R10749770

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RPP-WTP PDC

RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Air-Operated Diaphragm Pumps

Content applicable to ALARA? ☐ Yes ☒ No

ADR No. **Rev**

Quality Level
CM
DOE Contract No. DE-AC27-01RV14136

NOTE: Contents of this document are Dangerous Waste Permit affecting.

REV	DATE	BY	CHECK	REVIEW	E&NS	QA	DPEM
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SPECIFICATION No. 24590-WTP-3PS-MPPD-T0001 **Rev** 3

Revision History

Revision	Reason for Revision
0	Issue for Use
1	Reissue with new ALARA Coversheet
2	Corrected Project Number on Coversheet
3	Incorporated SCNs 24590-WTP-3PN-MPPD-00001, 00002, 00003 and 00005; Incorporated by
	Reference 24590- WTP-SDDR -PROC-04-00987, 00988, 00991 and 01123, 24590-WTP- SDDR-
	M-05-00110, Rev 1; Revised to current project format

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA) are regulated at the U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

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1 Scope

1.1 Project Description and Location

The River Protection Project-Waste Treatment Plant (WTP) is a complex of waste treatment facilities where the US Department of Energy (DOE) Hanford Site tank waste will be put into stable glass form. The WTP Contractor will design, build and start-up the WTP pretreatment and vitrification facilities for the DOE Office of River Protection (ORP). The waste treatment facilities will pretreat and immobilize the low-activity waste (LAW) and high-level waste (HLW) currently stored in underground storage tanks at the Hanford Site.

The Hanford Site occupies an area of about 560 square miles and is located along the Columbia River, north of the city of Richland, Washington. The WTP Facility will be constructed at the east end of the 200 East Area of the Hanford Site. The counties of Benton, Franklin, and Grant surround the Hanford Site.

1.2 Equipment, Material, and Services Required

The Seller shall design, furnish materials, fabricate, shop test, and deliver air-operated diaphragm pumps in accordance with this specification and the requirements contained in the Material Requisition. Each pump assembly shall include all components and accessories required to develop the performance described in this specification and the Pump Data Sheets. The Seller shall provide the following as a minimum:

1.2.1 Air-powered double-diaphragm pumps, each complete with non-lubricated air distribution valve, relief valve, air filter, regulator, air exhaust muffler and the accessories specified on individual Pump Data Sheets for Air-Operated Diaphragm Pumps.

1.2.2 Pumps shall be fully assembled, piped and wired, requiring only setting on the foundation and connecting to the Buyer's pipe, air supply and control systems.

1.2.3 Sets of any special tools required for installation and maintenance. The number of tool sets will be specified in the Material Requisition.

1.2.4 One lot of consumable spare parts per item for start-up and one year of operation.

1.3 Work by Others

1.3.1 Material unloading and storage at jobsite

1.3.2 Installation labor

1.3.3 Foundation and anchor bolts

1.3.4 Interconnecting pipework external to unit

1.3.5 Plant Service Air supply

1.3.6 Wiring external to pump

1.4 Definitions and Acronyms

1.4.1 Definitions

Quality Level	WTP Project's quality classifications of structures, systems, and components based on their importance to safety. See Supplier Quality Assurance Program Requirements Datasheet and individual Pump Data Sheets for quality requirements.
Commercial Quality	Structures, systems, components, and associated services that are required to meet the requirements of DOE Order 414.1A. See Supplier Quality Assurance Program Requirements Datasheet and individual Pump Data Sheets for Quality Requirements.
Seismic Category	WTP Project's seismic classifications of structures, systems, and components based on their safety function. See 24590-WTP-3PS-FB01-T0001, Engineering Specification for Structural Design Loads for Seismic Qualification of Seismic Category III & IV Equipment and Tanks, and individual Pump Data Sheets for seismic requirements.

1.4.2 Acronyms of organizations and terms

ASME	American Society of Mechanical Engineers
HI	Hydraulic Institute
MSS	Manufacturing Standardization Society of the Valve and Fittings Industry
OSHA	Occupational Safety and Health Administration

1.5 Quality/Seismic Classifications

Quality Level and Seismic Category of each pump described in this specification will be listed on the individual Pump Data Sheets.

