SECTION 46 00 00

PROCESS EQUIPMENT INSTALLATION

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall be responsible for the installation, including the supply of anchor bolts, testing, operation, and Performance Verification of all equipment supplied and furnished by the Contractor and supplied by City, as listed in Section 01 64 00, City-Furnished Products.

1.2 DEFINITIONS

A. Testing: In this Division, testing is defined as the operation of a specific item of equipment under actual and/or simulated conditions for the purpose of ensuring the equipment satisfies its basic design criteria. Contractor will conduct testing. Be responsible for all materials, labour, and equipment required to conduct the tests.

B. Commissioning: In this Division, commissioning is defined as the operation of equipment systems under actual and/or simulated conditions for the purpose of ensuring the system performs its intended functions.

1.3 SUBMITTALS

A. Shop Drawings: Shop Drawings:
   1. Check all the shop drawings relative to the materials, dimensions, measurements, size and types of materials, and other details to affirm that they are correct and conform to the requirements and intent of the Contract.
   2. Where the shop drawings are submitted with coordination information missing, the Contract Administrator will return the submission as soon as practicable marked “Exceptions Noted, Resubmit”. Refer to Section 01 33 00, Submittal Procedures.

PART 2 PRODUCTS

2.1 GENERAL

A. Equipment, as listed in Section 01 64 00, City-Furnished Products, will be supplied by the City.

B. The Contractor will be responsible for installing all equipment shown on the drawings and listed in Section 01 64 00, City-Furnished Products. The Contractor will be responsible for furnishing and installing all additional equipment and materials necessary to complete the installation.

C. Incorporate all ancillary devices in the installation including those providing for cooling water, lubricant supply, process drains, and electrical connection, and instrumentation and control requirements.

2.2 MOUNTING REQUIREMENTS

A. Provide all supports, anchorage, and mounting of all equipment in accordance with the manufacturer's recommendations, the National Building Code of Canada with Manitoba Amendments, and industry standard requirements, unless otherwise specified.

B. Design and provide all elements required to resist the calculated forces or as required by the element manufacturer.

C. Design anchorage for all equipment bases, supports, and foundations in accordance with the National Building Code of Canada with Manitoba Amendments.

2.3 ANCHOR BOLTS

A. Rotating Equipment below 15 kW: use 304 stainless steel adhesive anchors of the following materials:
1. Interior: 304 stainless steel
2. Submerged: 316 stainless steel

B. Provide nuts and washers of the same material and of equal or greater strength than bolts. Use tapered washers where the mating surface is not square with the nut.

C. Where stainless steel anchor bolts are required, double nut all connections or use nylon locking nuts.

2.4 EQUIPMENT BASE GROUT

A. For equipment base grout, use nonshrink hydraulic cement grout as per Division 3 except where the equipment supplier specifically recommends nonshrink epoxy grout.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate the routing of ancillary piping with the Division 40 and existing mechanical and electrical components in the WTRPO Facility.

B. Coordinate the routing of electrical and control wiring and conduit with Division 40 and existing mechanical and electrical components in the WTRPO Facility.

3.2 PREPARATION

A. Before commencing installation of the work, inspect and take field measurements and ensure that work conducted previously in the area is not prejudicial to the proper installation of the works.

B. Dimensions shown on the Contract Documents for equipment, equipment bases, piping connections, etc., are approximate and must be adjusted by to suit the exact dimensions of the equipment provided for each application. Arrange any necessary modifications to equipment bases, piping connections, pipework, or other ancillaries at no cost and after acceptance by the City.

3.3 RAW WATER LINE

A. The Contractor shall supply and install all piping, fittings, and manual valves from the raw water line to the raw water pump/raw water pump bypass, and between the raw water pump/raw water pump bypass and the DAF tank, and from the raw water line to the main drain header, as shown in the Contract Drawings.

B. Provide a flanged spool piece for a future flow control valve and actuator.

C. The Contractor will be responsible for the installation of all associated equipment and instrumentation, as shown in the Contract Drawings and listed in Section 01 64 00, City-Furnished Products.

3.4 DAF SYSTEM INSTALLATION

A. For the installation of the DAF System, Refer to Section 46 01 01, DAF System Installation.

3.5 OZONE CONTACTOR INSTALLATION

A. For the installation of the Ozone Contactor System, Refer to Section 46 02 01, Ozone Contactor Installation.

3.6 OZONE SYSTEM GENERAL INSTALLATION

A. For the installation of the Ozone Generation System and the Ozone Destruct System, Refer to Section 46 02 02, Ozone System General Installation.

3.7 FILTER COLUMN AND BACKWASH INSTALLATION

A. For the installation of the Filter Column System and Filter Backwash System, Refer to Section 46 03 01, Filter Column and Backwash Installation.

