CITY OF TAMPA, FLORIDA - RFQ
c/o Contract Administration Department
306 East Jackson Street #280A4N
Tampa, Florida 33602

25-C-00024 Howard F. Curren AWTP High Purity Oxygen Generation Facility Replacement Design Build

PUBLIC ANNOUNCEMENT IN COMPLIANCE WITH REQUIREMENTS OF SECTION 287.055, FLORIDA STATUTES (CONSULTANTS' COMPETITIVE NEGOTIATION ACT) APPLICABLE LAW, EXECUTIVE ORDERS, RULES, REGULATIONS, AND THE CITY'S STANDARD PROCEDURES. A NOTICE OF INTENT TO AWARD SHALL BE POSTED, IF AT ALL, ON THE CITY'S WEBSITE ACCESSIBLE BY UTILIZING THIS WEBSITE LINK: www.tampagov.net/contract-administration/programs/architectural-engineering-construction-and-related-rfqs .

The City of Tampa Wastewater Department desires to obtain Design-Build Services for the replacement of the high purity oxygen generation facility located at the Howard F. Curren Advanced Wastewater Treatment Plant.

Services will be provided under a contract with negotiated fixed fees for selection and evaluation of the HPO generation system, final design, permitting, project management, overhead, profit, and a guaranteed maximum price with appropriate surety bonds. Services will also include, but are not limited to, engineering investigations, site planning, cost estimating, advertising and administration of subcontracts, start-up, O&M manuals, training, and all related work required for a complete project.

Background: Howard F. Curren AWTP is permitted to treat 96-MGD with a Type I two-stage, high rate (pure oxygen and fine bubble aeration) activated sludge biological nitrification/denitrification domestic wastewater treatment plant. This plant is operated to discharge advanced wastewater treated, high-level disinfected and de-chlorinated effluent to Hillsborough Bay. Currently annual average daily flows are 60 MGD and peak flows of 200 MGD.

The treatment plant currently has two cryogenic oxygen generation plants to produce high purity oxygen that is used in the HPO reactors to oxidize influent biological oxygen demand (BOD) that remains in the water following the primary sedimentation tanks. The two plants were built in 1977, each with a capacity of 59-tons per day. Changes in plant operation were later made that resulted in decreased oxygen demand and HPO reactors now use around 25 to 34 tpd on an annual average basis. The oxygen plants have been refurbished and modified to maintain performance and meet the oxygen demands of the aeration system. The plants have a turn down capability of 27 to 44 tpd and excess oxygen produced by the plants is stored in liquid oxygen storage tanks to provide backup if the oxygen plants are not operating. In 2004, the City made improvements to Plant No. 1 and used it exclusively until 2015 when plant No. 2 was refurbished. Due to the condition of the Plant No.1, currently only Plant No. 2 remains in operation. Since Plant No. 2 is due for rehabilitation, the City recently completed a study to evaluate alternatives for the replacement of the HPO system in lieu of continued rehabilitations of the existing cryogenic plants. The results of this evaluation recommended the replacement of the cryogenic systems with a new 59 tpd vacuum pressure swing adsorption (VPSA) HPO generation system.

The scope of the design-build contract will include but may not be limited to:

1. Evaluation and selection of VPSA equipment and manufacturer
2. Determining equipment layout and requirements for constructing and installing the system at the treatment plant
3. Complete design of the installation
4. Construction and installation of the system
5. Start up and commissioning the system

Estimated fee is $35,000,000-$45,000,000

Additional material may be found at demandstar.com and at: https://www.tampa.gov/contract-administration/programs/architectural-engineering-construction-and-related-rfqs .

Questions may be directed to Jim Greiner, P.E., Contract Administration, City of Tampa, (813) 274-8598, or E-Mail jim.greiner@tampagov.net.

A Pre-Submittal Conference will be held at 2 P.M. April 29, 2025, in the Howard F. Curren AWTP Maintenance Training Room 2700 Maritime Blvd, Tampa, FL 33605. The only site visit/walk-through will follow the meeting. Firms must email names, cell phone numbers and companies represented for

all attendees a minimum 24 hours in advance to Deann.Wheeler@tampagov.net and Jeremy.Beck@tampagov.net to obtain security clearance and to be registered in the treatment plant emergency notification software. Attendance is not mandatory.

In accordance with the Americans with Disabilities Act ("ADA") and Section 286.26, Florida Statutes, persons with disabilities needing a reasonable accommodation to participate in this public hearing or meeting should contact the City of Tampa's ADA Coordinator at least 48 hours prior to the proceeding. The ADA Coordinator may be contacted via phone at 813-274-3964, email at TampaADA@tampagov.net, or by submitting an ADA - Accommodations Request form available online at tampagov.net/ADARequest.

An individual or entity ("Firm") responding to this RFQ must provide evidence of any required licenses, certificates, or registrations with its submission or within 10 days thereof in order to be considered. The City shall own all ideas, documents, plans, and materials developed as a result of this solicitation and Firm is informed same shall be subject to reuse in accordance with Section 287.055(10), Florida Statutes. Firm (i) confirms it has read and is familiar with Section 119.071(3), Florida Statutes regarding certain building plans, blueprints, schematic drawings, which depict the internal layout and structural elements of a building, facility, or other structure owned or operated by the City or other agency that are per said section exempt from Section 119.07(1), Florida Statutes and Section 24(a), Art. I of the Florida Constitution ("Exempt Plans") and (ii) agrees Firm shall remain in compliance with same, including maintaining the exempt status of such Exempt Plans for so long as they are held by Firm or otherwise in its possession. Bid openings and tabulations for subcontracts must be made available to the City. Pursuant to Section 2-282, City of Tampa Code, during the solicitation period, including any protest or appeal, NO CONTACT with City officers or employees is permitted from any proposer, other than as specifically stated in this solicitation. The City may cancel, withdraw, or modify this RFQ at any time and reserves the right to reject any or all responses and to waive irregularities, formalities, and informalities as it determines in the City's best interest. The City of Tampa will not request documentation of or consider a bidder's (proposer's) social, political, or ideological interests when determining if the bidder (proposer) is a responsible vendor and will not give preference to a proposer based on the proposer's social, political, or ideological interests.

Firms should consider applicable concepts in the City's Climate Action And Equity Plan as posted at https://www.tampa.gov/document/climate-action-and-equity-plan-122846 .

In order to apply for 5 "Ban-The-Box" bonus points, a firm must provide the documentation required pursuant to the "Ban-The-Box" ordinance listed at https://library.municode.com/fl/tampa/ordinances/code_of_ordinances?nodeId=1171018,

Firms desiring to provide these services to the City must submit a single electronic file in searchable PDF format, Smaller than 10MB, that includes the attached RFQ Transmittal Memorandum completed as appropriate, a Letter of Interest addressed to Brad L, Baird, P.E., Chairman, and referring to this RFQ by number, together with a Statement of Qualifications and any supplemental material allowing evaluation for further consideration (short-listing) based upon the following criteria/point system: Successful Comparable Project Experience, (65); Workload and Availability (5 pts); Past Performance/Low amount of City Work (5 pts); Standard Form #A305 (5 pts)(Submit any confidential financial info in a separate PDF.); "Ban-The-Box"(5pts); Planned WMBE/SLBE Solicitation & Utilization, Form MBD 10 & 20 (20 pts).

The PDF file must be **E-Mailed to ContractAdministration@tampagov.net BEFORE 2 P.M., May 15, 2025.**

As a courtesy, the City will endeavor to provide an email acknowledgement usually sent within a few days after submission receipt (submissions received on the day of the deadline may not be acknowledged before the deadline or at all). It is Firm's responsibility to confirm its submission (PDF file) has been received.

RFQ: 25-C-00024 DESIGN-BUILD SERVICES FOR THE Howard F. Curren AWTP High Purity Oxygen Generation Facility Replacement

PREPARED BY:

Charlie Lynch, P.E. – PROJECT COORDINATOR
WASTEWATER DEPARTMENT

CITY OF TAMPA

April 2025

DESIGN CRITERIA PACKAGE

1. Purpose

The City of Tampa has prepared the Design Criteria Package for RFQ: 25-C-00024 Design-Build Services related to Howard F. Curren AWTP High Purity Oxygen Generation Facility Replacement. It is the City's intent that the rehabilitation be accomplished through a progressive design-build approach and be completed through the development and execution of a Guaranteed Maximum Price (GMP) proposal. The City may, at its option, directly purchase certain products for use on this contract.

1.1 The scope shall include, but not be limited to the following:

- Preliminary design services that will include:
    - Evaluation and selection of equipment and manufacturers
    - Preliminary Equipment layout and site requirements
    - Preliminary requirements for geotechnical, structural, mechanical, HVAC, and electrical and control system improvements
- Comprehensive design services of selected improvements
- Site planning
- Regulatory permitting
- Preconstruction Services with Development of Guaranteed Maximum Price (GMP) for Construction
- Construction of improvements, including the need for any demolition and rehabilitation of existing facilities
- Logistic sequencing for constructing improvements while maintaining plant operations
- Start-up and testing
- Operation and Maintenance manuals
- Training in the operation of the selected improvements
- Scheduling of all logistics
- Construction Management and Oversight
- Estimated Project Cost: $35,000,000.00-$45,000,000.00

1.2 This document provides the criteria for the design and construction of the replacement of the high purity oxygen generation facility. The intent is to list the minimum design-build criteria necessary for achieving this replacement.

1.3 This package is not a specification or prescriptive checklist and is not intended to replace the professional judgment by a competent licensed professional engineer after coordination with the end-user and stakeholders of the City of Tampa.

1.4 Additionally, nothing in this document should preclude consideration and use of emerging technologies and commercially available products if they can be proven to result in a successful and satisfactory design for the replacement of the high purity oxygen generation facility.

2. Design Criteria

2.1 The design is based on providing facilities and improvements that will meet the needs of the Wastewater Department to effectively and efficiently operate the high purity oxygen generation facility and related treatment plant facilities. These needs are based on mission and operation requirements. The design should consider existing conditions and the current and future needs of the Department. It is imperative that the final designer and preparer of construction documents fully understand the operational requirements, permitting, site logistics and all related requirements to design the facility and improvements accordingly.

2.2 The Howard F. Curren AWTP currently has two cryogenic oxygen generation plants to produce high purity oxygen that is used in the High Purity Oxygen (HPO) reactors to oxidize influent biological oxygen demand (BOD) that remains in the water following the primary sedimentation tanks. The two plants were built in 1977, each with a capacity of 59-tons per day (tpd). Changes in plant operation were later made that resulted in decreased oxygen demand and HPO reactors now use around 25 to 34 tpd on an annual average basis. The oxygen plants have been refurbished and modified to maintain performance and meet the oxygen demands of the aeration system. The plants have a turn down capability of 27 to 44 tpd and excess oxygen produced by the plants is stored in liquid oxygen storage tanks to provide backup if the oxygen plants are not operating. In 2004, the City made improvements to Plant No. 1 and used it exclusively until 2015 when plant No. 2 was refurbished. Due to the condition of the plant No.1, currently only plant No. 2 remains in operation.

2.3 The City recently completed a study to evaluate alternatives for the replacement of the HPO generation system in lieu of continued rehabilitations of the existing cryogenic plants. The results of this evaluation recommended the replacement of the cryogenic systems with one new 59 tpd vacuum pressure swing adsorption (VPSA) HPO generation system. The system will be owned, maintained, and operated by the City. The VPSA system shall use a molecular sieve adsorbent to separate oxygen from air at ambient temperatures and shall produce an oxygen product of 92%-93% purity. The system shall consist of a low pressure compressor and a vacuum pump, two (or more) molecular sieve beds, a product surge tank, interconnecting piping, and a programmable logic control (PLC) based control system. The supplier/manufacturer of the VPSA system shall have extensive experience with providing systems designed for wastewater treatment plants.

2.4 Design build services shall include the design and construction of all mechanical, structural, civil, HVAC, architectural, and electrical and control system improvements for the new facility. The facility shall be designed to meet all building code and all other related code requirements. It is

anticipated that the new facility will be housed within a concrete structure to meet noise abatement requirements and to protect the equipment. The facility shall also include an enclosed air conditioned control room for plant staff to monitor and operate the system.

2.5 The design build services shall include the design and construction of the electrical improvements needed to provide power to the new oxygen generation system. The design build team will be responsible for coordinating these improvements and providing necessary provisions to maintain continued operation of the treatment plant. The design build services shall include an arc flash assessment for selected electrical equipment and implementation of the safety measures needed to protect personnel from the potential Arc Flash Risks.

2.6 The Design Build team shall prepare and submit detailed construction plans and specifications at 60%, 90% and 100% phases. All drawings shall be produced in 3D (i.e. AutoCAD Civil 3D or Rivet as compatible for rendering) and shall be accurately georeferenced. Drawings shall meet the current Wastewater Department Drafting Standards.

2.7 The Design Build team will provide a GMP estimate at the 60% design phase and a final GMP after substantial completion of the design plans and specifications. The 60% GMP will be used to determine small and minority business subcontracting opportunities.

3 Site Development Criteria

The Howard F. Curren AWTP is located at 2700 Maritime Blvd. The new oxygen generation facility will be located on the treatment plant site near the existing oxygen cryogenic generation and HPO reactor facilities. The Design Build team shall be responsible for developing the final location and site requirements for the facility and for coordinating the location of the facility and related improvements with existing and planned facilities at the treatment plant.

4 Facilities Development Criteria

4.1 Conduct preliminary design services that will include the following:

- Evaluate current and future treatment plant operational information to determine and confirm operational requirements for the new oxygen generation facility.

- Determine available systems and equipment suppliers and perform evaluations to establish recommendations for final equipment selections. Equipment lead time shall be determined and considered as part the evaluation of the equipment selection as it is essential that the project be completed in a timely manner. Equipment selections shall include recommendations for the need and timing of early equipment procurement.

- Determine preliminary equipment layouts and preliminary requirements for geotechnical, site, structural, mechanical, HVAC, and electrical and control system improvements.

- Prepare cost estimate for selected improvements.

The City will evaluate the preliminary engineering information and will make a final selection of the required improvements that will be used for the final design.

4.2 Create final plans and specifications for the selected improvements that will include: Finalized Auto CAD and pdf drawings, technical specification and pricing proposals developed to a GMP document with all associated exhibits (scope, pricing, qualifications). Present final design; site plan, site preparation, construction schedule, equipment purchases and placement, building permits and all required approvals from regulatory agencies and local authorities.

5 Environmental Criteria/Permitting

The Design Build team will be responsible for all required environmental testing and permitting needed to complete the project. The scope of these requirements will be determined by the Design Build team based on the selected improvements and construction requirements. At a minimum it is anticipated the following tasks shall be completed:

- Performance of an Asbestos and Lead Paint survey. If the survey indicates any asbestos or lead paint that is designated to be removed, these items must be removed and disposed by a licensed contractor in accordance with Environmental Protection Commission (EPC) Standards.
- Preparation of plan sets, submittal, and responses to request for information (RFI's) to obtain building permits for the construction of the facility.

6 Project Management and Oversight

The Design Build team will be responsible for project management activities and oversight of the High Purity Oxygen Facility replacement with consistent coordination with the City during the design and construction portions. The contractors utilized for the project shall have the suitable personnel and equipment, resources, financial stability and experience to accomplish the Project requirements and objectives.

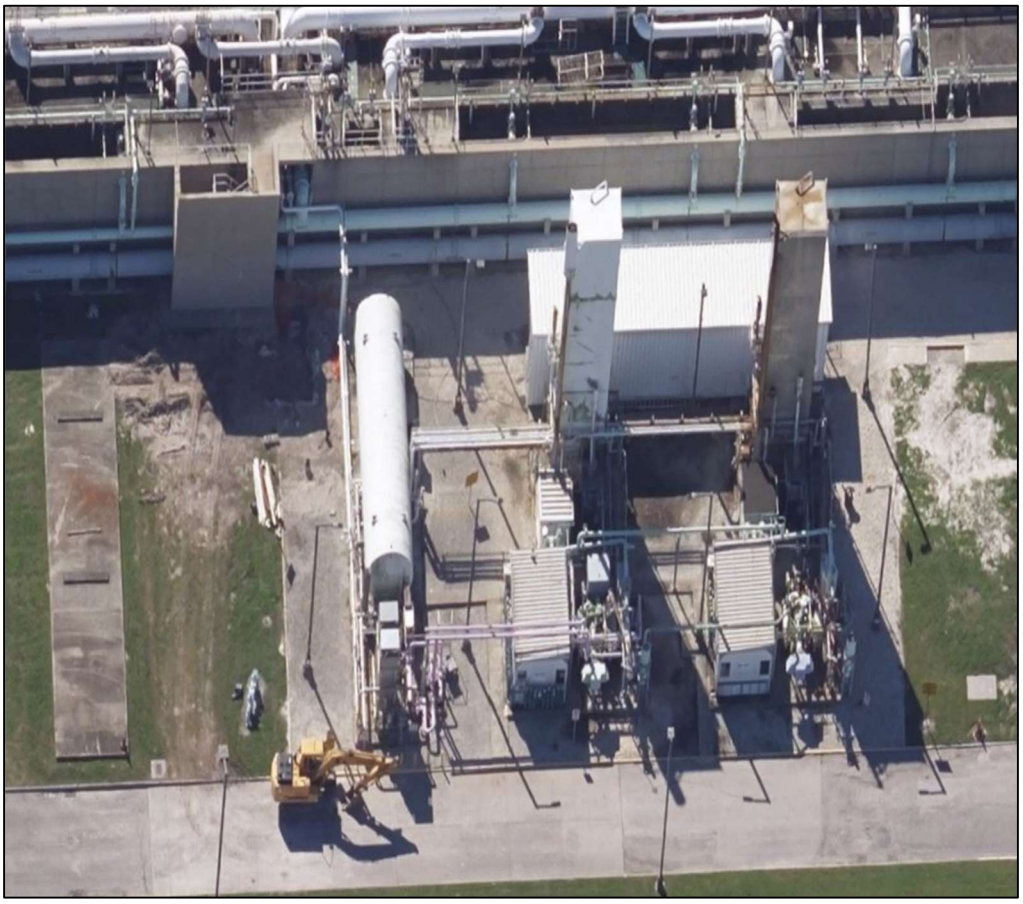
7 Start-up/Operations/Training

7.1 The Design Build team shall provide start-up of the new oxygen facility. The City will continue to operate the existing oxygen facility during the construction of the new facility. The design build team will be completely responsible to ensure the construction of new facility does not interfere or interrupt the operation of the existing oxygen facility or the operation of other treatment plant facilities. The City will not take over operation and maintenance of the new oxygen facility until the project is substantially complete as determined by the City.

7.2 The Design Build team shall provide detailed operation and maintenance (O&M) manuals to the City for review and approval. Upon approval, an electronic copy and a specific number of hard copies of the O&M manuals will be required. The actual quantity and specific format of the O&M manuals will be clearly defined during the design phase of the project. Specific equipment information will also need to be compiled through the City's Asset Tracking form and conveyed to the City so that the equipment's asset data can be entered in the City's Maintenance Management System.

7.3 The Design Build team shall provide AutoCAD as-builts drawings accurately depicting the as-built conditions of the facility and other improvements constructed during the project. Hard copies of the as-built drawings will also be required as will be determined during the design phase.

7.4 The Design Build team shall provide all Training on the equipment necessary for the proper maintenance and operation of the facility. The specific training requirements and equipment requiring training will be provided during the final design phase of the project.



Howard F. Curren AWTP – Master Plan Improvements: HPO Generation Alternatives Evaluation

Summary Report - Final

City Project No. 20-C-00001
Reliable Tampa Partners (RTP) Project No. 20-500
Hazen and Sawyer Project No. 41077-013 Task 211
August 7, 2023

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1. Introduction

The City of Tampa's (City) Howard F. Curren Advanced Water Treatment Plant (HFC AWTP) currently owns and operates two cryogenic oxygen generation plants to produce high purity oxygen (HPO). The HPO generated is used in the HPO reactors to oxidize influent biochemical oxygen demand (BOD) that remains in the water following the primary sedimentation tanks. The two plants were built in 1977, each with a capacity of 59 tons per day (tpd) of oxygen at 95% purity. Over the years these two facilities have been upgraded, refurbished, and modified to maintain performance or to better meet the oxygen needs of the aeration system. As part of a 1998 plant upgrade, Plant No. 2 was re-rated to a capacity of 80 tpd. Around the time of this upgrade, changes were made to the downstream treatment process which resulted in decreased oxygen demand. As a result, the City modified operations of the two cryogenic oxygen generation plants to operate Plant No. 1 in the colder months and Plant No. 2 in the warmer months. In 2004 the City made improvements to Plant No. 1 and used it exclusively until 2015 when Plant No. 2 was refurbished. Plant No. 2 is currently the only plant that is in operation.

The HPO reactors use around 25 to 34 tpd of HPO on an annual average basis. The cryogenic generators have a turn down capability of 27 to 44 tpd. Historically, excess oxygen production was stored in the existing liquid oxygen (LOX) storage tank with a storage capacity of 25,000 gallons (100 tons). The LOX storage tank is typically kept at 50% capacity to provide 2-3 days of storage if the HPO generation system is not working. However, recently operators have had to supplement the oxygen production with the stored LOX due to leaks in the cryogenic plant.

The existing HPO generation system is due for additional rehabilitation soon. Prior to moving forward with rehabilitation, the City wishes to evaluate alternatives to renew the HPO generation system rather than spending maintenance capital on continued improvements of the existing systems. Both plants have had long periods of inoperability due to broken components. This evaluation will consider how best to renew the HPO generation system to maximize customer capital throughout the life cycle of the equipment, maximize operator safety, and increase reliability.

2. Alternatives

The following four alternatives were evaluated for the HFC AWTP:

1. Adding one new 59 tpd cryogenic HPO generation system
2. Adding one new 59 tpd vacuum pressure swing adsorption (VPSA) HPO generation system
3. A long-term purchasing agreement for LOX with additional storage volume
4. Public-private partnership opportunities

Each of the four alternatives were evaluated based on approximate purchase costs, site layout and footprint, operational and maintenance requirements, electrical requirements, installation lists with references of similar applications, and time to complete installation. Proposals provided by manufacturers are provided in Appendix A, B, and C.

2.1 Alternative 1: Cryogenic HPO Generation System

The original 59 tpd cryogenic oxygen generators at the HFC AWTP were designed and supplied by Air Products and Chemicals (Air Products). Alternative 1 includes a like-for-like replacement of one of the existing cryogenic HPO generation plants. The new cryogenic plant would be sized for the same 59 tpd capacity and will continue to be owned, operated, and maintained by HFC AWTP staff. Cryogenic plants, like the units installed and operated at the HFC AWTP, use very low temperature to first liquefy air and then separate the contained oxygen through a multiple distillation process. Based on historical data (there are many 50, 60 and 70 year old operating cryo plant in the field today), we know that the distillation columns in the coldboxes of the HFC units are still usable and should have considerable additional life. The distillation columns are the most expensive part of the cryogenic plant. However, because of the City's past negative experience with refurbishment of the equipment on these existing units it is preferable to instead perform a full replacement of one of the existing plants.

Distillation of liquified air is the oldest process for the production of pure oxygen gas in today's marketplace, having been around in excess of a 100 years. But the temperatures required for the process (-300^{o}F) create maintenance issues that must be addressed on a yearly basis. There are a few companies that still have the expertise to perform these maintenance activities, namely Solutionwerks and Ranch Cryogenics. However, the ranks of cryogenic maintenance companies are thinning by the year.

Every year the HFC cryo plant has to be shutdown and warmed to ambient temperature (this maintenance activity is referred to as the annual turnaround). Once the plant is warm, the safety equipment associated with the plant has to be heated to 200^{o} – 300^{o}F to "burn-off" the hydrocarbons that have been captured from the incoming air during the last year. During the burn-off period the reversing heat exchanger switching valves are checked and rebuilt if needed. The lube oil system is also checked during the hydrocarbon burn-off period, as well as checks are done on the main air compressor associated with the plant. Once the safety equipment has been regenerated and any other required maintenance is performed, the entire plant begins the relatively slow process of drying out and cooling back down to operating temperatures again. The duration of this annual turnaround is generally about a week if everything goes properly. However, it is not uncommon with older cryo plants for this turnaround period to extend longer than a week. During the turnaround period, the cryo plant is totally out of commission and the aeration system is supplied with oxygen via purchased, trucked in LOX. If all goes according to plan and the turnaround lasts just a week, the HFC aeration basins will need 350 to 400 total tons of oxygen during this turnaround downtime. The current LOX storage tank has a storage capacity of approximately 100 tons. The new, larger storage tank planned for installation has a capacity of 120 tons. The combined 220 tons of storage will still require LOX deliveries to during the turnaround period to support the aeration system.

Within the last 5 to 10 years, the cryogenic oxygen generation market has shifted away from designing and selling "small" cryogenic oxygen generators. A "small" generator system is defined as 400 to 500 tpd, which is substantially larger than the 60 tpd capacity needs at HFC AWTP. The major industrial gas companies including Linde LLC, Air Liquide, and Air Products no longer provide equipment for small cryogenic plants. Despite this market shift, small cryogenic plants are still available from other entities outside of the major industrial gas companies. For example, Nikkiso Cosmodyne is a recognized cryogenic equipment company with a long history in the gas separation marketplace. Nikkiso Cosmodyne is a

worldwide supplier of cryogenic processes, with gas separation being just one type of product offered. For this analysis, Cosmodyne's economic and technical details were used to evaluate this option (Appendix A).

2.2 Alternative 2: Vacuum Pressure Swing Adsorption (VPSA) HPO Generation System

Alternative 2 proposes to replace one existing 59 tpd cryogenic plant with a 59 tpd sized ambient temperature oxygen generator called a Vacuum Pressure Swing Adsorption (VPSA) plant. The VPSA will be owned, operated, and maintained by the HFC AWTP staff, similar to the existing cryogenic oxygen generators. VPSA plants have been in the industrial and wastewater marketplace since the early 1990s and is the current state-of-the-art method for producing "small" (<500 tpd) quantities of oxygen gas and can be supplied by all the major industrial gas companies. At present, VPSA plants are the most energy efficient, yet simple to operate method of producing gaseous, high-purity oxygen for smaller production capacities.

VPSA systems use molecular sieve adsorbent (which is an engineered, synthetic zeolytic material) to separate oxygen from air at ambient temperatures. The system consists of a low-pressure compressor and a vacuum pump, two (or more) molecular sieve beds, a product surge tank, interconnecting piping, and a PLC based control system. The process operates at ambient temperatures, low pressures, and produces an oxygen product of 92% – 93% purity. The VPSA system does not require any additional purchased chemicals, and the HFC AWTP could remain self-reliant for HPO supply.

In the VPSA system the molecular sieve functions much like filter media in that it removes impurities (in this case nitrogen) from the desired product (oxygen). When the molecular sieve becomes filled with nitrogen, it is regenerated by de-pressurizing the sieve bed, which releases the nitrogen back to the atmosphere. The two (or more) sieve beds alternate regeneration. When one bed is producing oxygen the other is regenerating, which results in a continuous supply of product oxygen. The entire process is automatically controlled, requiring little, if any, operator attention. A flow schematic of a typical VPSA process is shown in Figure 2-1.

