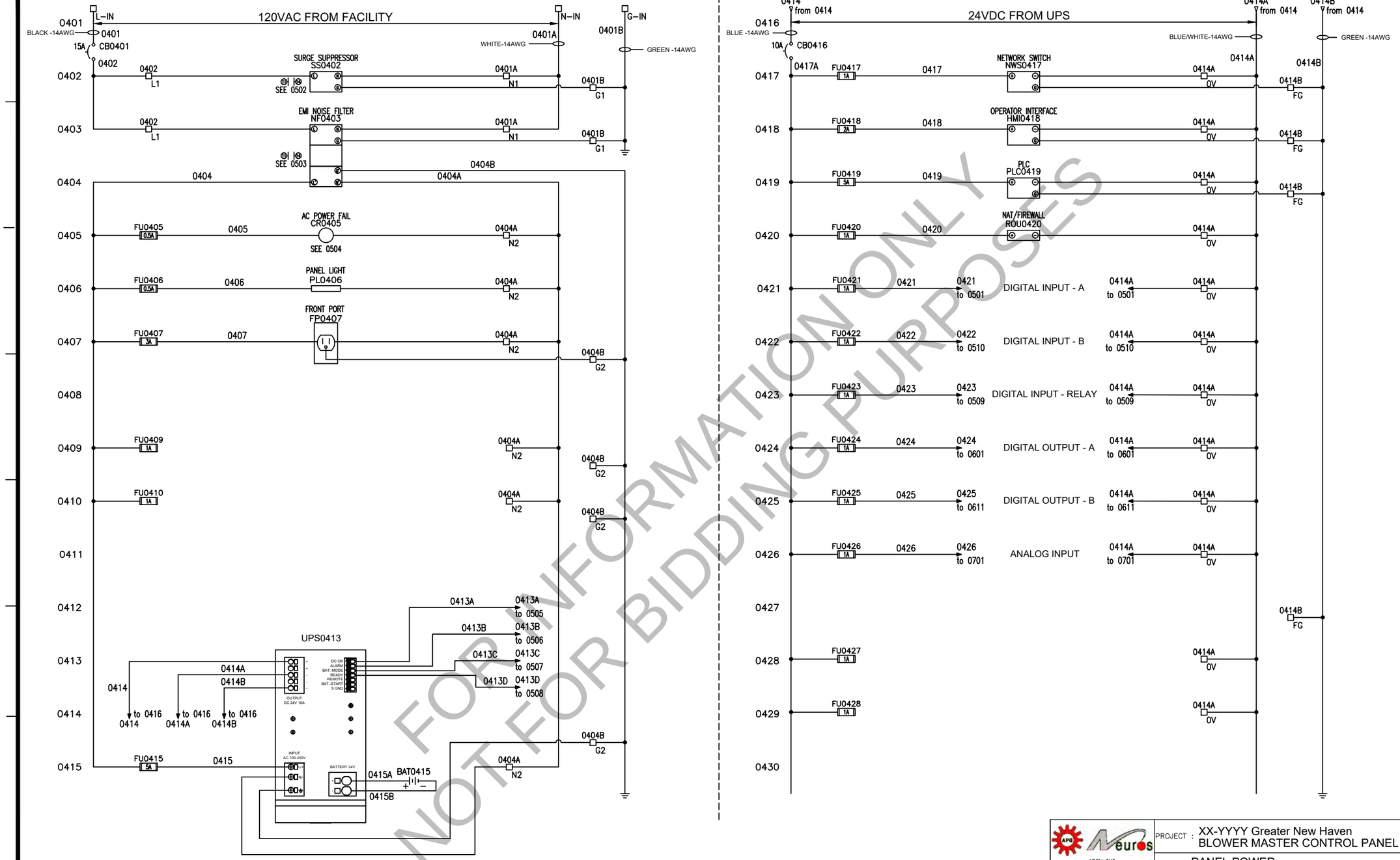
FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid			PAGE: 03



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PROJECTION

PROJECT :	XX-YYYY Greater New Haven BLOWER MASTER CONTROL PANEL
TITLE :	PANEL POWER
PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301 REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu — DATE: Jan-18-2022
CHECKED BY:	P. Mailloux — DATE: Jan-18-2022
DRAWN BY:	B. Yu — DATE: Jan-18-2022
APPROVED BY:	P. Mailloux — DATE: Jan-18-2022
FILE NAME:	XX-YYYY Greater New Haven - MCP Rev Bid — PAGE: 04

FIELD

PANEL

0501 SPARE INPUT
0502 SPARE INPUT
0503 SPARE INPUT
0504 SPARE INPUT
0505 SPARE INPUT
0506 SPARE INPUT
0507 SPARE INPUT
0508 SPARE INPUT
0509 SPARE INPUT
0510 SPARE INPUT
0511 SPARE INPUT
0512 SPARE INPUT
0513 SPARE INPUT
0514 SPARE INPUT
0515 SPARE INPUT
0516 SPARE INPUT
0517 SPARE INPUT
0518

FU0510 0.1A
FU0511 0.1A
FU0512 0.1A
FU0513 0.1A
FU0514 0.1A
FU0515 0.1A
FU0516 0.1A
FU0517 0.1A

0414 from 0423
0414A from 0423

CR0510
CR0511
CR0512
CR0513
CR0514
CR0515
CR0516
CR0517

0421 from 0421
0422 from 0422

BLUE-18AWG
JUMPER TO BE REMOVED IF ENABLE SIGNAL IS USED
ENABLE
(PROVIDED BY OTHER)

AB 1769-L24ER-QB1B BASE UNIT COMPACTLOGIX 24VDC 16-PT SINKING INPUT DI

0421 DI-A
0422 DI-B

IN 0 I:00/00 — ENABLE
IN 1 I:00/01 — SS0402 — 0502 — SURGE SUPPRESSOR FAULT
IN 2 I:00/02 — NF0403 — 0503 — EMI NOISE FILTER OK
IN 3 I:00/03 — CR0405 — 0504 — AC POWER OK
IN 4 I:00/04 — 0413A from 0412 — 0413A — UPS DC OK
IN 5 I:00/05 — 0413B from 0413 — 0413B — UPS ALARM
IN 6 I:00/06 — 0413C from 0413 — 0413C — UPS ON BATTERY
IN 7 I:00/07 — 0413D from 0414 — 0413D — UPS READY
IN 8 I:00/08 — CR0510 — 0510 — SPARE INPUT
IN 9 I:00/09 — CR0511 — 0511 — SPARE INPUT
IN 10 I:00/10 — CR0512 — 0512 — SPARE INPUT
IN 11 I:00/11 — CR0513 — 0513 — SPARE INPUT
IN 12 I:00/12 — CR0514 — 0514 — SPARE INPUT
IN 13 I:00/13 — CR0515 — 0515 — SPARE INPUT
IN 14 I:00/14 — CR0516 — 0516 — SPARE INPUT
IN 15 I:00/15 — CR0517 — 0517 — SPARE INPUT

0414A
COM 0
COM 1

0414A from 0421
SYSTEM ENABLE
SURGE SUPPRESSOR FAULT
EMI NOISE FILTER OK
AC POWER OK
UPS DC OK
UPS ALARM
UPS ON BATTERY
UPS READY
A

0414A from 0422
SPARE INPUT
SPARE INPUT
SPARE INPUT
SPARE INPUT
SPARE INPUT
SPARE INPUT
SPARE INPUT
SPARE INPUT
B

REVISIONS					
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PROJECT : XX-YYYY Greater New Haven BLOWER MASTER CONTROL PANEL
TITLE : PLC DIGITAL INPUT

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301			REV: Bid
DESIGNED/MODIFIED BY:	B. Yu	DATE	Jan-18-2022	
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FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid				PAGE: 05

PANEL

FIELD

AB
1769-L24ER-QB1B
BASE UNIT
COMPACTLOGIX
24VDC 16-PT SOURCING OUTPUT
PLC0603

0424 from 0424

0601 0424 +VDC

BLUE-18AWG

0602	SYSTEM RUNNING	2 O:00/00	OUT 0	0602	CR0602	SYSTEM RUNNING
0603	SYSTEM FAULT	3 O:00/01	OUT 1	0603	CR0603	SYSTEM FAULT
0604	SPARE OUTPUT	4 O:00/02	OUT 2	0604	CR0604	SPARE OUTPUT
0605	SPARE OUTPUT	5 O:00/03	OUT 3	0605	CR0605	SPARE OUTPUT
0606	SPARE OUTPUT	6 O:00/04	OUT 4	0606	CR0606	SYSTEM RUNNING
0607	SPARE OUTPUT	7 O:00/05	OUT 5	0607	CR0607	SYSTEM FAULT
0608	SPARE OUTPUT	8 O:00/06	OUT 6	0608	CR0608	SPARE OUTPUT
0609	SPARE OUTPUT	9 O:00/07	OUT 7	0609	CR0609	SPARE OUTPUT

A

0610 10 COM 0

BLUE/WHITE-18AWG

0425 from 0425

0611 0425 +VDC

0612	SPARE OUTPUT	12 O:00/08	OUT 8	0612	CR0612	SPARE OUTPUT
0613	SPARE OUTPUT	13 O:00/09	OUT 9	0613	CR0613	SPARE OUTPUT
0614	SPARE OUTPUT	14 O:00/10	OUT 10	0614	CR0614	SPARE OUTPUT
0615	SPARE OUTPUT	15 O:00/11	OUT 11	0615	CR0615	SPARE OUTPUT
0616	SPARE OUTPUT	16 O:00/12	OUT 12	0616	CR0616	SPARE OUTPUT
0617	SPARE OUTPUT	17 O:00/13	OUT 13	0617	CR0617	SPARE OUTPUT
0618	SPARE OUTPUT	18 O:00/14	OUT 14	0618	CR0618	SPARE OUTPUT
0619	SPARE OUTPUT	19 O:00/15	OUT 15	0619	CR0619	SPARE OUTPUT

B

0620 20 COM 1

0414A from 0424

0414A from 0425

REVISIONS					
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PROJECTION

PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

TITLE : PLC DIGITAL OUTPUT

PROJECT NO: XX-YYYY | DRAWING NO: MCP-220301 | REV: Bid

DESIGNED/MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
DRAWN BY:	B. Yu	DATE	Jan-18-2022
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022

FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid

FIELD | PANEL

0701					
0702	MAIN HEADER PRESSURE 1	0426	0414A	0414A AI–COM	
0703				0414A I:01/00–	0414A V/I IN 0–
0704				0702A I:01/00+	0702A I IN 0+ → I:01/00 → MAIN HEADER PRESSURE 1
0705		FU0705 (0.1A)		SHD	COM
0706	MAIN HEADER PRESSURE 2			0414A AI–COM	V IN 1+
0707				0414A I:01/01–	0414A V/I IN 1–
0708				0706A I:01/01+	0706A I IN 1+ → I:01/01 → MAIN HEADER PRESSURE 2
0709		FU0709 (0.1A)		SHD	COM
0710	SPARE INPUT			0414A AI–COM	V IN 2+
0711				0710 I:01/02–	0710 V/I IN 2–
0712				0710A I:01/02+	0710A I IN 2+ → I:01/02 → SPARE INPUT
0713		FU0713 (0.1A)		SHD	COM
0714	SPARE INPUT			0414A AI–COM	V IN 3+
0715				0714 I:01/03–	0714 V/I IN 3–
0716				0714A I:01/03+	0714A I IN 3+ → I:01/03 → SPARE INPUT
		FU0717 (0.1A)		SHD	COM

AB 1769-IF4 MODULE 1 COMPACTLOGIX 4-CH ANALOG INPUT — AI

BLACK(+) / WHITE(-) 20AWG

REVISIONS					
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PROJECT : XX-YYYY Greater New Haven BLOWER MASTER CONTROL PANEL
TITLE : PLC ANALOG INPUT

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301		REV: Bid
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CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
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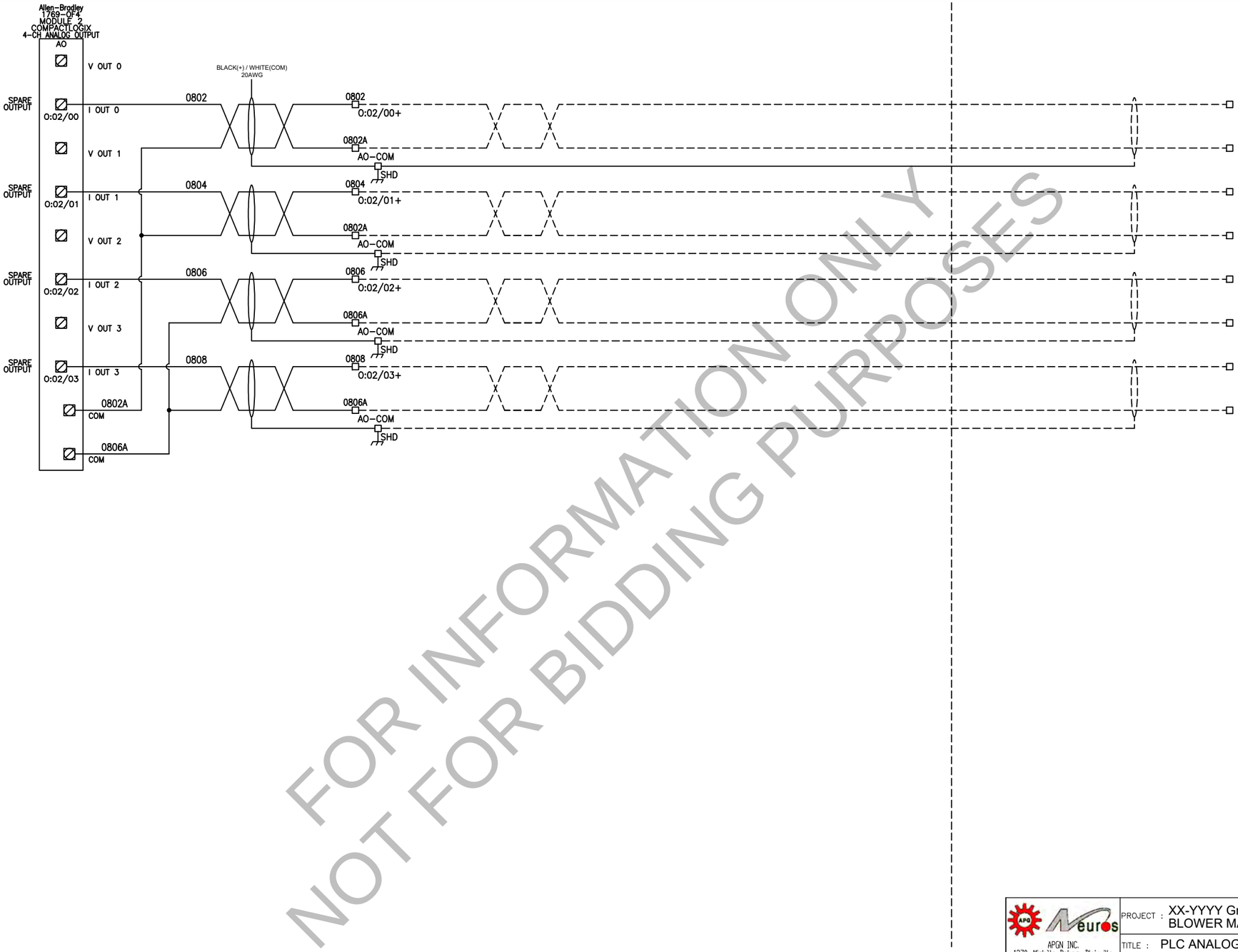
FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid			PAGE: 07

PANEL | FIELD



REVISIONS					
REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
Bid	Released for Bidding	Jan-18-2022	B.Yu	P. Mailloux	P. Mailloux

APG INC.
1270, Michèle-Bohec, Blainville,
Québec, CANADA, J7C 5S4
Tel: (450) 939-0799
Fax : (450) 939-2115

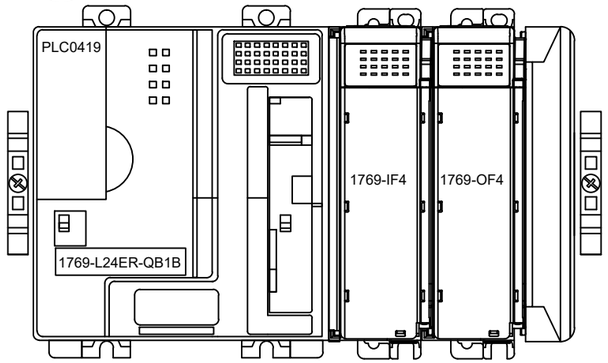
UNLESS OTHERWISE NOTED :
ALL DIMENSIONS ARE IN IN/MM
PROJECTION

PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

TITLE : PLC ANALOG OUTPUT

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301		REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
DRAWN BY:	B. Yu	DATE	Jan-18-2022
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022
FILE NAME:XX-YYYY Greater New Haven - MCP Rev Bid			PAGE: 08

A



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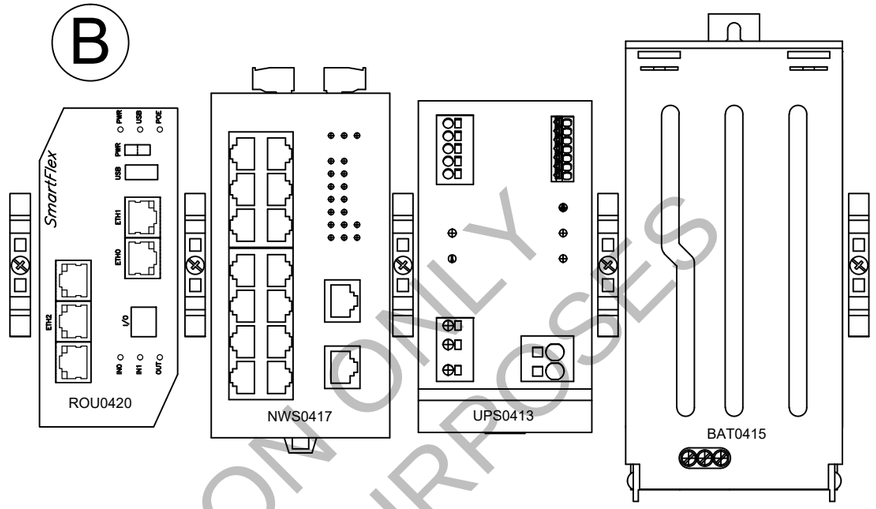

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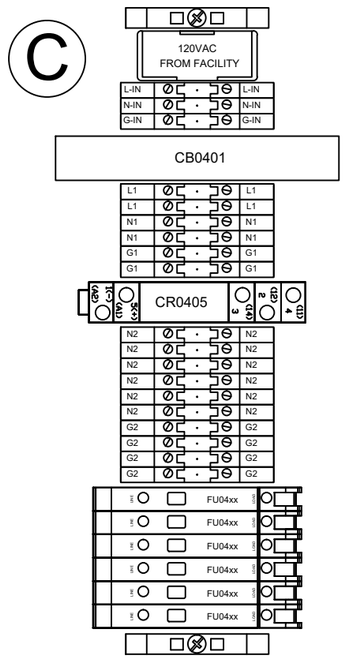

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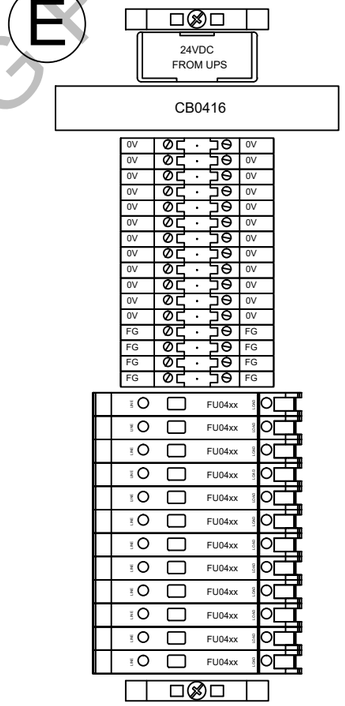

REVISIONS					
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Bid	Released for Bidding	Jan-18-2022	B.Yu	P. Mailloux	P. Mailloux

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UNLESS OTHERWISE NOTED :
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PROJECTION

PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

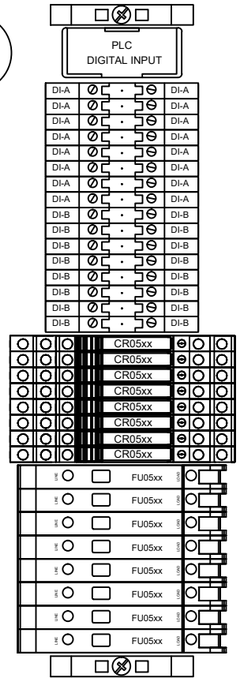
TITLE : PANEL LAYOUT DETAILS 1

PROJECT NO: XX-YYYY | DRAWING NO: MCP-220301 | REV: Bid

DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
DRAWN BY:	B. Yu	DATE	Jan-18-2022
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022

FILE NAME:XX-YYYY Greater New Haven - MCP Rev Bid

F



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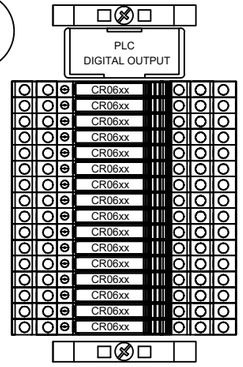

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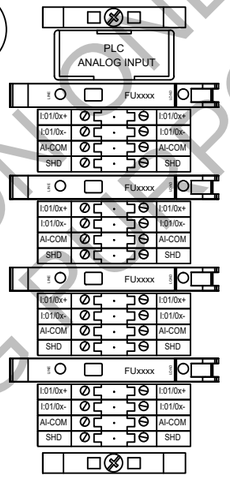

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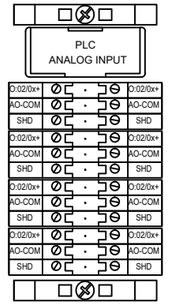

REVISIONS					
REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
Bid	Released for Bidding	Jan-18-2022	B.Yu	P. Mailloux	P. Mailloux

APGN INC.
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UNLESS OTHERWISE NOTED :
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PROJECTION

PROJECT : XX-YYYY Greater New Haven
BLOWER MASTER CONTROL PANEL

TITLE : PANEL LAYOUT DETAILS 2

PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301			REV: Bid
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022	
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022	
DRAWN BY:	B. Yu	DATE	Jan-18-2022	
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022	
FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid				PAGE: 10

BLOWER MASTER CONTROL PANEL

MCP Panel Nameplate

Material–Plastic laminated nameplate
Size–5" x 3"
WHITE background with BLACK engraved letters (1/2 inch high)

UL® LISTED

ENCLOSED INDUSTRIAL CONTROL PANEL

Assembler Shop UL Sticker

CONTROLES RL	120 VOLTS	1 PH
	15 AMP	60 HZ
	TYPE:	
	Ref. RL:	
	SCCR: 10K	
	Wiring diagram N°:	

Assembler Shop Sticker

Installed on the Door
Interior to the panel

REVISIONS					
REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
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PROJECTION

PROJECT :	XX-YYYY Greater New Haven BLOWER MASTER CONTROL PANEL		
TITLE :	NAMEPLATES & STICKERS		
PROJECT NO: XX-YYYY	DRAWING NO: MCP-220301	REV: Bid	
DESIGNED/ MODIFIED BY:	B. Yu	DATE	Jan-18-2022
CHECKED BY:	P. Mailloux	DATE	Jan-18-2022
DRAWN BY:	B. Yu	DATE	Jan-18-2022
APPROVED BY:	P. Mailloux	DATE	Jan-18-2022
FILE NAME: XX-YYYY Greater New Haven - MCP Rev Bid		PAGE: 11	

9. Motor Detailed Data

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Introduction :

SKF Magnetic Mechatronics is pleased to present in this document the main technical characteristics of the SKF high speed AB350 motor for direct and variable-speed drive of centrifugal air blower and /or compressor, along with the main characteristics of the magnetic bearings.

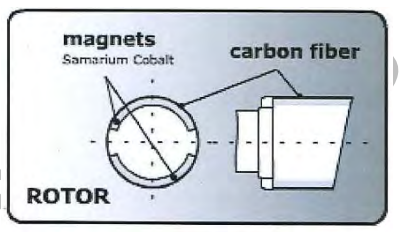
1.1 MOTOR DESIGN (ROTOR AND STATOR)

Type

HSPMSM (High Speed Permanent Magnet Synchronous Motor)

2 pole motor

Surface mount rare earth permanent magnet type



Typical rotor construction

Motor torque

Service factor 1.0
Maximum mechanical torque at shaft end : 180 Nm
The motor can deliver its rated torque from 4,000 rpm to 21,000 rpm

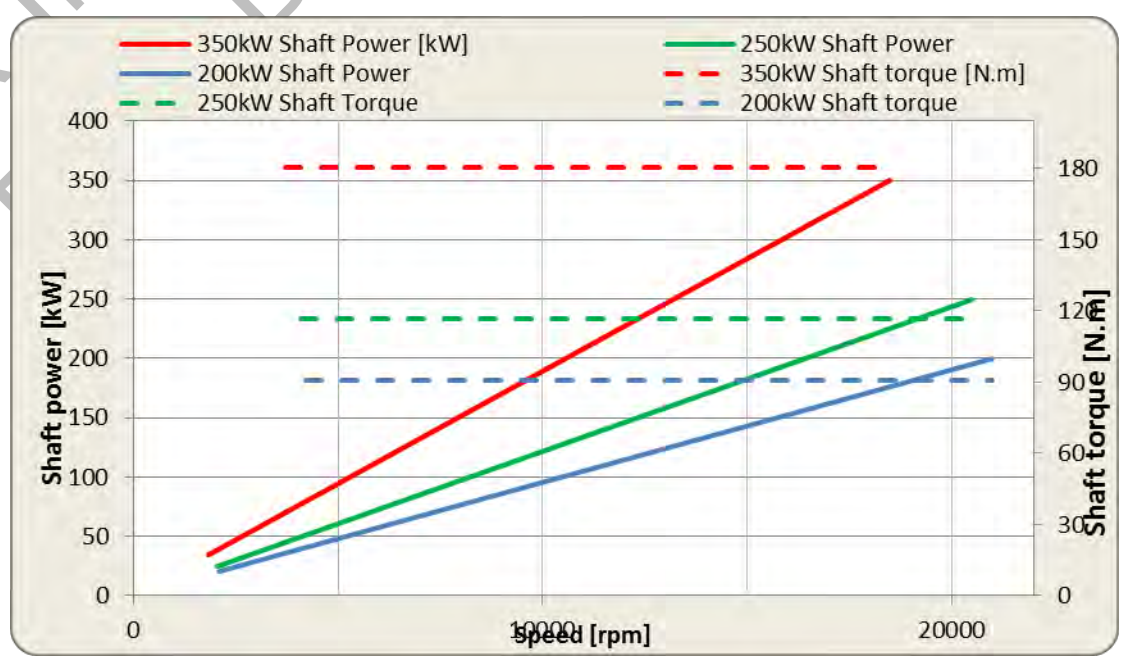
Motor power range

For 380V/50Hz market

Motor power range	200 to 350kW	
Preselected operating points	Power and Speed	Mechanical torque at shaft end
AB350	350 kW @ 18,500 rpm	180 N.m
AB350-bis	250 kW @ 20,500 rpm	116 N.m
AB350-ter	200 kW @ 21,000 rpm	91 N.m

Other different combinations of power levels and speed are possible depending on cooling conditions and possible inverter current or voltage limitation.