2 Applicable Documents

2.1 General

2.1.1 Work shall be done in accordance with the referenced codes, standards, and documents listed below, which are an integral part of this specification.

2.1.2 When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. If a date or revision is not listed, the latest issue, including addenda, at the time of Request for Quote (RFQ) shall apply, *except for*

material standards where the Seller ensures that the revision associated with currently available material is acceptable for the intended use of the material. When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent combination of requirements.

2.2 Codes and Industry Standards

Sponsor	Number	Subject
ASME	B1.1	Unified Inch Screw Threads
ASME	B1.20.1	Pipe threads, General Purpose (Inch)
ASME	B16.5	Pipe Flanges and Flanged Fittings
ASME	B16.11	Forged Fittings, Socket-Welding and Threaded
MSS	SP-55	Quality Standard for Steel Castings for Valves, Flanges and Fittings and other Piping Components
OSHA	1910.95	Occupation Noise Exposure

2.3 Engineering Specifications

2.3.1 24590-WTP-3PS-G000-T0001,General Specification for Supplier Quality Assurance Program Requirements

2.3.2 24590-WTP-3PS-G000-T0002, Specification for Positive Material Identification (PMI)

2.3.3 24590-WTP-3PS-G000-T0003,General Specification for Packaging, Shipping, Handling and Storage Requirements

2.3.4 24590-WTP-3PS-FB01 -T0001, Engineering Specification for Structural Design Loads for Seismic Qualification of Seismic Category III & IV Equipment and Tanks

3 Design Requirements

3.1 Basic Function

These air-operated diaphragm pumps will transfer liquids that may have high solids content and/or be radioactive and/or hazardous.

3.2 Performance

See the individual Pump Data Sheets.

3.3 Design Conditions

3.3.1 See the individual Pump Data Sheets.

3.3.2 Air-powered pumps shall be of double-diaphragm, double-acting type complete with enclosure, diaphragms, check valves, and air distribution valve. The pump design shall allow access for adjustment or replacement of liquid components, including seals, check valves,

other wetted parts that require maintenance. Equipment shall be designed to run safely to the relief-valve setting. The check valves shall be removable from the liquid end for servicing or replacement. The diaphragms shall be connected by means of a solid steel shaft. The pump flow rate shall be adjustable, by means of the furnished regulator, over the specific turndown ratio, no less than 10: 1, while the pump is running.

3.3.2.1 The design of the equipment shall be no less than utility grade suitable for continuous operation at the minimum and maximum capabilities of the furnished pump.

3.3.2.2 Maximum interchangeability of pump components is desired among similar pump designs. Parts in identical pump designs shall be completely interchangeable.

3.3.3 Diaphragms

3.3.3.1 Pumps shall be provided with diaphragms rated for no less than 110% of the duty conditions.

3.3.3.2 Diaphragms shall be used to provide isolation and transmit pressure from air to pumped fluid. Diaphragm materials shall be compatible with fluids contacted at all specified temperatures. Diaphragms shall be of sufficient thickness and density to prevent permeation.

3.3.3.3 Deleted.

3.3.4 Pump Check Valves

The suction and discharge check valve cartridges or seats and elements shall be replaceable in the field. Proper guiding of check valve elements shall be provided for quick seating action and maximum seal life.

3.3.5 Pressure-Containing Parts

3.3.5.1 Pressure-containing parts shall be positively bolted together (wing bolts, set screws, and clamps shall not be used) and shall be designed to prevent damaging distortion caused by temperature, pressure, torque, and allowable external forces and moments.

3.3.5.2 Through bolting is preferred. Tapped holes in pressure retaining parts shall be kept to a minimum. Studs shall be used in preference to cap screws. Sufficient metal (in addition to the metal allowance for corrosion) shall be left around the bottom of drilled and tapped holes to prevent leakage.