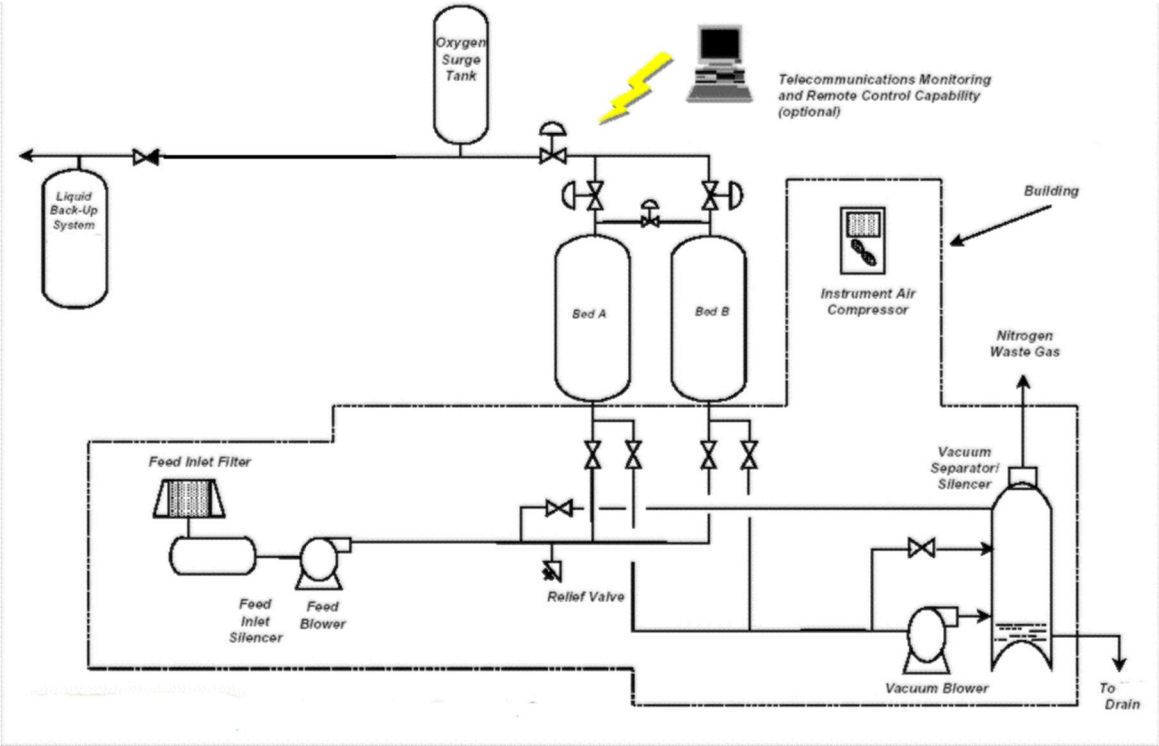


Figure 2-1: Typical VPSA Process Flow Diagram (source: Linde, LLC)

VPSAs, like any piece of equipment, require preventative maintenance. Unlike a cryogenic plant, however, annual maintenance requirements for a VPSA are relatively minimal. This is due to two critical factors: there is less equipment associated with the VPSA and the entire VPSA process operates at ambient temperatures. Annual preventative maintenance for a VPSA usually requires taking the plant down and testing the sieve bed switching valves. Valve testing takes a couple of hours. If the valves are leak tight, the plant can be put back online immediately after the few hour testing procedure. Typically, since the valves are in a high cycle duty, one or more valves do leak and need rebuilding. The rebuilding process is simple, consequently the average annual preventative maintenance downtime is generally about 2 to 3 days for the VPSA. Also during the VPSA annual shutdown, it is typical for both the vacuum pump and blower to have the oil changed. And unlike for the cryo plant, the VPSA preventative maintenance does not require expert outside assistance. The VPSA will be shutdown, maintained, and restarted solely by the HFC operations and maintenance staff. No third party assistance will be required. Additionally, the current LOX storage capacity (i.e., the old and new LOX tanks) has sufficient capacity to cover, without additional deliveries, the downtime required for VPSA preventative maintenance.

2.2.1 VPSA Manufacturers and Designs

There are two approaches to VPSA sieve bed design. The conservative design approach has a lower risk of fluidization of the sieve bed but has a slightly higher power consumption. The alternative design approach, typically provided by big industrial gas suppliers (Air Products, Air Liquide, Linde LLC, etc.), configures the sieve beds for a minimum pressure drop which results in approximately 10% reduction in power

consumption, but requires more operator engagement to properly monitor conditions to maintain the sieve bed.

The big industrial gas companies have systems with the lowest power consumption per ton of oxygen gas generated. To conserve power, the big industrial gas suppliers configure their sieve beds for minimum pressure drop. This type of design provides nominal power savings but risks fluidization of the sieve bed itself. A fluidized bed can cause physical degradation of the sieve itself, which may eventually require replacement of the sieve. Although most of the industrial gas companies will sell their VPSA units to clients, they encourage clients to execute a sale of gas contract for their equipment where their engineers monitor and operate the equipment. These are highly trained engineers with a thorough understanding of VPSA equipment and how to operate it. They are capable of spotting and correcting operating scenarios that could result in bed fluidization before those conditions happen. The typical wastewater plant operator, with all his other responsibilities, may not have the time available to do this consistently and prevent the gradual degradation of the sieve.

There are other VPSA vendors that do not offer sale of gas contracts, and instead sell their systems directly. These vendors, like AirSep, approach sieve bed design from a more conservative angle. Their objective, given the expense of sieve for their customers, is a bed design that essentially precludes fluidization. This bed design results in about 10% more power consumption but results in a VPSA unit that is more forgiving operationally. Sieve bed replacement requirements are a vendor proprietary item. When specifically asked about the life of their sieve, all the vendors say it doesn't need to be replaced for at least 30 or 40 years. It is difficult to actually confirm this replacement estimate because the oldest VPSAs are only now approaching these ages (therefore, the vendors themselves probably don't know the life of the sieve). What can be said is that the oldest, continuously running VPSA in the wastewater marketplace is approaching 30 years old. It still has its original sieve. Furthermore, there are no reports from any of the other VPSAs that are currently in the field at wastewater plants that are indicating the need to replace sieve. For this study it was assumed that sieve replacement, if required, would occur well beyond the 15 year life cycle considered.

Even though the VPSA technology has been in the marketplace for more than 30 years, sieve bed designs that minimize pressure drop to reduce power consumption are relatively new. Therefore, the risks and consequent costs associated with this type of bed design has not been definitively established. The preceding discussion about the differences between bed designs is theoretically sound, but there is a lack of operating experience needed to definitively support whether one bed design is more forgiving than another. Given the risk associated with bed fluidization, and lack of operational data to support otherwise, the bed design that precludes fluidization is preferred for this option to purchase and operate the VPSA. AirSep's design was used as the basis for this Alternative (Appendix B).

2.3 Alternative 3: LOX Purchase with Additional Storage Volume

Alternate 3 proposes eliminating the oxygen production facilities at the HFC altogether and replacing them with LOX storage supported by a long-term LOX supply contractor with off-site LOX production. These contractors are established, large industrial gas companies like Linde LLC, Matheson, Air Products, or another. The industrial gas suppliers generally are interested in LOX supply contracts for wastewater treatment plants if the wastewater plant's oxygen demand is less than 20 tpd. Because of the 59 tpd LOX

requirements of the HFC plant, however, this option may not even be viable for the reasons presented in the last paragraph. However, for studies such as this, viability can be assumed.

To properly assess alternate 3 requires an entirely new design approach compared to the other alternatives discussed herein. Since there will be no backup provisions associated with this alternative, a detailed assessment of the proper amount of on-site LOX storage is required. It was felt that this type of assessment was beyond the scope of this study, especially given the questions about the actual viability of this alternate. A cursory analysis of the currently proposed LOX storage capabilities (the old and new LOX storage tanks with a combined storage capacity of approximately 220 tons) would suggest that the amount of LOX storage currently proposed for the HFC site would be insufficient. At the HFC's current usage rate of 59 tpd, 220 tons of storage would cover the plant's needs for only about 4 days, the approximate length of a long weekend. Determining how much more storage would be needed would be a collaborative effort between all stakeholders (one of which would be the LOX supply vendor). Looking to other high purity oxygen plants that use LOX as their sole supply (all of these plants are much smaller than the HFCATWP), on-site LOX storage capacities vary from about 7 days to 21 days. Adding that much additional storage to the costs for this alternative, as it is currently configured in this study, would simply make it that much more economically unattractive.

This alternative is a relatively simple solution in terms of required equipment, but the current market for LOX and availability of suppliers makes this alternative more complicated. Although considered a "small" system in terms of on-site oxygen production (either by cryogenic or VPSA), LOX supply vendors are generally reluctant to commit to a guaranteed contract for 59 tpd supply. This volume of supply is much higher than typically seen in contracts and may impact the supplier's ability to meet all customer's needs, as LOX production facilities must allocate the facility's capacity across multiple customers. As part of this evaluation, the major industrial gas companies were contacted to gather cost estimates and determine the feasibility of a 59 tpd LOX supply contract. Only Matheson, the City's current LOX supplier, responded with input to use the City's current contract price ($1,010,000/yr per current Liquid Oxygen Purchase Agreement with Matheson, effective 14-Sep-2022 through 13-Sep-2023) for the economic evaluation. Recent market fluctuations and supply chain issues associated with LOX should also be considered when evaluating a switch. Replacing the cryogenic oxygenation system by entering into a LOX purchase agreement would make the City vulnerable to changing market conditions and other customer demands. There is also a high risk that deliveries could be interrupted during storm events.

2.4 Alternative 4: "Sale of Gas" Public-Private Partnership

Public-private partnership opportunities for Alternative 4 include an "Over-the Fence" arrangement. In this scenario, an oxygen generation plant supplier would provide the City with a Design-Build-Finance-Own-Operate delivery. The City would then enter a contract with the supplier to operate and maintain the plant for a specified duration. This typically requires a contract period of 10-30 years depending on the negotiated lease fee. This type of public/private partnership is known in the industrial gas marketplace as "Sale of Gas." This partnership would involve HFC AWTP bidding out the entirety of the new oxygen generation to an industrial gas supplier who will own, operate, and maintain a dedicated oxygen generation system, most likely a VPSA unit. The City would select the supplier and the plant supplier would then pay all the capital cost and handle the operation and maintenance of the facility. This oxygen generation system would exclusively supply the HFC AWTP's oxygen needs. The industrial gas supplier sells the gaseous oxygen at

a required quality to HFC AWTP under a long-term lease agreement. For the life cycle cost analysis the lease term for HFC AWTP was assumed to be 15 years, which is a typical duration for these types of partnerships.

Assuming a wastewater treatment plant doesn't want to own a VPSA, when a wastewater treatment plant's oxygen requirements are greater than 20 tpd, "sale of gas," not LOX, is the industrial gas supplier's preferred supply mechanism. "Sale of gas" is the predominate method that the non-wastewater marketplace uses to provide their oxygen needs. Even though the wastewater market prefers to own their oxygen generation equipment, there is one large U. S. wastewater plant that has a "sale of gas" arrangement. That plant is the large high purity oxygen facility in Louisville, KY. The "sale of gas" contract at the Morris Forman Water Quality Treatment Center is about 5 years old and the feedback from Louisville is that the arrangement operates exactly as it was advertised and that they are happy with the vendor (Linde LLC).

The oxygen generation equipment for Alternate 4 would be constructed on the HFC AWTP site. Fees for use of the land on the site occupied by the oxygen generation equipment would be negotiated with the supplier as part of the contract. The supplier will have sole access to the equipment and will be responsible for operating and maintaining his equipment for the duration of the contract period. At the end of the contract period, the supplier is obligated to remove all equipment at no cost to the City, unless the City extends the existing contract or negotiates a new contract. The contract for evaluation of this alternative was based on a sale of gas proposal provided by Air Products (Appendix C). This alternative would allow the City to avoid market fluctuations of LOX purchases, while also not being responsible for their own production.

3. Life Cycle Cost Analysis

3.1 Cost Estimating Approach

Capital costs for this analysis are based on quotes provided from the manufacturers and site-specific construction costs estimated by Reliable Tampa Partners with a 20% contingency (Appendix D). The site-specific costs assume that the new facility will require a pile foundation and need a finished floor elevation of 13 feet NAVD 1988 datum to meet FEMA flooding requirements. Equipment freight to the HFC AWTP site, installation, startup, and training costs were estimated based on past installation experience at other wastewater facilities and are generic in nature (See Appendix E). Cryogenic plant equipment removal costs were estimated based on information from an organization that specializes in cryogenic plant removal.

A lower than typical contingency was used on operating costs because for all alternatives considered, power consumption and LOX requirements are verifiable based on historical magnitudes.

This analysis focused on estimating each equipment and operating costs that were specific to each alternative and is not intended to capture all costs associated with replacing the existing cryogenic oxygen generation plants with new equipment. For example, utility costs associated with utility reconfiguration were not included. Costs presented in Appendix E are based on the American Association of Cost Estimation (AACE) Class V criteria, with accuracy range from -20% to -40% low end to +30% to +50% on high end. The site-specific construction costs were only developed for Alternative 2 (Appendix D), and

have a Class IV accuracy range. It is assumed that similar site-specific construction costs would be associated with Alternatives 1 and 4 and used accordingly to compare the alternatives.

The operating cost estimates prepared for this analysis are presented as "15-year life cycle" magnitudes, which is consistent with the assumed contract duration of Alternative 4, "Sale of Gas." These life cycle estimates incorporated inflation estimates for all ongoing annual costs, like electrical or consumable item costs. For this analysis, the assumed inflation magnitudes are shown in Table 3-1 and were assumed to be constant over the 15-year life cycle.

Table 3-1: 15-Year Life Cycle Inflation Estimates

Item	Annual Inflation
Electrical Cost	4%
Personnel Pay	1.6%
Facility Fee (alternative 4 only)	4%
Liquid Oxygen	4%
Consumables (including replacement parts)	4%

3.2 Life Cycle Cost Estimates

The 15-year life cycle cost analysis for Alternatives 1 through 4 is summarized in Table 3-2. Detailed cost estimates for each individual alternative are included in Appendix E. A contingency of 7.5% is included in the lease fee, energy costs, LOX costs and O&M costs.

Table 3-2: 15-Year Life Cycle Costs

Alternative	**1**	**2**	**3**	**4**
Cost Component	New 59 tpd Cryogenic Oxygen Generator (Owned)	New 59 TPD VPSA Oxygen Owned Generator (Owned)	Liquid Oxygen (LOX) Supply	59 tpd "Sale of Gas" Contract Operations
Lease Fee	$0	$0	$0	$26,480,000
Initial Capital Cost	$27,550,000	$26,150,000	$2,060,000[1]	$6,790,000[1]
Energy Costs	$12,210,000	$7,530,000	$0	$7,400,000
LOX Cost	$2,180,000[2]	$1,420,000[2]	$54,780,000	$1,420,000
O&M Cost	$4,350,000	$2,630,000	$10,000[3]	$60,000[3]
Total 15-Year Lifecycle Cost	**$46,290,000**	**$37,730,000**	**$56,850,000**	**$42,150,000**

1) *These cost items are for non-vendor scope items like site grading, foundations, electrical supply, lighting, HFC site safety requirements, etc.*
2) *These are the LOX costs associated with LOX evaporation from the storage tanks as well as the LOX used for annual preventative maintenance downtime. The difference shown between the new cryogenic and the new VPSA oxygen generation is due to the fact that the cryogenic plant downtime for maintenance is significantly more than that for the VPSA.*
3) *The O & M costs shown are nominal and account for minimal operator attention for data recording/review and, in the case of LOX Supply, operators occasionally checking on HFC assets (i.e, the vaporizers and LOX tanks).*

Based on review of 15-year life cycle costs, the 59 tpd VPSA system (Alternative 2) is the most economical alternative - followed by Sale of Gas Contract Operations (Alterative 4). The remaining two alternatives have significantly higher 15-year life cycle costs than VPSA. Alternative 2 is the most cost-effective oxygen supply method for the HFC AWTP.

4. Review of Alternatives

Based on discussion in the previous sections, the non-economic advantages and disadvantages for each Alternative are summarized in Table 4-1.

Table 4-1: Summary of Alternatives

Alternative	Advantages	Disadvantages
Alternative 1: New 59 tpd Cryogenic Oxygen Generator (Owned and Operated by City)	• Staff familiarity with technology and operations • Produces enough LOX to make up for evaporation losses • City owns and controls equipment • Eliminates reliance on external entities	• Most complicated process for oxygen generation • HFC AWTP staff handles operations and maintenance • Significant capital investment
Alternative 2: New 59 tpd VPSA Oxygen Generator (Owned and Operated by City)	• Lowest life cycle cost and energy usage; Almost 50% less power per ton of oxygen than cryogenic • Simple process, operation, and maintenance; Starting/stopping equipment is quicker than cryogenic; Requires little operator attention • City owns and controls equipment • Eliminates reliance on external entities • Operates at ambient temperatures	• HFC AWTP staff handles operations and maintenance • Unfamiliar technology • Significant capital investment
Alternative 3: Purchased LOX Supply	• Oxygen production is completely off-site • Ease of operations • Requires no internal plant power supply • Smaller capital investment	• Highest life cycle cost; Current cost estimates indicate this may not be feasible • Requires coordination with external entity • Vulnerable to supply chain issues and changes in market conditions impacting cost • Requires frequent deliveries
Alternative 4: 59 tpd "Sale of Gas" Contract Operations	• Plant operation and maintenance handled by others • Keep HFC AWTP up-to-date technically • Smaller capital investment	• Requires coordination with external entity • Time required for contract negotiation and disputes • Higher life cycle cost than City owned and operated

4.1 Recommendation for HPO Alternative

Based on the above evaluation and cost estimates, a VPSA owned and operated by the City is the recommended approach for the HPO generation alternative. The advantages of the VPSA system include operating at ambient temperatures, starting and stoping relatively quickly as compared to cryogenic systems, requiring little operator attention, and consuming almost 50% less power to generate a ton of oxygen than cryogenic methods of oxygen production.

These general characteristics of VPSA oxygen production are universal for all vendors of the technology. However, as previously discussed, subtle technical differences in VPSA equipment's bed design sold by the large industrial gas companies (low pressure drop across sieve bed, reduced energy use) require a more hands-on operation approach. AirSep specializes in equipment with a sieve bed design that manages this risk and is therefore the recommended manufacturer for the VPSA equipment. AirSep's experience with VPSA equipment ensures a quality design and owner support from the manufacturer after construction.

Ft. Lauderdale has recently completed the construction phase of conversion from a 50 tpd cryogenic plant to a 40 tpd AirSep VPSA system. Miami-Dade County also installed two 100 tpd AirSep VPSA systems. These are two examples of Florida utilities that have experience with the preliminary phases of conversion from cryogenic to VPSA oxygen production. Other utility contacts that have converted to VPSA and have experience with operations outside of Florida are available for the City.

As noted in section 2.2.1, there are other manufacturers of VPSA equipment (Air Products, Air Liquide, Linde LLC), but since these manufacturers are primarily in the business of selling gas, not equipment, they would not be the preferred manufacturer/equipment supplier. However, they can be contacted/evaluated during the design phase.

5. Required Modifications for Recommended Approach

5.1 Electrical Requirements

This section of the evaluation describes the modifications required to the Howard F. Curren electrical system in order to accommodate the proposed AirSep system.

5.1.1 Proposed Electrical Loads

The AirSep system electrical load consists of the following:

5.1.1.1 4.16KV Loads

The proposed 1,300 HP motor for the blower and vacuum pump shall be fed via a 4.16KV service. AirSep has verified that the full-load amp (FLA) of the motor will be approximately 172 amperes at 4.16KVolts. Due to the load of the blower motor it is recommended that a Reduced Voltage Soft Starter (RVSS) be employed to start the motor. However, due to the City's recent history with RVSS's, it is proposed that the motor be served by a Variable Frequency Drive (VFD). **The VFD shall be programmed to operate at set speed only, and is intended only for startup purposes.**

Due to the nature of starting a blower motor, ICON Technologies of Tampa recommended a heavy duty 4.16KV VFD with a drive current rating of 220 amperes.

5.1.1.2 480V Loads

- 30 hp supply air/compressor – 40 amperes at 480V assumed.

- Cooling system loads (6 – 5 HP fans, 1- 5 HP pump) – 54 amperes at 480V assumed.
- AC system for Control Room – 50 amperes at 480V assumed.
- Bridge Crane – 15 amperes at 480V assumed.
- Miscellaneous Load – 25 amperes at 480V assumed.

The total estimated load to be served at 480V is assumed as 209 amperes connected with a demand load of 184 amperes.

5.1.1.3 Total Loading

As noted above, the 1300 HP Motor will be served via a 4.16KV circuit. The 480V loads will be served via a 4.16KV to 480V transformer. From section 5.1.1.2, it is anticipated that a 300KVA transformer could be used for this purpose. Therefore, the total connected load of the proposed AirSep equipment at 4.16KV would be 172 amperes (blower motor) plus 42 amperes (300KVA transformer) which equates to 214 amperes.

5.1.2 Electrical System Modifications

Currently, the existing Oxygen Generation System's 4.16KV power is derived from two existing transformers. These transformers are each 13.2KV to 4.16KV and each are rated at 3,000/3,360/4,200KVA. These existing transformers are designated as 'T-1A-1' and 'T-1B-1'.

At 4.16KV the transformers are capable of delivering 416 amperes, 467 amperes and 584 amperes at their respective ratings.

Reliable Tampa Partners is currently finalizing the "Howard F. Curren AWTP – Master Plan Improvements: Main Switchgear Facility Replacement" technical memorandum. This memorandum outlines a proposed location for a new transformer structure where new 'T-1A-1', a new 'T-1B-1' transformers and new ancillary equipment (13.2KV disconnects and 4.16KV circuit breakers) would be located.

It is proposed that the new transformer structure be constructed ~~prior to (or~~ concurrently with~~)~~ the installment of the new AirSep equipment, the new 'T-1A-1' and 'T-1B-1' could be sized at 2,000KVA. At 2,000KVA the 4.16KV secondary of each transformer could provide 277 amperes. As the connected load of the AirSep equipment is 214 amperes, 2,000KVA transformers would suffice for the application.

It must be noted that there will be two 4.16KV feeders provided, but only a single AirSep unit is proposed. In order to provide redundancy, a 4.16KV manual transfer switch would be proposed.

5.1.3 Proposed Electrical System Configuration

The proposed electrical system is provided in Figure 5-1 on the following page.

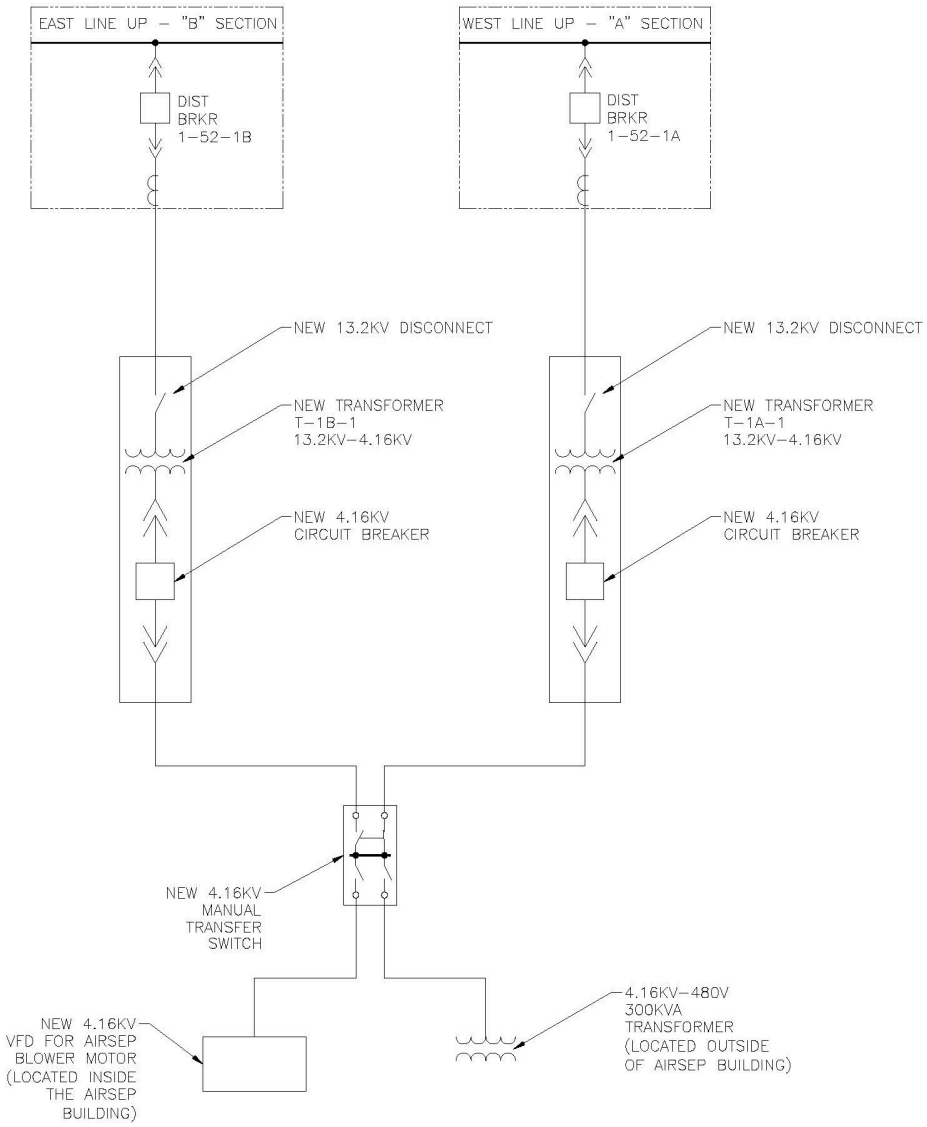


Figure 5-1: Proposed Electrical Equipment Configuration for AirSep Equipment

5.2 VPSA Requirements

5.2.1 Structural Pad

The proposed VPSA system will be placed on a raised concrete foundation pad to meet current flood elevation requirements of +13.00 NAVD 88 Datum. It is assumed that piles will be required for the overall structure.

