

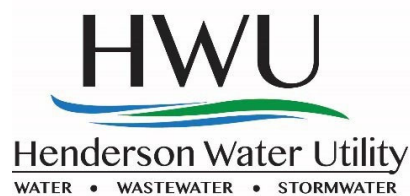
HENDERSON WATER UTILITY

INVITATION FOR BIDS and TECHNICAL SPECIFICATIONS

North WTP High Service Pumps, Motors, VFD's, and Controls Project

HENDERSON, KENTUCKY

March 2022



ADVERTISEMENT FOR BIDS

North WTP High Service Pumps, Motors, VFD's, and Controls Project

Description of Work: The Henderson Water Utility (Owner) hereby gives notice that separate, sealed bids will be received for furnishing materials for the North Water Treatment Plant High Service Pumps, Motors, VFD's and Controls Project, Bid Reference 2022-03

BID OPENING: Sealed Bids will be received until 1:30 p.m., Local Time on 3 March 2022, in the offices of Henderson Water Utility (HWU), 111 Fifth Street, Henderson, KY 42420. After the official bid closing time, the Bids will be publicly opened and read aloud.

BIDDING DOCUMENTS: Bidding Documents are on file for inspection and may be obtained at the offices of HWU, at the address listed above, during regular business hours, or access the HWU Bids Page at the this link: tinyurl.com/hwu-bids

Questions regarding the Bid Documents and Plans should be directed to Bart Boles, Project Engineer, at the address listed above, during regular business hours. Telephone: 270.869.6614

LEGAL PROVISIONS: Bids shall include all required submittals as identified in the Bid Documents

BID REJECTION/ACCEPTANCE/WITHDRAWAL: The Owner reserves the right to reject any and all Bids, waive informalities in bidding, or to accept the Bid or Bids which best serve the interests of the Owner.

Bart Boles
Project Engineer
Henderson Water Utility

Table of Contents

NORTH WTP HIGH SERVICE PUMPS, MOTORS, VFD'S, AND CONTROLS PROJECT

- Invitation to Bid, Solicitation Instructions and Conditions, **Bid Form and List of Required Attachments and Non-Collusive Bid Statement.**
- **Required Affidavit for Bidders, Offerors and Contractors Claiming Qualified Bidder Status.**
- **Required Affidavit for Bidders, Offerors and Contractors Claiming Resident Bidder Status.**
- **Statement Required Pursuant to KRS 45A.395.**
- Technical Specifications

Note: Items shown with **Bold Underline** in this Table of Contents must be completed in their entirety in the bid submittal.

INVITATION FOR BID

The Henderson Water and Sewer Commission of the City of Henderson, Kentucky will receive sealed competitive bids at its office at 111 Fifth Street, Henderson, Kentucky 42420, until 1:30 p.m. (CDT), on the 3rd day of March 2022, at which time the bids will be opened and considered for the purchase of the following:

**SUPPLY VERTICAL TURBINE FINISHED WATER PUMPS, MOTORS, VFD's, CONTROLS AND ACCESSORIES
FOR INSTALLATION AT THE
HENDERSON WATER UTILITY NORTH WATER TREATMENT PLANT**

**REF# 2022-03 North WTP – High Service Vertical Turbine Pumps, Motors, and VFD's
Project**

Specifications and Instructions to Bidders, and copies of plan sheets for this project may be obtained from:

HWU website: <http://tinyurl.com/hwu-bids>

HWU Administration Building: 111 Fifth Street, Henderson, KY 42420

The Water and Sewer Commission reserves the right to accept or reject any or all bids in whole or in part and to waive informalities and/or technicalities in the bids. Conflicts of interest, gratuities and kickbacks as defined and provided for in K.R.S. 45A.455 are absolutely prohibited.

Clarifications and Addenda will be posted on the HWU procurement web site as listed above.

SOLICITATION INSTRUCTIONS AND CONDITIONS

1. DEFINITIONS:

As used herein:

- a. The term "solicitation" includes the Invitation for Bid, Solicitation Instructions and Conditions, Bid Form and Technical Specifications, and any Clarifications or Addenda issued by the Owner.
- b. The term "offer" means "bid" or "proposal".
- c. The term "Vendor" shall mean the party responsible for furnishing submittals, equipment, accessories, controls, operation and maintenance manuals and training, startup services and warranting the equipment as required in this Request for Proposals. Prior to award of contract, a potential Vendor may be referred to by the terms "Bidder" or "Offeror".
- d. The term "Owner" shall mean the Henderson Water Utility (HWU), 111 Fifth Street, Henderson, Kentucky, 42420.
- e. The term "Engineer" refers to an individual employee of the Owner, acting as design engineer or inspector for this project or procurement.
- f. The term "Purchase Order" shall mean the document executed by the Vendor and the Owner of which each of the following form a part: the Invitation for Bids; the Vendor's Proposal; and the attached plans and technical specifications for NWTP High Service Vertical Turbine Pumps, Motors, VFD's, and Controls, prepared for Henderson Water Utility by J.R. Wauford Engineering, dated January 2022.
- g. The term "Nonresident bidder" is defined by KRS 45A.494(3).
- h. The term "Resident bidder" is defined by KRS 45A.494(2).
- i. The term "Qualified bidder" means Kentucky Industries for the Blind, Incorporated; any nonprofit corporation that furthers the purposes of KRS Chapter 163; or a qualified nonprofit agency for individuals with severe disabilities as described in KRS 45A.465(3).

2. PREPARATION OF OFFERS

- a. Offerors shall examine the drawings, specifications, schedule, and all instructions. Failure to do so shall be at the offeror's risk.
- b. Offers shall set forth full, accurate, and complete information as required by the solicitation. Offers that contain an offeror's own special terms and conditions in conflict with the terms of the solicitation or state statutes and regulations may be rejected.
- c. Each offeror shall furnish the information required by the solicitation on the bid forms included herein. The offeror shall sign the solicitation in ink and type or print in ink his name, firm, address, telephone number, and date. Erasures or other changes shall be initialed in ink by the person signing the offer. Approved electronic format may also be accepted.
- d. Any explanation or statement which the offeror wishes to make concerning the bid shall be written separately and independently of the proposal or bid, attached to the bid form, and placed in the envelope with the bid. Any such statement or explanation must refer to the bid submitted and shall also be signed by the offeror.
- e. Unit price for each unit offered shall be shown and such price shall include packing and delivery to HWU unless otherwise specified within the Bid Form, and shall include startup and training services where specified in the Technical Specifications. Fuel Surcharges and any other miscellaneous charges should be included in the unit price. A total shall be entered in the

amount column of the schedule for each item offered. In case of discrepancy between a unit price and extended price, the unit price shall govern.

- f. Cash discounts shall not be considered in making the award of the contract.
- g. Trade discounts shall be deducted by the vendor in calculating the unit price quoted, unless otherwise stated.
- h. Offers for supplies or services other than those specified shall not be considered unless authorized by the solicitation.
- i. Proposal shall include guaranteed time schedules for submission of shop drawings after award of the Purchase Order, and for shipment of equipment after receipt of approved shop drawings. The award of the Purchase Order will be based on the quoted price and an acceptable shop drawing and equipment delivery schedule.
- j. Time, if stated as a number of days, shall include Saturdays, Sundays, and Holidays. One day is 24 hours; one week is 7 days; one month is 28 days.

3. OFFEROR CLARIFICATION – REQUEST AND RESPONSE

Any explanation desired by an offeror regarding the meaning or interpretation of the solicitation drawings, specifications, etc., **shall be requested in writing to the HWU Purchasing Manager, not less than five (5) calendar days prior to the bid opening date.** Oral explanations or instructions given before the award of the contract shall not be binding. Any information given to a prospective vendor concerning a solicitation shall be furnished to all prospective vendors as an amendment or clarification of the solicitation, if such information is necessary to vendors in submitting offers on the solicitation, or if the lack of such information would be prejudicial to uninformed vendors.

4. ACKNOWLEDGEMENT OF ADDENDA TO SOLICITATIONS

Receipt of an addendum to a solicitation shall be acknowledged by the offeror. Acknowledgement shall be received prior to the hour and date specified for receipt of offers, or shall be shown in the appropriate place on the Bid Form. Verbal acknowledgement shall not be accepted. Failure to acknowledge addenda may cause the bid to be considered non-responsive.

5. PROTEST PROCEDURES

a. Protests prior to bid opening

Any protests, prior to bid opening must be submitted in writing and received by HWU at least ten (10) calendar days prior to bid opening. This ten (10) calendar day deadline may be waived by the HWU Purchasing Manager for good cause shown. The HWU Purchasing Manager will issue a response to the protest no later than five (5) calendar days after receipt of the protest. The response shall be in writing and set forth the reasons for the response.

Upon receipt of a protest, the HWU Purchasing Manager will immediately determine if the bid opening should be postponed. If the bid opening is postponed, HWU will notify all prospective bidders who have been furnished a copy of the specifications that a request for review has been received and that the bid opening is postponed. Upon issuance of its response to the protest, HWU will issue an appropriate addendum rescheduling the bid opening.

b. Protests after bid opening

Protests after bid opening will be considered only as to issues which were not apparent before bid opening. After bid opening no protests of specifications will be considered.

Any protest after bid opening, including a protest of contract award, must be submitted in writing and received by HWU within five (5) calendar days of the action being protested. No other form of protest will be considered. After the time for protest of contract award has expired, these protest procedures will be considered to be inapplicable, and any disputes will be resolved by HWU under contract provisions or other remedies, if available.

Protests submitted to HWU shall:

- (a) Include the name and address of the protestor.
- (b) Identify clearly the procurement under which the protest is being submitted.
- (c) Identify the action being protested and provide sufficient detailed documentation to support the protest action.
- (d) Indicate the action, ruling or relief desired from HWU.

The HWU Purchasing Manager will review the protest and render his or her decision in writing within five (5) calendar days of receipt of the protest, setting forth reasons for his or her decision.

HWU is responsible, in accordance with good administrative practice and sound business judgment, for the settlement of all contractual and administrative issues arising out of the procurement, including protests, contract defaults, disputes or breaches. The decision of the HWU Purchasing Manager as to protests shall be final and conclusive, unless, within five (5) calendar days of the date a decision was rendered by the HWU Purchasing Manager, a written appeal of the same is submitted by the bidder to the City of Henderson Water and Sewer Commissioners. Any appeal to the Commissioners shall include:

- (a) A statement of the grounds for review and any supporting documentation.
- (b) A copy of the protest filed with HWU and a copy of the HWU Purchasing Manager's decision.

