

DIVISION 15
MECHANICAL

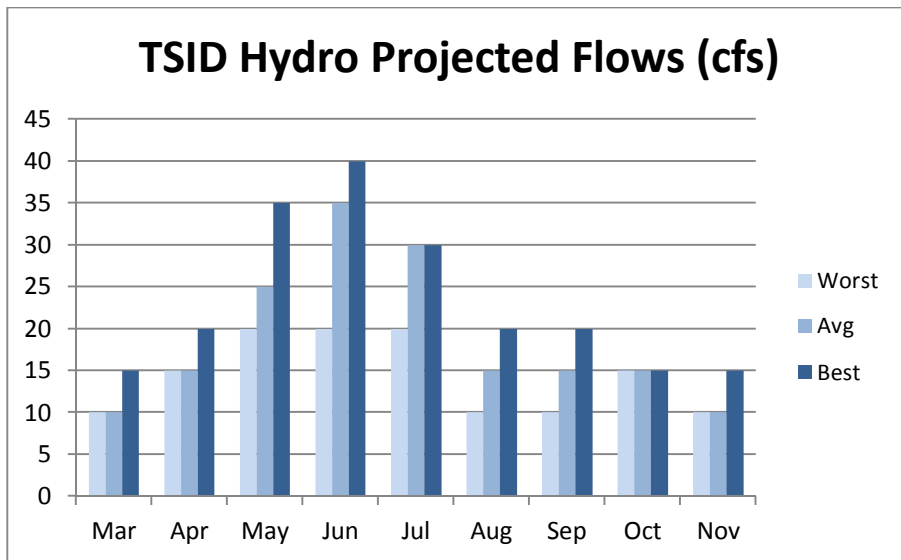
SECTION 15000
DESIGN REQUIREMENTS AND OPERATING CONDITIONS

PART 1 - GENERAL

1.01 LOCATION AND DESIGN CONDITIONS

1.01.1 250 kW Francis

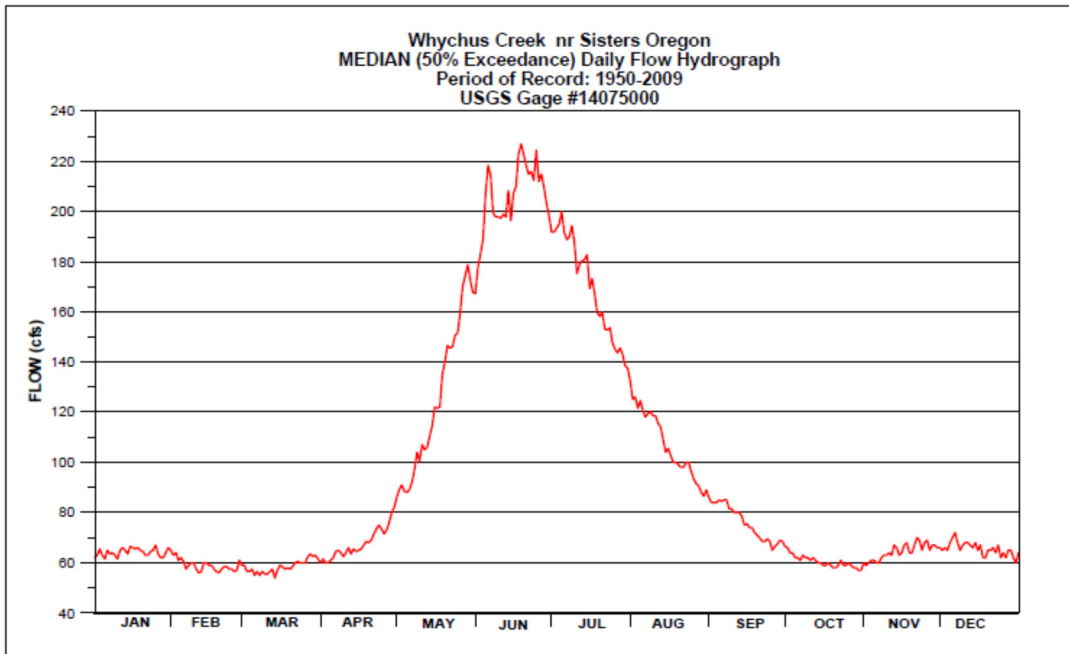
- A. The McKenzie Reservoir Hydroelectric project is located near Sisters, Oregon. The 250 kW Francis turbine will use water diverted from Whychus Creek at elevation 3184 feet that is carried in a 42” outer diameter HDPE penstock about 30,000 feet to the turbine inlet at elevation 3049.8 feet.
- B. The purpose of the project is to provide a long-term source of clean renewable energy to PacifiCorp and pay off the debt creating the penstock, restoring Whychus Creek and installing the fish screen and passage.
- C. Climate: The climate is a Pacific Northwest high desert dry climate typical of eastern Oregon State, with the annual temperature ranging from -20F to 100F.
- D. Available flows: The following graph shows the projected flow scenarios at the powerhouse for good, bad and average years:



1.01.2 50 kW Turgo or Pelton

- A. The 50 kW Turgo or Pelton turbine will use water diverted from Whychus Creek at elevation 3366.4 feet that is carried in a 54”- 18” outer diameter HDPE penstock about 49,000 feet to the turbine inlet at elevation 3049.8 feet.
- B. The purpose of the project is to provide a long-term source of clean renewable energy to PacifiCorp and pay off the debt creating the penstock, restoring Whychus Creek and installing the fish screen and passage.
- C. Climate: The climate is a Pacific Northwest high desert dry climate typical of eastern Oregon State, with the annual temperature ranging from -20F to 100F.
- D. Available flows are from 1 to 4 cfs.

