



RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION FOR EMF Centrifugal Pumps

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

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Revision History

Revision	Reason for Revision	Q Specification Revision Only Margin Reduced?		CM Only
		YES	NO	N/A
0	Issued for Quote	N/A	N/A	N/A
1	Issued for Purchase (Revised Section 8 Quality Assurance Requirements, Deleted Section 10.1.5, Corrected reference Section from 6.4 to 6.0 in Section 10.3.7.3, Corrected Exhibit No. in Section 10.3.7.4; added statements to determine status of SCNs applicable to Exhibits 1, 2, and 3; Incorporated C&I review comment for the use of a pressure transmitter in place of a pressure switch in Section 3.8.1. Add additional instrument, process connections and Foundation Fieldbus requirements in Sections 3.8.3, 3.8.4, 3.8.5, and 3.8.6.)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Issued for Purchase Revised Sections 2.2 and 3.8 (including its subsections), 6.3.6, and 6.3.7 to include C&I requirements on Seller's standard Plan 53B system. Pressure transmitters is moved from Seller's scope to Buyer's scope of work. Added Sections 10.3.1.4, 10.3.7.8, 10.3.7.9, and Exhibit 4 to capture submittals associated with the C&I requirements. Minor changes for revised document numbers and editorial changes are marked in the right-hand margin of the document. No EIEs against this document.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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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 Office of River Protection (ORP) and its contractors manage 177 underground radioactive waste storage tanks at the Hanford Site in Washington. These tanks contain approximately 56 million US gallons of radioactive waste. Bechtel National, Inc. (BNI) has entered into contract with the US Department of Energy to design, construct, and commission the Hanford Tank Waste Treatment and Immobilization Plant (WTP) to process and vitrify this waste into a stable form that is suitable for permanent storage. The WTP will be constructed in the 200 East Area of the Hanford Site, near Richland, Washington. The main facilities within the WTP complex will be the Pretreatment facility (PTF), Low-Activity Waste facility (LAW), High-Level Waste facility (HLW), Balance of Facilities (BOF), Analytical Laboratory (Lab), and the Effluent Management Facility (EMF).

1.2 Equipment, Material, and Services Required

This specification, combined with the applicable pump mechanical datasheets, project specifications and purchase order requisition documentation defines the minimum requirements for the design, dimensional requirements, materials of construction, testing, and documentation of centrifugal pumps for the EMF Facility which are designed in accordance with ASME B73.1, including:

- 1.2.1 Horizontal centrifugal pumps complete with electric motor, baseplate, startup strainer, and accessories as specified in individual Pump Data Sheets and Motor Data Sheets.
- 1.2.2 Specific modifications to pump, attachments, baseplate, baseplate attachments, electric motor, and/or electric motor attachments are detailed in individual Pump Data Sheets.
- 1.2.3 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 and cover a minimum 70% of the area between the baseplate and baseframe/top-plate. 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

The following items and services will be supplied by the Buyer and are not included in the Seller's scope of work:

- 1.3.1 Material shipping, 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
- 1.3.7 Pressure transmitters

1.4 Definitions

- 1.4.1 Definitions – See ASME B73.1 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

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 414.1C. 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 Exhibit 1, *Structural Design Loads for Seismic Qualification of Seismic Category III & IV Equipment and Tanks*, and individual Mechanical Pump Data Sheets for seismic requirements.

1.4.2 Acronyms of Organizations and Terms

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials, International
AWS	American Welding Society
BEP	Best Efficiency Point
BNI	Bechtel National Inc.
BOM	Bill of Materials
CFR	Code of Federal Regulations
CM	Commercial Quality Level
DEP	Direct Feed LAW Effluent Management Facility Process System
DFLAW	Direct Feed Low-Activity Waste
DOE	Department of Energy
EMF	Effluent Management Facility

FDT/DTM	Field Device Tool/Device Type Manager
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronic Engineers
MCSF	Minimum Continuous Stable Flow
MRQ	Material Requisition Quote
MRP	Material Requisition Purchase
NDE	Non-Destructive Examination
NEMA	National Electrical Manufacturers Association (NEMA)
NPSH	Net Positive Suction Head
NRTL	Nationally Recognized Testing Laboratory
OSHA	Occupational Safety and Health Administration
PIP	Process Industry Practices
PO	Purchase Order
QAP	Quality Assurance Program
RPP-WTP	River Protection Project – Waste Treatment Plant
SCN	Specification Change Notice
SDS	Safety Data Sheets
SPDT	Single Pole Double Throw
UL	Underwriters Laboratories, Inc.
WTP	Hanford Tank Waste Treatment

2 Applicable Documents

2.1 General

- 2.1.1** Work shall be done in accordance with the referenced codes, standards, and documents listed below and the exhibits, 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 (including exhibits), only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied.
- 2.1.3** In case of conflict between this specification and referenced codes and standards, the requirements for all must be met with the most stringent governing, as determined by Buyer.
- 2.1.4** For the codes and standards listed below, the specific edition year identified shall be followed. For the codes and standards that are incorporated by reference (daughter codes and standards), the referenced daughter edition or current edition shall be followed. If an edition year is not identified, the latest issue, including addenda, at the time of award shall apply.

2.2 Codes and Industry Standards

ASME B73.1	<i>Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process - 2001</i>
ASME B16.5	<i>Pipe Flanges and Flanged Fittings</i>
ABMA 9	<i>Load Ratings and Fatigue Life for Ball Bearings</i>
ABMA 11	<i>Load Ratings and Fatigue Life for Roller Bearing</i>
ASME B15.1	<i>Safety Standard for Mechanical Power Transmission Apparatus</i>
ASME B1.1	<i>Unified Inch Screw Threads</i>

ASME Section IX

*BPVC Section IX, Qualification Standard for Welding and
Brazing Procedures, Welders, Brazers, and Welding and
Brazing Operators*

UBC

Uniform Building Code – 1997

HIS

Hydraulic Institute Standards

PIP RESP002

*Design of ASME B73.1 and General Purpose Pump
Baseplates*

2.3 Reference Documents/Drawings

2.3.1 Reference Documents

The following documents and their associated change notices listed in Part 2 of the Material Requisition (MR) are applicable:

2.3.1.1 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*

2.3.1.2 24590-WTP-LIST-ESH-16-0001, *Restricted Materials List*

2.3.2 Reference Drawings

None.

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 EMF Facility within 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.

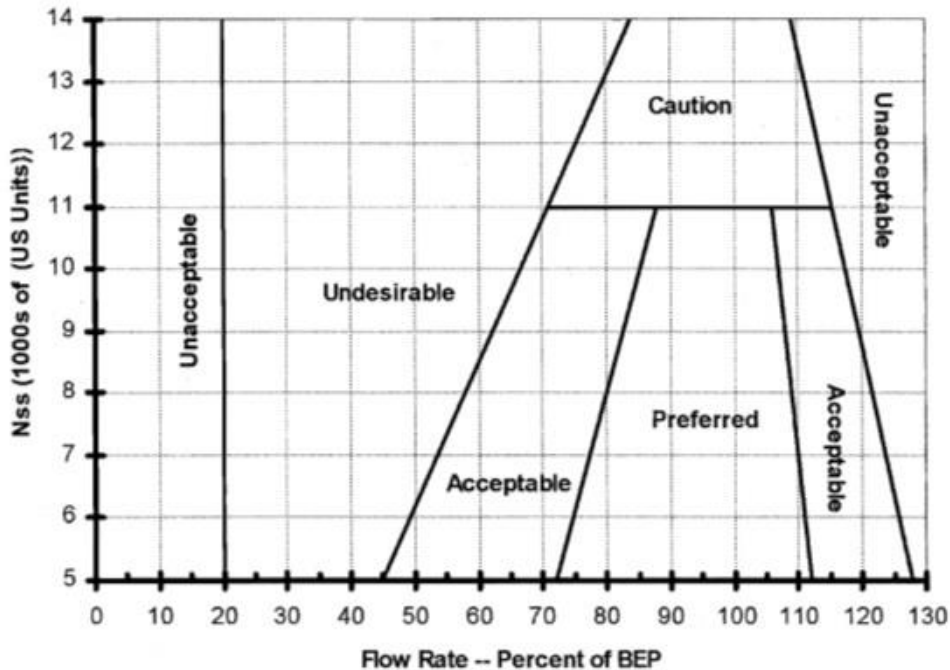
3.2.2 Pump shall be capable of a minimum head increase of 5% at the rated flow by installing a new impeller, up to the maximum allowable shown on the Seller's typical pump curves.

3.2.3 Unless otherwise noted in individual Pump Data Sheet, the net positive suction head (NPSH) available shall exceed the NPSH required by at least 3 feet 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.

Figure 1 Pump Operating Range



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 shall use special radiation resistant lubricants.

3.4.3 All pumps subject to decontamination shall be designed to withstand the process without degradation of function.

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 ASME B73.1, [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 ASME B73.1, [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 6.4 of this specification for positive material identification requirements.
- 3.5.5** Unless otherwise specified, all pumps shall be supplied with stainless steel baseplates to be welded to Buyer's baseframe/top-plate. Seller shall provide shim packs for leveling per Section 1.2.3 of this specification. See individual pump data sheets for additional baseplate requirements.
- 3.5.6** Seller shall note on pump data sheets or general arrangement drawings the weld type, size, and length to anchor the baseplate.
- 3.5.7** The combination noise level of the pump and motor shall not exceed 85 dBA when measured 3 feet in any direction from the pump/driver unit.
- 3.5.8** All pumps shall come with a mechanical seal, unless otherwise noted on the individual pump datasheets. Details associated with each seal are detailed on each individual pump datasheet.
- 3.5.9** All pumps shall be provided with a drain on the casing.
- 3.5.10** All pumps shall be designed to withstand decontamination with water without the degradation of function. Refer to section 5.3.4 of this specification for additional requirements for pump located within R3 or R4 area.

