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R10902453

RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

General Centrifugal Pumps to Meet Requirements of ASME B73.1M-2001 and ASME B73.2M-2003 for Commercial (CM) Components

Content applicable to ALARA? Yes No

ADR No.
24590-WTP-ADR-M-03-007

Rev
0

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

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

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SPECIFICATION No.
24590-WTP-3PS-MPC0-T0002

Rev
3

24590-WTP-3PS-MPC0-T0002, Rev 3
General Centrifugal Pumps to Meet Requirements of ASME
B73.1M-2001 and ASME B73.2M-2003 for Commercial (CM)
Components

Revision History

Revision	Reason for Revision
0	Issued for Use
1	Reissued for Use with General Revisions
2	Incorporate the following SCNs: 24590-WTP-3PN-MPC0-00007, -00010, -00012, -00014, -00015, -00020, & 00021 Incorporate the following SDDRs: 24590-WTP-SDDR-PROC-05-00097, 24590-WTP-SDDR-PROC-04-00614, -04-00659, -04-00660, -04-00804, -04-00895, -04-00928, -04-01117, & -05-00039 and 24590-WTP-SDDR-PROC-05-00096
3	Used current templates for specification cover sheet and specification; Revised sections 1.1, 1.2.5, 2.2, 3.2.1, 3.2.2, 3.5.5, 4.2.1, 5.2.1, 10.1.1, 10.2.9, 10.2.11; 10.2.12; Added section 2.4; Deleted sections 6.6.3, 7.4.3

Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the 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 Hanford Tank Waste Treatment and Immobilization Plant (WTP) is a complex of waste treatment facilities where the U.S. 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. The waste treatment facilities will pretreat and immobilize the low-activity waste and high-level waste 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

Seller shall design, fabricate and test, centrifugal pumps and accessories in accordance with ANSI/ASME Standards B73.1M & B73.2M including:

- 1.2.1 Horizontal centrifugal pumps complete with electric motor, baseplate, and accessories as specified in individual Pump Data Sheets.
- 1.2.2 Vertical in-line centrifugal pumps complete with electric motor and accessories as specified in individual Pump Data Sheets.
- 1.2.3 Specific modifications to pump, attachments, baseplate, baseplate attachments, electric motor, and/or electric motor attachments are detailed in individual Pump Data Sheets.
- 1.2.4 Deleted
- 1.2.5 Stainless steel (SS) shim packs for each foot mounting position for each pump and driver. The shims shall be cut and slotted to match each support baseplate. Unless otherwise agreed to by the Buyer, each shim pack shall contain the following:
 - 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

1.3 Work by Others

- 1.3.1 Material unloading and storage at job site

- 1.3.2 Installation labor
- 1.3.3 External piping
- 1.3.4 Electrical power supply
- 1.3.5 Wiring external to the pump
- 1.3.6 Motor starters (except adjustable speed drive motors)

1.4 Definitions and Acronyms

- 1.4.1 Definitions – See ANSI/ASME B73.1M and ANSI/ASME B73.2M and:

Buyer

Bechtel National Inc. for the WTP.

Seller

Designer, manufacturer, fabricator, vendor, supplier, bidder who provides equipment, components, services or other products for delivery or direct benefit to the Buyer.

- 1.4.2 Acronyms of Organizations and Terms

ABMA	American Bearing Manufacturers Association
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
BEP	Best Efficiency Point
NEMA	National Electrical Manufacturers Association
NPSH	Net Positive Suction Head
PIP	Process Industry Practices

2 Applicable Documents

2.1 General

- 2.1.1 Work shall be done in accordance with the applicable 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