Power and Torque versus speed

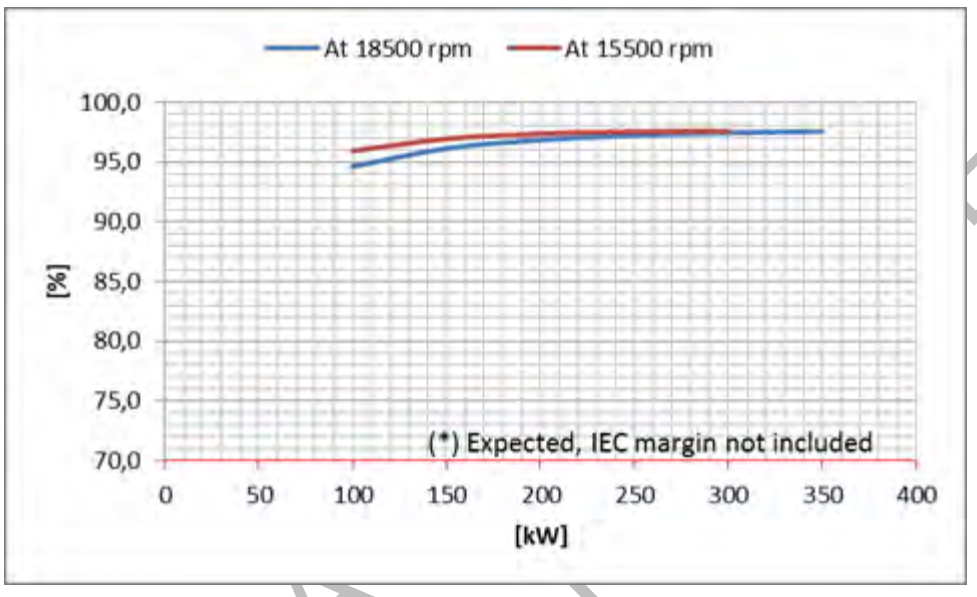


Speed range

Motor operating speed range : 4,000 rpm to 21,000 rpm

Across the 20 to 100% range of the speed, the motor can deliver up to its rated torque.

In the very low speed range (0 to 20%), the torque capability is limited by the VFD control algorithm and synchronization scheme due to the sensorless operation. For application with a high starting torque, please contact SKF.

Over speed capability	The rotor mechanical components and the rotor assembly without impeller is designed to withstand 10% overspeed with respect to 21 000 rpm. The system (when considering the addition of the impeller on the rotor, the electrical components such as motor and filters) withstands as a minimum over speed up to +5% of the maximum operating speed without any damage to the motor and electrical component.
Motor losses	Motor losses and motor efficiency : • consists in iron core losses, copper losses, magnet losses, Magnetic bearing losses, windage losses (typically in air at 1 bara) • vary with speed and torque (or power) operating points As an example, below is the efficiency at different power levels for the 350kW/18500rpm motor, plotted for 2 speeds: 

Motor rated voltage and current Versus power/speed level

GRID NOMINAL VOLTAGE (Vrms) : 460												
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Max. Motor current THD (THDi in %)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Motor power factor	0.92	0.88	0.84	0.8	0.93	0.9	0.86	0.82	0.94	0.9	0.87	0.84
Defluxing (yes/no)	No	No	No	No	No	No	No	No	No	No	No	No

GRID NOMINAL VOLTAGE (Vrms) : 400												
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Max. Motor current THD (THDi in %)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Motor power factor	0.92	0.88	0.84	0.8	0.93	0.9	0.86	0.82	0.94	0.9	0.87	0.84
Defluxing (yes/no)	No	No	No	No	No	No	No	No	No	No	No	No

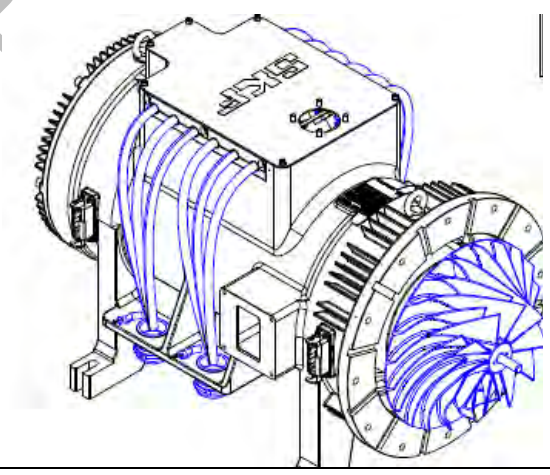
GRID NOMINAL VOLTAGE (Vrms) : 380												
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Motor input voltage ph-ph (Vrmsph-ph)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input current (Arms)	286	299	313	322	306	318	331	325	320	331	338	332
Max. Motor current THD (THDi in %)	445	555	665	776	412	514	615	725	393	490	590	695
Max. Motor current THD (THDi in %)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Motor power factor	0.92	0.88	0.84	0.82	0.93	0.9	0.86	0.87	0.94	0.9	0.88	0.89
Defluxing (yes/no)	No	No	No	Yes	No	No	No	Yes	No	No	Yes	Yes

Motor to be operated with a VFD equipped with a control strategy and algorithm that (in conjunction most of the time with the use of a sine filter), allow meeting the motor input current distortion as specified below :

- Current total harmonic distortion < 5%
- DC component ≤ 3% max
- Sum of harmonics below 11th ≤ 3%,
- Sum of harmonics 11th and above ≤ 1%

All values are in percentage of the RMS fundamental (i.e. first harmonic) component of motor rated current, the motor rated current being defined for operation at rated speed, rated torque and at motor rated power factor

Note : By experience, such low level of motor current distortion is required to reliably stay within the maximum allowable temperature indicated below.

Motor Housing	IP 00 Non magnetic alloy (aluminum) housing : ➢ with lifting eyebolts ➢ Built-in water jacket ➢ Designed for installation in horizontal position. *(Can be mounted vertically as well)* 
Motor stator	The motor stator is assembled into the housing with an interference fit between the stator outer diameter and housing bore. Equipped with 3 RTD devices (PT100 temperature probes) embedded in the winding heads to allow winding temperature monitoring.
Motor power connection and Motor cable	The motor is equipped with an integrated junction box, in order to connect the power cables (supplied by the customer). Cross section of power cable to be defined by customer according to rating of motor phase current (see table in section § 1.5) and cable characteristics (cable amperage capacity). Shielding of the power cables is required to comply with EMC regulations (the conductors of the 3 phases shall be inside the same shield).
Maximum operating temperature	The motor part shall not be operated at higher continuous temperature than indicated hereafter: • Rotor less than 140°C • Motor stator less than 150°C Motor cooling consists in: • Liquid cooling over the outer diameter of the motor stator lamination stack (water jacket) • Gas cooling in the motor cavity along rotor airgap and over stator winding heads

Cooling details	Forced cooling air (in rotor airgap and stator winding heads): • Flow: 380 Nm³/h minimum • Pressure drop : 3.5 kPa Liquid cooling in water jacket : • Water (or Water – Glycol mix (~20%)) • Flow : 18 – 20 l/min (temperature rise less than 5°C) • Max pressure : 4 barg Interfaces for air cooling please refer to interface drawing. Interfaces for water cooling inlet/outlet connections: please refer to interface drawing. The complete (air & water) cooling system is in the Customer scope of supply, based on the SKF cooling requirement and specification to be provided during the course of the project. A solution with EBM Papst air cooling fans has been identified and qualified by SKF (Part number of EBM Papst cooling fan available upon request).
Air quality	• Filtered (98% of filtration of 2 µm particles) • Dry
Motor Cavity Pressure	Nominal Atmospheric Pressure (1 bar abs)
Motor weight	Approx. 350 kg
Motor electrical data	

Motor back-EMF constant Vrms ph-ph/Hz	0,9
No load Back EMF Voltage Vrms ph-ph at rated speed (21krpm)	315
Motor synchronous inductance Ls=Lq=Ld (µH)	75
Motor phase resistance (mOhm)	1
Motor phase connection (Star or delta)	Star
Motor shaft spin inertia (kg.m²)	0.09

1.2 IMPELLER AND SEAL (CUSTOMER SUPPLIED)

ROTORDYNAMIC Characteristics **Impeller size, Mass, Spin and transverse inertia, center of mass, material**	A sufficient separation margin (25% minimum) must be maintained between the shaft 1st bending frequency and the rotating frequency to guarantee sub-critical operation in all its operation range and up to the maximum operation speed The design of the impeller, seal and impeller attachment (which have direct impact on the rotor dynamic) must be jointly optimized between customer and SKF to achieve sub-critical operation. A rotor dynamic modeling and calculation done by SKF is required with impeller and seal characteristics (weight, spin and transverse inertia, location of center of gravity, materials) to be communicated to SKF prior to the project for approval. The design and definition of the impeller and seal is under the customer responsibility. As a guide line, for a single stage configuration with a single impeller, the typical maximum impeller can be up to 9 kg
Impeller attachment and shaft end outer diameter	The shaft end diameter on impeller side is maximized to improve stiffness and allow a wide range of impellers. Impeller is axially held in place thanks to a tension bolt. Impeller is centered in shaft spacer thanks to pilot outer diameter (*STD Diameter 44 h6 ; extendable with added spacer (See example in Appendix 1*). Transmission of torque to the spacer by a key and from the spacer to the impeller by friction. Please refer to the appendix 1: Mechanical Interfaces.

Tension bolt (Customer Supplied)	Impeller is pressed and kept into contact with SKF shaft spacer by a tension bolt, installed with a hydraulic tensioner tool. Please refer to the shaft end figure in Appendix 1 : Mechanical Interfaces
Impeller clearance	Shall be compatible with the clearance of the auxiliary bearings as defined in section 1.3
Axial and radial load	Balanced equally in both directions and to be minimized. Characteristics to be communicated to SKF prior to the project for approval. General guideline: steady state loads should not exceed 50% of the bearing design capacity as outlined in section 1.3
Seals (Customer Supplied)	To be defined by the Customer including axial load balancing and leakage venting. Hot air leakage into the motor must be minimized. Seal clearance shall be compatible with the clearance of the auxiliary bearings as defined in section 1.3
MECHANICAL BALANCING OF ROTATING PARTS	Rotor and impeller to be balanced independently to G2.5 level (as per ISO 1940 definition). Final balancing of the rotor with its impeller and seals is not required.

1.3 ACTIVE MAGNETIC BEARINGS (AMB)

Radial bearing	Bearing coil rated for 150V and 4 Amp Temperature class of Isolation material : class F
Radial load capacity	900 N per axis
Displacement and monitoring sensor	SKF-S2M inductive type sensor with built-in harmonics rejection For a G2.5 quality level of balancing, rotor vibration (orbit) during steady state operation is typically less than 20 µm peak-peak in radial direction and less than 10 µm peak-peak in axial direction.

Axial bearing	Bearing coil rated for 150V and 16 Amp Temperature class of Isolation material : class F
Type	The axial bearing is designed for optimum dynamic response in an effort to cope with operation close to the surge line.
Axial peak load capacity	2,700 N for side 1 = impeller side axial bearing (at 0.5mm nominal airgap) 3,200 for side 2 = axial bearing on impeller opposite side (*) Axial bearings of AB350 are slightly different between side and side 2, which explains the difference in load capacity.
Displacement and monitoring sensor	The axial position sensor is located close to the impeller so to better control its axial position (minimum impact on impeller clearance) Rotor side 1 (at impeller side) acts as positioning end during motor rotation and rotor elongation at non-impeller side due to heat and float does not affect rotor end at impeller side. SKF inductive type position sensor, rotor elongation sensor, Temperature sensor integrated in each thrust bearing side (KTY 84) used for internal monitoring

Auxiliary bearings	Integrated in the magnetic bearing cartridge with the axial bearing acting as the auxiliary bearing carrier.
Type	Angular contact ball bearings, soft mounted and axially preloaded with damping devices. Dry lubrication. Minimum maintenance
Clearances	± 0.15 mm radial + floating ring tolerance 0.07mm → Total diametrical clearance = 2x(0.15+0.07)=0.44mm ± 0.20 mm axial → 0.4 mm total axial float
	The auxiliary bearings are at standstill and not spinning during normal operation. They are only (and rarely) used in case of gross overload of the magnetic bearing and in case of major electronic failure of the bearing controller. Note : During a black-out (loss of AC mains voltage) event, the UPS function built-in the controller maintains the levitation active during the deceleration of the rotating motor and consequently the rotor only safely drops on the auxiliary bearing below a low speed threshold with no induced wear. The auxiliary bearing are designed to withstand : • Several hundredth of high speed contact of short duration (less than 0.5sec) between the rotating shaft and aux. bearing • Several dozens of high speed contact of longer duration (0.5 to 2 sec) between the rotating shaft and aux. bearing • Five (5) to ten (10) 'full speed complete coast down' landings Assessment of the health of the Auxiliary bearings is facilitated with 2 features built-in the monitoring software of the bearing controller : ➢ Automated rotor to bearing clearances measurements ➢ Counters of high speed 'Rotor Landing' (with a soft-landing counter and a hard-landing one)

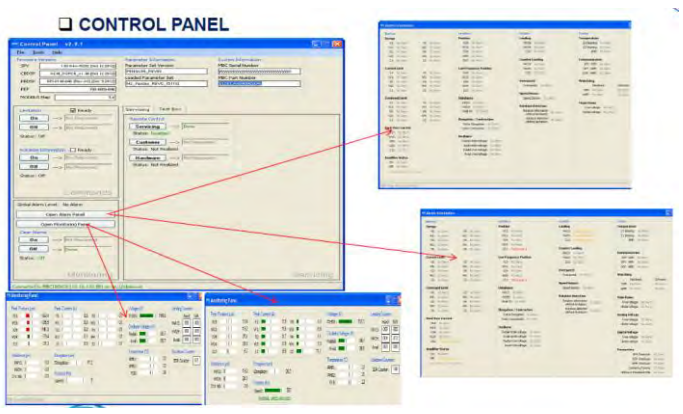
Bearing cables	1 cable for the front end bearing / 1 cable for the rear end bearing Multi conductors and shielded conductor pairs with overall shield Length : typical 3m (25m maximum) The cables are in the customer scope of supply. On specific request from the Customer, the cables can be supplied by SKF as an option.

1.4 MAGNETIC BEARING CONTROLLER (MBC)

MBC	Model 150/8-16_M

Type
 
	AMB control system includes:
	• Conformal coated boards
	• 10 channel Amplifier Power Board rated 150V and 4 or 16 Amp per channel
	• Digital Control and interface board with microprocessor based supervision
	• Built-in continuous monitoring of:
	  ○ Rotor radial displacement and unbalance
	  ○ Rotor axial displacement and thermal elongation
	  ○ Bearing current & temperature
	  ○ Rotor speed
	• DC supply from VFD DC bus
	• Integrated UPS function Board (*) : WIR 1500W DC/DC converter (connected to VFD DC bus)
	• Built-in 24V power supply
	• Built-in heat sink and fans for forced air cooling
	
	Integrated in a compact enclosure to be wall mounted inside Motor Drive cabinet by the customer.
	Conformal coated PC Boards
	
	Size : Height : 450mm x Width :353mm x Depth : 316mm
	
	Weight : 25 kg

Customer interface	The interface PC board is equipped with:
	• 3 digital outputs with outputs relay for hardwired safety signal
	  ○ Shut Down Request,
	  ○ Ready to Rotate (usually hardwired to VFD)
	  ○ MBC Alive
	• 3 digital inputs (option)
	  ○ Levitation
	  ○ Alarm rest
	  ○ Rotation
	• Serial link for digital interface with user PLC (Modbus RTU-RS485)
	• Test box connection capability available for tuning/testing phase
	• RJ45 interface for MBScope (**) connection
	
	Serial link Modbus communication : Modbus register mapping and definition available upon request

Integrated UPS function (*)	In the event of system power loss, the voltage generated by the PM Motor during coast down will maintain DC bus voltage to energize the magnetic bearings until motor has reached a low speed (typically below 5000 rpm) condition.
User's software (**)	Troubleshooting/Monitoring software for PC computer included (MBScope).  **Troubleshooting tool :** Test box (with BNC connectors to connect to oscilloscope or spectrum analyzer) can be proposed as an option.

1.5 VARIABLE FREQUENCY DRIVE (VFD)

Type

At the serial production stage, VFD procurement and final integration in an enclosure or cabinet is under the customer responsibility for the serial production stage.

At the prototype phase, VFD procurement and integration in an enclosure or cabinet can be either directly managed by and under the customer responsibility or as an option can be managed by SKSF.

Variable frequency drive to be interfaced with SKF motor and consisting in :

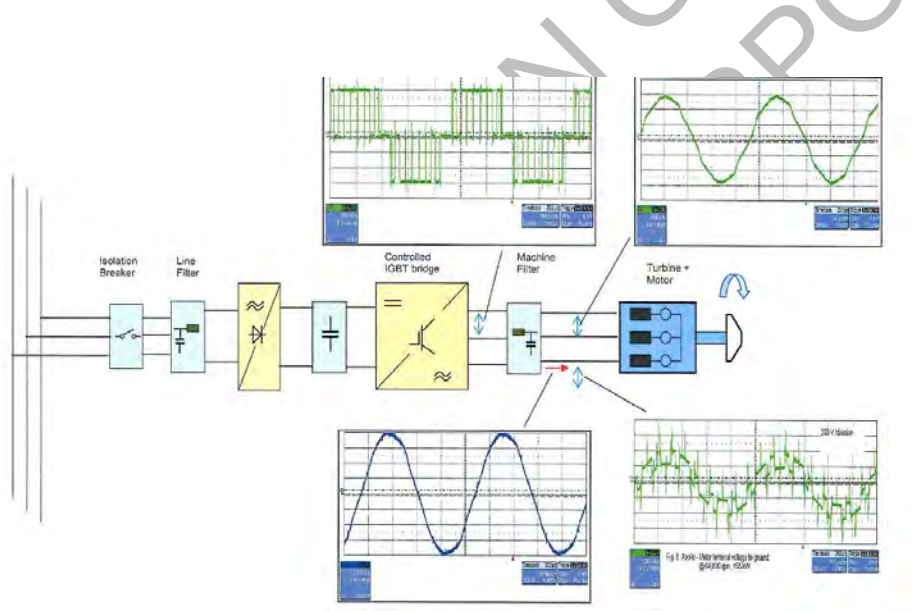
- EMI filter (option)
- Line filter chokes
- Passive rectifier
- PWM inverter
- Sinus output filter
- Water cooling (Air cooled only possible for low power and low switching frequency)

Air cooled VFD power modules might be a possible solution and considered when the power level and switching frequency allow it. But it might still make sense to use water cooled VFD power module across the 200 to 300 kW range because of the compactness of water cooled VFD and the fact that water cooling is anyway necessary for LC filter and the motor cooling.

Recommended (preferred and qualified) supplier : Vacon or KEB.

VFD components to be integrated in a standard cabinet (Rittal or similar) or customized one as seems fit to the customer.

As part of the design of the VFD enclosure, we recommend leaving a compartment and space available in the VFD enclosure for mounting and installation of the bearing controller and THD board.



Motor-Inverter block diagram and typical waveforms

Recommended (preferred and qualified) supplier : Vacon or KEB.

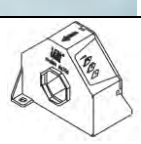
VFD components to be integrated in a standard cabinet (Rittal or similar) or customized one as seems fit to the customer.

As part of the design of the VFD enclosure, we recommend leaving a compartment and space available in the VFD enclosure for mounting and installation of the bearing controller and THD board.

VFD output Voltage and current requirements : refer to Appendix 4

Input voltage supply requirements :3 x 380 VAC +10% -0% 50Hz or 3 x 400 VAC +10% -0% 50Hz or 3 x 460 VAC +10% -0% 60Hz

NB : When the 3 phase VAC grid voltage drops below the nominal rating (380V or 400 or 460V), the VFD controls will command a higher level of field weakening (defluxing) operation in some instances, leading to an increase of the VFD output current. In some cases (for example grid voltage dropping as low as -10%), it might occur that VFD current limit is reached and that VFD output power and consequently motor shaft power is limited to less than its rated power.

THD board and current transducers	THD board ➢ Mounted on a Din rail with aWeidmüller RS100 support ➢ Size of TDB board : 155 x 104 mm   The THD board (supplied by SKF) : With the use of 2 LEM current transducers (placed on motor phase U & V), is sensing the 3 motor terminal voltages and 2 motor currents. From these input signals, the board is : • generating an isolated TTL level 'one pulse per revolution' speed signal for 'tachymeter feedback' to the bearing controller • monitoring the motor current waveform for current distortion (ITHD) and comparing this THD level to a predefined threshold. • When the current THD level exceeds the threshold (for instance increase in motor current harmonic level because of sine filter failure or VFD malfunction) and generates a level of overheating in the rotor that risks damaging the rotor, a fault is triggered and a fault relay contact is opened (which can be hardwired to the VFD or PLC to command a system shut-down).

1.6 ENVIRONMENT	
	Indoor operation and safe area for both mechanical parts and electrical parts
External ambient temperature	• Operation : 0°C to 40°C • Storage : -25°C to 55°C • Transport : -25°C to +55°C • Atmospheric pressure
Humidity	30% to 70% RH - no condensation allowed
Elevation	Up to 1000 m – Derating applicable above 1000 m

1.7 DOCUMENTATION	
DOCUMENTATION INCLUDED	Motor mechanical interface drawing Interconnection and servitude diagram One user manual in English (CD-Rom) Spare part list available upon request

1.8 CERTIFICATION	
CERTIFICATION	The certification of the complete machine : - Requirements as per applicable standards to be defined by the Customer - to be performed by the Customer (optional SKF support and assistance possible upon request) The motor is designed to comply with CE machinery directive. The MBC is compliant with : • CE low voltage and EMC directives • UL 508 and CSA C22-2 N°14-13

1.9 TESTING

SKF Factory acceptance test of prototype :

Full Speed, Low Load (with no impeller or dummy impeller)	Test of motor winding isolation resistance to ground Test of motor winding dielectric strength to ground Test of motor back-emf
Resonance verification with dummy impeller	Measures resonant frequency response of magnetically levitated rotor. Testing performed when rotor is static and again when under rotation. Confirms rotor dynamics, control loop stability.
Resonance verification with real impeller	Measures resonant frequency response of magnetically levitated rotor. Testing performed when rotor is static condition only no rotation) Confirms rotor dynamics, control loop stability.
High Speed drop	Confirms backup bearing function when magnetic bearings are disabled. One drop at full speed, no external thrust load applied. Maximum duration : 5 seconds

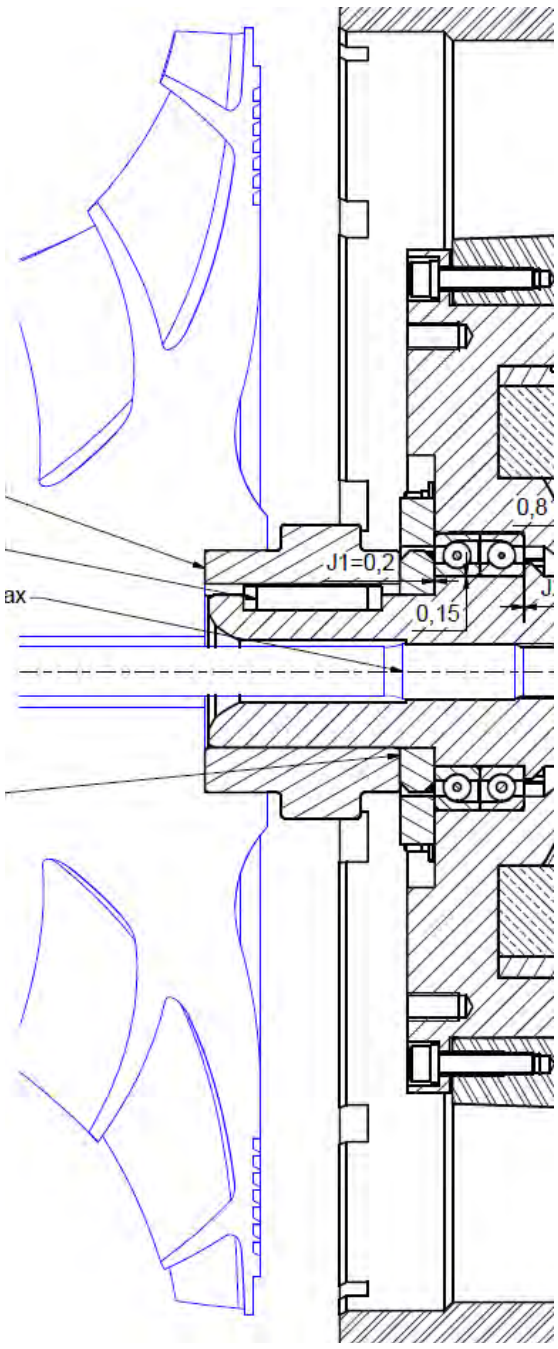
Test of prototype at OEM or compressor manufacturer facilities :

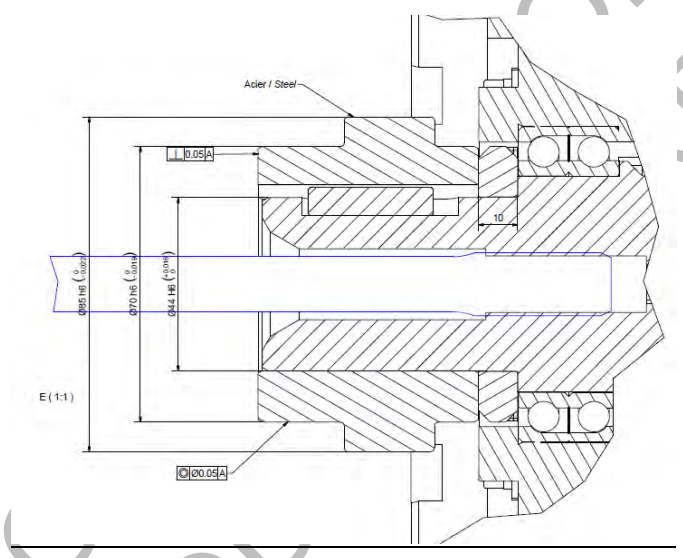
Full speed, full load	Will be conducted with the real impeller and real compressor load at customer facility. Rated load test and temperature rise measurement

Serial production unit : SKF Factory acceptance tests

Full Speed, Low Load test with no impeller or dummy impeller	Test of motor winding isolation resistance to ground Test of motor winding dielectric strength to ground Test of motor back-emf Confirms resonance, rotor resonance and control loop stability.