3.6 Loadings

- 3.6.1** Seller shall submit allowable nozzle/flange loadings to Buyer for review on individual Pump Data Sheets.
- 3.6.2** Pump assemblies shall be designed for seismic loads as specified in the individual Pump Data Sheets. Design loads shall be calculated in accordance with Exhibit 1, *Structural Design Loads for Seismic Category III & IV Equipment and Tanks*.

3.7 Electrical Requirements

- 3.7.1** Low Voltage Induction Motors shall conform to Exhibit 3, *Low Voltage Induction Motors*.
- 3.7.2** Electric Motors shall be sized so that they are not overloaded at any point on the performance curve.

3.8 Instrumentation and Control Requirements

- 3.8.1** Instrumentation that is included on the barrier fluid system (Plan 53B system, if specified on mechanical data sheets) shall be designed per Seller's Standard.

- 3.8.2 Seal failure detection shall be equipped with the barrier fluid systems which include discreet contacts or other electronic data signal interface for Buyer's external alarm (pressure alarm). Seller shall provide recommendation on the pressure alarm settings for use in BUYER's Distributed Control System.
- 3.8.3 Deleted.
- 3.8.4 Deleted
- 3.8.5 Deleted.
- 3.8.6 Pressure Transmitter Connection
 - 3.8.6.1 Seller shall provide an end connection detail associated with the connection of the pressure transmitter.
- 3.8.7 Instrument Data Sheet
 - 3.8.7.1 Seller shall provide an instrument datasheet for the pressure transmitter containing information as shown in Exhibit 4. Buyer will procure final device. However, seller shall supply a unit as required for testing.

3.9 Accessibility and Maintenance

- 3.9.1 Frequency of inspection and maintenance intervals shall be in accordance with equipment Seller's recommendations.
- 3.9.2 Seller shall specify access and space requirements to facilitate maintenance during normal plant operation or scheduled shutdown.
- 3.9.3 Seller shall specify recommended startup strainer for each pump application including screen size or perforation size. This shall be noted on each individual pump data sheet and on the Bill of Materials.

4 Materials

4.1 Construction

- 4.1.1 Materials of construction and corrosion allowance are shown on individual pump data sheets.
- 4.1.2 Horizontal end suction centrifugal pump construction shall be in accordance with ASME B73.1.
- 4.1.3 Restrictions to repair of pressure containing or wetted parts shall be in accordance with ASME B73.1 [paragraph 4.8]. No repairs may be made on any wetted part without prior Buyer approval. Repairs by plugging, peening, or impregnation are not allowed on parts wetted by the pumped fluid.

4.2 Prohibited Materials

4.2.1 All materials in contact with stainless steel or nickel-based alloys shall not cause corrosion or other harmful effects. Requirements:

- The total chloride/fluoride content shall not exceed 200 ppm.
- The total sulfur content shall not exceed 400 ppm.
- The total of low melting point metals such as lead, zinc, copper, tin, antimony, and mercury shall not exceed 1 percent; of this, mercury shall not exceed 50 ppm.

4.2.2 The materials listed in 24590-WTP-LIST-ESH-16-0001, *Restricted Materials List*, shall not be used on any supplied equipment or brought onto the WTP site.

4.3 Special Requirements

4.3.1 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

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

5 Fabrication

5.1 General

5.1.1 For the equipment supplied per this specification, the Seller shall ensure that all sharp edges are broken/smoothed and all burrs removed. Machined metal surfaces subjected to human touch through maintenance or operational reason shall be constructed to have no sharp edges unless it serves the function of the equipment.

5.2 Welding

5.2.1 Weld repairs required shall be performed and inspected by qualified operators in accordance with Section IX of the ASME Code. Either the original WPS or one submitted as a designated repair WPS shall be used.

5.2.2 Weld repair records shall be included with document submittal package.

5.3 Assembly

5.3.1 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.

5.3.2 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.

- 5.3.3 Nonferrous parts, nameplates, instruction plates, machined faces and fittings, preparations for field welding, and parts to be embedded in concrete shall not be painted.
- 5.3.4 The pumps located within an area with a classification of R3 or R4 (as shown on individual pump data sheets) shall be radiation resistant and be able to withstand decontamination activities, including water and 0.5M nitric acid washdown.

6 Tests and Inspections

6.1 Personnel Qualifications

- 6.1.1 Seller's inspection and test personnel qualifications shall be made available for Buyer's supplier quality representative.

6.2 Pressure Tests

- 6.2.1 Hydrostatic tests on machined parts shall be in accordance with ASME B73.1 [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 datasheets 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 ASME B73.1 [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.
- 6.3.4 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 for using alternative facilities.
- 6.3.5 Motors shall be tested per requirements in Exhibit 3, *Low Voltage Induction Motors*, Section 5.1.
- 6.3.6 Instrumentation within Seller's scope shall be calibrated with test and calibration equipment that are traceable to NIST standards.
- 6.3.7 Mechanical Pump Seals (Plan 53B system, if specified on mechanical data sheets) shall be tested in accordance with Seller's Standard to ensure the functionality of the pump assembly.

6.4 Positive Material Identification

- 6.4.1 Positive material identification (PMI) shall be performed in accordance with Exhibit 2, *Positive Material Identification (PMI) for Shop Fabrication*.

6.5 Safety Requirements

- 6.5.1 See individual pump data sheets for specific safety requirements.
- 6.5.2 Safety guards shall be furnished in accordance with ASME B73.1, [paragraph 4.12.1].

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 specification 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*.

7.2 Tagging

- 7.2.1 Nameplates for pumps shall be provided and attached as specified in ASME B73.1 [paragraph 7.3].
- 7.2.2 Nameplates for motors shall comply with Exhibit 3, *Low Voltage Induction Motors*, Section 4.3.
- 7.2.3 Buyer's equipment number listed on the individual pump data sheets shall be included on nameplate.
- 7.2.4 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.

7.3 Packaging

- 7.3.1 All equipment shall be packed, securely anchored, and protected for shipment in accordance with specification 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*.
- 7.3.2 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.
- 7.3.3 All equipment shall be packaged for outdoor storage at Buyer's site. Refer to 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*.

8 Quality Assurance

The Seller shall establish and implement a quality assurance program that conforms to the requirements specified in this specification, and to the other applicable codes and standards as cited in the engineering specification. These supplier quality assurance requirements shall apply to the work necessary for carrying out this contract, including design, procurement, fabrication, installation, and testing.

Seller shall submit their Quality Assurance Program (QAP) manual applicable to production of standard product offerings of this procurement for the Buyer's record.

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 7.2 of this specification. Configuration management is maintained by conformance to approved drawings and procedures. If approved drawings and procedures cannot be followed, Buyer shall be promptly notified.

10 Documentation and Submittals

10.1 General

- 10.1.1 Documents required by Buyer shall be made available as prescribed in Section 7 of ASME B73.1 and shall include a certificate of compliance with ASME B73.1. See the Material Requisition for submittal format requirements.
- 10.1.2 Documentation shall be submitted to the Buyer in accordance with this specification, and as summarized on the G-321-E and G-321-V forms. The G-321-V form lists all the documents required for quality verification and the G-321-E form lists those engineering documents required.
- 10.1.3 Each document to be submitted must be listed on the 15EX form. This form tracks the scheduled and actual delivery of each submittal. The form shall be submitted per the G-321-E.
- 10.1.4 All deviations and/or conflicts considered for incorporation in the work must be submitted to the Buyer on completed Supplier Deviation Disposition Request (SDDR) form, as attached to Part 2 of the MR, for Buyer's approval.

10.1.5 DELETED

10.2 Schedule

10.2.1 Schedule and Drawing Index

The Seller shall develop and deliver to the Buyer, a schedule detailing the chronological sequence of activities required to meet the equipment delivery date. At a minimum, the

schedule shall cover equipment design, procurement, fabrication and manufacturer, tests and inspection, verifications and hold points, and production deliverables.

10.3 Submittals

10.3.1 Data Sheets

10.3.1.1 Pump Data Sheets

The Seller shall deliver to the Buyer the completed Bechtel Pump Data Sheet.

10.3.1.2 Motor Data Sheets

The Seller shall deliver to the Buyer the completed Bechtel Motor Data Sheets.

10.3.1.3 Safety Data Sheets

Seller shall provide Safety Data Sheets (SDS) for all hazardous materials shipped to WTP, including but not limited to lubricants, gear oils, greases, solvents, etc.

10.3.1.4 Instrument Data Sheets

Seller shall provide data sheets, in Seller's standard format, for instrumentation within Seller's scope. Seller shall provide an instrument datasheet for the pressure transmitter containing information as specified in section 3.8.7.1. Seller shall incorporate Buyer-supplied instrument tag numbers into the applicable instrument documentation.

10.3.2 Drawings

10.3.2.1 Outline Drawings

Seller shall provide drawings with outline dimensions' services, foundations, and mounting details. Drawings shall show external envelope, location and size for electrical cable, conduit, fluid, other service connections, locations and identification of parts included in the parts list, and details related to foundations and mountings. Outline drawings of each pump assembly, including outline and detail drawings for each component as follows:

- Pump
- Motor
- Seal
- Coupling
- Baseplate

10.3.2.2 Assembly Drawings

Seller shall provide assembly drawings for the pump motors per Exhibit 3, *Low Voltage Induction Motors*, Section 9.1.1(i).

