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RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Centrifugal Pumps to Meet Requirements of API Standard 610, Eighth Edition, and for Quality Levels QL-1 and QL-2

DOE Contract No.
DE-AC27-01RV14136

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Contents

1 Scope

1.1 Project Description and Location

The River Protection Project – Waste Treatment and Immobilization 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

Design, furnish materials, fabricate, assemble, test and deliver the centrifugal pumps and accessories in accordance with this specification, including:

1.2.1 Centrifugal pumps, each complete with electric motor and accessories specified on the individual Pump Data Sheets for API 610, 8th Edition.

1.2.2 Services of an installation supervisor when required.

1.2.3 Sets of all special tools required for installation and maintenance. The order will specify the quantity of tool sets to be furnished.

1.2.4 Stainless steel shim packs shall be furnished for each mounting position for each pump and driver. The shims shall be cut and slotted to match each support surface. Each shim pack shall contain:

1 each SS shim 0.250" in thickness
2 each SS shim 0.125" in thickness
2 each SS shim 0.0625" in thickness
2 each SS shim 0.040" in thickness
2 each SS shim 0.010" in thickness
2 each SS shim 0.005" in thickness

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

1.2.6 The Seller shall advise recommended openings in start-up strainers for each pump application.

1.2.7 Each pump, motor and baseplate assembly shall include all components and accessories fully assembled, piped and wired, requiring only setting on the foundation and connecting to Buyer's piping, electrical and control systems.

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 the unit

1.3.5 Electric power supply and connection

1.3.6 Wiring external to the pump and driver

1.3.7 Motor starters

1.4 Definitions and Acronyms

1.4.1 Definitions – See API-610 and:

Important to Safety (ITS)	Project classification of Structures, Systems and Components (SSCs) based on their importance to safety controlling normal releases, accident prevention, and mitigation. ITS classifications are 1) Safety Design Class (SDC), 2) Safety Design Significant (SDS), 3) Other important to safety SSCs and 4) Commercial Grade SSCs.
SDC	Safety Design Class SSCs include those that, by performing their specified safety function, prevent workers or the maximally exposed member of the public from receiving a radiological exposure that exceeds the accident exposure standards defined in the Safety Requirements Document. SDC also applies to those features that, by functioning, prevent the worker or maximally exposed member of the public from receiving a chemical exposure that exceeds the ERPG-2 (AIHA 1988) chemical release standard.
SDS	Safety classification for Important to Safety SSCs needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation; and SSCs that can, if they fail or malfunction, place frequent demands on or adversely affect the function of SDC SSCs.
Other SSCs	Those SSCs that are neither SDC nor SDS.
Quality Level	WTP Project's quality classifications of SSCs based on their importance to safety. Quality Levels are 1 (QL-1), 2 (QL-2), 3 (QL-3) and Non-Quality Related. See Supplier Quality Assurance Program Requirements Datasheet and individual Pump Data Sheet.
QL-1	SDC items.

QL-2	SDS items. QL-2 shall also be used to identify other items and activities for which NQA-1 (1989) compliance is required.
QL-3	Quality Level 3 is for product quality-affecting items and associated services that affect the functionality of an SSC item that is not designated as SDC or SDS.
Non-Quality Related	Remaining SSC items and associated services (those that are not designated as SDC or SDS) that are manufactured using standard commercial practices. For designed items, quality requirements will be defined in applicable design documents.
Seismic Category	WTP Project's seismic classifications of SSCs based on their safety function. Seismic Categories are I (SC-I), II (SC-II), III (SC-III), IV (SC-IV) and V (SC-V). See Engineering Specification 2.3.8 and individual Pump Data Sheets.
SC-I	SSC important to safety and which has a seismic safety function.
SC-II	SSC important to safety, whose failure during a seismic event could prevent a Seismic Category I SSC from performing its seismic safety function.
SC-III	(a) SSC important to safety, but without seismic safety function. (b) SSC not important to safety, but has an inventory of radioactive or hazardous material in an amount less than an important-to-safety significant quantity.
SC-IV	SSC not important to safety and without an inventory of radioactive or hazardous material, but requiring seismic protection.
SC-V	SSC not important to safety and does not require seismic design