If the appeal is submitted prior to award of a contract, HWU will not award until the matter is resolved. If the contract has been awarded prior to the appeal, the contractor shall proceed diligently with the performance of the contract.

6. SUBMISSION OF OFFERS

- a. Offers and modifications thereof shall be enclosed in sealed envelopes and addressed to the office specified in the solicitation. The offeror shall show the opening hour and date specified in the solicitation, the solicitation number, and the name and address of the offeror on the face of the envelope(s).
- b. Telegraphic or facsimile offers shall not be considered unless authorized by the solicitation; however, offers may be modified by telegraphic or facsimile notice, if such notice is received prior to the hour and date specified for receipt. Telegraphic or facsimile modifications shall not mention unit prices or total price; but shall only refer to percentage change or numerical change (i.e., "*reduce unit price of item 1 by \$1.00*").
- c. Samples of items, if required, shall be submitted within the time specified, and not unless otherwise specified, at no expense to HWU. If not destroyed by testing, samples shall be returned at the offeror's request and expense, unless otherwise specified by the solicitation.

Unless a request for their return is made within thirty (30) days of award of contract, all samples shall become property of HWU.

7. MODIFICATION OR WITHDRAWAL OF OFFERS

Offers may be modified or withdrawn by written notice received prior to the exact hour and date specified for receipt of offers. An offer may also be withdrawn in person by an offeror or his authorized representative, if his identity is made known and he signs a receipt for the offer, but only if the withdrawal is made prior to the exact hour and date set for receipt of offers.

8. LATE OFFERS AND MODIFICATIONS

Offers and modifications of offers received at the office designated in the solicitation after the exact hour and date specified for receipt shall not be considered for an award of contract, UNLESS:

- a. No bids are received other than the late bid; and
- b. The needs of HWU are determined to preclude the re-solicitation of bids.

9. MULTIPLE AND ALTERNATE BIDS

Bidders shall submit one response only to the solicitation and shall not propose more than one price, model, and brand for each bid item. Multiple or alternate bids offering more than one bid price in total (or by line-item) shall be cause for rejection unless specifically called for in special provisions provided elsewhere in the solicitation.

10. AWARD OF CONTRACT

- a. It is the intent of HWU to award this contract to the vendor or vendors offering the lowest evaluated bid price for products which meet the specifications set forth in this document. Any and all anticipated costs for HWU to implement the project will be taken into consideration.
- b. HWU reserves the right to reject any offers and to waive informalities and minor irregularities in offers received. The award of this contract will be contingent upon funds being appropriated for this purchase.
- c. The bidder, if awarded an order or contract, agrees to protect, defend, and save harmless the Henderson Water and Sewer Commission and the Henderson Water Utility against any demand for the use of any patented materials, process, article, or device, that may enter into the manufacture, construction, or form a part of the work covered by either order or contract and he further agrees to indemnify and save harmless the Henderson Water and Sewer Commission and the Henderson Water Utility from suits or actions of every nature and description brought against it, for on account of any injuries or damages received or sustained by any party or parties, by or form any of the acts of the contractor, his servants, or agents.
- d. The awarded contract shall agree to offer the prices and the terms and conditions offered herein to any municipality, county or state government; public utility; non-profit hospital; educational institute; special governmental agency; and non-profit corporation performing governmental functions in Western Kentucky area who wish to participate in a cooperative purchase program with Henderson Water Utility. Other agencies will be responsible for entering into separate agreements with the Contract and for all payments thereunder.
- e. The bidder agrees to hold the proposed pricing for up to 90 days after bid proposal is opened, or for such time as specified on the Bid Form, if different.

- f. A written award mailed (or otherwise furnished) to the successful offeror within the time for acceptance specified in the offer shall be deemed to result in a contract without further actions by either party.

11. METHOD OF AWARD: BEST VALUE – RANKING APPROACH

The Owner intends to award a Contract to the Contractor whose bid, conforming to the BID FORM, is the most advantageous on the basis of “best value” for all products, services, and requirements contained herein. An evaluation committee or a designated individual will evaluate the information provided by the Contractor in response to the established measurable criteria contained herein.

Measurable Criteria: Price 100 Points
TOTAL POINTS 100 Points

Each Contractor is responsible for submitting all relevant, factual and correct information with their Bid to enable the evaluator(s) to afford each Contractor the maximum score based on the available data submitted by the Contractor. The Contractor shall explicitly adhere to the BID FORM which contains adequate space for the Contractor’s pricing.

Bid Price (100 Points)

The bidder with the lowest Bid Price receives the maximum score. The bidder with the next lowest Price receives points by dividing the lowest Price by the next lowest Price and multiplying that percentage by the available points. For Example, 100 points is allocated to the lowest Price criteria for this procurement, Bidder “A” bids \$3.00 as the lowest bidder and receives the maximum 100 points ($\$3.00 / \$3.00 = 1.00 \times 100 = 100$). Assume Bidder “B” is next lowest bidder at \$4.00, then “B” receives 75 points ($\$3.00 / \$4.00 = .75 \times 100 = 75$).

Best Value scoring is subject to Reciprocal preference for Kentucky resident bidders and Preferences for a Qualified Bidder or the Department of Corrections, Division of Prison Industries (KAR 2005:410).

The Contractor is required to submit a complete copy of the “Required Affidavit for Bidders, Offerors, and Contractors Claiming Resident Bidder Status” attached to the BID FORM.

12. KENTUCKY / INDIANA SALES AND USE TAXES

Sales of tangible personal property or services to HWU are not subject to state sales or use taxes. Henderson Water Utility’s Kentucky/Indiana sales tax exemption number will be provided to the successful bidder(s).

Henderson Water Utilities sales tax exemption status may not be used by the Proposer to acquire materials or supplies on a sales-tax-exempt basis. Any sales taxes or other taxes incurred by the Proposer remain the responsibility of the Proposer. It is assumed that all such costs incurred by any Proposer are included in his price.

13. COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS

Any contracts or orders placed as a result of the offer shall be governed by the laws of the Commonwealth of Kentucky. The rights and obligations of the parties thereto shall be determined in accordance with these laws. Any offer conditioned upon governance by the laws of a state other than Kentucky shall not be considered.

Conflicts of interest, gratuities and kickbacks as defined and provided for in KRS 45A.455 are absolutely prohibited. Bidder acknowledges and certifies by submission of his bid that all the provisions of KRS 45A.455 are complied with fully.

Contractor shall comply with all applicable federal, state, and local statutes, regulations, ordinances, or other legal requirements which apply. Before commencing with the performance of any work under this bid, the Contractor shall obtain all necessary permits and licenses as may be necessary. Before and during the progress of work under this bid, the bidder shall give all notice and comply with all the laws, ordinances, rules and regulations of every kind and nature now or hereafter in effect promulgated by any Federal, State, County, or other Governmental Authority, relating to the performance of work under this bid. If the bidder performs any work that is contrary to any such law, ordinance, rule, or regulation, he shall bear all the costs arising therefrom.

A City of Henderson business license is required for all vendors servicing accounts within the City of Henderson.

A Henderson County business license is required for all vendors servicing accounts at HWU locations outside the City of Henderson but in Henderson County. Information regarding the business license can be obtained by calling the business license office at 270-831-1200. Vendors will be allowed ten (10) days after award of bid to submit a copy of their current business license(s) to the Purchasing Manager.

14. CONFLICTS OF INTEREST – Gratuities and kickbacks – Use of confidential information (KRS45A.455)

- a. It shall be a breach of ethical standards for any employee with procurement authority to participate directly in any proceeding or application; request for ruling or other determination; claim or controversy; or other particular matter pertaining to any contract, or subcontract, and any solicitation or proposal therefore, in which to his knowledge:
 - i. He, or any member of his immediate family has a financial interest therein; or
 - ii. A business or organization in which he or any member of his immediate family has a financial interest as an officer, director, trustee, partner, or employee, is a party; or
 - iii. Any other person, business, or organization with whom he or any member of his immediate family is negotiating or has an arrangement concerning prospective employment is a party. Direct or indirect participation shall include but not be limited to involvement through decision, approval, disapproval, recommendation, preparation of any part of a purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigation, auditing or in any other advisory capacity.
- b. It shall be a breach of ethical standards for any person to offer, give, or agree to give any employee or former employee, or for any employee or former employee to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment, in connection with any decision, approval, disapproval, recommendation, preparation of any part of a purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling or other determination, claim or controversy, or other particular matter, pertaining to any contract or subcontract and any solicitation or proposal therefore.

- c. It is a breach of ethical standards for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor or any person associated therewith, as an inducement for the award of a subcontract or order.
- d. The prohibition against conflicts of interest and gratuities and kickbacks shall be conspicuously set forth in every local public agency written contract and solicitation therefore.
- e. It shall be a breach of ethical standards for any public employee or former employee knowingly to use confidential information for his actual or anticipated personal gain, or the actual or anticipated personal gain of any other person.

15. CONTRACT MODIFICATIONS

During the period of the contract, no modification shall be permitted in any of its conditions and specifications unless the contractor receives written approval from the Purchasing Manager.

If the contractor finds at any time that existing conditions make modification in requirements necessary, he shall promptly report such matter to the Purchasing Manager for consideration and decision. All contract modifications shall be subject to the provisions of 200 KAR 5:311.

16. ADDITIONAL CHARGES/FEEES

The bid price of the product is the complete product price. There will be no fuel surcharges, delivery fees, handling fees, container return fees, or any other fees/charges associated with the purchase, installation or delivery of products.

17. WARRANTY – CORRECTIVE WORK

The Contractor shall guarantee all work performed under this contract for a period of one (1) year after the date of Substantial Completion. This provision covers any work performed by the Contractor that is found to be defective, the repair of any damages to the site and adjacent areas that the contractor used during construction. Where defective work has been corrected or removed and replaced, the correction period with respect to that work will be extended for an additional period of one year after correction has been satisfactorily completed.

18. SELLER'S INVOICES

Invoices shall be prepared and transmitted via fax or USPS to HWU at the provided address. Invoices shall contain, at a minimum, the following information: Purchase Order number, Bill of Lading number, delivery location, and an appropriate weight ticket, where applicable.