10.3.2.3 Electrical Drawings, Schematics, and Wiring Diagrams

Seller shall provide single line diagrams, schematic diagrams and data, diagrams including wire gauges applicable to the supplied units only, external connections for power and measurement shown on these diagrams, and in accordance with Exhibit 3, *Low Voltage Induction Motors*, Section 9.1.1(c).

10.3.2.4 Pump Performance Curve

Seller shall provide pump performance curves showing NPSH required, horsepower, efficiency, flow vs. head at applicable speeds. Seller shall identify the tolerance of the design point for each as-built pump.

10.3.3 Lists

10.3.3.1 Recommended Spare Parts List

Seller shall provide complete replacement parts lists that identifies all components by name, type, size, quantity, location, manufacture, and model number, in addition to current pricing information. Parts list shall identify those parts required during the first year of operation. Identify the equipment parts with drawings providing sectional views of parts and assembly locations. Also, Seller shall identify limits to shelf-life and storage requirements of parts anticipated to have functional life spans shorter than the equipment design life.

10.3.3.2 Nameplate Engraving List

Seller shall provide a nameplate engraving list and drawing for all nameplates.

10.3.3.3 Bill of Materials (BOM)

Seller shall supply Buyer with a spreadsheet format Bill of Materials (BOM) showing in complete detail split shipment packaging content and their shipping dates. Include sub-tier BOMs and shipped loose component lists. As a minimum, the spreadsheet shall indicate the following: Supplier's name, part numbers, Buyer's equipment or skid numbers, Seller's reference drawing number, forecast ship date, actual ship date for each carton or container, erection / "Issued for Construction" drawing number, quantity, unit of measure, weight, length, width, and height.

10.3.4 Product Data

10.3.4.1 Catalog Data

Seller shall provide catalog information for all equipment and instrumentation within scope of supply.

10.3.4.2 Motor Data

Seller shall provide information about lubricants, gaskets and seals in accordance with Exhibit 3, *Low Voltage Induction Motors*, Section 9.1.1(k) and (l).

10.3.5 Manuals

10.3.5.1 Installation Instruction Manual

Seller shall submit an Installation Instruction Manual as prescribed in ASME B73.1, including any explanations for special tools in accordance with 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*, Section 11.1.1.

10.3.5.2 Operating Manuals and Instructions

Seller shall submit an Operating Manual as prescribed in ASME B73.1. The manual shall include specific instructions, procedures, and illustrations for safety precautions, operator prestart, startup, shutdown, post-shutdown, normal operations (including control diagrams), emergency operations, operator service requirements, environmental conditions for equipment, and lay-up.

10.3.5.3 Maintenance Manuals and Instructions

Seller shall submit a Maintenance Manual as prescribed in ASME B73.1.

Seller shall submit maintenance manuals with detailed written instructions to disassemble, reassemble, and maintain systems or components. Manuals shall include specific instructions, procedures, and illustrations for preventative and corrective maintenance. Provide information on calibration testing equipment required to perform specific tests and a list of special tools required for operation, maintenance, and repair of components.

Preventative maintenance manuals shall include lubrication data and a preventative maintenance plan and schedule with manufacturer's schedule for routine preventative maintenance, inspections, testing, and adjustments. Provide manufacturer's projection of preventative maintenance frequency of work and hours to complete the task.

Corrective maintenance manuals shall include the manufacturer's procedures and instructions for correcting problems and making repairs. Provide a troubleshooting guide and diagnostic techniques, maintenance and repair procedures, removal and replacement instructions for components, identification of all parts of end items subject to replacement (including special hardware requirements), warranty information, and personnel training requirements for operating and maintaining equipment.

10.3.5.4 Site Storage, Handling, and Maintenance Requirements Manual

Seller shall submit a Site Storage, Handling, and Maintenance Requirements Manual with procedures and instructions for site storage, handling, and maintenance that will preserve equipment until it is put into operation in accordance with 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*, Section 11.1.2.

10.3.6 Procedures

10.3.6.1 Test and Inspection Procedures

Seller shall submit test procedures for all tests and inspections required per Section 6 of this specification.

10.3.6.2 Pressure Test Procedures

Seller shall submit hydrostatic pressure testing procedures required to satisfy the requirements of Section 6.2 of this specification.

10.3.6.3 Functional Shop Test Procedures

Seller shall submit all functional shop testing procedures required to satisfy the requirements of Section 6.3 (pump performance test) of this specification.

10.3.6.4 Positive Material Identification Procedures

Seller shall submit procedures covering how PMI will be conducted and documented per Exhibit 2, *Positive Material Identification (PMI) for Shop Fabrication*, Section 3.2.

10.3.6.5 Electrical Test Procedures

Seller shall provide electrical test procedures and reports to demonstrate that design function and operational parameters are met (e.g., impulse, overload, continuity, voltage, temperature rise, calibration, saturation loss, etc.).

10.3.6.6 Material Control Procedures

Seller shall provide material control procedures including controlling issuance, handling, storage, and traceability of materials such as weld rod.

10.3.6.7 Transportation and Shipping Procedure

Seller shall provide drawings and a proposed tie down plan as well as a shipping procedure for applicable items in accordance with 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*, Section 11.2.

10.3.6.8 Weld Repair Procedure

Repair plans that use welding for repairs of welds or base metals shall be submitted for review prior to use. This applies to the repair of cavities that exceed 3/8" or 10% of the section thickness (whichever is smaller), or in the case of fillet welds, when the entire fillet weld needs to be replaced. A repair plan shall include the following:

- The method of defining the type and the extent of the defect
- The methods used for removing the defect
- The testing conducted to ensure that the defect has been removed
- The welding procedure employed
- The NDE methods used to inspect the completed repair

A review status of "Work May Proceed" for the repair plan must be obtained prior to use.

10.3.7 Reports

10.3.7.1 Pressure Test Report

Seller shall submit a test report for the hydrostatic pressure testing required per Section 6.2 of this specification.

10.3.7.2 Inspection and Functional Test Reports

Seller shall provide inspection and test reports for all pumps in accordance with ASME B73.1 [paragraph 7.2].

10.3.7.3 Positive Material Identification (PMI) Reports

Seller shall submit PMI testing reports, including a PMI map per Exhibit 2, *Positive Material Identification (PMI) for Shop Fabrication*, Section 6.0.

10.3.7.4 Seismic Analysis Report

Seller shall complete a seismic analysis for each pump. Loadings shall be calculated in accordance with the appropriate requirements of Exhibit 1, *Structural Design Loads for Seismic Category III & IV Equipment and Tanks*.

10.3.7.5 Electrical Test Report

Seller shall submit motor test reports in accordance with Exhibit 3, *Low Voltage Induction Motors*, Section 5.1.

10.3.7.6 Material Certificates of Compliance

Seller shall submit Certificates of Compliance (C of C) for materials supplied for the pump assemblies, nozzles, instrumentation, and accessories.

10.3.7.7 Weld Repair Reports

Seller shall submit all weld repair records.

10.3.7.8 Pressure Alarm Settings Documentation

Seller shall provide the recommended pressure alarm settings documentation for Buyer's review and acceptance per section 3.8.2.

10.3.7.9 Instrumentation Calibration Certificates

Seller shall provide certification of calibration for instrumentation within Seller's scope.

Exhibit 1

Structural Design Loads for Seismic III & IV Equipment and Tanks

Specification 24590-WTP-3PS-FB01-T0001, Rev. 6 was used to create this exhibit. Specification change notices (SCNs) have been evaluated and there are no applicable SCNs.

1 Scope	
1.1 General	<p>This exhibit provides structural design loads for Seismic Category III (SC-III) and Seismic Category IV (SC-IV) equipment and tanks on the River Protection Project – Waste Treatment Plant (RPP-WTP) located at the Department of Energy (DOE) Hanford Site in Richland, Washington. The seismic categories are derived from the performance categories defined in DOE-STD-1020-94 (Ref. 2.7). The loads include dead, live, wind, fluid, earthquake, snow, ashfall, lateral earth pressure, operating pipe reaction, and thermal loads.</p> <p>This exhibit is to be used in combination with the Equipment/Tank Technical Specifications, which may include supplemental codes applicable to the specific Structure, System, or Component (SSC). In case of conflicts between this exhibit and other technical requirements in the Equipment/Tank Technical Specifications, the Seller shall identify such conflicts to the Buyer in writing and obtain resolutions documented in writing. These conflicts may also include inconsistency of load definitions, conditions and combinations as specified by the referenced codes and standards.</p>
1.2 Definitions	<p>EQUIPMENT: Mechanical, electrical, or control system component or element that is part of a mechanical and/or electrical system.</p> <p>SC-IV EQUIPMENT/TANK: Equipment/Tank required to be designed for the SC-IV loads and load combinations provided in this exhibit. This includes equipment/tank assigned SC-IV for seismic design per the facility-specific Preliminary Documented Safety Analysis (PDSA) document or Documented Safety Analysis document.</p>
2 Applicable Documents	For the codes and standards listed below, the specific revision or effective date identified, as well as the specific revision or effective date of codes and standards that they incorporate by reference (daughter codes and standards), shall be followed. The effective dates and revisions listed in Section 2 shall apply to subsequent references to the codes and standards within this exhibit.
2.1 American Concrete Institute (ACI)	ACI 318-99 Building Code Requirements for Structural Concrete and Commentary.
2.2 American Concrete Institute (ACI)	ACI 349-01 Code Requirements for Nuclear Safety related Concrete Structures and Commentary.
2.3 American Institute of Steel Construction (AISC)	AISC M016-89 Manual of Steel Construction — Allowable Stress Design, Ninth Edition.
2.4 American Society of Civil Engineers (ASCE)	Manuals and reports on Engineering Practice; No. 78, Structural Fire Protection, ASCE 1992.
2.5 American Society of Civil Engineers (ASCE)	Minimum Design Loads for Buildings and Other Structures, ASCE 7-98.
2.6 American Society for Testing and Materials (ASTM) International	Material for steel anchor bolts, ASTM F1554 grade 36, unless specified otherwise on the design drawings.
2.7 Department of Energy (DOE)	DOE-STD-1020-94 (Including Change Notice #1 dated Jan 1996) Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities.
2.9 International Conference of Building Officials (ICBO)	Uniform Building code, UBC-97