E. The following graph shows the flow duration and monthly distribution of flows in Whychus Creek at the TSID diversion:



1.02 GENERAL DESCRIPTION OF FACILITIES

A. The powerhouse will be a poured concrete block building housing one horizontal-shaft, Francis turbine-generator, inlet valve, and controls; rated to produce approximately 250 kW at 35 cfs flow; and one Turgo or Pelton turbine-generator, inlet valve, and controls; rated to produce approximately 50 kW at 4 cfs flow. The generating units will be designed for fully automatic shutdown and for one-button start-up. All controls will be located at the powerhouse. The powerhouse will be designed for unattended operation and a full time operator will not be necessary. The equipment shall be designed with a SCADA (remote operator’s terminal) system that will allow remote monitoring and control of the plant from the District office from a separate desk top computer and other remote locations. Manual operation will also be possible from the McKenzie powerhouse. A preliminary powerhouse floor plan is attached in Appendix A, “Drawings.” Enough floor space will be provided inside the powerhouse to allow disassembly of the unit to remove the runner.

B. Turbine/Generators: The turbines for this project will be one horizontal-shaft, 250 kW Francis, and one 50 kW Turgo or Pelton, based on the head and flow requirements.

<u>Design Parameters:</u>	<u>250 kW</u>	<u>50 kW</u>
Intake Elevation:	3184 feet	3366.4 feet
Turbine Inlet Valve Centerline:	3049.8 feet	3049.80 feet
Gross Head:	134.2 feet	316.6 feet
Net Head at max flow:	109 feet	190 feet
Maximum Flow Rate:	40 cfs	4 cfs
Minimum Flow Rate:	5-10 cfs	1cfs

1.03 POWERHOUSE STRUCTURE

- A. The powerhouse will be partially buried. The powerhouse will be approximately 30 feet by 30 feet. The 12-foot walls will be buried to a depth of six feet on three sides. A tailrace channel will convey water to McKenzie Reservoir. A drawing showing the project layout is included in the Appendix A.

END OF SECTION

SECTION 15010

GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.00 SECTION INCLUDES

- A. General Mechanical Requirements

1.01 SECTION SUMMARY

- A. The provisions of this Section are the general requirements for all of the equipment and mechanical work in the scope of the project and wherever specifically required in these Specifications. Comply with all requirements of General Technical Requirements.
- B. The SUPPLIER shall direct the attention of all subSUPPLIERS of equipment and related appurtenances for the Work to the applicable provisions in the Contract Documents wherever they may occur.

1.02 MATERIAL AND EQUIPMENT QUALIFICATIONS

- A. Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory utility use for two years prior to Proposal opening. The two-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two-year period.
- B. Alternates to equipment and materials specified shall be quoted on Proposal forms and will be reviewed and accepted or rejected at the DISTRICT's option. Accepted alternates will be identified in the DISTRICT-SUPPLIER agreement.

1.03 SUBMITTALS

- A. Submit material and equipment data under provisions of Section 1300, SUBMITTALS.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable codes including those listed in federal and Oregon Safety and Health Administration (OSHA) requirements.

1.05 PROJECT/SITE CONDITIONS

- A. Prepare Drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections.

1.06 STANDARDS FOR THE WORK

- A. Complete systems: Pip, fittings, wiring, and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams and to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the SUPPLIER shall select appropriate locations and show them on Shop Drawing submittals for review.

- B. Equipment and material shall be new and without imperfections and shall be erected (by others) in a neat and workmanlike manner; aligned, leveled, cleaned, and adjusted per the manufacturer's requirements and the best standard practices for this type of Work. Equipment erection (by others) shall be completed so that subsequent connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance, and repair. Oil and lubrication fittings shall be located clear of and away from guards, bases, and rotating or moving equipment and within reach from the operating floor.

1.07 MANUFACTURER'S INSTRUCTIONS

- A. SUPPLIER shall provide installation, erection, startup, and commission procedures per Division 1 requirements.
- B. The recommendations and instructions of the manufacturers of products used in the Work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.08 FACTORY ACCEPTANCE TESTS

- A. Factory acceptance tests (FAT) shall be performed for each piece of equipment where specifically called for in the Section specifying that equipment. Note that FAT are inherent in many reference standards. The requirement for a FAT in a referenced standard shall make that requirement a part of these Specifications. Conduct FAT at the same speeds and loads at which the equipment will operate in the field, except as noted.
- B. Where specifically noted, FAT may be witnessed by the DISTRICT or their representative. The SUPPLIER shall inform the DISTRICT in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, certified FAT reports shall be supplied by the SUPPLIER.

1.09 UNITS

- A. All units used including equipment sizing, drawings, specification, measurement, and gage readout shall be provided in English units.
- B. Acceptable English units include any and all of the following basic units:
 - 1. Fahrenheit, Temperature
 - 2. Feet of Head or Pounds per square inch, Pressure
 - 3. Feet and inches, Length
 - 4. Kilowatts, Power
 - 5. Pounds force, Force
 - 6. Pounds, Mass

PART 2 - PRODUCTS

2.01 DESIGN

A. General

All equipment shall be designed for the service intended, shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and during continuous or intermittent operation. All equipment shall be adequately stayed, braced, and anchored, and shall be installed (by others) in a

neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. Materials of construction shall be cathodically compatible.