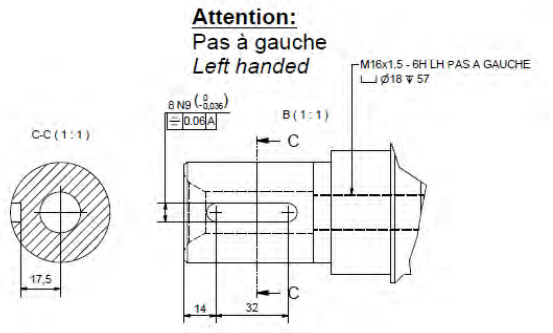
Appendix 1 : Rotor mechanical Interfaces



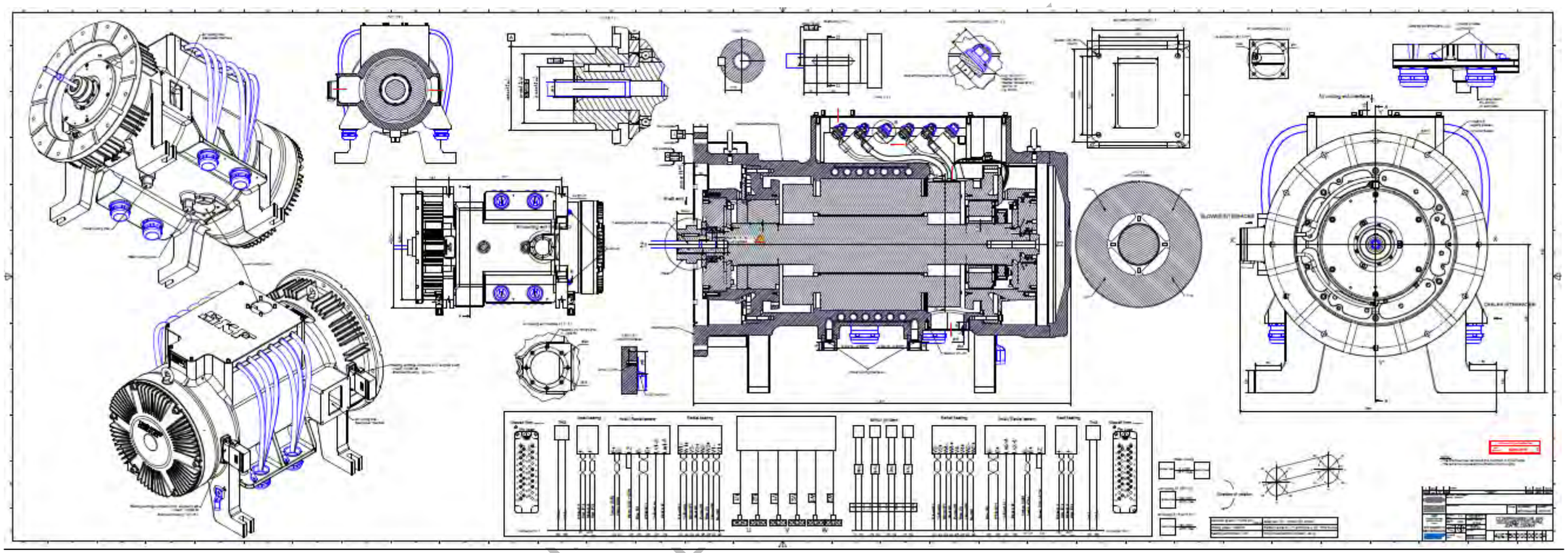


Impeller attachment with a central M16x1.5 stretch bolt

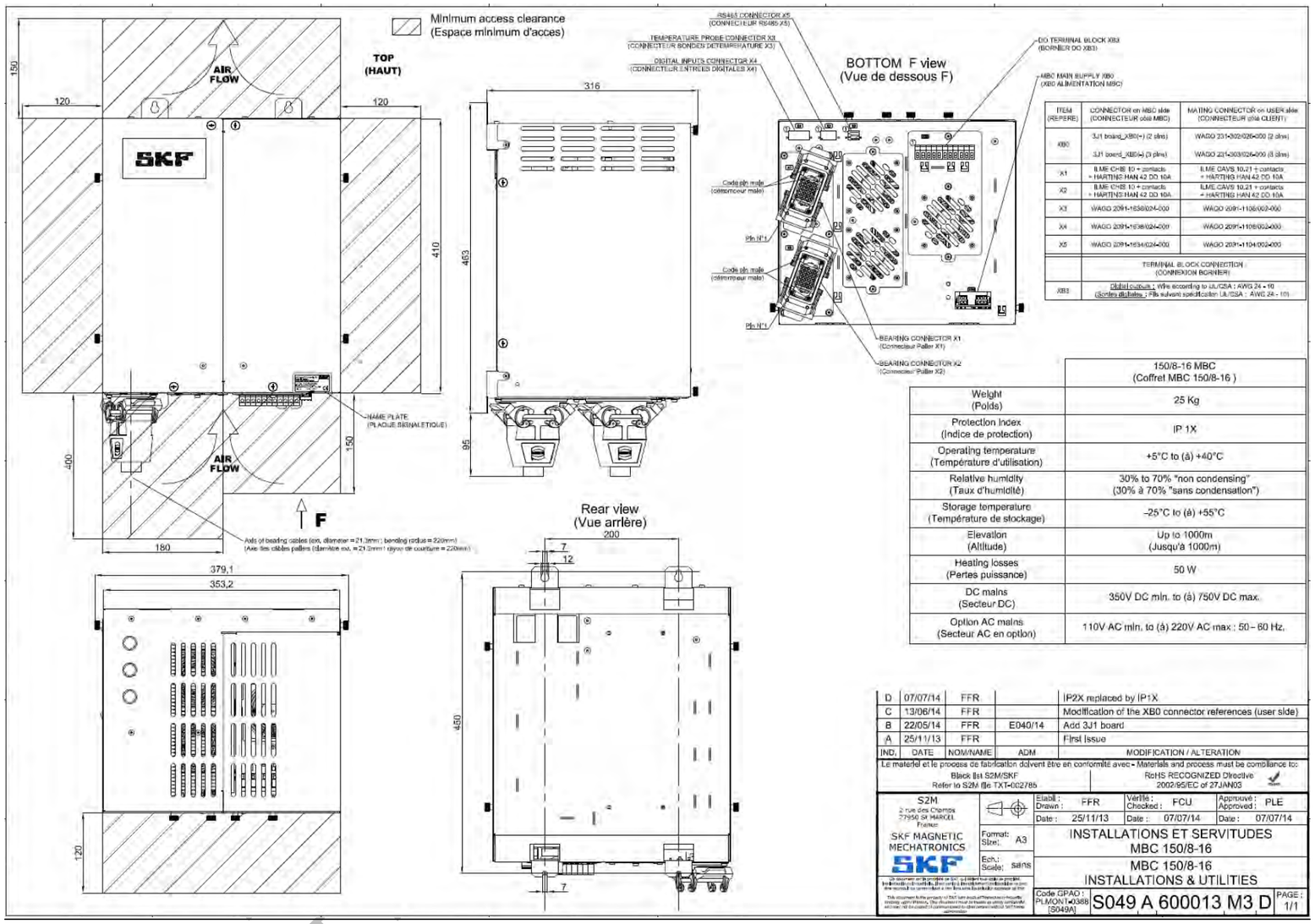
(105kN max pre-stretch load)



Appendix 2 : Motor interface drawing



Appendix 3 : 150/4-16 Bearing controller interface



ITEM (REPERE)	CONNECTOR on MBC side (CONNECTEUR côté MBC)	MATING CONNECTOR on USER side (CONNECTEUR côté CLIENT)
XB0	3J1 board_XB0(+) (2 slins)	WAGO 231-302/026-000 (2 slins)
	3J1 board_XB0(-) (3 plins)	WAGO 231-303/026-000 (3 slins)
X1	ILME CHE 10 + contacts + HARTING HAN 42 DD 10A	ILME CAVS 10,21 + contacts + HARTING HAN 42 DD 10A
X2	ILME CHE 10 + contacts + HARTING HAN 42 DD 10A	ILME CAVS 10,21 + contacts + HARTING HAN 42 DD 10A
X3	WAGO 2091-1638/024-000	WAGO 2091-1108/002-000
X4	WAGO 2091-1638/024-000	WAGO 2091-1108/002-000
X5	WAGO 2091-1634/024-000	WAGO 2091-1104/002-000
	TERMINAL BLOCK CONNECTION (CONNEXION BORNIER)	
XB3	Digital outputs : Wire according to UL/CSA : AWG 24 - 16 (Sorties digitales : Fils suivant spécification UL/CSA : AWG 24 - 16)	

	150/8-16 MBC (Coffret MBC 150/8-16)
Weight (Poids)	25 Kg
Protection index (Indice de protection)	IP 1X
Operating temperature (Température d'utilisation)	+5°C to (à) +40°C
Relative humidity (Taux d'humidité)	30% to 70% "non condensing" (30% à 70% "sans condensation")
Storage temperature (Température de stockage)	-25°C to (à) +55°C
Elevation (Altitude)	Up to 1000m (Jusqu'à 1000m)
Heating losses (Pertes puissance)	50 W
DC mains (Secteur DC)	350V DC min. to (à) 750V DC max.
Option AC mains (Secteur AC en option)	110V AC min. to (à) 220V AC max ; 50 - 60 Hz.

IND.	DATE	NOM/NAME	ADM	MODIFICATION / ALTERATION
D	07/07/14	FFR		IP2X replaced by IP1X
C	13/06/14	FFR		Modification of the XB0 connector references (user side)
B	22/05/14	FFR	E040/14	Add 3J1 board
A	25/11/13	FFR		First issue

Le matériel et le process de fabrication doivent être en conformité avec - Materials and process must be comblance to:
Black list S2M/SKF
Refer to S2M file TXT-002785
RoHS RECOGNIZED Directive 2002/95/EC of 27/JAN/03

S2M
2 rue des Champs
27950 St MAGEL
France
SKF MAGNETIC MECHATRONICS

Etabli : Drawn :	FFR	Vérifié : Checked :	FCU	Approuvé : Approved :	PLE
Date :	25/11/13	Date :	07/07/14	Date :	07/07/14

Format: A3 Size:
Ech.: sans Scale:

INSTALLATIONS ET SERVITUDES
MBC 150/8-16
MBC 150/8-16
INSTALLATIONS & UTILITIES

Code GPAO : PLMONT-0388 [S049A] | S049 A 600013 M3 D | PAGE : 1/1

Appendix 4 : Sine filter and VFD data

GRID NOMINAL VOLTAGE (Vrms)	460											
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Rated torque (Nm)	103,2	129,0	154,9	180,7	95,5	119,4	143,2	167,1	90,9	113,7	136,4	159,2
Number of pair of pole	1	1	1	1	1	1	1	1	1	1	1	1
Rated frequency (Hz)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Recommended Sine filter data												
Filter 'L' component (µH)	30				30				30			
Filter 'C' component (µF) - Delta connection	250	250	300	300	200	200	250	250	150	200	250	250
Capacitor current at rated frequency (Arms)	139	144	145	190	128	133	173	173	106	145	190	197
Capacitor current with 10% margin (Arms)	153	158	160	209	141	146	190	190	117	160	209	217
Capacitor max voltage (Vrms)	335				354				410			
Filter resonance 1 (Hz)	670	670	611	611	750	750	670	670	865	750	670	670
Filter resonance 2 (Hz)	1255	1255	1145	1145	1403	1403	1255	1255	1620	1403	1255	1255
VFD requirements (when used with above mentioned sine filter)												
Output voltage ph-ph (Vrms ph-ph)	283	303	322	347	302	321	337	362	317	330	344	368
Output current at rated frequency (Arms)	415	490	562	636	390	461	531	600	370	446	513	573
Output current with 10% margin for harmonics (Arms)	457	539	618	700	429	507	584	660	407	491	564	630
Min switching frequency (kHz)	3,4	3,4	3,4	3,4	3,7	3,7	3,7	3,7	3,9	3,9	3,9	3,9
Recommended practical min switching frequency (kHz)	4	4	4	4	5	5	5	5	5	5	5	5
DC bus voltage (Vdc) min value under load	620											
VFD max output voltage assumption	410											

GRID NOMINAL VOLTAGE (Vrms)	400											
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Rated torque (Nm)	103,2	129,0	154,9	180,7	95,5	119,4	143,2	167,1	90,9	113,7	136,4	159,2
Number of pair of pole	1	1	1	1	1	1	1	1	1	1	1	1
Rated frequency (Hz)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	328	306	318	331	346	320	331	344	358
Motor input current (Arms)	445	555	665	775	412	514	615	717	393	490	586	683
Recommended Sine filter data												
Filter 'L' component (µH)	30				30				30			
Filter 'C' component (µF) - Delta connection	250	250	300	300	200	200	250	250	150	200	250	250
Capacitor current at rated frequency (Arms)	139	144	145	190	128	133	173	173	106	145	190	197
Capacitor current with 10% margin (Arms)	153	158	160	209	141	146	190	190	117	160	209	217
Capacitor max voltage (Vrms)	335				354				410			
Filter resonance 1 (Hz)	670	670	611	611	750	750	670	670	865	750	670	670
Filter resonance 2 (Hz)	1255	1255	1145	1145	1403	1403	1255	1255	1620	1403	1255	1255
VFD requirements (when used with above mentioned sine filter)												
Output voltage ph-ph (Vrms ph-ph)	283	303	322	347	302	321	337	360	317	330	344	368
Output current at rated frequency (Arms)	415	490	562	636	390	461	531	600	370	446	513	573
Output current with 10% margin for harmonics (Arms)	457	539	618	700	429	507	584	660	407	491	564	630
Min switching frequency (kHz)	3,4	3,4	3,4	3,4	3,7	3,7	3,7	3,7	3,9	3,9	3,9	3,9
Recommended practical min switching frequency (kHz)	4	4	4	4	5	5	5	5	5	5	5	5
DC bus voltage (Vdc) min value under load	523											
VFD max output voltage assumption	350											

GRID NOMINAL VOLTAGE (Vrms)	380											
AB Motor model	**AB350**											
Shaft Power (kW)	200	250	300	350	200	250	300	350	200	250	300	350
Shaft Power (HP)	268	336	403	470	268	336	403	470	268	336	403	470
Rated speed (krpm)	18,5	18,5	18,5	18,5	20	20	20	20	21	21	21	21
Rated torque (Nm)	103,2	129,0	154,9	180,7	95,5	119,4	143,2	167,1	90,9	113,7	136,4	159,2
Number of pair of pole	1	1	1	1	1	1	1	1	1	1	1	1
Rated frequency (Hz)	308	308	308	308	333	333	333	333	350	350	350	350
Motor input voltage ph-ph (Vrmsph-ph)	286	299	313	322	306	318	331	325	320	331	338	332
Motor input current (Arms)	445	555	665	776	412	514	615	725	393	490	590	695
Recommended Sine filter data												
Filter 'L' component (µH)	30				30				30			
Filter 'C' component (µF) - Delta connection	250	250	300	300	200	200	250	250	150	200	250	250
Capacitor current at rated frequency (Arms)	139	144	145	186	128	133	173	170	106	145	185	185
Capacitor current with 10% margin (Arms)	153	158	160	205	141	146	190	187	117	160	204	204
Capacitor max voltage (Vrms)	355				354		380		410			
Filter resonance 1 (Hz)	670	670	611	611	750	750	670	670	865	750	670	670
Filter resonance 2 (Hz)	1255	1255	1145	1145	1403	1403	1255	1255	1620	1403	1255	1255
VFD requirements (when used with above mentioned sine filter)												
Output voltage ph-ph (Vrms ph-ph)	283	303	322	340	302	321	337	340	317	330	340	340
Output current at rated frequency (Arms)	415	490	562	650	390	461	531	632	370	446	521	618
Output current with 10% margin for harmonics (Arms)	457	539	618	715	429	507	584	695	407	491	573	680
Min switching frequency (kHz)	3,4	3,4	3,4	3,4	3,7	3,7	3,7	3,7	3,9	3,9	3,9	3,9
Recommended practical min switching frequency (kHz)	4	4	4	4	5	5	5	5	5	5	5	5
DC bus voltage (Vdc) min value under load	500											
VFD max output voltage assumption	340											

10. AFD Detailed Catalog Cut Sheets

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

ENGINEERING
TOMORROW

Selection Guide | VACON® NXP Liquid Cooled | 7.5 kW – 5.3 MW

Robust, silent and **space-saving** control for all drive needs in **demanding applications**

Up to
25%
savings in total life cycle costs compared to air cooled solutions

drives.danfoss.com | VACON®

Quiet. Compact. Cool.

VACON® NXP Liquid Cooled AC drives are the ultimate in space-saving, high power density AC drives. They are well suited for locations where air-cooling is difficult, expensive or impractical such as onboard ships or in locations affected by altitude, or simply where installation space is at a premium. Their robust, modular design makes the VACON® NXP a suitable platform for all drive needs in demanding applications and are available in the power range from 7.5 to 5300 kW at 380-690 VAC supply voltages.

Power packed

As no air ducts are required, liquid cooled drives are extremely compact and suitable for a wide variety of heavy industries with harsh operating conditions such as marine & offshore, pulp & paper, renewable energy and mining & metal.

Thanks to the high degree of protection (IP54) achieved with these drives, they can be installed almost anywhere in the plant or vessel. This eliminates the load on the air-conditioning system in the electrical rooms – an important cost and space consideration in many retrofit applications. And since liquid cooled drives do not require large cooling fans, they are also among the most silent AC drives on the market.

We are committed to providing you with the ultimate in high power density. VACON® NXP liquid cooled products have one of the best power/size ratios on the market. For example, our compact 12 pulse, 1.5MW drive includes a built-in rectifier, inverter and optional brake all in the same package, and all this can be mounted in an 800 mm wide enclosure.

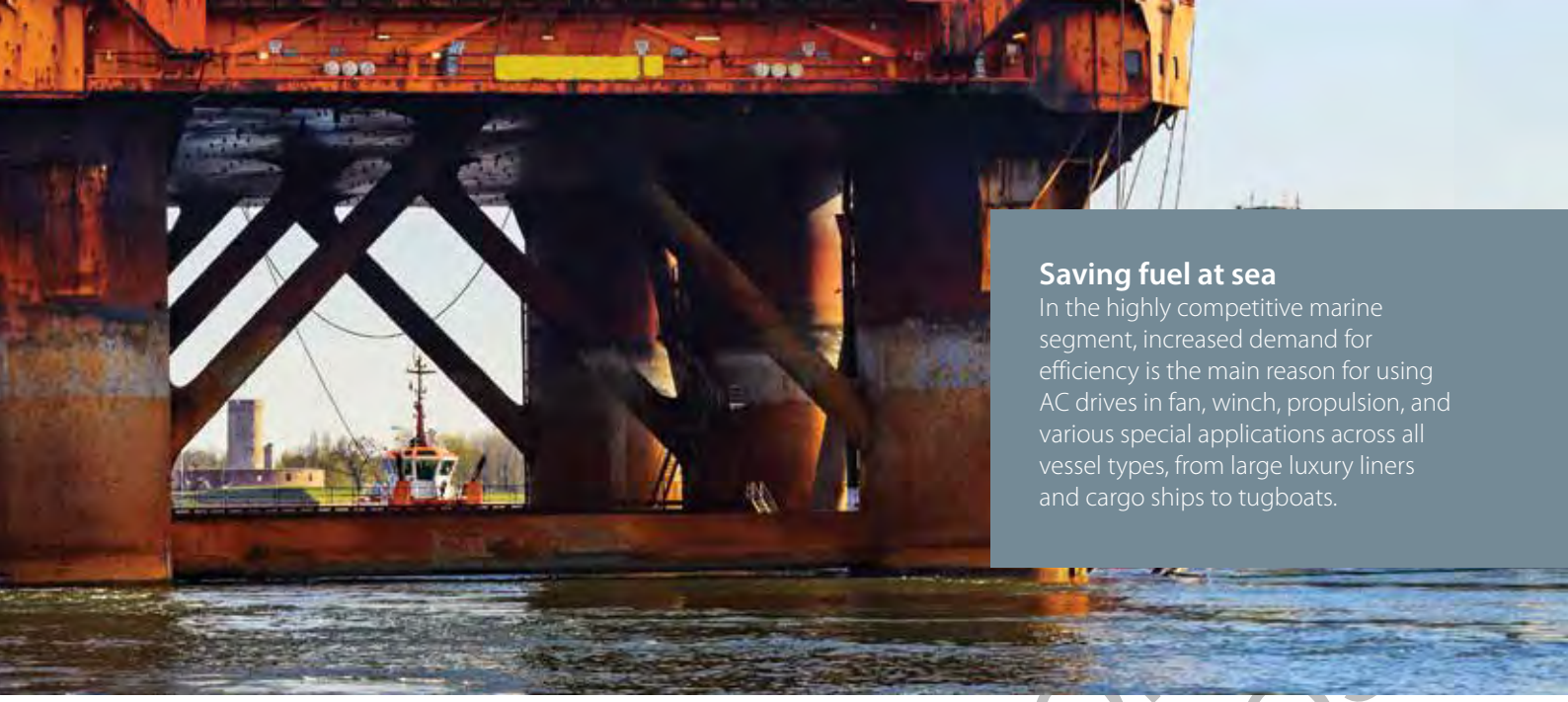
Our liquid cooled range offers the ultimate in motor control, for both induction and permanent magnet motors, gearless drive applications and paralleling solutions for high power motors.

Certification and grid expertize

Our VACON® NXP liquid cooled portfolio fulfills all relevant international standards and global requirements, including marine, safety and EMC & Harmonics approvals. VACON® NXP liquid cooled AC drives can be used in regenerative energy and smart grid applications, which ensures customers can effectively monitor and control energy use and costs.

Typical segments

- Marine and offshore
- Renewable energy
- Mining and metals
- Water and wastewater
- Energy management
- Pulp and paper
- Oil and gas
- Machine building



Saving fuel at sea
In the highly competitive marine segment, increased demand for efficiency is the main reason for using AC drives in fan, winch, propulsion, and various special applications across all vessel types, from large luxury liners and cargo ships to tugboats.

What's in it for you

Minimizes investment and operation costs

Saves floor space and infrastructure needs

Saves time and money

Compact and easy to install

Virtually silent operation

Benefits

- Compact size and high power density
- No large air conditioning systems needed as state-of-the-art liquid cooled AC drive design allows heat loss to be transferred to the most convenient place with no need for vast amounts of filtered air
- Easy to adapt to various uses due to ready-to-use applications
- Flexible and scalable system for additional I/O, fieldbus and f unctional safety boards with five built-in expansion slots
- Silent operation due to eliminated need for large cooling fans

Typical applications

- Propeller and thrusters systems
- Compressors
- Wind turbines
- Extruders
- Pumps and fans
- Test bench systems
- Cranes and winch systems
- Power conversion systems
- Production lines
- Oil rigs
- Crushers
- Conveyors

The liquid way to stay cool

VACON® NXP Liquid Cooled AC drives have been pioneering for more than a decade in demanding industries with a proven track record of highly reliable products. We have succesfully mitigated the common risks of leakage and reliability in our product design.

Climate considerations

When comparing cooling technology solutions, it is important to understand the effects on the infrastructure of the electrical room, and the room's requirements. Additional comparison parameters are the geographical location, relevant industry and process.

In warm climates it is extremely important to observe the amount of heat load transferred to the electrical room because of its indirect effect on electrical energy consumption.

The type-tested switchgears standard EN 60439-1 specifies that the electrical room's 24-hour average temperature should be below +35 °C and the maximum temporary temperature cannot exceed +40 °C. As a result, the cooling system in electrical rooms is typically comprised of air conditioning chillers, which are dimensioned according to the maximum heat load, the temperature inside the electrical room and the maximum temperature outdoors. The typical electrical energy consumption of air conditioning is approx. 25-33% of the cooling power.

The higher the power, the greater the savings

In many cases liquid cooled drives are the most cost-effective option, simply due to the fact that there is no need for additional air conditioning capacity or extra ventilation for the areas in which they are used. The related savings enable shorter payback times and the higher the power, the greater the savings potential.

The continuously growing cost of energy certainly supports a wider use of liquid cooled drives technology, and the number of installations is growing rapidly.

A driving force in wind energy
VACON® AC drives are designed to provide proven performance in demanding environments. Our drives are serving the wind energy industry globally with a combined installed capacity of almost one gigawatt.

Exclusively designed for liquid cooling

Many other liquid cooled drives on the market are based on modifications of an air cooled drive, rather than exclusively designed for the purpose. The VACON® NXP Liquid Cooled dissipates only 0.1 -0.15% of its heat losses to air.* A state-of-the-art cooling heatsink enables the cooling efficiency of the components to be higher than ever.

Cooling technology advantages

Up to **25%** savings in total life cycle costs compared to air cooled solutions

20dBA
less noise than air cooled drive

25% smaller unit can deliver the same or better performance

*400 kW, 690 VAC liquid cooled drive

Extensive portfolio of liquid cooled drive modules

Significant energy savings and optimal performance can be achieved with the right configuration. Liquid cooled AC drives can be used in a multitude of combinations – from a single dedicated frequency converter to large-scale Common DC bus systems.

Dedicated frequency converter

The VACON® NXP Liquid Cooled drives are available as 6- or 12-pulse frequency converters. In addition, our largest unit, the CH74, can also be used as an 18-pulse converter. The AC drive consists of a power unit, control unit and possibly one or more input chokes.

An internal brake chopper is available as standard for our smallest unit CH3. For CH72 (only 6-pulse) and CH74, it is available as internal option while in all other sizes the brake chopper is available as an option and installed externally.

Front-end units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus and, in certain cases, vice versa.

Active front-end (AFE)

The AFE unit is a bi-directional (regenerative) power converter (supply unit) for the front-end of a common liquid cooled DC bus drive line-up. An external LCL filter is used at the input. This unit is suitable for applications where a low level of mains harmonics and high power factor are required. AFE units can operate in parallel to provide increased power and/or redundancy without any drive to drive communication between the units. AFE units can also be connected to the same fieldbus with inverters, and controlled and monitored via fieldbus. Fuses, LCL filters, pre-charging rectifiers and resistors can be specified and ordered separately.

The LCL filter guarantees that harmonics are not an issue in any network. With a power factor > 0.99 and low harmonics, the supply chain transformers, generators, etc. can be sized very accurately without reserving margins for the reactive power. This can mean a saving of 10% in supply chain investments. Likewise the payback time is faster as regenerative energy is fed back to the grid.

Non-regenerative front-end (NFE)

The NFE unit is an unidirectional (motoring) power converter for the front-end of a common DC bus drive line-up. The NFE is a device that operates as a diode bridge. A dedicated external choke is used at the input. This unit is suitable as a 6 or 12 pulse rectifying device when a normal level of harmonics is accepted and no regeneration to the mains is required. NFE units can be paralleled to increase power without any drive to drive communincation between the units.