2.15 American Society of Mechanical Engineers (ASME)	ASME Boiler and Pressure Vessel Code, Section II, Part D, Subpart 1 (Any edition of the code between 1995 and current edition)
3 Methodology	Methodology used in the seismic design of Seismic Category III & IV equipment and tanks shall be as defined in the Equipment/Tank Technical Specifications and the supplemental codes applicable to the SSC. For SC-IV equipment designed to UBC-97 (Ref. 2.9) Section 1632, attachments for floor or roof mounted equipment weighing less than 400 pounds need not be designed.
4 Design Loads	
4.3 Earthquake Loads	
4.3.1	Earthquake loads on equipment and tanks supported by structures shall be calculated per the provisions of UBC-97 (Ref 2.9), Section 1632, using the following parameters: $I_p = 1.0$ $C_a = 0.24$ $a_p = 1.0$ for rigidly mounted rigid* equipment $= 2.5$ for flexible equipment** and flexibly mounted rigid equipment $= 1.0$ for tanks * Rigid equipment are defined as those with a fundamental period of less than or equal to 0.06 seconds ($\geq 17\text{Hz}$). ** Flexible equipment are defined as those with a fundamental period of greater than 0.06 seconds ($< 17\text{Hz}$). $R_p = 3.0$ To be used when equipment is attached directly to structural steel $= 1.5^{***}$ To be used by suppliers unless otherwise specified on the Equipment/Tank Specification *** Based on actual conditions and location, Buyer's Civil, Structural, Architectural (CSA) personnel may approve an R_p of 3.0 in calculations.
4.3.2	Earthquake loads for self-supporting tanks (i.e. supported on their own foundation) shall be calculated per the provisions of UBC-97 (Ref. 2.9), Section 1634, using the following parameters: $I = 1.0$ $C_a = 0.24$ $C_v = 0.32$
4.4 Dead Loads	Dead loads include the weight of permanent equipment/tanks as well as their Attachments.
4.5 Live Loads on Equipment-Supported and Tank-Supported Platforms and Walkways	Platforms and Walkways - 100 psf Stairs treads - 100 psf or 300 lbs. concentrated loads applied over an area of four (4) square inches, whichever load produces greater effect on equipment. Handrails for stairs and platforms - Per Table 16B of UBC-97 (Ref. 2.9)
4.6 Thermal Loads	
4.6.1 Base Temperature	The base temperature for thermal analyses shall be 70 °F. This temperature is based on recommendations from ACI 349 (Ref. 2.2).
4.6.2 Outdoor Ambient Temperatures	Unless specified otherwise in the Equipment/Tank Technical Specifications or datasheets, ambient air temperatures shall be as follows: For SC-IV equipment: 115 °F maximum, -25 °F minimum
4.6.3 Operating Temperatures (Normal and Abnormal), T_o	Operating (normal and abnormal) temperatures are provided in WTP Equipment/Tank Technical Specification. Abnormal Temperatures are due to an anticipated eight-hour loss of cooling event, which is postulated to occur once per year, and is not the result of an accident or natural phenomena hazards (NPH). Abnormal temperature thermal loads shall not be considered concurrent with earthquake (E) loads. For load combinations which include

	<p>earthquake (E), T_o shall be normal operating temperature thermal loads only. For load combinations without seismic (E), T_o shall be greater of normal or abnormal operating temperature thermal loads.</p>
4.6.4 Accident Temperatures (Design Basis Event), T _a	<p>Accident temperatures are associated with the Design Basis Event (DBE) and provided in the WTP Equipment/Tank Technical Specifications, unless noted otherwise in Section 5 of this exhibit and are described as:</p> <ul style="list-style-type: none"> a) High energy line break (HELB). Which are to be considered concurrent with NPH loads in accordance with the appropriate codes. b) Loss of facility cooling combined with extreme outdoor temperatures. This load and NPH Temperature load shall not be considered concurrent with earthquakes (E) loads.
4.6.5 Temperature Limitations on Structural Elements	<p>SC-IV designed steel and stainless steel structures shall use reduced yield stress (F_y) and elastic modulus (E) in accordance with the ASCE Engineering Practice 78 (Ref. 2.4), see example provided in Appendix A.</p>
5 Loads and Load Combinations	<p>The following loads and load combinations are applicable to SC-IV equipment and tanks.</p>
5.1 Structural Steel Design Load Combinations	<p>For the design of equipment and tanks, the following loads shall be combined with other applicable loads, per the provisions of the Equipment/Tank Technical documents included with the Purchase Order (P.O.).</p> <ul style="list-style-type: none"> A Ashfall Loads D Dead Loads E Earthquake (Seismic) Loads (Due to DBE) L Live Loads S_N Snow Loads W Wind Loads T_o Thermal Loads during Normal & Abnormal Operating Conditions T_a Thermal Loads due to Accident (DBE) Temperature P_o Maximum or minimum differential pressure load generated by Normal or Abnormal HVAC operations P_a Maximum or minimum differential pressure load generated by DBE S Allowable Stress per Allowable Stress Design Method <p>For the design of equipment/tank supports, the following service-level load combinations shall apply. Note: the 1/3 allowable stress increase discussed in UBC-97 (Ref. 2.9), Section 1612.3.2, has been incorporated into the following combinations through the use of the 0.75 factor. No further stress increase is allowed.</p> <p>The following load combinations are based on Section 1612.3.2 of UBC-97 and using the Allowable Stress Design Values of AISC M016, ASD Ninth Edition (Ref. 2.3).</p> <ul style="list-style-type: none"> $S = D+L+A+P_o+T_o$ $S = D+L+S_N+P_o+T_o$ $S = 0.75(D+L+W+P_o+T_o)$ $S = 0.75(D+L+S_N/2+W+P_o+T_o)$ $S = 0.75(D+L+S_N+W/2+P_o+T_o)$ $S = 0.75(D+L+P_o+T_o+E/1.4)$ $S = 0.75(0.9D+P_o+T_o\pm E/1.4)$ $S = 0.75(D+L+P_a+T_a)$ $S = 0.75(D+L+T_a+E/1.4)$ Where T_a is Due to HELB
5.1.2 Other Loads	<p>Where other loads are to be considered in design, each applicable load shall be added to the combinations specified above per requirements of Section 1612.3.3 of UBC-97 (ref. 2.9).</p>

<p>5.2 Reinforced Concrete Design Load Combinations (Anchorage design)</p>	<p>For equipment and tanks anchorage design, the following loads shall be combined with other applicable loads, per the provisions of the Equipment/Tank Technical Specifications.</p> <p>A Ashfall Loads D Dead Loads E Earthquake Loads F Fluid Loads H Lateral Earth Pressure Load L Live Loads R_o Operating Pipe Reaction Load S_N Snow Loads T_o Thermal Loads during Normal & Abnormal Operating Conditions W Wind Loads T_a Thermal Loads due to Accident (DBE) Temperature P_o Maximum or minimum differential pressure load generated by Normal or Abnormal HVAC operations P_a Maximum or minimum differential pressure load generated by DBE U Required Strength per Strength Design Method</p> <p>The following load combinations are based on section 9.2 of ACI 318 (Ref. 2. 1).</p> <p>$U = 1.4D+1.7L+1.7A$ $U = 1.4D+1.7L+1.7S_N$ $U = 0.75(1.4D+1.7L+1.7W)$ $U = 0.75(1.4D+1.7L+1.7S_N+1.7W)$ $U = 0.9D\pm 1.3W$ $U = 1.4D+1.7L+1.7A+1.7H$</p> <p>$U = 1.4D+1.7L+1.7S_N+1.7H$ $U = 0.9D+1.7H$ $U = 1.4D+1.7L+1.7A+1.4F$ $U = 1.4D+1.7L+1.7S_N+1.4F$ $U = 0.9D+1.4F$ $U = 1.4(D+T_o)$</p> <p>In addition, the following load combinations based on UBC Section 1612.2.2 shall apply.</p> <p>$U = 1.1(0.9D\pm E)$ $U = 0.75(1.4D+1.7L+1.7S_N+1.4T_a+1.4R_o)$ Where T_a is Accident (DBE) Temperature [see 4.6.4(b)] $U = D+L+S_N+F+H+T_a+R_o+E$ Where T_a is due to (HELB) [see 4.6.4(a)] $U = 0.75(1.4D+1.7L+1.4T_o+1.4P_o+1.4R_o)$ $U = 0.75(1.4D+1.7L+1.7S_N+1.4T_o+1.4P_o+1.4R_o)$ $U = 1.4(D+T_o+P_o)$ $U = 1.1(1.2D+L+0.2S_N+1.3F+1.6H+1.2T_o+1.2P_o+1.2R_o+E)$ Where T_o and P_o are the normal operating values only</p> <p>$U = 0.75(1.4D+1.7L+1.7S_N+1.4T_a+1.4P_a+1.4R_o)$ $U = D+L+S_N+F+H+T_a+P_a+R_o$</p>
<p>6 Equipment and Tank Anchorage</p>	<p>The Supplier shall furnish the Buyer with the following information:</p> <ul style="list-style-type: none"> • Location of anchorage in relation to equipment. • Design loads on the anchorage shall be reported by individual load and load combination. • Coordinate system and sign conventions.