B. Controls

Unless noted otherwise, the design of the electrical control of any equipment system and/or equipment package shall be the responsibility of the manufacturer of the equipment system and/or equipment package. The written operating descriptions in the specifications; the elementary control diagrams as shown on the Electrical Drawings; and the diagrams shown on the Instrumentation Drawings are illustrative of control and monitoring requirements pertaining to various equipment of this Project. The manufacturers shall design their own functional electric control devices and circuitry, in consultation with the specific elementary control diagrams and other Project Specifications, to meet the equipment control requirements. All such systems and package controls shall be furnished by the equipment manufacturer, except that controls shown in motor control centers and process controllers, remote control devices, and their interconnecting wiring (other than 24-volt heating, ventilating, and air conditioning control circuits) shall be provided under Division 16.

2.02 MATERIALS AND STANDARD SPECIFICATIONS

A. Materials

1. Design, fabricate, and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.

B. Uniformity

1. Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

C. Standard Specifications

1. Provide equipment and materials suitable for service conditions and meeting standard specifications such as ANSI, ASME, AWWA, ASTM, AWS, IEEE, NEC, NEMA, UBC, and UL.

2.03 SEISMIC REQUIREMENTS

A. Equipment and supports shall be designed to resist the design lateral seismic force.

B. Stresses shall be calculated as the effect of the lateral force applied at the center of gravity of the equipment from any horizontal direction.

C. Equipment and supports shall be designed for lateral forces in accordance with the following:

$$F_p = .355gW_p$$

Where: F_p = Lateral force on the equipment.

W_p = Total Weight of the equipment supplied by the SUPPLIER.

G = Gravitational Acceleration.

2.04 LUBRICATION

- A. Provide lubricants of types recommended by various equipment sub-suppliers, in quantities sufficient for consumption prior to completion, testing, and final acceptance. Provide equipment lubrication systems that require attention no more often than weekly during continuous operation, do not require attention during startup or shutdown, and do not waste lubricants.

2.05 EQUIPMENT BASES AND BEDPLATES

- A. Equipment assemblies shall be provided, mounted on a single heavy cast iron or welded steel bedplate unless otherwise shown or specified. Provide bases and bedplates with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Corners shall be rounded or chamfered and ground smooth. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth.
- B. Provide jacking screws in equipment bases and bedplates to aid in leveling prior to grouting.

2.06 ANCHORS AND FASTENERS

- A. SUPPLIER shall furnish all embedded metalwork, anchor bolts, shims and hardware required to secure equipment in addition to items specified herein or shown on the Drawings.
- B. Each equipment manufacturer shall furnish the required anchor bolts, nuts, and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1.5 inches of grout under bedplates and adequate anchorage into structural concrete unless otherwise shown or specified.
- C. Anchor and assembly bolts and nuts shall be of ample size and strength for the purpose intended. All bolts shall be standard machine bolts, with cold pressed hexagon nuts. Unless otherwise specified or noted on the Drawings, materials shall be as follows: Bolts submerged in water or buried in earth shall be Type 304 stainless steel. Bolts for supports or for equipment outdoors or in moist locations shall be galvanized steel, hot-dipped, with oversize nuts. Any space wholly or partially underground, or having a wall or ceiling forming part of a water channel, is classified as a moist location.
- D. Other bolting materials shall be used where specifically called for in these Specifications or on the Drawings.
- E. All motor-driven equipment shall be furnished with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Expansion type anchors shall not be used for motor-driven equipment.
- F. Provide non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Drawing, expansion-type anchors may be used.

2.07 PIPING AND VALVES

A. General

1. All piping systems, valves, and fittings required for the turbine shall be designed

and furnished by SUPPLIER (and installed by others). Valves and other operating devices shall be easily accessible, and gauges and other indicating devices shall be located where they can be conveniently read. All gages shall be liquid filled design with isolation valves.

2. Materials and specifications for piping, tubing, fittings, and valves not specified in this Contract, shall be selected by SUPPLIER and will be reviewed for acceptance by DISTRICT. All piping materials, design, and installation shall be in accordance with ASME B31.1 – Power Piping, latest edition. Material certifications of compliance shall be furnished. Low pressure cooling water piping, 50 psi (350 Kpa or less) may be manufacturer’s standard material.
3. The piping and piping materials to be furnished shall consist of all necessary water, and oil piping together with associated strainers, valves, fittings, supports, anchors, hangers, etc. required for complete operating systems for the equipment specified.
4. The piping and piping materials to be furnished shall be new and suitable for the duty and the best of their respective kinds, and shall be subject to acceptance by DISTRICT and ENGINEER. Stainless steel tubing of appropriatedesign may be submitted in place of steel pipe at5. Piping 2.5 inch and larger in diameter shall be shop fabricated, insofar as practical for transportation and installation. Each fabricated pipe spool shall be uniquely identified both on the pipe and on the applicable piping installation drawing. All sharp edges and weld spatter shall be removed prior to coating. Accessible internal welds shall be reduced to a smooth contour by grinding. Fabricated pipe sections requiring field fit-up shall have a loose flange at one end or extra material for field trimming and welding. Connections to rotating equipment shall be made by flexible connections.
6. Arrangement of the piping and the locations of valves and joints shall be such that there will be a minimum disturbance of the piping and interference with other service systems when the equipment is dismantled or parts removed for inspection or repairs.
7. Long radius pipe fittings shall be used in lieu of standard pipe fittings whenever feasible to do so. Insulating flanges, couplings, bushings, or unions shall be used to join ferrous pipe with nonferrous pipe.
8. Welding of branches, headers, bends, etc., shall be done in the shop consistent with the requirements for shipment and erection. Piping between fittings shall not be welded unless the piece to be fabricated is greater in length than the standard manufactured length of pipe. Any welds in the piping which cannot be visually inspected on the inside of the pipe shall be made with backing rings or consumable inserts, in accordance with an approved welding procedure.
9. Piping shall be supported in accordance with ANSI B31.1 code requirements and standard practice. Hangers, supports, and guides shall be such that the pipe is maintained in alignment without sagging or excessive strain on the lines due to uncontrolled movement under operating conditions. Piping shall be arranged to facilitate flushing, draining, and bleeding of the main lines. Air bleed valves shall be located at high points of the hydraulic system where necessary and drain valves

shall be located at low points.