Inverter unit (INU)

The INU is a bidirectional DC-fed power inverter for the supply and control of AC motors. The INU is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC-side charging circuit is external for inverter types.

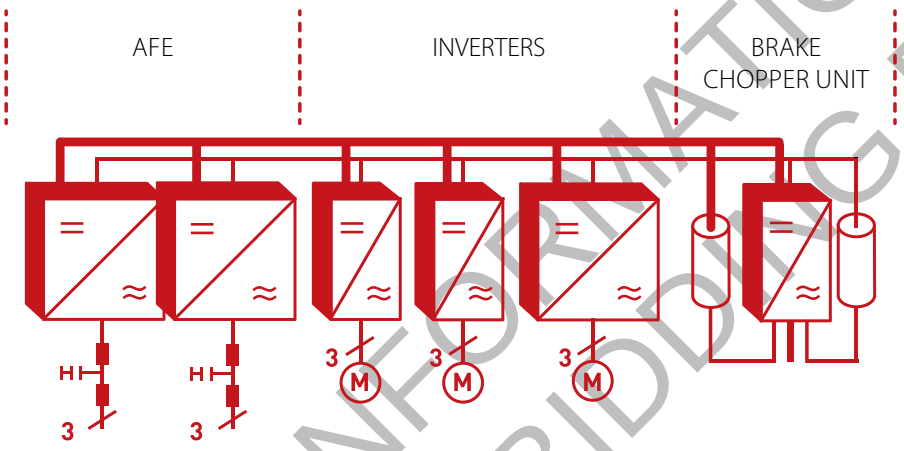
Pre-charging resistors and switches or fuses are not included in an INU delivery and must be specified and ordered separately.

Brake chopper unit (BCU)

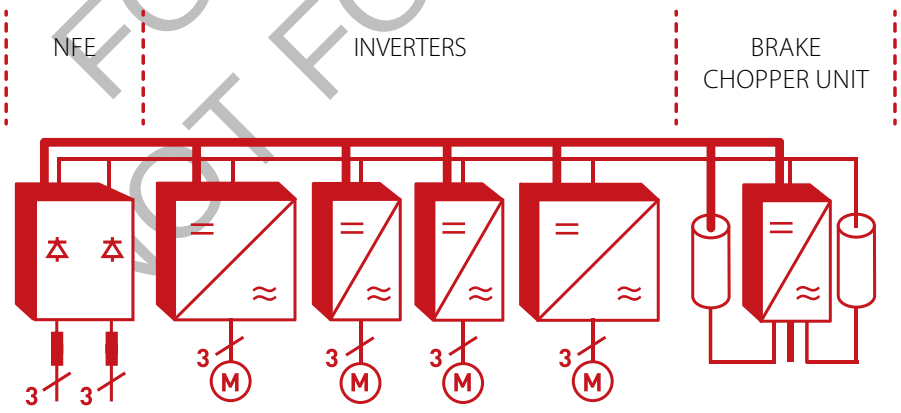
The BCU is a unidirectional power converter for the supply of excessive energy from a common DC bus drive line-up or big AC drive to resistors where the energy is dissipated as heat. External resistors are required. However, resistors or fuses are not included in a BCU delivery and can be specified and ordered separately.

BCU's improve a drive's dynamic performance in a regenerative operating point and protect common DC bus voltage level from overvoltage. In some cases they also reduce the need for AFE investments.

A regenerative Common DC bus system



A non-regenerative common DC bus system



VACON® NXP Liquid Cooled Enclosed drive

The low harmonic and regenerative VACON® NXP Liquid Cooled Enclosed Drives range has been developed especially with ease of use in mind. Packed full of features, these fully standardized, compact and robust AC drives with a full power range help maximize the utilization of space while minimizing overall costs.

These enclosed drives are the ideal solution for applications and locations where space is at a premium. The sturdy cabinet makes it ideal for harsh environments. See technical ratings and dimensions on page 19 for further information.

High power density

VACON® NXP Liquid Cooled Enclosed Drive can be used with AC motors in power sizes from 800–1550 kW. However, using the patented VACON® DriveSynch control concept, four enclosed drives can be run in parallel taking the power range up to an outstanding 5 MW.

Fast installation

VACON® NXP Liquid Cooled Enclosed Drives are pre-designed and engineered. That means they're good to go as soon as you receive them. Simply connect to the cooling system and the power and motor supplies. Being liquid cooled, the product is virtually silent and you'll have greater flexibility with where to put it. You don't have to worry about leaving space for air flow, and you'll save on air-conditioning energy costs.

Packed with cool performance

The enclosed unit comes equipped with the same advantages of efficient and quiet cooling performance as the rest of the VACON® NXP product family. When we say that this product is liquid cooled, we are talking about the entire product. The modules and also all its main components, such as LCL and dU/dt filters, are liquid cooled as standard. The reliable heat exchanger is offered as an option to provide a worry-free life cycle for the product.

You can also enjoy the same fast commissioning with the aid of the easy to use Startup Wizard. The slide-out racks provide easy access for maintenance. Leakage indicators alert the operator to any potential issues in the cooling system.

A solution for all your needs
We provide enclosed solutions to any segment and application. And while we focus on the drives, you can concentrate on your performance.

Eliminate production disturbances

Continuous energy supply is important to ensure your processes are optimized. Distortions in the energy supply, caused by the presence of harmonic currents and voltages, can trigger equipment disturbances and create energy losses. VACON® front-end drives with low harmonic technology maintain a constant energy supply and eliminate the disruption harmonics can cause to production.

Advanced monitoring

The VACON® NXP Liquid Cooled Enclosed Drive's built-in Fieldbus interface communicates effectively with your process automation system. This reduces the need for cabling and gives you increased monitoring and control of process equipment.

Safety is a given

One of the most visible features of the enclosed product is the integrated main breaker switch. This simple on/off switch quickly and easily disconnects and activates the power supply as and when necessary.

Benefits

- Saves floor space and infrastructure needs
- Saves time and money in installation
- Faster and easier servicing
- Improves safety
- Enhances reliability
- Low harmonic input
- Virtually silent operation

Key features

- Optimized design with power range up to 5 MW
- All standard protection components included
- Silent design with no large cooling fans needed
- Slide-out feature
- Leakage detector
- AFE technology
- Pre-engineered solution with all-liquid-cooled design (including filters)
- Cooling system monitoring

Multiple options

VACON® NXP control

High-performance control platform for all demanding drive applications

- Excellent processing and calculation power
- Supports induction and permanent magnet motors
- Maximum utilization of control features over wide power and voltage range
- Built-in PLC functionality
- Integration of customer-specific functionalities
- Bumpless transfer between open loop and closed loop control

Option boards

VACON® NXP control provides exceptional modularity

- 5 plug-in extension slots
- Fieldbus boards
- Encoder boards
- IO boards
- Easy plug-in without need to remove other components

Fieldbus options

Easy integration with plant automation systems

- PROFIBUS DP
- DeviceNet™
- Modbus RTU
- CANopen

Ethernet connectivity

Ethernet connectivity allows remote drive access for monitoring, configuring and troubleshooting

- Modbus/TCP
- PROFINET IO
- EtherNet/IP™
- EtherCAT

Functional safety and reliability

Safe Torque Off (STO)
Available for all VACON® NXP drives
- Prevents drive from generating torque on motor shaft
- Prevents unintentional start-ups
- Corresponds to an uncontrolled stop
- In accordance with stop category 0, EN60204-1

Safe Stop 1 (SS1)
Available for all VACON® NXP drives
- Initiates motor deceleration
- Initiates STO function after application specific time delay
- Corresponds to an uncontrolled stop
- In accordance with stop category 1, EN60204-1

Advanced Safety Options
Support more safety functions

Safe Stop functions::
- STO – Safe Torque Off
- SS1 – Safe Stop 1
- SS2 – Safe Stop 2
- SBC – Safe Brake Control
- SQS – Safe Quick Stop

Safe Speed functions:
- SLS – Safely-limited Speed
- SSM – Safe Speed Monitor
- SSR – Safe Speed Range
- SMS – Safe Maximum Speed

Conformal coating
- Conformal coated circuit boards as standard
- Improved performance
- Increased durability
- Reliable protection against dust and moisture
- Extended lifetime of drive and components

ATEX- certified thermistor input
Especially designed for motor temperature supervision
- Stops feeding energy to motor in case of over-heating
- Certified and compliant with the European ATEX directive 94/9/EC

Commissioning made easy

User-friendly keypad
- Removable panel with plug-in connection
- Graphical and text keypad with multiple language support
- Text display multi-monitoring function
- Parameter backup and copy function with the panel's internal memory
- The startup wizard ensures a hassle-free set up

Software modularity
All-in-One application package
- Seven built-in software applications

Several segment-specific and advanced applications such as:
- System Interface
- Marine
- and much more

For setting, copying, storing, printing, monitoring and controlling parameters

Includes handy Datalogger function
- Track failure modes & perform root cause analysis

Communicates with drive via:
- RS232
- Ethernet TCP/IP
- CAN (fast multiple drive monitoring)
- CAN@Net (remote monitoring)

Independent paralleling
Our patented independent paralleling configuration of front-end (AFE) units:
- Offer high redundancy
- Eliminate need for drive-to-drive communication
- Enables automatic load sharing

Dedicated applications

Intelligent system interfaces for heavy industries

VACON® System Interface Application (SIA) provides a flexible and extensive interface for use in coordinated drives, which have an overriding control system. VACON® SIA utilizes the most advanced functions of our VACON® NXP motor control software and is suitable for demanding drive systems such as those in the pulp & paper and metal industries, processing lines as well as many other standard applications.

Benefits

- Power extension with VACON® DriveSynch
- Master Follower functions for torque sharing
- Freely configurable PLC logic

Dedicated marine application

Our Marine Application provides flexibility and performance across all marine segment applications. VACON® Liquid Cooled drives bring many benefits to this segment in particular such as energy efficiency, improved process availability due to high redundancy, better process quality and control, as well as silent operation and substantially reduced emissions.

Benefits

- Black Out prevention logic
- Cost savings in electric propulsion system
- State-of-the-art load sharing and load trooping

VACON® NXP Grid Converter

The VACON® NXP Grid Converter is a solution that improves energy efficiency and environmental performance in marine industry use. It enables ships to source energy from local grids on shore, allowing for the ship's main generators to be completely switched off.

Benefits

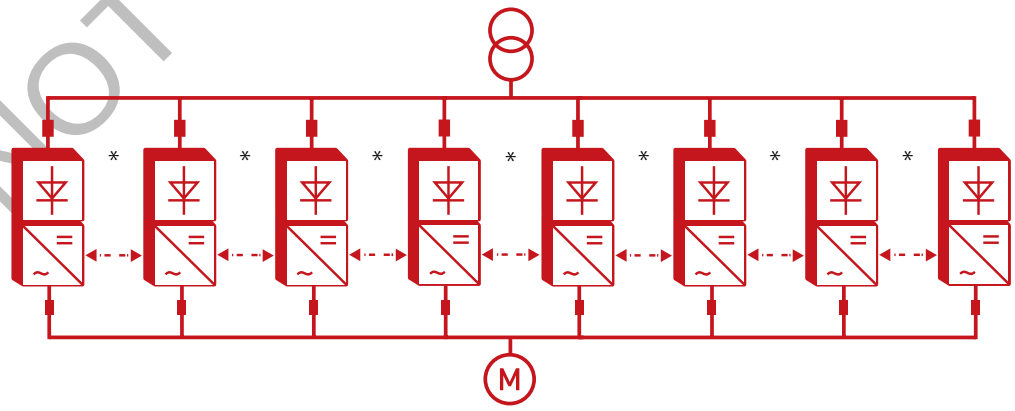
- Reduces fuel consumption and emissions
- Reduces noise and vibrations

High power and improved redundancy

VACON® DriveSynch is a patented control concept for running standard drives in parallel to control high-power AC motors or increase the redundancy of a system. This concept suits high power single or multiple winding motors, typically above 1 MW. High power AC drives above 5 MW can be built using standard drive components.

Benefits

- System redundancy is higher than in a conventional drive because each unit can run independently
- Identical units and standard modules reduce overall costs by reducing need for spares and specialist skills in engineering, installation,commissioning and maintenance



* Fiber optic link

Liquid to liquid heat exchangers

We have a range of cooling units based on liquid-to-liquid heat exchangers (HX), which improve the availability and usability of AC drive systems. The cooling units belong to the liquid cooled VACON® NXP range and offer reliable and cost-effective cooling without ventilation concerns. The heat exchanger is a pre-designed, pre-tested and fully functional package that ensures safety and reliability.

Intelligent system interfaces for heavy industries

- Self-supporting module rack construction
- Cooling circuit equipped with threaded joints or flanges
- Heavy industry, stainless steel
- Industrial water heat exchanger, three-way-valve, pump, AC drive
- Flow and pressure sensors
- Stainless steel AISI piping
- Two-way-valve
- Heat exchanger installed inside a Rittal TS8 or VSG VEDA 5000 cabinet
- Double pumps for marine class requirements, types 120 kW and 300 kW

Ratings and dimensions

VACON® NXP Liquid Cooled AC drives, 6-pulse and 12-pulse, mains voltage 400-500 VAC

AC drive type 6-pulse	AC drive type 12-pulse	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis	Choke type 6-pulse*	Choke type 12-pulse
		Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (400 V) [kW]	Optimum motor at I_{th} (500 V) [kW]				
NXP00165A0N1SWS		16	15	11	7.5	11	0.4/0.2/0.6	CH3	CHK0023N6A0	
NXP00225A0N1SWS		22	20	15	11	15	0.5/0.2/0.7	CH3	CHK0023N6A0	
NXP00315A0N1SWS		31	28	21	15	18.5	0.7/0.2/0.9	CH3	CHK0038N6A0	
NXP00385A0N1SWS		38	35	25	18.5	22	0.8/0.2/1.0	CH3	CHK0038N6A0	
NXP00455A0N1SWS		45	41	30	22	30	1.0/0.3/1.3	CH3	CHK0062N6A0	
NXP00615A0N1SWS		61	55	41	30	37	1.3/0.3/1.5	CH3	CHK0062N6A0	
NXP00725A0N0SWS		72	65	48	37	45	1.2/0.3/1.5	CH4	CHK0087N6A0	
NXP00875A0N0SWS		87	79	58	45	55	1.5/0.3/1.8	CH4	CHK0087N6A0	
NXP01055A0N0SWS		105	95	70	55	75	1.8/0.3/2.1	CH4	CHK0145N6A0	
NXP01405A0N0SWS		140	127	93	75	90	2.3/0.3/2.6	CH4	CHK0145N6A0	
NXP01685A0N0SWS		168	153	112	90	110	4.0/0.4/4.4	CH5	CHK-0261-6-DL	
NXP02055A0N0SWS		205	186	137	110	132	5.0/0.5/5.5	CH5	CHK-0261-6-DL	
NXP02615A0N0SWS		261	237	174	132	160	6.0/0.5/6.5	CH5	CHK-0261-6-DL	
NXP03005A0N0SWF		300	273	200	160	200	4.5/0.5/5.0	CH61	CHK-0400-6-DL	
NXP03855A0N0SWF		385	350	257	200	250	6.0/0.5/6.5	CH61	CHK-0400-6-DL	
NXP04605A0N0SWF	NXP04605A0N0TWF	460	418	307	250	315	6.5/0.5/7.0	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05205A0N0SWF	NXP05205A0N0TWF	520	473	347	250	355	7.5/0.6/8.1	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05905A0N0SWF	NXP05905A0N0TWF	590	536	393	315	400	9.0/0.7/9.7	CH72	CHK-0650-6-DL	2 x CHK-0400-6-DL
NXP06505A0N0SWF	NXP06505A0N0TWF	650	591	433	355	450	10.0/0.7/10.7	CH72	CHK-0650-6-DL	2 x CHK-0400-6-DL
NXP07305A0N0SWF	NXP07305A0N0TWF	730	664	487	400	500	12.0/0.8/12.8	CH72	CHK-0750-6-DL	2 x CHK-0400-6-DL
NXP08205A0N0SWF		820	745	547	450	560	12.5/0.8/13.3	CH63	CHK-0820-6-DL	
NXP09205A0N0SWF		920	836	613	500	600	14.4/0.9/15.3	CH63	CHK-1030-6-DL	
NXP10305A0N0SWF		1030	936	687	560	700	16.5/1.0/17.5	CH63	CHK-1030-6-DL	
NXP11505A0N0SWF		1150	1045	766	600	750	18.5/1.2/19.7	CH63	CHK-1150-6-DL	
NXP13705A0N0SWF	NXP13705A0N0TWF	1370	1245	913	700	900	19.0/1.2/20.2	CH74	3 x CHK-0520-6-DL	2 x CHK-0750-6-DL
NXP16405A0N0SWF	NXP16405A0N0TWF	1640	1491	1093	900	1100	24.0/1.4/25.4	CH74	3 x CHK-0650-6-DL	2 x CHK-0820-6-DL
NXP20605A0N0SWF	NXP20605A0N0TWF	2060	1873	1373	1100	1400	32.5/1.8/34.3	CH74	3 x CHK-0750-6-DL	2 x CHK-1030-6-DL
NXP23005A0N0SWF		2300	2091	1533	1250	1500	36.3/2.0/38.3	CH74	3 x CHK-0820-6-DL	
NXP24705A0N0SWF	NXP24705A0N0TWF	2470	2245	1647	1300	1600	38.8/2.2/41.0	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0650-6-DL
NXP29505A0N0SWF	NXP29505A0N0TWF	2950	2681	1967	1550	1950	46.3/2.6/48.9	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0750-6-DL
NXP37105A0N0SWF	NXP37105A0N0TWF	3710	3372	2473	1950	2450	58.2/3.0/61.2	2 x CH74	6 x CHK-0650-6-DL	4 x CHK-1030-6-DL
NXP41405A0N0SWF	NXP41405A0N0TWF	4140	3763	2760	2150	2700	65.0/3.6/68.6	2 x CH74	6 x CHK-0750-6-DL	4 x CHK-1150-6-DL
2 x NXP24705A0N0SWF	2 x NXP24705A0N0TWF	4700	4300	3100	2450	3050	73.7/4.2/77.9	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0650-6-DL
2 x NXP29505A0N0SWF	2 x NXP29505A0N0TWF	5600	5100	3700	2900	3600	88/5/93	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0750-6-DL
2 x NXP37105A0N0SWF	2 x NXP37105A0N0TWF	7000	6400	4700	3600	4500	110.6/5.7/116.3	4 x CH74	12 x CHK-0650-6-DL	8 x CHK-1030-6-DL
2 x NXP41405A0N0SWF	2 x NXP41405A0N0TWF	7900	7200	5300	4100	5150	123.5/6.9/130.4	4 x CH74	12 x CHK-0750-6-DL	8 x CHK-1150-6-DL

G

I_{th} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any load variation or margin for overloadability.

I_L = Low overloadability current. Allows +10% load variation. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% load variation. 50% exceeding can be continuous.

All values with cosφ = 0,83 and efficiency = 97%

***) c** = power loss into coolant; **a** = power loss into air; **T** = total power loss; power losses of input chokes not included. All power losses obtained using max. supply voltage, Ith and switching frequency of 3.6 kHz and Closed Loop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula **P = √3 x Un x In x cosφ x eff%** to calculate the NX Liquid-Cooled drive output power.

The enclosure class for all NX Liquid-Cooled AC drives is IP00.

If the motor is continuously run at frequencies below 5 Hz (besides start and stop ramps), please pay attention to the drive dimensioning for low frequencies, i.e. maximum I = 0.66* I_{th} or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon.

Drive overrating may also be necessary if the process requires high starting torque.

CH3 and CH4 have air cooled choke as standard. CH5 and above have Liquid cooled choke as standard and air cooled choke as option.

VACON® NXP Liquid Cooled AC drives, 6-pulse and 12-pulse, mains voltage 525-690 VAC

AC drive type 6-pulse	AC drive type 12-pulse	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis	Choke type 6-pulse	Choke type 12-pulse
		Ther-mal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Opti-mum motor at I_{th} (525 V) [kW]	Opti-mum motor at I_{th} (690 V) [kW]				
NXP01706A0T0SWF		170	155	113	110	160	4.0/0.2/4.2	CH61	CHK-0261-6-DL	
NXP02086A0T0SWF		208	189	139	132	200	4.8/0.3/5.1	CH61	CHK-0261-6-DL	
NXP02616A0T0SWF		261	237	174	160	250	6.3/0.3/6.6	CH61	CHK-0261-6-DL	
NXP03256A0T0SWF	NXP03256A0T0TWF	325	295	217	200	300	7.2/0.4/7.6	CH72	CHK-0400-6-DL	2 x CHK-0261-6-DL
NXP03856A0T0SWF	NXP03856A0T0TWF	385	350	257	250	355	8.5/0.5/9.0	CH72	CHK-0400-6-DL	2 x CHK-0261-6-DL
NXP04166A0T0SWF	NXP04166A0T0TWF	416	378	277	250	355	9.1/0.5/9.6	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP04606A0T0SWF	NXP04606A0T0TWF	460	418	307	300	400	10.0/0.5/10.5	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05026A0T0SWF	NXP05026A0T0TWF	502	456	335	355	450	11.2/0.6/11.8	CH72	CHK-0520-6-DL	2 x CHK-0261-6-DL
NXP05906A0T0SWF		590	536	393	400	560	12.4/0.7/13.1	CH63	CHK-0650-6-DL	
NXP06506A0T0SWF		650	591	433	450	600	14.2/0.8/15.0	CH63	CHK-0650-6-DL	
NXP07506A0T0SWF		750	682	500	500	700	16.4/0.9/17.3	CH63	CHK-0750-6-DL	
NXP08206A0T0SWF	NXP08206A0T0TWF	820	745	547	560	800	17.3/1.0/18.3	CH74	3 x CHK-0400-6-DL	2 x CHK-0520-6-DL
NXP09206A0T0SWF	NXP09206A0T0TWF	920	836	613	650	850	19.4/1.1/20.5	CH74	3 x CHK-0400-6-DL	2 x CHK-0520-6-DL
NXP10306A0T0SWF	NXP10306A0T0TWF	1030	936	687	700	1000	21.6/1.2/22.8	CH74	3 x CHK-0400-6-DL	2 x CHK-0520-6-DL
NXP11806A0T0SWF	NXP11806A0T0TWF	1180	1073	787	800	1100	25.0/1.3/26.3	CH74	3 x CHK-0400-6-DL	2 x CHK-0650-6-DL
NXP13006A0T0SWF	NXP13006A0T0TWF	1300	1182	867	900	1200	27.3/1.5/28.8	CH74	3 x CHK-0520-6-DL	2 x CHK-0650-6-DL
NXP15006A0T0SWF	NXP15006A0T0TWF	1500	1364	1000	1050	1400	32.1/1.7/33.8	CH74	3 x CHK-0520-6-DL	2 x CHK-0820-6-DL
NXP17006A0T0SWF	NXP17006A0T0TWF	1700	1545	1133	1150	1550	36.5/1.9/38.4	CH74	3 x CHK-0650-6-DL	2 x CHK-1030-6-DL
NXP18506A0T0SWF	NXP18506A0T0TWF	1850	1682	1233	1250	1650	39.0/2.0/41.0	2 x CH74	6 x CHK-0400-6-DL	4 x CHK-0520-6-DL
NXP21206A0T0SWF	NXP21206A0T0TWF	2120	1927	1413	1450	1900	44.9/2.4/47.3	2 x CH74	6 x CHK-0400-6-DL	4 x CHK-0650-6-DL
NXP23406A0T0SWF	NXP23406A0T0TWF	2340	2127	1560	1600	2100	49.2/2.6/51.8	2 x CH74	6 x CHK-0400-6-DL	4 x CHK-0650-6-DL
NXP27006A0T0SWF	NXP27006A0T0TWF	2700	2455	1800	1850	2450	57.7/3.1/60.8	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0750-6-DL
NXP31006A0T0SWF	NXP31006A0T0TWF	3100	2818	2066	2150	2800	65.7/3.4/69.1	2 x CH74	6 x CHK-0520-6-DL	4 x CHK-0820-6-DL
2 x NXP18506A0T0SWF	2 x NXP18506A0T0TWF	3500	3200	2300	2400	3150	74,2/3,8/77,9	4 x CH74	12 x CHK-0400-6-DL	8 x CHK-0520-6-DL
2 x NXP21206A0T0SWF	2 x NXP21206A0T0TWF	4000	3600	2700	2750	3600	85,4/4,5/89,9	4 x CH74	12 x CHK-0400-6-DL	8 x CHK-0650-6-DL
2 x NXP23406A0T0SWF	2 x NXP23406A0T0TWF	4400	4000	2900	3050	3950	93,4/5,0/98,4	4 x CH74	12 x CHK-0400-6-DL	8 x CHK-0650-6-DL
2 x NXP27006A0T0SWF	2 x NXP27006A0T0TWF	5100	4600	3400	3500	4600	109,7/5,8/115,5	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0750-6-DL
2 x NXP31006A0T0SWF	2 x NXP31006A0T0TWF	5900	5400	3900	4050	5300	124,8/6,5/131,3	4 x CH74	12 x CHK-0520-6-DL	8 x CHK-0820-6-DL

Standard chokes for VACON® NX Liquid Cooled product range

Choke type	Heat losses [W]	Dimensions W x H x D [mm]	Weight [kg]
CHK0023N6A0	145	230 x 179 x 121	10
CHK0038N6A0	170	270 x 209 x 145	15
CHK0062N6A0	210	300 x 214 x 160	20
CHK0087N6A0	250	300 x 233 x 170	26
CHK0145N6A0	380	200 x 292 x 185	37
CHK-0261-6-DL	323	308 x 500 x 270	70
CHK-0400-6-DL	484	308 x 497 x 276	75
CHK-0520-6-DL	574	450 x 502 x 276	104
CHK-0650-6-DL	468	450 x 505 x 284	121
CHK-0750-6-DL	816	450 x 557 x 284	135
CHK-0820-6-DL	731	450 x 506 x 282	118
CHK-1030-6-DL	777	450 x 642 x 274	124
CHK-1150-6-DL	882	450 x 647 x 308	162