5.2.2 CMU Enclosure

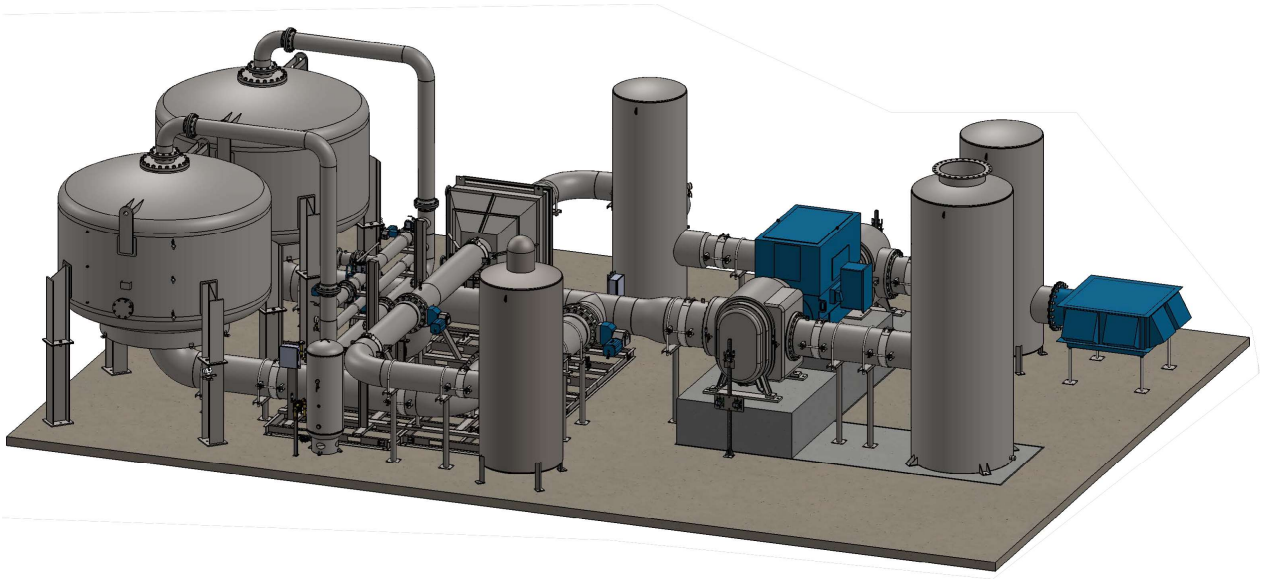
In order to provide noise abatement for the blowers and protect the AirSep equipment from the elements, a CMU enclosure (with roofing) is recommended. Ventilation will be provided in this area, but air conditioning is not required.

5.2.3 Small Control Room

A separate enclosed, air-conditioned control room will be located within the overall CMU structure for plant staff to monitor and control the VPSA system. The control room will house the PLC for the VPSA system. The control room will also be provided with a viewport window for staff to visually monitor the equipment, with the benefit of not requiring hearing protection.

5.3 Conceptual Layout

A conceptual layout of the 59 TPD VPSA system equipment by AirSep is shown in Figure 5-2. A conceptual layout showing the CMU enclosure and control room is included in Appendix F.



See Appendix B for detailed drawings, dimensions, and labeling of proposed conceptual AirSep equipment

Figure 5-2: AirSep Conceptual Equipment Layout

Appendix A: Cosmodyne Cryogenic Oxygen Generation Proposal

BUDGETARY PROPOSAL 6043

POPLAR

CRYOGENIC AIR SEPARATION PLANT

Prepared for
DWG Associates

Submitted by: Steve Mogck
smogck@cosmodyne.com

REVISION	DESCRIPTION	DATE
Rev. P	Initial release to customer	2023/01/27

Valid for 30 days

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INTRODUCTION

NIKKISO Cosmodyne is pleased to submit this high-level budgetary proposal (+25%/-15%) for a POPLAR Series air separation plant to DWG Associates. This proposal is in response to DWG Associates inquiry dated Jan 23, 2023, and subsequent correspondence (hereinafter "The Specification") and is based on the following customer requirement:

PRODUCT	*PRODUCTION (MIN)*	*PURITY (MIN)*	*PRESSURE (MIN)*
Oxygen	100% gaseous	99.0%	3 PSIG

Budgetary pricing, delivery, payment terms and scope of supply are presented in Schedule A. Plant performance and other technical specifications are contained in Schedule B.

Cosmodyne has been designing and building custom engineered cryogenic systems since 1958 and has installed over 450 air separation plants globally. Cosmodyne regularly supplies air separation plants to the large, international, industrial gas suppliers as well as end users globally.

KEY FEATURES

Highly Modularized Design Concept

- Simplifies installation, minimizes installation cost and insures the highest level of quality
- Simple arrangement with excellent service access
- Independent, compression, air treatment and turboexpander skids
- Shop fabricated, tested and finish painted cold box.

High Efficiency Process

- Ultra-low specific power consumption for plant size class
- High efficiency turboexpander system with removable "cartridge" style rotating assemblies
- Independent water-cooled aftercoolers
- Economic turndown to 75 % (varies with final compressor selection)

State of the Art Plant Control

- Fully automated for unattended operation
- Remote operation, monitoring and startup via internet
- Siemens PLC

Customer Support

- 24-hour emergency remote technical support via internet
- Global on-site technical support
- In-factory & on-site operations training
- Site audits (maintenance and operation) available after commissioning
- 5 service Facilities in North America offering service, service agreements, spare parts

A Poplar Series ASU Installation

SCHEDULE A: COMMERCIAL

1. Budgetary Prices

Item	*Description*	*QTY*	*Price (USD)*
1.	**POPLAR SERIES Air Separation Unit producing oxygen** in accordance with the specifications and scope of supply contained herein and Cosmodyne Standard Terms and Conditions of Sale, attached hereto. Manufactured at Nikkiso Cosmodyne India Pvt Limited ISO 9001-2015 facility.	1	$5,520,000
2.	Cooling tower with circulation pump (skidded)	1 set	included
	Options		
3.	Operating Spare Parts	1 set	TBD
4.	Capital Spare Parts	1 set	TBD
5.	Site Advisory Services	1 set	TBD

2. Delivery

Approximately eighteen (18) months after receipt of order (to be confirmed at time of order), execution of mutually acceptable sales agreement and down payment.

3. Payment Terms

To be determined based upon the final scope and associated spending schedule.

4. Shipping Terms

Base Plant: Main Plant: FOB (Incoterms 2020) Nhava Sheva Port, India. Optionally: Nikkiso Cosmodyne Murrieta, California, USA

Pumps, Compressors, Turbomachinery: FOB (Incoterms 2020), Port of embarkation, country of origin (USA, Germany, China, or Korea).

5. Terms and Conditions

See Cosmodyne Standard Terms and Conditions of Sale

6. Proposal Validity

The prices stated are valid for 30 days from the date of this proposal.

7. Warranty

Warranty conditions are contained in Cosmodyne Terms and Conditions of Sale, Schedule D1. The effective Warranty period is twelve (12) months from the date the plant is placed in service but not more than eighteen (18) months from the date the Equipment is released for shipment.

8. Scope of Supply

Cosmodyne's Scope							Customer's Scope				
QTY	*U/M*	*Description*	*Basic Engineering*	*Design*	*Supply*	*Installation*	*Basic Engineering*	*Design*	*Supply*	*Installation*	*Notes*
1	**ea**	**Feed Air Compressor**	**X**	**X**	**X**					**X**	
1	set	intercoolers	X	X	X	X					
1	ea	main drive motor	X	X	X	X					
1	ea	discharge check valve	X	X	X	X					
1	ea	blow off valve, silencer	X	X	X					X	
1	ea	I/O module	X	X	X	X					
1	ea	charge of lubrication oil	X	X	X					X	
1	ea	OEM standard cleaning and painting	X	X	X	X					
1	ea	OEM standard lubrication system	X	X	X	X					
1	**ea**	**Air Chiller Module/Skid**	**X**	**X**	**X**					**X**	
1	ea	refrigerant compressor	X	X	X	X					
1	ea	condenser	X	X	X	X					
1	ea	evaporator	X	X	X	X					
1	ea	receiver	X	X	X	X					
1	ea	expansion valve	X	X	X	X					
1	ea	moisture separator	X	X	X	X					
1	ea	initial charge of refrigerant	X	X	X					X	
1	ea	I/O module	X	X	X	X					
1	ea	OEM standard cleaning and painting	X	X	X	X					
1	ea	**Air Treatment System**	**X**	**X**	**X**					**X**	
2	ea	adsorber vessels and internals	X	X	X					X	
1	ea	initial adsorbent charge	X	X	X					X	
1	ea	regeneration heater	X	X	X	X					
1	ea	thaw heater	X	X	X	X					
1	set	interconnecting piping within skid	X	X	X	X					
1	set	interconnecting piping between skid and adsorber vessels	X	X	X					X	
1	ea	after filter	X	X	X	X					
1	set	bed switching valves	X	X	X	X					
1	ea	pressurization valves	X	X	X	X					
1	ea	depressurization valves	X	X	X	X					
1	ea	I/O module	X	X	X	X					

Cosmodyne's Scope							Customer's Scope				
QTY	U/M	Description	Basic Engineering	Design	Supply	Installation	Basic Engineering	Design	Supply	Installation	Notes
1	ea	OEM standard clean, prime paint	X	X	X	X					
1	set	Insulation on adsorbers and Skidded piping	X	X	X	X					
1	**ea**	**Turboexpander System**	**X**	**X**	**X**					**X**	
1	ea	Turboexpander, booster loaded	X	X	X	X					
1	ea	lubrication system	X	X	X	X					
2	ea	lubrication pumps	X	X	X	X					
1	ea	seal gas system	X	X	X	X					
1	ea	cold box (interface)	X	X	X	X					
1	ea	rockwool insulation	X	X	X					X	
1	set	connecting expansion joints	X	X	X					X	
1	ea	I/O module	X	X	X	X					
1	ea	surge bypass valve	X	X	X	X					
1	ea	inlet trip valve	X	X	X	X					
1	ea	OEM standard cleaning and painting	X	X	X	X					
1	**ea**	**Aftercooler**	**X**	**X**	**X**					**X**	
1	**ea**	**Cold Box**	**X**	**X**	**X**					**X**	
1	ea	cold box structure	X	X	X	X					
1	ea	nitrogen distillation column	X	X	X	X					
1	ea	oxygen distillation column	X	X	X	X					
1	ea	main reboiler/condenser	X	X	X	X					
1	ea	main heat exchanger	X	X	X	X					
1	ea	main sub-cooler	X	X	X	X					
1	ea	internal piping, valves and controls	X	X	X	X					
1	ea	I/O module	X	X	X	X					
1	ea	purge system	X	X	X	X					
1	ea	cold box pressure relief system	X	X	X	X					
1	ea	drain/derime manifold	X	X	X	X					
1	lot	internal insulation (perlite)	X	X					X	X	
1	ea	OEM standard clean, prime paint	X	X	X	X					
1	ea	finish paint	X	X	X	X					
1	**ea**	**Plant Control System**	**X**	**X**	**X**					X	
1	ea	PLC rack	X	X	X					X	

Cosmodyne's Scope							Customer's Scope				
QTY	*U/M*	*Description*	*Basic Engineering*	*Design*	*Supply*	*Installation*	*Basic Engineering*	*Design*	*Supply*	*Installation*	*Notes*
1	ea	computer, monitor, keyboard, mouse	X	X	X					X	
1	set	HMI software and licenses	X	X	X	X					
1	ea	plant control program	X	X	X	X					
1	ea	I/O module	X	X	X					X	
1	ea	Uninterruptible Power Supply (UPS) for the control system only	X	X	X					X	
1	**ea**	**Analytical System**	**X**	**X**	**X**					X	
1	ea	analyzer rack	X	X	X					X	
1	set	plant analyzer set	X	X	X					X	
1	set	interconnecting piping, valves and controls	X	X	X					X	
1	**ea**	**Cooling tower with cooling water system pump circulation skid**	**X**	**X**	**X**					**X**	
1	**set**	**Spares and consumables, startup and commissioning**	**X**	**X**	**X**					**X**	
1	**set**	**Interconnecting materials (pipe, tubing, cable, etc.)**	**X**	**X**	**X**					**X**	
1	**set**	**Documentation,** as per proposal	**X**	**X**	**X**					**X**	

Notes:

(1) The Scope of Supply can be modified as requested by the buyer during the project development phase.

SCHEDULE B: TECHNICAL

1. Utilities

Electricity:

	Unit	Design
Electrical Frequency	Hz	60
Control Voltage	V	110/220V, 1-ph
Low Voltage (LV)	V	220V, 3-ph
Medium Voltage (MV)	V	4,160, 3-ph

Air Quality:

Filtration and air purification systems design are based on standard air composition. Maximum contaminant levels will be specified.

Cooling Water

Cosmodyne cooler metallurgy chosen with the assumption that standard cooling water quality make-up and water treatment will be provided by client.

Plant Utility Consumption (excluding ASU electricity):

The following utilities are required for plant operation and assumed supplied by the Customer:

Cooling Water		
Rate	GPM	550
Temperature	F	78.8
Pressure	PSIG	30.3
Temperature Rise	F	14.4
Required Connected Heat Load	MMBtu/hr	39.78
Nitrogen Seal Gas/Purge		
Min Supply Pressure	PSIG	25.3
Rate	NM^3/hr	TBD
Instrument Air		
Min Supply Pressure	PSIG	80
Rate	NM^3/hr	20
Maximum Connected Rate	NM^3/hr	TBD

2. Performance

Product: Gaseous Oxygen (GOX)		
Rate	NM^3/hr	1,600
	STD	60
Purity	% O2	99
Pressure	PSIG	3
Power Consumption	kW	900

NOTES:

1. Flow rate(s) and pressure(s) are measured at the cold box discharge flange.
2. Does not include power required for a cooling water system (estimated a 30 kW) and other equipment outside of Cosmodyne's scope of supply.
3. The above Performance is based upon: 0 ft ASL, barometric pressure 14.7 PSIA, Dry Bulb temperature 85 ºF, Wet Bulb temperature 72 ºF, Cooling Water Supply temperature 79 ºF (50% RH)
4. Production and Power is guaranteed within three percent (± 3 %) of expected value, subject to final compressor selection and measurement tolerances during the performance test.

a. Design Codes and Standards (typical)

ASME Boiler & Pressure Vessel Code (BPVC), Section VIII, Division 1
ASME Process Piping Code B31.3
ASME Refrigeration Piping Code B31.5
ASME Welding & Brazing Qualifications Code, Section IX for Weld Procedures and qualifications
ASME B16.5 for Flanges & Flanged Fittings
ASCE 7, Minimum Design Loads & Associated Criteria for Buildings & other Structures
ALPEMA Standards for Aluminum Plate-Fin Heat Exchangers
TEMA Class C Standards for Unfired Shell & Tube Heat Exchangers
ISA Standards for Valve Sizing & Calculations
NFPA 70, National Electric Code (NEC) for the electrical equipment
NEMA MG-1 Standard for Motors & Generators
NEMA Standards for Electrical Enclosures
ASME Materials for Pressure Vessels
ASTM Materials for Piping, Fittings, Structural, etc.

b. Environmental Design Loads

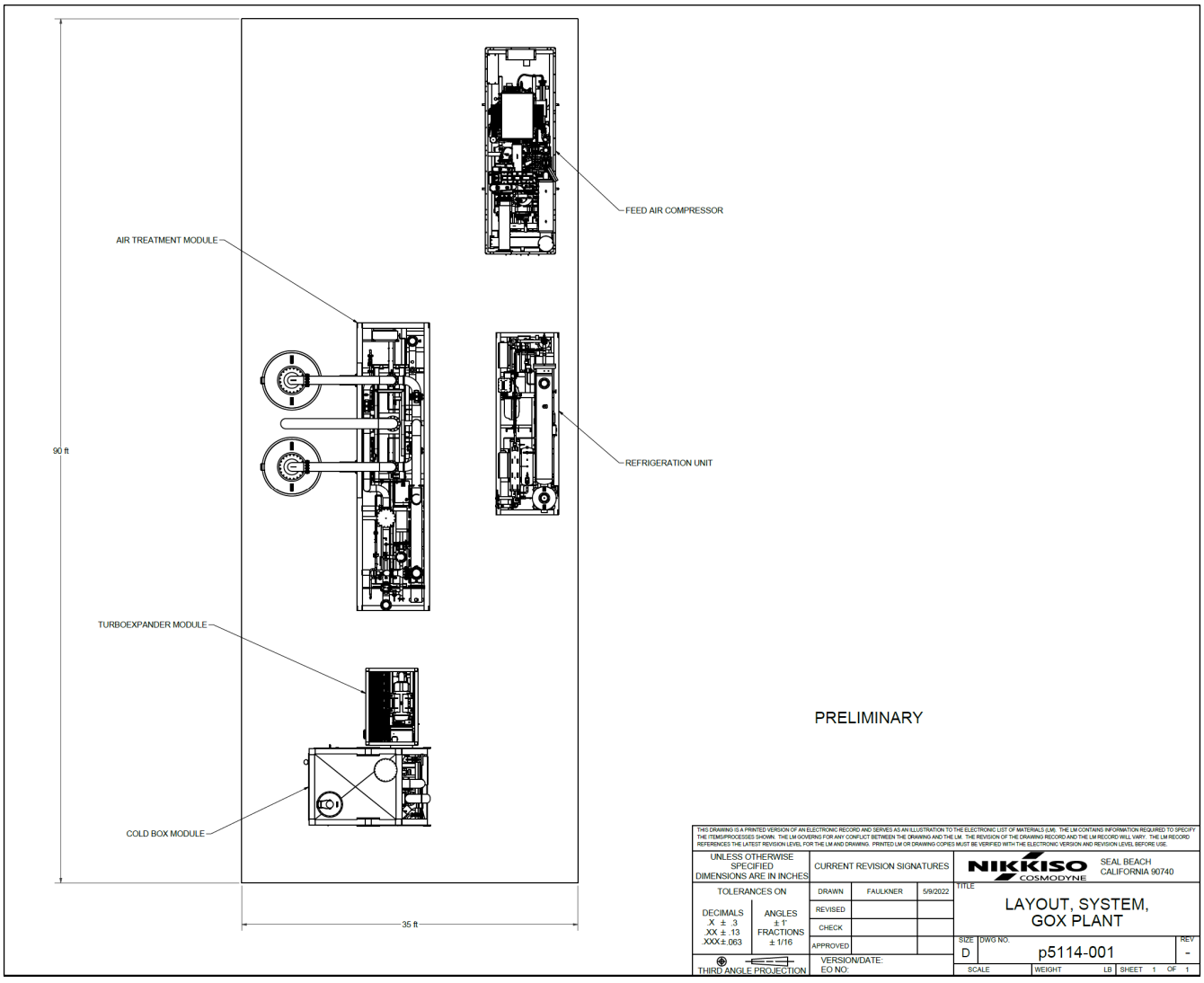
Wind	165 km/hour (maximum)
Earthquake	Seismic Zone 3

c. Reference Operating Data

Derime/Thaw:	
Estimated Time	12 hours
Recommended Frequency	After extended downtime or after maintenance
Estimated Plant Startup Time	
Warm Plant	12 hours to stable liquid levels
Cold Plant	3 hours to stable liquid levels
Design Onstream Time	>98.0 %
Estimated Production Turndown	~75 % of full capacity with marginal reduction in specific power (final compressor design required)
Estimated Maintenance Frequency, Duration	Typically, a 2-to-3-week maintenance outage is required approximately every 3 to 4 years.

3. Typical Plant Arrangement

As the majority of a Cosmodyne plant is skidded and prefabricated just requiring generally connections between the systems and the modules during installation. Cosmodyne can generally customize a layout based upon the customer's space limitations or requirements. Further modifications can be made by the customer, if required.



The above drawing illustrates a complete production facility for gaseous oxygen. Note that all major components are skidded, and shop tested.

4. Documentation Deliverables

NIKKISO Cosmodyne uses SI units of measure. Other options may be available to meet client's individual requirements.

Description	Months After Receipt of Order
Piping & Instrumentation Diagram (P&ID)	6
Recommended Spare Parts List	9
Curb Plan ▪ Plant Arrangement ▪ Operating weights and dimensions of major equipment, foundation load design data as required for detailed structural design of foundations by Buyer. ▪ Examples of equipment anchors	8
Single Line Electrical Diagram with load list	8
Outline Drawing ▪ General arrangement drawing showing overall dimensions and piping connections for individual modules ▪ May be combined with Curb Plan at NIKKISO Cosmodyne's discretion	9
Electrical System Schematic ▪ Schematic illustration of functional relationship of all low voltage, instrument and control components required for the plant as supplied by NIKKISO Cosmodyne ▪ Includes general location of control enclosures	9
Installation Drawing	3 Months before delivery of the plant
Operating and Maintenance Manual	Upon delivery of plant
Vendor Data Book containing operating and maintenance manuals for all P&ID components, other supporting vendor information	Upon delivery of plant
Quality Data Report (QDR) for major pressure vessels	Upon delivery of plant
Process Flow Diagram	Upon delivery of plant

Appendix B: AirSep VPSA Oxygen Generation Proposal

Commercial Products Division

AirSep Corporation
260 Creekside Drive
Buffalo, NY 14228-2075
(716) 691-0202
(716) 691-1255

Model ASV60000

AIRSEP TECHNICAL PROPOSAL
DATE: March 17, 2023

TABLE OF CONTENTS

I. INTRODUCTION

AirSep Corporation has 25 years of experience in the design and manufacture of onsite

PSA/VPSA Oxygen Generation Systems.

Each system is custom engineered for the end-user's specific site and process requirements.

All AirSep PSA/VPSA oxygen systems are optimized for peak efficiency, low power consumption, high reliability with an expected on-stream efficiency of 99%, and an expected equipment life of +20 years. All system designs are highly integrated into skids to minimize footprint size, and simplify on-site installation.

This document describes the complete on-site oxygen generation system to be furnished. It includes the process description, equipment specifications, instrumentation and control requirements, as well as specifications for process piping, cleaning, electrical systems, painting, safety signs, field services and spare parts. These specifications may be used in their entirety to ensure high quality equipment with the resulting desired high level of reliability.

The oxygen generation system shall be the "Vacuum Pressure Swing Adsorption" (VPSA) type supplied by AirSep.

II. PROCESS DESCRIPTION

Air contains 21% oxygen, 78% nitrogen and 1% other gases. AirSep systems separate oxygen from air utilizing a unique Vacuum Pressure Swing Adsorption (VPSA) air separation process. The PSA process uses packed beds of Molecular Sieve (a synthetic zeolite) which attract (adsorb) nitrogen from air at high pressure and release (desorb) it at low pressure.

AirSep systems use two molecular sieve beds as adsorbents. Air is passed through one adsorbent bed at high pressure. The Molecular Sieve adsorbs nitrogen allowing the oxygen to pass through as product gas. Before the bed becomes saturated with nitrogen, the inlet air is switched to a second bed. The first bed is now regenerated by desorbing nitrogen through depressurization and then purging it with oxygen. The complete cycle is then repeated.

A microprocessor is utilized to accurately control the valve sequencing. AirSep has also incorporated a fail-safe control that returns the plant to a safe condition in the event of an unexpected power failure.

Molecular sieve under normal operating conditions and assuming proper plant maintenance is completely regenerative will have a 20+ Year Expected Life.

III. DESIGN CONDITIONS

The specified site conditions for design and the temperature working limits are as follows:

These are design values for energy consumption and oxygen production.

As per the climate data supplied by the customer, the AirSep VPSA Oxygen System has been designed to operate in the following local conditions:

Parameter	
Plant Location	Designed for indoor installation. Due to noise constraints a VPSA building is recommended.
Elevation	14.7 psia
Maximum Temperature Outside Building	95 F
Design Temperature	95 F
Minimum Temperature Inside Building	40 F
Relative Humidity for Design Temperature	66%
Relative Humidity for Maximum Temperature	66%
Cooling Water Temperature	Recirculating Coolant Design

The required inside building temperature range with a standard AirSep design must be within a minimum 40 F, and up to a maximum 95 F.

Optional designs are available for conditions outside of the above temperature range.

IV. SYSTEM REQUIREMENTS

Oxygen Flow Rate	:	60,000 SCFH
Oxygen Purity	:	91%+/-1%
Oxygen Pressure	:	3 to 5 PSIG
Oxygen Usage Pattern	:	Continuous

V. SYSTEM PERFORMANCE

Plant Capacity Each	:	60,000 SCFH
Oxygen Pressure	:	3 to 5 PSIG
Oxygen Purity	:	91%+/-1%
Consumption	:	.98 KWH+/-5% per 100 SCF of Total Flow* At 3 PSIG

* At Maximum Plant Capacity for Separation Only

** Standard conditions referenced to, 70^{o}F, 0% RH, 14.7 psia

***

VI. CONSTRUCTION CODES AND STANDARDS

The scope and specifications are based on AirSep's standard scope of supply and engineering standard.

The AirSep Model ASV VPSA Oxygen System is designed with reference to the following codes and norms:

Item	Codes & Standards
Pressure Vessels	ASME VIII div 1
Piping	ASME B31.3 Std.
Electrical System	ISA recommendations and manufacturers standard, markings applicable.
Electrical Motors and Panels NOTE: NEMA 4X shall be provided for HFC AWTP project.	- Insulation Class F (Motors) IEC Std - Protection Grade NEMA 4 for Outdoor Equipment - Protection Grade NEMA 12 for Indoor Equipment
Programmable Controllers	Allen Bradley Compact Logix
Instruments	ISA Output Signal 4-20 mA Control Voltage 24 VDC
Machines	International manufacturer and AirSep standards
Painting	AirSep Epoxy Primer and Machine Supplier's Standard Primer for Equipment Inside Building

VII. MATERIALS OF CONSTRUCTION

All materials used for the process piping, including valves and expansion joints, shall be selected with due consideration for such factors as the corrosive nature of the gas, the oxygen content of the gas, cleanliness of the system, and the gas velocity in the case of oxygen.

Process Air Service

All piping materials used for process air service shall be ASTM.A-53 Grade B, ASTM A106, Gr.B, or API 5L, Gr.B carbon steel. All applicable piping shall be welded construction and conform to the latest edition of ASME B-31.3 Process Piping code.

Where required by code, Welders are to be qualified per ASME Code.

Valve bodies and trim are to be appropriate for service conditions.
Process air valves shall be 150# ANSI flanged or wafer type with cast iron or carbon steel bodies. Trim shall be stainless steel.

VIII. OVERPRESSURE PROTECTION

Safety relief devices shall be provided to prevent runaway over pressurization.

IX. SAFETY SIGNS AND LABELS

The following safety sign as supplied by AirSep shall be used to indicate and define hazards which, if not designated, may lead to accidental injury to personnel or to property damage. The sign's size, shape and color shall be in accordance with the Occupational Safety and Health Act (OSHA) Federal Register Part 2, paragraph 1910.45.

A. Danger - No Smoking, Matches or Open Flames

X. PROCESS CONTROL

The Control System main human/machine interface (HMI) is based on an Allen Bradley PLC with Color Touch Screen installed in the supplied AirSep control panel and integrated to the valve skids. The pressure and vacuum blowers, and the oxygen blower/compressor, if supplied, signals are directly wired to the Allen Bradley PLC. Critical process parameters are monitored and recorded every 250 milliseconds.

XI. AIRSEP SCOPE OF SUPPLY Per Each VPSA Oxygen Plant

1 Set	-	PSA Valves
1 Set	-	Pressure Relief Valves
1 Set	-	PSA Control Panel (Deluxe) Touch Screen Design with Rosemount Digital Flowmeter and Oxygen Analyzer, Remote Monitoring.
2 Sets	-	Proprietary Feed Screen
1 Set	-	Feed and Waste Manifold Skidded Design
1 Set	-	Product Manifold Skidded Design
1 Set	-	Miscellaneous Valves, Temperature Gauges, Pressure Switches, Pressure Transducers, for Safety Controls, Oxygen Flow Meter
1 Set	-	Molecular Sieve Lithium Type
1 Set	-	Instruction Manuals
1 Set	-	Water Cooled Aftercooler
1 Set	-	Start-up Assistance by AirSep Engineers
1 Set	-	Connecting piping and miscellaneous valves

1 Set - Two Adsorbers , and Low Pressure Oxygen Surge Tank
1 Set - Roots Pressure and Vacuum Blowers with Motor
1 Set - Process Silencers
1 Set - Operation and Maintenance Manual
1 Set - Turndown Capability from Full Flow to 40% capacity with Power Saving
1 Set - Recirculating Closed Loop Coolant System

1. **VPSA Plant**

A. Two stainless steel screens for the adsorbers.

B. 36,000 lbs... of molecular sieve.

C. One feed and waste manifold with:
- Two 18 inch Jamesbury pneumatic feed valves.
- Two 20 inch Jamesbury pneumatic waste valves.