10. Piping shall be installed in neat and orderly manner to result in a pleasing appearance and not obstruct traffic patterns or maintenance in the powerhouse, as determined by the DISTRICT.
11. Welded joints of the same size pipe shall be beveled and butt welded for piping 2.5” (65 mm) and larger and socket welded for piping 2” (50 mm) and smaller.
12. Valves shall be provided wherever necessary for operation of the system and for maintenance.
13. All valves shall have close guide clearances so as to minimize vibration of the gates when operating under pressure and at partial opening. All gate valves, over six-inch size installed in pressure lines, shall be provided with standard bypasses for equalizing pressures.
14. All pipe, valve seats, valves and heat exchangers in contact with water shall have SUPPLIER specified materials resistant to corrosion and the erosive effects of sediment in the water.
15. Following installation, all piping and tubing shall be flushed with the service fluid and filtered (by others).

2.08 PRESSURE VESSELS

- A. Pressure vessels shall be provided in accordance with ASME Boiler and Pressure Vessel Code.
- B. SUPPLIER shall provide all necessary documentation for each pressure vessel in order for all pressure vessels to be registered in accordance with ASME “Boiler and Pressure Vessel Code” and State of Oregon regulatory requirements.
 1. Pressure vessel documentation shall include but not be limited to:
 - a. Design data such as ASME code specification, material specifications, pressure ratings, temperature ratings and type of service.
 - b. Drawings showing dimensions, construction and welding details of the proposed vessel design.
 - c. ASME code calculations.

2.09 SAFETY GUARDS

- A. SUPPLIER shall provide covers for belt or chain drives, fan blades, couplings, exposed shafts, and other moving or rotating parts on all sides with safety guards conforming to all State and local codes and regulations which pertain; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide spring-loaded hinged doors with latch for service and lubrication access.
- B. All pipes, manifolds, heaters, and other surfaces that have a surface temperature sufficient to burn human tissue, shall be covered with a thermal insulating material or

otherwise guarded against contact.

2.10 LIFTING RINGS

All equipment weighing over 100 pounds shall be supplied with steel lifting rings. Parts of equipment assemblies which are normally serviced separately, such as motors, shall have lifting rings of their own.

2.11 MARKING AND TAGGING

A. Marking and tagging shall conform to ANSI standards. Engraved corrosion resistant nameplates shall be securely attached at easily accessible and visible points for all equipment and components. The nameplates shall be stamped with information required by applicable code(s) and shall include Manufacturer's name, serial number, shop order number, project identification number, type of equipment, and tag number. All marking shall agree with similar markings on the Drawings. Nameplates shall be stainless steel or other material approved by DISTRICT. The method of attachment shall be non-deleterious to the equipment.

B. All separate components and accessories shall be fully identified.

C. All packaged equipment and other separate components that are match marked for field assembly shall be clearly marked by letters and numbers so that they can be identified and cross-checked with shipping papers, and applicable erection drawings.

D. Turbine nameplates listing the name and address of the turbine manufacturer together with the machine identification, rating, hydraulic characteristics and rated capacity shall be furnished. The size and materials shall be the manufacturer's standard design. Nameplate data shall be permanently inscribed by engraving, embossing, or stamping. The nameplates shall be suitable for mounting on the turbine.

E. Subassemblies and component parts shall be identified by a permanent system such as stenciling or silk screen marking using permanent inks, by engraved labels or stamping on or adjacent to the respective components.

F. Nameplates for all instruments, relays, control switches, selector switches, pushbuttons, circuit breakers, and other devices shall be furnished and mounted by SUPPLIER. Nameplate size and designation shall be coordinated with DISTRICT/ENGINEER. All nameplates shall be black and engraved with white lettering of laminated plastic material similar to Lamicaid. Nameplates shall be fastened in place with corrosion-resistant screws or bolts.

G. Nameplates for all piping and tubing runs shall be mounted engraved corrosion resistant nameplates stating fluid type and service type and showing fluid flow direction with an arrow.

H. Direction of Rotation

Each piece of rotating equipment shall have a direction of rotation arrow.

2.12 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy

bituminous coatings, nonmetallic separators or washers, or other approved materials. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings, or bushings.

2.13 CONTACTS

- A. For interlock or failure indicating contacts specified to be supplied as part of equipment, provide SPDT switches rated for 120 VAC, 60 Hz at 5 amperes resistive or 3 amperes inductive loading, and terminated at screw-type barrier strips in a NEMA 4 enclosure, unless otherwise shown or specified.