HWU is a municipality and invoices are processed for payment not less than once per month. Terms are net 30 after receipt of invoice.

19. PRECEDENCE OF PROVISIONS

In the event of an inconsistency between provisions of the solicitation, the inconsistency shall be resolved by giving precedence in the following order:

- a. Addenda and Clarifications issued prior to bidding;
- b. Solicitation Instructions and Conditions;
- c. General Conditions;
- d. Other provisions of the contract, whether incorporated by reference or otherwise; and
- e. The specifications.

20. INSURANCE

Contractors, including all Subcontractors, furnishing labor, and/or equipment under this requirement shall carry the following insurance in addition to all insurance required by law. Valid certificates of insurance shall be furnished to the Owner prior to the Contractor causing any work to begin.

A. Workman’s Compensation	Statutory
B. Broad Form Comprehensive General Liability including coverage for Bodily Injury, Personal Injury, Products, Completed Operations, and Broad Form Property Damage, (No deductible clauses are acceptable for these coverages), and Independent Contractors (Subcontractors)	Bodily Injury: \$1,000,000 each occurrence \$2,000,000 aggregate Property Damage: \$1,000,000 each occurrence
C. Comprehensive Automobile Liability, including Hired Car and Employer’s Non-Ownership Liability Coverage.	\$1,000,000 Combined Single Limit
D. Endorsement naming as additional insured “The Henderson Water and Sewer Commission, its elected and appointed officials, employees, agents, boards, consultants, assigns, volunteers and successors in interest.”	
E. Endorsement that Contractor’s insurance coverage shall be primary insurance as respects HWU. Any insurance or self-insurance maintained by HWU shall be separate from Contractor’s insurance and shall not contribute with it.	
F. Certificates of insurance, issued by companies authorized to do business in the state of Kentucky, satisfactory in form to the HWU and signed by the Bidder’s insurer shall be supplied by Bidder to HWU evidencing that the above insurance is in force and that not less than thirty (30) calendar days written notice will be given to the HWU prior to any cancellation or restrictive modification of the policies. Bidder shall replace any cancelled policy within the thirty (30) day notice period so that there is no lapse in coverage at any time during the period covered by this contract.	

The insurance shall:

- a) Include the interests of the Owner, Contractor, Subcontractor, Engineer, Engineer’s consultants and any other individuals, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.
- b) Be written on a Builder’s Risk “all-risk” or open peril or special causes of loss policy form that shall at least include insurance for physical loss and damage to the work, temporary buildings, falsework, and materials and equipment in transit and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss.
- c) Remain in effect for the duration of the contract and warranty period.

21. INDEMNIFICATION & ASSIGNMENT:

The Contractor shall defend, indemnify, and hold harmless HWU, its officers, directors, agents and employees from and against all claims, damages, losses, and expenses, including attorneys’ fees, arising out of negligent acts, errors or omissions or willful misconduct in the performance of this project and

those of its agents or employees. The Contractor is not obligated to indemnify HWU in any manner whatsoever for HWU's own negligence.

Any attempt by Contractor to assign or otherwise transfer any interest in this agreement without the prior written consent of HWU shall be void.

22. NONDISCRIMINATION

Civil Rights Act of 1964: In accordance with the provisions of Title VI of the Civil Rights Act of 1964 and the regulations of the Federal Department of Transportation (49 CFR, part 21) issued pursuant to such Act, all bidders are hereby notified that HWU will affirmatively insure that the contract entered into pursuant to this advertisement will be awarded to the responsible bidder with the lowest evaluated bid without discrimination on the grounds of race, color, national origin, disability, gender, or age.

Americans with Disabilities Act: In accordance with the provisions of The Americans with Disabilities Act of 1990 (ADA) which specifically prohibits discrimination against persons with disabilities, all bidders are hereby notified that the contract entered into pursuant to this advertisement shall include a clause that specifically requires compliance with the ADA and prohibits discrimination against persons with disabilities. The ADA further requires that all new construction, reconstruction, and alterations to existing pedestrian facilities be constructed in accordance with Federal accessibility standards.

23. GOVERNING LAW:

Should there be any contract/agreement acquired, bidder agrees that it shall be governed by and construed in accordance with the laws of the Commonwealth of Kentucky. No action involving this contract agreement may be brought except in a court of competent jurisdiction located in Henderson County.

24. MISCELLANEOUS PROVISIONS

Penalties: In case of default by Contractor, HWU may procure the products and/or services from other sources and may deduct from any unpaid balance due Contractor or collect against the bond, security, or surety for the amount of excess costs so paid.

Intellectual Property and Third-Party Rights: Any drawings, written reports or other works made by Contractor shall be considered works for hire and become the property of HWU. Any such works shall not be stamped with the Contractor's proprietary markings. This agreement is made for the benefit of HWU and Contractor, not for any outside party.

Non-Endorsement: As a result of the selection of a Contractor to supply services, HWU is neither endorsing nor suggesting that the Contractor's services are the best or only solution. Contractor agrees to make no reference to HWU in any literature, promotional material, brochures, sales presentations, or the like, without the express written consent of HWU.

Severability: If a competent court or arbitrator holds any of the terms, covenants, provisions and agreements contained herein invalid, illegal or unenforceable, this agreement shall be interpreted as if such invalid terms, covenants, provisions, or agreements were not contained herein and the remaining provisions shall be valid and enforceable.

BID FORM

PROJECT IDENTIFICATION: NWTP High Service Vertical Turbine Pumps, Motors, VFD’s, & Controls
Henderson Water Utility
Ref# - 2022 – 03

THIS BID SUBMITTED TO: Henderson Water Utility
111 Fifth Street
Henderson, KY 42420

CONTACT INFORMATION: All questions regarding this bid solicitation should be directed to the Purchasing Manager as per item #3 in the Solicitation Instructions and Conditions.

DATE REFERENCES: Last day for bid clarifications: 25 February 2022
Bid Closing: 03 March 2022, 1:30 p.m.
HWU Board Meeting (award): 21 March 2022

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to furnish equipment as specified or indicated in the Bid Documents and Technical Specifications for the Bid Price(s) and in accordance with the other terms and conditions of the Bid Documents and Technical Specifications.
2. BIDDER accepts all of the terms and conditions of the Advertisement or Invitation to Bid and the Bid Documents and Specifications. This bid will remain subject to acceptance for ninety days after the day of bid closing.
3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement that:
 - a. BIDDER has examined copies of all the Bidding Documents and of the following addenda (receipt of all which is hereby acknowledged):

DATE	NUMBER

- b. BIDDER has familiarized itself with the nature and extent of the Bid Documents and Technical Specifications, and all conditions, laws and regulations that in any manner may affect cost, or furnishing the equipment required.

- c. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other Bidder or over the PURCHASER. Bidder acknowledges and certifies by submission of his bid that all the provisions and statutes of KRS 45a.465 are complied with fully.
- d. Specify a unit price in figures for each bid item for which a quantity is given and show the products of the respective unit prices and quantities written in figures in the space provided for that purpose. Round the products by dropping all digits past the cent. Write in ink or type all figures. Where unit prices and extended amounts are not properly computed, the unit price shall govern. Where words and figures do not agree, figures shall govern. It is the intention of the Owner to award all items to be constructed to a single bidder.

Bid Form
Vertical Turbine Pumps, Motors, Controls, VFD's and Accessories
Pricing to be held for 60 days after submittal is opened

Item	Brand/Model/Details	Unit Price	Total Price
High Service Vertical Turbine Pumps, Motors and Controls- 5600 GPM, 400 HP, including 60 month warranty (Quantity of 2 each)		\$	\$
Back Wash Vertical Turbine Pumps, Motors and Controls-7,200 GPM, 150 HP, including 60 month warranty (Quantity of 1, each)		\$	\$
Variable Frequency Drives and Accessories for 400 HP Motors, including 60 month warranty (Quantity of 2, each)			
Variable Frequency Drive and Accessories for 150 HP Motor, including 60 month warranty (Quantity of 1, each)			
Variable Frequency Drives and Accessories for 450 HP Motor, including 60 month warranty (Quantity of 1, each)			
Start-Up Assistance & Delivery of O&M Manuals			\$
		Total Cost	\$

Product References: Please list 3 customers who are currently using the proposed equipment and their contact information.

1. _____

2. _____

3. _____

Shop Drawing / Equipment Delivery Schedule:

Number of days from Award of Purchase Order to Submission of Shop Drawings: _____ days

Number of days from Receipt of Approved Shop Drawings to Equipment Delivery: _____ days

Attachments Required:

Site Requirements for Delivery and Installation of Equipment: Detail any special requirements for installation of the equipment at the site, including special provisions for handling and unloading. (If none, so state).

Exceptions Taken to this Proposal: List any and all exceptions.

Schedule of Materials: A schedule of materials proposed for all system components, with any applicable ASTM standards listed.

Schedule of Accessories: Include a schedule of accessories to be provided, including but not limited to power cables, installation hardware, anchor bolts, accessories and spare parts.

SIGNATURE PAGE:

Non-Collusive Bid Statement: The undersigned bidder, having fully informed himself regarding the accuracy of the statements made herein, certifies that: (1) The bid has been arrived at by the bidder independently and has been submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment, or services described in the bid, designed to limit independent bidding or competition, and (2) The contents of the bid have not been communicated by the bidder or its employees or agents to any person not any employee or agent of the bidder or its surety on any bond furnished with the bid, and will not be communicate by any such person prior to the official opening of the bid.

Signature of Authorized Official

Name and Title (printed)

Legal Name of Business

Address

Address

Telephone Number

Date

Affix seal below if bid is by corporation.

This seal was herewith affixed in the presence of:

Signature_____Title_____

**REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS
CLAIMING QUALIFIED BIDDER STATUS**

FOR BIDS AND CONTRACTS IN GENERAL:

I. The bidder or offeror swears and affirms under penalty of perjury that the entity bidding, and all subcontractors therein, meets the requirements to be considered a “qualified bidder” in accordance with 200 KAR 5:410(3); and will continue to comply with such requirements for the duration of any contract awarded. Please identify below the particular “qualified bidder” status claimed by the bidding entity.