ANSI/ASME B73.1M	<i>Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process - 2001</i>
ANSI/ASME B73.2M	<i>Specification for Vertical In-Line Centrifugal Pumps for Chemical Process - 2003</i>
ANSI/ASME B16.1	<i>Cast Iron Pipe Flanges and Flanged Fittings</i>
ANSI/ASME B16.5	<i>Pipe Flanges and Flanged Fittings</i>
ANSI/ABMA 9	<i>Load Ratings and Fatigue Life for Ball Bearings</i>
ANSI/ABMA 11	<i>Load Ratings and Fatigue Life for Roller Bearings</i>
ANSI/ASME B15.1	<i>Safety Standard for Mechanical Power Transmission Apparatus</i>
ASME B1.1	<i>Unified Inch Screw Threads</i>
ASME Section VIII, Division 1	<i>American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section VIII, Division 1, "Rules for Construction of Pressure Vessels"</i>
ASME Section IX	<i>BPVC Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators</i> <i>Deleted</i>
PIP RESP002	<i>Design of ASME B73.1 and General Purpose Pump Baseplates</i> <i>Deleted</i> <i>Deleted</i>
UBC	<i>Uniform Building Code - 1997</i> <i>Deleted</i>

Deleted
HIS *Hydraulic Institute Standards*
Deleted

2.3 Reference Documents

24590-WTP-3PS-G000-T0001	<i>General Specification for Supplier Quality Assurance Program Requirements</i>
24590-WTP-3PS-G000-T0002	<i>Specification for Positive Material Identification (PMI)</i>
24590-WTP-3PS-G000-T0003	<i>General Specification for Packaging, Shipping, Handling and Storage Requirements</i>
24590-WTP-3PS-EVV1-T0001	<i>Engineering Specification for Low Voltage Adjustable Speed Drives</i>
24590-WTP-3PS-MUMI-T0001	<i>Specification for Medium Voltage Induction Motors</i>
24590-WTP-3PS-MUMI-T0002	<i>Specification for Low Voltage Induction Motors</i>
24590-WTP-3PS-FB01-T0001	<i>Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks</i>

2.4 Government Documents

40 CFR 264	<i>Code of Federal Regulations Part 264—Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities</i>
29 CFR 1910	<i>Code of Federal Regulations Part 1910—Occupational Safety and Health Standards (OSHA) - 1995</i>

3 Design Requirements

3.1 Basic Function

- 3.1.1 The centrifugal pumps shall provide motive force required to move various process liquids (defined in individual Pump Data Sheets) in the facilities that make up the WTP Project.

3.2 Performance

- 3.2.1 Pump head capacity characteristic curves shall be selected to rise continuously as flow is reduced to shutoff. Head rise to shut-off shall be at least 10 % of the head at the rated capacity.

- 3.2.2 Pump shall be capable of a minimum head increase of 5 % at the rated flow by installing a new impeller, up to the maximum allowable shown on the Seller's typical pump curves.
- 3.2.3 The net positive suction head (NPSH) available shall exceed the NPSH required by at least 3 ft from minimum continuous flow to 110 % of rated operating point.
- 3.2.4 Pumps with suction Specific Speeds (N_{ss}) greater than 11,000 require approval from the Buyer.
- 3.2.5 Both the normal and rated flow rates shall be within the acceptable and preferred flow rate ranges established in Figure 1. Buyer approval is required before deviating from this chart.

3.3 Design Conditions

- 3.3.1 Equipment and accessories are to be used in a plant with a design life of 40 years. The design objective for pumps purchased to this Specification shall be 40 years of useful life with periodic maintenance as recommended by the Seller. Maintainable items will be specified for cost-effective design lives taking into account current technology and standards.
- 3.3.2 Specific design conditions shall be detailed in individual Pump Data Sheets for each pump.

3.4 Environmental Conditions

- 3.4.1 Pumps shall be subjected to the operating conditions specified in individual Pump Data Sheets.
- 3.4.2 When noted in individual Pump Data Sheets, the seal elastomer components shall use radiation-tolerant materials.

When noted in individual Pump Data Sheets, bearings may require special radiation resistant lubricants.