3.8 CHEMICAL FEED SYSTEMS

A. For the installation of the Chemical Feed Systems, Refer to Section 46 04 01, Chemical Feed Systems.

3.9 RESIDUALS LINE INSTALLATION

A. The Contractor shall supply and install all piping, fittings, and valves along the main drain header to the thickened sludge equalization tank (TSET), as shown in the Contract Drawings.

3.10 INSTALLATION OF EQUIPMENT

A. Install all equipment specified in other sections, detailed on the equipment specification sheets, or shown on the drawings.

B. Supply and install all necessary shims, gaskets, etc., required to complete the installation.

C. Provide all necessary lifting and loading equipment and all tools required to complete the installation.

D. Comply with the specific requirements for installation noted in other sections of this specification and with the instructions of the Manufacturer. Where there is a conflict in these requirements, identify the conflict to the City and Contract Administrator and proceed as directed.

3.11 EQUIPMENT BASES AND ANCHORAGE

A. As indicated in the drawings, mount equipment (end suction centrifugal pumps) on concrete pads.

B. Drill anchor bolt locations in concrete pads.

C. Adhesive anchor bolts
   1. Drill anchor bolts after concrete has cured. Ensure hole is sufficiently sized to accept grout.
   2. Place anchor bolt in prepared hole and apply grout as per manufacturer’s directions.

D. Place equipment bases on shims to appropriate height to ensure level installation.

E. Provide full contact with the equipment bases unless otherwise recommended by the equipment manufacturer and accepted by the City. Neatly bevel, form or trim the grout.

F. Where equipment is supplied with a plate steel base, use a pour grade, use nonshrink hydraulic cement grout as per Division 3 to fill the entire void under the base.

3.12 ALIGNMENT

A. Set and align all rotating equipment in accordance with the more stringent requirements of either the manufacturer's requirements or the following:
   1. Level base, use machinists level on all machined bases.
   2. Align couplings to satisfy the following criteria:

Coupling Speed	Allowable Angular Misalignment	Allowable Parallel Misalignment
Under 100 rpm, below 50 hp	4’00”	0.25 mm
100 to 600 rpm	2’00”	0.12 mm
600 to 1800 rpm	1’00”	0.10 mm
1800 to 3600 rpm	0’35”	0.05 mm

3. Check for soft foot, maximum permissible 0.002 mm.

B. Demonstrate to the City and Contract Administrator the final alignment.

3.13 LUBRICANTS

A. Extend any inaccessible lubrication points and lubricant drains to convenient locations.

B. Remove storage lubricant and provide the initial fill of new lubricants for the equipment. Lubricant grade to be as recommended by the Manufacturer.

END OF SECTION

SECTION 46 01 01

DAF SYSTEM INSTALLATION

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall supply and install all components, piping, wiring, connections, accessories, etc. required to complete the installation of the City-Furnished Products and Contractor supplied equipment.

1.2 WORK COVERED BY CONTRACTOR

A. Installation of the City-Furnished Products at the Site, as specified in the Contract Drawings, including:
1. the DAF tank, complete with mixers, a scraping mechanism, and motors;
2. a DAF recycle pump;
3. a saturator vessel;
4. an air compressor with ancillary devices;
5. a DAF Overflow Tank;
6. mixers;
7. flow indicators;
8. level indicators;
9. flow meters;
10. turbidimeters;
11. a solenoid valve; and
12. pressure gauges.

B. All compressed air piping, fittings, and isolation and process valves between the air compressor, filter columns, and saturator vessel.

C. All recycle system piping, fittings, and valves between the DAF tank, the DAF recycle pump the saturator, and the saturated water injection point.

D. All external conduit and wiring between separate equipment, unless otherwise specified, shall be supplied and installed, as indicated in Division 26.

E. Grouting for installing equipment onto concrete equipment pads.

PART 2 PRODUCTS

2.1 ELECTRICAL

A. All electrical Work shall comply with the requirements of Divisions 26 and 29.

2.2 MECHANICAL

A. All mechanical Work shall comply with the requirements of Divisions 40, 43, and 46.

B. Piping shall comply with the requirements of Section 40 27 00, Process Piping General, including all subsections.

C. Contractor shall provide and install all interconnecting piping, fittings, and manual valves, as per the Contract Drawings. Unless otherwise specified, provide valves that are the Manufacturer's standard suitable for the intended service conditions.