Appendix A

Strength and Modulus Reduction for Structural Steel & Stainless Steel

The equation below is from ASCE Manuals and Reports on Engineering Practice No. 78, Structural Fire Protection, Appendix A.1.2.2 for 0°C < Temperature < 600°C (32°F < Temperature < 1112 °F)

For A36 Steel: Tensile yield strength, $F_y := 36 \cdot \text{ksi}$ Modulus of Elasticity, $E := 29 \cdot 10^3 \cdot \text{ksi}$

$$F_{y\text{Reduction}_i} := \left[1 + \frac{\frac{5}{9} \cdot (\text{Temp}_i - 32)}{900 \cdot \ln \left[\frac{\frac{5}{9} \cdot (\text{Temp}_i - 32)}{1750} \right]} \right] \cdot F_y$$

$$E_{\text{Reduction}_i} := \left[1 + \frac{\frac{5}{9} \cdot (\text{Temp}_i - 32)}{2000 \cdot \ln \left[\frac{\frac{5}{9} \cdot (\text{Temp}_i - 32)}{1100} \right]} \right] \cdot E$$

The tensile strength and modulus of elasticity of steel decrease with increasing temperature as shown below for A36 steel:

<u>Yield Strength</u>	<u>Temperature °F</u>	<u>Modulus of Elasticity</u>
35.2	> 150	28.7·10 ³
34.7	200	28.5·10 ³
34.2	250	28.2·10 ³
33.6	300	27.9·10 ³
32.2	400	27.2·10 ³
30.5	500	26.4·10 ³
28.6	600	25.3·10 ³
$F_{y\text{Reduction}} = 27.6$ ksi	Temp = 650	$E_{\text{Reduction}} = 24.7 \cdot 10^3$ ksi
26.4	700	24·10 ³
25.2	750	23.3·10 ³
23.9	800	22.5·10 ³
22.5	850	21.5·10 ³
21	900	20.5·10 ³
19.5	950	19.4·10 ³
17.8	1000	18.1·10 ³

Exhibit 2

Positive Material Identification (PMI) for Shop Fabrication

Specification 24590-WTP-3PS-G000-T0002, Rev. 9 was used to create this exhibit. There are no specification change notices (SCNs) applicable to this Exhibit.

1 Scope	This exhibit covers the minimum requirements for and the extent of application of Positive Material Identification (PMI) testing of shop fabricated pressure retaining equipment and piping. This exhibit applies to shop fabrication only.
3 Technical Requirements	
3.1 General	<p>The purpose of PMI is to provide evidence that the materials are correctly supplied as specified by project documents. PMI is required for shop-fabricated items fabricated from the alloys identified in Table 1.</p> <p>When required by this exhibit, PMI testing will be done on each component of a pressure retaining assembly. This shall include each individual segment of pipe, each plate, and all other pieces of base materials (e.g., forgings, fittings, and tubing) and all required pressure retaining welds.</p> <p>For purposes of this exhibit, the following definitions are used:</p> <p><u>Alloy</u>: Metallic materials (including welding filler materials) which contain alloying elements including but not limited to: Chromium (Cr), Nickel (Ni), Molybdenum (Mo), Copper (Cu) or Tungsten (W).</p> <p><u>300 Series Stainless</u>: Austenitic Stainless Steels (304L, 316L, etc.)</p> <p><u>6 % Mo</u>: AL6XN, 254 SMO, etc.</p> <p><u>Duplex Stainless Steel</u>: CD4MCu, etc.</p> <p><u>Nickel Base</u>: Alloy C-22, 625, 690, etc.</p>
3.2 Responsibility	The Seller shall submit to the Buyer, for review and comment prior to fabrication, procedures covering how PMI will be conducted and documented. The Seller's procedures shall include the instrument manufacturer's procedures and requirements, operator qualification/re-qualification requirements, instrument calibration method(s), calibration frequency during testing, criteria for acceptance or rejection, material identification method, and record keeping.
3.3 Verification Method	
3.3.1	<p>Instruments used for PMI shall be of the type that will provide quantitative, recordable, elemental composition results for positive identification of the alloy elements present.</p> <ul style="list-style-type: none"> a) PMI shall be done per the procedures outlined by the manufacturer of the PMI instrument being used. Modification of these procedures must be approved by the Buyer. b) Each PMI instrument shall be calibrated according to the manufacturer's requirements.

3.3.2	<p>The methods/instruments listed below are acceptable. In application, they must not be used in a "go-no-go" mode. The only acceptable objective is the positive identification, listing, and quantification of the relevant elements listed in Section 7.</p> <p>a) Portable X-ray fluorescence analyzers. Use is limited to the following instruments or their equivalent unless prior approval is given by the Buyer:</p> <ul style="list-style-type: none"> • TN Technologies Alloy Analyzer 9266, 9277 (The Metallurgist XR) or 9288 • Outokumpu X-Met 840, or X-Met 880 • Niton Alloy Analyzer (800 Series) • Thermo Scientific Niton XL3t Analyzer • Metorex X-Met 920, X-Met 3000TA or X-Met 3000TX Metal Analyzer • Innov-X Systems XT Series Analyzer • Innov-X Systems Alpha 6500 Series Analyzer • Innov-X Systems Delta Model DP-2000, DS-2000, or DC-200 Analyzer <p>b) Portable optical emission analyzers. Use is limited to the following instruments or their equivalent unless prior approval is given by the Buyer:</p> <ul style="list-style-type: none"> • SpectroPort Model TP-07 or TFO-02 • Outokumpu ARC-MET 900 or the New Spectrotest • SpectroLab, Spectrotest and Spectrotest Jr. <p>Any other instrument will require Buyer's approval via the submittal process.</p> <p>Note: Arc strikes, if any, need not be removed.</p>
3.3.3	<p>In lieu of using portable instruments, chemical analysis can be performed on actual material samples. Care must be exercised while collecting samples, as contamination can be contributed by the removal tools. Sample extraction shall not weaken or reduce the functionality of the component. Laboratory analysis reports shall be traceable to the individual component from which the sample was taken (See Section 6, below).</p>
3.3.4	<p>Parts that are too small to be tested using an alloy analyzer are exempt from PMI testing. If such exemption is claimed, the PMI procedure shall specify the minimum part size capable of being tested.</p>
3.4 Welding Consumable Control	<p>In addition to PMI testing required by this exhibit, the Seller shall have in place, and implement, welding consumable material control systems that can be verified by auditing. PMI of completed pressure retaining welds is required as indicated in Table 1. Production "Run Off" weld test coupons may be used for chemical analysis checks.</p>
4 Extent of PMI	<p>PMI shall be performed on completed equipment, or assembled parts of equipment, at such time as to ensure that only verified materials have been used in the fabrication and final assembly of components. If the assembled equipment configuration prevents PMI of any individual part, then that part shall be tested prior to assembly and be noted as such on the PMI documentation.</p>
4.1 Vessels, Exchangers, Tanks, Filters and other Manufactured Equipment	<p>Vessels, exchangers, and other manufactured equipment shall have PMI testing performed at the Seller's facilities. This shall include piping and components supplied as part of an equipment "package" or skid.</p>
4.2 Shop Fabricated Piping	
4.2.1	<p>PMI is required for all piping and piping components, circumferential pressure retaining welds, and non-autogenous longitudinal welds as indicated in Tables 1 and 2. Note that to the greatest extent possible (considering minimum size restraints of the PMI analyzer), the requirements for examining tubing are equivalent to that of piping.</p>
4.2.2	<p>PMI is not required on autogenous welds, fillet welds, or socket welds.</p>