_____ A nonprofit corporation that furthers the purposes of KRS Chapter 163

_____ Per KRS 45A.465 (3), a “Qualified nonprofit agency for individuals with severe disabilities” means an organization that:

- (a) Is organized and operated in the interest of individuals with severe disabilities; and
- (b) Complies with any applicable occupational health and safety law of the United States and the Commonwealth; and
- (c) In the manufacture or provision of products or services listed or purchased under KRS 45A.470, during the fiscal year employs individuals with severe disabilities for not less than seventy-five percent (75%) of the man hours of direct labor required for the manufacture or provision of the products or services; and
- (d) Is registered and in good standing as a nonprofit organization with the Secretary of State.

The BIDDING AGENCY reserves the right to request documentation supporting a bidder’s claim of qualified bidder status. Failure to provide such documentation upon request may result in disqualification of the bidder or contract termination.

Signature

Printed Name

Title

Date

Company Name

Address

Subscribed and sworn to before me by _____ this _____ day of _____, 2022.

Notary Public

My Commission Expires

[Seal of Notary}

Check this box if not claiming Qualified Bidder Status

**REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS
CLAIMING RESIDENT BIDDER STATUS**

FOR BIDS AND CONTRACTS IN GENERAL:

The bidder or offeror hereby swears and affirms under penalty of perjury that, in accordance with KRS 45A.494(2), the entity bidding is an individual, partnership, association, corporation, or other business entity that, on the date the contract is first advertised or announced as available for bidding:

1. Is authorized to transact business in the Commonwealth;
2. Has for one year prior to and through the date of advertisement
 - a. Filed Kentucky corporate income taxes;
 - b. Made payments to the Kentucky unemployment insurance fund established in KRS 341.49; and
 - c. Maintained a Kentucky workers' compensation policy in effect.

The BIDDING AGENCY reserves the right to request documentation supporting a bidder's claim of resident bidder status. Failure to provide such documentation upon request shall result in disqualification of the bidder or contract termination.

Signature

Printed Name

Title

Date

Company Name

Address

Subscribed and sworn to before me by _____ this _____ day of _____, 2022.

Notary Public

My Commission Expires

[Seal of Notary}

Check this box if not claiming Resident Bidder Status

**Statement Required Pursuant to KRS 45A.395
NON-COLLUSIVE AFFIDAVIT OF PRIME BIDDER**

State of _____)

County of _____)

_____, being first duly sworn, deposes and says that:

1. He or she is the owner, partner, officer, representative, or agent of _____, the Bidder that he or she has submitted the attached bid;
2. He or she is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;
3. Such Bid is genuine and is not a collusive or sham Bid;
4. Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached bid or of any other bidder, or to fix any overhead, profit or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Henderson Water Utility, the City of Henderson or any person interested in the proposed Contract: and
5. The price or prices quoted in the attached bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed

Title

Subscribed and sworn to before me this
____ day of _____, 2022.

Title

My commission expires _____

TECHNICAL SPECIFICATIONS

RFP# _____

**WATER LUBRICATED VERTICAL TURBINE FINISHED WATER PUMPS,
MOTORS, VARIABLE FREQUENCY DRIVES, CONTROLS, AND ACCESSORIES
FOR INSTALLATION AT
THE NORTH WATER TREATMENT PLANT
FOR THE HENDERSON WATER UTILITY
IN HENDERSON, KENTUCKY**

1. Scope of Request

This request is for a proposal to furnish all equipment and materials and to perform all services necessary for three complete and operable water lubricated vertical turbine pumps, motors and accessories, four complete variable frequency drives, and control panel to be installed by others at the North Water Treatment Plant for the Henderson Water Utility, Henderson, Kentucky. Proposals shall include sales tax and all other applicable fees and taxes, including freight to Henderson, Kentucky. Only proposals from approved factory representatives will be considered.

2. Submittals (Shop Drawings)

The Vendor shall submit to the Engineer a minimum of five copies of information describing and depicting the details of the equipment, controls, materials and/or services to be provided, hereinafter referred to as "shop drawings." After approval, the Engineer will distribute the shop drawings as follows: one set to Engineer's central files, two sets to the Owner, one set to the Contractor that installs the equipment, and one set to the Vendor. The Engineer will review up to seven sets of each shop drawing submittal.

REJECTION OF THE SAME SHOP DRAWINGS ON THREE SEPARATE OCCASIONS WILL CONSTITUTE GROUNDS FOR TOTAL REJECTION OF THE PROPOSED VENDOR AS BEING UNABLE TO OR UNWILLING TO MEET THE REQUIREMENTS OF THIS REQUEST FOR PROPOSALS.

Shop drawings for the equipment and materials described in this Request for Proposals must show, as a minimum, the following information:

- a. General and detailed equipment and control layouts.
- b. Anchor bolt setting and erection plans.

- c. Weight and load values at each bearing.
- d. Capacity-head-efficiency-horsepower-net positive suction head required curves as specified for all pumps.
- e. Manufacturer's rated efficiency, service factor, horsepower, normal full load amperes, and maximum load ampere ratings for all motors for all devices powered by electric motors.
- f. List of spare parts and special tools. Special tools shall be furnished as required by the nature of the equipment or as specifically called for in this Request for Proposals.

3. Operation and Maintenance Manual Requirements

After approval of submittals but prior to installation and start-up of equipment, three copies of installation, operating and maintenance instructions shall be furnished to the Owner. These materials shall include complete manufacturer's certified prints of ALL major equipment, giving ALL major dimensions and longitudinal cross section views of important details; COMPLETE AND COMPREHENSIVE instructions for operation and maintenance, including detailed piping arrangements, lubrication schedules, charts, name and address of the manufacturer's representative, parts lists, wiring diagrams, capacity-head-efficiency-horsepower curves, design data, guides for trouble-shooting, and ALL other pertinent texts, diagrams, and illustrations. These shall be delivered in a standard 8 ½-inch x 11-inch hard-back three-ring binder. Oversized drawings shall be folded as necessary and supplied in pouches included in the three-ring binders.

4. Supervision and Certification of Installation

a. General

The Vendor shall include in his price and furnish the services of competent factory representatives for the purpose of supervising the installation, start-up, and adjustment of the equipment furnished. **Sales representatives do not meet the definition of "factory representative". Additionally, the Vendor shall include one day of on-site training for the Owner's personnel.**

The Vendor shall furnish sufficient service for proper installation of the equipment and to insure operation as intended. Such service shall be furnished until final acceptance by the Owner and throughout the warranty period.

THE VENDOR SHALL INCLUDE IN THE QUOTATION A MINIMUM OF 6 MAN-DAYS ON-SITE FACTORY SERVICE DURING 3 MAN-TRIPS TO THE PROJECT SITE FOR INSTALLATION AND STARTUP SERVICES

AND ONE MAN-DAY ON-SITE DURING ONE MAN-TRIP TO THE PROJECT SITE FOR TRAINING OF THE OWNER'S PERSONNEL. This minimum on-site period does not include travel time to and from the project site.

b. Mechanical Tests

After installation, each unit of mechanical equipment shall be operated continuously for a period of 24 hours by the Owner. During this period, the equipment shall be inspected for defects or weaknesses. Any part of the unit showing a defect or weakness shall at once be replaced by the Vendor, or shall be made good by the Vendor in a satisfactory manner at no expense to the Owner. After any part of the equipment showing defects or weaknesses has been replaced or made good, additional mechanical tests will be made with the equipment operating continuously for a 24-hour period until no further defects or weaknesses occur in the unit.

c. Certification

After installation and final testing of equipment, the Vendor shall make written certification to the Owner that his equipment has been properly installed in accordance with the Purchase Order, that this equipment installation will be warranted by the Vendor as specified in this Request for Proposals, and that the Operation and Maintenance Manuals have been furnished to the Owner.

5. Material to be Obtained from the Vendor

The Vendor shall provide all items named in this Request for Proposals or so noted on the Purchase Order and such incidental items as may be required for the safe and proper installation and operation of the equipment furnished for the purpose(s) intended. Unless otherwise noted or described, connecting piping is excluded from this requirement.

The materials described in this Request for Proposals will be unloaded by the Vendor, stored by the Owner and installed by the Owner's Construction Contractor. The Owner's Construction Contractor will supply labor for installation and any grouting work required for installation. The Vendor shall provide all lubricants, anchor bolts, expansion anchors, assembly fasteners and other miscellaneous items required to install the material described in this Request for Proposals. **All anchor bolts, expansion anchors, and assembly fasteners shall be STAINLESS STEEL meeting the requirements of ASTM A276, Type 304 or Type 316 and of a size determined by the Vendor as necessary to anchor their specific materials, unless otherwise specified.**

Shop drawings will not be approved until all materials are listed.

Equipment offered contrary to the provisions of this Paragraph will be subject to rejection.

6. Patents

a. General

The Vendor shall guarantee to the Owner that all materials offered under this Request for Proposals and/or any process resulting from the use of such materials in the manner stated is not the subject of patent litigation and that he is not knowingly offering equipment the installation or use of which is likely to result in a patent controversy, in which the Owner as user is likely to be made the defendant.

b. License

Where patent infringements are likely to occur, each Vendor shall submit, as a part of his proposal, license arrangements between himself and the patent owner or the controller of the patent which will permit the use in the specified manner of such material or process as he may be bidding upon.

c. Liability

The Vendor, by submitting his Proposal, agrees to hold and save the Owner and the Owner's officers, agents, servants, and employees, including the Engineer, harmless from liability of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the work under this Purchase Order, including the use of same by the Owner.

7. Painting

All ferrous components of equipment and machinery shall be cleaned and painted with a prime coat at the Vendor's facility prior to shipment to the project site. Finish coat painting shall be performed by the Owner after equipment and machinery are installed.

Specified painting products are those manufactured by Tnemec Company, Inc. and are specified as the standard of quality required for use on this project. Equivalent products by other manufacturers are acceptable, providing they meet or exceed all performance criteria of the specified materials. Products that would decrease film thicknesses or offer a change in the generic type of coating specifically shall not be considered. Paint coating data shall be furnished with shop drawings.

Unless specified otherwise in the Technical Specifications section of this Request for Proposals, ferrous components of all machinery and equipment shall be thoroughly cleaned and shall have one prime coat of Series 160 TNEME-Fasprime (2.0 to 3.0 mils DFT) applied in the Vendor's shop.