1.4.2 Acronyms of Organizations

ABMA	American Bearing Manufacturers Association
AGMA	American Gear Manufacturers Association
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
HI	Hydraulic Institute
ISO	International Organization for Standardization
NEMA	National Electrical Manufacturers Association

NFPA	National Fire Protection Association

1.4.3 Other Acronyms

BPVC	Boiler and Pressure Vessel Code (ASME)
CFR	Code of Federal Regulations

1.5 Quality/Seismic Classifications

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

2 Applicable Documents

2.1 General

2.1.1 Work shall be done in accordance with 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. When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent governing.

2.2 Codes and Industry Standards

2.2.1	40 CFR 264	*Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities*
2.2.2	ABMA Std. 7	*Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plan*
	ABMA Std. 9	*Load Ratings and Fatigue Life for Ball Bearings*
	ABMA Std. 20	*Radial Bearings of Ball, Cylindrical Roller and Spherical Roller Types Metric Design*
2.2.3	AGMA 9002	*Bores and Keyways for Flexible Couplings (Inch Series)*
2.2.4	AIHA ERPG	*Emergency Response Planning Guidelines (1988)*
2.2.5	ANSI Z535.1	*Safety Color Code*
2.2.6	API 610	*Centrifugal Pumps for Petroleum, Heavy Duty Chemical, Eighth Edition, and Gas Industry Service. (See its Appendix A for additional Referenced Publications and International Standards)*
2.2.7	ASME B1.1	*Unified Inch Screw Threads (UN and UNR Thread Form)*
	ASME B1.20.1	*Pipe Threads, General Purpose (Inch)*

	ASME B15.1	*Safety Standard for Mechanical Power Transmission Apparatus*
	ASME B30.20	*Below-the-Hook Lifting Devices*
	ASME B16.5	*Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24*
	ASME B31.3-96	*Process Piping*
	ASME BPVC	*Section V, Nondestructive Examination*
		Section VIII, Div. 1, Pressure Vessels
		Section IX, Welding and Brazing Qualifications
	ASME NQA-1-89	*Quality Assurance Program Requirements for Nuclear Facilities*
2.2.8	ASNT SNT-TC-1A	*Personnel Qualification and Certification in Nondestructive Testing*
2.2.9	ASTM E94	*Standard Guide for Radiographic Examination*
	ASTM E709	*Standard Guide for Magnetic Particle Examination*
2.2.10	HI M300	*Centrifugal Pump Standards*
2.2.11	ISO 1940	*Mechanical Vibration – Balance Quality Requirements of Rigid Rotors (Part 1 & 2)*
2.2.12	NEMA MG 1	*Motors and Generators*
2.2.13	NFPA-70	*National Electric Code*

2.3 Engineering Standards

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

2.3.2 24590-WTP-3PS-G000-TP002, *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-MUMI-T0001, *Specification for Medium Voltage Induction Motors*

2.3.5 24590-WTP-3PS-MUMI-T0002, *Specification for Low Voltage Induction Motors*

2.3.6 24590-WTP-3PS-EVV1-T0001, *Specification for Low Voltage Adjustable Speed Drives*

2.3.7 24590-WTP-3PS-SS90-TP001, *Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks*

3 Design Requirements

3.1 Basic Function

3.1.1 These centrifugal pumps will move liquids between locations requiring a QL-1 or QL-2 pump.

3.1.2 The pumps may be located in "hot cells" which will require remote maintenance and handling design features. (See the individual Pump Data Sheets.)

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 The equipment and appurtenances will be used in a plant that has a nominal design life of 40 years. The design objective for these centrifugal pumps shall be based on a useful life expectancy of 40 years with periodic maintenance as recommended by the Seller.