D. One product manifold with:
- Two 8 inch Jamesbury pneumatic product valves.
- One 10 inch Jamesbury pneumatic equalization valve.
- One 6 inch Jamesbury pneumatic purge valve.

E. One feed air water cooled aftercooler.

F. One set interconnecting piping with miscellaneous valves.
- 18 inch diameter piping from the Roots Pressure Blower to the aftercooler
- 18 inch diameter piping from the aftercooler to the feed air manifold
- 20 inch diameter piping from the feed/waste manifold to the Vacuum Blower

2. Control Package

A. Microprocessor will be supplied to control valve sequencing with built-in protection against line voltage fluctuation.
B. Fail Safe Control to protect the adsorbent from Damage in case of any power failure
C. Electrical cabinet containing valve sequence control equipment
D. Oxygen analyzer with low purity alarm.
E. Digital flow meter self-compensating for temperature and pressure.
F. Automatic Turndown Capacity Control
G. Allen Bradley HMI with 14 in. Color Touch Screen

3. Roots Blower Package

Pressure Blower	-	Single stage dry type
Vacuum Blower	-	Single stage dry type
Motors	-	One 1300 HP Motor, 3/60/4000
Cooling Water	-	Recirculating Closed Loop Coolant System

4. Oxygen Compressor : N/A

Capacity	:
Discharge Pressure	:
Motor Characteristics	:
Cooling Water Req.	:

5. Instrument Air Supply : 30 HP, 3/60/460

XII. VPSA SYSTEM PRELIMINARY DESIGN

1. Adsorbent vessels and low and high pressure oxygen surge tanks.

   Approximate Weights and Dimensions

   (a) Adsorber Vessels (each)

1. Outer Diameter	-	140 inch
2. Height (seam to seam)	-	65 inch
3. Molecular Sieve Weight	-	18,000 lbs.

   (b) Product Oxygen Surge Tank -

1. Outer diameter	-	120 inch
2. Height (seam to seam)	-	260 inch

2. The Feed Air/Waste and Product Manifolds will be constructed of Schedule 40 carbon steel pipe and provided with class 150 carbon steel flanges and gaskets.

Approximate Weights and Dimensions (per plant)

(a) Feed Manifold

(1) Length	-	24 ft
(2) Height	-	3 ft
(3) Width	-	4 ft
(4) Weight	-	14,000 lbs.
(5) Connection Size	-	18 inch

(b) Waste Manifold

(1) Length	-	24 ft
(2) Height	-	3 ft
(3) Width	-	4 ft
(4) Weight	-	16,000 lbs.
(5) Connection Size	-	20 inch

(c) Product Manifold

(1) Length	-	24 ft
(2) Height	-	3 ft
(3) Width	-	4 ft
(4) Weight	-	12,000 lbs.
(5) Connection Size	-	8 inch

XIII. DOCUMENTATION

Documents:	Delivery from coming into force:
Process	
Process description	**At delivery**
Preliminary P&ID	**1 month**
Final P&ID	**3 months**
Civil work & Mechanical	
Preliminary layout	**4 months**
Final layout	**5 months**
Electricity & Instrumentation	
Preliminary schematic wiring	**12 weeks**
Design schematic	**16 weeks**
Vessels & Equipment	
Pressure vessel documentation	**At delivery**
MDR (Manufacturer Data Report)	**At delivery**
Material test certificates	**At delivery**
Complete documentation	**At delivery**
Packing list of equipment	**1 month prior to ship**
Erection & start-up	

Erection manual	**38 to 42 weeks**
Operation	
Operating and maintenance manual	**At delivery**

XIV. PRICING

A. One AirSep VPSA Plant - $5,000,000 USD
B. One Set Roots Blowers - Included

C. Price is quoted ExWorks Suppliers Sites. This Proposal is Valid for 30 Days from the Proposal date.

XV. TERMS OF PAYMENT

- 20% Down Payment, Order will commence upon receipt of Down Payment
- 30% Upon Approval of Engineering Drawings and readiness to order equipment
- 40% Progress Payment Upon Proof of Readiness to Ship, Equipment will be released for Shipment upon receipt of this Payment,
- Final 10% Due After Startup Onsite and Acceptance of Equipment by Customer, or a maximum of 90 Days after Shipment.

XVI. DELIVERY SCHEDULE

A. VPSA Plant - 18 Months

XVII. WARRANTY

Sellers Warrantee ends 12 months after take over of the total plant at customers site maximum 18 months after shipping**.**

XVIII. FIELD SERVICES

General

The following advisory personnel field services for checkout of equipment and instrumentation and initial operation of the Oxygen Generation System shall be provided.

A. Construction Assistance

On-site advisory assistance of personnel competent in all necessary fields shall be provided, as required, during the construction period to advice regarding the installation and erection of the components of the system. These services will include, but are not limited to, installation of mechanical equipment, instrumentation and controls, piping and consultation services including specification and drawing interpretation in the areas of oxygen cleaning, storage of equipment prior to installation, welding procedures and electrical terminations.

B. Checkout

Advisory services shall be provided for the Contractor's preliminary field testing following installation. Sufficient tests shall be conducted to demonstrate to the Owner that all system components are fully operational, that all control and instrumentation components have been calibrated and properly adjusted, that all connecting piping is leak proof and properly anchored and that the entire system is ready for continuous, safe operation. The purpose of checkout shall be to insure that each individual system component has been correctly installed, will operate fully in the manner intended and is ready to perform its function as a part of an integrated system when placed in continuous operation.

C. Start-Up

When checkout and classroom training have been completed and we have received formal notice of the Owner's or Engineer's mechanical and electrical acceptance, the Oxygen Generation System shall be started up. The Owner shall supply all utilities and sufficient qualified personnel during each shift to operate the Oxygen Generation System and related equipment. Our representative shall advise the Owner's personnel of all adjustments necessary during the start-up period for proper, efficient and safe operation.

D. Training

AirSep shall provide both classroom and hands-on training for the owner's supervisory and operating personnel covering the operation and maintenance of the Oxygen Generation System. Classroom training shall be conducted during regular working hours on weekdays at the owner's plant site. Hands-on training shall be conducted during and as part of start-up.

E. Performance Testing

The ability of the Oxygen Generation System to satisfy the performance guarantees will be determined on the basis of the performance tests. The tests shall be conducted by the Owner and may be witnessed by AirSep. Data is to be collected by the Owner's operating personnel utilizing the installed meters and instruments. The method of making corrections to

measurements standards of all calibrating meters shall be mutually agreed upon by the Owner and AirSep. Laboratory facilities and analytical representatives shall advise the owner's personnel of adjustments necessary during the performance-testing period for proper and efficient operation.

*ALL of the above services shall be provided up to a total of 30 Man-Days total for each VPSA plant. 60 Man Days if Two Plants are Purchased.

F. Additional Services

Services required in excess of the above will be provided to the Contractor and/or Owner upon request at the rate of $1,800.00/ 8 hour man day plus travel and expense. Any special instrumentation and/or equipment required over and above installed apparatus will be made available upon request to the Owner.

XIV APPENDIX

1.0 VPSA Layout Drawing, see preliminary layout drawing, V8801, 1 sheet, Dated 10/13/2022.

2.0 VPSA Preliminary P&ID, see drawing, VPSA CN 02, 5 Pages.

NOTES:

1.) DRAWING REPRESENTS A TYPICAL 60 TON VPSA OXYGEN PLANT LAYOUT. ACTUAL DIMENSIONS AND LOCATION OF EQUIPMENT MAY VARY SLIGHTLY DEPENDING ON ACTUAL PLANT SIZE, SITE CONDITIONS OR EQUIPMENT CONFIGURATION.

2.) REFERENCE THE FOLLOWING SHEETS OF THIS DRAWING FOR ADDITIONAL DETAILS AND INFORMATION.
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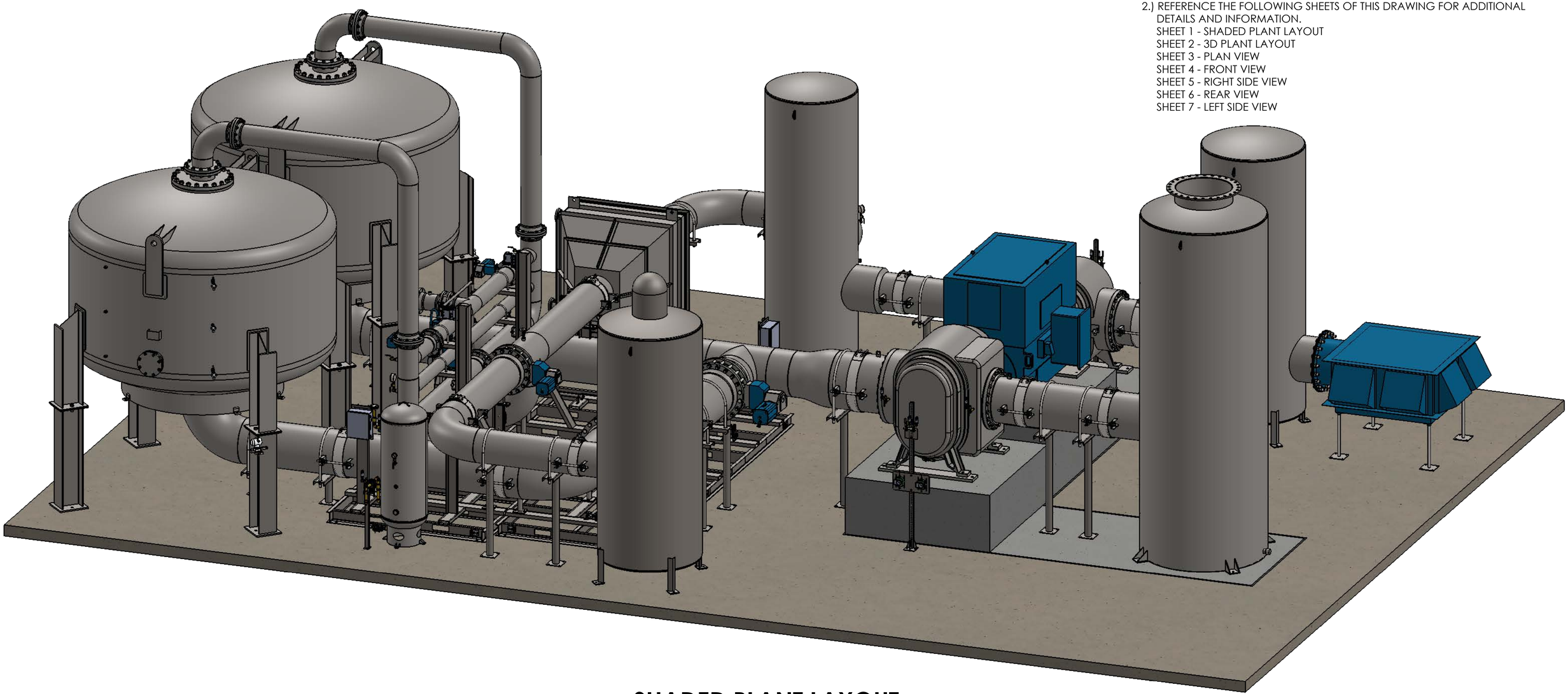

SHADED PLANT LAYOUT

REV	ECO	REVISION DESCRIPTION	BY	DATE
A	N/A	INITIAL RELEASE OF DRAWING	S.P.M.	06/02/17

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	U.B.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL:
SEE DRAWING

FINISH:
N/A

CHART INDUSTRIES, INC.

AIRSEP Corporation
Buffalo, New York 14228

TITLE
TYPICAL 60 TON VPSA OXYGEN PLANT ASSEMBLY

DWG. NO. **ASV10-60 TON** REV **A**

SCALE: 1:25 | DO NOT SCALE DRAWING | SHEET 1 OF 7

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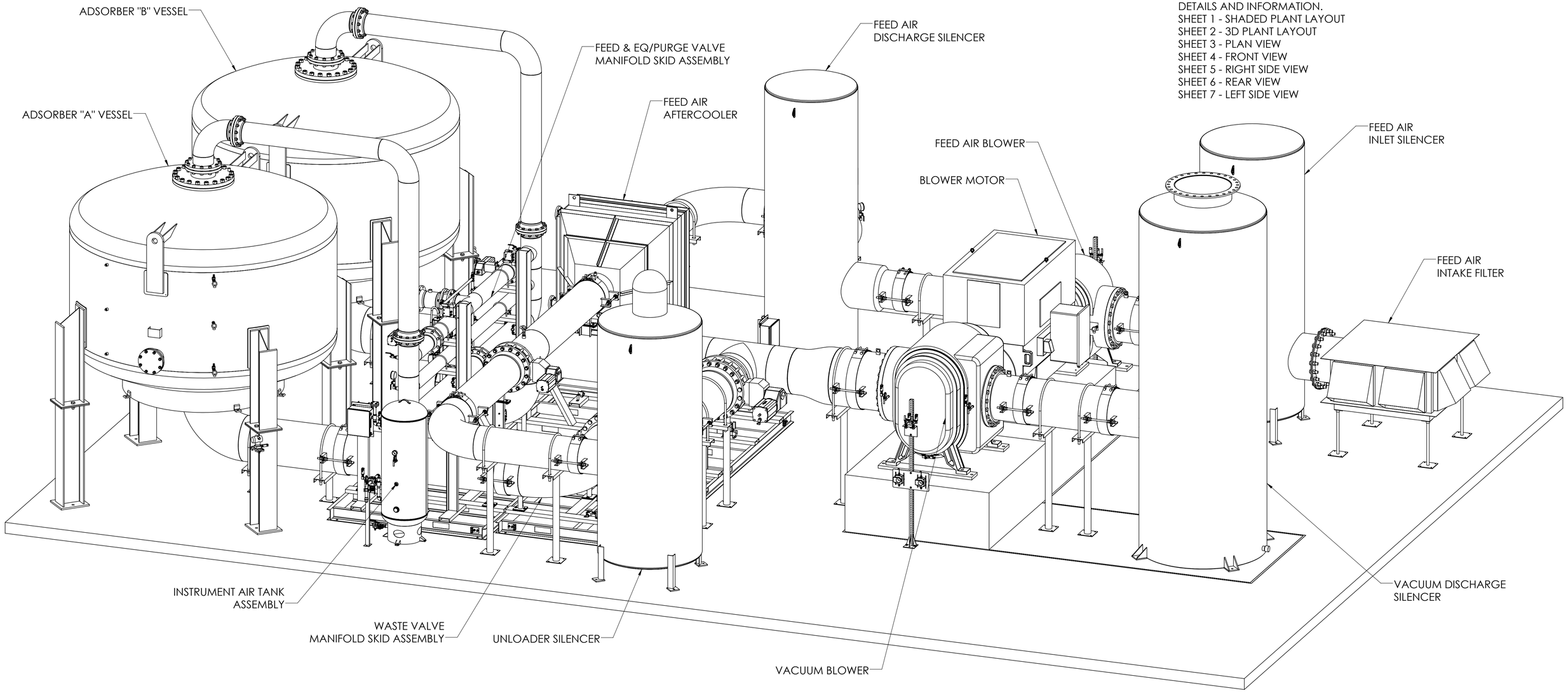

3D PLANT LAYOUT

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	U.B.

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MATERIAL:
SEE DRAWING

FINISH:
N/A

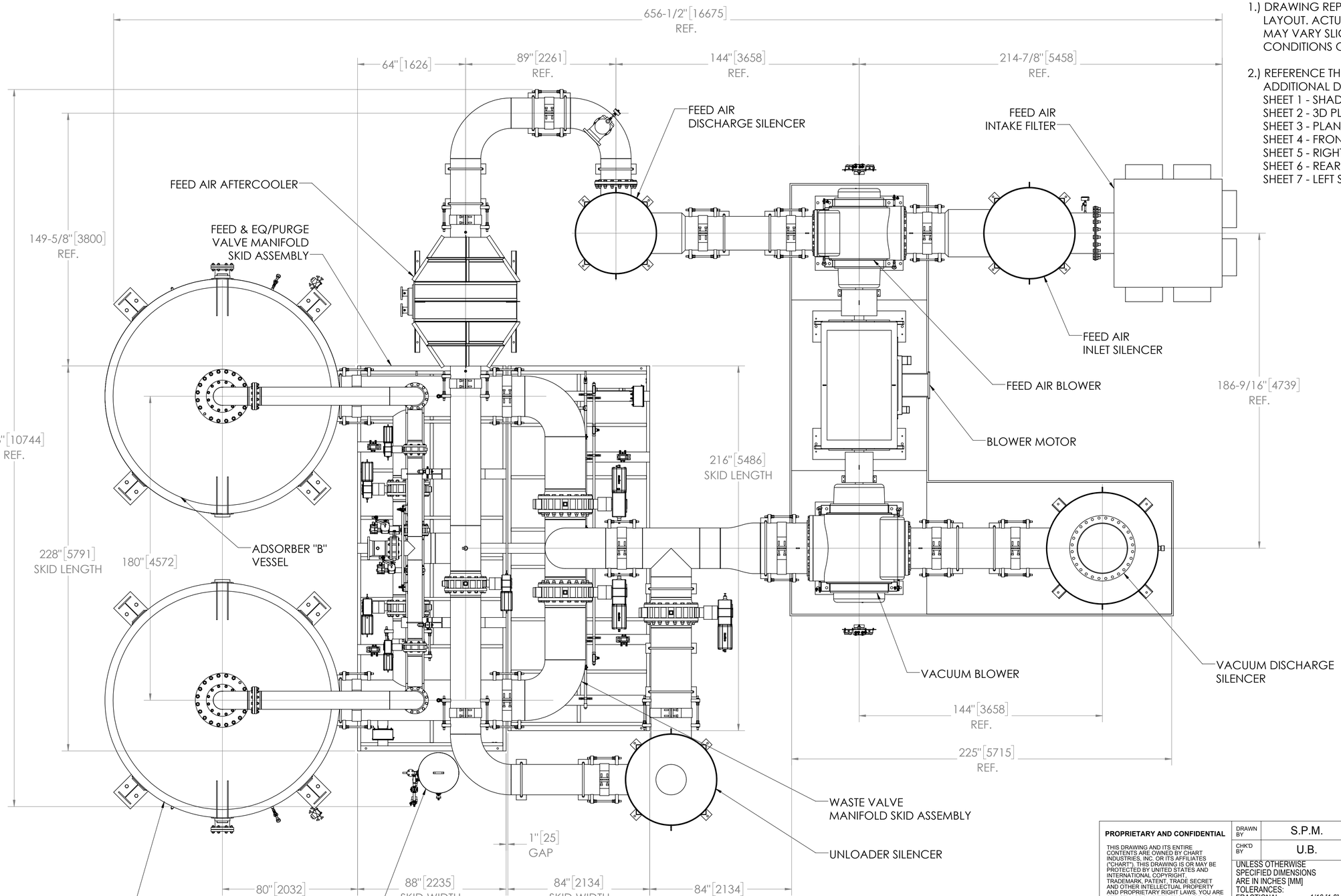
CHART® **CHART INDUSTRIES, INC.**

AIRSEP® Corporation Buffalo, New York 14228

TITLE
TYPICAL 60 TON VPSA OXYGEN PLANT ASSEMBLY

SIZE D | DWG. NO. ASV10-60 TON | REV A

SCALE: 1:25 | DO NOT SCALE DRAWING | SHEET 2 OF 7



PLAN VIEW

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FINISH: N/A

CHART® **CHART INDUSTRIES, INC.**

AIRSEP® Corporation Buffalo, New York 14228

TITLE
TYPICAL 60 TON VPSA OXYGEN PLANT ASSEMBLY

MIN-SIZE D | DWG. NO. ASV10-60 TON | REV A

SCALE: 1:30 | DO NOT SCALE DRAWING | SHEET 3 OF 7

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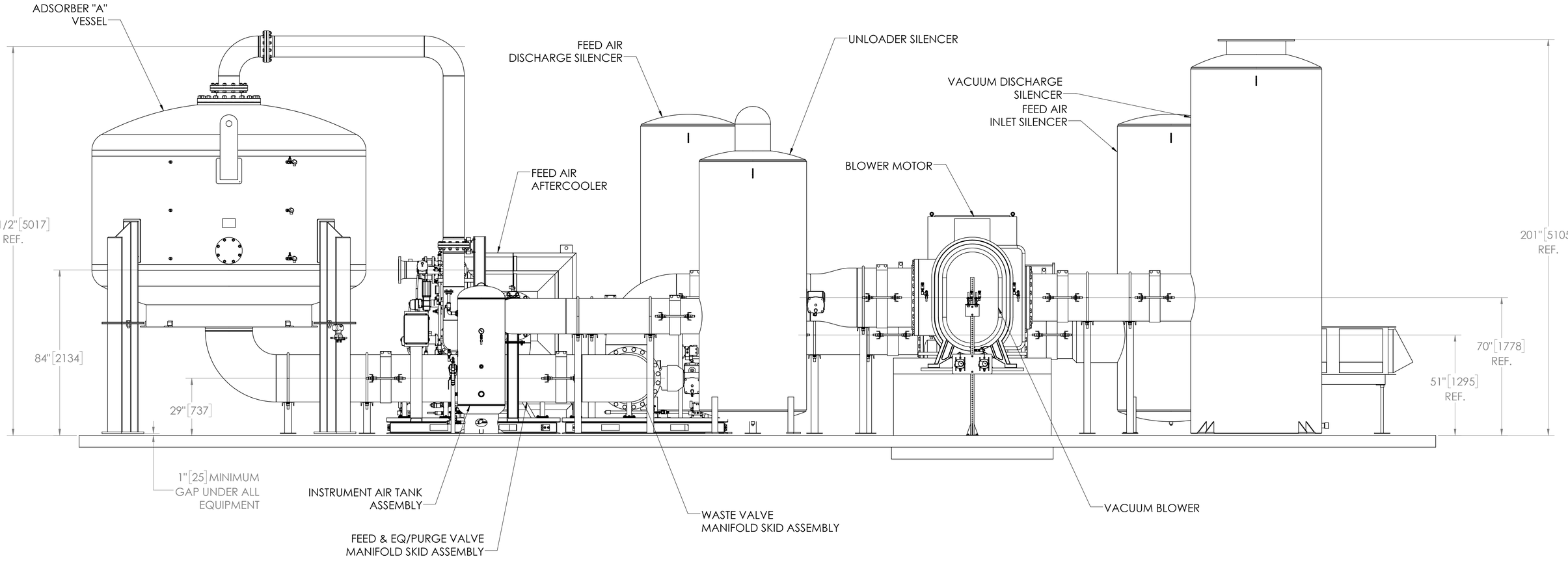

FRONT VIEW

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	U.B.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
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ANGLES	± 0.5°
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MATERIAL: SEE DRAWING

FINISH: N/A

CHART INDUSTRIES, INC.