4.4 Valves and Pumps	PMI of valves and pumps is required for materials as indicated in Table 1 and piping fluid codes as indicated in Table 2.
4.5 Bulk Materials (Straight Run Piping, Fittings, Stock Valves, Etc.)	PMI is required as indicated in Table 1. Table 2 does not apply.
5 Identification	
5.1 General	All shop-fabricated items/pieces that have been successfully subjected to the required PMI shall be marked. The mark shall be durable and last through transportation and receiving inspection at the Buyer's facility. See Section 7 for items that do not pass PMI.
5.2 Marking Materials	Marking materials and adhesive tape selected shall not cause corrosion or other harmful effects. Requirements for marking materials: <ul style="list-style-type: none"> • The total chloride/flouride content shall not exceed 200 ppm. • The total sulfur content shall not exceed 400 ppm. • The total of low melting point metals such as lead, zinc, copper, tin, antimony, and mercury shall not exceed 1 percent; of this, mercury shall not exceed 50 ppm.
5.3 Equipment and Equipment Components	When it has been verified that the material has a composition consistent with the material specified, then it must be stamped with letters "PMIV". Use low stress stamps for identification. Items that cannot be stamped shall have an alternate system of marking. Heat exchanger tubing shall not be stamped. Any alternate system, and the items for which it will be used, must have Buyer approval. To the maximum extent possible, the stamping/markings shall be located for ease of future reference/verification.
5.4 Piping Materials	When it has been verified that the material has a composition consistent with the material specified, then a colored adhesive tape, or other approved marking method, shall be applied at one end to facilitate proper identification.
5.5 Fasteners and Small Parts	Fasteners and small parts shall be marked in accordance with the Seller's procedure using a hard marking method, an indelible ink, or paint.
6 Records of PMI	Results shall be recorded on PMI report forms, which shall indicate, as a minimum, the following for each examination: <ol style="list-style-type: none"> a) Name of inspector b) Date of testing c) Test method, including PMI instrument name and serial number d) Equipment tag number or pipe spool number (PO number for bulk items) for the specific piece tested e) Quantitative analysis results for relevant elements (see Section 7) <p>A PMI map consisting of assembly and sub-assembly drawings shall be prepared for each piece of fabricated equipment or pipe spool. The map shall include components and welds and show the locations of PMI testing.</p> <p>An extended Shop Spool Sheet shall be provided for each individual spool number where PMI was done.</p> <p>In the case of bulk items, PMI results may be submitted in the form of a certificate verifying that parts were tested according to the requirements of this exhibit. Results shall be reported by heat/lot and shall include the following: <ol style="list-style-type: none"> a) Name of inspector b) Date of testing c) Test method, including PMI instrument name and serial number d) Type and number of pieces tested e) Acceptable composition ranges for the relevant elements (see Section 7) f) Material identified </p>

	<p>PMI forms shall become a part of the permanent inspection records. Seller shall submit the completed forms as part of the Final Document Package when required by the Form G-321-V in the Purchase Order.</p>												
<p>7 Acceptance, Rejection and Retesting Requirements</p>	<p>All materials tested shall be identified by the PMI instrument as being consistent with the composition of the specified material. The results shall fall within the chemical composition requirements of the ASTM, AWS or other applicable material specification allowing for the accuracy of the instrument. Any questionable PMI result shall be re-analyzed by the same or another instrument, after verification of proper surface preparation. See Section 7.1, below, for materials and welds that fail to meet requirements on the second analysis.</p> <p>The following elements shall be identified and recorded, even if the instrument does provide immediate identification (e.g. display of "316", "6 Mo", etc.):</p> <table border="1" data-bbox="537 590 1365 781"> <thead> <tr> <th>Alloy</th> <th>Elements</th> </tr> </thead> <tbody> <tr> <td>304, 304L</td> <td>Ni, Cr</td> </tr> <tr> <td>316, 316L</td> <td>Ni, Cr, Mo</td> </tr> <tr> <td>347</td> <td>Ni, Cr, Nb</td> </tr> <tr> <td>Duplex, 6% Mo, 254 SMO, AL6XN, etc.</td> <td>Ni, Cr, No, Cu</td> </tr> <tr> <td>Nickel base alloys, C-22, 625, 690, etc.</td> <td>Ni, Cr, Mo, W</td> </tr> </tbody> </table> <p>Welds joining dissimilar base materials or having filler materials that do not match the base material composition may include an allowance for dilution. Acceptable composition ranges for commonly used combinations of base material and weld filler metals are included in Table 3. Other combinations, when required, shall be identified to the Buyer for approval. Please note that the only proper use of Table 3 is for assessing dissimilar welds.</p>	Alloy	Elements	304, 304L	Ni, Cr	316, 316L	Ni, Cr, Mo	347	Ni, Cr, Nb	Duplex, 6% Mo, 254 SMO, AL6XN, etc.	Ni, Cr, No, Cu	Nickel base alloys, C-22, 625, 690, etc.	Ni, Cr, Mo, W
Alloy	Elements												
304, 304L	Ni, Cr												
316, 316L	Ni, Cr, Mo												
347	Ni, Cr, Nb												
Duplex, 6% Mo, 254 SMO, AL6XN, etc.	Ni, Cr, No, Cu												
Nickel base alloys, C-22, 625, 690, etc.	Ni, Cr, Mo, W												
<p>7.1</p>	<p>If any material, component, or weld of a type not requiring 100% testing is found to be unacceptable, all other materials, components, or welds (same heat, lot, etc.) represented by that failed item shall be considered suspect. The Buyer shall be notified immediately if a component is confirmed to have failed the PMI. The Seller will then have the following options, with Buyer concurrence:</p> <ul style="list-style-type: none"> a) Scrapping/removing all materials, components, or welds represented by the test piece (all of that heat, lot, etc.) and replacing with new components or filler metals, or b) Performing 100 percent examination of the remainder of the represented materials, components, or welds, and replacing each item that fails the PMI check, or c) Verifying correct chemistry by laboratory chemical analysis. 												
<p>7.2</p>	<p>If questionable values obtained with portable analyzers are verified by laboratory analysis, the laboratory analysis data shall be used and recorded.</p>												
<p>7.3</p>	<p>Any item or component containing materials that have not passed the PMI shall be clearly marked as "DO NOT USE — PMI FAILED" and segregated from the remainder of the stock.</p>												

Table 1 PMI Requirements for Shop Fabricated Items/Pieces

ITEM - (NOTE 1)	VERIFICATION REQUIRED
Type 304 & 304L Stainless Steel Components	No
Type 316, 316L, & 347 Stainless Steel Components	Yes – 100%
6% Mo Components	Yes – 100%
Duplex Stainless Steel Components	Yes – 100%
Nickel Base Alloy Components	Yes – 100%
Alloy Valves	Yes – 100% Body and Bonnet Only
Alloy Pumps	Yes – 100% Casing Only
Alloy Piping – including non-autogenous longitudinal welds (Spools, Fittings, Straight-Run Pipe, and Tubing)	Yes – 100% for 6 % Mo alloys and Nickel base alloys Yes – 100% for 316L, used in the fluid codes listed in Table 2
Alloy Pressure Retaining Welds	Yes – 100% of completed welds that join material required to have PMI testing
Bolting — B8M used for Pressure Retaining Connections	Yes – 5 % of total bolts, minimum one check per heat
Alloy Heat Exchanger Tubing	Yes – 5 % of total tubes, minimum one check per heat
Venturis	Yes – 100% pipes and welds

Note:

1. The following items are exempted unless specifically designated for PMI by the Purchase Order:

- a) All type 304L stainless steel components, piping, and welds
- b) Deleted
- c) Non pressure-retaining parts, such as baffles, trays, tray clips, supports, pall-rings, support rings, etc.
- d) Non pressure-retaining welds and sections of piping, such as drains, vents, overflows, etc.
- e) Gaskets
- f) Instrumentation (except when the instrument is a shop fabricated piping component placed in-line of a piping system requiring PMI)
- g) Internal instruments parts (including pressure retaining parts)
- h) Instrument tubing less than 1/2 inch in diameter
- i) HVAC ducting
- j) Piping components located within piping systems for which PMI is NOT required.

Table 2 Fluid Codes Requiring PMI Testing (Shop Fabricated Piping and Piping System Components)

Fluid Code		Fluid Code		Fluid Code	
DR	Suspect Radioactive Steam	GU	Nitric Acid Fume	GV	Vessel Vent Radioactive
HN	Nitric Acid	HR	Recovered Nitric Acid	PA	Radioactive Aqueous
PB	LAW Feed	PC	HLW Feed Slurry	PE	Entrained Solids Concentrate
PF	Cs/Tc Concentrate	PH	LAW Melter Feed	PJ	HLW Melter Feed
PP	Ultrafilter Permeate	PR	Suspect Radioactive Liquid	PS	Suspect Radioactive Slurry
PU	Suspect Radioactive Gas/Vapor	PV	Strontium Carbonate	PW	Radioactive Gas/Vapor
PX	Radioactive Slurry	PZ	Waste Feed	RK	Sodium Permanganate
ZE	Plant Wash Fluid	ZF	Plant Washings	ZH	Acidic Effluent
ZJ	Alkaline Effluent	ZL	Spent IX Resin	ZN	Neutralized Effluent
ZR	Suspect Radioactive Condensate	ZS	Process Radioactive Condensate	ZX	Special Decontaminant
ZY	Scrubber Effluent				

Table 3 Base Material and Weld Filler Metal Composition Requirements (Wt %)

MATERIAL	Cr	Ni	Mo	Cu	W	Notes
304L BM	18.0 - 20.0	8.0 - 12.0	---	---	---	
308L WFM	19.5 - 22.0	9.0 - 11.0	0.75 max	---	---	E/ER308L & LT
304L Welds	18.0 - 22.0	8.0 - 12.0	0.75 max	---	---	Note 1
304L BM	18.0 - 20.0	8.0 - 12.0	---	---	---	
316L BM	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	---	---	
316L WFM	17.0 - 20.0	11.0 - 14.0	2.0 - 3.0	---	---	E/ER316L & LT
304L/316L Welds	16.0 - 20.0	8.0 - 14.0	3.0 max	---	---	Note 1
304L BM	18.0 - 20.0	8.0 - 12.0	---	---	---	
316L BM	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	---	---	
308L WFM	19.5 - 22.0	9.0 - 11.0	0.75 max	---	---	E/ER308L & LT
304L/316L Welds	16.0 - 22.0	8.0 - 14.0	3.0 max	---	---	Note 1
304L BM	18.0 - 20.0	8.0 - 12.0	---	---	---	
308L WFM	19.5 - 22.0	9.0 - 11.0	0.75 max	---	---	E/ER308L & LT
CD4MCu BM	24.5 - 26.5	4.75 - 6.0	1.75 - 2.25	2.75 - 3.25	---	
304L/CD4MCu Welds	18.0 - 26.5	4.75 - 12.0	2.0 max	---	---	Note 1

Table 3 Base Material and Weld Filler Metal Composition Requirements (Wt %) (cont.)