3.5 Mechanical Requirements

- 3.5.1 See individual Pump Data Sheets.
- 3.5.2 Suction and discharge nozzles shall be flanged in accordance with ANSI/ASME B73.1M, [paragraph 4.2] and/or ANSI/ASME B73.2M, [paragraph 4.2]. See individual Pump Data Sheets for additional requirements.
- 3.5.3 Modifications and/or special nozzle configurations are specified in individual Pump Data Sheets.
- 3.5.4 Seal gland shall be as specified in ANSI/ASME B73.1M, [paragraph 4.6.6] or ANSI/ASME B73.2M, [paragraph 4.6.6]. For services where the pump case is a higher grade alloy, the seal gland shall be of the same material as the pump case or an alloy of greater corrosion resistance. See paragraph 6.5 of this specification for positive material identification requirements.

3.5.5 Unless otherwise specified, horizontal end suction centrifugal pumps shall be supplied with suitable baseplates designed for grouting in accordance with reference PIP RESP002 [section 4].

3.5.6 The underside of fabricated baseplates, beneath pump and driver supports, shall have reinforcing cross members welded to full depth. The members shall be shaped to be held in position by the grout. All welding shall be continuous. Stitch welding, top or bottom, is unacceptable.

3.6 Loadings

3.6.1 Seller shall submit allowable flange loadings to Buyer for review.

3.6.2 Pumps shall be designed for seismic loads as specified in the individual Pump Data Sheets. Design loads shall be calculated in accordance with *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks* (24590-WTP-3PS-FB01-T0001).

3.7 Electric Motors

3.7.1 Medium and Low Voltage Induction Motors shall conform to specifications *Specification for Medium Voltage Motors* (24590-WTP-3PS-MUMI-T0001) and *Specification for Low Voltage Motors* (24590-WTP-3PS-MUMI-T0002) respectively.

3.7.2 Adjustable speed drives shall be in accordance with *Engineering Specification for Low Voltage Adjustable Speed Drives* (24590-WTP-3PS-EVV1-T0001).

3.7.3 Electric Motors shall be sized so that they are not overloaded at any point on the performance curve.

3.7.4 For other requirements see individual motor data sheets, if provided; otherwise see additional motor specifications listed in the individual pump data sheets.

3.8 Instrumentation and Control Requirements

3.8.1 Barrier fluid systems, when specified in individual Pump Data Sheets, shall be equipped with seal failure detection as required by 40 CFR 264. Switch supplied shall be a single pole double throw (SPDT), hermetically sealed dry contact design suitable for the environmental conditions where it is located.

3.8.2 Seal failure detection on barrier fluid systems, shall include discreet contacts for Buyer's external alarm as required by 40 CFR 264.

3.9 Accessibility and Maintenance

3.9.1 Frequency of inspection and maintenance intervals shall be in accordance with equipment Seller's recommendations or as required by plant maintenance.

- 3.9.2 Buyer's layout specifies access and space requirements to facilitate maintenance during normal plant operation or scheduled shutdown.
- 3.9.3 Detailed drawings of facility specific maintenance equipment requirements, if any, are referenced in individual pump data sheets.
- 3.9.4 Seller shall advise recommended screen size or perforation size in startup strainers for each pump application.

4 Materials

4.1 Construction

- 4.1.1 See individual Pump Data Sheets.
- 4.1.2 Horizontal end suction centrifugal pump construction shall be in accordance with ANSI/ASME B73.1M.
- 4.1.3 Vertical in-line centrifugal pump construction shall be in accordance with ANSI/ASME B73.2M.
- 4.1.4 Restrictions to repair of pressure containing or wetted parts shall be in accordance with ANSI/ASME B73.1M [paragraph 4.8] and/or ANSI/ASME B73.2M [paragraph 4.8].

4.2 Prohibited Materials

- 4.2.1 Bronze, copper, lead, zinc, tin, antimony, cadmium, 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 asbestos is prohibited.

4.3 Special Requirements

Special conditions and requirements, if any, are detailed in individual pump data sheets.

4.4 Storage of Special Materials (e.g., Stainless Steel) Prior to Work

Storage of Special Materials (Seller's Location) shall be in accordance with the Seller's QAP and *General Specification for Packaging, Shipping, Handling and Storage Requirements* (24590-WTP-3PS-G000-T0003).