2.14 CLEANING, PAINTING, AND FINISHING

A. Cleanliness

1. At time of shipment, the equipment shall be clean inside and outside.
2. All waste such as metal chips or filings, welding stubs, dirt, rags, debris and any other foreign material shall be removed from the interior of each component. All mill scale, rust, oil, grease, chalk, crayon, or paint marks, and other deleterious material shall be removed from all interior and exterior surfaces.
3. Solvent cleaning shall be performed in accordance with Steel Structures Painting Council SP1 "Solvent Cleaning."
4. Cleaning of stainless steel surfaces shall be performed with solvents, cloths, and abrasives that do not contain halides. Only stainless steel, clean, iron-free hand or power tools, or aluminum oxide abrasives shall be used on stainless steel components. Materials used to clean carbon steel or cast iron shall not be used to clean stainless steel surfaces.
5. Following installation, all piping and equipment components containing fluids shall be flushed with the service fluid. Flushing shall continue until the flushing fluid contains particles not exceeding size or quantity limits allowed by the equipment manufacturer. Bearings shall be isolated during flushing operations; this will require installing temporary jumpers. SUPPLIER shall submit a flushing plan, with piping sketches.

B. Surface Preparation and Coating

1. The equipment and all accessories shall be thoroughly cleaned and all external cast iron, carbon steel and low alloy steel surfaces shall be prepared for priming by blast cleaning in accordance with Steel Structures Painting Council Specification SP-6, "Commercial Blast Cleaning." The blast pattern shall have a 1 to 2 mil profile as measured with a Keane-Tator Surface Profile Comparator or alternate acceptable to DISTRICT.
2. Primer shall be applied after blast cleaning and before rusting occurs.
3. Application of primer shall be in accordance with SSPC-PA-1, "Shop, Field and Maintenance Painting" and the Manufacturer's written instruction. In the event of discrepancy or contradiction, the Manufacturer's instruction shall govern. Measurement of dry film thickness shall be in accordance with SSPC-PA-2, "Measurement of Dry Film Thickness with Magnetic Gauges."

4. All external cast iron, carbon steel, and low alloy steel surfaces of the equipment and accessories installed indoors shall be shop primed with one of the following primers, or alternate acceptable to DISTRICT/ENGINEER:

Primer	No. of Coats	Min-Max Dry Film Thickness (Mils)	Manufacturer
Carboline GP-10	One	2 to 4	Carboline Co.
Chromox 13-R-50	One	2 to 4	Mobil Chemical Co.

5. All external cast iron, carbon steel, and low alloy steel surfaces of the equipment and accessories installed outdoors shall be shop primed with one of the following primers, or alternate acceptable to DISTRICT/ENGINEER:

Primer	No. of Coats	Min-Max Dry Film Thickness (Mils)	Manufacturer
Durazinc 555	One	3 to 5	Imperial Professional
Mobil Zinc 7 (13-F-12)	One	3 to 5	Mobil Chemical Co.
Carbo Zinc 11	One	3 to 5	Carboline Co.

6. Stainless steel, galvanized steel, bronze, and other nonferrous surfaces shall not be sand blasted or primed.
7. Carbon steel surfaces within 4 inches of field weld ends shall be protected by coating with Deoxaluminat (Special Chemical Corp.) or alternate acceptable to DISTRICT/ENGINEER.
8. All machined cast iron, carbon steel, and low-alloy steel surfaces shall be coated with an easily removable (by alkaline solution, steam, or hot water) corrosion-preventative compound meeting MIL-C-16173, Grade 1 requirements. SUPPLIER shall include in the Instruction Manual under Installation, the name, make, type, properties, and removal instructions of the compound he intends to use.
9. SUPPLIER shall furnish with his proposal a complete description of the corrosion protection he intends to provide, including applicable cleaning and coating procedures and specific description of coating materials to be used for acceptance by ENGINEER and DISTRICT. Alternate coating specifications may be offered by SUPPLIER for ENGINEER's and DISTRICT's review and acceptance.
10. Equipment finish coat shall be by the same paint manufacturer as primer. The color shall be selected by DISTRICT. Application method for the finish coat shall be the same as that of primer. Finish coat color shall be; water piping - blue, oil piping - gray.

11. All joints, cracks, or crevices inside oil tanks shall be seal welded to prevent the lodgment of foreign matter in the oil. The outside surfaces shall be free of ridges, indentations, depressions, blisters, or bumps which will produce highlights when painted. All welds shall be a smooth, clean, workmanlike job. Each oil tank shall be thoroughly cleaned of all rust, oil, grease, dirt, and mill scale inside and outside. The inside of the tanks shall be carefully and thoroughly cleaned by rotating in shot blast or by sandblasting the entire surface, in accordance with SSPC-SP6. The interior surfaces of the oil tanks shall be coated with an oil-proof enamel, such as General Electric, Glyptal No. 1248, or other approved material, with a minimum thickness of 2 mils, to prevent deterioration of the metal. The outside of the tank shall be prime coated. The priming paint shall be applied immediately after shot or sandblasting so there will not be opportunity for rusting in the interval between cleaning and painting.
12. Panels and cabinets shall be painted in standard ANSI 61 Grey color on the outside and white on the inside. Paint quality and surface preparation shall be as specified herein.
13. No lead-based paint or primer shall be used on any equipment.

2.15 MATERIALS AND WELDING

A. Materials

1. All materials shall be subject to acceptance by DISTRICT/ENGINEER.
2. If SUPPLIER determines that any specified material is not suitable for the application and requires upgrading, he shall so state and also indicate qualifications for using the alternate material. Where material is not specified, it shall be SUPPLIER's responsibility to select materials suitable for the service intended and in accordance with ASTM Standard Specifications.
3. The material specifications, including grades, class, or type, shall be shown on the appropriate detail drawings submitted to DISTRICT/ENGINEER for review.
4. Certificates of compliance with the appropriate ASTM specification shall be provided.
5. Where components are subjected to hydrostatic pressure or action of external forces on the principal stress carrying parts, the bolting material shall be made of alloy steel ASTM A193 Grade B8 Class 2 with heavy hex nut of ASTM A194, Grade 6. Washers shall be hardened steel ASTM F436.