VACON® NXP Liquid Cooled inverter units, DC bus voltage 465-800 VDC

AC drive type	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (540 VDC) [kW]	Optimum motor at I_{th} (675 VDC) [kW]		
NXP00165A0T1IWS	16	15	11	7.5	11	0.4/0.2/0.6	CH3
NXP00225A0T1IWS	22	20	15	11	15	0.5/0.2/0.7	CH3
NXP00315A0T1IWS	31	28	21	15	18.5	0.7/0.2/0.9	CH3
NXP00385A0T1IWS	38	35	25	18.5	22	0.8/0.2/1.0	CH3
NXP00455A0T1IWS	45	41	30	22	30	1.0/0.3/1.3	CH3
NXP00615A0T1IWS	61	55	41	30	37	1.3/0.3/1.5	CH3
NXP00725A0T0IWS	72	65	48	37	45	1.2/0.3/1.5	CH4
NXP00875A0T0IWS	87	79	58	45	55	1.5/0.3/1.8	CH4
NXP01055A0T0IWS	105	95	70	55	75	1.8/0.3/2.1	CH4
NXP01405A0T0IWS	140	127	93	75	90	2.3/0.3/2.6	CH4
NXP01685A0T0IWS	168	153	112	90	110	2.5/0.3/2.8	CH5
NXP02055A0T0IWS	205	186	137	110	132	3.0/0.4/3.4	CH5
NXP02615A0T0IWS	261	237	174	132	160	4.0/0.4/4.4	CH5
NXP03005A0T0IWF	300	273	200	160	200	4.5/0.4/4.9	CH61
NXP03855A0T0IWF	385	350	257	200	250	5.5/0.5/6.0	CH61
NXP04605A0T0IWF	460	418	307	250	315	5.5/0.5/6.0	CH62
NXP05205A0T0IWF	520	473	347	250	355	6.5/0.5/7.0	CH62
NXP05905A0T0IWF	590	536	393	315	400	7.5/0.6/8.1	CH62
NXP06505A0T0IWF	650	591	433	355	450	8.5/0.6/9.1	CH62
NXP07305A0T0IWF	730	664	487	400	500	10.0/0.7/10.7	CH62
NXP08205A0T0IWF	820	745	547	450	560	12.5/0.8/13.3	CH63
NXP09205A0T0IWF	920	836	613	500	600	14.4/0.9/15.3	CH63
NXP10305A0T0IWF	1030	936	687	560	700	16.5/1.0/17.5	CH63
NXP11505A0T0IWF	1150	1045	766	600	750	18.4/1.1/19.5	CH63
NXP13705A0T0IWF	1370	1245	913	700	900	15.5/1.0/16.5	CH64
NXP16405A0T0IWF	1640	1491	1093	900	1100	19.5/1.2/20.7	CH64
NXP20605A0T0IWF	2060	1873	1373	1100	1400	26.5/1.5/28.0	CH64
NXP23005A0T0IWF	2300	2091	1533	1250	1500	29.6/1.7/31.3	CH64
NXP24705A0T0IWF	2470	2245	1647	1300	1600	36.0/2.0/38.0	2 x CH64
NXP29505A0T0IWF	2950	2681	1967	1550	1950	39.0/2.4/41.4	2 x CH64
NXP37105A0T0IWF	3710	3372	2473	1950	2450	48.0/2.7/50.7	2 x CH64
NXP41405A0T0IWF	4140	3763	2760	2150	2700	53.0/3.0/56.0	2 x CH64
2 x NXP24705A0T0IWF	4700	4300	3100	2450	3050	69.1/3.9/73	4 x CH64
2 x NXP29505A0T0IWF	5600	5100	3700	2900	3600	74.4/4.6/79	4 x CH64
2 x NXP37105A0T0IWF	7000	6400	4700	3600	4500	90.8/5.2/96	4 x CH64
2 x NXP41405A0T0IWF	7900	7200	5300	4100	5150	101.2/5.8/107	4 x CH64

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 540 VDC = Rectified 400 VAC supply

Input 675 VDC = Rectified 500 VAC supply

VACON® NXP Liquid Cooled inverter units, DC bus voltage 640-1100 VDC [1)]

AC drive type	Drive output current			Motor shaft power		Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (710 VDC) [kW]	Optimum motor at I_{th} (930 VDC) [kW]		
NXP01706A0T0IWF	170	155	113	110	160	3.6/0.2/3.8	CH61
NXP02086A0T0IWF	208	189	139	132	200	4.3/0.3/4.6	CH61
NXP02616A0T0IWF	261	237	174	160	250	5.4/0.3/5.7	CH61
NXP03256A0T0IWF	325	295	217	200	300	6.5/0.3/6.8	CH62
NXP03856A0T0IWF	385	350	257	250	355	7.5/0.4/7.9	CH62
NXP04166A0T0IWF	416	378	277	250	355	8.0/0.4/8.4	CH62
NXP04606A0T0IWF	460	418	307	300	400	8.7/0.4/9.1	CH62
NXP05026A0T0IWF	502	456	335	355	450	9.8/0.5/10.3	CH62
NXP05906A0T0IWF	590	536	393	400	560	10.9/0.6/11.5	CH63
NXP06506A0T0IWF	650	591	433	450	600	12.4/0.7/13.1	CH63
NXP07506A0T0IWF	750	682	500	500	700	14.4/0.8/15.2	CH63
NXP08206A0T0IWF	820	745	547	560	800	15.4/0.8/16.2	CH64
NXP09206A0T0IWF	920	836	613	650	850	17.2/0.9/18.1	CH64
NXP10306A0T0IWF	1030	936	687	700	1000	19.0/1.0/20.0	CH64
NXP11806A0T0IWF	1180	1073	787	800	1100	21.0/1.1/22.1	CH64
NXP13006A0T0IWF	1300	1182	867	900	1200	24.0/1.3/25.3	CH64
NXP15006A0T0IWF	1500	1364	1000	1050	1400	28.0/1.5/29.5	CH64
NXP17006A0T0IWF	1700	1545	1133	1150	1550	32.1/1.7/33.8	CH64
NXP18506A0T0IWF	1850	1682	1233	1250	1650	34.2/1.8/36.0	2 x CH64
NXP21206A0T0IWF	2120	1927	1413	1450	1900	37.8/2.0/39.8	2 x CH64
NXP23406A0T0IWF	2340	2127	1560	1600	2100	43.2/2.3/45.5	2 x CH64
NXP27006A0T0IWF	2700	2455	1800	1850	2450	50.4/2.7/53.1	2 x CH64
NXP31006A0T0IWF	3100	2818	2066	2150	2800	57.7/3.1/60.8	2 x CH64
2 x NXP18506A0T0IWF	3500	3200	2300	2400	3150	64,9/3,5/68,4	4 x CH64
2 x NXP21206A0T0IWF	4000	3600	2700	2750	3600	71,8/3,8/75,6	4 x CH64
2 x NXP23406A0T0IWF	4400	4000	2900	3050	3950	82,1/4,4/86,5	4 x CH64
2 x NXP27006A0T0IWF	5100	4600	3400	3500	4600	95,8/5,1/100,9	4 x CH64
2 x NXP31006A0T0IWF	5900	5400	3900	4050	5300	109,7/5,8/115,5	4 x CH64

[1)] High power 525-690V AFE, INU and BCU units available as wide voltage range version (NX_8 models) with DC bus voltage 640-1200 VDC. The units are ordered with the nominal mains voltage code 8 instead of 6 as for the standard version.

The following additional requirements applies to the wide voltage version:

- output filter with an inductance of at least 0.7% needed
- external 24VDC supply for the control unit

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 710 VDC = Rectified 525 VAC supply
Input 930 VDC = Rectified 690 VAC supply

VACON® NXP Liquid Cooled dimensions: drives consisting of one module

Chassis	Width [mm]	Height [mm]	Depth [mm]	Weight [kg]
CH3	160	431	246	15
CH4	193	493	257	22
CH5	246	553	264	40
CH60	246	673	374	55
CH61/62	246	658	372	55
CH63	505	923	375	120
Ch64	746	923	375	180
CH72	246	1076	372	90
Ch74	746	1175	385	280

One-module drive dimensions (mounting base included). Please note that AC chokes are not included.

VACON® NXN Liquid Cooled non regenerative front-end, DC bus voltage 465-800 V DC, 6/12-pulse

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	400 VAC mains I_{th} [kW]	500 VAC mains I_{th} [kW]	400 VAC mains I_L [kW]	500 VAC mains I_L [kW]		
NXN20006A0T0	2000	1818	1333	1282	1605	1165	1458	5.7/0.5/6.2	CH60

VACON® NXN Liquid Cooled non regenerative front-end, DC bus voltage 640-1100 V DC, 6/12-pulse

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	525 VAC mains I_{th} [kW]	690 VAC mains I_{th} [kW]	525 VAC mains I_L [kW]	690 VAC mains I_L [kW]		
NXN20006A0T0	2000	1818	1333	1685	2336	1531	2014	5.7/0.5/6.2	CH60

VACON® NXN Liquid Cooled non regenerative front-end line filters

Choke type	Suitability	Power loss c/a/T*) [kW]	Dimensions 1 pc W x H x D	Total weight [kg]	Pcs for NXN	Cooling
CHK-1030-6-DL	**NXN20006A0T0WWVA1A2BHB100**	1.18/0.5/1.68	506 x 676 x 302	237	2	Liquid

VACON® NXA Liquid Cooled active front-end, DC bus voltage 465-800 VDC

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	400 VAC mains I_{th} [kW]	500 VAC mains I_{th} [kW]	400 VAC mains I_L [kW]	500 VAC mains I_L [kW]		
NXA01685A0T02WS	168	153	112	113	142	103	129	2.5/0.3/2.8	CH5
NXA02055A0T02WS	205	186	137	138	173	125	157	3.0/0.4/3.4	CH5
NXA02615A0T02WS	261	237	174	176	220	160	200	4.0/0.4/4.4	CH5
NXA03005A0T02WF	300	273	200	202	253	184	230	4.5/0.4/4.9	CH61
NXA03855A0T02WF	385	350	257	259	324	236	295	5.5/0.5/6.0	CH61
NXA04605A0T02WF	460	418	307	310	388	282	352	5.5/0.5/6.0	CH62
NXA05205A0T02WF	520	473	347	350	438	319	398	6.5/0.5/7.0	CH62
NXA05905A0T02WF	590	536	393	398	497	361	452	7.5/0.6/8.1	CH62
NXA06505A0T02WF	650	591	433	438	548	398	498	8.5/0.6/9.1	CH62
NXA07305A0T02WF	730	664	487	492	615	448	559	10.0/0.7/10.7	CH62
NXA08205A0T02WF	820	745	547	553	691	502	628	10.0/0.7/10.7	CH63
NXA09205A0T02WF	920	836	613	620	775	563	704	12.4/0.8/12.4	CH63
NXA10305A0T02WF	1030	936	687	694	868	631	789	13.5/0.9/14.4	CH63
NXA11505A0T02WF	1150	1045	767	775	969	704	880	16.0/1.0/17.0	CH63
NXA13705A0T02WF	1370	1245	913	923	1154	839	1049	15.5/1.0/16.5	CH64
NXA16405A0T02WF	1640	1491	1093	1105	1382	1005	1256	19.5/1.2/20.7	CH64
NXA20605A0T02WF	2060	1873	1373	1388	1736	1262	1578	26.5/1.5/28.0	CH64
NXA23005A0T02WF	2300	2091	1533	1550	1938	1409	1762	29.6/1.7/31.3	CH64

VACON® NXA Liquid Cooled active front-end, DC bus voltage 640-1100 VDC [1)]

AC drive type	AC current			DC power				Power loss c/a/T*) [kW]	Chassis
	Thermal I_{th} [A]	Rated I_L [A]	Rated I_H [A]	525 VAC mains I_{th} [kW]	690 VAC mains I_{th} [kW]	525 VAC mains I_L [kW]	690 VAC mains I_L [kW]		
NXA01706A0T02WF	170	155	113	150	198	137	180	3.6/0.2/3.8	CH61
NXA02086A0T02WF	208	189	139	184	242	167	220	4.3/0.3/4.6	CH61
NXA02616A0T02WF	261	237	174	231	303	210	276	5.4/0.3/5.7	CH61
NXA03256A0T02WF	325	295	217	287	378	261	343	6.5/0.3/6.8	CH62
NXA03856A0T02WF	385	350	257	341	448	310	407	7.5/0.4/7.9	CH62
NXA04166A0T02WF	416	378	277	368	484	334	439	8.0/0.4/8.4	CH62
NXA04606A0T02WF	460	418	307	407	535	370	486	8.7/0.4/9.1	CH62
NXA05026A0T02WF	502	456	335	444	584	403	530	9.8/0.5/10.3	CH62
NXA05906A0T02WF	590	536	393	522	686	474	623	10.9/0.6/11.5	CH63
NXA06506A0T02WF	650	591	433	575	756	523	687	12.4/0.7/13.1	CH63
NXA07506A0T02WF	750	682	500	663	872	603	793	14.4/0.8/15.2	CH63
NXA08206A0T02WF	820	745	547	725	953	659	866	15.4/0.8/16.2	CH64
NXA09206A0T02WF	920	836	613	814	1070	740	972	17.2/0.9/18.1	CH64
NXA10306A0T02WF	1030	936	687	911	1197	828	1088	19.0/1.0/20.0	CH64
NXA11806A0T02WF	1180	1073	787	1044	1372	949	1247	21.0/1.1/22.1	CH64
NXA13006A0T02WF	1300	1182	867	1150	1511	1046	1374	24.0/1.3/25.3	CH64
NXA15006A0T02WF	1500	1364	1000	1327	1744	1207	1586	28.0/1.5/29.5	CH64
NXA17006A0T02WF	1700	1545	1133	1504	1976	1367	1796	32.1/1.7/33.8	CH64

[1)] DC bus voltage 640-1200 VDC for wide range voltage version (NX_8).
* C = power loss into coolant, A = power loss into air, T = total power loss

VACON® Liquid Cooled regenerative line filters

LCL filter type	Suitability	Power loss c/a/T*) [kW]	Dimensions L_{net} 1pcs WxHxD [mm]	Dimensions L_{drive} 1pcs (total 3pcs) WxHxD [mm]	Dimensions C_{bank} 1pcs WxHxD [mm]	Total weight [kg]
RLC-0385-6-0	CH62/690VAC: 325A & 385A	2,6/0,8/3,4	580 x 450 x 385	410 x 415 x 385	360 x 265 x 150	458
RLC-0520-6-0	CH62/500-690VAC	2,65/0,65/3,3	580 x 450 x 385	410 x 415 x 385	360 x 265 x 150	481
RLC-0750-6-0	CH62/500VAC, CH63/690VAC	3,7/1/4,7	580 x 450 x 385	410 x 450 x 385	360 x 275 x 335	508
RLC-0920-6-0	CH63/500VAC, CH64/690VAC	4,5/1,4/5,9	580 x 500 x 390	410 x 500 x 400	360 x 275 x 335	577
RLC-1180-6-0	CH63/500VAC, CH64/690VAC	6,35/1,95/8,3	585 x 545 x 385	410 x 545 x 385	350 x 290 x 460	625
RLC-1640-6-0	CH64/500-690VAC	8,2/2,8/11	585 x 645 x 385	420 x 645 x 385	350 x 290 x 460	736
RLC-2300-5-0	CH64/500VAC: 2060A & 2300A	9,5/2,9/12,4	585 x 820 x 370	410 x 820 x 380	580 x 290 x 405	896

The RLC filter contains a 3-phase choke on the mains side, capacitors and 3pcs 1-phase chokes on the AFE side.

VACON® NXB Liquid Cooled external brake chopper, DC bus voltage 460-800 VDC

AC drive type	Current				Braking power		Power loss c/a/T*) [kW]	Chassis
	BCU rated cont. braking current I_{br} [A]	Rated min resistance 800 VDC (Ω)	Rated min resistance 600 VDC (Ω)	Rated max input current (Adc)	Rated cont. braking power 2*R 800 VDC [kW]	Rated cont. braking power 2*R 600 VDC [kW]		
NXB00315A0T08WS	2*31	25.7	19.5	62	49	37	0.7/0.2/0.9	CH3
NXB00615A0T08WS	2*61	13.1	9.9	122	97	73	1.3/0.3/1.5	CH3
NXB00875A0T08WS	2*87	9.2	7.0	174	138	105	1.5/0.3/1.8	CH4
NXB01055A0T08WS	2*105	7.6	5.8	210	167	127	1.8/0.3/2.1	CH4
NXB01405A0T08WS	2*140	5.7	4.3	280	223	169	2.3/0.3/2.6	CH4
NXB01685A0T08WS	2*168	4.7	3.6	336	267	203	2.5/0.3/2.8	CH5
NXB02055A0T08WS	2*205	3.9	3.0	410	326	248	3.0/0.4/3.4	CH5
NXB02615A0T08WS	2*261	3.1	2.3	522	415	316	4.0/0.4/4.4	CH5
NXB03005A0T08WF	2*300	2.7	2.0	600	477	363	4.5/0.4/4.9	CH61
NXB03855A0T08WF	2*385	2.1	1.6	770	613	466	5.5/0.5/6.0	CH61
NXB04605A0T08WF	2*460	1.7	1.3	920	732	556	5.5/0.5/6.0	CH62
NXB05205A0T08WF	2*520	1.5	1.2	1040	828	629	6.5/0.5/7.0	CH62
NXB05905A0T08WF	2*590	1.4	1.1	1180	939	714	7.5/0.6/8.1	CH62
NXB06505A0T08WF	2*650	1.2	1.0	1300	1035	786	8.5/0.6/9.1	CH62
NXB07305A0T08WF	2*730	1.1	0.9	1460	1162	833	10.0/0.7/10.7	CH62

VACON® NXB Liquid Cooled external brake chopper, DC bus voltage 640-1100 VDC [1)]

AC drive type	Current				Braking power		Power loss c/a/T*) [kW]	Chassis
	BCU rated cont. braking current I_{br} [A]	Rated min resistance 1100 VDC (Ω)	Rated min resistance 840 VDC (Ω)	Rated max input current (Adc)	Rated cont. braking power 2*R 1100 VDC [kW]	Rated cont. braking power 2*R 840 VDC [kW]		
NXB01706A0T08WF	2*170	6.5	4.9	340	372	282	4.5/0.2/4.7	CH61
NXB02086A0T08WF	2*208	5.3	4	416	456	346	5.5/0.3/5.8	CH61
NXB02616A0T08WF	2*261	4.2	3.2	522	572	435	5.5/0.3/5.8	CH61
NXB03256A0T08WF	2*325	3.4	2.6	650	713	542	6.5/0.3/6.8	CH62
NXB03856A0T08WF	2*385	2.9	2.2	770	845	643	7.5/0.4/7.9	CH62
NXB04166A0T08WF	2*416	2.6	2	832	913	693	8.1/0.4/8.4	CH62
NXB04606A0T08WF	2*460	2.4	1.8	920	1010	767	8.5/0.4/8.9	CH62
NXB05026A0T08WF	2*502	2.2	1.7	1004	1100	838	10.0/0.5/10.5	CH62

1) DC bus voltage 640-1136 VDC for wide range voltage version (NX_8).
NOTE: The rated currents in given ambient (+50 °C) and coolant (+30 °C) temperatures are achieved only when the switching frequency is equal to or less than the factory default.
NOTE: Braking power: $P_{brake} = 2*U_{brake}^2 / R_{resistor}$ when 2 resistors are used
NOTE: Max input DC current: $I_{in\_max} = P_{brake\_max} / U_{brake}$

VACON® NXP Liquid Cooled AC drive, internal brake chopper unit, braking voltage 460-800 VDC

Converter Type	Loadability	Braking capacity 600 VDC		Braking capacity 800 VDC		Chassis
	Rated min resistance [Ω]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	
NX_460-730 5 [1)]	1.3	276	461	492	615	CH72
NX_1370-2300 5	1.3	276	461	492	615	CH74

1) Only 6 pulse drives

VACON® NXP Liquid Cooled AC drive, internal brake chopper unit, braking voltage 840-1100 VDC

Converter Type	Loadability	Braking capacity 840 VDC		Braking capacity 1100 VDC		Chassis
	Rated min resistance [Ω]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	
NX_325-502 6 [1)]	2.8	252	300	432	392	CH72
NX_820-1700 6	2.8	252	300	432	392	CH74

1) Only 6 pulse drives

The internal brake chopper can also be used in motor application where 2…4 x Ch7x drives are used for a single motor, but in this case the DC connections of the power modules must be connected together.

VACON® external brake resistors for liquid cooled CH72 (CH74) drives – IP20

Product code	Voltage range [VDC]	Maximum brake power [kw]	Maximum average power [kW] (1 puls/2min)	Resistance [Ω]	Maximum energy [kJ] (predefined power pulse)	Dimensions W x H x D [mm]	Weight [kg]
BRW-0730-LD-5 [1]	465…800 VDC	637 [3]	13.3	1.3	1594	480 x 600 x 740	55
BRW-0730-HD-5 [2]	465…800 VDC	637 [3]	34.5	1.3	4145	480 x 1020 x 740	95
BRW-0502-LD-6 [1]	640…1100 VDC	516 [4]	10.8	2.8	1290	480 x 760 x 530	40
BRW-0502-HD-6 [2]	640…1100 VDC	516 [4]	28	2.8	3354	480 x 1020 x 740	85

NOTE: Thermal protection switch included

1) LD = Light Duty: 5s nominal torque braking from nominal speed reduced linearly to zero once per 120s
2) HD = Heavy duty: 3s nominal torque braking at nominal speed + 7s nominal torque braking from nominal speed reduced linearly to zero once per 120s.
3) at 911 VDC
4) at 1200 VDC

Liquid to liquid heat exchangers

	HXL-M/V/R-040-N-P	HXL/M-M/V/R-120-N-P	HXL/M-M/R-300-N-P
Cooling power	0…40 kW	0…120 kW	0…300 kW
Mains supply	380…420 VAC	380…420 VAC	380…500 VAC
Flow	40…120 l/min	120…360 l/min	360…900 l/min
Distribution pressure	0.3 bar / l=10 m, DN32*	HXL: 1 bar / l = 40 m, DN50 HXM: 0.7 bar / l = 30 m, DN50	HXL: 1 bar / l = 40 m, DN80 HXM: 0.7 bar / l = 25 m, DN80
Double pump		HXM	HXM
Cabinets	VEDA, Rittal	VEDA, Rittal	Rittal
Dimensions W x H x D [mm] (without cabinet)	305 (506) x 1910 x 566	705 (982) x 1885 x 603	1100 x 1900 x 750

* l = maximum distribution distance with specific DN diameter

VACON® NXP Liquid Cooled Enclosed drive

AC drive type	Rated current			Electrical output power		Chassis	Dimensions W x H x D W/O Cooling unit [in]
	Thermal ITH [A]	Cont. I_L [A]	Cont. I_H [A]	Motor at I_{th} (400 VAC) [kW]	Motor at I_{th} (500 VAC) [kW]		
NXP13705A5T0RWN-LIQC	1370	1245	913	700	900	CH64	2000 x 2100 x 900
NXP16405A5T0RWN-LIQC	1640	1491	1093	900	1100	CH64	2000 x 2100 x 900

AC drive type	Rated current			Electrical output power		Chassis	Dimensions W x H x D W/O Cooling unit [in]
	Thermal ITH [A]	Cont. I_L [A]	Cont. I_H [A]	Motor at I_{th} (525 VAC) [kW]	Motor at I_{th} (690 VAC) [kW]		
NXP08206A5T0RWN-LIQC	820	745	547	560	800	CH64	2000 x 2100 x 900
NXP09206A5T0RWN-LIQC	920	836	613	650	850	CH64	2000 x 2100 x 900
NXP10306A5T0RWN-LIQC	1030	936	687	700	1000	CH64	2000 x 2100 x 900
NXP11806A5T0RWN-LIQC	1180	1073	787	800	1100	CH64	2000 x 2100 x 900
NXP13006A5T0RWN-LIQC	1300	1182	867	900	1200	CH64	2000 x 2100 x 900
NXP15006A5T0RWN-LIQC	1500	1364	1000	1000	1400	CH64	2000 x 2100 x 900
NXP17006A5T0RWN-LIQC	1700	1545	1133	1150	1550	CH64	2000 x 2100 x 900

Technical data

Mains connection	Input voltage U_{in}	NX_5: 400…500 VAC (–10%…+10%); 465…800 VDC (–0%…+0%) NX_6: 525…690 VAC (–10%…+10%); 640…1100 VDC (–0%…+0%) NX_8: 525…690 VAC (–10%…+10%); 640…1136 VDC (–0%…+0%)[1)] NX_8: 525…690 VAC (–10%…+10%); 640…1200 VDC (–0%…+0%)[2)]
	Input frequency	45…66 Hz
Motor connections	Output voltage	0-U_{in}
	Output frequency	0…320 Hz
	Output filter	VACON® liquid cooled NX_8 unit must be equipped with a output filter with an inductance of at least 0.7%.
Control characteristics	Control method	Frequency control U/f Open loop vector control (5-150% of base speed): speed control 0.5%, dynamic 0.3%sec, torque lin. <2%, torque rise time ~5 ms Closed loop vector control (entire speed range): speed control 0.01%, dynamic 0.2% sec, torque lin. <2%, torque rise time ~2 ms
	Switching frequency	NX_5: Up to and including NX_0061: 1…16 kHz; Factory default 10 kHz From NX_0072: 1…6 kHz; Factory default 3.6 kHz (1…10 kHz with special application) NX_6/NX_8: 1…6 kHz; Factory default 1.5 kHz
	Field weakening point	8…320 Hz
	Acceleration time	0…3000 sec
	Deceleration time	0…3000 sec
	Braking	DC brake: 30% of TN (without brake resistor), flux braking
Ambient conditions	Ambient operating temperature	–10 °C (no frost)…+50 °C (at I_{th}); The NX liquid cooled drives must be used in an heated indoor controlled environment.
	Installation temperature	0…+70 °C
	Storage temperature	–40 °C…+70 °C; no liquid in heatsink under 0 °C
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality - chemical vapours - mechanical particles"	No corrosive gases IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2 (no conductive dust allowed)
	Altitude	NX_5: (380…500 V): 3000 m ASL; in case network is not corner grounded NX_6/NX_8: (525…690 V) max. 2000 m ASL. For further requirements, contact factory 100% load capacity (no derating) up to 1,000 m; above 1,000 m derating of maximum ambient operating temperature by 0,5 °C per each 100 m is required.
	Vibration	5…150 Hz
	EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3…31 Hz Max acceleration amplitude 1 G at 31…150 Hz
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP00 / standard in entire kW/HP range
EMC	Immunity	Fulfils all EMC immunity requirements
	Emissions	EMC level N, T (IT networks)
Safety		EN 50178, EN 60204-1, IEC 61800-5-1, CE, UL, CUL; (see unit nameplate for more details)
Functional safety *)	STO	EN/IEC 61800-5-2 Safe Torque Off (STO) SIL2, EN ISO 13849-1 PL"d" Category 3, EN 62061: SILCL2, IEC 61508: SIL2.
	SS1	EN /IEC 61800-5-2 Safe Stop 1 (SS1) SIL2, EN ISO 13849-1 PL"d" Category 3, EN /IEC62061: SILCL2, IEC 61508: SIL2.
	ATEX Thermistor input	94/9/EC, CE 0537 Ex 11 (2) GD
	Advance safety option	STO (+SBC),SS1,SS2, SOS,SLS,SMS,SSM,SSR
Approvals	Type tested	SGS Fimko CE, UL
	Type approval	DNV, BV, Lloyd's Register (other marine societies delivery based approvals)
	Approvals our partners have	Ex, SIRA
Liquid cooling	Allowed cooling agents	Drinking water Water-glycol mixture
	Temperature of cooling agent	0…35 °C (I_{th})(input); 35…55 °C, please see manual for further details Temperature rise during circulation max. 5 °C No condensation allowed
	System max. working pressure	6 bar/ 30 bar peak
	Pressure loss (at nominal flow)	Varies according to size, please see manual for further details
Protections		Overvoltage, undervoltage, earth fault, mains supervision, motor phase supervision, overcurrent, unitover-temperature, motor overload, motor stall, motor underload, short-circuit of +24 V and +10 V reference voltages.