3.3.3 This (Bechtel WTP) specification covers the minimum requirements for centrifugal pumps designed in accordance with API Standard 610, Eighth Edition, "Centrifugal Pumps for Petroleum, Heavy Duty Chemical, and Gas Industry Services" as modified by this section. Bulleted items in API 610 not addressed in this specification shall have the decisions noted on the individual Pump Data Sheets.

The terms "Supplier" or "Seller" in this specification is equivalent to "Vendor" as defined in API 610.

API 610 Paragraph Numbers

The paragraph numbers in this Section correspond to those in API 610 and each of the paragraphs denotes an "Addition", "Decision", or "Modification" to the API requirements.

1.2.2 (Decision) Dimensions shall be US Standard. Pumps shall comply with applicable US Standards unless a Code or Standard specified dictates otherwise. (See modification of API Paragraph 1.3, Conflicting Requirements.)

1.3 Conflicting Requirements (Modification)

In case of conflict between this specification and other referenced documents, Buyer shall be notified. If no resolution, the following order of precedence shall govern:

- Purchase Order
- Data Sheets
- This Specification
- API 610
- Other referenced specifications and standards

2.1.1 (Modification) Design service life is 40 years. See 3.3.2 of this (Bechtel WTP) specification.

2.1.9 (Decision) Pump Suction Specific Speed (S) shall not exceed 12,000 (calculated using rotative speed in rev/min, BEP flow at the maximum diameter impeller in GPM and NPSH in feet). Pumps offered with suction specific speeds > 12,000 may be accepted subject to Buyer's written approval.

2.1.11 (Addition) Pumps for parallel operation shall have equal head rise (within ±1 % as measured on the performance test) to shutoff.

2.1.14 (Addition) Noise level shall not exceed 85 dBA measured 3 ft from the edge of the baseplate.

2.1.29 (Decision) Pumps and auxiliaries shall be suitable for outdoor installation in the climatic zone specified on the data sheets, but will normally be located indoors.

2.2.4 (Modification) The maximum allowable working pressure shall apply to all parts referred to in the definition of "pressure casing" (See API paragraph 1.4.40), except for double-casing pumps. Components and sections of double-casing pumps which are normally subjected to suction pressure shall be designed to permit, as a minimum, a hydrostatic test pressure equal to the casing maximum allowable working pressure.

2.3.2.1 (Modification) All pumps, except double-casing designs, shall have suction and discharge flanges of equal rating.

2.3.3.3 (Decision) Cylindrical threads shall not be used.

2.3.3.10 (Addition) Unless otherwise specified on individual Pump Data Sheets, casings shall be provided with flanged vents and drains. Flanges shall be the same rating as the pump discharge nozzle.

2.3.3.11 (Decision) Pressure gauge connections shall not be provided.

2.6.4.1 (Addition) The wear ring running clearance (adjusted for temperature) and diameter, shall be clearly stated in the proposal for each service. Pump efficiencies shall be based on the corrected clearances.

3.2.12 (Addition) If non-sparking coupling guards are required, they shall be specified on the data Sheets.

3.3.3 (Addition) Centers of the mounting pads shall be at the correct relative elevation with 0.002 inch per foot of separation between the pads. Each pad shall be machined flat to within 0.002 inch total variation across the surfaces.

3.3.21 (New) To insure that final alignment can be achieved in the field, the equipment manufacturer shall align the pump and driver to within 0.010 inch parallel offset and 0.002 inch/inch angular in the shop. The bolts shall be centered in their holes after the preliminary alignment. Undercutting of hold-down bolts is not acceptable.

Note: Hold down bolts shall not be bolt bound after final alignment in the field. The hold-down bolt shall be reasonably centered, based on visual inspection after the final field alignment.

4.3.2.1a (Modification) Double-casing pumps and other special-design pumps, as approved by an engineering representative of the purchaser, may be segmentally tested at the appropriate section pressure. Segmental hydro testing of horizontal multistage pumps is not acceptable. Hydrostatic testing, whether on a component basis or assembled pump, shall be done after all machining and welding (such as piping connections, drain, vents, seal welding) has been completed.