B. Welding

1. All welding procedures and specifications, repair welding procedures and specifications, and welders to be employed shall have been qualified in accordance with the requirements of ASME Section IX or AWS D1.1, as applicable.
2. Repair procedures for defects in base materials shall follow requirements of the applicable material specification, ASME Section IX and this specification.
3. All welding and repair welding procedures shall be submitted to

DISTRICT/ENGINEER for review prior to use. Welding shall be performed in accordance with the accepted welding procedures.

4. The welding procedures qualification test data shall be submitted to DISTRICT/ENGINEER for review. Notched specimen (Charpy V-Notch) test data at -30°F are required of the base metal, heat affected zone and weld metal. Such data shall be obtained from weldments produced by all high energy welding processes, according to the procedures and thermal treatments used for production welds. Where requested, when such qualification tests and specimen testing are to be performed in compliance to these specifications, they shall be conducted in the presence of DISTRICT's representative. In any case, ENGINEER and DISTRICT shall have the authority to reject unsatisfactory processes or operators, as well as unsatisfactory workmanship. When doubt exists regarding acceptability of any qualification test, a retest may be allowed at the discretion of ENGINEER's/DISTRICT's representative.
5. Welding materials shall conform to the applicable ASME SFA Filler Metal specifications listed in the ASME Section IIC or AWS and the requirements of this specification.
6. Welds shall be post-weld heat treated in accordance with ASME Section VIII, Paragraphs UW-40, UCS-56, or the applicable material specification. Dissimilar metal weldments shall undergo heat treatment as specified for the material requiring the higher PWHT temperature. Code allowed exemptions shall be subject to DISTRICT/ENGINEER's review with attention given to appropriate additional preheat requirements.
7. Additional general requirements for post-weld heat treatment are as follows:
 - a. Where joint members are unequal thickness, the nominal section thickness at the location of the weld heat affected zone in the heavier section shall be the governing thickness for determining the heat treatment hold time and heating and cooling rates.
 - b. A complete automatic temperature record shall be made of all post-weld heat treating operations and be available for ENGINEER/DISTRICT review.
 - c. For furnace heat treatment, thermocouple shall be attached directly to the component, or to test blocks placed in the hottest and coolest parts of the furnace. A sufficient number of thermocouple shall be used to ensure temperature uniformity.
 - d. The minimum heated band width for induction or resistance heating shall be 5 times the thickness of the thicker component.

2.16 NOISE AND VIBRATION

- A. Mechanical and electrical equipment, as installed in this Project, shall not create sound levels that are in excess of that permitted by the OSHA requirements for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved.

2.17 ASBESTOS

- A. No materials containing asbestos shall be used.

2.18 BEARINGS

- A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association (AFBMA). Bearings requiring field lubrication shall be equipped with readily accessible grease (“Zerk”) fittings, with grease lines extending to readily accessible locations (not requiring fall protection, ladders, or other safety equipment for access). Bearings shall have a minimum L-10 life expectancy over 5 years or 20,000 hours, whichever comes first for intermittent operation and at least 60,000 hours for continuous operation.

PART 3 – EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in appropriate containers. Maintain products in clean, new condition in accordance with Section 01600, Product Delivery, Storage, and Handling.
- B. Ship, receive, and handle all products and materials so as not to damage surfaces, coatings, linings, and as required to prevent cracking, breakage, or corrosion. Damaged products and materials shall be repaired or replaced at the SUPPLIER's expense.
- C. Use appropriate tools, equipment, and procedures to handle and transport products and materials.

3.02 PROTECTION

- A. Protect openings of piping, equipment, and other materials and products against entry of foreign materials, and remove any such materials before assembly. Protect all exposed surfaces against damage and moisture.
- B. Equipment containing electrical control enclosures, motors, oil reservoirs, or any equipment provided with space heaters or other weather/condensation protection shall be stored in a heated, dry building prior to installation.

3.03 INSPECTION

- A. SUPPLIERS Field Service Engineer shall inspect each item of equipment for damage, defects, completeness, and correct operation (if possible) before installation (by other). Inspect previously installed related Work and verify that it is ready for installation of equipment.
- B. Field Service Engineer shall verify installation conditions as satisfactory to receive work of this Section. Do not install (by others) until unsatisfactory conditions are corrected.

3.04 MANUFACTURERS’ FIELD SUPERVISION

- A. Conform to applicable requirements of Section 01450, Erection Supervision and Section 01500, Commissioning, Start-Up and Testing.

3.05 LUBRICATION

- A. Field Service Engineer will assure that initial lubrication for all equipment shall be furnished and is properly installed (by others) the prior to operation.

3.06 STARTUP, TESTING, AND ACCEPTANCE

- A. Upon completion of the Work of this Division, and after all systems are set and

balanced, the SUPPLIER shall witness performance tests in accordance applicable Sections of these Specifications.

- B. The Work shall be demonstrated to be fully operational prior to acceptance by the DISTRICT.
- C. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced, all at the SUPPLIER's expense. The SUPPLIER shall pay for all re-tests involved in warranty work.

3.07 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted in accordance with the requirements of Section 01300, Submittals and Section 01080, Operations and Maintenance Data.

3.08 SPARE PARTS

- A. Where specified or shown on the Drawings, provide the indicated spare parts at the completion of construction. All spare parts shall be new and unused and shall be individually tagged with the following information: part description; equipment name (where the part is used); shop drawing number (where the part is called out). Spare parts shall be furnished in substantial wooden boxes, all boxes labeled with the Contract name and equipment name. Part tags shall be 2 inch by 4 inch aluminum-laminated tags, McMaster P/N 1692T34, or equal. A bill of materials shall be attached to each box, enclosed in a metal pocket or sleeve on the face of the box.