8. Warranty

The Vendor shall warrant all materials and components provided and installed in accordance with this Request for Proposals to be free from defects in materials and workmanship and to meet all specified performance criteria for a period of sixty months after the date of delivery. The Vendor shall remedy any defects in the materials and components and correct any deficiencies occurring prior to sixty months after delivery to Owner including, but not necessarily limited to, replacement of defective or non-performing materials and/or components, providing transportation to the project site for replacement materials and components and for removal from the site of defective or non-performing materials and components, providing all labor required to remove defective or non-performing materials and components and to install replacement materials and components, and all factory representative on-site field supervision required to remedy the defect or non-performance.

9. Payment Schedule

In an effort to protect the Owner's interests and to encourage manufacturers, suppliers and subcontractors to complete their work and troubleshooting in an expeditious fashion, the following provisions concerning payment for equipment shall apply:

- a. No more than 90 percent of the cost of equipment stored (less allowance for the work of servicemen) will be paid. This percentage is subject to reduction based on inspection of the equipment for apparent completeness with respect to approved shop drawings and visual inspection of the condition and the means of storage.
- b. Normally the retainage will be reduced to 5 percent of the total contract price upon the successful initial start-up operation of the facility. The Owner may continue to hold the full 10 percent retainage on the Contract if unsatisfactory progress is being made.
- c. After acceptable operation of the equipment for sixty days and acceptance by the Engineer, the remaining retainage shall be paid.

10. Attachments

The following attachments to this Request for Proposals will be incorporated into any Purchase Order issued in response to Vendor's proposal.

- Plans for the North Water Treatment Plant, Henderson, Kentucky

11. Technical Specifications

a. Scope

The Vendor shall furnish water lubricated finished water vertical turbine pumps including, but not limited to, pumps, motors, anchor bolts, power cables, air release valves, installation and start-up service by a factory representative, and other accessories specified herein. The Vendor shall also furnish complete and operable variable frequency drives which are to be used in conjunction with the finished water pumps to furnish potable water at the capacity and head conditions specified herein. The pumps shall be for continuous service. The equipment, materials and devices included with the vertical turbine pumps shall be furnished with all fasteners and fittings necessary for installation at the location shown on the Plans provided with this Request for Proposals without any additional equipment or materials furnished by others.

b. Information Required with Proposal

The Vendor shall include the following information with the Proposal:

- A schedule of the materials proposed for all principal system components with any applicable ASTM Standards listed.
- A schedule of the accessories to be provided including, but not limited to, power cable, installation hardware, and anchor bolts and appurtenances.
- A list of any and all exceptions taken to this Request for Proposals.

c. Criteria for the Evaluation of Proposals

The Owner will evaluate the Proposals based on the prices provided and based on the technical information provided with the Proposals. The Owner reserves the right to reject any or all Proposals, to waive informalities and to issue the Purchase Order to a Vendor other than the Vendor offering the lowest price.

d. Materials or Equipment to be Furnished (“Equal to” and “or approved equal” clauses)

Where the specifications state "equal to" followed by a brand name or model, a standard of quality is being set. The naming of a brand or model is a matter of convenience to avoid writing a volume. Other brands or equipment under this category may be submitted. The Engineer will consider other products on the basis of materials of construction, weight, function, size (it must fit the space provided), service history and electrical and mechanical characteristics.

Where the specifications state one or more model numbers and manufacturers followed by the words "or approved equal" the meaning is that the product(s) specified is acceptable and that while there may be other products that are acceptable the only way to be assured is to submit the desired substitution during the BID PROCESS and receive an affirmative answer. The Engineer will consider the factors previously described in making the determination.

Unless otherwise specified, all materials shall be the best of their respective kinds and shall be in all cases fully equal to approved samples. The Engineer shall have the right to require the use of such specifically designated material, article, or process. The Engineer, where practical, may require submission of actual samples of materials or products.

e. Utilities Provided

Electric power provided for the motors will be 480 volts, three phase, four wire, 60 Hertz alternating current. Motors will be operated by variable frequency drives.

f. Non-witnessed Shop Tests

The pumps shall be fully tested as per AWWA E101 Section A-6 before shipment for all six (6) items listed in Section A-6.1. The non-witnessed running test shall include shutoff head and at least five (5) other points on the curve including two points beyond the design head and such other conditions of head and capacity necessary to establish properly that it has met all guarantees on the characteristic curves submitted by the Engineer. The manufacturer shall furnish actual numerical test data. The final performance curve shall be on such a scale that is acceptable to the Engineer permitting interpolation. Pumps with "dog-legs" or "flat sections" near the design condition will be rejected.

A hydrostatic test of the pump column, pump bowl castings and discharge head shall be performed as per said AWWA E-101, Section A-6.10. Test curves shall have a numerical tabulation of every point used to make the curve. Four (4) certified copies of the results of these witnessed tests shall be furnished to the Engineer.

The Engineer shall be informed in writing of the date and time proposed for such tests at least five (5) days in advance as per Section A-6.1.

g. Vertical Hollow Shaft Electric Motor

(1) General

All electric motors described at this Paragraph and furnished to drive equipment described at this Request for Proposals shall be manufactured by a company that is an active member of the National Electrical Manufacturers Association (NEMA) and that has designed and manufactured similar electric motors for 10 years or longer; and shall comply with the requirements of this Paragraph and with the current applicable standards promulgated by the following agencies:

- National Electrical Manufacturers Association (NEMA);
- Institute of Electrical and Electronics Engineers (IEEE);
- Anti-Friction Bearing Manufacturers Association (AFBMA);
- American National Standards Institute (ANSI);
- American Society of Testing Materials (ASTM);
- Hydraulic Institute (HI); and
- American Water Works Association (AWWA).

Vertical motors shall have hollow shafts.

All motors shall have an **embossed nameplate** mechanically affixed to the motor enclosure describing the HP, speed, frequency, NEMA KVA Code and Design, voltage, serial number, service factor, insulation class, maximum ambient, full load current (amps) and frame size.

(2) Service Conditions

All electric motors described at this Paragraph furnished to drive equipment described at this Request for Proposals shall be suitable for continuous use and following conditions of services.

- Indoor installation in a clean environment
- Ambient temperature not greater than 40°C
- Electric power voltage variations of plus or minus ten percent of the motor's rated voltage
- Electric power frequency variations of plus or minus five percent of the motor's rated electric power frequency. Motors will be operated with variable frequency drives.
- Electric power voltage and frequency variations, in combination of absolute values on a percentage basis of the motor's rated values for these operating parameters, of ten percent.

(3) Enclosures

All vertically mounted motors described in this Paragraph shall be open drip-proof.

(4) Electrical Design

The phase, frequency and voltage of the power supply, and the method for starting for electric motors are described in the Subsection describing the equipment to be driven by the motor.

Unless described otherwise in the following Subsections or depicted differently on the Plans, all motors shall have three leads terminating in the main motor conduit box.

The insulation system for all motors shall be rated Class F (155°C) or higher. Magnet wire shall be copper and rated Class H (180°C) or higher. Magnet wire shall be classified "Pulse Endurance" and be suitable for variable frequency applications. Varnish shall be 100 percent solids polyester. Water-borne varnish shall not be acceptable.

Rotor bars shall be cast aluminum.

The maximum motor temperature rise at its rated horsepower shall not exceed Class B limits (80°C). The maximum motor temperature rise at the 1.15 service factor shall not exceed Class F limits (115°C).

All motors shall be premium efficiency in accordance with the values established by "NEMA PREMIUM™" for horsepower, speed and enclosure.

(5) Mechanical Design

The driven equipment shall not cause any motor to exceed its rated horsepower at any possible operating condition.

Bearings utilized in motor construction shall be rated for a five-year minimum L-10 life at the specified operating condition of the driven equipment. Bearings shall be the anti-friction type and may be either ball or roller as necessary to obtain the hereinbefore described five-year minimum L-10 life under specified operating conditions.

Motors utilizing oil lubricated bearings shall include an externally visible sight glass to view the oil level. Oil-fill ports shall be located to prevent

over-filling. Synthetic oil shall be used as the lubricant when spherical roller bearings are utilized. Grease lubricated bearings shall be specially designed for use in electric motors. Grease lubricated bearings shall be factory lubricated with Exxon Polyrex EM or equal grease product. Fittings to apply grease to bearings shall be Alemite™ type and not smaller than one-quarter inch size. All grease exits shall be the automatic pressure relief- type not smaller than one-quarter inch in size.

The maximum vibration of the motor measured in any direction on the bearing housing when tested in accordance with the requirements of NEMA MG 1 shall not exceed 0.08 inches per second peak velocity.

The motor sound power load when measured at a “no load” condition shall not exceed 90 dBA when determined in accordance with the requirements of IEEE Standard 85.

All motors shall have permanent lifting eyes or lugs capable of supporting ten times the weight of the motor when in tension.

All external fasteners shall be hexagon-head, cadmium plated steel rated Class 5 or harder. Internal fasteners may be slotted-head, Phillips head, or socket head. All fasteners shall be sized in English units.

All airway openings on weather protected enclosures shall be covered with stainless steel screen having a one-quarter inch maximum screen opening.

The shop applied paint finish of all cast iron components of motors shall be corrosive resistant and the coating shall be capable of passing a 250-hour salt spray test in accordance with the requirements of ASTM B117.

(6) Accessories

All motors with power ratings greater than 20 horsepower shall be fitted with anti-condensation heaters capable of maintaining motor windings at a temperature at least 10°F above ambient temperature. Anti-condensation heaters shall be for single-phase, 60 Hertz, 120 volt electrical power supply and a separate auxiliary outlet box shall be provided for termination of the heater leads.

All motors with power ratings greater than 20 horsepower shall be furnished with winding thermostats. One winding thermostat shall be furnished for each phase, normally closed, connected in series. A separate auxiliary outlet box shall be provided for termination of the thermostat leads. The main terminal box for all motors shall include provisions for grounding.

(7) Testing

Correlated performance data for the design of each motor shall be provided to the Engineer.