3.3.5.3 Threading shall conform to ASME B1.1.

3.3.5.4 Clearances shall be provided to bolt locations to permit ease of access and the use of socket or box-type wrenches.

3.3.6 Nozzles and Miscellaneous Connections

3.3.6.1 Process and air connections shall be flanged. Flanges shall conform to ASME B16.5 standards except that marking requirements are not applicable. Flanges shall have through bolting. The back surface of all flanges shall be full or spot-faced at the bolt circle. The

suction nozzle flanges (ratings) shall be designed for the same pressure as the discharge flange.

3.3.6.2 Pipe threads shall be taper pipe threads in conformance with ASME B1.20.1. Tapped openings not used shall be plugged with a solid metal plug of material equal to the material of the tapped components and furnished in accordance with ASME B16.11. Plugs shall be of corrosion resistant material. Threads shall be lubricated.

3.3.6.3 Auxiliary piping and tubing, and/or conduit or cable for instrumentation, when furnished by the pump manufacturer, shall be securely supported to resist vibration and damage in the field. Auxiliary tubing shall be heavy-wall stainless steel suitable for the service conditions. Connection for auxiliary systems shall be as specified. A means for disassembly (unions, flanges, connections, etc.) shall be provided.

3.3.7 Pump unit shall have a noise level less than 85 dBA when measured 3 feet in any direction from pump unit. **(OSHA** 1910.95) Seller shall furnish expected noise data.

3.4 Environmental Conditions

3.4.1 See individual Pump Data Sheets.

3.4.2 Pumps and auxiliaries shall be suitable for outdoor installation in the climatic zone specified on the data sheets, but will be normally located indoors. Indoor and outdoor environmental conditions will be specified on the individual Pump Data Sheets.

3.5 Mechanical Requirements

3.5.1 See the individual Pump Data Sheets.

3.5.2 Assuming normal maintenance practices are performed by Buyer as recommended by Seller and based on information provided in individual Pump Data Sheets, Seller shall provide data similar to the following for the pump:

- estimated service life
- common modes of failure (i.e., diaphragm failure, etc.) and the estimated hours until such an event occurs
- maintenance time for replacement of major maintenance items (such as diaphragms), assuming normal work environments

3.6 Loadings

3.6.1 See the individual Pump Data Sheets for Seismic Classification. Equipment shall be designed for the seismic forces corresponding to that defined in 24590-WTP-3PS-FB0l-T0001, Engineering Specification for Structural Design Loads for Seismic Qualification of Seismic Category III & IV Equipment and Tanks as applicable.

3.6.2 Seller shall advise maximum allowable nozzle forces and moments.

3.7 Instrumentation and Control Requirements

3.7.1 See individual Pump Data Sheets.

3.7.2 If noted in individual Pump Data Sheets, pumps shall be provided with electronic diaphragm failure/ leak detection system. Seller shall submit output signal specifications for Buyer review.

4 Materials

4.1 General

Materials used in constructing the equipment shall be suitable for the specified service and subject to review and acceptance by Buyer. Where specific materials are identified in the individual Pump Data Sheets, the base bid shall be based on their use. However, the Seller may additionally offer the option of utilizing alternative materials of equal or superior properties for Buyer's consideration.

4.2 Prohibited Materials

4.2.1 Mercury and other low melting point metals, their alloys, or materials containing such metals as their basic constituents shall not be used in the construction of pumps.

4.2.2 Products which contain asbestos are prohibited. This prohibition includes items such as gaskets even though the item is encapsulated or the asbestos fibers are impregnated with binder material.

5 Fabrication

5.1 General

5.1.1 Use Seller's standard procedures and those of sub-suppliers for fabrication and manufacture of items covered by this specification provided they do not render these items unsuitable for service and conditions specified herein. Where Seller's (or sub-suppliers) standard procedures conflict with applicable specifications, codes or other standards, apply the most stringent requirements to fabricate and manufacture equipment specified.

5.1.2 All equipment shall be furnished neatly finished and free of burrs and fins.

5.1.3 Conform to MSS-SP-55 for visual examination acceptance standards of all casting surfaces. Impregnated castings shall not be furnished.