MATERIAL	Cr	Ni	Mo	Cu	W	Notes
316L BM	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	---	---	
316L WFM	17.0 - 20.0	11.0 - 14.0	2.0 - 3.0	---	---	E/ER316L & LT
316L Welds	16.0 - 20.0	10.0 - 14.0	2.0 - 3.0	---	---	Note 1
316L BM	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	---	---	
316L WFM	17.0 - 20.0	11.0 - 14.0	2.0 - 3.0	---	---	E/ER316L & LT
CD4MCu BM	24.5 - 26.5	4.75 - 6.0	1.75 - 2.25	2.75 - 3.25	---	
316L/CD4MCu Welds	16.0 - 26.5	4.75 - 16.0	1.75 - 3.0	---	---	Note 1
AL6XN BM	20.0 - 22.0	23.5 - 25.5	6.0 - 7.0	0.75 max	---	
625 WFM	20.0 - 23.0	58.0 min	8.0 - 10.0	0.50 max	---	E/ERNiCrMo-3
AL6XN Welds	20.0 - 23.0	25.5 min	7.0 - 10.0	0.75 max	---	Note 2
C-22 BM	20.0 - 22.5	Remainder	12.5 - 14.5	---	2.5 - 3.5	
CD4MCu BM	24.5 - 26.5	4.75 - 6.0	1.75 - 2.25	2.75 - 3.25	---	
C-22 WFM	20.0 - 22.5	Remainder	12.5 - 14.5	0.5 max	2.5 - 3.5	E/ERNiCrMo-10
C-22/CD4MCu Welds	16.0 - 22.5	25.0 min	10.5 - 14.5	---	2.5 - 4.5	
C-22 BM	20.0 - 22.5	Remainder	12.5 - 14.5	---	2.5 - 3.5	
C-22 WFM	20.0 - 22.5	Remainder	12.5 - 14.5	0.5 max	2.5 - 3.5	E/ERNiCrMo-10
C-22 Welds	20.0 - 22.5	52.0 min	12.5 - 14.5	---	2.5 - 3.5	Note 1
Alloy 625 BM	20.0 - 23.0	58.0 min	8.0 - 10.0	---	---	
to 304L	18.0 - 20.0	8.0 - 12.0	---	---	---	
to 316L	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	---	---	
625 WFM	20.0 - 23.0	55.0 min	8.0 - 10.0	0.50 max	---	E/ERNiCrMo-3
Alloy 625 to 304L/316L Welds	19.0 - 23.0	50.0 min	8.0 min	0.50 max	---	
AL6XN (N08367) BM	20.0 - 22.0	23.5 - 25.5	6.0 - 7.0	0.75 max	---	
to 304L	18.0 - 20.0	8.0 - 12.0	---	---	---	
to 316L	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	---	---	
625 WFM	20.0 - 23.0	55.0 min	8.0 - 10.0	0.50 max	---	E/ERNiCrMo-3
N08367 to 304L/316L Welds	19.0 - 23.0	25.0 min	4.0 - 10.0	---	---	

BM = Base metal; WFM = Weld filler metal

Notes:

1. Acceptance is based on the combined base metal and WFM spec requirements.
2. Acceptance is based on WFM spec and the expected amount of dilution for molybdenum.

Exhibit 3

Low Voltage Induction Motors

Specification 24590-WTP-3PS-MUMI-T0002, Rev. 3 was used to create this exhibit. Specification change notices (SCNs) have been evaluated and there are no applicable SCNs.


1 Scope	
1.1 General	
1.1.2	If conflicts arise between this exhibit and the primary mechanical packaged specification, the primary specification shall take precedence.
1.2 Equipment, Material, and Services Required	
1.2.2	All motors covered by this exhibit shall conform to the applicable requirements of NEMA MG1, ANSI, and NEC standards, except where a deviation is approved by the Buyer.
1.2.3	Motors manufactured to IEC standards, shall meet the applicable requirements of IEC-60034 and IEC-60072.
1.2.5	All materials and components associated with the fabrication of motors per this exhibit shall be new. Refurbished materials are not acceptable.
1.3 Acceptability Criteria	
1.3.1	All electrical equipment and material shall be suitable for installation and use in conformity with Article 110-3 of the National Electrical Code, NFPA 70-1999.
1.3.2	Motors of types specifically required by NFPA 70 (e.g. fire water pump, and hazardous applications) shall be listed.
1.5 Definitions	Buyer: Bechtel National Inc. Supplier: This is a comprehensive term and includes seller, vendor, contractor, subcontractor, sub-supplier, etc. Primary Specification: The mechanical packaged equipment specification in which this "Low Voltage Induction Motors" exhibit is referenced.
1.6 Safety/Quality Classifications	
1.6.1	This exhibit covers motors based on their quality classification: <ul style="list-style-type: none"> a) Quality level classified as "CM" (Commercial Grade - motor meets industry standards and codes) b) Not used
1.6.2	The Safety Classification, Quality Level and Seismic Category of the motors shall be in accordance with the system functionality of the referenced primary specification and data sheets attached to the primary specification.
2 Applicable Documents	For the purposes of this exhibit, the word "should" shall be replaced with the word "shall" wherever it appears in the referenced Codes and Standards. Any conflicts between the referenced documents shall be identified to the Buyer in writing for resolution. In general, when resolving conflicts, the following order of precedence shall apply: <ul style="list-style-type: none"> • Purchase Order (by the primary specification) • Data Sheets • This Exhibit • Referenced Codes and Standards • Manufacturer Standard
2.1 Codes	NFPA 70-1999 - National Electrical Code

2.2 Industry Standards	IEEE Std. 85 - Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery IEEE Std.112 - Test Procedure for Poly-phase Induction Motors and Generators NEMA MG 1-1998 - Motors and Generators ABMA 9-1990 - Load Ratings and Fatigue life for Ball Bearings ABMA 11-1999 - Load Ratings and Fatigue Life for Roller Bearings IEC-60034 (As applicable) - Rotating Electrical Machines IEC-60072 (As applicable) - Dimensions and Output Series for Rotating Electrical Machines
3 Design Requirements	
3.1 General	
3.1.1	Motors shall be rated for continuous duty for 3-phase, 60 Hz, 460 volts.
3.1.2	All motors shall be NEMA Design B, except in special applications requiring higher starting torques where other NEMA Design is permitted.
3.2 Environmental Conditions	The actual environmental conditions requirement of the motors will be shown in the corresponding primary specification/data sheets.
3.3 Electrical Performance	
3.3.1 Voltage Rating	<ul style="list-style-type: none"> • Motors smaller than 1/2 Hp - 115 volts, 1-phase, 60 Hz • Motors 1/2 Hp to 300 Hp - 460 volts, 3-phase, 60 Hz • Reversing motors - 460 volts, 3-phase, 60 Hz <p><u>Note:</u> Deviation from these limits will be permissible if technically justified on a case-by-case basis.</p>
3.3.2 Insulation System	Motors shall be furnished with Class F insulation minimum, and shall be selected for operation within their full load rating without applying the service factor.
3.3.3 Temperature Rise	Ratings shall be based on a maximum ambient temperature of 40 °C, 3,300 feet (1000 m) altitude or less, with a maximum temperature rise of 80 °C by resistance at 1.0 service factor, (90 °C temperature rise at service factor 1.15 up to 150HP). Inverter duty motors shall not exceed Class F rise at any speed under the defined load.
3.3.4 Locked Rotor Current	Unless otherwise approved by the Buyer, the locked rotor current of motors shall not exceed the values as shown in NEMA MG-1-1998, section 12.35.1 "Maximum Locked-Rotor Current for 60-Hz Design B, C, and D Motors at 230 Volts". The locked-rotor current of motors designed for voltage 460 shall be proportional to the ratio, 230/460.
3.3.5 Service Factor	The motor shall be sized so that it will not be loaded beyond its design power rating at service factor of 1.0.
3.3.6 Starting Duty	The motor shall be capable of two successive starts with the motor already at full load temperature, or three successive motor starts at ambient temperature, accelerating the load from zero up to full load speed with the motor terminal voltage between 80% and/or 110% of the rated voltage.
3.5 Mechanical Requirements	
3.5.1 General	
3.5.1.1	All motors heavier than 50 lbs shall be supplied with an eye bolt for lifting.
3.5.1.2	Where practical, the motor base shall be drilled for ground connection. A bolt shall be provided complete with nut and washers.
3.5.1.3	Vertical jacking bolts shall be furnished on all horizontal motors 1000 lbs and heavier.
3.5.1.5	Protection shall be provided against galvanic action between dissimilar metals by the use of gaskets, washers or other appropriate means.
3.5.2 Motor Enclosures	