(8) Electrical Equipment Associated with Motors

In general, electrical equipment described at the following Sub-Section(s) of these Detailed Specifications will be connected to the electrical system depicted on the Plans. **THE EQUIPMENT VENDOR SHALL BE RESPONSIBLE FOR ANY CHANGES IN ELECTRICAL EQUIPMENT CAUSED BY AN INCREASE IN HORSEPOWER FROM THE HORSEPOWER FOR ANY ELECTRIC MOTOR DEPICTED ON THE PLANS OR LISTED IN THIS SECTION. ANY CHANGES CAUSED BY SUCH AN INCREASE IN HORSEPOWER SHALL BE AT NO EXPENSE TO THE OWNER.**

h. Air Release Valves

The Vendor shall furnish one air release valve with each pump and the pump columns shall be appropriately tapped for each. Air release valves shall be located at the top of the pump column above the motor floor. Air release valves shall be sized by the pump Vendor; however, the minimum size for the valve at the top of the pump column shall be 2 inches. Air release valves shall be Apco, Val-Matic, Vent-o-Mat, or approved equal and shall be rated for a suitable working pressure.

i. Pump Performance Requirements

The Vendor shall supply pumps to deliver the desired flow and head as follows.

Henderson Standard Pressure Zone Pumps

Number of pumps	2
Capacity, gpm	5,600
Total Dynamic Head, feet	200
Bowl Efficiency, Minimum, percent	82
Minimum Shutoff Head, feet	320
Maximum Speed, RPM	1,800
Maximum Horsepower (must be NOL for entire curve)	400
Minimum Discharge Flange Size, inches	12
Motor Voltage	480 V 60 Hz

Henderson Backwash Pump

Number of pumps	1
Capacity, gpm	7,200
Total Dynamic Head, feet	60
Bowl Efficiency, Minimum, percent	83
Minimum Shutoff Head, feet	95
Maximum Speed, RPM	900
Maximum Horsepower (must be NOL for entire curve)	150
Minimum Discharge Flange Size, inches	12
Motor Voltage	480 V 60 Hz

j. Pump Materials and Construction

(1) General

The pumps shall be water lubricated vertical turbine pumps with above ground discharge design and shall be designed to resist the forces of starting against shut off head.

The natural frequency of the assembled pump and its supporting structure shall be at least 25% higher than the maximum pump speed or 25% lower than the minimum pump speed.

(2) Setting Depth and Discharge Location

The motor floor is at elevation 391.50. For bidding purposes, the Vendor shall assume that the bottom of the finished water intake sump is at elevation 365.0 and shall determine setting depth based on the manufacturer's recommended distance between the bottom of the sump and pump suction. Prior to manufacturer of the pumping units, the Vendor or a manufacturer's representative shall examine the existing structure and field verify all dimensions and elevations. Evidence of such examination shall be provided during the shop drawing phase.

(3) Bowl Assembly

The pump bowls, including the suction bell, shall be ASTM A48 Class 30 cast iron, free of blow holes, sand holes and other detrimental defect. They shall be accurately machined with register fit circles. All bowls should be of the flanged type construction. All pump bowls shall have porcelain or powder epoxy lined water passageways. The outside of the bowl shall be epoxy coated.

The pump shaft shall be type 416 stainless steel turned and ground. It shall be supported by bronze bearings above and below each impeller. The suction bell bearing shall be extra long and permanently grease packed and sealed with a bronze sand collar. The discharge case shall also contain an extra long support bearing. The suction case and intermediate bowls shall be fitted with replaceable 410 stainless steel wear rings. Wear rings shall have the minimum practical clearance to the mating cylindrical surface of the impeller to provide adequate sealing independent of vertical positioning of the impellers. The discharge case shall have vanes to deliver the flow of water with minimum turbulence. Drain ports shall be provided with a sufficient area and shape to permit the escape of water that passes through the pump bowl bearings.

(4) Impellers

The impellers shall be of the enclosed or semi open type cast 316 stainless steel suited for finished water service, accurately cast, machined, balanced, and filed for optimum performance and minimum vibration. The impellers shall be capable of adjustment by means of an adjusting device on the top of the vertical hollow shaft motor. The impeller shall be securely fastened to the bowl shaft with tapered lock collets, threaded lock collets or double keys. The impellers shall be fitted with 420 stainless steel wear rings. The impeller shaft shall be 416 stainless steel.

(5) Line Shaft and Bearings

The line shaft shall be 416 stainless steel, turned and ground. They shall be furnished in interchangeable sections not over 5 feet in length. The butting faces shall be machined square to the axis of the shaft with the maximum permissible axial misalignment of the threaded axis with the shaft axis .002 inch in 6 inches. The size of the shaft shall be no less than determined by ANSI/AWWA specification E101, section A4.15 line shaft selection and shall be such that elongation due to hydraulic thrust will not exceed the actual clearance of the impellers in the pump bowls. Stainless steel line shaft couplings with a safety factor of 1.5 times the shaft safety factor shall join the line shafts. These threaded couplings shall have left-hand threads to tighten during pump operation.

The top line shaft shall be provided with a top shaft adjusting nut at the top of the vertical hollow shaft motor for adjusting impeller clearances. The nut shall have a lock screw or lock washer which maintains the nut in position thus maintains the impeller setting.

(6) Column Pipe

The column pipe shall be epoxy coated inside and outside. Column assembly shall be of flanged type construction. **The outer column shall be a butt welded steel pipe and in interchangeable sections, not more than 5 feet in length.** The ends of each section shall be machined parallel. Register fit circles shall be machined on the flanges on each end and positive alignment shall be assured by accurately machined bearing retainers with register fit circles. The column size shall be such that the friction loss will not exceed 5 feet per 100 feet of length at the rated capacity of the pump and shall not be smaller than the minimum size specified. The column pipe should be A53, Grade B and of sufficient wall thickness for the application.

(7) Two-Piece Top Shaft

Each vertical turbine pump shall be equipped with a two-piece top shaft. The coupling shall be provided between the packing box in the pump head and the motor.

(8) Strainer

A stainless steel basket-type strainer shall be provided for the finished water pumps. The strainer shall be securely attached to the suction bowl of the pump by use of at least four stainless steel bolts or set screws that will not loosen under vibrating conditions.

k. Field Acceptance Tests

The pumping units will be accepted upon the basis of the Shop Tests subject to a four (4) hour field test. The test will be required for the purpose of determining if the pumping units will operate under installed conditions within a reasonable degree of correlation with the Shop Tests.

Included in the field acceptance test will be a check of the motor's vibration. The procedure to be utilized is outlined in Subparagraph m. Quietness of Operation of this Paragraph hereinafter.

If, in the opinion of the Engineer, the four (4) hour test does not indicate a close correlation with the Shop Tests, then the Engineer will direct that a complete field test be made under the applicable standards of the Hydraulics Institute. If the pumps are accepted, this test will be paid for by the Owner. It will be witnessed by representatives of the pump manufacturer and the Engineer. The results of this complete field test will then be the final basis of acceptance or non-acceptance of

the pumping units. If the pumps are not accepted, the test will be paid for by the manufacturer.

l. Quietness of Operation

The pumps and motors shall operate at the specified capacities in the range of heads specified without undue noise and vibration. A test for vibration will be made by placing a new 5 cent piece (nickel) on edge; if it stands, the pump passes; if it falls, the pump manufacturer may either repair the equipment or perform a vibration test in accordance with the standards of the Hydraulics Institute.

Any undue noise in the pump and motor, which is objectionable in the opinion of the Engineer, will be sufficient cause for rejection of the unit. The NEMA or manufacturer's standards for motor noise level will be considered in determining if noise is objectionable.

m. Control Panel Construction

(1) General

All control panels shall utilize 3-point latch type doors. Control panels shall be supplied for the following location:

- High Service Pump PLC Control Panel
Type: NEMA 4X Stainless Steel

The Control Panel shall be built to UL508A standards, shop tested prior to shipment, physically mounted by the General Contractor, and started up by the Owner. Panels shall be furnished as follows:

- (a) The control panels shall be freestanding with mounting feet or wall mounted and shall be constructed of painted steel or stainless steel as indicated. Control panels shall be furnished with space heaters and/or ventilation as required by the application. Enclosures shall be manufactured Hoffman or approved equal. Color samples shall be submitted to the Engineer for approval.
- (b) All PLC equipment shall be suitable for operation 120V, 60 Hz, single phase power. If the control panel is powered by other than 120 volts, the control panel supplier shall furnish control power transformers as necessary. Receptacles with isolated ground shall be supplied for computer devices in the control room and internal to the control panel enclosures.

- (c) All field wiring terminations shall be made to terminal strips capable of accommodating the wire size shown on the Plans. Terminal strips shall be mounted using DIN rails. Terminal strips shall be as manufactured by Phoenix Contact, Allen-Bradley or approved equal.
- (d) All analog inputs and outputs including designated points shall be protected from surges using three-level surge/transient suppression. Analog surge protectors shall be manufactured by Edco, CITEL or approved equal. Field termination points shall be installed in the control panel to allow each of the analog inputs to be preconfigured for two-wire loop powered or field source 4-20 mA devices as determined by field device source type needs. 24 VDC power supplies shall be included for use on two-wire loop powered devices.
- (e) Separate DC power supplies shall be provided for the PLC and for field analog and digital inputs. All DC power supplies shall be protected via fast acting fuses. Indicating fuse holders shall be DIN rail mounted.
- (f) Surge protectors shall be provided internal to the PLC enclosure to provide transient and surge protection.
- (g) An Eaton Powerware (5115 1000 VA) or equal Uninterruptible Power Supply shall be provided integral to each control panel enclosure. Alternatively, the Systems Integrator may provide a 24 volt DC UPS consisting of battery, controller and dedicated 24 volt power supply.
- (h) Two (2) circuit breakers shall be provided integral to each control panel. One circuit breaker shall provide protection to each control panel's internal power supplies and the other circuit breaker shall provide protection to a Ground Fault Interrupt (GFI) duplex utility outlet.
- (i) An Edco, CITEL, or equal power surge protector shall be installed integral to the control panel to provide transient and surge protection for incoming AC power. A separate GFI duplex utility outlet shall be protected by the surge protector and shall be used only for the UPS system.

(2) Control Relays

Control relays shall be plug-in enclosed polycarbonate type. Coil winding shall be polyurethane insulated with insulation resistance of 100 megohms minimum. Dielectric strength shall be 2500 volts R.M.S. Operating temperature range shall be -40°C to +70°C. Mechanical life expectancy shall be in excess of 10 million operations. Pull-in and release speeds shall be less than 30 milliseconds. Relays shall have a continuous duty cycle and U.L. listed. Relays shall be Finder Relays, Inc. Model 62.32 (42), Allen-Bradley or equal.