*) with OPT-AF board (SS1 requires external safety relay)
1) NX_8 drives only available as Ch6x NXB units.
2) NX_8 drives only available as Ch6x NXA/NXP units.

Typecode key

VACON® NXP Liquid Cooled drives

NXP	0000	5	A	0	N	1	S	W	V	A1 A2 00 00 C3	-LIQC	+HXC1

NXP — **Product Range**
NXP = AC drive or inverter unit
NXA = Active front-end unit
NXB = Brake-chopper unit
NXN = Non Regenerative Front End (NFE)

0000 — **Nominal current**
0007 = 7 A
0022 = 22 A
0205 = 205 A etc.
0920 = 920 A

5 — **Nominal mains voltage**
5 = 380-500 VAC
6 = 525-690 VAC

A — **Control keypad**
A = standard alpha-numeric
B = no local control keypad
F = dummy panel
G = graphical keypad

0 — **Enclosure class**
0 = IP00
5 = IP54

N — **EMC emission levels**
N = No EMC emission protection; to be installed on enclosures
T = Fulfills standard 61800-3 for IT-networks

1 — **Brake chopper**
0 = no brake chopper
1 = integrated brake chopper (CH3, CH72 (6-pulse) & CH74 only)

S — **Hardware modifications: supply**
I = Inverter unit; DC-supply
2 = Active front-end unit
S = 6-pulse **with A/C chokes**
Y = 6-pulse **with L/C chokes**
N = 6-pulse, **no chokes**
T = 12-pulse **with A/C chokes**
U = 12-pulse, **no chokes**
W = 12-pulse **with L/C chokes**
R = Low harmonic

W — **Hardware modifications: cooling**
W = Liquid-cooled module with aluminium heatsink
P = Liquid-cooled module with nickel-coated aluminium heatsink

V — **Hardware modifications: boards**
F = Fiber connection, standard (from CH61)
G = Fiber connection, varnished (from CH61)
S = Direct connection, standard
V = Direct connection, varnished

If OPT-AF option board is used
N = IP54 control box, fiber connection, standard boards, (from CH61)
O = IP54 control box, fiber connection, varnished boards, (from CH61)

A1, **A2** — **Option boards; each slot is represented by two characters:**
A = basic I/O boards,
B = expander I/O boards
C = fieldbus boards
D = special boards

00
00
C3

-LIQC — **Liquid Cooled Enclosed Drive**

+HXC1 — **Heat Exchanger option for enclosed drive**
+HXC1 = Stainless steel piping, 1-pump
+HXC2 = Stainless steel piping, 2-pumps

*) Note, the control unit of NX_8 drives need to be supplied with a external 24 Vdc power source.

Marine approvals

Type approvals

Delivery based approvals

Option boards

Type	Description	Card slot					I / O signal																					
		A	B	C	D	E	DI	DO	DI DO	AI (mA/V/±V)	AI (mA) isolated	AO (mA/V)	AO (mA) isolated	RO (NO/NC)	RO (NO)	+10Vref	Therm	+24V/ EXT +24 V	pt100	KTY84	42-240 VAC input	DI/DO (10...24 V)	DI/DO (RS422)	DI ~ 1Vp-p	Resolver	Out +5 V/+15 V/+24 V	Out +15 V/+24 V	Out +5 V/+12 V/+15 V
Basic I/O cards (OPTA)																												
OPTA1	DI/DO/AI/AO/ 10V/ 24V	■					6	1		2		1				1		2										
OPTA2	Relay output (NO/NC)		■											2														
OPTA3	Relay output + Thermistor input		■											1	1		1											
OPTA4	Encoder TTL type			■			2																3/0			1		
OPTA5	Encoder HTL type			■			2															3/0					1	
OPTA7	Double encoder HTL type			■																		6/2					1	
OPTA8	"OPTA1 + Analogue signals galvanically isolated as a group"	■					6	1		2		1				1		2										
OPTA9	OPTA1 + 2,5mm2 connectors	■					6	1		2		1				1		2										
OPTAE	Encoder HTL type (Divider + direction)			■				2														3/0					1	
OPTAF	STO, ATEX therm		■				2							1	1		1											
OPTAK	Sin/Cos encoder interface			■																				3			1	
OPTAN	DI/AI/AO	■					6			2		2																
I/O expander cards (OPTB)																												
OPTB1	Programmable I/O		■	■	■	■			6									1										
OPTB2	Relay output + Thermistor input		■	■	■	■								1	1		1											
OPTB4	"Analog input/output Analogue signals galvanically isolated separately"		■	■	■	■					1		2					1										
OPTB5	Relay output		■	■	■	■									3													
OPTB8	"Temperature Measurement option PT100"		■	■	■	■												1	3									
OPTB9	DI + Relay output		■	■	■	■	2								1						5							
OPTBH	"Temperature Measurement option pt100, pt1000, Ni1000, KTY84"		■	■	■	■													3	3								
OPTBB	EnDat + Sin/Cos 1 Vp-p			■	■	■	2																0/2	2				1
OPTBC	Resolver, 3xDO (Wide range)			■	■	■																3/3			1			
OPTBE	EnDat/SSI/BiSS C		■	■	■	■																						
OPTBL	Advanced safety option			■	■	■	4	2										1										
OPTBM	OPTBL+ HTL/TTL encoder			■	■	■	4	2										1										
OPTBN	OPTBL+ Sin/Cos encoder			■	■	■	4	2										1										
Fieldbus cards (OPTC and OPTE)*																												
OPTE2	RS485 with screw terminal				■	■	RS485 with screw terminal																					
OPTE3	PROFIBUS DP with screw terminal				■	■	PROFIBUS DP with screw terminal																					
OPTE5	PROFIBUS DP with D9-connector				■	■	PROFIBUS DP with D9-connector																					
OPTE6	CANopen				■	■	CANopen																					
OPTE7	DeviceNet				■	■	DeviceNet																					
OPTE8	RS485 with D9-connector				■	■	RS485 with D9-connector																					
OPTE9	Dual-port Ethernet				■	■	Dual-port Ethernet																					
OPTEA	Advanced Dual-port Ethernet				■	■	Advanced Dual-port Ethernet																					
OPTC2	RS485 with screw terminal				■	■	RS485 with screw terminal																					
OPTC3	PROFIBUS DP with screw terminal				■	■	PROFIBUS DP with screw terminal																					
OPTC4	LonWorks				■	■	LonWorks																					
OPTC5	PROFIBUS DP with D9-connector					■	PROFIBUS DP with D9-connector																					
OPTC6	CANopen				■	■	CANopen																					
OPTC7	DeviceNet				■	■	DeviceNet																					
OPTC8	RS485 with D9-connector				■	■	RS485 with D9-connector																					
OPTCI	Modbus/TCP				■	■	Modbus TCP																					
OPTCJ	BACnet MS/TP				■	■	BACnet MS/TP																					
OPTCP	PROFINET IO				■	■	PROFINET IO																					
OPTCQ	EtherNet/IP				■	■	EtherNet/IP																					
Communication cards (OPTD)																												
OPT-D1	SystemBus adapt, 2xfibre-optic				■	■	System Bus adapter (2 x fiber optic pairs)																					
OPT-D2	SystemBus (1xfiber), isol. CAN				■	■	System Bus adapter (1 x fiber optic pair) & CAN-bus adapter (galvanically decoupled)																					
OPT-D3	RS232 adapter (no galv.isol.)				■	■	RS232 adapter card (galvanically decoupled), used mainly for application engineering to connect another keypad																					
OPT-D6	CAN-Bus (galv. decoupled)		■		■	■	CAN-bus adapter (galvanically decoupled)																					
OPT-D7	Line voltage measurement			■			Line voltage measurement																					

**) OPTE series fieldbus cards provide most recent features on market and they are recommended for new installation*

1) Analogue signals galvanically isolated as a group
2) Analogue signals galvanically isolated separately

DrivePro® Life Cycle services
Delivering a customized service experience!

We understand that every application is different. Having the ability to build a customized service package to suit your specific needs is essential.

DrivePro® Life Cycle Services is a collection of tailormade products designed around you. Each one engineered to support your business through the different stages of your AC drive's life cycle.

From optimized spare-part packages to condition-monitoring solutions, our products can be customized to help you achieve your business goals.

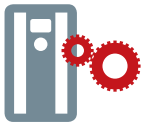
With the help of these products, we add value to your application by ensuring you get the most out of your AC drive.

When you deal with us, we also offer you access to training, as well as the application knowledge to help you in planning and preparation. Our experts are at your service.

You're covered
with DrivePro® Life Cycle service products

DrivePro® Retrofit
Minimize the impact and maximize the benefit

Manage the end of product lifecycle efficiently, with professional help to replace your legacy drives.
The DrivePro® Retrofit service ensures optimal uptime and productivity during the smooth replacement process.



DrivePro® Spare Parts
Plan ahead with your spare part package

In critical situations, you want no delays. With DrivePro® Spare Parts you always have the right parts on hand, on time. Keep your drives running at top efficiency, and optimize system performance.

DrivePro® Extended Warranty
Long-term peace of mind

Get the longest coverage available in the industry, for peace of mind, a strong business case and a stable, reliable budget. You know the annual cost of maintaining your drives, up to six years in advance.

DrivePro® Exchange
The fast, most cost-efficient alternative to repair

You obtain the fastest, most cost-efficient alternative to repair, when time is critical. You increase uptime, thanks to quick and correct replacement of the drive.

DrivePro® Upgrade
Maximize your AC drive investment

Use an expert to replace parts or software in a running unit, so your drive is always up-to-date. You receive an on-site evaluation, an upgrade plan and recommendations for future improvements.

DrivePro® Start-up
Fine-tune your drive for optimal performance today

Save on installation and commissioning time and cost. Get help from professional drives experts during start-up, to optimize drives safety, availability and performance.

DrivePro® Preventive Maintenance
Take preventive action

You receive a maintenance plan and budget, based on an audit of the installation. Then our experts perform the maintenance tasks for you, according to the defined plan.

DrivePro® Remote Expert Support
You can rely on us every step of the way

DrivePro® Remote Expert Support offers speedy resolution of on-site issues thanks to timely access to accurate information. With the secure connection, our drives experts analyze issues remotely reducing the time and cost involved in unnecessary service visits.

DrivePro® Remote Monitoring
Fast resolution of issues

DrivePro® Remote Monitoring offers you a system that provides online information available for monitoring in real time.
It collects all the relevant data and analyzes it so that you can resolve issues before they affect your processes.

To learn which products are available in your region, please reach out to your local Danfoss Drives sales office or visit our website
http://drives.danfoss.com/danfoss-drives/local-contacts/

ENGINEERING
TOMORROW

A better tomorrow is **driven by drives**

Danfoss Drives is a world leader in variable speed control of electric motors.
We offer you unparalleled competitive edge through quality, application-optimized products and a comprehensive range of product lifecycle services.

You can rely on us to share your goals. Striving for the best possible performance in your applications is our focus. We achieve this by providing the innovative products and application know-how required to optimize efficiency, enhance usability, and reduce complexity.

From supplying individual drive components to planning and delivering complete drive systems; our experts are ready to support you all the way.

You will find it easy to do business with us. Online, and locally in more than 50 countries, our experts are never far away, reacting fast when you need them.

You gain the benefit of decades of experience, since 1968. Our low voltage and medium voltage AC drives are used with all major motor brands and technologies in power sizes from small to large.

VACON® drives combine innovation and high durability for the sustainable industries of tomorrow.

For long lifetime, top performance, and full-throttle process throughput, equip your demanding process industries and marine applications with VACON® single or system drives.

- Marine and Offshore
- Oil and Gas
- Metals
- Mining and Minerals
- Pulp and Paper
- Energy
- Elevators and Escalators
- Chemical
- Other heavy-duty industries

VLT® drives play a key role in rapid urbanization through an uninterrupted cold chain, fresh food supply, building comfort, clean water and environmental protection.

Outmaneuvering other precision drives, they excel, with remarkable fit, functionality and diverse connectivity.

- Food and Beverage
- Water and Wastewater
- HVAC
- Refrigeration
- Material Handling
- Textile

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DKDD.PB.909.A5.02

11. Special Requirements

No Special Requirements are necessary.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

f. Energy Requirements

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

1. Estimated Annual Energy Requirement

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Greater New Haven - Life Cycle Cost Analysis APG-Neuros

Wednesday, February 2, 2022

Investment & Life Cycle Cost Analysis of APG-Neuros Turbo Blower		
Prices valid in 2022 Economy Year	**APG-Neuros APGN500**	**Comments**
Required Performance- Blower Performance		
Operating Blowers, Duty	5	
Standby Blowers,	1	
Rated Power, HP	470	
Discharge Pressure, psig	**10.25**	
Total Factored Wire Power Draw - per Blower , kW	**274.1**	
Total Factored Wire Power Draw - per System , kW	**1370.5**	
Operating Energy Cost savings		
Operational Time, hours/year	8760	24hrs x 365days/year
Total Power Consumption, kWh/year	2,401,116	
Energy Cost, $/kWh	$0.125	Average $/KWh 12.5Cents
Power Cost per year - Per Blower, $/year	$300,140	
Power Cost per year - Per System, $/year	$1,500,698	

Base Bid

No heat rejection to the blower room. Heat is piped outside the blower room.

Greater New Haven - Life Cycle Cost Analysis APG-Neuros

Wednesday, February 2, 2022

Investment & Life Cycle Cost Analysis of APG-Neuros Turbo Blower		
Prices valid in 2022 Economy Year	**APG-Neuros APGN500**	**Comments**
Required Performance- Blower Performance		
Operating Blowers, Duty	5	
Standby Blowers,	1	
Rated Power, HP	470	
Discharge Pressure, psig	**7.70**	
Total Factored Wire Power Draw - per Blower , kW	**217.6**	
Total Factored Wire Power Draw - per System , kW	**1088.0**	
Operating Energy Cost savings		
Operational Time, hours/year	8760	24hrs x 365days/year
Total Power Consumption, kWh/year	1,906,176	
Energy Cost, $/kWh	$0.125	Average $/KWh 12.5Cents
Power Cost per year - Per Blower, $/year	$238,272	
Power Cost per year - Per System, $/year	$1,191,360	

Base Bid

No heat rejection to the blower room. Heat is piped outside the blower room.

Greater New Haven - Life Cycle Cost Analysis APG-Neuros

Wednesday, February 2, 2022

Investment & Life Cycle Cost Analysis of APG-Neuros Turbo Blower		
Prices valid in 2022 Economy Year	**APG-Neuros APGN500**	**Comments**
Required Performance- Blower Performance		
Operating Blowers, Duty	5	
Standby Blowers,	1	
Rated Power, HP	470	
Discharge Pressure, psig	**10.25**	
Total Factored Wire Power Draw - per Blower , kW	**287.0**	
Total Factored Wire Power Draw - per System , kW	**1435.0**	
Operating Energy Cost savings		
Operational Time, hours/year	8760	24hrs x 365days/year
Total Power Consumption, kWh/year	2,514,120	
Energy Cost, $/kWh	$0.125	Average $/KWh 12.5Cents
Power Cost per year - Per Blower, $/year	$314,265	
Power Cost per year - Per System, $/year	$1,571,325	

Alternate Bid

No heat rejection to the blower room. Heat is discharged to the processed air.

Greater New Haven - Life Cycle Cost Analysis APG-Neuros

Wednesday, February 2, 2022

Investment & Life Cycle Cost Analysis of APG-Neuros Turbo Blower		
Prices valid in 2022 Economy Year	**APG-Neuros APGN500**	**Comments**
Required Performance- Blower Performance		
Operating Blowers, Duty	5	
Standby Blowers,	1	
Rated Power, HP	470	
Discharge Pressure, psig	**7.70**	
Total Factored Wire Power Draw - per Blower , kW	**228.9**	
Total Factored Wire Power Draw - per System , kW	**1144.5**	
Operating Energy Cost savings		
Operational Time, hours/year	8760	24hrs x 365days/year
Total Power Consumption, kWh/year	2,005,164	
Energy Cost, $/kWh	$0.125	Average $/KWh 12.5Cents
Power Cost per year - Per Blower, $/year	$250,646	
Power Cost per year - Per System, $/year	$1,253,228	

Alternate Bid

No heat rejection to the blower room. Heat is discharged to the processed air.

2. Guaranteed wire power: Table 3 Under Article 1.10

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

E. Compressor manufacturer shall guarantee to ship any parts required for emergency repairs on all compressors within 5 working days of acknowledged receipt of the order, or the parts are free of charge to the Owner.

1.10 POWER GUARANTEE

A. Guaranteed Performance: The manufacturer shall submit guaranteed compressor package total wire power (kW) values with the proposal and submittal at the listed design points for both 7.7 psig and 10.25 psig discharge pressures as outlined in Table 3 below. The wire power shall include all losses associated with the compressor package at all specified operating points. The completed table shall be submitted by Manufacturer with the proposal and will be considered the basis of the power guarantee and all related requirements as specified herein.

B. Actual Performance: The actual performance of the compressor package total wire power (kW) will be obtained during the factory performance test as specified herein. Include the results for each compressor package with the factory performance test submittal.

Discharge Pressure: 7.7psig

Table 3
Guaranteed Performance Evaluation [1]

Operating Condition	Total Flow (scfm)	Inlet Temp. (deg. F)	Relative Humidity (%)	Recommended No. of Compressors Online [3]	Flow per Compressor (scfm) [3]	Total Wire Power per Compressor Package (kW)[2]	Power Evaluation Factor	Factored Total Wire Power per Compressor Package (kW)
Condition 1	9,500	-5	54	1	9500	232	0.15	34.8
Condition 2	31,900	-5	54	4	7975	193	0.20	38.6
Condition 3	16,000	60	70	2	8000	225	0.30	67.4
Condition 4	13,000	40	86	2	6500	172	0.20	34.3
Condition 5	43,600	104	50	5	8720	283	0.15	42.5

[1] Allowable Deviation: Flow 0%, Pressure 0%, Power + 1 %.

[2] Guaranteed data shall be provided for each compressor package at each discharge operating condition at both discharge pressures of 7.7 and 10.25 psig.

[3] Manufacturer to provide recommended number of online compressors at the given operating condition. This shall be used to determine flow per compressor for each test condition.

Base Bid

No heat rejection to the blower room. Heat is piped outside the blower room.

E. Compressor manufacturer shall guarantee to ship any parts required for emergency repairs on all compressors within 5 working days of acknowledged receipt of the order, or the parts are free of charge to the Owner.

1.10 POWER GUARANTEE

A. Guaranteed Performance: The manufacturer shall submit guaranteed compressor package total wire power (kW) values with the proposal and submittal at the listed design points for both 7.7 psig and 10.25 psig discharge pressures as outlined in Table 3 below. The wire power shall include all losses associated with the compressor package at all specified operating points. The completed table shall be submitted by Manufacturer with the proposal and will be considered the basis of the power guarantee and all related requirements as specified herein.

B. Actual Performance: The actual performance of the compressor package total wire power (kW) will be obtained during the factory performance test as specified herein. Include the results for each compressor package with the factory performance test submittal.

Discharge Pressure: 10.25psig

Table 3
Guaranteed Performance Evaluation [1]

Operating Condition	Total Flow (scfm)	Inlet Temp. (deg. F)	Relative Humidity (%)	Recommended No. of Compressors Online [3]	Flow per Compressor (scfm) [3]	Total Wire Power per Compressor Package (kW)[2]	Power Evaluation Factor	Factored Total Wire Power per Compressor Package (kW)
Condition 1	9,500	-5	54	1	9500	290	0.15	43.5
Condition 2	31,900	-5	54	4	7975	243	0.20	48.7
Condition 3	16,000	60	70	2	8000	282	0.30	84.7
Condition 4	13,000	40	86	2	6500	221	0.20	44.1
Condition 5	43,600	104	50	5	8720	353	0.15	53.0

[1] Allowable Deviation: Flow 0%, Pressure 0%, Power + 1 %.

[2] Guaranteed data shall be provided for each compressor package at each discharge operating condition at both discharge pressures of 7.7 and 10.25 psig.

[3] Manufacturer to provide recommended number of online compressors at the given operating condition. This shall be used to determine flow per compressor for each test condition.

Base Bid

No heat rejection to the blower room. Heat is piped outside the blower room.

E. Compressor manufacturer shall guarantee to ship any parts required for emergency repairs on all compressors within 5 working days of acknowledged receipt of the order, or the parts are free of charge to the Owner.

1.10 POWER GUARANTEE

A. Guaranteed Performance: The manufacturer shall submit guaranteed compressor package total wire power (kW) values with the proposal and submittal at the listed design points for both 7.7 psig and 10.25 psig discharge pressures as outlined in Table 3 below. The wire power shall include all losses associated with the compressor package at all specified operating points. The completed table shall be submitted by Manufacturer with the proposal and will be considered the basis of the power guarantee and all related requirements as specified herein.

B. Actual Performance: The actual performance of the compressor package total wire power (kW) will be obtained during the factory performance test as specified herein. Include the results for each compressor package with the factory performance test submittal.

Discharge Pressure: 7.7psig

Table 3
Guaranteed Performance Evaluation [1]

Operating Condition	Total Flow (scfm)	Inlet Temp. (deg. F)	Relative Humidity (%)	Recommended No. of Compressors Online [3]	Flow per Compressor (scfm) [3]	Total Wire Power per Compressor Package (kW)[2]	Power Evaluation Factor	Factored Total Wire Power per Compressor Package (kW)
Condition 1	9,500	-5	54	1	9500	242	0.15	36.3
Condition 2	31,900	-5	54	4	7975	202	0.20	40.3
Condition 3	16,000	60	70	2	8000	236	0.30	70.7
Condition 4	13,000	40	86	2	6500	180	0.20	35.9
Condition 5	43,600	104	50	5	8720	305	0.15	45.7

[1] Allowable Deviation: Flow 0%, Pressure 0%, Power + 1 %.

[2] Guaranteed data shall be provided for each compressor package at each discharge operating condition at both discharge pressures of 7.7 and 10.25 psig.

[3] Manufacturer to provide recommended number of online compressors at the given operating condition. This shall be used to determine flow per compressor for each test condition.

Alternate Bid

No heat rejection to the blower room. Heat is discharged to the processed air.

E. Compressor manufacturer shall guarantee to ship any parts required for emergency repairs on all compressors within 5 working days of acknowledged receipt of the order, or the parts are free of charge to the Owner.

1.10 POWER GUARANTEE

A. Guaranteed Performance: The manufacturer shall submit guaranteed compressor package total wire power (kW) values with the proposal and submittal at the listed design points for both 7.7 psig and 10.25 psig discharge pressures as outlined in Table 3 below. The wire power shall include all losses associated with the compressor package at all specified operating points. The completed table shall be submitted by Manufacturer with the proposal and will be considered the basis of the power guarantee and all related requirements as specified herein.

B. Actual Performance: The actual performance of the compressor package total wire power (kW) will be obtained during the factory performance test as specified herein. Include the results for each compressor package with the factory performance test submittal.

Discharge Pressure: 10.25psig

Table 3
Guaranteed Performance Evaluation [1]

Operating Condition	Total Flow (scfm)	Inlet Temp. (deg. F)	Relative Humidity (%)	Recommended No. of Compressors Online [3]	Flow per Compressor (scfm) [3]	Total Wire Power per Compressor Package (kW)[2]	Power Evaluation Factor	Factored Total Wire Power per Compressor Package (kW)
Condition 1	9,500	-5	54	1	9500	302	0.15	45.3
Condition 2	31,900	-5	54	4	7975	253	0.20	50.7
Condition 3	16,000	60	70	2	8000	295	0.30	88.5
Condition 4	13,000	40	86	2	6500	229	0.20	45.8
Condition 5	43,600	104	50	5	8720	378	0.15	56.7

[1] Allowable Deviation: Flow 0%, Pressure 0%, Power + 1 %.

[2] Guaranteed data shall be provided for each compressor package at each discharge operating condition at both discharge pressures of 7.7 and 10.25 psig.

[3] Manufacturer to provide recommended number of online compressors at the given operating condition. This shall be used to determine flow per compressor for each test condition.

Alternate Bid

No heat rejection to the blower room. Heat is discharged to the processed air.

g. Warranties

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Customer: Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Description of Goods: Six (6) x APGN500

CERTIFICATE OF WARRANTY
HIGH EFFICIENCY TURBO BLOWERS

In accordance with the Specification Section 44 42 19 – Section 1.09, APG-Neuros accepts unit responsibility for all equipment furnished and equipment manufactured under the Specification Section.

A. **Scope of Warranty:** APG-Neuros warrants that its products and parts, when shipped, will be free from defects in materials and workmanship and its start-up and maintenance services will be performed in a professional manner. The warranty specified herein shall apply to this contract, but it is specifically understood that products sold hereunder are not warranted for outdoor installation with no pre-approved shelter which may damage electrical components, painted surfaces and may tend to build-up within the product. No product or part shall be deemed to be defective by reason of operating environment and the Customer shall have no claim whatsoever against APG-Neuros, therefore, for problems resulting from improper protection, improper installation, start-up without the presence of an APG-Neuros certified technician, exposure to direct rain, debris or vibration during construction, build-up of foreign material and, excessive H_2S, debris, dust, or fluids/gasses within the unit. APG-Neuros will have a minimum 10-year guarantee or a minimum 50,000 start/stop count guarantee on bearing failure

B. **Warranty Period:** APG-Neuros products are warranted for **Ten (10) years** from date of completion of the Blower start-up, as indicated on the start-up performance certificate, or **One Twenty Six (126) months** from the date of shipment to the Customer from the APG-Neuros facility, whichever occurs first.

C. **Procedure for Warranty Claims:** If a problem arises with the APG-Neuros equipment within the applicable warranty period (as stated in ***Section B*** of this Certificate), it is the responsibility of the Customer to promptly notify APG-Neuros in writing underlining a brief explanation of the problem or defect, a description of the way the product is used, their name, address and phone number. The customer agrees to provide, at their cost, remote access via VPN or cellular communication to monitor operation of the equipment.

D. **Repair by Other than APG-Neuros:** A repair done by anyone other than APG-Neuros must be approved in writing in advance by APG-Neuros. Repairs done by Others without APG-Neuros approval may render the warranty void for the remainder of the warranty period.

E. **Repairs or Parts Replacement Within the Scope of Warranty:** Within a reasonable time after receiving written notification, APG-Neuros will correct any defects in its product(s). If a product is defective due to workmanship or materials and the defect occurs during the warranty period, APG-Neuros will either repair the product or replace it with a new one, whichever APG-Neuros believes to be appropriate under the circumstances. APG-Neuros will bear the expense of parts and labor for repair only. Defective items must be professionally packed at the Customers' expense and must be held for APG-Neuros' inspection before being returned to the original agreed point of delivery per latest INCO terms upon request.