4.3.3.2 (Modification) Bearing temperatures shall be measured at all five points of the performance test.

4.3.4.1.1 (Addition) NPSHR test shall be performed if the NPSH required by the pump differs from the specified available NPSH by 3 feet or less. The NPSH test will be a vacuum tank suppression test unless a suction valve throttling test has been approved by the purchaser.

5.2.6.2b (Decision) The oil side operating pressure shall be higher than the water side operating pressure.

5.2.6.2c1 (Modification) Reservoir retention time shall be at least 5 minutes.

5.2.6.2e (Modification) A duplex full-flow filter with replaceable elements and filtration of 10 microns nominal or finer shall be provided.

SECTION 6 – SUPPLIER'S DATA The requirements of Section 3 of the Material Requisition shall be applicable in addition to the API-610 requirements.

End Of Comments to API 610

3.4 Environmental Conditions

3.4.1 See individual Pump Data Sheets.

3.4.2 When noted on the Data Sheets, motors shall have radiation shielding or radiation hardened motors as specified. The shielding shall be furnished by the motor Seller with consideration for motor cooling air flow.

3.4.3 When noted on the Data Sheets, all bearings shall have special radiation resistant lubricants.

3.4.4 When noted on the Data Sheets, the seal elastomer components shall use high radiation-tolerance materials.

3.5 Mechanical Requirements

See API 610 and individual Pump Data Sheets.

3.6 Loading

3.6.1 Must meet the API 610 requirements.

3.6.2 See the individual Pump Data Sheets for Seismic Classification.

3.7 Electrical Requirements

3.7.1 See the individual Motor Data Sheets, if provided, otherwise the individual Pump Data Sheets.

3.7.2 Electric motors shall meet the requirements of Project Specifications 24590-WTP-3PS-MUMI-T0001 or 24590-WTP-3PS-MUMI-T0002 for Induction Motors.

3.7.3 Adjustable Speed Drive Motors shall be in accordance with Project Specification 24590-WTP-3PS-EVV1-T0001, for Low Voltage Adjustable Speed Drives.

3.8 Instrumentation and Control Requirements

3.8.1 See the individual Pump Data Sheets.

3.9 Remote Handling Requirements

3.9.1 When Remote Handling capability is required per the individual Pump Data Sheets, detailed specifications and drawings of the Remote Handling requirements will be included. Pumps shall be furnished with Remote Handling provisions in accordance with Project requirements.

3.9.2 Detailed drawings of modifications for Remote Handling shall be furnished for Buyer review prior to the start of work.

4 Materials

4.1 Construction

See the individual Pump Data Sheets and, if provided, the individual Motor Data Sheets.

4.2 Prohibited Materials

4.2.1 Bronze, copper, lead, zinc, tin, antimony, cadmium, or other low melting point metals, their alloys, or materials containing such metals as their basic constituents, or molybdenum and halogens, shall not be used in direct contact with stainless steel, with the exception of oil impregnated bronze bearings. This prohibition applies to the use of tools, fixtures, paints, coatings and sealing compounds, and any other equipment or materials used by the Seller in handling, assembly and storage of stainless steel parts or components.

4.2.2 The use of Teflon seals is prohibited.

4.2.3 The use of asbestos is prohibited.

4.3 Special Requirements

4.3.1 See the individual Pump Data Sheets and, if provided, the individual Motor Data Sheets.

4.4 Storage of Special Materials prior to work

The Seller shall advise any special storage requirements.

5 Fabrication

5.1 Welding

5.1.1 Welding and weld repairs shall follow the requirements of API 610 and other referenced codes and standards as applicable.

5.1.2 Weld repair records shall be included with document package.

5.2 Assembly

Where possible, the pump, motor, baseplate assemblies shall be shipped as a complete package. When this is not possible, Seller shall advise Buyer in advance.