AIRSEP Corporation Buffalo, New York 14228

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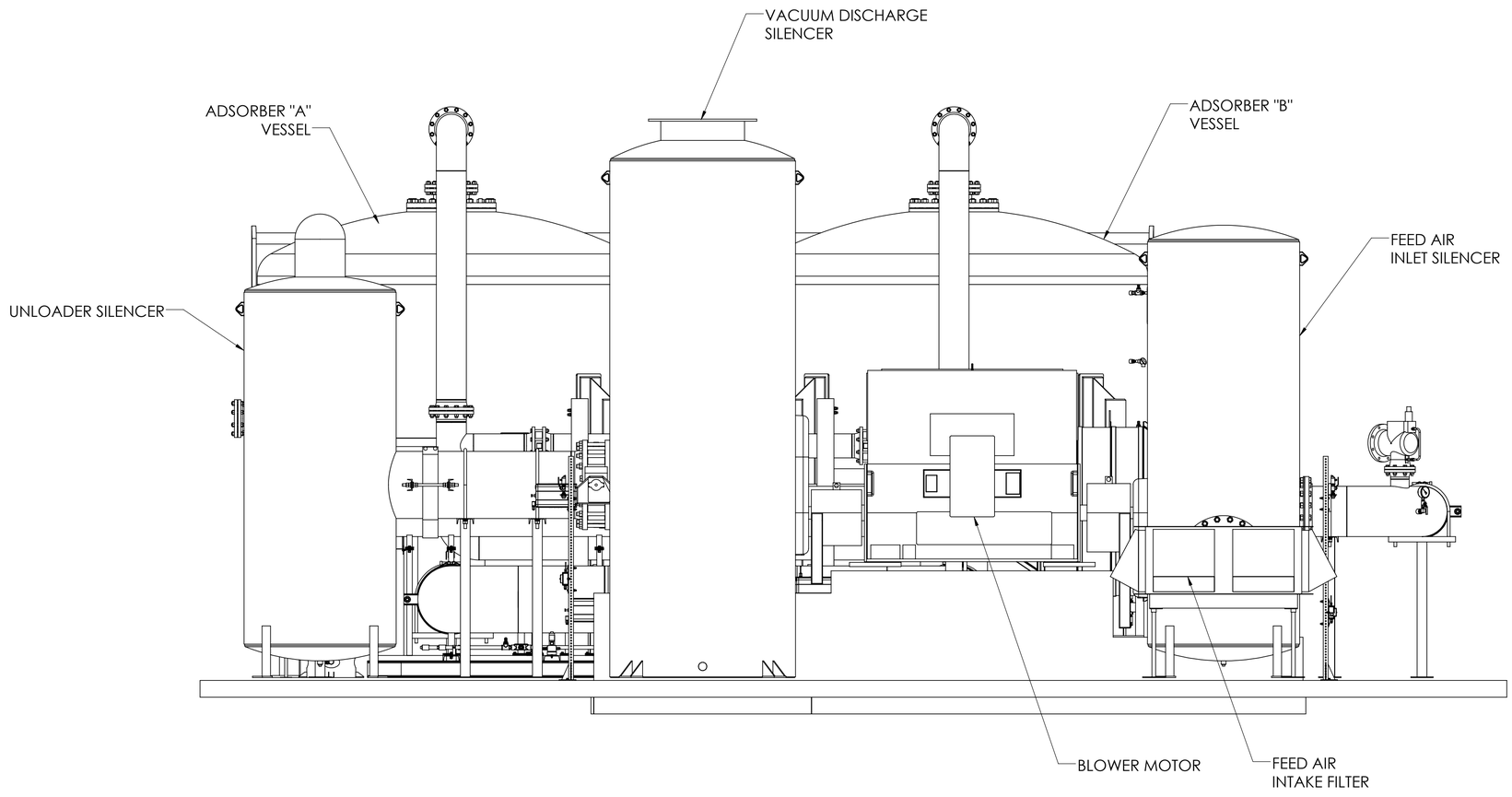

RIGHT SIDE VIEW

THIRD ANGLE PROJECTION

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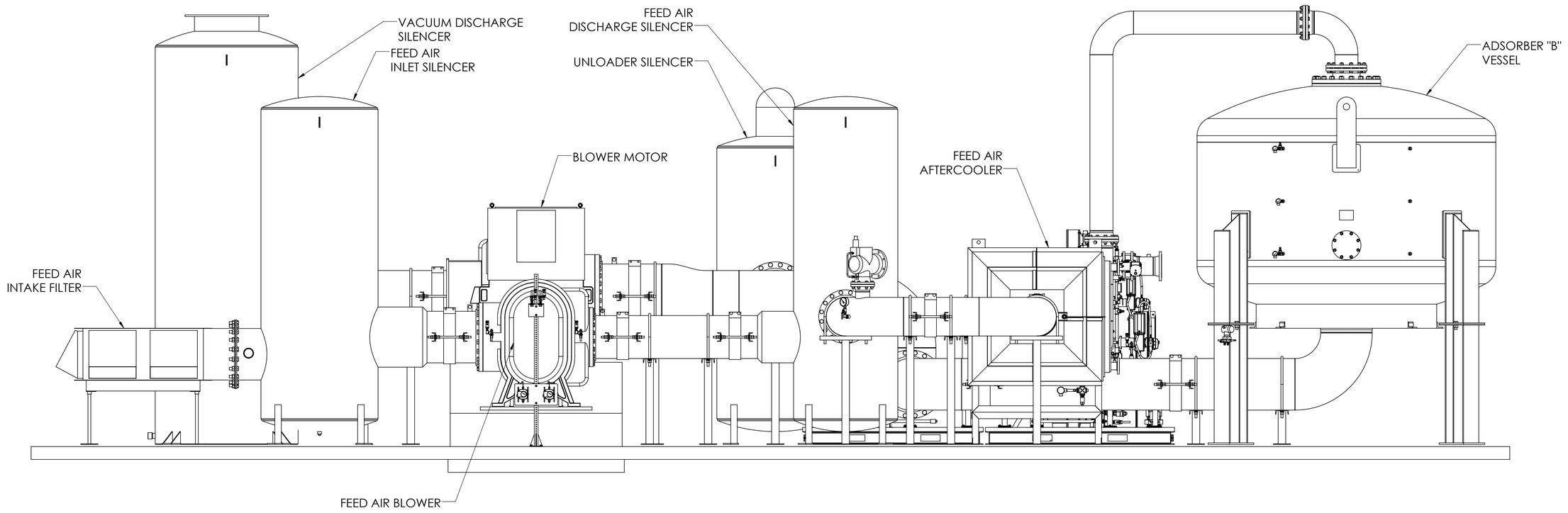


REAR VIEW

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	U.B.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: SEE DRAWING

FINISH: N/A

CHART® **CHART INDUSTRIES, INC.**

AIRSEP® Corporation Buffalo, New York 14228

TITLE
TYPICAL 60 TON VPSA OXYGEN PLANT ASSEMBLY

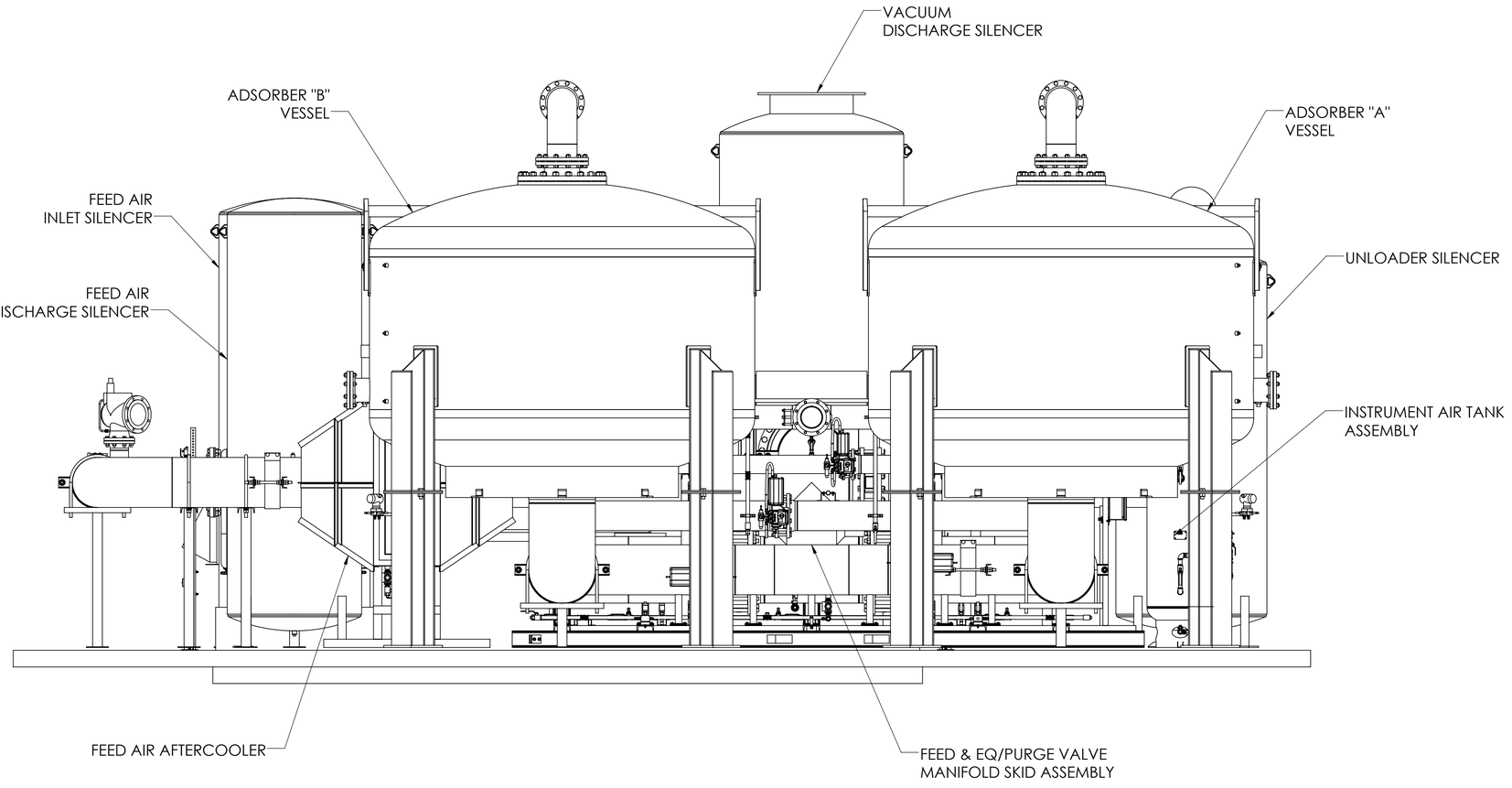
PIN - 10 | D | DWG. NO. **ASV10-60 TON** | REV A

SCALE: 1:25 | DO NOT SCALE DRAWING | SHEET 6 OF 7

NOTES:

1.) DRAWING REPRESENTS A TYPICAL 60 TON VPSA OXYGEN PLANT LAYOUT. ACTUAL DIMENSIONS AND LOCATION OF EQUIPMENT MAY VARY SLIGHTLY DEPENDING ON ACTUAL PLANT SIZE, SITE CONDITIONS OR EQUIPMENT CONFIGURATION.

2.) REFERENCE THE FOLLOWING SHEETS OF THIS DRAWING FOR ADDITIONAL DETAILS AND INFORMATION.
SHEET 1 - SHADED PLANT LAYOUT
SHEET 2 - 3D PLANT LAYOUT
SHEET 3 - PLAN VIEW
SHEET 4 - FRONT VIEW
SHEET 5 - RIGHT SIDE VIEW
SHEET 6 - REAR VIEW
SHEET 7 - LEFT SIDE VIEW



LEFT SIDE VIEW

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	U.B.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL:
SEE DRAWING

FINISH:
N/A

CHART INDUSTRIES, INC.

AIRSEP Corporation
Buffalo, New York 14228

PART NO. ASV10

TITLE
TYPICAL 60 TON VPSA
OXYGEN PLANT ASSEMBLY

SIZE D | DWG. NO. ASV10-60 TON | REV A

SCALE: 1:25 | DO NOT SCALE DRAWING | SHEET 7 OF 7

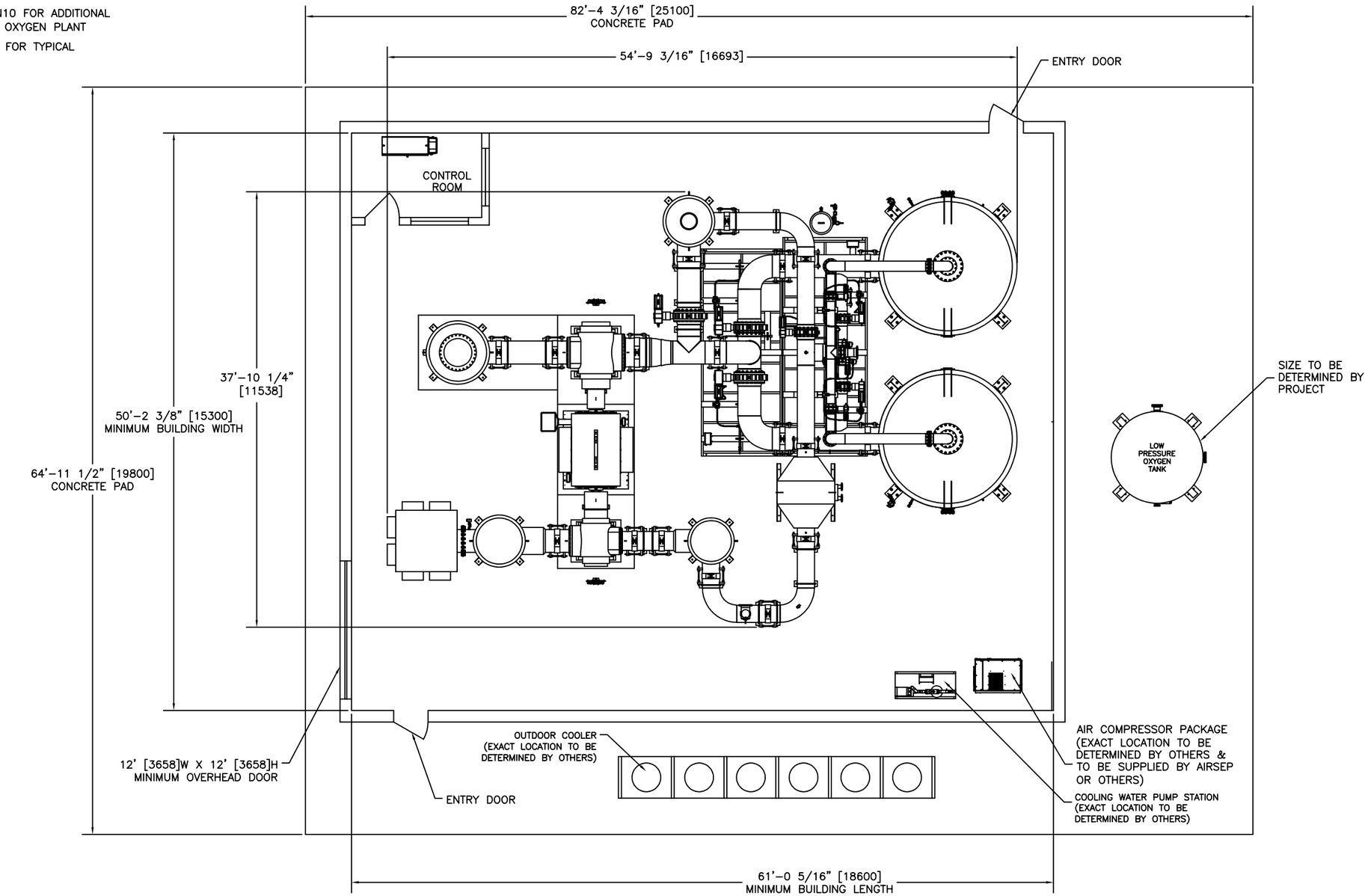
NOTES:

1.) DIMENSIONS SHOWN ARE IN FEET/INCHES.

2.) DRAWING REPRESENTS A TYPICAL 60 TON VPSA OXYGEN PLANT BUILDING LAYOUT. ACTUAL DIMENSIONS AND LOCATIONS OF EQUIPMENT MAY VARY DEPENDING ON ACTUAL PLAN SIZE AND SITE CONDITIONS.

3.) REFERENCE AIRSEP DRAWING #ASV60TON10 FOR ADDITIONAL DIMENSIONS AND DETAILS ON THE VPSA OXYGEN PLANT

4.) REFERENCE AIRSEP DRAWING #VPSA_NC FOR TYPICAL P&I DIAGRAM OF THIS PLANT



PLAN VIEW

REV	ECO	REVISION DESCRIPTION	BY	BY	DATE
1	N/A	INITIAL RELEASE OF DRAWING	S.P.M.	T.L.D.	03/21/23

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

FINISH: N/A

AIRSEP Corporation Buffalo, New York 14228

PART NO. TBD

TITLE

ASV60000 OXYGEN PLANT TYPICAL OVERALL BUILDING LAYOUT

SIZE	DWG. NO.	REV
D	ASV60TON01_NC	1

SCALE: 1:60	DO NOT SCALE DRAWING	SHEET 1 OF 1

DRAWING LISTING:
SHEET 1 - LEGEND
SHEET 2 - FEED/WASTE/OXYGEN PROCESS PIPING
SHEET 3 - PRODUCT OXYGEN PROCESS PIPING
SHEET 4 - INSTRUMENT AIR PIPING/OXYGEN SAMPLE TUBING
SHEET 5 - OXYGEN COMPRESSOR PROCESS PIPING (IF REQUIRED)
SHEET 6 - COOLING WATER PROCESS PIPING (IF REQUIRED)

LEGEND

- CHECK VALVE (CV)
- BUTTERFLY WAFER VALVE
- BALL VALVE
- GLOBE VALVE
- GATE VALVE
- 3-WAY BALL VALVE
- MANUAL VALVE W/HANDLE
- MANUAL VALVE W/LOCK PLATE
- MANUAL VALVE W/GEARWHEEL, SPROCKET & CHAIN
- MANUAL OVERIDE ON AUTOMATIC VALVE
- RELIEF VALVE
- REGULATOR
- LOCAL DEVICE
- PANEL MOUNTED DEVICE
- S SOLENOID VALVE
- M MOTORIZED VALVE
- T TIMED SOLENOID VALVE
- 4-WAY VALVE
- CYLINDER ACTUATOR DOUBLE ACTING W/ POSITIONER
- SPRING RETURN ACTUATOR
- DIAPHRAM ACTUATOR
- ACTUATOR
- D DEPRESSURIZE
- DO DIGITAL OUTPUT
- DI DIGITAL INPUT
- AO ANALOG OUTPUT
- AI ANALOG INPUT
- INSTRUMENT AIR LINE
- ELECTRICAL LINE
- PROCESS LINE
- PIPING SUPPLIED BY OTHERS
- ** COMPONENTS SUPPLIED BY OTHERS
- * SUPPLIED COMPONENTS WITH EQUIPMENT
- FILTER
- STR "Y' STRAINER
- STRAUB FLEXIBLE CONNECTION
- FLANGE CONNECTION
- REDUCER
- ROTOMETER
- FLOW METER
- VENT SILENCER

(XXXXXX) AIRSEP EQUIPMENT NUMBER (PART NUMBER) IS FIVE DIGIT PROJECT NUMBER FOLLOWED BY TWO DIGIT EQUIPMENT NUMBER. PROJECT NUMBER LEFT OUT ON P&I FOR CLARITY

INSTRUMENT SOCIETY OF AMERICA TABLE

LETTER	FIRST LETTER (S)		SUCCEEDING LETTERS		
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (+)		ALARM		
B	BURNER FLAME		USERS CHOICE (+)	USERS CHOICE (+)	USERS CHOICE (+)
C	CONDUCTIVITY			CONTROL	
D	DENSITY (S.G)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAUGE		GLASS	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION				MIDDLE
N	TORQUE		USERS CHOICE (+)	USERS CHOICE (+)	USERS CHOICE (+)
O	USERS CHOICE (+)		ORIFICE		
P	PRESSURE (OR VACUUM)		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE	INTEGRATE		
R			RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE (+)		MULTIFUNCTION (+)	MULTIFUNCTION (+)	MULTIFUNCTION (+)
V	VISCOSITY OR VIBRATION			VALVE OR DAMPER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED (+)	X-AXIS	UNCLASSIFIED (+)	UNCLASSIFIED (+)	UNCLASSIFIED (+)
Y	EVENT	Y-AXIS		RELAY OR COMPUTE (+)	
Z	POSITION	Z-AXIS		DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(+) WHEN USED, EXPLANATION IS SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS AND LETTER SYMBOLS.

ABBREVIATION	DESCRIPTION
ATM	ATMOSPHERE
CS/SS	CARBON STEEL TO STAINLESS STEEL
FO	FAIL OPEN
FC	FAIL CLOSE
IA	INSTRUMENT AIR
I/P	CURRENT TO PRESSURE
P	PRESSURE
SS	STAINLESS STEEL
AO	AIR TO OPEN

NUMBER LEGEND:
0 - 99 - INSTRUMENT AIR
100'S - PROCESS AIR
200'S - WASTE GAS
300'S - PRODUCT OXYGEN
400'S - PRODUCT OXYGEN COMPRESSOR
500'S - COOLING

NOTE:

ALL PIPING TO BE CARBON STEEL ASTM A106 GRB, OR ASTM A53 GRB SCHEDULE 40 (OR STD) UNLESS OTHERWISE NOTED.

ALL NOTED STAINLESS STEEL PIPING TO BE ASTM A312, GRADE TP304L OR GRADE 316/316L SCHEDULE 40.

ALL INSTRUMENTS AND VALVES ARE TO BE SUPPLIED BY AIRSEP UNLESS OTHERWISE NOTED.

ALL OPEN PORTS TO HAVE SHIPPING PLUGS INSTALLED ON THEM.

ALL PRESSURES ARE GAUGE PRESSURE UNLESS NOTED OTHERWISE.

PRELIMINARY

LEGEND

REV	ECO	REVISION DESCRIPTION	BY	APPD.	DATE
1	N/A	INITIAL RELEASE OF PRELIMINARY P&ID	S.P.M.	T.L.D.	03/2723

THIRD ANGLE PROJECTION

DRAWN BY: S.P.M.
CHK'D BY: T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

FINISH: N/A

AIRSEP Corporation Buffalo, New York 14228

TITLE
TYPICAL VPSA OXYGEN PLANT
PROCESS & INSTRUMENTATION DIAGRAM

SIZE D | DWG. NO. VPSA02 | REV 1

SCALE: N/A | DO NOT SCALE DRAWING | SHEET 1 OF 6

PRODUCT MANIFOLD

AIR FROM VPSA ROOM

?" DIFF.

UNLOAD SILENCER (26)

MV-318

SAMPLE

MV-319 (CS/SS)

FM-PB

FM-PA

FM-PU

FM-EQ

AV-PA (F/O)

AV-PB (F/O)

AV-PU (F/C)

AV-EQ (F/C)

MV-302

PI 302

MV-312

PI 312

MV-317

?"X1/2"

SAMPLE

MV-301

MV-311

ADSORBER A (82)

ADSORBER B (83)

5VM34

TIT-121-C

TIT-121-B

TIT-121-A

TIT-131-C

TIT-131-B

TIT-131-A

PDT 121

PDT 131

TO SHEET 3

13.6% OXYGEN
85.7% NITROGEN
0.59% ARGON

VENT TO ATMOSPHERE

VACUUM DISCHARGE SILENCER (27)

PIT 202

PIT 201

TIT 202

TIT 201

MV-202

MV-201

ROOTS VACUUM BLOWER (22)

LSL 202

VT 201

LSL 201

SV-200

AV-200 (F/O)

ATM

WASTE MANIFOLD

SV-WA

SV-WB

AV-WA (F/C)

AV-WB (F/C)

PI 200

MV-200

MV-121

PIT 121

MV-131

PIT 131

FEED MANIFOLD

21% OXYGEN
78% NITROGEN
1% ARGON

SEPARATE BLOWER MOTORS MAY BE AN OPTION

MOTOR

VT 150

INSIDE AIR AIR INLET/FILTER (20)

MV-100

PIT 100

TIT 101

FEED AIR INLET SILENCER (23)

PIT 101

PIT 102

MV-101

MV-102

TIT 102

ROOTS FEED BLOWER (21)

LSL 101

VT 101

LSL 102

MV-111

FEED AIR DISCHARGE SILENCER (24)

1/2" OD SS TUBING

PSV 111

PI 111

RV-111 SET @ ?? PSIG (?? BAR)

TCV 500

COOLING WATER IN

COOLING WATER OUT

MV-501

MV-500

MV-566

MV-565

1/2"

AFTERCOOLER (25)

LSH 112

MV-112

DRAIN (NO FLOW)

AV-115 (F/O)

SV-115

SV-FA

SV-FB

AV-FA (F/C)

AV-FB (F/C)

PSV 121

RV-121 SET @ 1/2" X 3/4"

PSV 131

RV-131 SET @ ?2 PSIG 1/2" X 3/4"

TIT 113

LSH 113

MV-113

AV-114 (F/O)

SV-114

DRAIN (NO FLOW)

PRELIMINARY

FEED AIR/WASTE/OXYGEN PROCESS PIPING

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

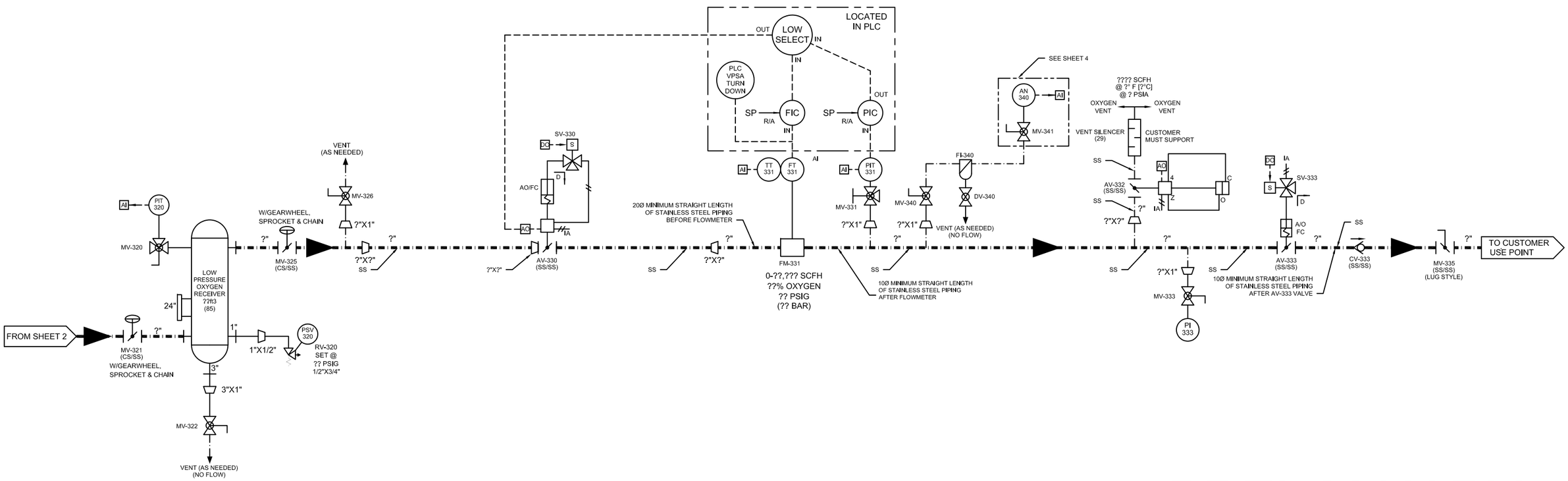
FINISH: N/A

AirSep Corporation Buffalo, New York 14228

TITLE
TYPICAL VPSA OXYGEN PLANT
PROCESS & INSTRUMENTATION DIAGRAM

ENG-S D DWG. NO. VPSA02 REV 1

SCALE: N/A | DO NOT SCALE DRAWING | SHEET 2 OF 6



PRELIMINARY

PRODUCT OXYGEN PROCESS PIPING

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

FINISH: N/A

AirSep Corporation
Buffalo, New York 14228

TITLE
TYPICAL VPSA OXYGEN PLANT
PROCESS & INSTRUMENTATION DIAGRAM

SIZE D | DWG. NO. VPSA02 | REV 1

SCALE: N/A | DO NOT SCALE DRAWING | SHEET 3 OF 6

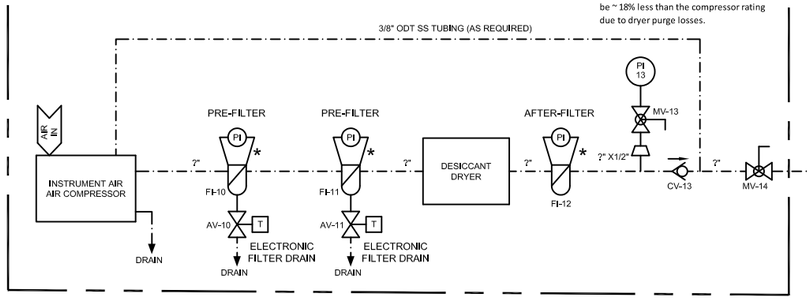
INSTRUMENT AIR PACKAGE (14)
SUPPLIED BY AIRSEP OR OTHERS

MUST MEET THE FOLLOWING REQUIREMENTS:
1.) AIR QUALITY TO BE PER ISO 8573.1, QUALITY - 1,2,1.
2.) FLOW; SEE INSTRUMENT AIR REQUIREMENT TABLE
3.) DEW POINT; -40°C DEW POINT
4.) PRE FILTER; COALESCING FILTER - 0,1 PPM LIQUIDS
5.) PRE FILTER; PARTICULATE FILTER - 0,01 PPM LIQUIDS
6.) AFTER FILTER; PARTICULATE FILTER - 1,0 MICRON PARTICULATES

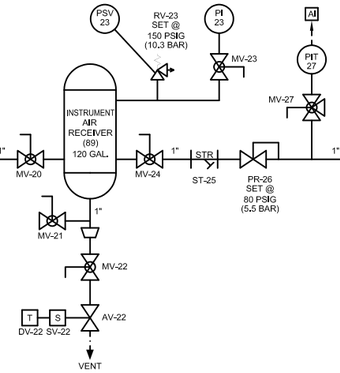
Instrument Air Requirements By VPSA Plant Size (Approximate)

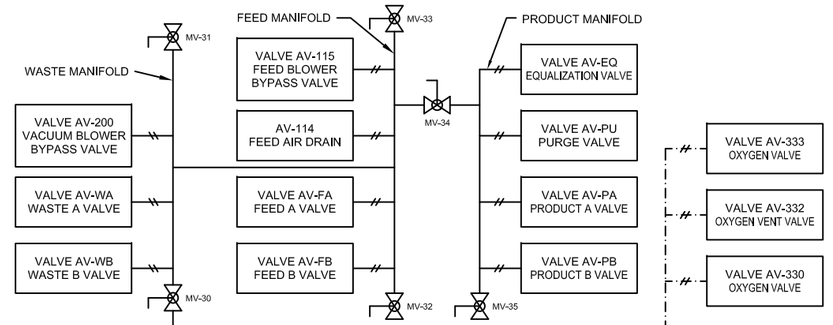
Plant size in TPD	Compressor rating in ACFM	Approx. Compressor HP
>5 to 10	18	5
>10 to 15	38	10
>15 to 20	55	15
>20 to 40	83	20
>40 to 60	100	25
>60 to 125	115	30

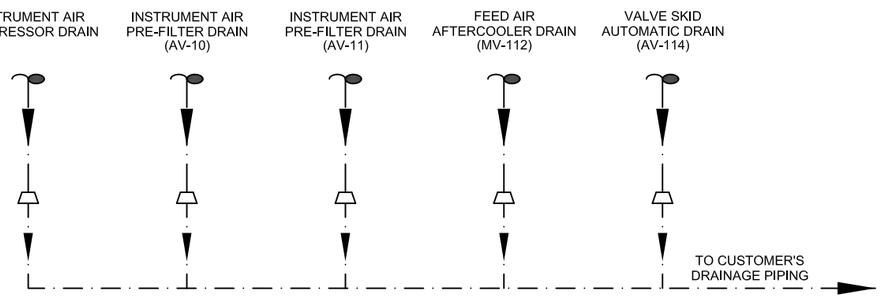
Actual flow available after the dryer will be ~ 18% less than the compressor rating due to dryer purge losses.