D. Valves shall comply with the requirements of Section 40 27 02, Process Valves and Operators.

PART 3 EXECUTION

3.1 DELIVERY OF EQUIPMENT AND INSTALLATION

A. The DAF System shall be installed by the Contractor in accordance with the Contract Drawings.

B. Contractor shall coordinate delivery, handling, storage and installation of equipment as per Section 01 64 00, City-Furnished Products, and Section 46 00 00, Process Equipment Installation.

C. Run all piping in vertical and horizontal plane, unless shown otherwise in the Contract Drawings. Arrange piping to ensure that undue stresses are not transmitted to equipment components. Do not route piping in locations or at heights that will create tripping hazards or impede the required movement of WTP personnel.

D. Do not route piping directly above power supply units.

E. Where possible, locate process valves, instrumentation, and other control devices that require regular operation and/or maintenance at an elevation of no more than 1.8 m above the finished floor, or walkway, or mezzanine, where applicable.

F. Instruments with local indication that are located above 1.8 m from floors shall be provided with remote indicators mounted no more than 1.2 m from the finished floor, or walkway, or mezzanine, where applicable.

3.2 DAF SYSTEM EQUIPMENT AND INSTRUMENTATION

A. The City will supply all equipment and instrumentation associated with the DAF System to the Contractor. The Contractor will be responsible for the installation of all equipment and instrumentation, associated with the DAF System.

3.3 DAF TANK SUPPORT

A. The DAF tank support will be constructed and supplied by others, as set forth in Bid Opportunity No. 25-2014, “Mezzanine, Walkway and Equipment Supports for a Water Treatment Research and Process Optimization Facility”.

3.4 EQUIPMENT PADS

A. The concrete equipment pads for the DAF recycle pump and saturator vessel will be provided in another contract.

3.5 DAF TANK DRAINS AND SLUDGE LINE

A. The Contractor shall supply and install all piping, fittings, and valves from the DAF tank to the residuals drain header, including the sludge line, as shown in the Contract Drawings.

3.6 DAF RECYCLE SYSTEM

A. The Contractor shall supply and install all piping, fittings, and valves between the DAF tank and the recycle pumps, between the recycle pumps and the saturator vessel, between the saturator vessel and the saturated water injection point, and to the main drain header, as shown in the Contract Drawings.

3.7 SATURATOR VESSEL

A. The Contractor shall install the saturator vessel, and associated instruments and accessories on the saturator vessel, as shown in the Contract Drawings.

3.8 COMPRESSED AIR SYSTEM

A. The Contractor shall supply and install all piping, fittings, and valves between the air compressor and the filter columns, and the air compressor and saturator vessel, as shown in the Contract drawings. The Contractor shall install the air compressor with all existing ancillary devices required to allow for proper operation.

3.9 DAF OVERFLOW TANK

A. The Contractor shall supply and install all piping, fittings, and valves between the DAF tank and the DAF Overflow Tank, between the DAF Overflow Tank and the Filter Water Tank, and from the DAF Overflow Tank to the main drain header, as shown in the Contract Drawings.

3.10 DAF EFFLUENT

A. The Contractor shall supply and install all piping, fittings, and valves between the DAF tank and the Contactor Pumps.

END OF SECTION

SECTION 46 02 01

OZONE CONTACTOR SYSTEM INSTALLATION

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall supply and install all components, piping, wiring, connections, accessories, etc. required to complete the installation of the City-Furnished Products and Contractor supplied equipment.

1.2 WORK COVERED BY CONTRACTOR

A. Installation of the City-Furnished Products at the Site, as per the Contract Drawings, including:
1. ozone contactor pumps (2);
2. ozone contactor diffusers (2);
3. an Ozonated Water Holding Tank;
4. static mixers;
5. flow indicators;
6. pH meters;
7. level indicators;
8. pressure gauges; and
9. a dissolved ozone analyzer.

B. Supply, fabrication, and installation of ozone contactors. City will supply the ozone contactor diffusers to the Contractor to install within the ozone contactors.

C. All external conduit and wiring between separate equipment, unless otherwise specified, shall be supplied and installed, as indicated in Division 26.

D. Grouting for installing equipment onto concrete equipment pads.

PART 2 PRODUCTS

2.1 ELECTRICAL

A. All electrical Work shall comply with the requirements of Divisions 26 and 29.

2.2 MECHANICAL

A. All mechanical Work shall comply with the requirements of Divisions 40, 43, and 46.

B. Piping shall comply with the requirements of Section 40 27 00, Process Piping General, including all subsections.

C. Contractor shall provide and install all interconnecting piping, fittings, and manual valves as per the Contract Drawings. Unless otherwise specified, provide valves that are the Manufacturer's standard suitable for the intended service conditions.