3.09 LUBRICANTS

- A. Sufficient lubricants for initial flushing, fill and commissioning of the equipment shall be provided with the equipment. Lubricant delivery tools, such as grease guns, funnels, drain plug wrenches, etc. shall be furnished with the supply of lubricant.

3.10 SPECIAL TOOLS

- A. Special Tools shall be supplied by the SUPPLIER in accordance with Section 1100, Spare Parts and Maintenance Information.

END OF SECTION

SECTION 15200
HORIZONTAL 250 kW FRANCIS TURBINE AND
50 kW TURGO OR PELTON TURBINE

1.01 SCOPE

A. General

This section describes the requirements for designing, manufacturing, delivery, installation supervision and testing of one horizontal-shaft 250 kW Francis turbine complete with appurtenances, to be installed at the McKenzie Reservoir Hydroelectric Project.

This section describes the requirements for designing, manufacturing, delivery, installation supervision and testing of one 50 kW Turgo or Pelton turbine complete with appurtenances, to be installed at the McKenzie Reservoir Hydroelectric Project.

B. Turbine Type and General Requirements (please provide detailed description and specifications)

1. Type

250 kW Horizontal Francis.

50 kW Turgo or Pelton.

2. General Requirements

The turbine will be installed indoors at a turbine centerline elevation as shown on the drawings. Heating and ventilation systems within the powerhouse will maintain the interior temperature between 45°F and 105°F.

1.02 CODES, STANDARDS AND REGULATIONS

A. General

1. The equipment and design furnished shall be in accordance with, but not necessarily limited to, the following codes and standards, including all addenda, in effect at date of purchase order unless otherwise stated in this specification:

AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ACI	American Concrete Institute
ASME	American Society of Mechanical Engineers including Boiler and Pressure Vessel Code, Power Test Codes
ANSI	American National Standards Institute (including Pressure Piping Code ANSI-B 31.1)
STM	American Society for Testing and Materials
AWS	American Welding Society
ICEA	Insulated Cable Engineer's Association
IEC 60041	International Electrotechnical Commission, Publication 60041
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code

NFPA	National Fire Protection Association
SSPC	Steel Structures Painting Council
UL	Underwriters Laboratories Inc.

2. These codes and standards set forth minimum requirements which may be exceeded by SUPPLIER if, in the SUPPLIER's judgment and with DISTRICT's acceptance, superior or more economical designs or materials are available for successful and continuous operation of SUPPLIER's equipment, as required by this specification.
3. In the event of any apparent conflict among standards, codes, or this Specification, SUPPLIER shall refer the conflict to DISTRICT and ENGINEER for written resolution.

1.03 SUBMITTALS

Shop Drawings and data shall be submitted in accordance with the requirements of Section 01300. Shop drawings shall provide a complete understanding of the equipment and enable the DISTRICT/ENGINEER to review the design of the installation. Such Shop Drawings and data shall include, but are not limited to, those specified herein.

A. Shop Drawings

First Submittal - Within the number of days quoted in the Proposal Form:

1. Submittals schedule incorporating data from DISTRICT's submittal list revised to show all Shop Drawings, calculations, and Product Data to be submitted along with scheduled submittal dates. This shall become the Submittals Schedule, which shall include, but not be limited to, submittals required in other specification sections.
2. Turbine inlet valve and turbine-generator: assembly plans, elevation drawings, and foundation plans and elevations. Foundation drawings shall be provided both as drawings and in electronic format on CDROM compatible with AutoCAD electronic drafting system.
3. SUPPLIER shall furnish detailed equipment component drawings showing dimensions, tolerances, finish requirements and materials of construction for all parts of the turbine and auxiliaries.
4. Design load and stress calculations on principal load carrying parts including foundation loadings.
5. Erection and maintenance clearances.
6. Material lists with material specification and certification requirements, heat treatment requirements, test requirements, welding details and procedures, dimensional tolerance requirements, and all other tests and inspections required of principal parts both for shop and field work.
7. Production schedule.
8. Quality control plan.
9. Shop test and inspection schedule.
10. Proposed plant control logic diagrams.

Second Submittal - Within the number of days quoted in Proposal Forms, the remaining

Shop Drawings and data shall be submitted and shall include the following:

1. All electrical interconnection wiring diagrams.
2. Plant control and SCADA system program.
3. Plant control schematic diagram.
4. Final plant control logic diagram.
5. Conduit schedule showing conduit sizes, start and end points and number and size of conductor for all circuits.
6. Catalog cuts and product data for all purchased parts.

Third submittal – Within the number of days quoted in the Proposal after Notice to Proceed, submit:

1. Field installation and erection instructions
2. Plan and elevation drawings of assembled units.
3. Turbine-generator field test requirements.
4. Commissioning and start-up test plan as specified in Section 01500.

Test Reports

Test reports for shop and field tests shall be submitted within 30 days of completion of the tests.