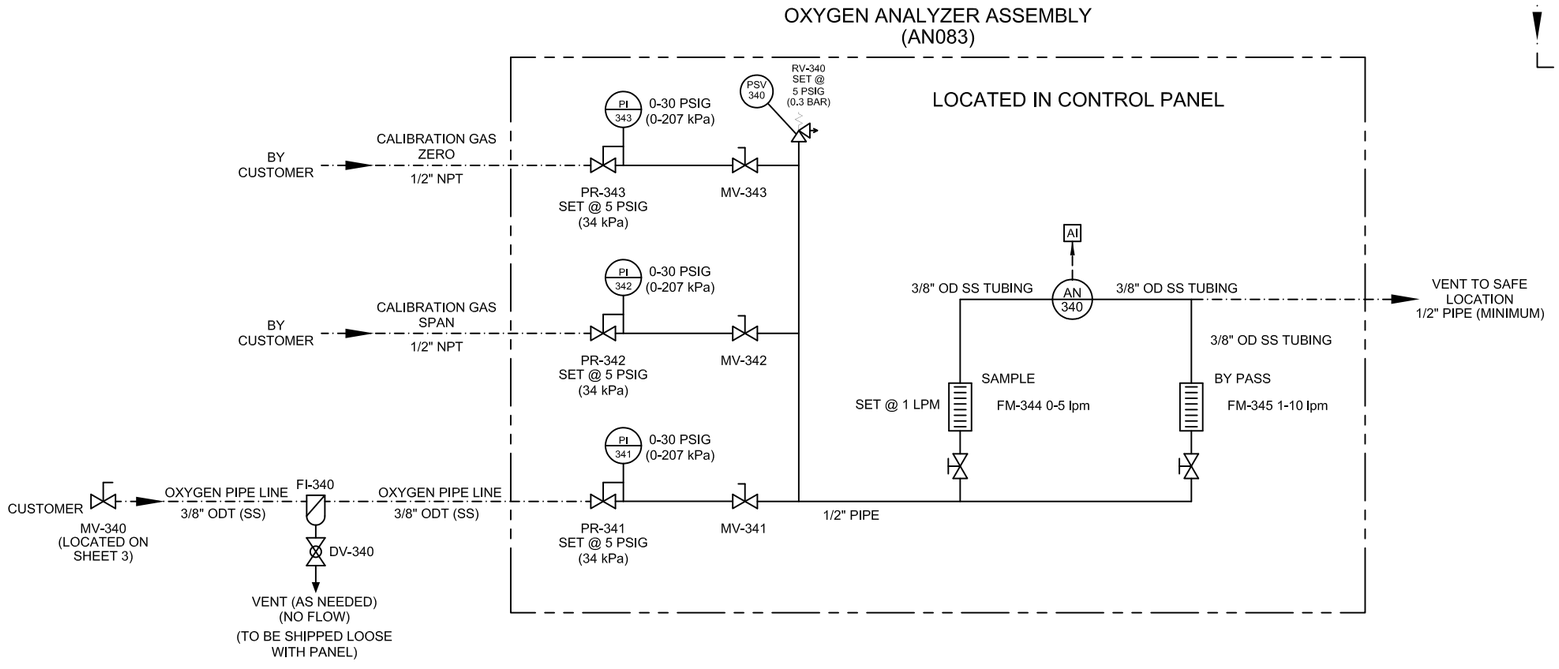
INSTRUMENT AIR PIPING







DRAINAGE PIPING



OXYGEN SAMPLE PIPING/TUBING

PRELIMINARY

INSTRUMENT AIR PIPING
OXYGEN SAMPLE LINE

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

FINISH: N/A

AirSep Corporation Buffalo, New York 14228

TITLE
TYPICAL VPSA OXYGEN PLANT PROCESS & INSTRUMENTATION DIAGRAM

SIZE D | DWG. NO. VPSA02 | REV 1

SCALE: N/A | DO NOT SCALE DRAWING | SHEET 4 OF 6

THIS SHEET IS LEFT BLANK FOR FUTURE USE

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

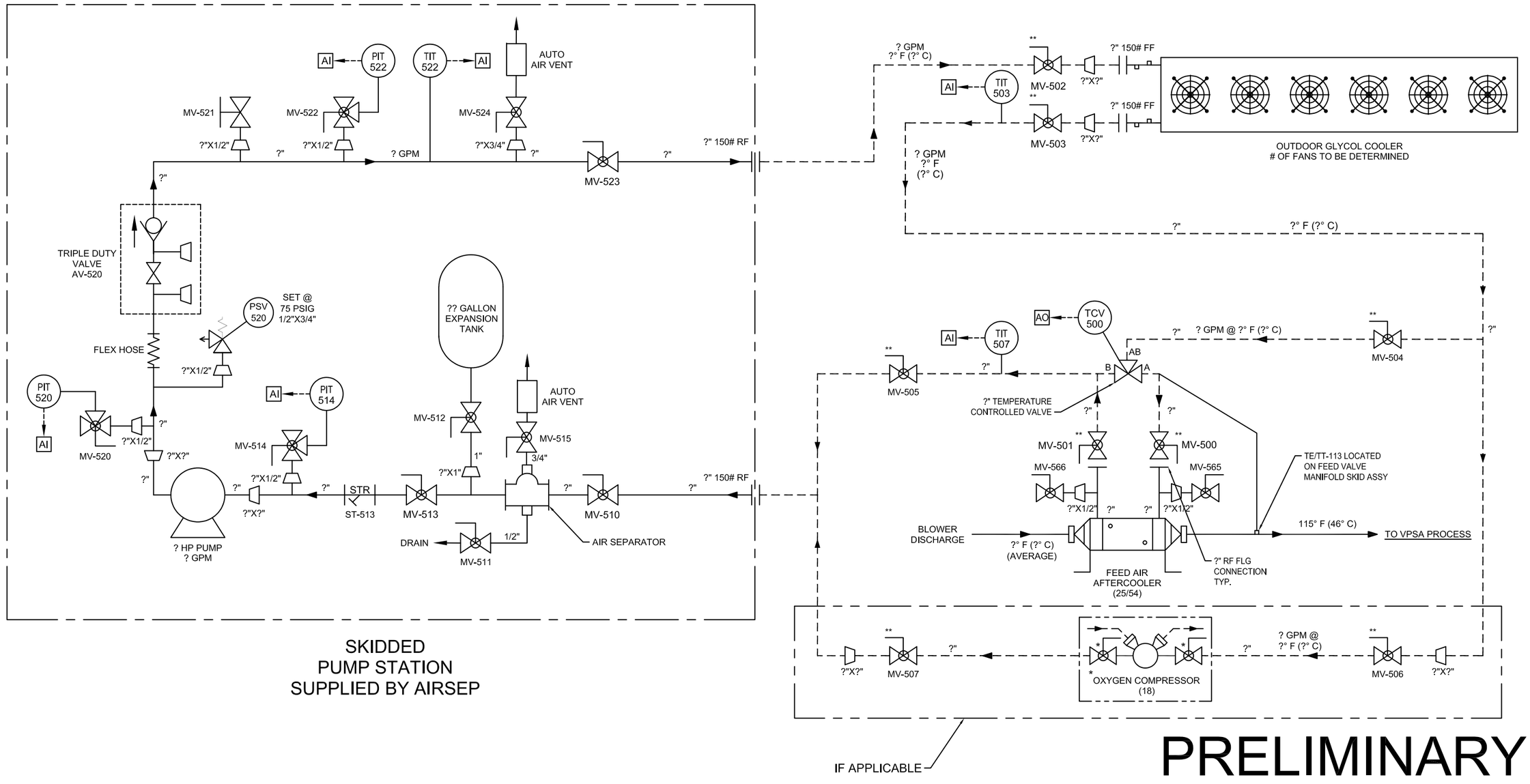
FINISH: N/A

AIRSEP Corporation
Buffalo, New York 14228

TITLE
TYPICAL VPSA OXYGEN PLANT
PROCESS & INSTRUMENTATION DIAGRAM

SIZE D | DWG. NO. VPSA02 | REV 1

SCALE: N/A | DO NOT SCALE DRAWING | SHEET 5 OF 6



SKIDDED
PUMP STATION
SUPPLIED BY AIRSEP

PRELIMINARY

COOLING WATER PROCESS PIPING

NOTES

1. ALL ???V, 3PH, ??HZ
2. COOLING FLUID - 80% WATER, 20% PROPYLENE GLYCOL.
3. INSTALL VENTS IN ALL HIGH POINTS.

THIRD ANGLE PROJECTION

DRAWN BY	S.P.M.
CHK'D BY	T.L.D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: N/A

FINISH: N/A

AIRSEP Corporation Buffalo, New York 14228

TITLE
TYPICAL VPSA OXYGEN PLANT
PROCESS & INSTRUMENTATION DIAGRAM

SIZE D DWG. NO. VPSA02 REV 1

SCALE: N/A | DO NOT SCALE DRAWING | SHEET 6 OF 6

Appendix C: Air Product Sale of Gas Contract Proposal

BUDGETARY OFFERING

PRISM® O2 VSA ON-SITE GENERATION SYSTEM

Wastewater Treatment

February 8, 2023

Prepared by:

Kelly Sheets
Business Development Manager
Generated Gases - SOG
210-749-5597

Christina Curreri
Account Executive
Equipment Sales & Plant Support - SOE
610-791-8488

Plant Design and Performance Specifications

A. Process Gas Discharge

Flow rate (contained O2)	Supply pressure (note 1)
60,000 scfh	3 psig

B. Gaseous Oxygen Product Analysis

(Based on Clean Inlet Air; see Attachment 2 to Scope of Supply)

Oxygen + inert products purity	Primary inerts
93% +	Ar & N2

C. Utilities (note 2)

Electrical feeds, non-hazardous classification
480 V, 3 Φ, 60 Hz feed

D. Power Consumption

Average power consumption presented at site elevation of 48 feet above sea level and average ambient conditions of 74°F dry bulb and 70% relative humidity.

Average power consumption, +/- 10%
492 kW

E. Environmental

- Expected average noise level of 85 dba 3 feet from the generator plant fence line.
- Assumed non-hazardous area adjacent to generator plant.

Commercial Highlights – Sale of Gas

Generator Sale of Gas Agreement / Budgetary Pricing

Note: The pricing provided below is budgetary in nature and is also subject to further approval of Air Products' management.

Based upon the information contained herein and the various assumptions, this budgetary offer is presented under a take-or-pay Sale of Gas Agreement whereby Air Products will design, construct, own, operate and maintain a PRISM® VSA Oxygen Generator system over a **15 Year Product Supply Agreement** in return for a monthly Base Facility Charge.

Budgetary pricing for the oxygen VSA system:

System Description	Monthly Base Facility Charge (+/- 20%)
M21 O2 VSA	$64,000

On-stream Warranty

98% onstream**:** The VSA generator offering described herein is expected to be online greater than 98% of the time. The 2% annual downtime is inclusive of planned and unplanned downtime. Should the plant exceed 2% annual downtime, a credit for the cost of additional LOX needed to back up the generator in excess of 2%.

Price Adjustment

Base Facility Charge
One Hundred percent (100%) of the Base Facility Charge shall be adjusted at contract commencement and Fifty Percent (50%) annually thereafter on the anniversary of the Commencement Date, in direct proportion to changes in the Employment Cost Index - Compensation, Private Industry Workers, Professional and Related occupations (Not Seasonally Adjusted), as published quarterly by the Bureau of Labor Statistics.

Delivery Schedule

The proposed VSA generator system can be made available ~26 months after execution of a mutually acceptable Agreement or binding Letter-of-Intent.

Commercial Highlights – Sale of Equipment

Generator Sale of Equipment Agreement / Budgetary Pricing

Note: The pricing provided below is budgetary in nature and is also subject to further approval of Air Products' management.

Based upon the information contained herein and the various assumptions, this budgetary offer is presented under a Sale of Equipment Agreement whereby Air Products will engineer, design, procure, supply, and startup the equipment for the VSA in accordance with this Technical Description.

Budgetary pricing for the oxygen VSA system:

System Description	SOE Equipment Package Pricing (+/- 20%)
M21 O2 VSA	$4,450,000

Delivery Schedule

The proposed VSA generator system can be made available ~26 months after execution of a mutually acceptable Agreement.

Scope Split Highlights

WHAT'S INCLUDED	SOG	SOE
Air blower and Vacuum blower module with motors	✓	✓
Valve skid module	✓	✓
Modular bed VSA adsorber vessels	✓	✓
Low pressure O2 buffer tank	✓	✓
Prefabricated interconnecting piping including piping to tie-in point at fenceline	✓	✓
Control system panel (PLC installed in AP supplied modular control room)	✓	✓
Motor Control Center; including motor starters	✓	✓
Engineering Labor and T&L	✓	✓
Freight (ocean Freight, inland freight to site)	✓	✓
Mechanical and electrical construction	✓	
Startup and commissioning	✓	
Ongoing operation and maintenance	✓	
Spare parts (startup & commissioning spares)	✓	
Capital spares	✓	

WHAT'S NOT INCLUDED – BOTH SOG & SOE
LOX Backup System
Instrument Air System
4160V to 480V Transformation
Civil design (APCI will provide loading diagrams only)
Prefabricated interconnecting piping including piping to tie-in point at fenceline
Civil construction including foundations
Pipelines to customer
Buildings
Roads, lighting, fencing, etc.
Section 301 Tariffs
Short term interest, permits

VSA Oxygen Generator Process Description

The PRISM VSA Oxygen Generator uses adsorption technology to separate atmosphere air into its two principal components – nitrogen and oxygen. Oxygen, at your specified purity, is provided to your application at the required pressure, and the waste stream (impure nitrogen, water and carbon dioxide) is vented to the atmosphere. Utilizing a fully automated batch process, the VSA's molecular sieve adsorber vessels alternately pressurize to produce oxygen, then depressurize, regenerate and purge to be ready for the next cycle. Uninterrupted, consistent oxygen flow to your application is maintained by a product buffer tank which stores oxygen to ensure supply at all times during the operating cycle. Unlike cryogenic air separation processes, the VSA generator works at ambient temperature, significantly reducing power consumption and capital investment.

Features/Benefits

Reduced capital expenditures

- Efficiently skidded for low installation cost
- Modular design for easy relocation
- Minimum required plot space.

Lower operating costs

- Operating cost savings within turndown range
- Power-efficient gas supply
- Designed for unmanned operation

High reliability

- Fully automatic controls
- Monitoring 24/7
- Full local and remote monitoring

Flexibility

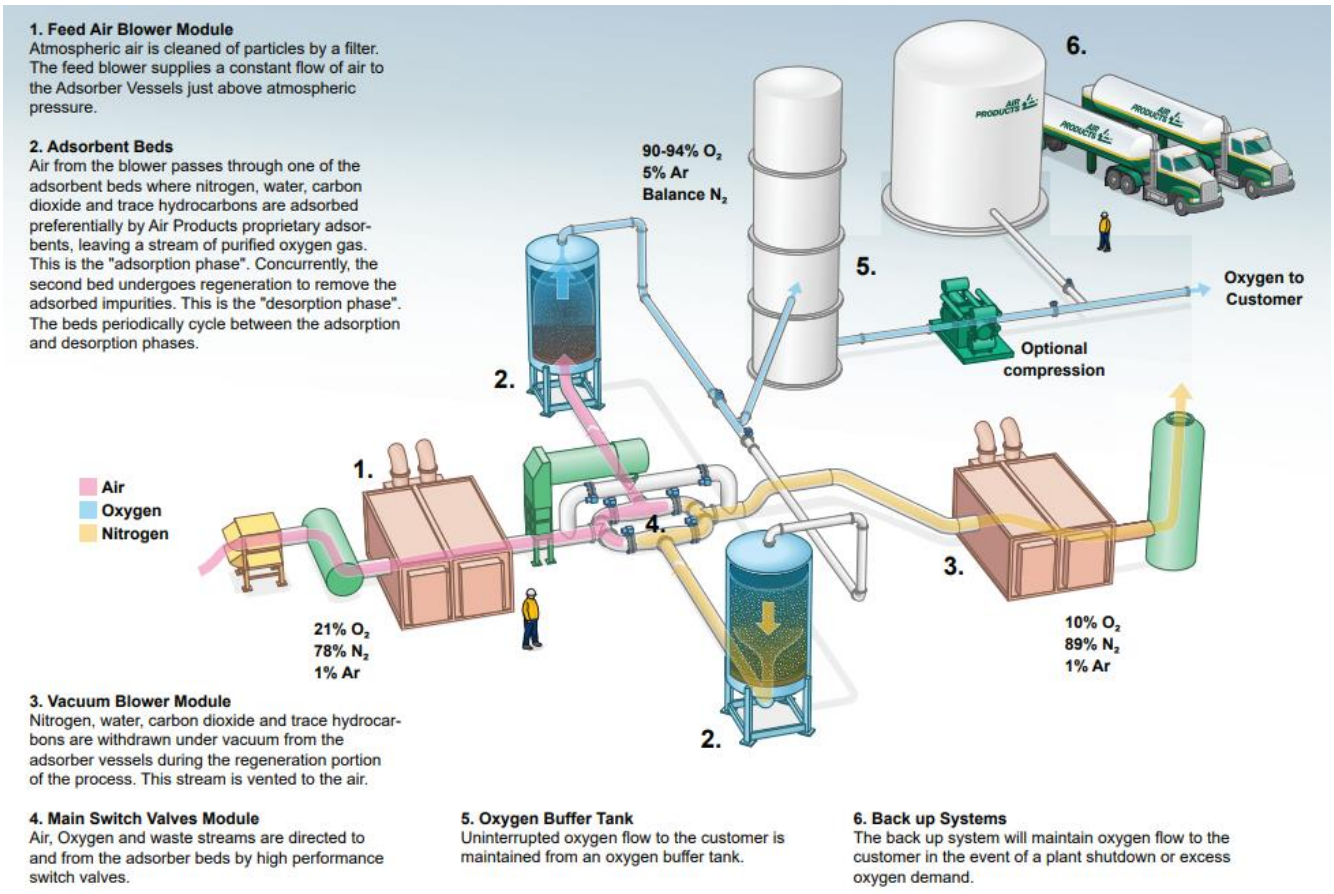
- Efficient turndown to 50% of full capacity
- Advanced sound abatement
- Specific industry focus

Customizable options

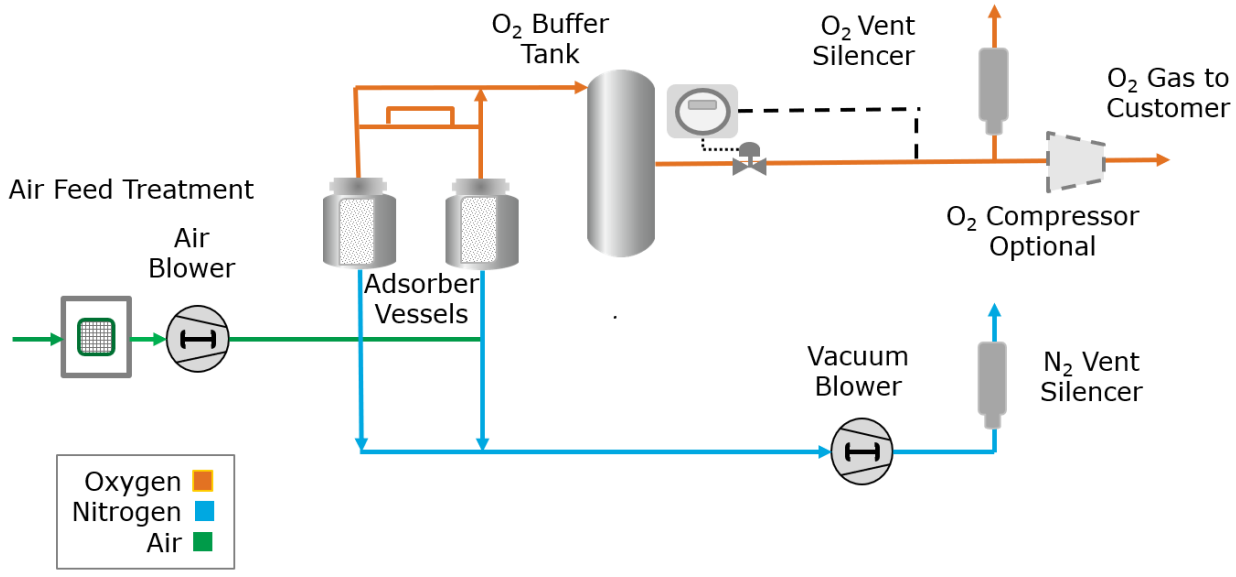
- Oxygen booster compressor with closed loop cooling skid
- Stand-alone instrument air supply
- Reduced voltage start-up
- Full enclosed building for increased sound abatement
- Tight pressure control
- Flexible layouts

PROCESS FLOW DIAGRAMS

1.



2.



FEED AIR SPECIFICATION

Component	Maximum Air Inlet Time Average Concentration ppm by Volume
Hydrogen (H_2)	10
Carbon Monoxide (CO)	20
Carbon Dioxide (CO_2)	400
Methane (CH_4)	10
Acetylene (C_2H_2)	1.0
Ethane (C_2H_6)	0.1
Ethylene (C_2H_4)	0.3
Propylene (C_3H_6)	0.2
Propane (C_3H_8)	0.05
Butane and Heavier Hydrocarbons	1.0
Nitrous Oxide (N_2O)	0.5
Sulphur Dioxide (SO_2)	0.1
Mercaptans	0.1
Hydrogen Sulphide (H_2S)	0.05
Ammonia (NH_3)	1.0
Chlorides, Chlorine, Chlorine Oxides	0.05
Oxides of Nitrogen ($NO + NO_2$)	0.05
All Other Gaseous Impurities (other than Kr, Xe, Ne and He)	Nil
Particulate Matter	<2.5 milligrams/cubic meter, with not more than 3 wt% of all particles larger than 2 microns. Particles to be non corrosive and chemically inert.

Note: Some contaminants will be concentrated in the Equipment and this may affect the Product purity and/or Equipment safety. If necessary, air should be sampled prior to installation. The Equipment is to be located on an Equipment Site with the air compressor intake well away from known sources of contaminants. The air intake must be sited at least 50' (15 m) from continuously running petrol or diesel engines or other hydrocarbon and hydrogen sources

Thank you
tell me more

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Appendix D: RTP Preliminary VPSA Oxygen Generation Cost Estimate

Howard F. Curren AWTP Master Plan Improvements

Task 253 – Bldg. 041

HPO Generation Alternatives Evaluation

Contract No. 20-C-00001

Cost Estimate

Prepared by Reliable Tampa Partners

Issued July 3rd, 2023

SUMMARY

Presented herein is the preliminary estimate of construction cost for the Howard F. Curren AWTP Master Plan Improvements HPO Generation Alternatives Evaluation – Alternative 1: Vacuum Pressure Swing Adsorption (VPSA). This is a Class 4 Estimate (-30% / +50%) developed in accordance with the Technical Memorandum prepared by Hazen and Sawyer. The estimated cost for this project is $26,153,000, including a Firm's Contingency of twenty-precent (20%).

COST ESTIMATE

VPSA Oxygen Generation System Preliminary Budget		
General Conditions	**$**	**1,979,000.00**
Cost of Construction	**$**	**16,490,000.00**
General Requirements	**$**	**1,171,000.00**
Consultants	**$**	**690,000.00**
Site & Civil	**$**	**268,000.00**
Site Preparation and Maintenance	$	20,000.00
Site Restoration	$	133,000.00
Stormwater Pollution Prevention	$	115,000.00
VPSA Structure	**$**	**10,175,500.00**
Earthwork	$	505,500.00
Pile Foundations & Concrete	$	2,199,000.00
Masonry	$	360,000.00
Metals	$	56,000.00
Woods, Plastics, and Composites	$	10,000.00
Thermal and Moisture Protection	$	173,000.00
Openings	$	150,000.00
Finishes	$	252,000.00
Specialties	$	20,000.00
Overhead Bridge Crane	$	250,000.00
Heating Ventilating and Air Condition	$	200,000.00
Process Interconnections	$	1,000,000.00
Process Gas and Liquid Equipment	$	5,000,000.00
Electrical & Control Room	**$**	**235,500.00**
Concrete	$	24,500.00
Masonry	$	30,000.00
Thermal and Moisture Protection	$	18,000.00
Openings	$	53,000.00
Finishes	$	21,000.00
Specialties	$	9,000.00
Heating Ventilating and Air Condition	$	80,000.00
Instrumentation & Controls	**$**	**350,000.00**
Electrical (Includes New Transformers)	**$**	**3,000,000.00**
New Transformer Structure	**$**	**600,000.00**
Firm's Contingency (20%)	**$**	**3,694,000.00**
Design-Build Fee (7%)	**$**	**1,552,000.00**
Owner's Contingency	**$**	**500,000.00**
Allowances	**$**	**1,300,000.00**
Bonds & Insurance (2.5%)	**$**	**638,000.00**
Total	**$**	**26,153,000.00**

CLARIFICATIONS

RTP has prepared this estimate with the following clarifications:

1. This cost estimate is based on current market conditions and does not account for escalation.
2. No Davis-Bacon, other prevailing wage requirements, or American Iron and Steel (AIS) provisions are incorporated in the pricing.
3. It is assumed this scope of work will be included in a GMP with other master plan improvements and will occur concurrently with these other improvements.
4. No provisions for an Inspector's trailer are included.
5. The cost estimate does not include any temporary power or temporary backup power.
6. No below grade site investigation has been performed. This estimate assumes piles will be required.