D. Valves shall comply with the requirements of Section 40 27 02, Process Valves and Operators.

PART 3 EXECUTION

3.1 DELIVERY OF EQUIPMENT AND INSTALLATION

A. The Ozone Contactor System shall be installed by the Contractor in accordance with the Contract Drawings.

B. Contractor shall coordinate delivery, handling, storage and installation of equipment as per Section 01 64 00, City-Furnished Products, and Section 46 00 00, Process Equipment Installation.

C. Run all piping in vertical and horizontal plane, unless shown otherwise in the Contract Drawings. Arrange piping to ensure that undue stresses are not transmitted to equipment components. Do not route piping in locations or at heights that will create tripping hazards or impede the required movement of WTP personnel.

D. Do not route piping directly above power supply units.

E. Where possible, locate process valves, instrumentation, and other control devices that require regular operation and/or maintenance at an elevation of no more than 1.8 m above the finished floor, or walkway, or mezzanine, where applicable.

F. Instruments with local indication that are located above 1.8 m from floors shall be provided with remote indicators mounted no more than 1.2 m from the finished floor, or walkway, or mezzanine, where applicable.

3.2 OZONE CONTACTOR SYSTEM EQUIPMENT AND INSTRUMENTATION

A. The City will supply all equipment and instrumentation associated with the Ozone Contactor System to the Contractor, with the exception of the ozone contactors which will be supplied by the Contractor. The Contractor will be responsible for the installation of all equipment and instrumentation, associated with the Ozone Contactor System.

3.3 EQUIPMENT PADS

A. The concrete equipment pads for the contactors, Ozonated Water Holding Tank, and contactor pumps, will be installed by others, as set forth in Bid Opportunity No. 25-2014, "Mezzanine, Walkway and Equipment Supports for a Water Treatment Research and Process Optimization Facility".

3.4 CONTACTOR INFLUENT

A. The Contractor shall supply and install all piping, fittings, and valves from the contactor pumps to the contactor columns, as well as the contactor by-pass line, as shown in the Contract Drawings.

3.5 OZONE CONTACTORS

A. The Contractor shall supply all materials, piping, fittings, and valves, required to construct the ozone contactors and complete their installation, as shown in the Contract Drawings. The City will supply the ozone contactor diffusers to the Contractor to install within the ozone contactors.

3.6 OZONATED WATER HOLDING TANK

A. The Contractor shall supply and install all piping, fittings, and valves between the contactor columns and the Ozonated Water Holding Tank, as shown in the Contract Drawings.

3.7 DRAINS

A. The Contractor shall supply and install all piping, fittings, and valves between the contactor columns, the Ozonated Water Holding Tank, and the main drain header.

3.8 OZONATED WATER HOLDING TANK EFFLUENT

A. The Contractor shall supply and install all piping, fittings, and valves between the Ozonated Water Holding Tank and the filter pumps, as shown in the Contract Drawings.

3.9 OZONE SYSTEM GENERAL INSTALLATION

A. For the installation of the Ozone Generation System and the Ozone Destruct System, Refer to Section 46 02 02, Ozone System Equipment Installation.

END OF SECTION

SECTION 46 02 02

OZONE SYSTEM EQUIPMENT INSTALLATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The Ozone System Equipment is to be installed in the WTRPO Facility located at the Winnipeg WTP.

B. The Contractor shall supply and install all components, piping, wiring, connections, accessories, etc. required to complete the installation of the City-Furnished Products (Section 01 64 00).

1.2 SCOPE

A. Installation of an Ozone System Equipment supplied by City, complete and operable, including:
1. an air preparation unit (1);
2. an air-fed ozone generator (1);
3. an ozone destruct system complete with blower (1);
4. demister (1);
5. flow indicators;
6. pressure gauges;
7. temperature indicators;
8. ozone monitors (dissolved and ambient); and
9. warning signal lamps, as listed in Section 01 64 00, City-Furnished Products.

B. The Contractor will be responsible for furnishing and installing all additional materials (e.g. piping, valves, etc.) necessary to complete the installation.

C. All external conduit and wiring between separate equipment, unless otherwise specified, shall be installed, as indicated in Division 26.

D. Contractor Scope of Supply:
1. Unloading and storing Ozone System Equipment at Site in accordance with manufacturer’s instructions
2. Installation and onsite services during construction and commissioning of Ozone System Equipment.
3. Equipment supports, U bolts, and hardware to install all equipment needed for a fully functional Ozone System.
4. Hardware, fasteners, gaskets, anchor bolts, nuts, plates, and angles necessary for the installation of the Ozone System Equipment.
5. Air relief valves, drain valves, cooling water valves (where applicable), and associated piping, not within the equipment skid(s) limit, necessary for proper operation of the Ozone System.