All small plug-in relays that are driven from a TRIAC type output and have an impedance greater than 2500 ohms shall have a 4200 ohm, 5-watt wire-wound resistor installed across the coil. These resistors shall be mounted in a group away from the relays so they will be adequately cooled and so the produced heat will not affect other components.

(3) Wiring

All conductors used in fabricating the Control and Monitoring Panels shall be stranded cable. Wiring descriptions and details shall be entered into the PLC hardware configuration for all I/O addresses. Insulation shall be MTW or better for control conductors and THW or better for power conductors. Wiring ducts, wire wrap and hardware shall be used as required. Wiring bundles that cross door hinge areas shall be protected from chafing with a plastic spiral wrap or other suitable material. Wiring shall be in accordance with the following color and size code:

AC Control	-----	RED	-----	#16AWG (or larger)
DC Control	-----	BLUE	-----	#16AWG (or larger)
120VAC Power	-----	BLACK	-----	#14AWG (or larger)
480VAC Power	-----	BLACK	-----	#10AWG (or larger)
External Control	-----	YELLOW	----	#16AWG (or larger)
Ground	-----	GREEN	-----	#14AWG (or larger)
Neutral	-----	WHITE	-----	#14AWG (or larger)
Shielded	-----		-----	#18AWG (or larger)

All conductors inside the Control and Monitoring Panel enclosures shall be identified by permanent wire markers in accordance with the wire identification shown on the Manufacturer's submittal drawings. Wire markers shall not rotate or slide on the wire and shall be positioned with the number facing the most reasonable location of observation. Numbers shall be the same at both ends of each conductor and, if a PLC based control

system is utilized, the numbers shall be listed in accordance with the PLC I/O addresses or drawing line reference numbers.

All wiring shall be grounded to the ground bus or other suitable ground in accordance with NEC requirements. The enclosure shall be connected to the ground bus with a dedicated grounding screw.

(4) Terminal Strips for Local Control Panels

Terminal strips shall be provided in all local control panels to match the I/O list hereinafter.

(5) Variable Frequency Drive (Four Required)

(a) General

The Variable Frequency Drive (VFD) system for motors shall use an Active Front End (AFE) Low Harmonic design and shall contain all components required to meet the performance, protection, safety and certification criteria of this specification. VFD systems shall be supplied by Irby Electric.

The VFD shall comply with all of the applicable provisions of NEMA, ANSI, NEC, and IEEE, and shall be U.L. or E.T.L. listed. A U.L. or E.T.L. listed label shall be attached to the inside of each drive enclosure for verification of listing.

The VFD ampere rating shall be equal to or greater than the ampere rating listed on the motor being driven by the VFD.

VFDs shall be furnished for the following pump/motor combinations.

<u>Pump/Motor Designation</u>	<u>HP</u>	<u>New/Existing</u>	<u>Number of VFDs Required</u>
5,600 GPM High Service Pump	400	New	2
7,200 GPM Backwash Pump	150	New	1
7,000 GPM High Service Pump	450	Existing	1

(b) Variable Frequency Drive Enclosures

The enclosures shall comply with the requirements for IP20 enclosures. Operation, maintenance and parts replacement shall be through front access doors.

Access doors shall have a lockable handle and a thru-door, lockable input circuit breaker shall be provided.

(c) Drive Construction

The drive units shall be modularly constructed. Printed circuit boards shall be connected in such manner that they are easily removed from the unit. Power components shall be readily accessible and be connected in such manner that they are easily removed from the unit.

(d) Input Power Conditioning

The manufacturer shall be aware that the variable frequency drives may be operated by a future standby diesel generator during times of power failure and shall include any necessary power conditioning equipment necessary for proper operation.

(e) Harmonic Mitigation

The VFD shall use a transistor-based Active Front End as the input rectifier that uses a Selective Harmonic Elimination algorithm, mitigating the harmonics enough to meet IEEE-519-2014 without the need for phase shifting transformers and multi-pulse diode rectifiers. Total current harmonic distortion shall not exceed 5% at the VFD input terminals in all load conditions.

An AFE rectifier shall be phase rotation insensitive, tolerant of line voltage imbalance up to 10% without affecting the harmonic mitigation or VFD output, and capable of operating the motor at full output with a 10% drop on input voltage. The VFD shall use an LCL filter assembly to filter up to and including the 50th harmonic to reduce EMI/RFI emissions. The LCL filter assembly shall include Passive Dampening. The drive will provide Active Resonance Detection and Protection to minimize any damage to the drive from supply side resonance.

(f) Operation

The alternating current (AC) variable frequency drives shall convert input AC main power to an adjustable frequency and voltage. The output frequency and voltage of the AC drive shall be adjustable to maintain a constant voltage to frequency ratio throughout the operating range.

The variable frequency drive units shall convert the fixed voltage, fixed frequency, AC line power to a fixed DC power. The DC bus voltage shall be filtered to protect against large voltage transients on the incoming line. The rectifier shall not be affected by phase rotation of the AC power and shall not cause a displacement factor of less than 0.95 under any operating speed or load conditions. An inverter shall convert the fixed DC voltage signal from the rectifier to a variable frequency that can be sensed by a standard NEMA B motor. The drive control efficiency at rated load and frequency shall be 95 percent minimum.

The input signal to the drive units received from the automatic control system shall be a 4 to 20 milliamp signal. The output signal from the variable frequency drive shall be a PWM type frequency waveform ranging from 0 to 60 Hertz. The variable frequency drive units shall provide an output frequency signal to increase or decrease the speed of the pump motor. In the event of loss of the input signal from the automatic pump control system, the drive shall deactivate the operating pump and activate the variable frequency drive fault alarm.

(g) Design Features

The variable frequency drives shall include all standard design features of the manufacturer along with the features described hereinafter. The variable frequency drives shall include a motor overload protection circuit that senses a motor load current exceeding 150 percent of the rated torque and reduces the drive output voltage or acceleration rate of pump startup until the load is reduced to acceptable levels.

The variable frequency drives shall be capable of starting the pump motor at a preset startup speed and accelerate to the speed as described in these Technical Specifications. The acceleration rate shall be adjustable. The drive shall be capable of generating a discrete signal indicating that the associated motor is operating at

minimum amperage usage. This signal shall be processed by the automatic pump control system to confirm that a variable speed pump is in operation.

The variable frequency drive units shall be capable of restarting automatically after malfunction is repaired or after a loss of primary power. Power interruptions up to 0.5 seconds shall be allowable without the drive shutting down on a fault. The drive unit shall attempt to restart a maximum of five times. If the drive is unsuccessful in restarting and running for 120 seconds, the restart circuit shall lockout and activate the variable frequency drive's fault alarm.

The variable frequency drive units shall be a microprocessor based and utilize digital input for parameter adjustment. Use of potentiometer for parameter adjustment is acceptable for manual control switches, but unacceptable for configuration control. The command center shall include the following:

i. Hand/Off/Auto Selector Switch

Provide a "Hand/Off/Auto" selector switch, mounted on the enclosure door. The "Hand/Off/Auto" selector switch shall start the drive in the "Hand" mode and stop the drive in the "Off" mode. In the "Auto" mode the drive shall be started and stopped from a remote "RUN" contact. In all modes, Auxiliary and Enable inputs to the drive control interface board must be present before the drive will start.

When a HMI is present, the stop function shall always be available to stop the drive regardless of the selected mode ("Hand" or "Auto"). The HMI will be non-functional (except for the display and programming) when the switch is in "Off" mode. The HMI shall stop the drive if the switch is in the "Auto" mode with the remote start contact initiated. The drive speed reference shall be controlled from the HMI, unless a separate door-mounted potentiometer is provided, when in "Hand" mode (factory default setting).

The drive shall have the capability of smoothly transferring from the automatic speed reference to the manual speed reference on the HMI, without perturbation in the speed reference. The drive speed reference shall be controlled by a remote 420 mA input when in "Auto" mode. The device

shall be an Allen-Bradley Bulletin 800T (30mm) mounted on the drive system enclosure door.

ii. Configuration Controller

The configuration controller shall allow the following parameters to be programmed: startup speed, minimum speed, maximum speed, acceleration and deceleration rates, volts/Hertz ratio, torque boost, slip compensation, over frequency limit, current limit and jog frequency. The controller shall have an internal means of deactivating keypad parameter adjustments to eliminate unauthorized data entry.

iii. Display

A light emitting diode (LED) or alphanumeric display readable through a cutout in the front of the enclosure shall be provided that digitally indicates frequency output of the variable frequency drive in Hertz, voltage output of the variable frequency drive in volts, motor speed in RPM, variable speed drive fault indication. The display shall be alphanumeric only.

The variable frequency drives are to be used for pump operation.

(h) Drive Monitoring Circuit

The drive units shall monitor the following functions, generate a discrete signal for transmission to the Control and Monitoring Panel, and stop the drive unit. The integral display panel shall provide first fault indication of these functions.

- i. Motor current exceeding 110% of rated torque for longer than one minute
- ii. Output phase-to-phase short circuit condition
- iii. Ground fault under any operating condition (starting and running)
- iv. High input line voltage
- v. Low input line voltage
- vi. Loss of input signal
- vii. External fault
- viii. Thermal overload

- ix. CPV Error
- x. Controller Overheat

(i) Manufacturer

The variable frequency drives shall be manufactured by Yaskawa and shall be capable of communicating in accordance with the control panel provisions specified herein.

n. Programmable Logic Controllers (PLCs)

(1) General

The programmable logic controller (PLC) shall include but not to be limited to: Processor modules (CPU), module chassis, power supplies, I/O modules, communications modules, programming, communications configuration, data acquisition. The PLC shall collect data, process control functions, communicate with other PLCs, distribute process information via Ethernet IP communications protocol. The PLC processor may have its program downloaded from programmer's terminal via the Ethernet network, and be locally programmed through the processors USB port.

The PLC system shall be furnished by a single vendor who has actively been manufacturing programmable logic controllers of the required specified capabilities and whose products have operated successfully for a period of at least eight years. All PLC equipment shall be UL listed.

GE RX3i Series Controllers are set forth as mandatory - no alternatives will be considered. (Processor memory size shall support a minimum of 50% future expansion capabilities.)