F. **Repairs Outside the Scope of Warranty:** Equipment problems due to improper installation, operation by untrained staff, exposure to construction debris or vibration, improper maintenance through failure to operate and maintain the product as outlined in the Operation and Maintenance manual and Service Instructions, improper application, non-APG-Neuros pre-approved additions or modifications, or other problems not due to defects in APG-Neuros' workmanship or materials will not be covered by this warranty. If APG-Neuros determines that the problem with the product is not due to defects in workmanship or materials, then the Customer will be responsible for the cost of any necessary repairs. In addition, consumable components mainly defined as, but not limited to, air filters elements, BOV diaphragm and replaceable internal components, butterfly and check valve internal seals and internal replaceable components, fasteners, nuts, bolts, gaskets, sealing rings and strips, coolant fluid (if applicable), power supply, RTD sensors, connectors, Thermocouples, Transformers and sound attenuation material are not covered by this warranty.

G. **Warranty and Liability Limitation:** This Warranty and Service Policy represent APG-Neuros' sole and exclusive warranty obligation with respect to APG-Neuros' products. APG-Neuros' liability to a Customer or any other person shall not exceed the APG-Neuros sales price of the applicable product.

THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABLITY AND FITNESS.

Signature Duly Authorized Official

February 2, 2022
Date

Omar Hammoud – President APG-Neuros
Name and Legal Title of Official

h. Warranty and Service Agreement

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

2. Extended Warranty

APG – Neuros
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Tel : (450) 939-0799, www.apg-neuros.com

AFTERMARKET SUPPORT PROGRAMS

EFFICIENT & AFFORDABLE TECHNOLOGY

CONTACT US FOR FURTHER DETAILS

1-855-423-2746
24/7 technical support,
immediate answer

customerservice@apg-neuros.com

www.apg-neuros.com

1270 Michèle-Bohec, Blainville, QC J7C5S4
Toll-free: 1-855-423-2746
www.apg-neuros.com

A WORD OF APPRECIATION FROM OUR PRESIDENT

Dear Valued Customer,

Thank You for having chosen APG-Neuros as your supplier of Turbo Blowers. Thanks to you, we have proudly been serving the North American and European markets for over 10 years, with more than 1,100 units in the field. APG-Neuros is continuously listening to its customers to develop the highest quality products and offer innovative services to meet your needs.

We recognize the importance of availability of efficient support options for continued operations of our product in your facilities. We worked hard to understand your needs and bench marked with industry leaders to develop flexible and competitive support plans that we are proud to offer you.

We invite you to take advantage of our Support Plans and look forward to your successful operation of our product. Please let us know if you have suggestions for improving our support or ideas for other services we can offer.

Sincerely,

Omar Hammoud
President & CEO
APG-Neuros

" APG-Neuros may well be among the nicest or the nicest company we have ever had the privilege to work with and your team member was a pleasure to speak with. We appreciate all of our vendors, partners and friends, but your company ranks at the very top of the list. Thank you for the great news you had for us today regarding the expedited delivery of the turbo blowers "

Jim Jacobsen Sr. , DePue Mechanical, Inc.
City of Joliet East Side, IL
NX350-C070 (2) Installation

1270 Michèle-Bohec, Blainville, QC J7C5S4
Toll-free: 1-855-423-2746
www.apg-neuros.com

APG-NEUROS AFTERMARKET SUPPORT PLANS

- ***Service Plans***
  - Extended Preventive Routine Maintenance (EPRM)
  - Maintenance Service Plan (MSP)

- ***Component Repair and Replacement Upgrade Plans***
  - Repair and Return to Service
  - Exchange – No return
  - Rental Component during repair
  - Inspection, cleaning and refurbishment

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SERVICE PROGRAMS

Extended Preventive Routine Maintenance and Maintenance Service Plan

Program	Benefits
Extended Preventive Routine Maintenance (EPRM)	• Preventive maintenance • Routine inspections and routine maintenance, once or twice a year • On site refresher training • Bump start alignment of the core bearings • Inspection of control parameters and adjustment to adapt to the operating environment • Availability of parts and modules within 24 hours • Remote technical support – 24/7 availability, immediate answer • Replacement cores available for rent • APG-Neuros free publication • Product improvements/upgrades for an additional charge
Maintenance Service Plan (MSP)	• Extended warranty, full package • Parts and labour for repairs of failures • Parts and labour for repair of unscheduled maintenance • Preventive maintenance • Routine inspections and routine maintenance, once or twice a year • Hardware upgrades • No rental charges for replacement cores • On site refresher training • Bump start alignment of the core bearings • Inspection of control parameters and adjustment to adapt to the operating environment • Software upgrades • Priority technical support • Remote technical support – 24/7 availability, immediate answer • Priority on availability of parts and modules within 24 hours • Parts exchange program, free of charge replacement • Product mandatory or recommended modifications or upgrades • Participation in manufacturer's maintenance and support developments • Fine tuning of turbo blower and aeration system • Remote Monitoring System and support as permitted by the customer • Trend monitoring • APG-Neuros free publication • Rotating seat on APG-Neuros user's group

The Maintenance Service Plan (MSP) is customized for each customer. Prices will be provided upon selection of customer options.

1270 Michèle-Bohec, Blainville, QC J7C5S4
Toll-free: 1-855-423-2746
www.apg-neuros.com

3. Service Agreements

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

AM&MSP Service Plan (Optional)

Subject: Proposal for a 5-Year Asset Management and Maintenance Services Plan (AM&MSP)

Equipment covered: all blowers appurtenances and accessories
Original Period: 5 years

The comprehensive **Asset Management and Maintenance Service Plan (AM&MSP)** is designed to provide high availability, always upgraded unlimited useful life (No retirement period) of the Turbo Blowers.

The **Asset Management and Maintenance Services Plan (AM&MSP)** covers all the previously mentioned tasks in the 5-Year Service contract in addition to components and software upgrades, five (5) years extended warranty.

Our Asset Management Service Plan includes:

I. Service contract

- Four (4) on-site maintenance and inspections by our Field Service technician per year.
- Refresher training.
- Inspect and clean/replace the air intake filters.
- Inspect and clean dirt and debris in enclosure, seal as required.
- Check health of core and fine tune operating parameters to adapt to changing site operating requirement.
- Ensure PLC and HMI software is operational and suitable for the blower control.
- Inspect for loose connections and tighten them as required.
- Verify sensors functionality and replace them as required.
- Inspect control parameters and adjust to adapt to the operating environment.
- Inspect of paint and fasteners and apply touch-up or replacement as required.
- Issue maintenance reports with recommended maintenance action

II. Extended Warranty (5 years)

It covers the cost of repairing or replacing major component when out of service.

Includes:

1. Blower Core
   - High efficiency impeller,
   - Permanent magnet synchronous motor,

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- Diffuser fan,
- Motor casing

2. Variable Speed Drive/Inverter
3. Input Line Reactor
4. Sine-wave (sinus) filter
5. Blower Local Control Panel and PLC components
6. HMI Touch Screen components
7. Internal vibration and absorption mounts
8. Vibration sensors and monitoring
9. Discharge Expander (discharge cone)
10. Blow off by-pass valve and solenoid parts
11. Blow off silencer
12. Sound attenuating inside enclosure
13. Check valve seals and discs
14. Stop valve body seals and discs
15. External expansion joint

III. Asset Management (AM) allows for keeping the turbo blower with updated technology

1. PLC software upgrades
2. HMI graphics and operating system upgrades
3. Product mandatory or recommended modifications
4. Upgrades and new component developments
5. Fine tuning of turbo blower and aeration system
6. Participation in manufacturer's maintenance and support developments

IV. Remote Monitoring System and support as permitted by the customer.

1. View all analog values of the blower in real-time.
2. Compare operational data for trending your process values and changes.
3. Export historical data to Excel for manipulation or viewing purposes
4. Elevated security with 3G/ LTE mobile network connection (No onsite Internet connection required)
5. Remote Technical Support by a Field Service Team Member to help analyze the data

V. Guaranteed priority availability of parts

VI. 24/7 Technical Support

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3. Quality of Construction and Qualification

APG-Neuros provides high-quality electrical and mechanical components that are UL listed.

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February 2, 2022

Gabriel Varca
Director of Finance and Administration
260 East Street
New Haven, CT 06511

Process Air Compressor System for Low Level Nitrogen Removal at the East Shore Water Pollution Abatement Facility CWF 2019-04 Process Air Compressor Equipment Preselection

Subject: Statement of Conformance

This is to confirm that APGN Inc. submittal package is in full compliance with the technical specification and confirms that the proposed blowers' configuration and the equipment provided shall meet the performance requirements as defined in this Request for Proposal (RFP), Addendum No.1 & 2 and the Manufacturer's completed Guaranteed Wire Power Table.

Omar Hammoud

President & CEO

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

4. Americon Iron and Steel Bidders Certification

As per the Environmental Protection Agency under Q/A #22 that blower/aeration equipment is not considered construction material and under the AIS requirements, including their appurtenances necessary for their intended use and operation – which means valves, CV, flexjoints, etc

Our proposed equipment is built and assembeled in the United States of America.

It is our understanding that the Infrastructure Investment and Jobs Act (IIJA) H.R. 3684 which includes the “Title IX - Build America, Buy America” (BABA) became law in November 2021. It is also our understanding that this law supersedes all other AIS/Buy America requirements.

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5. Authorization to Bid

APG-Neuros is a US based subsidiary of APGN Inc. that owns 100% of the US subsidiary. APG Neuros Corp, located in Plattsburgh, NY, also APGN Inc owns the UK based company APG Neuros Limited.

APG Neuros's head office is presenting this bid and the forms are duly signed by the President and CEO of APG Neuros - Omar Hammoud.

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APG-Neuros Company Profile

Manufacturer of High Efficiency Turbo Blowers & Aeration Systems

Advanced aerospace technology, energy efficiency and quality are the driving forces behind our products. Reliable and low maintenance, APG-Neuros Turbo Blowers and Aeration Systems provide our customers with environmentally sustainable solutions in a variety of different wastewater treatment applications. APG-Neuros has been leading the way through innovation and education in the turbo blower market, modernizing an aging industry.

ABOUT US

APG-Neuros is recognized as the force behind the successful introduction of the high speed turbo blower technology in the wastewater treatment markets in North America, Western Europe and the Middle East.

APG-Neuros is a privately-owned company with headquarters located in Quebec, Canada and production facility in Plattsburgh, NY. Engineers and owners recognize our company as the force behind the successful market introduction of the high-speed turbo blower technology in the wastewater treatment market. We are an award-winning company that strives for continuous technological developments and innovations. We own our technological foundation, conducting in-house R&D programs to keep innovating and improving our products and services. Since 2005, we have followed a focused approach, based on aerospace models, for product introduction. Our approach highlights our technical competency, proven design, high quality components, and UL & CSA certification.

This focused approach has led to the success of our products and the wide acceptance of the High Speed blower technology in the wastewater treatment and industrial sectors in North America. We have achieved over 1,000% growth in our sales revenue, exceeding $200 million in cumulative sales between 2006 and 2019. Our blowers currently achieve the highest installed base of any High Speed Turbo Blower manufacturer, with over 1,350 units installed and more than 100 units on order in North America and Europe. Combined with deliveries from our partner Neuros, worldwide installations exceed 5,000 units.

Industry leading experts and think-tanks have awarded APG-Neuros on numerous occasions. In 2011 and 2012, APG-Neuros received the Artemis Project and APEX awards for most promising companies in the water industry for applying innovative and sustainable product to address water industry challenges. In 2012, the company also received the Product Innovation Award from Frost & Sullivan in the aeration technology market in North America. Frost & Sullivan evaluated APG-Neuros blowers against key competitors based on criteria such as the innovative element of the product that leverages leading edge technologies, the value added features, customer benefits of the product, the increased customer Return on Investment leading to decision on acquisition. In 2013, 2015, and 2016 PROFIT 500 Magazine listed APG-Neuros on the top 500 of Canada's Fastest-Growing Companies. In July 2016, the company was honored by the Canadian Business Executive with 2016 "Best of Canada" award. Finally, in July 2017 APG-Neuros CEO was awarded as "Best Turbo Blower Manufacturer CEO – North America" by CEO Monthly.

Our Facilities

PRODUCTION & TESTING

APG-Neuros Production & Testing Facility
Plattsburgh, NY, United States

APG-Neuros Production & Testing plant is located in a 60,000 square foot facility in Plattsburgh, NY, approximately 75 miles south of Montreal, QC where all the high speed turbo blowers are assembled, tested and inspected. It houses engineering, testing, assembly, field service, administrative, quality control and support personnel. The facility's warehouse has a large spare parts inventory for quick response time to support its operational fleet.

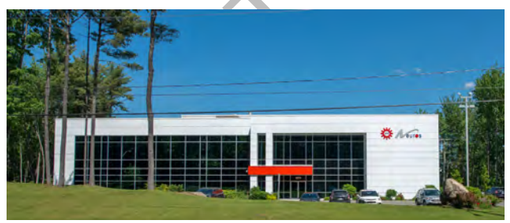
The production plant has two state of the art test cells for conducting acceptance testing. The test cells and associated equipment are fully ISO 5389 and ASME PTC-10 compliant and can test cores as well as complete packages. Each test cell has a Data Acquisition System to monitor pressure, flow, vibration, power and temperature. Top of the line equipment is used for data verification and all equipment is calibrated to national and international standards. Every test cell has its own control room where customers can witness test. APG-Neuros has 12 test technicians in this production facility dedicated to high speed turbo blowers.

HEADQUARTERS

APG-Neuros Headquarters
Blainville, QC, Canada

The Headquarters of APG-Neuros is located in a 32,000 square foot facility in Blainville, QC Canada where the supply of blowers is managed and engineered. It houses the executive, finance, administrative, engineering, support, research and development, customer service, quality control, repair/overhaul, and assembly/testing personnel.

There are currently over 70 employees in the two facilities.



COMPANY OVERVIEW

OUR VISION

To be recognized as the reference technology company for producing innovative products, including the Turbo Blowers, Turbo Compressors, and other efficient and affordable technology products.

OUR MISSION

APG-Neuros is committed to achieving customer satisfaction by providing quality products and services delivered on time. To establish close presence to our customers and build local relationships to help them use our product more effectively and optimize their preformance.

OUR VALUES

1 ***Innovation***

We strive for continuous technological development and innovation. We conduct in-house R&D programs to keep innovating and improving our products and services.

2 ***Integrity***

Promote a culture of transparency, continuous improvements and strive for a sustainable business model.

3 ***Team***

Ensure employee empowerment and fulfillment through continued skills development and career advancement.

4 ***Environment***

We strive to limit the impact of our activities and our product on the environment.

Company History

15 YEARS OF ACHIEVEMENT

Since 2005, APG-Neuros has been leading the way through innovation and education in the turbo blower market, modernizing an aging industry. Today, it is recognized as the force behind the successful introduction of high speed turbo blower technology in the wastewater treatment markets in North America, Western Europe and the Middle East.

2005 — THE COMPANY WAS ESTABLISHED

APG-Neuros was established in Blainville, QC Canada.

2006 — FIRST TURBO BLOWER INSTALLATION

First Turbo Blower Installed in Saint-Pie, QC. The blower was installed outdoors.

2010 — NEW FACILITIES

APG-Neuros opened the Plattsburgh, NY US production facility and the new headquarters in Blainville, QC Canada.

2011-2019 — AWARDS

APG-Neuros became the recipient of a multitude of industry and business awards for its work in innovation, modernization and education of the wastewater treatment market.

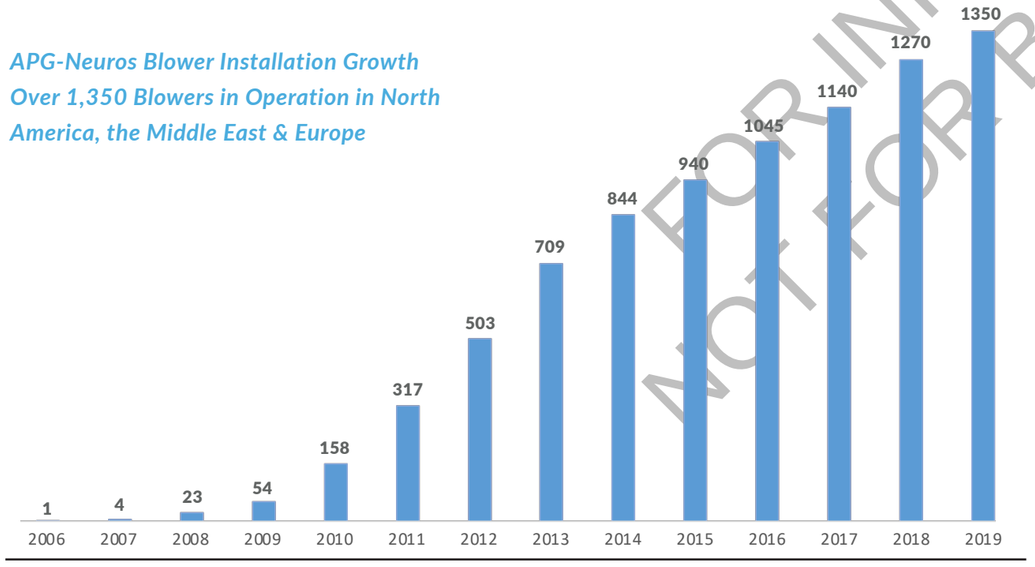
2019 — OVER 5,000 BLOWERS INSTALLED WORLDWIDE

Over 1,350 blowers installed in North America, Europe and the Middle East and over 5,000 blowers installed worldwide.

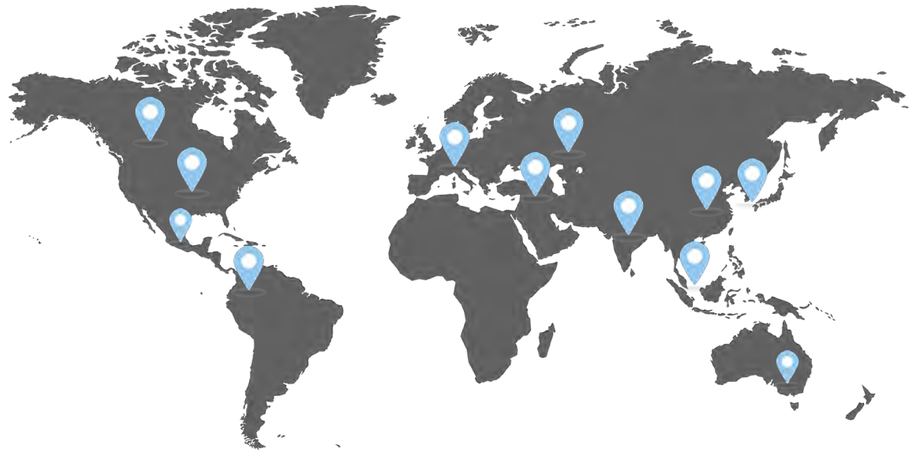
TODAY — NEW CAPABILITIES TURN-KEY SOLUTIONS

Today, APG-Neuros provides its customers with turn-key solutions including blowers, aeration control systems, diffusers, pipework, instrumentation and remote monitoring.

APG-Neuros Blower Installation Growth
Over 1,350 Blowers in Operation in North America, the Middle East & Europe



Over 5,000 Turbo Blowers Installed Worldwide

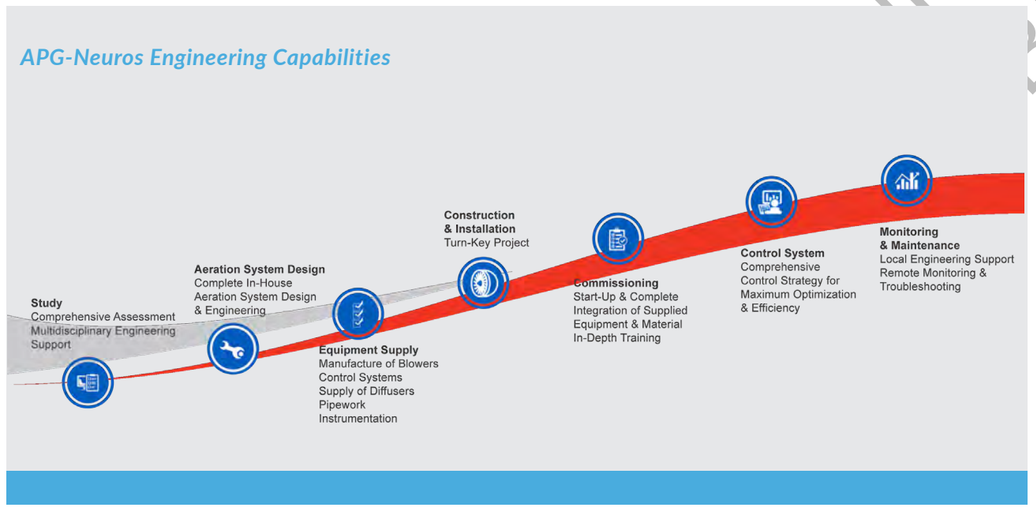


Our Services

APG-Neuros provides turn-key solutions for its customers - from study phase to after-sale support, monitoring and maintenance.

APG-Neuros is a privately owned high growth company. Its corporate structure is based on business models of successful industrial and aeronautic companies. APG-Neuros Senior Management, Sales, Operations Management and Finance teams are located in Montreal, Quebec, Canada. APG-Neuros also employs Sales, Technical Service and Support staff located in the US, Canada and Europe, in close proximity to its customers. Additionally, APG-Neuros has developed a highly efficient Field Service Network comprised of internal commercial and technical service teams and Field Service Engineers as well as Third-Party service providers located within proximity to its customers. In addition to its local resources in North America, APG-Neuros has direct access to Neuros technical resources with high level technical competencies in the areas of compressor, air bearing, permanent magnet synchronous motor and controls technologies. The technical resources from Neuros have been relocated to APG-Neuros in a systematic manner consistent with its operations growth in the western world. Through obtaining/developing the internal resources required to design, produce and test the equipment in-house, APG-Neuros is able to successfully meet accelerated submittal and delivery schedules without compromising quality or customer satisfaction.

APG-Neuros Engineering Capabilities



WHAT WE CAN DO

We help our customers every step of the way

STUDY & AUDIT ASSESSMENT

We assist our customers with comprehensive assessment and audits to determine the best possible solutions for each of their needs including multidisciplinary engineering support.

AERATION SYSTEM DESIGN

Complete in-house engineering & design of aeration systems. Process simulation, mechanical/electrical design, layout & drawings. PLC/SCADA controls and communications.

EQUIPMENT SUPPLY & INSTALLATION

Manufacture of Turbo Blowers, Control Systems, Supply of Diffusers, Pipework, Instrumentation, etc. We also take care of construction and installation for you.

COMMISSIONING

Testing, Start-Up and Complete integration of the supplied equipment & material. In-depth on-site training.

CONTROL SYSTEMS

Comprehensive Control Strategy for Maximum Optimization & Efficiency designed by APG-Neuros in-house.

MONITORING & MAINTENANCE

Local engineering support. Remote Monitoring & Troubleshooting System - reduced maintenance costs, historical data trends and preventive maintenance.

OUR INSTALLATIONS

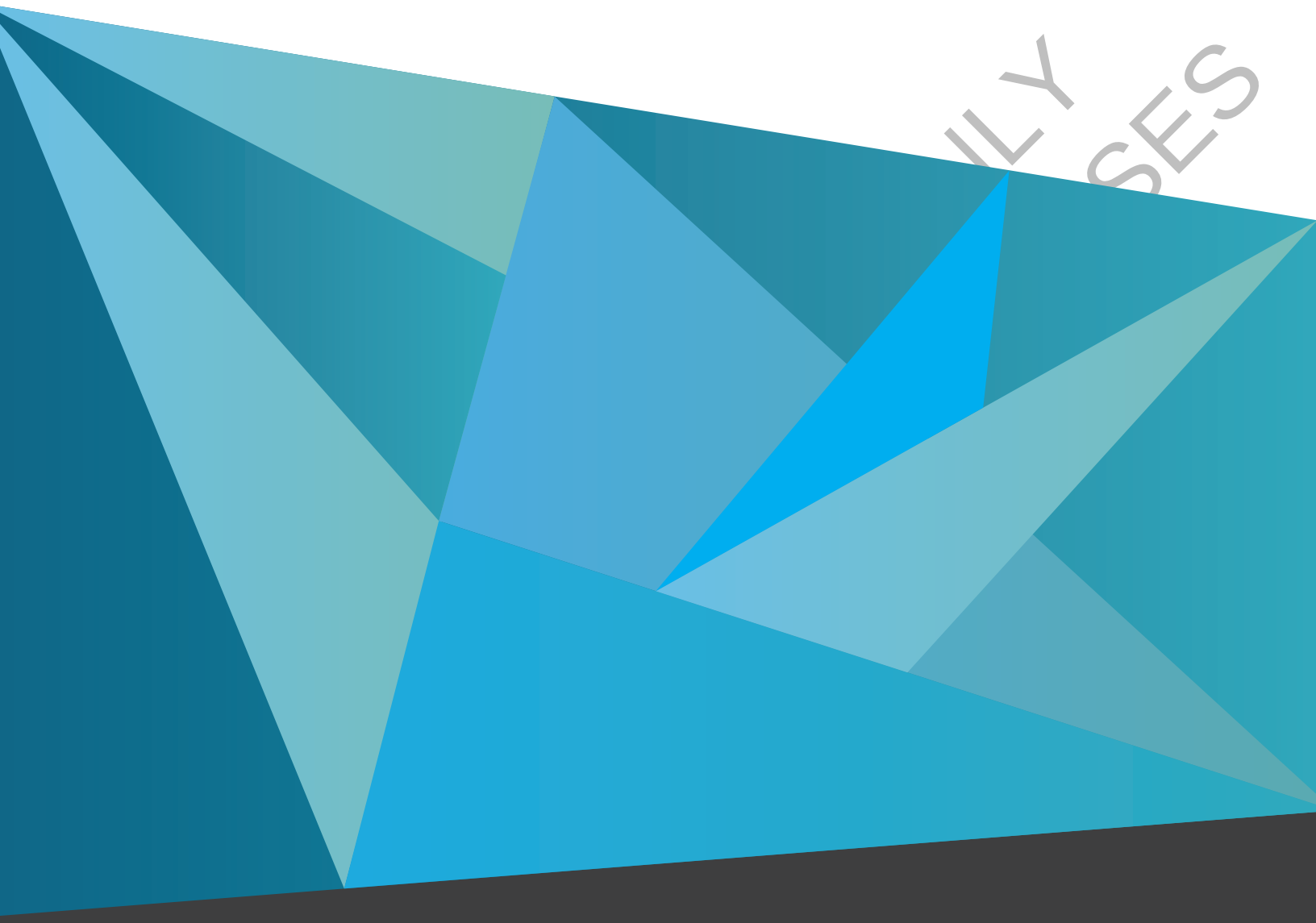
OVER 5,000 TURBO BLOWERS WORLDWIDE

1. New York City, NY
2. Washington D.C.
3. Abu Dhabi, UAE
4. London, UK
5. King County, WA
6. Cincinnati, OH

OUR INSTALLATIONS

OVER 5,000 TURBO BLOWERS WORLDWIDE

1. **Bend, OR**
2. **Brembate, Italy**
3. **Pumpkinvine, GA**
4. **Las Vegas Valley, NV**
5. **Hollister, CA**



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6. Proof of financial strength

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

Subject: The Manufacturer is an established, financially stable, and ongoing business.