6. Touch-up painting of any shipping or installation damage to the finish, following installation.
7. Conduit, fittings, supports, hubs, wiring including wire terminations and terminators for installation of Control and Power Panels (CPPs), instruments, analyzers, and devices supplied as part of the Ozone System but external to the limits of the skids
8. Field verification of all instruments provided under this Equipment Contract and all control loop checks.
9. Provide a 120 VAC, 1 phase power supply to the air-fed ozone generator.
10. Provide a 120 VAC, 1 phase power supply to the air preparation unit.
11. Provide a 400 VAC, 3 phase power supply to the ozone destruct unit.
12. Provide a 600 VAC 3 phase power supply to the ozone destruct unit transformer.
13. Provide status and control wiring between the Ozone System master PLC and CP-X10 PLC control panel.

1.3 REFERENCES

A. Install the Ozone System equipment to conform to the latest editions or revisions in effect at the time of the bid submission of the applicable, codes, standards, and regulations from the following regulating bodies:
1. American National Standards Institute (ANSI)
2. American Society of Mechanical Engineers (ASME)
3. American Society for Testing and Materials (ASTM):
4. Canadian Electrical Code (CEC).
5. American Water Works Association (AWWA).
6. American Welding Society (AWS).
7. Canadian Standards Association (CSA).
8. Electrical Safety Authority (ESA).
9. The Instrument, Systems and Automation Society (ISA).

1.4 SUBMITTALS

A. General
1. Submit as required in Section 01 33 00, Submittal Procedures, and Section 01 77 00, Closeout Procedures.
2. Complete all documentation in accordance with Section 46 00 00, Process Equipment Installation.
3. Other data as required to verify all specified requirements.
4. Qualifications and experience records of proposed Contractor’s or Manufacturer’s representatives who will assist in testing of equipment.

B. Provide the following Quality Control Submittals for all equipment:
1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer’s printed instructions for installation of all equipment included in this Contract.

PART 2 PRODUCTS

2.1 GENERAL

A. Position all skid mounted equipment in such a way that connections for off-skid piping and wiring are easily accessible and that equipment and instrumentation are accessible for maintenance.

B. Verify that all Ozone System equipment components are compatible and that all components and materials of construction are suitable for the intended service. For parts in contact with ozone gas or ozone off-gas, use Type 316L stainless steel.

C. Pipe all drains on the Ozone System equipment to one of the existing drains in the WTRPO Facility.

2.2 PIPING AND TUBING

A. Contractor to supply the interconnecting piping, outside of supplied skids limits.

B. Unless otherwise specified, provide valves that are the Manufacturer's standard, suitable for the intended service conditions.

C. Service Legend Piping Material:

Service	Legend	Piping Material
Air High Pressure	AHP	Copper Tubing, Type L, hard drawn
Cooling Water Supply	CWS	Copper Tubing, Type L, hard drawn
Cooling Water Return	CWR	Copper Tubing, Type L, hard drawn
Ozone Gas	OZG	Type 316L SS, Tubing
Ozone Off Gas	OZO	Type 316L SS, Tubing or Piping

D. Provide control and instrumentation tubing, fittings, and valves for instruments of Type 316 stainless steel.

2.3 VALVES

A. Refer to the Manual Valve Schedule in Section 40 27 02, Process Valves and Operators.

2.4 ELECTRICAL

A. All Work shall comply with the requirements of Divisions 26 for all Electrical Work and Division 29 for all Instrumentation and Controls Work.

PART 3 EXECUTION

3.1 DELIVERY OF EQUIPMENT AND INSTALLATION

A. The Ozone System shall be installed by the Contractor in accordance with the the Contract Drawings and the equipment Manufacturers' written recommendations and directions.

B. Contractor shall coordinate delivery, handling, storage and installation of equipment as per Section 01 64 00, City-Furnished Products, and Section 46 00 00, Process Equipment Installation.

C. All equipment will be received, uncrated, and installed by the Contractor at the Site, in accordance with the Contract Work Schedule.

D. Run all piping in vertical and horizontal planes. Arrange piping to ensure that undue stresses are not transmitted to equipment components. Do not route piping in locations or at heights that will create tripping hazards or impede the required movement of WTP personnel.

E. Do not route water piping directly above power supply units.

F. Where possible, locate process valves, instrumentation, and other control devices that require regular operation and/or maintenance at an elevation no more than 1.8 meters above finished floor.

G. Instruments with local indication that are located above 1.8 m from floors shall be provided with remote indicators mounted not more than 1.2 meters from the finished floor.