The PLC shall be configured with "Heart Beat" status bits to allow detection of a "stale" or failed data communications link on the IP Network.

All PLC read and write data that shall be controlled and displayed on the SCADA network shall be configured in the controller program for contiguous tags that can be accessed over the IP network using Produced and Consumed Tags or Peer to Peer messaging. The assigned tags shall be well defined, organized and documented for use by SCADA over the IP network. An unlocked Microsoft Excel spread sheet shall be provided with all relevant tags for use by the SCADA Systems Integrator for project development.

Each Processor chassis shall contain at a minimum the following hardware:

- 1 Each PLC, Chassis Power Supply and I/O modules. To include expansion cables and end caps as required.

Each Remote Ethernet I/O chassis shall contain at a minimum the following hardware:

- 1 Each remote I/O adaptor with, Chassis Power Supply and I/O modules. To include expansion cables and end caps as required.
- I/O Modules: Module count and type as required to support all system control functions (Include 25% spare I/O points for all types used).

(2) Design Description

- (a) The Programmable Automation Controller shall be designed to provide the basic requirements of the application with the capability of expansion to address particular needs. The expansion shall exist as additional I/O expansion modules or as remote I/O connected through one of the networks available.
- (b) Modules are defined herein as devices that can be removed individually from its position for replacement and are keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into the wrong position via an electronic method for identifying a module. Electronic keying performs an electronic check to ensure that the physical module is consistent with what was configured.
- (c) The Programmable Automation Controller shall have the ability to be updated electronically to interface with new modules.
- (d) All hardware of the Programmable Automation Controller shall operate at an ambient temperature of 0 to 60 degrees C (32 to 140 degrees F), with an ambient temperature rating for storage of -40 to +85 degrees C (-40 to +185 degrees F) per IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat) and IEC 60068-2-14 (Test Nb, Operating Thermal Shock).

- (e) The Programmable Automation Controller hardware shall function continuously in the relative humidity range of 5% to 95% with no condensation per IEC 60068-2-30 (Test Db, Unpackaged Damp Heat).
- (f) The Programmable Automation Controller system shall be described and tested to operate in a high electrical noise environment.
- (g) The Programmable Automation Controller shall include as an optional feature the capability of addressing remote input and output modules on EtherNet/IP.
- (h) The Programmable Automation Controller shall support Produced/Consumed Connections which allows seamless exchanging of data between multiple Logix based Controllers.
- (i) The Programmable Automation Controller shall use multiple independent, asynchronous scans. These concurrent scans shall be designated for processing of input and output information, program logic, and background processing of other controller functions. Input and output devices located in the same backplane (local I/O) as the CPU will be produced at the rate of the configured RPI (Requested Packet Interval).
- (j) The Programmable Automation Controller shall have the ability to support multiple data communications links by using Ethernet/IP, and other 3rd party networks.
- (k) The Programmable Automation Controller shall have one dedicated Universal Serial Bus Type B port (USB 2.0). The USB port is a device only programming port. The USB port must be usable for programming and data monitoring purposes.

(3) Controller Hardware

- (a) The CPU shall be a self-contained unit and will provide control program execution and support remote or local programming. This device will also supply I/O scanning and inter-controller and peripheral communication functions.
- (b) The operating system firmware shall be contained in non-volatile memory. An option shall be possible to store both the user program and system firmware in a removable non-volatile memory for backup/restore purposes.

- (c) The operating system firmware can be updated via a separate software update tool to allow for easy field updates. The controllers shall allow the operating system to be updated using a suitably configured removable non-volatile memory card.
- (d) The controller shall contain a minimum user memory of .6 Mbyte.
- (e) The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating indicators on the controller's faceplate.

<u>LED Function</u>	<u>Label</u>	<u>Color</u>
Module Status	OK	Green/Red
Force State	FORCE	Yellow
Controller Mode	RUN	Green
SD Activity	SD	Green/Red
I/O State Status	I/O	Green/Red
Network Status	NS	Green/Red
Ethernet port 1 Link status	Link 1	Green
Ethernet port 2 Link status	Link 2	Green

- (f) The CPU shall include a method of storing energy to provide power backup for user programs and data when the main power supply is not available.
- (g) The front panel of the Controller shall include a mounted mode switch. The mode switch shall select the following Controller modes: RUN – No control logic edits possible, program always executing; PROGRAM – Programming allowed, program execution disabled; and REMOTE – Programming terminal can make edits and change processor mode, including test mode, whereby the logic executes and inputs are monitored, but edits are not permanently active unless assembled.
- (h) The front panel of the Controller shall include a USB port, to support upload and download, online edits, firmware upgrades, and bridging to other modules in the same chassis.
- (i) The front panel of the Controller shall include an integrated latching mechanism for the purpose of securing the removable Secure Digital card.

- (j) The Programmable Automation Controller shall operate with or without removable media installed.
- (k) All system modules, local and remote chassis shall be designed to provide for free airflow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be required.
- (l) The controller shall include an integrated Real Time Clock (RTU). This clock value should be in a form of a predefined tag and should be accessible via logic or remotely.

(4) Power Supplies

- (a) The Programmable Automation Controller shall operate using module power of (24VDC nominal).
- (b) A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Other power supplies shall provide power to remotely located racks.
- (c) At the time of power-up, the power supply shall inhibit operation of the controller and I/O modules until the DC voltages of the backplane are within specifications.
- (d) In addition to the electronic protection described above the power supply shall offer a failsafe fuse that is accessible by the user.

(5) Program Creation and Storage

- (a) Memory capacity shall be selectable to allow for the most economical match to the intended application. It shall be possible to upgrade to a controller with a larger memory size simply by saving the program, upgrading the controller and downloading the program to the new system without having to make any program changes.
- (b) The energy storage module shall provide enough power for the controller to write all program and variable data to internal non-volatile memory during a loss of power. A faulty energy storage module shall generate a minor fault and will be detectable in ladder logic.

- (c) The controller shall provide the capability to use commercially available, removable nonvolatile Secure Digital memory cards. Secure Digital cards shall be available from the supplier as an industrial rated device suitable for use in the same environment as the controller.
- (d) The controller will have the ability to store the user program, controller firmware and firmware for all other modules residing in the same chassis to the removable Secure Digital memory card. Additionally, when memory is restored a user selectable option to be restored in Run mode or Program mode shall be provided.
- (e) The removable Secure Digital memory card shall support a Windows file system allowing multiple files to be stored on the card. The user can manually trigger the controller to save or load from the card and also configure the controller to load from the card on power up.
- (f) The operator should be able to backup volatile memory, including data and program logic onto a personal computer storage device.
- (g) All user memory in the controller not used for program storage shall be allocable from main memory for the purpose of data storage. The Programmable Automation Controller system shall be capable of storing 4 data types:
 - i. Predefined
 - ii. User-defined
 - iii. Module-defined
 - iv. Add-on defined
 - a) User-defined: User defined data is related to structures. Each structure shall contain one or more data definitions, referred to as members. User defined tags shall contain up to 500 members.
 - b) Module-defined: Object includes a structure for each I/O module and system or module specific information (hidden from user).
 - c) Add-On defined: Add-on defined data type includes the Local and Parameter tags of the add-on instruction. It does not include the logic.

- (h) All data shall have the option to be displayed in ASCII, Binary, Octal, Hexadecimal, or Decimal radices. Function-specific data types such as PID, Axis, Axis Group or Message shall have dedicated displays available annotating the meaning of specific control bits and words within them and allowing for selective control where appropriate.
 - (i) If instructions or entire rungs are intentionally deleted from an existing logic program, the remaining program shall be automatically repositioned to fill this void. Whenever contacts or entire rungs are intentionally inserted into an existing program, the original program shall automatically be repositioned to accommodate the enlarged program. All rung comments shall maintain their original links.
 - (j) The number of times a normally open (N.O.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory capacity to store these instructions.
 - (k) The number of times a timer or counter can be programmed shall be limited only by the memory capacity to store these instructions.
 - (l) Controller programs shall have immediate access to the sub elements of control structures by address and sub element mnemonic, such as timer accumulator value, timer done bit, or PID Process Variable value.
- (6) Security
- (a) The Programmable Automation Controller shall utilize digitally signed firmware to guard against malicious or fraudulent firmware downloads.
 - (b) The Programmable Automation Controller shall be configurable to only accept firmware updates from authorized users.
 - (c) The Programmable Automation Controller shall be configurable to allow modification only by authorized users.
 - (d) The Programmable Automation Controller project files shall be configurable to allow modification only by authorized users.
 - (e) It shall be possible to determine if the configuration of a Programmable Automation Controller has been modified.

- i. It shall be possible to make this determination quickly – on the order of one second after the modification has been made.
 - ii. It shall be possible to make this determination from another Programmable Automation Controller or from PC based software monitoring the Programmable Automation Controller.
- (f) It shall be possible to configure the Programmable Automation Controller as to what events constitute configuration changes. Examples include, but are not limited to:
 - i. Online edits modified controller program
 - ii. Firmware update attempted
 - iii. Controller mode change
 - iv. Removable media inserted or removed
 - v. Constant tag value changed
- (g) The Programmable Automation Controller shall keep a log of its most recent configuration changes. The Programmable Automation Controller shall expose the log for use by PC based software.
- (h) The Programmable Automation Controller shall allow individual tags, memory addresses, or variables to be configured by external applications according to each element's user defined access level.
 - i. These individual tags, memory addresses, or variables shall be configurable to be read/write, read only, or none.
 - ii. The Programmable Automation Controller shall enforce these access levels at runtime.
- (i) The Programmable Automation Controller shall allow individual tags, memory addresses, or variables to be configured as constants to prevent controller logic from changing an elements value.
- (j) Individual routines or custom instructions in the Programmable Automation Controller shall be configurable to prevent modification or viewing by unauthorized individuals.
- (k) Custom instructions can be digitally signed so that their contents can be easily audited for unexpected changes.

(7) Installation

- (1) Installation shall be in compliance with all manufacturer requirements, instructions and contract drawings, including:
 - (a) Space surrounding the PLC to maintain adequate cooling.
 - (b) Conditioning of space surrounding the PLC enclosure to maintain the manufacturer's ambient temperature and humidity ranges.
 - (c) Accessibility of PLC diagnostic lights, communication ports and memory modules – these components shall be free from obstructions at all times.