5.3 Heat Treatment

Heat treatment shall be conducted as required by Seller, API 610 and other referenced codes and standards.

5.4 Other Processes (as required)

Positive Material Identification is required for pressure retaining casings per Engineering Standard 2.3.2.

6 Tests and Inspections

6.1 Personnel Qualifications

Qualification of Seller's inspection and test personnel shall be verified by the Buyer's Supplier Quality Representative.

6.2 Non-Destructive Examinations

Personnel performing non-destructive examinations or reviewing such test results shall be certified to ASNT Standard SNT-TC-1A.

6.3 Shop Tests

6.3.1 Seller shall conduct and be responsible for all shop tests listed in the individual Pump Data Sheets, the individual Motor Data Sheets (if provided), API-610 and other applicable standards and reference documents. Tests may be witnessed by the Buyer's Supplier Quality Representative.

6.3.2 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. This shall include testing to verify remote handling requirements, if specified.

6.4 Site Tests

Buyer's startup personnel will run field performance tests after installation. Buyer may request Seller's assistance during startup.

7 Preparation for Shipment

7.1 Cleanliness

All dirt, oil, grease, loose mill scale, weld spatter and other foreign matter shall be removed from all surfaces per API 610, Engineering Standards 24590-WTP-3PS-G000-T0003.

7.2 Painting

After visual examination, all exposed surfaces shall be primed and coated in accordance with Seller's standard procedures and API 610. Seller shall submit their conforming procedures as part of the documentation package. Color, if specified, shall be advised later.

7.3 Tagging

Tagging shall be per Paragraph 2.12 of API 610.

7.4 Packaging and Shipping Instructions

7.4.1 All equipment shall be packed, securely anchored and protected for shipment in accordance with Engineering Standard 24590-WTP-3PS-G000-T0003. Pumps, drive motors and all furnished auxiliaries shall be shipped fully assembled on their specific baseplates. Non-mounted drivers, if approved by Buyer, shall be shipped along with the main assembly.

7.4.2 Special applications requiring different shipping instructions shall be mutually agreed by Buyer and Seller.

8 Quality Assurance

8.1 QA Requirements Specific to Item(s) or Service

8.1.1 The Seller Quality Assurance Program (QAP) requirements are included in 24590-WTP-3PS-G000-T0001.

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

8.2 Program QA elements

Seller's Quality Assurance Program, as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements Data Sheets 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 on the individual Data Sheets. Each item shall be tagged per Section 7.3.

10 Documentation and Submittals

10.1 General

10.1.1 Submittals and document quantities, including Drawings, Installation Procedures, Inspection and Test Reports, Calculations, Manuals, Certificates of Conformance, Schedules, Material Certificates, and others appropriate to the purchased equipment, are detailed in Section 3 of the Material Requisition, including Forms G-321-E and G-321-V, and Section 6.3 of API 610.

10.1.2 The documents and data shall include information listed in the Descriptions in Appendix O of API 610.

10.2 Submittals

10.2.1 Drawings shall satisfy Section 3 of the Material Requisition, and Section 6.3 of API 610.

10.2.2 Priced recommended spare parts lists for start-up and one (1) year's operation along with complete lists of equipment parts with drawings showing assembly locations shall be provided. See Paragraph 6.3.5 of API 610. Seller shall identify limits to shelf-life and storage requirements of parts anticipated to have functional life spans shorter than the equipment design life.

10.2.3 Inspection and Test Reports shall be provided in accordance with Sections 3 and 5 of the Material Requisition, and Appendix O of API 610.

10.2.4 Forces and Moments capabilities, as a minimum, shall meet requirements of Paragraph 2.4 of API 610. Calculations, if specified, shall be furnished.

10.2.5 Manuals shall be furnished to provide information on the correct installation, operation and maintenance of the equipment assembly. They shall be as described in Appendix O of API 610.

10.2.6 Manufacturing schedules and progress reports shall be furnished and sent directly to the Project Expeditor as shown in Section 3 of the Material Requisition.