5.2 Welding

Fabricated sections and repairs shall be welded using Weld Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), Weld Filler Materials, Preheat, Post Weld Heat Treatment, and Welder Performance Tests in accordance with Seller's Quality Assurance Program and related Procedures.

5.3 Assembly

All components furnished under this specification shall be preassembled in Seller's shop to maximum extent consistent with shipping, handling, and erection constraints.

6 Tests

Specified tests shall be conducted in accordance with applicable HI Standards, except as noted in this section. The chloride content of liquids used to test austenitic stainless steel materials shall not exceed 50 parts per million. To prevent deposition of chlorides as a result of evaporative drying, all residual liquid shall be removed from tested parts at the conclusion of the test.

6.1 General

6.1.1 Seller shall conduct and be responsible for all shop tests listed in the individual Pump Data Sheets and other applicable standards and reference documents. Tests may be witnessed by the Buyer's Supplier Quality Representative.

6.1.2 As a minimum, every pump shall have a hydrostatic and a performance test. Seller shall submit testing procedures for Buyer review and acceptance.

6.1.3 Seller shall furnish all facilities necessary for the performance of such tests. In the event Seller's own facilities are not suitable for such tests, Seller shall advise Buyer and obtain advanced written permission for using alternative facilities.

6.1.4 The Seller shall supply Buyer with all certified test data whether witnessed or not.

6.2 Hydrostatic Tests

Pressure retaining casings shall be hydrostatically tested at not less than 125 percent of design (shutoff) pressure or 150 percent of head at specified rated condition, whichever is greater. Hydrostatic test pressure shall be maintained for at least 10 minutes and checked for leaks.

6.3 Positive Material Identification

If specified on individual Pump Data Sheets, Positive Material Identification (PMI) will be required for pressure retaining casings, see 24590-WTP-3PS-G000-T0002, Specification for Positive Material Identification (PMI). Seller shall submit their PMI Procedures and PMI Verification Reports to the Buyer as required in this specification.

7 Preparation for Shipment

7.1 Cleanliness

All dirt, oil, grease, loose mill scale, cuttings, weld spatter, and other foreign matter shall be removed from all interior and exterior surfaces per 24590-WTP-3PS-G000-T0003, General Specification for Packaging, Shipping, Handling and Storage Requirements.

7.2 Painting

7.2.1 After visual examination, all exposed ferrous surfaces shall be primed and coated in accordance with Seller's standard procedures. Color, if specified, shall be advised later.

7.2.2 Machined faces and fittings, preparations for field welding, parts to be embedded in concrete, nonferrous parts, nameplates, and instruction plates shall not be painted. Rust preventative means, such as coating with a preservative, shall be employed to provide protection of ferrous surfaces during shipment and storage.

7.2.3 Seller shall submit their cleaning and coating procedure for Buyer's review prior to performing the work.

7.3 Tagging

7.3.1 Each pump shall be provided with a permanent corrosion-resistant nameplate(s) securely attached at a readily visible location on the equipment and on any other major piece of auxiliary equipment.

7.3.2 The nameplate(s) shall be stamped with the following information in units consistent with the datasheet:

7.3.2.1 Plant item (equipment tag) number.

7.3.2.2 Purchase order number.

7.3.2.3 Seller's size and model number.

7.3.2.4 Pump serial number.

7.3.2.5 Capacity.

7.3.2.6 Minimum and maximum inlet air pressure.

7.3.2.7 Maximum pump discharge pressure @ maximum inlet air pressure.

7.3.2.8 Casing hydrostatic test pressure.

7.3.2.9 Maximum allowable working pressure (MAWP).

7.3.3 In addition to being stamped on the nameplate(s), the pump serial number shall be plainly and permanently marked on the pump casing(s).

7.3.4 Nameplate(s) shall be of austenitic stainless steel or of nickel-copper alloy (Monel or its equivalent). Attachment pins shall be of the same material. Welding is not permitted.