3.5.2.1	Motor enclosures as required on the data sheets, shall be as follows: <ul style="list-style-type: none"> • Motors 1/2 hp up to 200 hp: TEFC or TENV (IP54 for IEC motors) • Motors larger than 200 hp: TEFC, WPI or WPPI
3.5.2.2	Motor enclosures, bearing bracket and fan guard shall preferably be of ferrous material unless otherwise specified.
3.5.3 Drains	Where practical, corrosion resistant, replaceable automatic drainage fittings shall be provided at the low point(s) of the motor enclosure for water drainage.
3.5.4 Mounting	The mounting and shaft configuration on all motors shall be defined by the driven equipment manufacturer.
3.5.5 Bearing	
3.5.5.1	Unless otherwise indicated on the motor data sheets, continuous duty motors shall have anti-friction type bearings in accordance with the motor manufacturer's standard design. The bearings shall have basic rating life L-10 of 26,280 h minimum per ABMA 9-1990 or ABMA 11-1999.
3.5.5.2	For motor sizes larger than 200 HP, shaft-currents shall be prevented by providing insulated bearings.
3.5.5.3	Vertical motors shall be equipped with thrust bearings and guide bearings.
3.5.5.4	Sealed bearings shall be provided for motors located in hot cell and/or contaminated area (i.e. C5), and will be specified on the primary mechanical equipment data sheets.
3.5.6 Shaft Seals	
3.5.6.1	All motors, except those required to be explosion proof, shall have shaft seals suitable for the environment specified.
3.5.6.2	Shaft seals for continuous duty motors, shall be non-contact-while-rotating type and shall be used on both motor ends.
3.5.7 Rotor	Unless otherwise specified, all motors shall have die cast aluminum rotor cages as standard.
3.5.8 Bearing Lubrication	The lubricant and frequency of lubrication of the motors shall be defined by the manufacturer.
3.6 Conduit Boxes	
3.6.1 Motor Leads Conduit Box	<ul style="list-style-type: none"> a) Conduit boxes shall be rotatable in 90° turns, gasketed, cast iron construction with tapped conduit entrance hole(s). b) Conduit boxes for explosion proof motors shall have a machined metal to metal fit. c) A ground lug shall be provided inside the conduit box on all motors. d) Conduit box size shall be one size larger than NEMA MG-1/NEC standard.
4 Materials	
4.1 Prohibited Materials	The use of asbestos, PCB and mercury in the manufacture, fabrication, assembly and finish of the motors are prohibited.
4.2 Special Requirements	
4.2.1	Design requirements for special motors shall be determined jointly by the Supplier and the Buyer prior to any fabrication of the motor.
4.2.2	Motors for adjustable speed applications shall be rated for inverter duty. They shall be selected by the supplier, and designed and tested in accordance with NEMA MG-1 part 31.
4.3 Nameplates	Each motor shall have a non-corrosive stainless steel nameplate with no less than the minimum information called for in NEMA MG 1. The nameplates shall be attached with pins of the same materials, with the following data as a minimum: <ul style="list-style-type: none"> 1. Manufacturer's Type and Frame designation 2. Horsepower output 3. Time Rating

	<ol style="list-style-type: none"> 4. Temperature rise/Insulation Class 5. Speed at rated Load 6. Frequency 7. Number of Phases 8. Rated Voltage 9. Rated Load Current 10. Code Letter for Locked-rotor kVA 11. Service Factor 12. Buyer's Motor Tag No. <p>Additional Nameplate Information:</p> <ol style="list-style-type: none"> 1. Type of Enclosure 2. Manufacturer's name 3. Serial number or date of manufacture
4.4 Noise Level	
4.4.1	Sound level shall be limited to values per NEMA MG-1, Table 9-1.
5 Tests and Inspections	
5.1 Shop Tests	
5.1.1	Unless with Buyer's prior written approval, all motors, size and type, shall be subjected to a "routine test". A complete or "full test" is required for motors if identified by the primary specification. All tests shall be performed in accordance with applicable National Codes and Industry Standards and/or Manufacturer Standard test procedures and acceptance. As required, all tests shall be performed at the manufacturer's facility. Certified test results shall be provided as identified in the primary specification.
5.1.2	The primary equipment Supplier shall maintain all test schedules and upon notification, the Buyer has the option to witness all the tests to be performed on the motor(s). The primary equipment Supplier has the ultimate responsibility of all submittals.
5.1.3	As a minimum, the following are considered "Routine Test" and "Full Test".
5.1.3.1	<p>Routine Test:</p> <ol style="list-style-type: none"> a) Measurement of winding resistance (cold). b) No-load readings of current, power, and nominal speed at rated voltage and frequency. c) Mechanical vibration check in accordance with NEMA MG-1, Part 7, using either elastic or rigid mount. d) High potential test in accordance with Paragraph 12.3 of NEMA MG-1 Part 12.
5.1.3.2	<p>Full test (Performance Test):</p> <ol style="list-style-type: none"> a) Measurement of winding resistance (cold and hot). b) No-load readings of current, power, and nominal speed at rated voltage and frequency. c) Measurement to allow calculation of locked rotor current and torque. d) High potential test in accordance with Paragraph 12.3 of NEMA MG-1 Part 12. e) Inspection (at full load) of bearings and mechanical operation of motor. f) Full load heat run. g) Measurement of slip at full load. h) Measurement to allow calculation of pull-out torque. i) Measurement to allow calculation of starting torque. j) Measurement to allow calculation of efficiency at full, three quarter and half load. k) Measurement to allow calculation of power factor at full, three quarter and half load. l) Mechanical vibration check in accordance with NEMA MG-1, Part 7, using either elastic or rigid mount.

	In cases where one or more of the "full" tests are specified and there are duplicate motors, only one motor will be subjected for the specified "full" tests.
6 Preparation for Shipment	Packaging, shipping, handling and storage requirements for motors, associated with this exhibit shall be in accordance with applicable sections of the Material Requisition/Purchase Order of the primary specification.
9 Documentation and Submittals	
9.1 General	
9.1.1	<p>For each motor supplied by the driven-equipment manufacturer, the Supplier shall furnish the following documents as per form G-321E in the primary material requisition:</p> <ul style="list-style-type: none"> a) Completed motor data sheets attached to the primary material requisition. b) Dimensional Outline Drawings for motor including terminal box dimensional details and arrangement. c) Wiring diagram d) Not used e) Not used f) Not used g) Recommended spare parts list for one year of operation h) Not used i) Assembly drawing, if required j) Test reports as specified in the primary specification k) Lubricant Data - Supplier shall identify the manufacturer, grade, viscosity, applicable API standard or recommended substitutions. SDS shall be provided for the lubricant. l) Data for the gaskets or seals - Supplier to provide the shelf life and cure dates of gaskets or seals m) Not used n) Not used

GENERAL	1	Facility	System	Tag number								
	2	Service										
	3	Line no/Jumper no/Line description				P&ID/V&ID/MHD						
	4	Hazardous area class		Contamination & Radiation class								
	5	Safety class (active)		SSC Characteristic								
	6	Quality level		Quality level (boundary)								
	7	Seismic category	Seismic (boundary)	Design life								
	8	Max inst dose rate	Time integ dose	Wetted parts dose								
	9	Supply loss failure mode		Signal loss failure mode								
	10											
PIPE LINE OR EQUIPMENT	11	Line size		Line schedule								
	12	Pipe material class		Pipe material	Pipe insulation							
	13											
PROCESS CONDITIONS	14	Fluid name		Fluid state								
	15	Corrosive	Erosive	Toxic	Build-up tendency							
	16	PROCESS DESIGN CONDITIONS				Units	Minimum	Units	Maximum			
	17	Design pressure										
	18	Design temperature						----				
	19	MATERIAL FLOW CONDITIONS				Units	Minimum	Normal	Maximum			
	20	Temperature										
	21											
22												
TRANSMITTER BODY	23	Body/Flange type				DIAPHRAGM SEALS	50	Seal type				
	24	End conn size	Rating				51	End conn size	Rating			
	25	End conn type	Style				52	End conn type	Style			
	26	Vent/Drain location					53	Diaphragm extension lg				
	27	Vent/Drain size	Style				54	Flush conn qty	Size			
	28	Mounting type					55	Instr conn nom size				
	29	Body/Flange material					56	Capillary fitting diameter		Length		
	30	Vent/Drain material					57	Diaphragm material				
	31	Flange adapter material					58	Capillary-armor material				
	32	Bolting material					59	Bolting material				
	33	Gasket/O ring material					60	Upper housing material				
	34	Mounting kit material					61	Lower/Flange material				
	35						62	Gasket/O ring material				
	SENSING ELEMENT	36	Detector type					PERFORMANCE	63	Fill fluid material		
		37	Min pressure span	Max					64			
38		Diaphragm/Wetted material				65	Pressure accuracy					
39		Fill fluid material				66	Pressure LRL		URL			
40					67	Seal fill fluid sp gr	AT					
TRANSMITTER	41	Output signal type				SPECIAL REQUIREMENTS	68	Material identification				
	42	Enclosure type number					69	Software configuration				
	43	Digital communication					70					
	44	Signal power source				PURCHASE	71	Purchase order number				
	45	Integral indicator style				Notes: Seller to complete or correct ALL instrument properties of proposed items.						
	46	Signal termination type										
	47	Cert/Approval type										
	48	Enclosure material										
49												
72	CS/Fieldbus tag number		Measurement/Test	Input LRV	Input URV	Units	Action	Output LRV	Output URV	Units		
73			Press - Output signal									
74	---		Pressure - Scale									
75			Temp - Output signal									
76												
77	Component type		Manufacturer	Model number								
78												
79												
					Project name:							
					Project number:							
					Site:							
					INSTRUMENT DATA SHEET							
					Sheet			of				
No	Org	Chkd	Apvd	NSE	Date	Description	Form:	DS No:	Rev:			