5 Fabrication

5.1 Welding

- 5.1.1 Weld repairs required to certify pressure containing parts shall be performed and inspected by qualified operators using procedures which are qualified in accordance with Section VIII, Division 1 and Section IX of the ASME Code.
- 5.1.2 Weld repair records shall be included with document submittal package.

5.2 Assembly

- 5.2.1 Pump and driver mounted by the Seller shall be properly aligned prior to shipment. To ensure final alignment can be achieved in the field, the equipment Seller shall align the pump and driver within 0.002 inch parallel offset. The driver shall not be bolt bound in any direction and hold down bolts shall not be undercut or undersized to relieve this condition.
- 5.2.2 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 Buyer's piping, electrical, and control systems.

6 Tests and Inspections

6.1 Personnel Qualifications

Seller's inspection and test personnel qualifications shall be verified by Buyer's supplier quality representative.

6.2 Non-Destructive Examinations

Hydrostatic tests on machined parts shall be in accordance with ANSI/ASME B73.1M, [paragraph 5.2.1] or ANSI/ASME B73.2M, [paragraph 5.2.1]. See individual pump data sheets for additional tests.

6.3 Shop Tests

- 6.3.1 Buyer's inspection plan shall indicate tests and inspections to be witnessed. The individual Pump Data Sheets may further define inspection, test requirements, and pump media type.
- 6.3.2 Pump performance tests shall be performed per Hydraulic Institute Standards (HIS) as required by ANSI/ASME B73.1M [paragraph 5.2] or ANSI/ASME B73.2M [paragraph 5.2].
- 6.3.3 Hydrostatic testing of equipment shall be performed using potable water with chlorine content of no more than 50 ppm.

6.4 Site Tests

Buyer's startup personnel shall perform field tests after installation. Buyer may request Seller's assistance during startup at no additional cost.

6.5 Positive Material Identification

Positive material identification (PMI) shall be performed in accordance with *Specification for Positive Material Identification (PMI)* (24590-WTP-3PS-G000-T0002).

6.6 Safety Requirements

6.6.1 See individual pump data sheets for specific safety requirements.

6.6.2 Safety guards shall be furnished in accordance with ANSI/ASME B73.1M, [paragraph 4.12.1] or ANSI/ASME B73.2M [paragraph 4.12.1].

6.6.3 Deleted

7 Preparation for Shipment

7.1 Cleanliness

All dirt, oil, grease, loose mill scale, weld splatter and other foreign matter shall be removed from all surfaces in accordance with *General Specification for Packaging, Handling and Storage Requirements*.

7.2 Painting

Manufacturer's standard procedures shall be submitted for Buyer's review.

7.3 Tagging

7.3.1 Nameplate shall be provided and attached as specified in of ANSI/ASME B73.1M [paragraph 5.3] or ANSI/ASME B73.2M [paragraph 5.3].

7.3.2 Buyer's equipment number listed on the individual pump data sheets shall be included on nameplate.

7.3.3 Buyer's instrument tag numbers listed on the individual instrument data sheets shall be included on name tags affixed to instruments. Seller shall supply stainless steel wired instrument tags engraved with Buyer's purchase order number, item number, and instrument tag number.

7.4 Packaging

- 7.4.1 All equipment shall be packed, securely anchored, and protected for shipment in accordance with *General Specification for Packaging, Handling, and Storage Requirements*. Non-mounted drivers (if approved by Buyer) shall be shipped along with the main pump assembly unless otherwise agreed by Buyer or specified on individual pump data sheets.
- 7.4.2 Pumps, drive motors, and all furnished auxiliaries shall be shipped fully assembled on their specific baseplates. Special applications requiring different shipping instructions are detailed in individual pump data sheets.
- 7.4.3 Deleted

8 Quality Assurance

8.1 QA Requirements Specific to Item(s) or Service

- 8.1.1 The Seller's quality assurance program (QAP) requirements are included in *General Specification for Supplier Quality Assurance Program Requirements (24590-WTP-3PS-G000-T0001)*.
- 8.1.2 Seller's QAP manual shall be submitted to Buyer for review in accordance with *General Specification for Supplier Quality Assurance Program Requirement*.