3.2 EQUIPMENT PADS

A. Installation of a concrete equipment pad for the Ozone System Equipment will be provided in a separate contract.

3.3 FIELD FINISHING

A. All equipment is to be factory standard finished. Restrict field painting of equipment to touchup painting only. Supply sufficient quantities of paint as may be necessary for field touchup painting. Field touchup painting will be performed by the Contractor.

3.4 OZONE GENERATOR

A. The Contractor shall supply and install all external piping and valves between the air preparation unit and the ozone generator, for the cooling water line to the ozone generator, and from the ozone generator to the WTRPO Facility room drain, as outlined in the Contract Drawings.

3.5 OFF-GAS DESTRUCT SYSTEM

A. The Contractor shall supply and install all external off-gas piping between the ozone generator, the ozone contactors, the Ozonated Water Holding Tank, and the demister; the demister and ozone destruct skid; and piping downstream of the ozone destruct system skid, as outlined in the Contract Drawings.

3.6 OZONE DISSOLUTION

A. The Contractor shall supply and install all external gas piping between the ozone generator and the diffusers within the ozone contactors, as outlined in the Contract Drawings.

3.7 CONTRACTOR'S FIELD REQUIREMENTS

A. Refer to Section 01 43 33, Contractor's Field Requirements, for requirements during the installation and testing of the Ozone System Equipment.

END OF SECTION

SECTION 46 03 01

FILTER COLUMN AND BACKWASH INSTALLATION

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall supply and install all components, piping, wiring, connections, accessories, etc. required to complete the installation of the City-Furnished Products and Contractor supplied equipment.

1.2 WORK COVERED BY CONTRACTOR

A. Installation of the City-Furnished Products at the Site, as specified in the Contract Drawings, including:
1. filter pumps (2);
2. filter nozzles (8);
3. a Filtered Water Tank;
4. backwash (B/W) pump (1);
5. static mixers;
6. flow indicators;
7. flow meters;
8. level indicators;
9. pH meters;
10. pressure transmitters;
11. pressure gauges;
12. turbidimeters;
13. particle counters; and
14. solenoid valves (8).

B. Supply, fabrication, and installation of filter columns. City will supply the filter nozzles to the Contractor to install within the filter columns.

C. All external conduit and wiring between separate equipment, unless otherwise specified, shall be supplied and installed, as indicated in Division 26.

D. Grouting for installing equipment onto concrete equipment pads.

E. Installation of filter media into filter columns.

PART 2 PRODUCTS

2.1 ELECTRICAL

A. All electrical Work shall comply with the requirements of Divisions 26 and 29.

2.2 MECHANICAL

A. All mechanical Work shall comply with the requirements of Divisions 40, 43, and 46.

B. Piping shall comply with the requirements of Section 40 27 00, Process Piping General, including all subsections.

C. Contractor shall supply and install all interconnecting piping, fittings, and manual valves as per the Contract Drawings. Unless otherwise specified, provide valves that are the Manufacturer's standard suitable for the intended service conditions.

D. Contractor shall install solenoid valves, which will be supplied by the City, as per Section 01 64 00, City-Furnished Products.

E. Valves shall comply with the requirements of Section 40 27 02, Process Valves and Operators.

PART 3 EXECUTION

3.1 DELIVERY OF EQUIPMENT AND INSTALLATION

A. The Filter Column System shall be installed by the Contractor in accordance with the Contract Drawings.

B. Contractor shall coordinate delivery, handling, storage and installation of equipment as per Section 01 64 00, City-Furnished Products, and Section 46 00 00, Process Equipment Installation.

C. Run all piping in vertical and horizontal plane, unless shown otherwise in the Contract Drawings. Arrange piping to ensure that undue stresses are not transmitted to equipment components. Do not route piping in locations or at heights that will create tripping hazards or impede the required movement of WTP personnel.

D. Do not route piping directly above power supply units.

E. Where possible, locate process valves, instrumentation, and other control devices that require regular operation and/or maintenance at an elevation of no more than 1.8 m above the finished floor, or walkway, or mezzanine, where applicable.

F. Instruments with local indication that are located above 1.8 m from floors shall be provided with remote indicators mounted no more than 1.2 m from the finished floor, or walkway, or mezzanine, where applicable.

3.2 FILTER COLUMN SYSTEM EQUIPMENT AND INSTRUMENTATION

A. The City will supply all equipment and instrumentation associated with the Filter Column System to the Contractor, with the exception of the filter columns which will be supplied

by the Contractor. The Contractor will be responsible for the installation of all equipment and instrumentation, associated with the Filter Column System.

3.3 EQUIPMENT PADS

A. The concrete equipment pads for the filter columns, Filtered Water Tank, filter pumps, and filter B/W pump, will be installed by others, as set forth in Bid Opportunity No. 25-2014, “Mezzanine, Walkway and Equipment Supports for a Water Treatment Research and Process Optimization Facility”.