Appendix E: HPO Generation Alternatives Detailed Cost Estimates

DWG ASSOCIATES, INC

PROBABLE CONCEPTUAL CONSTRUCTION COSTS

( ) No Design Complete
(X) Preliminary
( ) Final Design

Howard F. Curren Oxygen Generation Plant Improvements
Project No.: 41077-013C
Checked By:

Date: 01-Mar-23
Estimated By: H & S/DWG Associates
Table Purpose: Initial Capital Costs

Summary Of: Initial Capital Costs		Quantity		Material		Non-capital costs		Total Cost
		No. Units	Unit Measure	Per Unit	Total	Per Unit	Total	
New 59 TPD Cryogenic Oxygen Generator (Owned)								
New 59 TPD Cryo Plant including pad & utility connections (no sound provisions)		1	Lump	$5,520,000	$5,520,000	$2,760,000	$2,760,000	$8,280,000
Freight to HFCAWTF site		1	Lump		$0	$358,800	$358,800	$359,000
Demolition & removal of one existing Cryo (15 crew days @ $20,500/crew day)		1	Lump	$0	$0	$307,500	$307,500	$308,000
Cooling Tower w pumps (part of cryo plant scope)		1	Lump		$0	$0	$0	$0
Instrument Air System		1	Lump	$80,000	$80,000	$24,000	$24,000	$104,000
Site specific installation adder (pilings, flood control, electrical upgrades, OH, etc.)		1	Lump		$0	$7,250,000	$7,250,000	$7,250,000
		1	EA	$0	$0	$0	$0	$0
		1	EA	$0	$0	$0	$0	$0
	Subtotal							$16,301,000
CONTRACTOR CHARGES ---	Contractor Mobilization/demobilization, 3%							$489,030
	Contractor General Conditions (bonds and insurance, admin), 8%							$1,304,080
	Contractor Overhead & Profit, 18%							$2,934,180
	Contingency, 40%							$6,520,400
	Total Estimated Construction Cost - Alternate 1							**$27,548,690**
New 59 TPD VPSA Oxygen Generator (Owned)								
New VPSA System including pad, sound bldg, IA, cooling sys & utility connections		1	Lump	$4,730,000	$4,730,000	$3,311,000	$3,311,000	$8,041,000
Freight to HFCAWTF site		1	Lump	$0	$0	$165,550	$165,550	$166,000
Demolition & removal of one existing Cryo		1	Lump	$0	$0	$307,500	$307,500	$308,000
Site specific installation adder (pilings, flood control, electrical upgrades, OH, etc.)		1	Lump	$0	$0	$6,960,000	$6,960,000	$6,960,000
		1	EA	$0	$0	$0	$0	$0
					$0		$0	$0
		1	EA	$0	$0	$0	$0	$0
		1	EA	$0	$0	$0	$0	$0
			EA		$0		$0	$0
	Subtotal							$15,475,000
CONTRACTOR CHARGES ---	Contractor Mobilization/demobilization, 3%							$464,250
	Contractor General Conditions (bonds and insurance, admin), 8%							$1,238,000
	Contractor Overhead & Profit, 18%							$2,785,500
	Contingency, 40%							$6,190,000
	Total Estimated Construction Cost Alternate 2							**$26,152,750**
Liquid Oxygen (LOX) Supply								
New 30,000 gallon LOX tank		1	Lump	$695,000	$695,000	$173,750	$173,750	$869,000
Freight to HFCAWTF site		1	Lump		$0	$41,700	$41,700	$42,000
Demo of existing cryo plant		1	Lump		$0	$307,500	$307,500	$308,000
Site specific installation adder (pilings, flood control, electrical upgrades, OH, etc.)		1	Lump	$0	$0	$0	$0	$0
Electrical		1	Lump		$0	$0	$0	$0
I&C		1	EA	$0	$0	$0	$0	$0
		1	Lump		$0	$0	$0	$0
		1	EA	$0	$0	$0	$0	$0
	Subtotal							$1,220,000
CONTRACTOR CHARGES ---	Contractor Mobilization/demobilization, 3%							$36,600
	Contractor General Conditions (bonds and insurance, admin), 8%							$97,600
	Contractor Overhead & Profit, 18%							$219,600
	Contingency, 40%							$488,000
	Total Estimated Construction Cost Alternate 3							**$2,061,800**
59 TPD "Sale of Gas" Contract Operations								
Site specific installation adder (pilings, flood control, electrical upgrades, OH, etc.)		1	Lump	$0	$0	$3,000,000	$3,000,000	$3,000,000
Pads, fencing, & utilities		1	Lump	$620,000	$620,000	$93,000	$93,000	$713,000
Demo of existing cryo plant		1	Lump	$0	$0	$307,500	$307,500	$308,000
		1	Lump	$0	$0	$0	$0	$0
		1	EA	$0	$0	$0	$0	$0
					$0		$0	$0
		1	EA	$0	$0	$0	$0	$0
		1	EA	$0	$0	$0	$0	$0
	Subtotal							$4,020,000
CONTRACTOR CHARGES ---	Contractor Mobilization/demobilization, 3%							$120,600
	Contractor General Conditions (bonds and insurance, admin), 8%							$321,600
	Contractor Overhead & Profit, 18%							$723,600
	Contingency, 40%							$1,608,000
	Total Estimated Construction Cost Alternate 4							**$6,793,800**

NOTE: All costs shown are based on the American Association of Cost Estimation (AACE) Class V criteria. This level of estimation is used for conceptual design estimating, where approximately 3 - 5% of detailed design has been completed. Accuracy of the estimating procedure ranges from -20% to -40% low end to +30% to +50% high end.

Lifecycle costs here account
for escalation - RTP's did not
for the preliminary cost est

DWG ASSOCIATES, INC

15 YEAR LIFE CYCLE COSTS - Alternate 1

( ) No Design Complete
(x) Preliminary
( ) Final Design

Howard F. Curren Oxygen Generation Plant Improvements	**Date:**	01-Mar-23
Project No.: 41077-013C	**Estimated By:**	**H & S/DWG Associates**
Checked By:	**Alt. Description:**	**New 59 TPD Cryogenic Oxygen Generator (Owned)**

Life Cycle Operational Costs

Component	Lifecycle (years)	Electricity Usage (kWh/Year)	Average Escalated Electricity Rate (Cost/kWh)*	Total Cost
Air Compressor	15	7,750,463	$0.096	$11,173,829
Instrument Air	15	0	$0.096	$0
Cooling System pumps	15	130,699	$0.096	$188,429
	15	0	$0.096	$0
Subtotal of Energy Costs				**$11,362,258**
7.5% Energy Cost Contingency				$852,169
15 Year Energy Costs				**$12,214,427**
	Lifecycle (years)	**LOX Usage, tons/yr**	**Average Escalated (Cost/ton)***	
LOX Costs	15	861.6	$156.74	$2,025,768
7.5% Operational Cost Contingency				$151,933
15 Year Purchase of LOX Costs				**$2,177,700**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Operations and Maintenance manpower	15			$423,159
Maintenance Capital (parts, equip., etc.)	15	$182,400	1.335	$3,652,302
7.5% O&M Cost Contingency				$273,923
15 Year O & M Costs				**$4,349,384**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Facility Fee	15	$0	1.335	$0
7.5% Contingency				$0
15 Year Facility Fee (Lease Fee)				**$0**

Calculation of Annual Usage or Costs

Electricity Usage

	hp	kW	kWh/day	kWh/Year**
Air Compressor	1,186	885	21,234	7,750,463
Instrument Air	0	0	0	0
Cooling System pumps	20	15	358	130,699
		0	0	0

O & M Costs (Manpower and Comsumables)

			Maint. Costs (parts, equip.) $/mo	$/yr ##
Annual Equipment & Parts Maintenance Costs			$15,200	$182,400

Liquid Oxygen (LOX) Usage

			LOX Usage, tons/mo.#	LOX Usage, tons/yr
Purchased Liquid Oxygen Usage (To cover planned Shutdowns)			71.8	861.6

O&M Costs

	Hours/week ***	Total Hours/yr.	Average Escalated Hourly Rate ($/hour)	Total Cost
Operations Manpower	80.7	4,196	$80.65	$338,443
Maintenance Manpower	20.2	1,050	$80.65	$84,716
Subtotal of O&M manpower costs				**$423,159**

Notes

7.5% Contingency applied to electrical costs
7.5% Contingency applied to operational costs
7.5% Contingency applied to O&M costs and Lease Fee
* See "Escalation Tables,"
** 15 kW/TPD for cryo system, cooling system pumps @ nameplate, IA only used during startup
*** Operations (12 hrs/day for 350 days/yr) & Maintenance manpower (3 hrs/day for 350 days/yr) assumed the same as for current cryos
# Lox cost = 4% downtime per year with evaporative losses made up by cryo kettle (365d/yr x 4% x 59 ton/d) / 12 mo/yr) = tons/mo
About 3% of capital cost of new cryo equip.

DWG ASSOCIATES, INC	15 YEAR LIFE CYCLE COSTS -- Alternate 2	
	( )	No Design Complete
	(x)	Preliminary
	( )	Final Design
Howard F. Curren Oxygen Generation Plant Improvements	Date:	01-Mar-23
Project No.: 41077-013C	Estimated By:	H & S/DWG Associates
Checked By:	Alt. Description:	New 59 TPD VPSA Oxygen Generator (Owned)

Life Cycle Operational Costs				
Component	Lifecycle (years)	Electricity Usage (kWh/Year)	Average Escalated Electricity Rate (Cost/kWh)*	Total Cost
Air Compressor/Vacuum Pump	15	4,626,752	$0.096	$6,670,380
Oxygen Booster Compressor (not required)	15	0	$0.096	$0
Instrument Air	15	130,699	$0.096	$188,429
Closed-loop Cooling System	15	98,024	$0.096	$141,322
Subtotal of Energy Costs				**$7,000,131**
7.5% Energy Cost Contingency				$525,010
15 Year Energy Costs				**$7,525,140**
	Lifecycle (years)	**LOX Usage, tons/yr**	**Average Escalated (Cost/ton)***	
LOX Costs	15	562.8	$156.74	$1,323,238
7.5% Operational Cost Contingency				$99,243
15 Year Purchase of LOX Costs				**$1,422,481**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Operations and Maintenance manpower	15			$180,335
Maintenance Capital (parts, equip., etc.)	15	$114,000	1.335	$2,282,689
7.5% O&M Cost Contingency				$171,202
15 Year O & M Costs				**$2,634,226**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Facility Fee	15	$0	1.335	$0
7.5% Contingency				$0
15 Year Facility Fee (Lease Fee)				**$0**

Calculation of Annual Usage or Costs				
Electricity Usage				
	hp	**kW**	**kWh/day**	**kWh/Year****
Air Compressor/Vacuum Pump	708	528	12,676	4,626,752
Oxygen Booster Compressor (not required)	0	0	0	0
Instrument Air	20	15	358	130,699
Closed-loop Cooling System	15	11	269	98,024
O & M Costs (Manpower and Comsumables)				
			Maint. Costs (parts, equip.) $/mo	**$/yr ##**
Annual Equipment & Parts Maintenance Costs			$9,500	$114,000
Liquid Oxygen (LOX) Usage				
			LOX Usage, tons/mo.#	**LOX Usage, tons/yr**
Purchased Liquid Oxygen Usage (Evap + Shutdowns)			46.9	562.8

O&M Costs				
	Hours/week ***	**Total Hours/yr.**	**Average Escalated Hourly Rate ($/hour)**	**Total Cost**
Operations Manpower	23	1,196	$80.65	$96,458
Maintenance Manpower	20	1,040	$80.65	$83,877
Subtotal of O&M manpower costs				**$180,335**

Notes

7.5% Contingency applied to electrical costs

7.5% Contingency applied to operational costs

7.5% Contingency applied to O&M costs and Lease Fee

* See escalation tables

** ~8.95 kW/TPD for VPSA, closed loop cooling system, instrument air @ nameplate

*** Estimated from data on operations and maintenance from Dululth and Rocky Mount

Lox cost = 2% downtime per year plus evaporative losses @ 0.25% of storage volume/day (365d x 2% x 59 ton/d) / 12 mo/yr + (tons LOX x 0.0025 x 365d/yr)/12 mo/yr = tons/mo

About 2% of capital cost of VPSA

DWG ASSOCIATES, INC	15 YEAR LIFE CYCLE COSTS -- Alternate 3	
	( )	No Design Complete
	(x)	Preliminary
	( )	Final Design
Howard F. Curren Oxygen Generation Plant Improvements	Date:	01-Mar-23
Project No.: 41077-013C	Estimated By:	H & S/DWG Associates
Checked By:	Alt. Description:	Liquid Oxygen (LOX) Supply

Life Cycle Operational Costs

Component	Lifecycle (years)	Electricity Usage (kWh/Year)	Average Escalated Electricity Rate (Cost/kWh)*	Total Cost
Air Compressor/Vacuum Pump	15	0	$0.096	$0
Oxygen Booster Compressor	15	0	$0.096	$0
Instrument Air	15	0	$0.096	$0
Closed-loop Cooling System	15	0	$0.096	$0
Subtotal of Energy Costs				**$0**
7.5% Energy Cost Contingency				$0
15 Year Energy Costs				**$0**
	Lifecycle (years)	**LOX Usage, tons/yr**	**Average Escalated (Cost/ton)***	
LOX Costs	15	21672.0	$156.74	$50,954,549
7.5% Operational Cost Contingency				$3,821,591
15 Year Purchase of LOX Costs				**$54,776,140**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Operations and Maintenance manpower	15			$8,388
Maintenance Capital (parts, equip., etc.)	15	$0	1.335	$0
7.5% O&M Cost Contingency				$0
15 Year O & M Costs				**$8,388**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Facility Fee	15	$0	1.335	$0
7.5% Contingency				$0
15 Year Facility Fee (Lease Fee)				**$0**

Calculation of Annual Usage or Costs

Electricity Usage

	hp	kW	kWh/day	kWh/Year**
Air Compressor/Vacuum Pump	0	0	0	0
Oxygen Booster Compressor	0	0	0	0
Instrument Air	0	0	0	0
Closed-loop Cooling System	0	0	0	0

O & M Costs (Manpower and Comsumables)

			Maint. Costs (parts, equip.) $/mo	$/yr
Annual Equipment & Parts Maintenance Costs			$0	$0

Liquid Oxygen (LOX) Usage

			LOX Usage, tons/mo.#	LOX Usage, tons/yr
Purchased Liquid Oxygen Usage			1806.0	21672

O&M Costs

	Hours/week ***	Total Hours/yr.	Average Escalated Hourly Rate ($/hour)	Total Cost
Operations Manpower	2	104	$80.65	$8,388
Maintenance Manpower	0	0	$80.65	$0
Subtotal of O&M manpower costs				**$8,388**

Notes

7.5% Contingency applied to electrical costs

7.5% Contingency applied to operational costs

7.5% Contingency applied to O&M costs and Lease Fee

* See escalation tables.

** All oxygen vaporized with atmospheric vaporizers.

*** Operations & Maintenance manpower estimated based on Orange County, CA experience

Lox cost = 59 TPD plus evaporative losses @ 0.25% of storage volume/day (365d x 59 ton/d) / 12 mo/yr + (tons LOX x 0.0025 x 365d/yr)/12 mo/yr = tons/mo

DWG ASSOCIATES, INC	15 YEAR LIFE CYCLE COSTS -- Alternate 4	
	( )	No Design Complete
	(x)	Preliminary
	( )	Final Design
Howard F. Curren Oxygen Generation Plant Improvements	Date:	01-Mar-23
Project No.: 41077-013C	Estimated By:	H & S/DWG Associates
Checked By:	Alt. Description:	59 TPD "Sale of Gas" Contract Operations

Life Cycle Operational Costs				
Component	Lifecycle (years)	Electricity Usage (kWh/Year)	Average Escalated Electricity Rate (Cost/kWh)*	Total Cost
Air Compressor/Vacuum Pump	15	4,548,332	$0.096	$6,557,323
	15	0	$0.096	$0
Instrument Air	15	130,699	$0.096	$188,429
Closed-loop Cooling System	15	98,024	$0.096	$141,322
Subtotal of Energy Costs				**$6,887,073**
7.5% Energy Cost Contingency				$516,530
15 Year Energy Costs				**$7,403,604**
	Lifecycle (years)	**LOX Usage, tons/yr**	**Average Escalated (Cost/ton)***	
LOX Costs	15	562.8	$156.74	$1,323,238
7.5% Operational Cost Contingency				$99,243
15 Year Purchase of LOX Costs				**$1,422,481**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Operations and Maintenance manpower	15			$29,357
Maintenance Capital (parts, equip., etc.)	15	$1,200	1.335	$24,028
7.5% O&M Cost Contingency				$1,802
15 Year O & M Costs				**$55,187**
	Lifecycle (years)	**Cost/yr**	**Average Escalation Rate***	
Facility Fee	15	$1,230,000	1.335	$24,629,013
7.5% Contingency				$1,847,176
15 Year Facility Fee (Lease Fee)				**$26,476,189**

Calculation of Annual Usage or Costs				
Electricity Usage				
	hp	**kW**	**kWh/day**	**kWh/Year****
Air Compressor/Vacuum Pump	696	519	12,461	4,548,332
	0	0	0	0
Instrument Air	20	15	358	130,699
Closed-loop Cooling System	15	11	269	98,024
O & M Costs (Manpower and Comsumables)				
			Maint. Costs (parts, equip.) $/mo	**$/yr**
Annual Equipment & Parts Maintenance Costs##			$100	$1,200
Liquid Oxygen (LOX) Usage				
			LOX Usage, tons/mo.#	**LOX Usage, tons/yr**
Purchased Liquid Oxygen Usage (Evap + Shutdowns)			46.9	562.8

O&M Costs				
	Hours/week	**Total Hours/yr.**	**Average Escalated Hourly Rate ($/hour)**	**Total Cost**
Operations Manpower##	7	364	$80.65	$29,357
Maintenance Manpower##	0	0	$80.65	$0
Subtotal of O&M manpower costs				**$29,357**

Notes

7.5% Contingency applied to electrical costs

7.5% Contingency applied to operational costs

7.5% Contingency applied to O&M costs and Lease Fee

* See escalation tables.

** 8.8 kW/TPD for VPSA, closed loop cooling system, instrument air @ nameplate

Lox cost = 2% downtime per year plus evaporative losses @ 0.25% of storage volume/day (365d x 2% x 59 ton/d) / 12 mo/yr + (tons LOX x 0.0025 x 365d/yr)/12 mo/yr = tons/mo

Estimated based on experience from Louisville, KY

Escalation Tables

Life Cycle Cost Duration: 15 years

Electrical Cost Escalation		
Escalation Rate:		4.0%
Electricity ($/kWh)		0.072
Year	Unit	($/kWh)
FY1	0	$0.0720
FY2	1	$0.0749
FY3	2	$0.0779
FY4	3	$0.0810
FY5	4	$0.0842
FY6	5	$0.0876
FY7	6	$0.0911
FY8	7	$0.0947
FY9	8	$0.0985
FY10	9	$0.1025
FY11	10	$0.1066
FY12	11	$0.1108
FY13	12	$0.1153
FY14	13	$0.1199
FY15	14	$0.1247
FY16	15	$0.1297
FY17	16	$0.1349
FY18	17	$0.1402
FY19	18	$0.1459
FY20	19	$0.1517
15 Yr. Avg.		**$0.0961**

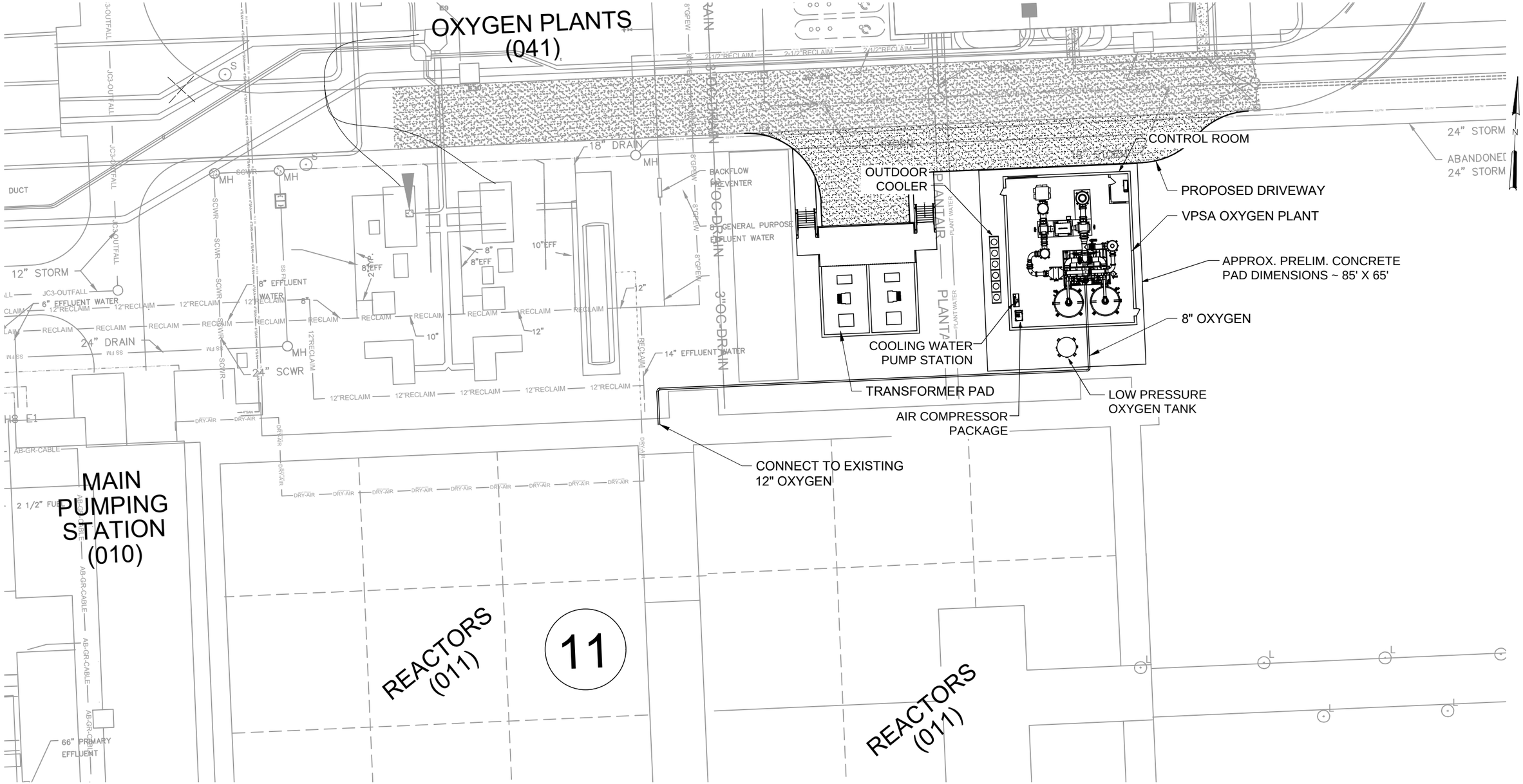
O&M Personnel Pay Escalation		
Inflation Rate:		1.6%
Initial $/hr		$72
Year	Unit	($)
FY1	0	$72.00
FY2	1	$73.15
FY3	2	$74.32
FY4	3	$75.51
FY5	4	$76.72
FY6	5	$77.95
FY7	6	$79.19
FY8	7	$80.46
FY9	8	$81.75
FY10	9	$83.06
FY11	10	$84.39
FY12	11	$85.74
FY13	12	$87.11
FY14	13	$88.50
FY15	14	$89.92
FY16	15	$91.36
FY17	16	$92.82
FY18	17	$94.30
FY19	18	$95.81
FY20	19	$97.34
15 Yr. Avg.		**$80.65**

Replacement (O&M) Equip. Escalation		
Inflation Rate:		4.0%
Initial Monthly Fee Multiplier		1
Year	Unit	
FY1	0	1.0000
FY2	1	1.0400
FY3	2	1.0816
FY4	3	1.1249
FY5	4	1.1699
FY6	5	1.2167
FY7	6	1.2653
FY8	7	1.3159
FY9	8	1.3686
FY10	9	1.4233
FY11	10	1.4802
FY12	11	1.5395
FY13	12	1.6010
FY14	13	1.6651
FY15	14	1.7317
FY16	15	1.8009
FY17	16	1.8730
FY18	17	1.9479
FY19	18	2.0258
FY20	19	2.1068
15 Yr. Avg.		**1.3349**

Facility Fee Escalation		
Inflation Rate:		4.0%
Initial Monthly Fee Multiplier		1
Year	Unit	
FY1	0	1.0000
FY2	1	1.0400
FY3	2	1.0816
FY4	3	1.1249
FY5	4	1.1699
FY6	5	1.2167
FY7	6	1.2653
FY8	7	1.3159
FY9	8	1.3686
FY10	9	1.4233
FY11	10	1.4802
FY12	11	1.5395
FY13	12	1.6010
FY14	13	1.6651
FY15	14	1.7317
FY16	15	1.8009
FY17	16	1.8730
FY18	17	1.9479
FY19	18	2.0258
FY20	19	2.1068
15 Yr. Avg.		**1.3349**

LOX Escalation		
Inflation Rate:		4.0%
Initial $/ton delivered		$117.42
Year	Unit	($/Ton delivered)
FY1	0	$117.42
FY2	1	$122.12
FY3	2	$127.00
FY4	3	$132.08
FY5	4	$137.36
FY6	5	$142.86
FY7	6	$148.57
FY8	7	$154.52
FY9	8	$160.70
FY10	9	$167.13
FY11	10	$173.81
FY12	11	$180.76
FY13	12	$187.99
FY14	13	$195.51
FY15	14	$203.33
FY16	15	$211.47
FY17	16	$219.93
FY18	17	$228.72
FY19	18	$237.87
FY20	19	$247.39
15 Yr. Avg.		**$156.74**

Appendix F: Conceptual Site Layout



LEGEND

- EXISTING CONCRETE SIDEWALK
- EXISTING PAVEMENT
- PROPOSED PAVEMENT

SCALE: 1" = ' 40 20 0 40

Hazen

HAZEN AND SAWYER
1000 NORTH ASHLEY DRIVE, SUITE 1000
TAMPA, FLORIDA 33602

HOWARD F. CURREN AWTP
MASTER PLAN IMPROVEMENTS

FIGURE 1-1

Procurement Guidelines To Implement Women, Minority, & Small Business Participation

Underutilized WMBE Primes by Industry Category

FORMAL PROCUREMENT

Construction	Construction-Related	Professional	Non-Professional	Goods
Black	Asian	Black	Black	Black
Hispanic	Native Am.	Hispanic	Asian	Hispanic
Native Am.	Woman	Asian	Native Am.	Asian
Woman		Native Am.		Native Am.
		Woman		Woman

Underutilized WMBE Sub-Contractors / Sub-Consultants

SUB WORK

Construction	Construction-Related	Professional	Non-Professional	Goods
Black	Black	Black	Black	Black
	Asian	Asian	Asian	Asian
	Native Am.	Native Am.	Native Am.	Native Am.
	Woman	Woman		Woman
		Hispanic		

Policy

The Guidelines apply to formal procurements and solicitations. WMBE participation will be narrowly-tailored for affected groups.