We are pleased to submit our proposal in response to the referenced RFP. We confirm our full Compliance with the Bidder's qualification requirements and corresponding evidences

The Manufacturer is an established, financially stable, and ongoing business.APGN Inc. dba APG-Neuros is a Canadian Company that owns 100% of the US subsidiary. APG Neuros Corp, located in Plattsburgh, NY, also APGN Inc owns the UK based company APG Neuros Limited.

APG-Neuros has been leading the High-Speed Turbo Blower market from 2006 with blowers ranging from 30 to 1500 HP using Air Bearing and Magnetic Bearing systems. We pride our selves with our continuous improvements and innovations to adapt our product to our customers' requirements. We offer most proven product with over 1500 installed blowers in more than 600 WWTPs. Over 30% of our orders are repeat customers, a strong testimony to our customer loyalty. The experience gained between 2006 and 2012 led to technological improvements applied successful leading to our very reliable operation and enhancement to our product efficiency. APG-Neuros has more than 190 blowers installed in California at 70 different facilities, some of which have been operating for over 12 years and achieving a high reliability and availability rate of above 99%.

The Headquarters of APG-Neuros is located in a 32,000 square foot facility in Blainville, QC, Canada where the supply of blowers is managed and engineered. It houses the executive, finance, administrative, engineering, support, research and development, customer service, quality control, repair/overhaul, and assembly/testing personnel.

APG – Neuros
1270, Michele-Bohec
Blainville, Québec, Canada, J7C 5S4
Tel : (450) 939-0799, www.apg-neuros.com

In 2009, we established our US subsidiary APG-Neuros Corp. We have 32 employees at USA and operating 60,000 square foot Production & Testing plant in Plattsburgh, NY, where all the high-speed turbo blowers are assembled and tested. It houses engineering, testing, assembly, field service, administrative, quality control and support personnel.

The production plant has two state of the art test cells for conducting acceptance testing. The test cells and associated equipment are fully ISO 5389, ASME PTC-10 and ASME PTC-13 compliant.

At APG-Neuros we pride ourselves with our culture of high customer responsiveness. We innovate and adapt our support system to help our customers to solve their challenges and meet their operational objectives. We have won several awards from the wastewater treatment community in the US and Canada including Best Product, Most Innovative Company, Best Turbo Blower Manufacturer and Best Turbo Blower Manufacturer CEO.

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APGN INC.

Consolidated Balance Sheet

December 31, 2020, with comparative information for 2019

	2020	2019
Assets		
Current assets:		
Cash and cash equivalents	$ 641,471	$ 1,163,029
Accounts receivable (note 2)	7,751,157	9,039,038
Income tax receivable	16,756	16,756
Unbilled revenues (note 3)	24,215,634	23,574,878
Inventories (notes 4)	13,238,482	16,280,596
Prepaid expenses and deposit	278,969	143,082
	46,142,469	50,217,379
Fixed assets (note 5)	5,166,822	5,378,609
Intangible assets (note 6)	9,129,511	7,385,295
Surrender value of life insurance policy	91,816	83,962
	$ 60,530,618	$ 63,065,245

See accompanying notes to consolidated financial statements.

APGN INC.

Consolidated Balance Sheet (continued)

December 31, 2020, with comparative information for 2019

	2020	2019
Liabilities and Shareholder's Equity		
Current liabilities:		
Bank loans (note 7)	$ 9,596,705	$ 7,645,777
Accounts payable (note 8)	10,162,329	14,385,877
Deferred revenue (note 3)	994,238	1,975,386
Current portion of obligations under capital leases (note 9)	32,675	37,306
Current portion of loans from a shareholder (note 11)	1,208,194	72,981
Current portion of long-term debt (note 10)	4,344,120	806,030
	26,338,261	24,923,357
Obligations under capital leases (note 9)	2,837	30,502
Loans from a shareholder (note 11)	13,840,669	13,157,184
Long-term debt (note 10)	8,683,378	12,040,289
Future income taxes (note 15)	243,673	461,955
	49,108,818	50,613,287
Shareholder's equity:		
Share capital (note 12)	4,461,859	4,461,859
Retained earnings	6,959,941	7,990,099
	11,421,800	12,451,958
Subsequent events (note 19)		
	$ 60,530,618	$ 63,065,245

See accompanying notes to consolidated financial statements.

On behalf of the Board:

Director

Director

APG-Neuros Receives Water & Energy Innovation Award

We are proud to announce that APG-Neuros has been awarded the **Water & Energy Innovation Award** in Valencia, Spain at the WEX Global event for the innovation and work that the company has done in the development of the 1 MW Turbo Blower.

Thank you to the Metro Wastewater Reclamation District and the dedicated APG-Neuros team that worked together to bring the 1 MW Turbo Blower from idea to its first ever installation in Denver, Colorado. The two teams have been working closely to develop, install and test first of its kind, 1 megawatt magnetic bearing high speed blower (APGN 1350).

After successful witness testing, the blower was delivered and installed at the Robert W. Hite Treatment Facility (Denver Metro Wastewater Reclamation District). It is replacing the old centrifugal blower that is much less efficient, difficult to control, requires oil changes, high vibration and temperature. APG-Neuros owes its success to Metro Denver, the co-recipient of this award for accepting to install and test the first production 1 MW (1350 HP, 30,000 SCFM) Turbo Blower; one of its kind in the world.

APG-Neuros is recognized as the force behind the successful introduction of the high-speed turbo blower technology in the wastewater treatment market in North America, Europe and the Middle East. Since 2006, APG-Neuros has been leading the way through innovation and education in the turbo blower market, modernizing an aging industry.

Advanced aerospace technology, energy efficiency and quality are the driving forces behind its products. Reliable and low maintenance, APG-Neuros Turbo Blowers and Aeration Systems provide its customers with environmentally sustainable solutions in a variety of different wastewater treatment applications. APG-Neuros is the market leader in the High-Speed Turbo Blower category in North America, with over 1350 units installed.

Dan Freedman, MWRD and Omar Hammoud, President/CEO of APG-Neuros

For more information about APG-Neuros' products and services, please consult our website www.apg-neuros.com or send your inquiries to sales@apg-neuros.com.

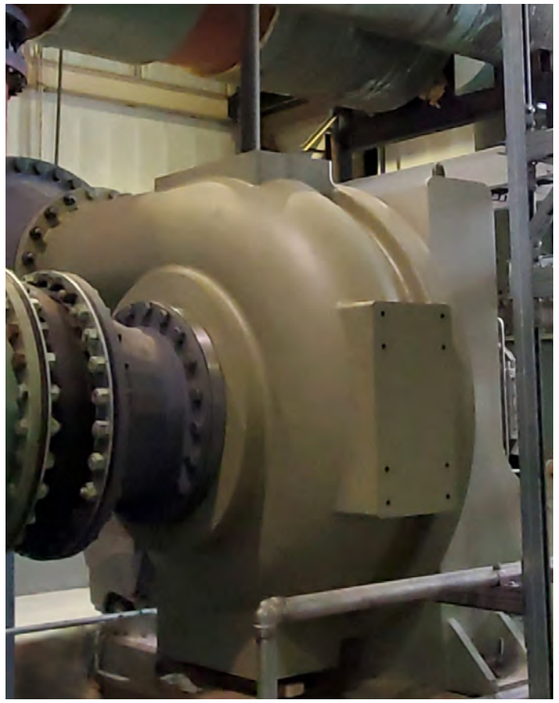
For media or any other inquiries, please contact:

Elana Podvalniuk: communications@apg-neuros.com

Tel: 866-592-9482

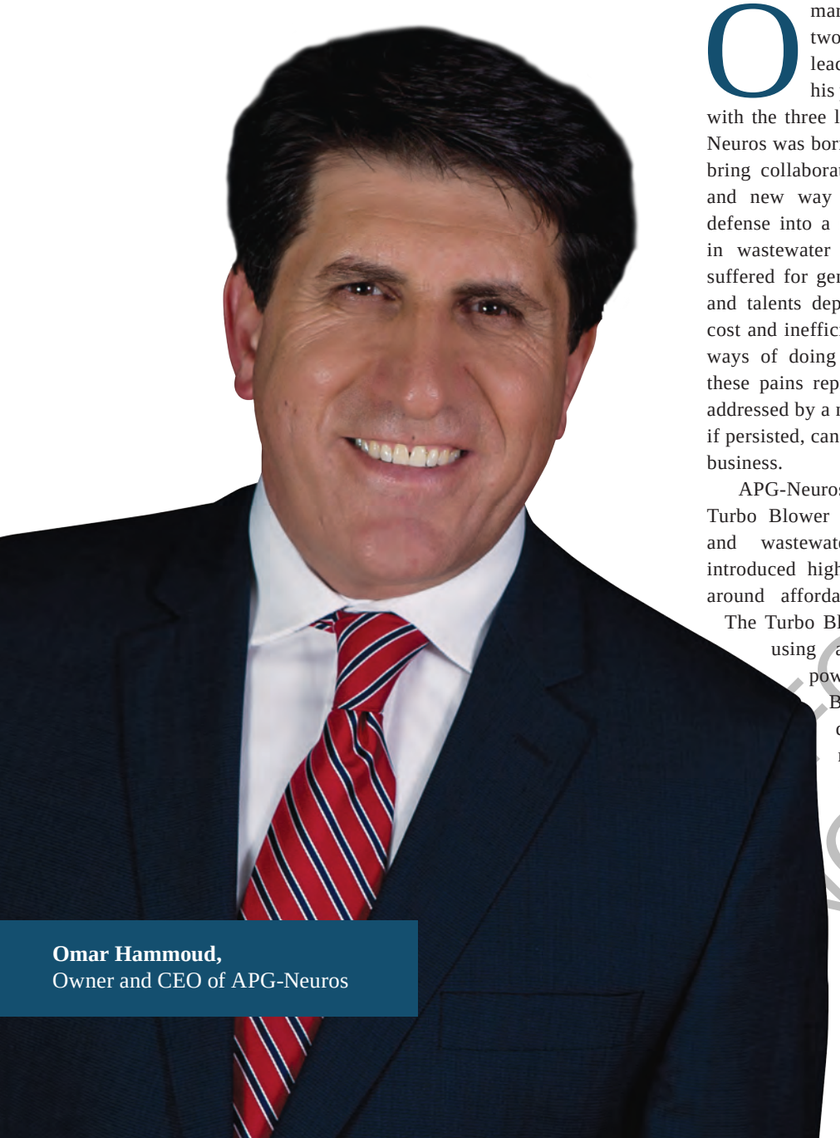
1 MW TURBO BLOWER:

APGN 1350 - 1 MW Turbo Blower



APG-Neuros

Redefining the Wastewater Treatment Arena



Omar Hammoud,
Owner and CEO of APG-Neuros

Omar Hammoud founded APG-Neuros nearly two decades ago with strong technical and leadership qualities that he culminated over his previous 25 years in leadership positions with the three leaders in the aerospace industry. APG-Neuros was born when an opportunity was identified to bring collaborative ideas and innovative technologies and new way of doing business in aerospace and defense into a stagnant industry. The aeration market in wastewater treatment and industrial applications suffered for generations the pain of quality liquidated and talents departed and all that remained were low cost and inefficient products combined with antiquated ways of doing business. APG-Neuros identified that these pains represent a great opportunity that can be addressed by a newcomer with leadership qualities, that if persisted, can lead to transformation and grow a good business.

APG-Neuros is recognized for its high-efficiency Turbo Blower technology that modenized the water and wastewater treatment market. APG-Neuros introduced highly innovative aeration solutions built around affordable high efficiency Turbo Blowers. The Turbo Blowers are designed for best efficiency using advanced technology aerospace and power generation design tools. The Turbo Blowers are manufactured with high quality components and certified to the most stringent standards to ensure high reliability and over 99% availability. APG-Neuros produced Turbo Blowers that are integrated within its offer of a smart aeration systems; built with artificial intelligence and customized to work reliably and efficiently with each customer's operating platform, with virtually no scheduled maintenance requirements.

APG-Neuros is recognized for its high-efficiency turbo blower technology to the water and wastewater treatment market

Today, APG-Neuros has grown its customer base to over 600 Cities and delivered close to 1,400 units over the past 14 years. These customers form a solid platform for launching new products and services and act as good references for new customers."We see APG-Neuros capitalizing on its existing customer base and its strong brand to succeed in introducing the multiple products recently launched, which include the following," says Omar:

• Higher capacity Turbo Blowers in the 1 to 3-Megawatt size that brings the company into the very large product size suitable for the very large wastewater treatment plants. This market segment was monopolized by a few companies offering very old technologies with not much happening over the past 50 years.

• Brand New Gas Turbine Blower that will help the customers to save over 60% on their energy cost, take them off the electric grid and allow them to use productively their Biogas, that is otherwise emitted as pollutant to the atmosphere.

• Brand New Light Turbo Blower product line that addresses the customers looking for low cost option that provides the basics.

These innovative products combined with the higher-pressure capacity model also introduced in 2020 are expected to bring the company new industrial applications in addition to increasing its market size in places all over the world in municipal wastewater treatment. In the addition to the new products launch, APG-Neuros also launched advance new services that proved to strengthen its customers satisfaction while bringing in new stream of aftermarket sales revenues.

With the new products and services, APG-Neuros is well positioned to accelerate its expansions into international markets not currently served by the company. This expansion is currently underway in Continental Europe, the Middle East and South America. Further expansion into east Asia is being assessed with APG-Neuros sub-contract manufacturing partner located in South Korea. APG-Neuros believes that success to bring in innovations can be further enhanced with reforming the government procurement laws to move away from low-bid practices. Improving the municipal agencies' decision making and empowering them to more easily procure what they believe to be best product from the best company will further assist APG-Neuros to develop even more interesting products and technical solutions.

The steadfast leader is also passionate for the environment and his duty to the global community, drove him to embark on a long cycle of bold innovations. Omar cares about the global community and empowers his employees and inspires his customers to work together to accomplish efficiencies in everything we do as part of our fight of the global warming. The CEO has applied creativity and showed courage, persistence and resilience to overcome the hurdles coming from entrenched competition, a conservative customer base and dealing with low bidding prices that ruled the market for decades. Omar is inspiring with his focus on transforming the customers and advices them to focus on efficiency and reducing the footprint of all human activities. Omar's drives towards making the world a more sustainable place and hand it over to the future generations better than what the past had received. ITO

APG-Neuros

Recognized by INDUSTRY TECH OUTLOOK Magazine as

INDUSTRY TECH OUTLOOK
10 MOST INSPIRING
CEOs TO WATCH IN 2020

Inspiring Evolution with Turnkey Technologies
Transforming Business Demographics

APG-NEUROS AWARDS

Industry Recognition

ARTEMIS PROJECT TOP 50 & APEX SUSTAINABILITY

APG-Neuros was selected in 2011 & 2012 by the Artemis Project as the Top 50 Water Companies that are applying innovation in the market to address today's dire water challanges. Likewise, APG-Neuros was awarded the APEX Sustainability Prize recognizing sustainable business models and technologies transforming water management.

FROST & SULLIVAN BEST PRACTICES AWARD

In 2012, APG-Neuros was awarded the Best Practices: North American Aeration New Product Innovation Award. APG-Neuros was evaluated against key competitors based on criteria such as the innovation, value-added features, customer benefits of the product and ROI leading to decision on acquisition.

PROFIT 500 2013, 2015, 2016

APG-Neuros was listed in 2013, 2015 and 2016 as part of the top 500 Canada's Fastest-Growing Comapanies based on five-year revenue growth.

BEST TURBO BLOWER MANUFACTURER - CEO

Omar Hammoud, Presient & CEO of APG-Neuros, received the CEO Monthly Award for Best Turbo Blower Manufacturer CEO - North America. The award recognizes the CEO's work on ensuring that their company remains at the forefront of its industry and provies clients with the highest standards of products.

CANADIAN BUSINESS AWARDS - 2016 & 2017

In 2017, APG-Neuros was awarded the Most Innovative Aeration Technology Company & Award for Excellence in Turbomachinery Manufacturing & in 2016 the Mid-Market Achievement Award as the Best Turbo Blower Technology Manufacturer by Corporate Vision.

The European: Global Business Awards

APG-Neuros was awarded by The European the Most Innovative Wastewater Solution Provider - Aeration Systems – North America Award in 2018 as part of the Global Business & Finance Awards.

Blowing the Competition Away

APG-Neuros, is a Canadian company holy owned by Aviation and Power Group (APG), headquartered in greater Montreal, Québec . The company has its foundation in aeronautic technologies with the mandate for sales, distribution, manufacturing, aftermarket support and continued development of high efficiency Turbo-machinery, turbo blowers and complete aeration systems for the municipal and industrial markets in North and South America, Europe, & Middle East. We spoke to Omar Hammoud to discuss winning the Best Turbo Blower Manufacturer CEO - North America award.

Omar started APG in 2006 with a vision to be the world leader in the development and commercialization of high efficiency turbo-machinery. The company's product development started with its high efficiency high speed turbo blower system. APG's headquarters is located in Blainville, Quebec, Canada (28 km north of Montreal) and its production, warehouse and testing facility is located in Plattsburgh, New York, USA. Omar talks us through the origins of the firm, detailing how it has grown and what services it provides to a variety of clients today.

"APG began in 2006 with our first customer in St Pie, Quebec, Canada and are now today the leaders in the North American high speed turbo blower market with more than 400 customers and over 1100 units delivered. The great majority of our customers are municipalities; from small towns to large cities. Our customers vary from the wastewater facility owner, operator and maintenance manager to large industrial companies, consortiums of consulting engineering firms and general contractors. We strive to support all of our customers from the simple beginnings, of project feasibility, to providing the owner a turnkey solution. We provide our customers with our technical knowledge and experience in the waste water industry throughout the process of the design of aeration system and assist them in best selecting their blower systems. We are recognized as custom technical solution providers; we build all of our blowers and master control panel to meet the specific needs of each of our customers. We also lead our industry with our knowledge and leadership to develop new standards that raises the quality of the products in general."

Discussing how it feels to win this award, Omar is very humbled, noting how grateful he feels to have his hard work recognized. Providing innovative products to customers, along with his and his staff's dedication and perseverance to providing only the best to clients are the main reasons that Omar attributes to his success.

"Honestly, I feel humbled with this award and grateful for the strength and visionary team at AI Global Media and CEO Monthly that work hard to recognize CEOs from across the corporate landscape. I attribute the success to assisting my customers with new innovative products and my dedication and perseverance along with my staff, family and partners in striving to bring the blower technology to the 21st century. Winning this award tells me that I have done the right thing and made good decisions. It allows me to use my achievements as a stepping stone to take on more serious challenges and develop more innovative blower technologies further in the future."

Drawing on his past experience and outlining his previous roles, Omar tells us how he came to achieve his position as CEO of APG. Having been fortunate enough to be hold several leadership roles in the past, Omar explains how is family supported him when he made the decision to start his new company. Using his previous experience to build a good team around him, Omar has grown APG to be the force it is today.

"In the past, I was fortunate to be a part of several leaders in aerospace and defense industry such as General Electric, United Technologies and French company SAFRAN for over 25 years where for seven years held executive positions. In 2005, with the support of my family, I took my savings, accumulated knowledge and experience and began the journey down the unbeaten path with the creation of the Aviation Power Group (APG). Introduced to the blower technology at the Water Environmental Federation trade show WEFTEC in 2006. I was able to benefit from my aerospace and defense industry knowledge and experience to successfully introduce the high speed turbo blower to the North American Market. I used my experience in executive roles, to grow the team around me. I began APG in the basement on my home and grew it to a team of 80 people located throughout North American, Western Europe and the Middle East."

When undertaking a new project, it is important to get to know the client and build relationships. Omar comments on his approach to new clients, listing how he ensures right from the start that the outcome meets the needs of everyone involved. He emphasises how the company and its staff are always ready to respond to any challenge or opportunities.

"Responsiveness. I strive to instill in my team to the importance of responding to the needs and wants of our existing customers and to our potential new customers. We take much pride in the ability to respond to any and all inquiries big or small, simple or complex. To ensure we do get it right the first time, we have built a multi-skilled team with background close to our customer's applications. We organized our sales force to work together as an integrated team to analyze and respond to the customers' requirements; taking into consideration the application specifics and our experience with similar installations in the past. We grew our technical competency over the last ten years to provide our customers turn-key aeration solutions that meet the evolving customers' requirement. This high technical competency differentiated us and brought us much success in our goal to maintain our leadership in the market."

Regarding the state of the engineering and aviation industry currently, Omar talks to us about the particular issues and challenges facing the firm. Becoming more energy efficient, companies are determined to make their mark. However, Omar believes that, as a market leader, APG will continue to introduce new technologies, which will help the firm in its mission to become energy self-sufficient. "Fundamentally, we have seen the industry take a large step forward in goal to be more energy efficient with the acceptance of the high speed turbo blower technology. We have seen the number of industry players growing all striving to make their marks in the industry. As market leader, it is our role to continue to strive away from the beaten path and continue to introduce new technologies into the industry, in its ultimate goal to become energy self-sufficient."

Being a successful CEO is all about ensuring that all staff work together to achieve the same missions and reach the same goals. Leading by example, staff are able to look up to Omar and follow his lead. He points out that although his staff learn from him and follow his lead, he also learns from them, making a point of listening and meeting all of his employees.

"Importantly, I strive to lead by example. Throughout the years, I have had to wear many hats to bring our company to where it is today. In such, I am today able to mentor my team in their day to day challenges with use of my knowledge and experience obtained not only in past roles but those at APG. Through "can do" spirit, hard work, there is no obstacle we cannot conquer as a team. As much as my team has to learn from me, I learn as much from my team's knowledge and experience from their past careers. I am fortunate to have good people as part of my team. I make it a point to meet and listen to all of my team leaders and members to ensure that we all row in the same direction to cross the finish line as leaders."

Regarding the future of the firm, Omar is excited about a new project that APG has embarked on, with more announcements to come. Furethermore, Omar is looking forward to CEO's continuing to be recognised for the hard work they put in to their companies, particularly with regard to technology becoming more green and self-sufficient.

"Ultimately, we have already embarked on a significant new product development with even greater benefits to our customers. We hope to make announcements of our new products sometime during the first half of 2018. I enjoy what I am doing now and hope to continue growing my company and teams. I will also be looking at new acquisitions in the near future. I look forward to see other CEO's recognized by your team to strive to be influential in keeping the world moving to adopt green technologies and to support say Innovation and innovators."

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Most Innovative Aeration Technology Company & Award for Excellence in Turbomachinery Manufacturing

Aviation and Power Group (APG-Neuros) is recognized as the force behind the successful introduction of the high speed turbo blower technology in the wastewater treatment market in the Western World. We profile the firm and explore the secrets behind its success.

Founded in 2005, APG-Neuros has its foundation in the development of high efficiency aeronautic and power generation technologies. The firm is networked into the Canadian and North American industrial and aeronautic communities with its local strong Engineering, production capability, and repair and customer service capability in Canada and the US. APG-Neuros currently manufactures its production units for the North American and western European market in Blainville, QC and Plattsburg, NY production facility.

Since inception APG-Neuros has grown into the market leader, with the highest number high speed turbo blower installations in North America with over 1000 units. APG-Neuros' largest percent of customers is in the municipal waste-water treatment sector. The company is also fortunate to have customers in other municipal sectors, such as potable water treatment, as well as several industrial sectors, such as food and beverage and medical supplies.

As a firm, APG-Neuros offers its customer an all-inclusive service, providing both consulting engineering firms and on-staff facility decision makers assistance in the design of their respective air system equipment upgrades. With APG-Neuros' two production facilities, Blainville, Quebec, Canada and Plattsburgh, New York, United States, it is able to provide its customers blower systems configured specifically to their needs in market leading delivery timelines. Finally, with an extensive, North American wide, field service network, APG-Neuros is able to service its customers with very little down time, in turn providing a fleet availability of over 98% of total operation time.

Looking ahead, APG-Neuros' goal for the future is to maintain market leader in the north American turbo blower market, and in order to achieve this the firm are continuously working on product improvement through technology innovation, as well as pushing the scope of work of the turbo blower manufacturer by offering a more services, ie installation work, consulting engineering work, and offering additional project required equipment/material, ie pipe work, filtration systems, automation systems.

In addition, APG-Neuros has recently introduced an extension to its popular "Dual-Core" model line to include smaller sized motors, 100 to 200 HP. This will allow the smaller facilities to benefit from this model line, offering performance of two independent units combined into one.

Ultimately, APG-Neuros is proud to be recognized by consulting engineering firms, in the water treatment field, as a benchmark equipment manufacturer.

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Most Innovative Digital Marketing Company - Toronto & Digital Marketing VP of the Year - Toronto

Art & Science Digital Experience Design Inc is an innovative digital marketing firm offering a wide range of services. We caught up with award winning Vice President Adam Green to find out more.

Art & Science is a unique digital agency that combines the creative inspiration of the artist with the analytic rigour of the scientist to produce campaigns, products and even new companies.

"Here at Art & Science, we work with clients of all sizes from a wide range of industries. Some of the more recognizable brands we have worked with include: The Toronto International Film Festival (TIFF), Starbucks, Hermes, Panasonic, Partners for Mental Health and more. Art & Science is a full-service agency providing discovery and strategy, design and development, analytics and advertising, and our success can be attributed to our incredibly innovative and engaging work that integrates digital interactions into the physical environment."

Within the Canadian digital marketing sector, Adam foresees an increased focus on mobile marketing and ecommerce going forward.

"Canada is one of the most connected nations in the world and yet we are lagging behind in areas such as the adoption of ecommerce. Our brands have been slower to fully invest in their e-commerce experience and Canadians are still "webrooming" and then buying in store rather than online. This trend is changing, however, with major players such as Amazon brining in Prime in 2013.

"In addition, we are also seeing brands asking for more from their advertising dollars and are seeking partners who understand the whole digital landscape and how they can leverage digital to achieve their objectives. More dollars are being shifted to digital and in particular the mobile space and we are keen to work with clients to ensure that they put their message out there in a way that reaches their target market."

Specifically, with regards to Art & Science Adam is optimistic for the future and believes that his firm will continue to grow and succeed.

"Looking ahead, Art & Science positioned well for growth and are focused making 2017 a record-breaking year. We are still learning how to tell our unique story, and are committed to getting better at it this year and beyond. We believe we have a very special story to tell, and that we are great agency that is producing some incredible work for our clients."

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