3.4 FILTER COLUMN INFLUENT

A. The Contractor shall supply and install all piping, fittings, and valves from the filter pumps to the filter columns, as shown in the Contract Drawings.

3.5 FILTER COLUMNS

A. The Contractor shall supply all materials, piping, fittings, and valves, required to construct the filter columns and complete their installation, as shown in the Contract Drawings. The City will supply the filter nozzles to the Contractor to install within the filter columns.

3.6 FILTERED WATER TANK

A. The Contractor shall supply and install all piping, fittings, and valves between the filter columns and the Filtered Water Tank, as shown in the Contract Drawings.

3.7 DRAINS

A. The Contractor shall supply and install all piping, fittings, and valves between the filter columns, the Filtered Water Tank, and the main drain header.

3.8 FILTER BACKWASH SYSTEM

A. The Contractor shall supply and install all piping, fittings, and valves between the Filtered Water Tank and the filter B/W pump, and between the filter B/W pump and the filter columns, as shown in the Contract Drawings.

3.9 COMPRESSED AIR

A. For the installation of the compressed air lines to the filter columns, Refer to Section 46 01 01, DAF System Installation.

3.10 FILTER MEDIA INSTALLATION

A. The City will supply the filter media for the filter columns.

B. The Contractor shall coordinate delivery, handling, storage and installation of the filter media into the filter columns.

C. The Contractor is responsible for loading the filter media into the filter columns and shall coordinate with the City and Contract Administrator to ensure that the proper procedure is followed. Refer to Supplements 1 and 2 at the end of the Specification for the Filter Media Loading Procedure and Filter Backwash Procedure.

D. The City and Contract Administrator may be present to oversee the installation of the filter media.

E. The Contractor shall provide all necessary lifting and loading equipment and all tools required to complete the installation.

3.11 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Specification.
1. Filter Media Loading Procedure.
2. Filter Backwash Procedure.

END OF SECTION

FILTER MEDIA LOADING PROCEDURE

1. Mix the required amount of filter media with water to create a slurry. Slurry transport is recommended to avoid dust in the filter area.
2. Close filter effluent valve and influent valve.
3. Remove the top flange of the filter.
4. Add the slurry hydraulically from the top through an eductor, slurry pump, blow case, or specially built trucks. Where bags, bulk boxes, or other bulk containers are used, an eduction system should be constructed.
5. Add media to the level approximately 85% of the final volume. Coordinate with person at bottom to obtain approximate media depth. Permanent expansion of 15% will occur due to stratification of the bed after it is backwashed.
6. Media depth is measured from the center of the bottom flange to the top of the media.
7. Backwash media to remove fines. Wash until backwash water is clean.
8. Stop backwash and allow media to settle without compaction. Backwash flow rate should be turned off gradually to provide stratification and adsorption efficiency. Mark the top of media level on the column with tape.
9. Add media as required to desired level.
10. The operating media level will be 1/3 of the way up between the compacted and uncompacted marks. Place a tape marker at this level.
11. Backwash and confirm that media is at the operating level.

FILTER BACKWASH PROCEDURE

1. Turn off filter effluent solenoid valves on filters to be backwashed.
2. Turn off filter feed pumps.
3. Close valve on filter influent line (valve located just above rotameter).
4. Close valve on filter effluent line.
5. Open backwash feed valve at bottom of filter.
6. Open the isolating valve on the pressure relief line located downstream of the backwash pump (P-X403) which allows water to flow back into the Filtered Water Tank.
7. Turn the backwash pump (P-X403) on.
8. Slowly open and adjust the isolating valve downstream of the backwash pump (P-X403) to achieve a flow rate that produces a bed expansion of approximately 50% (make sure media is not washed out of overflow).
9. Backwash for 10 minutes.
10. Over a period of 4 minutes, slowly reduce the flow rate of the backwash stream by gradually closing the isolating valve downstream of the backwash pump (P-X403) to restratify media.
11. Turn the backwash pump (P-X403) backwash pump off.
12. Close backwash feed valve at the bottom of the filter.
13. Backwash next filter until all are washed.
14. Open valve on filter effluent line.
15. Open influent valve and turn filter pump on. Adjust to desired rate.
16. Turn filter effluent solenoid valves back to AUTO.

SECTION 46 04 01

CHEMICAL FEED SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The Contractor shall supply all piping, tubing, fittings, and valves required to complete the installation of the chemical feed systems.

B. The Contractor shall supply chemical feed pump panels for each chemical used in the process at the WTRPO Facility and install all associated chemical feed equipment, piping, tubing, fittings, and valves on each panel, as shown in the Contract Drawings.