1.04 TURBINE RATING AND OPERATING REQUIREMENTS

A. Turbine Ratings and Site Conditions

The turbine shall be rated as follows:

McKenzie	250 kW	50 kW
Maximum static head	134.2 feet	316.6 feet
Maximum operating head	109 feet	190 feet
Design (rated) head	134.2 feet	316.6 feet
Minimum operating head	109 feet	190 feet
Design (rated) flow at Design head	40 cfs	4 cfs
Minimum flow for power operation, not more than	5-10 cfs	1 cfs
Turbine power output at Design head and maximum turbine flow	250 kW	50 kW

B. Design Stresses (please provide detailed description and specifications)

C. Turbine Hydraulic Design (please provide detailed description and specifications)

2.01 MATERIALS (please provide detailed descriptions of the following components and their properties)

- A. Runner
- B. Shaft
- C. Bearings

D. Housing

E. Shaft Seal

2.02 TURBINE INLET AND DISTRIBUTOR PIPING (please provide detailed description and specifications)

2.03 AIR ADMISSION SYSTEM (please provide detailed description and specifications if needed)

2.04 HARDWARE AND FASTENERS

Anchor bolts, nuts and washers shall be hot-dip galvanized where exposed to atmosphere. Submerged nuts and bolts shall be stainless steel Type 316 or bronze, ASTM B21 UNS No. C45400 or equal.

2.05 TURBINE TERMINAL BOX

A separate terminal cabinet for terminating the turbine electrical circuits shall be provided in accordance with Division 16. The terminal box shall be a NEMA 4 enclosure, surface mount. Conduit and wiring between electrical devices and the terminal box shall conform to Division 16. At least 20% spare terminals shall be provided on the terminal strips.

2.06 SPARE PARTS

Spare parts shall be supplied as specified in Section 01100. Spare parts shall be properly packed and labeled for shipment and for storage by the DISTRICT. Spare parts shall be individually packaged with complete identification including descriptive nomenclature and part numbers permanently printed on the exterior of the packages.

2.07 TOOLS AND ERECTION DEVICES

All special tools, devices or equipment that may be required to facilitate assembling and dismantling any part of the turbine shall be provided by the SUPPLIER and remain the property of the DISTRICT. If a lifting device is required for lifting of the housing cover, and the turbine runner it shall also be provided by the SUPPLIER and remain the property of the DISTRICT.

2.08 SHOP ASSEMBLY AND TESTS

The following work shall be performed by the SUPPLIER in its shop before shipment of the equipment.

A. The turbine and inlet valve shall be assembled, aligned, fitted and properly match-marked and doweled to ensure correct assembly in the field. Dowels shall be furnished for installation during field erection. Separate subassemblies of related parts, when matched with adjacent parts, will be permitted. If subassemblies are used, the fittings and match-marking procedure shall ensure that subassemblies will fit when the equipment is assembled in the field.

C. Leakage, distortion, or other defects developed during or after the tests shall be corrected to the satisfaction of the DISTRICT/ENGINEER. The tests shall be repeated, if in the opinion of the DISTRICT/ENGINEER, further tests are necessary.

D. Following shop testing equipment shall be matchmarked and export packaged prior to shipment. Packaging shall be marked to identify the contents and weight and shall include the bill of lading.

2.09 CONSTRUCTION

A. Installation

Installation of the turbine will be performed by the DISTRICT. Installation of the turbine, inlet valves and appurtenances shall be performed according to the SUPPLIER'S approved installation and erection procedures and the direction of its Field Service Engineer as specified in Section 01450. The necessary tools, equipment and materials shall be furnished by SUPPLIER as required for a complete installation. The sequence of operations and the method of installing the parts shall be the responsibility of the DISTRICT, working in conjunction with the Field Service Engineer and subject to approval by the DISTRICT/ENGINEER.

B. Commissioning, Startup, and Testing

Commissioning, startup and testing of the equipment shall be performed by the DISTRICT under the supervision of the SUPPLIER's Field Service Engineer, as specified in Section 01500.

Performance testing of the combined turbine and generator will be performed by the DISTRICT using a third party testing service. Tests will be performed in accordance with Section 01500.

END OF SECTION

SECTION 15494
TURBINE SHUTOFF VALVES

Please use this section to provide a detailed description and specification for designing, manufacturing, and delivery of two Turbine Shutoff Valves for the McKenzie Reservoir Hydroelectric Project.

PART 1 – GENERAL

Please include sections on submittals, quality assurance and warranty.

PART 2 – PRODUCTS

Please include sections on components and accessories.

PART 3 – EXECUTION

Please provide sections on preparation, installation and field quality control and testing.

END OF SECTION

SECTION 15495
HYDRAULIC POWER SYSTEMS

Please use this section to provide a detailed description and specification for designing, manufacturing, and delivery of Hydraulic Power Systems for the McKenzie Reservoir Hydroelectric Project.

PART 1 – GENERAL

Please include sections on submittals, quality assurance and warranty.

PART 2 – PRODUCTS

Please include sections on components and accessories.

PART 3 – EXECUTION

Please provide sections on preparation, installation and field quality control and testing.

END OF SECTION

**SECTION 15496
LUBE OIL SYSTEMS**

Please use this section to provide a detailed description and specification for designing, manufacturing, and delivery of Lube Oil Systems for the McKenzie Reservoir Hydroelectric Project.

PART 1 – GENERAL

Please include sections on submittals, quality assurance and warranty.

PART 2 – PRODUCTS

Please include sections on components and accessories.

PART 3 – EXECUTION

Please provide sections on preparation, installation and field quality control and testing.

END OF SECTION

SECTION 15497
COOLING WATER SYSTEMS

Please use this section to provide a detailed description and specification for designing, manufacturing, and delivery of Lube Oil Systems for the McKenzie Reservoir Hydroelectric Project.

PART 1 – GENERAL

Please include sections on submittals, quality assurance and warrantee.

PART 2 – PRODUCTS

Please include sections on components and accessories.

PART 3 – EXECUTION

Please provide sections on preparation, installation and field quality control and testing.

END OF SECTION