7.4 Packaging and Shipping Instructions

7.4.1 All equipment shall be packed, securely anchored, and protected for shipment in accordance with 24590-WTP-3PS-G000-T0003, General Specification for Packaging, Shipping,

Handling, and Storage Requirements. The Seller shall submit his Shipping Preparation Procedures for Buyer's Review.

7.4.2 All lifting points shall be clearly marked. Lifting lugs shall be provided for pump assemblies.

7.4.3 All openings shall be covered or plugged with substantial one piece plywood, metal or plastic closures, securely fastened and suitable for prolonged exposure prior to final installation.

7.4.4 Packaging shall provide protection for equipment during transit and storage. Equipment may be stored outdoors at jobsite for as long as one year before it is installed.

8 Quality Assurance

8.1 General Requirements

8.1.1 The Seller's Quality Assurance Program (QAP) Requirements are included in 24590-WTP-3PS-G000-T0001, Supplier Quality Assurance Program.

8.1.2 Seller's QAP Manual shall be submitted to Buyer for review in accordance with 24590-WTP-3PS-G000-T0001, Supplier Quality Assurance Program.

8.1.3 Seller's QAP, as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements Data Sheet(s) listed in Section 2 of the Material Requisition.

9 Configuration Management

Equipment and/or components covered by this specification are identified with Plant Item (equipment tag) numbers as given in the individual Data Sheets. Each item shall be tagged per Paragraph 7.3.

10 Documentation and Submittals

10.1 General

Submittals and document quantities shall be submitted as summarized on Forms G-321-E, for Engineering Documents, and G-321-V for Quality Documents. See Material Requisition Section 3.

10.2 Drawings

Drawings shall be inclusive of all following requirements:

10.2.1 Outline drawings of pump assembly, including outline and detail drawings, for each component.

10.2.2 Mounting dimensions and information required for the design of supports and/or foundations.

10.2.3 Dimensions and details for process flanges and other connections.

10.2.4 Locations and identification of parts included in the parts list.

10.2.5 Wiring schematic diagrams and data. Diagrams shall include wire gauges applicable to the supplied units only. External connections for measurement shall be shown on these diagrams.

10.2.6 Gasket, seal, and diaphragm drawings.

10.3 Parts List

Recommended spare parts lists for start-up and one (1) year's operation along with complete lists of prices and equipment parts with drawings showing sectional view of identified parts and assembly locations shall be provided. Seller shall identify limits to shelf-life and storage requirements of parts anticipated to have functional life spans shorter than the equipment design life.

10.4 Test Reports

10.4.1 Completed Data Sheets, as applicable, incorporating required information

10.4.2 Performance curves showing NPSH required, air consumption, efficiency, flow vs. pressure at applicable inlet air pressures.

10.4.3 Hydrostatic test results

10.5 Forces and Moments

Maximum allowable external forces and moments on pump nozzles shall be provided.

10.6 Manuals

Manuals shall be furnished to provide information on the correct storage, installation, operation, and maintenance of the equipment assembly.

10.7 Other

Noise data per paragraph 3.3.7.

10.8 Records

The following Documents shall be submitted for review and maintained on file at Seller's shop and be accessible for Buyer's review:

10.8.1 Hydrostatic test procedures

10.8.2 Performance test procedures

10.8.3 Cleaning and painting procedures

10.8.4 Shipping preparation procedures

11 Design Changes Incorporated by Reference

1. 24590-WTP-SDDR-PROC-04-00987 - Allows Impregnation of casting components for air motor
2. 24590-WTP-SDDR-PROC-04-00988 - Allows attachment of nameplates with stainless steel wire
3. 24590-WTP-SDDR-PROC-04-00991 - Allows reduction of hydrotest duration from 10 minutes to 9 minutes
4. 24590-WTP-SDDR-PROC-04-01123 - Allows Material Test Reports with ASTM year not matching specification requirements
5. 24590-WTP-SDDR-M-05-00110, Rev 1 - Item IV, Allows exceptions to specification sections 3.3.7, 7.3.3, 7.4.2, and 10.4.2