C. The Contractor shall install the chemical containment platforms and chemical drums, carboys, and tanks, as shown in the Contract Drawings.

1.2 WORK NOT INCLUDED

A. As indicated in Section 01 64 00, City-Furnished Products, the City will provide all chemical feed pumps for dosing:
1. sulphuric acid (93 %);
2. ferric chloride (39 %);
3. hydrogen peroxide (35 %);
4. sodium bisulphite (38 %);
5. filter aid; and
6. caustic soda (25%).

B. The City will be responsible for purchasing and arranging the delivery of all process chemicals in drums or carboys to Site, including:
1. sulphuric acid (93 %);
2. ferric chloride (39 %);
3. hydrogen peroxide (35 %);
4. sodium bisulphite (38 %);
5. filter aid; and
6. caustic soda (25%).

C. The City will provide all chemical containment platforms, tanks, and mixing equipment for the chemical feed systems.

1.3 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 33 00, Submittal Procedures

B. Manufacturer’s data and information.

C. Chemical resistance charts to indicate the compatibility of materials when exposed to each chemical used.

D. Shop drawings including dimensions and section view of equipment showing details of construction, arrangement and installation.

PART 2 PRODUCTS

2.1 CHEMICAL FEED PUMP PANEL

A. The Contractor shall supply and install a dedicated chemical feed pump panel complete with valves, and flexible hose connections, as shown in the Contract drawings. Chemical metering pumps will be supplied by the City and installed onto the chemical feed pump panels by the Contractor.

B. The chemical feed pump panel component materials shall be chemically resistance to the chemical application.

2.2 PRESSURE RELIEF VALVES

A. Sulphuric Acid Dosing System:
   1. Type V748 Pressure Relief Valve 6mm:
      a. 316L stainless steel, threaded male and NPTF ends, 690 kPa and 1724 kPa pressure range, FFKM seal.
      b. Manufacturers and Products:
         1) Parker Veriflo.

B. Ferric Chloride, Hydrogen Peroxide, Sodium Bisulphite, Filter Aid, and Caustic Soda Dosing Systems:
   1. Type V747 Back Pressure Relief Valve 6mm:
      a. Polypropylene, PTFE and Viton construction, pressure range greater than 52 kPa and 1035 kPa.
      b. Manufacturers and Products:
         1) Chemline.

2.3 BALL VALVES

A. Sulphuric Acid Dosing System:
   1. Type V320 Stainless Steel Ball Valve, 6 mm:
      a. 3-Piece High-Pressure Ball, 316 stainless steel body, 316 stainless steel ball and stem, tube fittings, PTFE seats, Fluorocarbon FKM O-ring, Phenolic Handle, Max. Temperature Pressure Rating 232°C at 860 kPa
      b. Manufacturers and Products:
         1) Swagelok; SS-83TS4.

B. Ferric Chloride, Hydrogen Peroxide, Sodium Bisulphite, Filter Aid, and Caustic Soda Dosing Systems:
   1. Type V330 PVC Ball Valve, 50 mm and Smaller:
      a. Rated minimum 1035 kPa at 22.8 degree C, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, PTFE seat, Teflon O-ring stem seals, to block flow in both directions.
      b. Manufacturers and Products:
         1) Chemline; Type 21

2.4 TUBING

A. Sulphuric Acid Dosing System:
   1. 316L tubing, refer to Section 40 27 00.09A, Stainless Steel Pipe and Fittings-Special Service.

B. Ferric Chloride, Hydrogen Peroxide, Sodium Bisulphite, Filter Aid, and Caustic Soda Dosing Systems:
   1. Polypropylene tubing, refer to Section 40 27 00.30, Polypropylene Tubing and Fittings.

2.5 FITTINGS:

A. Sulphuric Acid Dosing System:
   1. 316L SS, refer to Section 40 27 00.09A, Stainless Steel Pipe and Fittings; Special Service.

B. Ferric Chloride, Hydrogen Peroxide, Sodium Bisulphite, Filter Aid, and Caustic Soda Dosing Systems:
   1. PVC Fittings, refer to Section 40 27 00.10, Polyvinyl Chloride (PVC) Pipe and Fittings or;
   2. Polypropylene compression fittings, refer to Section 40 27 00.30, Polypropylene Pipe and Fittings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the chemical feed pump panels on the wall in close proximity to the accompanying chemical storage tanks, drums, or carboys.

B. Ensure the equipment is installed as required to provide satisfactory service

C. Provide all necessary lifting and loading equipment and all tools required to complete the installation.

3.2 TESTING

A. Ensure the equipment, including all component parts, operates as intended.

END OF SECTION