8.2 Program QA Elements

Seller's QAP, at a minimum shall contain the requirements detailed in the Supplier QAP requirements data sheets listed in Section 2 of the material requisition.

9 Configuration Management

Equipment covered by this Specification is identified with equipment numbers listed in individual pump data sheets. Each item is identified in accordance with Tagging in Paragraph 7.3 of this specification.

10 Documentation and Submittals

10.1 General

- 10.1.1 Documents required by Buyer shall be made available in as prescribed in Appendix A of ANSI/ASME B73.1M and/or ANSI/ASME B73.2M. See section 3 of the Material Requisition for submittal format requirements.

- 10.1.2 Submittals and document quantities including drawings, installation procedures, inspection and test reports, calculations, manuals, certificates of conformance, schedules and material certificates are detailed in section 3 (G-321-E Form) of the material requisition.

10.2 Submittals

10.2.1 Drawings

Drawings shall be inclusive of all following requirements:

- 10.2.2 Outline drawings of pump assembly, including outline and detail drawings for each component as follows:
- Pump
 - Motor
 - Seal
 - Coupling
- 10.2.3 Mounting dimensions and information required for the design of supports and foundations
- 10.2.4 Locations and identification of parts included in the parts list
- 10.2.5 Wiring, schematic diagrams and data; diagrams including wire gauges applicable to the supplied units only; external connections for power and measurement shown on these diagrams; submittals to meeting requirements specified in *Specification for Medium Voltage Motors* (24590-WTP-3PS-MUMI-T0001, paragraph 10.1) or *Specification for Low Voltage Motors* (24590-WTP-3PS-MUMI-T0002, paragraph 10.1) as applicable
- 10.2.6 Pump performance curve showing NPSH required, horsepower, efficiency, flow vs. head at applicable speeds
- 10.2.7 Drawing submittal requirements as shown on G-321-E form of the material requisition
- 10.2.8 Mechanical seal drawing for pumps specified in individual pump data sheets

10.2.9 Parts List

A list of all pump parts for start-up and 1-year operation shall be provided by Seller as prescribed in ANSI/ASME B73.1M or ANSI/ASME B73.2M. Seller shall identify useful shelf life and storage requirements of parts anticipated to have functional life spans shorter than the pump design life.

10.2.10 Inspection and Test Reports

Seller shall provide test reports in accordance with ANSI/ASME B73.1M [paragraph 5.2] or ANSI/ASME B73.2M [paragraph 5.2]. See section 5 and section 3 of the material requisition.

10.2.11 Forces and Moments

Allowable external forces and moments on pump nozzles shall be provided as prescribed in ANSI/ASME B73.1M [paragraph 5.1.2] and/or ANSI/ASME B73.2M [paragraph 5.1.2].

10.2.12 Manuals

Manuals shall be supplied to provide information on the correct installation, operation, and maintenance of the pump assembly. Manuals shall be as prescribed in ANSI/ASME B73.1M [paragraph 7.3.8] or ANSI/ASME B73.2M [paragraph 7.3.8].

10.2.13 Schedules

Seller shall provide fabrication and delivery schedule and progress reports for pumps described in individual pump data sheets. See section 3 of the material requisition for submittal requirements.

11 Design Changes Incorporated by Reference

24590-WTP-SDDR-PROC-04-00614

24590-WTP-SDDR-PROC-04-00659

24590-WTP-SDDR-PROC-04-00660

24590-WTP-SDDR-PROC-04-00804

24590-WTP-SDDR-PROC-04-00895

24590-WTP-SDDR-PROC-04-00928

24590-WTP-SDDR-PROC-04-01117

24590-WTP-SDDR-PROC-05-00039

24590-WTP-SDDR-PROC-05-00097

Figure 1 Pump Operating Range