Index

Black (BBE) = Black/African-American Business Enterprise
Hispanic (HBE) = Hispanic Business Enterprise
Asian (ABE) = Asian Business Enterprise
Native American (NBE) = Native American Business Enterprise
Woman (WBE) = Woman Business Enterprise (Caucasian)

Industry Categories

Construction is defined as: new construction, renovation, restoration, maintenance of public improvements and underground utilities.
Construction-Related Services are defined as: architecture, professional engineering, landscape architecture, design build, construction management services, or registered surveying and mapping.
Professional Services are defined as: attorney, accountant, medical doctor, veterinarian, miscellaneous consultant, etc.
Non-Professional Services are defined as: lawn maintenance, painting, janitorial, printing, hauling, security guard, etc.
Goods are defined as: all supplies, materials, pipes, equipment, machinery, appliances, and other commodities.

DMI-70 Form

Points Pursuant to Designated Industry Category:_____ ***DMI-71 FORM*** **(Refer to DMI 70 Form and DMI 50 Form -GFE Outreach)**		
	Evaluation Criteria	**Point**
A.	Underutilized WMBE Firms participating as the Prime Contractor (City of Tampa Certified Only)	16-20
B.	City of Tampa Certified WMBE and/or SLBE Prime Contractor with meaningful sub-(contractor, consultant) participation by City Certified Underutilized WMBE and/or SLBE firms	5 - 15
C.	Non-City of Tampa Certified WMBE & SLBE Prime Contractor with meaningful sub-(contractor, consultant) participation by City Certified Underutilized WMBE and/or SLBE firms	1 - 15
D.	* External agency WMBE & SLBE/DBE certifications recognized by the City of Tampa for designated RFP, RFQ, and RFI solicitations	0 – 7
NOTE: The maximum points available for WMBE and/or SLBE participation will not exceed twenty (20). In addition, evaluation points will be awarded for To-Be-Determined (TBD) participation.		

Points are determined as follows (Requires DMI 50 Form -GFE):

A. A maximum of twenty (20) rating points **may** be awarded when the Proposer is a City of Tampa Certified WMBE firm deemed underutilized within the industry category established by the RFQ/RFP/RFI.

B. A maximum of fifteen (15) rating points **may** be awarded when the Proposer is a City of Tampa-certified WMBE and/or SLBE with meaningful participation by City-certified WMBE and/or SLBE sub-contractors/consultants.

C. One to Fifteen (1-15) rating points **may** be awarded when the Proposer is not a City of Tampa certified WMBE & SLBE prime contractor but utilizes either Underutilized WMBE and/or SLBE certified firm(s) as sub-contractors/consultants and assigned to perform meaningful segments of the contractual services detailed herein and documented on the enclosed DMI 10-20 Form.

D. A maximum of seven (7) "discretionary" rating points **may** be awarded when the Proposer provides WMBE & SLBE participation from an external agency recognized by the City. Discretionary points may be awarded for ancillary participation (see definition). **In addition, evaluation points will be awarded for To-Be-Determined (TBD) participation.** The point values for ancillary participation may be subordinate to weighted values outlined in categories A, B, and C above.

**NOTE: ***WMBE participation is narrowly tailored (per policy) to target the underutilization of affected groups in specific trade/industry categories. Any WMBE & SLBE achievement that was not designated on the DMI 70 Form is considered ancillary. Ancillary participation may be counted with overall participation and credited to your rating points when underutilization criteria are met.

The maximum number of points available for WMBE and/or SLBE participation will not exceed a total of twenty (20) points.

Equal Business Opportunity Evaluation Weighted Points: CCNA Proposal Guidelines

Under CCNA solicitations, proposers must submit to preconstruction Good Faith Efforts (GFE) requirements covering the inclusion of City of Tampa-certified WMBE and SLBE firms. Such inclusion shall be clearly addressed and documented utilizing DMI 10, 20, and 50 Forms. Proof of certification shall include copies of current certification certificates. This applies to ALL Phase 1 preconstruction design services.

Points awarded during the shortlist selection process will be more heavily weighted predominantly on the design side (this does not preclude identification of phase 2 projections of construction participation that follow in the future, i.e., GMPs). In order to ensure the maximum points, a proposer must **clearly identify and quantify** its planned participation without ambiguity. Simply marking "To Be Determined" (TBD) will not satisfy this requirement and may receive significantly lower ratings. Finally, additional favorable consideration will be granted to the firm(s) that beyond all others, provide(s) the highest *relevant* and most binding participation.

Additional Evaluation Information:

The evaluation includes but is not limited to the following criteria:

- Diversity of WMBE & SLBE subcontractors listed to be utilized (DMI Form 20)
- Percentage of proposal/scope committed to WMBE & SLBE subcontracting.
- The collective factors in determining the total points awarded will be based on the overall weight of evidence in the proposal that specified the participation.
- Subcontractors utilized for meaningful tasks. The meaningful task is viewed as being related to the core scope of work.

In all cases, the Proposer and/or subcontractor(s) must be WMBE and/or SLBE certified prior to the opening date and time of the RFP to be eligible to earn WMBE & SLBE rating points. The evaluation process of WMBE and SLBE participation will be evaluated by the City of Tampa's Office of Equal Business Opportunity. The Successful Proposer will be required to execute the DMI 40 Form (Letter of Intent-LOI) with their subcontractors/sub-consultants prior to award.

Failure to Complete, Sign and Submit Forms 10, 20, & 50 SHALL render the Bid or Proposal Non-Responsive

Page 1 of 4 – DMI Solicited/Utilized Schedules

City of Tampa – Schedule of All Solicited Sub-(Contractors/Consultants/Suppliers)

(DMI 10 Form)

Contract No.:_____ Contract Name:_____

Company Name:_____ Address:_____

Federal ID:_____ Phone:_____ Fax:_____ Email:_____

Check applicable box(es). Detailed Instructions for completing this form are on page 2 of 4.

☐ **No Firms were contacted or solicited for this contract.**

☐ **No Firms were contacted because:**_____

☐ **See attached list of additional Firms solicited and all supplemental information (List must comply to this form)**

Note: Form DMI-10 must list ALL subcontractors solicited including Non-minority/small businesses

NIGP Code Categories: Buildings = 909, General = 912, Heavy = 913, Trades = 914, Architects = 906, Engineers & Surveyors = 925, Supplier = 912-77

S = SLBE W=WMBE O = Neither Federal ID	Company Name Address Phone, Fax, Email	Type of Ownership (F=Female M=Male) BF BM = African Am. HF HM = Hispanic AF AM = Asian Am. NF NM = Native Am. CF CM = Caucasian	Trade or Services NIGP Code (listed above)	Contact Method L=Letter F=Fax E=Email P=Phone	Quote or Response Received Y/N

It is hereby certified that the information provided is an accurate and true account of contacts and solicitations for sub–contracting opportunities on this contract.

Signed:_____ Name/Title:_____ Date:_____

Failure to Complete, Sign and Submit Forms 10, 20, & 50 SHALL render the Bid or Proposal Non-Responsive

Forms must be included with Bid / Proposal

Instructions for completing The Sub-(Contractors/Consultants/ Suppliers) Solicited Form (DMI 10 Form)

This form must be submitted with all bids or proposals. **All** subcontractors (regardless of ownership or size) solicited and subcontractors from whom unsolicited quotations were received must be included on this form. The instructions that follow correspond to the headings on the form required to be completed. Note: Ability or desire to self-perform all work shall not exempt the prime from Good Faith Efforts to achieve participation.

- **Contract No.** This is the number assigned by the City of Tampa for the bid or proposal.
- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business and/or doing business as (dba) if applicable.
- **Address.** The physical address of your business.
- **Federal ID.** FIN. A number assigned to your business for tax reporting purposes.
- **Phone.** Telephone number to contact business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **No Firms were contacted or solicited for this contract.** Checking the box indicates that a pre-determined Subcontract Goal or Participation Plan Requirement was not set by the City resulting in your business not using subcontractors and will self-perform all work. If during the performance of the contract you employ subcontractors, the City must pre-approve subcontractors. Use of the "Sub-(Contractors/Consultants/Suppliers) Payments" form (DMI 30 Form) must be submitted with every pay application and invoice. Note: Certified SLBE or WMBE firms bidding as Primes are not exempt from outreach and solicitation of subcontractors.
- **No Firms were contacted because.** Provide brief explanation why no firms were contacted or solicited.
- **See attached documents.** Check box, if after you have completed the DMI Form in its entirety, you need more space to list additional firms and/or if you have supplemental information/documentation relating to the form. All DMI data not submitted on the DMI 10 Form must be in the same format and have all requested data from DMI 10 Form included.

The following instructions are for information of any and all subcontractors solicited.

- **"S" = SLBE, "W" = WMBE.** Enter "**S**" for firms Certified by the City as Small Local Business Enterprises and/or "**W**" for firms Certified by the City as either Women/Minority Business Enterprise; **"O" = Non-certified others**.
- **Federal ID.** FIN. A number assigned to a business for tax reporting purposes. This information is critical in proper identification and payment of the contractor/subcontractor.
- **Company Name, Address, Phone & Fax**. Provide company information for verification of payments.
- **Type of Ownership.** Indicate the Ethnicity and Gender of the owner of the subcontracting business.
- **Trade, Services, or Materials** indicate the trade, service, or materials provided by the subcontractor. NIGP codes aka "National Institute of Governmental Purchasing" are listed at top section of document.
- **Contact Method L=letter, F=fax, E=Email, P=Phone.** Indicate with letter the method(s) of soliciting for bid.
- Q**uote or Resp. (response) Rec'd (received) Y/N**. Indicate "Y" Yes if you received a quotation or if you received a response to your solicitation. Indicate "N" No if you received no response to your solicitation from the subcontractor. Must keep records: log, ledger, documentation, etc. that can validate/verify.

If additional information is required or you have questions, please contact the Equal Business Opportunity Program - Office of Equal Business Opportunity at (813) 274-5522.

Failure to Complete, Sign, and Submit Forms 10, 20, & 50 SHALL render the Bid or Proposal Non-Responsive

City of Tampa – Schedule of All To-Be-Utilized Sub-(Contractors/Consultants/Suppliers)

(DMI 20 Form)

Contract No.:_____ Contract Name:_____

Company Name:_____Address:_____

Federal ID:_____ Phone:_____ Fax:_____ Email:_____

Check applicable box(es). Detailed Instructions for completing this form are on page 4 of 4.

☐ **See attached list of additional Firms Utilized and all supplemental information (List must comply to this form)**

Note: Form DMI-20 must list ALL subcontractors To-Be-Utilized including Non-minority/small businesses

☐ **No Subcontracting/consulting (of any kind) will be performed on this contract.**

☐ **No Firms are listed to be utilized because:**_____

NIGP Code General Categories: Buildings = 909, General = 912, Heavy = 913, Trades = 914, Architects = 906, Engineers & Surveyors = 925, Supplier = 912-77

Enter "S" for firms Certified as Small Local Business Enterprises, "W" for firms Certified as Women/Minority Business Enterprise, "O" for Other Non-Certified

S = SLBE W=WMBE O =Neither Federal ID	Company Name Address Phone, Fax, Email	Type of Ownership (F=Female M=Male) BF BM = African Am. HF HM = Hispanic Am. AF AM = Asian Am. NF NM = Native Am. CF CM = Caucasian	Trade, Services, or Materials NIGP Code Listed above	$ Amount of Quote. Letter of Intent (LOI) if available	Percent of Scope or Contract %

Total ALL Subcontract / Supplier Utilization $_____

Total SLBE Utilization $ _____

Total WMBE Utilization $ _____

Percent SLBE Utilization of Total Bid/Proposal Amt. _____% Percent WMBE Utilization of Total Bid/Proposal Amt. _____%

It is hereby certified that the following information is a true and accurate account of utilization for sub-contracting opportunities on this Contract.

_____ _____ _____

Failure to Complete, Sign and Submit Forms 10, 20, & 50 SHALL render the Bid or Proposal Non-Responsive Forms must be included with Bid / Proposal

Instructions for completing The Sub-(Contractors/Consultants/ Suppliers) to be Utilized Form

(DMI 20 Form)

This form must be submitted with all bids or proposals. All subcontractors (regardless of ownership or size) projected to be utilized must be included on this form. Note: Ability or desire to self-perform all work shall not exempt the prime from Good Faith Efforts to achieve participation.

Contract No. This is the number assigned by the City of Tampa for the bid or proposal.

- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business and/or doing business as (dba) if applicable.
- **Address.** The physical address of your business.
- **Federal ID.** FIN. A number assigned to your business for tax reporting purposes.
- **Phone.** Telephone number to contact business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **No Subcontracting/consulting (of any kind) will be performed on this contract.** Checking box indicates your business will not use subcontractors when no Subcontract Goal or Participation Plan Requirement was set by the City, but will self-perform all work. When subcontractors are utilized during the performance of the contract, the "Sub-(Contractors/Consultants/Suppliers) Payments" form (DMI 30 Form) must be submitted with every pay application and invoice. Note: certified SLBE or WMBE firms bidding as Primes are not exempt from outreach and solicitation of subcontractors, including completion and submitting Form-10 and Form-20.
- **No Firms listed To-Be-Utilized.** Check box; provide brief explanation why no firms were retained when a goal or participation plan requirement was set on the contract. **Note: Mandatory compliance with Good Faith Effort outreach (GFECP) requirements applies (DMI 50 Form) and supporting documentation must accompany the bid.**
- **See attached documents.** Check box, if after completing the DMI Form in its entirety, you need more space to list additional firms and/or if you have supplemental information/documentation relating to the scope/value/percent utilization of subcontractors. Reproduce copies of DMI-20 and attach. All data not submitted on duplicate forms must be in the same format and content as specified in these instructions.

The following instructions are for information of Any and All subcontractors To Be Utilized.

- **Federal ID.** FIN. A number assigned to a business for tax reporting purposes. This information is critical in proper identification of the subcontractor.
- **"S" = SLBE, "W" = WMBE.** Enter "**S**" for firms Certified by the City as Small Local Business Enterprises and/or "**W**" for firms Certified by the City as Women/Minority Business Enterprise; **"O" = Non-certified others**.
- **Company Name, Address, Phone & Fax**. Provide company information for verification of payments.
- **Type of Ownership.** Indicate the Ethnicity and Gender of the owner of the subcontracting business.
- **Trade, Services, or Materials (NIGP code if Known)** Indicate the trade, service, or material provided by the subcontractor. Abbreviated list of NIGP is available at http:/www.tampagov.net/DMI "Information Resources".
- **Amount of Quote, Letters of Intent** (required for both SLBEs and WMBEs).
- **Percent of Work/Contract.** Indicate the percent of the total contract price the subcontract(s) represent. For CCNA only (i.e. Consultant A/E Services) you must indicate subcontracts as percent of total scope/contract.
- **Total Subcontract/Supplier Utilization.** – Provide total dollar amount of all subcontractors/suppliers projected to be used for the contract. (Dollar amounts may be optional in CCNA depending on solicitation format).
- **Total SLBE Utilization.** Provide total dollar amount for all projected SLBE subcontractors/Suppliers used for this contract. (Dollar amounts may be optional in CCNA proposals depending on the solicitation format).
- **Total WMBE Utilization.** Provide total dollar amount for all projected WMBE subcontractors/Suppliers used for this contract. (Dollar amounts may be optional in CCNA proposals depending on the solicitation format).
- **Percent SLBE Utilization.** Total amount allocated to SLBEs divided by the total bid/proposal amount.
- **Percent WMBE Utilization.** Total amount allocated to WMBEs divided by the total bid/proposal amount.

If additional information is required or you have questions, please contact the Equal Business Opportunity Program - Office of Equal Business Opportunity at (813) 274-5522.

Failure to Complete, Sign, and Submit all Forms 10,20, & 50 SHALL render the Bid or Proposal Non-Responsive

Good Faith Effort Compliance Plan (GFECP) Guidelines

for Women/Minority Business Enterprise & Small Local Business Enterprise Participation
City of Tampa - Equal Business Opportunity Program
(DMI 50 Form – See detailed instructions on page 3 of 3)

Contract Name_____ **Bid Date** _____

Bidder/Proposer_____

Signature_____ **Date**_____

Name_____ **Title** _____

The Compliance Plan with attachments is a true account of Good Faith Efforts (GFE) made to achieve the participation goals as specified for Women, Minority Business Enterprises & Small Local Business Enterprises (WMBE & SLBE) on the referenced contract:

☐ **WMBE & SLBE participation Goal is Not Specified for this Solicitation however participation is aspirational and GFECP is required.**

☐ **WMBE & SLBE participation Goal is Met or Exceeded (refer to Goal-Set DMI 90 Form).**

☐ **WMBE & SLBE participation Goal is Not Fully Achieved (refer to Goal-Set DMI 90 Form).**

For each checkbox above Bidders/Proposers shall submit DMI 10 and 20 Forms which accurately report all subcontractors solicited and all subcontractors to-be-utilized. The following list is an overview of the required baseline GFECP action steps for all bids/proposals. Furthermore, it is understood that these GFECP requirements are weighted in the compliance evaluation based on the veracity and demonstrable degree of documentation provided with the bid/proposal:

(Check applicable boxes below - Must enclose supporting documents accordingly with Qualifying Remarks)

(1) Solicited through reasonable and available means the interest of WMBE & SLBEs that have the capability to perform the work of the contract. The Bidder or Proposer must solicit this interest within enough time to allow the WMBE & SLBEs to respond. The Bidder or Proposer must take appropriate steps to follow up initial solicitations with interested WMBE & SLBEs ☐ **See DMI report forms for subcontractors solicited**. ☐ **See enclosed supplemental data on solicitation efforts**.

☐ **Qualifying Remarks**

(2) Provided interested WMBE & SLBEs with adequate, specific scope information about the plans, specifications, and requirements of the contract, including addenda, in a timely manner to assist them in responding to the requested scope identified by bidder/proposer for the solicitation ☐ **See enclosed actual solicitations used**.

☐ **Qualifying Remarks**

(3) Negotiated in good faith with interested WMBE & SLBEs that have submitted bids (e.g. adjusted quantities or scale). Documentation of negotiation must include the names, addresses, and telephone numbers of WMBE & SLBEs that were solicited; the date of each such solicitation; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why agreements could not be reached with WMBE & SLBEs to perform the work. Additional costs involved in soliciting and using subcontractors is not a sufficient reason for a bidder/proposer's failure to meet goals or achieve participation, as long as such costs are reasonable. Bidders are not required to accept excessive quotes in order to meet the goal.

☐ **DMI Utilized Forms for sub-(contractor/consultant) reflect genuine negotiation ☐ this project is an RFQ/RFP in nature and negotiations are limited to clarifications of scope/percentages, specifications, qualifications and subs fee schedules.**

☐ **See enclosed documentation**.

☐ **Qualifying Remarks**

(4) Not rejecting WMBE & SLBEs as being unqualified without justification based on a thorough investigation of their capabilities. The WMBE & SLBEs standing within its industry, membership in specific groups, organizations / associations and political or social affiliations are not legitimate causes for rejecting or not soliciting bids to meet the goals.

☐ **Not applicable**. ☐ **See attached justification for rejection of a subcontractor's bid or proposal**. ☐ **Qualifying Remarks**

(5) Made scope(s) of work available to WMBE & SLBE subcontractors and suppliers; and, segmented portions of the work or material consistent with the available WMBE & SLBE subcontractors and suppliers, to facilitate meeting the goal. ☐ **In addition, Sub-Contractors could bid on their own choice of work or trade without restriction to a pre-determined**

portion. □ **See enclosed comments.**□ **Qualifying Remarks**

(6) Made good faith efforts, despite the ability or desire of Bidder/Proposer to perform the sub-tasks of a contract with its own forces/organization. A Bidder/Proposer who desires to self-perform the sub-tasks of a contract must demonstrate good faith efforts if the goal has not been met. □ **Sub-Contractors were not prohibited from submitting bids/proposals and were solicited on work typically self-performed by the prime.** □ **Qualifying Remarks w/Documents**

(7) Segmented the portions of the work to be performed by WMBEs & SLBEs in order to increase the likelihood that the goals will be met. This includes, where appropriate, breaking out contract work items into economically feasible units (quantities/scale) to facilitate WMBE & SLBE participation, even when the Bidder/Proposer might otherwise prefer to perform these work items with its own forces. □ **Sub-Contractors could bid on their own choice of work or trade without restriction to a pre- determined portion.**□ **Sub-Contractors were not prohibited from submitting bids/proposals and were solicited on work typically self- performed by the prime.** □ **See enclosed comments.**□ **Qualifying Remarks**

(8) Made efforts to assist interested WMBEs & SLBEs in obtaining bonding, lines of credit, or insurance as required by the City or contractor.
□ **See enclosed documentation on initiatives undertaken and methods to accomplish.** □ **Qualifying Remarks**

(9) Made efforts to assist interested WMBEs & SLBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, including participation in an acceptable mentor-protégé program. □ **See enclosed documentation of initiatives and/or agreements.** □ **Qualifying Remarks**

(10) Effectively used the services of the City and other organizations that provide assistance in the recruitment and placement of WMBEs & SLBEs.
□ **See enclosed documentation of services engaged.** □ **Overview (attached) of tactical actions and resources employed toward recruitment**

Note: Any unsolicited information in support of your Bid/RFP Compliance must accompany your submittal. □ **Identify Information Submitted**

Participation Plan: Guidance for Complying with Good Faith Efforts Outreach (page 3 of 3)

(1) All firms on the WMBE & SLBE Goal Setting List must be solicited and documentation provided for email, fax,letters, phone calls, and other methods of outreach/communication with the listed firms. The DMI Solicited and DMI-Utilized forms must be completed for all firms solicited and all firms utilized. Other opportunities for subcontracting should be explored to attain participation. May consult Tampa EBO Office and/or researching the on-line Diversity Management Business System Directory for Tampa certified WMBE & SLBEfirms.

(2) Solicitation of WMBE & SLBEs, via written or electronic notification, should provide specific information on the services needed, where plans can be reviewed and assistance offered in obtaining these, if required. Solicitations should be sent a minimum of a week (i.e. 5 city business days or more) before the bid/proposal date. Actual copies of the bidder's solicitation containing their scope-specific instructions should be provided.

(3) With any quotes received, a follow-up should be made when needed to confirm detail scope of work. For anyWMBE & SLBE low quotes rejected, an explanation shall be provided detailing negotiation efforts.

(4) If a low bid WMBE & SLBE is rejected or deemed unqualified the contractor must provide an explanation and supporting documentation for this decision.

(5) Prime shall break down portions of work into economical feasible opportunities for subcontracting. The WMBE & SLBE directory may be useful in identifying additional subcontracting opportunities and certified firms not listed in the "WMBE & SLBE Goal Setting Firms Contact List."

(6) Contractor shall not preclude WMBE & SLBEs from bidding on any part of work, even if the Contractor may desire to self-perform aspects of the work.

(7) Contractor shall avoid relying solely on subcontracting those scopes of work where WMBE & SLBE availabilityis not sufficient to attain pre-determined goals; including RFP/RFQ solicitations, all of which require GFECPcompliance to achieve sub-consultant participation.

(8) In its solicitations, the Bidder should offer assistance to WMBE & SLBEs in obtaining bonding, insurance, et cetera, if required of subcontractors by the City or Prime Contractor.

(9) In its solicitation, the Bidder should offer assistance in obtaining equipment for a specific job to WMBE & SLBEs, if needed. This includes mobilization where applicable.

(10) Contractor should use the services offered by such agencies as the Small Business Development Center (SBDC) @ University South Fla.; SBDC @ Hillsborough County Entrepreneur Collaborative Center; Hillsborough NAACP Empowerment Center; Hillsborough County Economic Development Department DM/DWBE/SBE Program and Prospera-Hispanic Business Assoc. to name a few for the recruitment and placement of available WMBEs/SLBEs.

RFQ TRANSMITTAL MEMORANDUM
FOR A SUBMITTAL TO THE CITY OF TAMPA, FLORIDA

TRANSMITTAL DATE:_____

RFQ NO. & TITLE: 25-C-00024 Howard F. Curren AWTP High Purity Oxygen Generation Facility Replacement Design Build

TO: Brad L. Baird, P. E., Chairman Selection & Certification Committee (CCNA)
c/o Contract Administration Department via **ContractAdministration@tampagov.net**
306 East Jackson Street, 4th Floor North, Tampa, Florida 33602

SUBMITTER ("Firm") NAME: _____

FEDERAL TAX ID#: _____

FIRM TYPE: ☐ Individual/Sole Proprietor ☐ Joint Venture (JV)* ☐ Partnership (PN)* ☐ Corporation
☐ Limited Liability Company ☐ Other: _____

FIRM CONTACT NAME: EMAIL: PHONE:

CERTIFICATIONS:

Firm is licensed, permitted, and certified as required to do business in Florida: [_]Yes [_] No
License/registration/certification no(s): _____

Per §287.133, Fla. Stat., individuals or entities (including those meeting the §287.133, Fla. Stat. definition of"affiliate") placed on the convicted vendor list ("List") following a conviction for public entity crimes may not submit a bid, proposal, or reply ("Response") on a contract to provide any goods or services to a public entity, may not submit a Response on a contract with a public entity for the repair or construction of a public building or public work, may not submit a Response for leases of real property to a public entity, and may not beawarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any publicentity; and may not transact business with any public entity in excess of the threshold amount provided in §287.017, Fla. Stat. for CATEGORY TWO for a period of 36 months from the date of placement on the List.Neither Firm nor its affiliates have been placed on the List: **[_]** Yes [_] No

Pursuant to Tampa Code Section 2-284; Bidder's Criminal History Screening Practices("Ban-The-Box"), the Firm hereby; **[_]** declines incentive points and attaches no documentation [_] applies for incentive points and attaches all the required documentation.

Firm shall comply with all applicable governmental rules & regulations, including the City's Ethics Code (Sec. 2- 522, Tampa Code). The City's Charter & Ethics Code prohibit any City employee from receiving any substantial benefit or profit out of any award or obligation entered into with the City, or from having any direct or indirect financial interest in effecting any such award or obligation. If Firm is successful, it shall ensure no City employeereceives any such benefit or interest as a result of such award (See Sec.2-514(d), Tampa Code): **[_]** Yes [_] No

Firm is not in arrears and is not in default upon any obligation to the City of Tampa: **[_]**Yes [_]No

Firm agrees that if the City of Tampa determines Firm has participated in any collusive, deceptive, or fraudulentpractices with regard to this submittal, in addition to any other remedy it may exercise, the City will have the right to debar Firm and deem invalid any contract let under such circumstances: **[_]** Yes [_] No

Data or material Firm asserts to be exempted from public disclosure under Chapter 119, Fla. Stat., is submittedin a separate, single electronic searchable PDF file labeled with the above RFQ number and the phrase "Confidential Material", which identifies the data/material to be protected, states the reasons the date/material isexempt from public disclosure, and the specific Florida statute allowing such exemption (if "No" or otherwise, then Firm waives any possible or claimed exemption upon submission, effective at opening): [_] Yes [_] No

FAILURE TO COMPLETE THE ABOVE MAY RESULT IN FIRM'S SUBMITTAL BEING DECLARED NON-RESPONSIVE

Authorized Signature : _____
Printed Name: _____
Title: ☐ Sole Prop ☐Pres ☐Sr VP ☐Gen Ptnr ☐LLC Auth.Mbr/Mgr
☐ Other_____(attach proof of authority)

* With submittal or within 10 days thereafter, Firm must provide a signed copy of the complete agreement between all JV/PN members indicating respective roles, responsibilities, and levels of participation.