SECTION 23 2500

HVAC WATER TREATMENT

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LANL MASTER SPECIFICATION

This specification specifies Garratt-Callahan, Lakos, and Thermo Polysonics products for chemical treatment of closed loop chilled water and heating hot water systems, open cooling tower, and steam boiler systems. Consult with the FOD Facility Engineer for the type of treatment system/chemicals required. All other text in regular type indicates mandatory requirements.

**All chemicals must be identified in LANL’s NPDES permit application and LANL’s waste profile form (WPF) as potential contaminants of concern. Consult with the LANL Water Quality Group.**

This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specifications must also be edited to delete specification requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  This specification template is tailored to meet requirements contained in the LANL Engineering Standards Manual (ESM). Additional tailoring requirements are contained in ESM [Chapter 1](http://engstandards.lanl.gov/ESM_Chapters.shtml#esm1) Section Z10 Att. F, Specifications. To seek relief from requirements of the ESM that are applicable, contact the ESM Mechanical[POC](http://engstandards.lanl.gov/POCs.shtml#mech)*.* Please contact POC with suggestions for improvement as well.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.

Specification developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.
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1. GENERAL
	1. SECTION INCLUDES
2. Cleaning of HVAC piping systems.
3. Chemical water treatment of [closed loop chilled water and heating hot water systems], [open cooling tower], and [steam boiler] system(s).
	1. PERFORMANCE REQUIREMENTS

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Use this article carefully; restrict statements to identify system performance requirements or function criteria only.

Select characteristics applicable to system.

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1. Provide system to treat water available at project site to maintain the following characteristics of water in [closed loop chilled water and heating hot water systems] [steam boiler] [open cooling tower] systems:
	* + 1. Hardness: [ 30-500 ] ppm
			2. [Iron: [ ] organisms/ml]
			3. Total Dissolved Solids: [less than 1000 ] ppm
			4. Alkalinity: [30-500] ppm
			5. [Silica: [ ] ppm]
			6. pH: [ 7.0-9.0 ]
			7. Chlorides [ <200 ] ppm
			8. Sulfates [ <200 ] ppm
	1. SUBCONTRACTOR REQUIREMENTS
2. Notify LANL Subcontract Technical Representative (STR) at 5 working days in advance to witness cleaning (flushing) and water treatment activity.
3. Do not fill or flush piping systems until source of water supply is approved by LANL STR.
4. Do not clean or chemically treat piping systems until systems have been successfully pressure tested.
5. For discharge requirements of water used for flushing and water treatment, comply with Section 01 3545, Water Discharge Requirements.
6. Notify LANL STR immediately in the event of any accidental discharge.
7. Do not place piping systems in service until LANL STR approves cleaning and chemical treatment composition are approved as described in Section 1.3.C.
	1. LANL STR REQUIREMENTS
8. For discharge requirements of water used for flushing and water treatment, comply with Section 01 3545, Water Discharge Requirements.
9. Verify proper cleaning, flushing, chemical concentration and circulation.
10. Immediately after receiving list of chemicals to be used from subcontractor, including chemical composition, submit copy to the LANL Water Quality Group for approval.
	1. action submittals

A. Flushing plan detailing how each piping system will be flushed in accordance with these requirements, including provisions for temporary bypasses and pumps. When: Provide prior to the start of work.

1. Catalog data of flushing and chemical water treatment chemicals and equipment including electrical characteristics and connection requirements.
2. Shop Drawings indicating system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
3. Manufacturer's Installation Instructions showing placement of equipment in systems, piping configuration, and connection requirements.
4. Manufacturer's Certification of products to meet or exceed specified requirements.
5. Operation and Maintenance data on equipment, procedures, and treatment program. Include instructions on test procedures including target concentrations.
6. Material list of all chemicals to be used, including chemical composition. When: 30 days prior to using chemicals. Do not begin chemical treatment until chemicals have been approved by the LANL Water Quality Group.
7. Manufacturers Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
	1. INFORMATIONAL SUBMITTALS
		1. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.
		2. Field quality-control reports.
		3. Other Informational Submittals:
			1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.
			2. Water Analysis: Illustrate water quality available at Project site.
			3. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.
	2. CLOSEOUT SUBMITTALS
		1. Operation and Maintenance Data: For sensors, injection pumps, [water softeners,] [RO equipment,] [water filtration units,] and controllers to include in emergency, operation, and maintenance manuals.
	3. QUALIFICATIONS OF CHEMICAL SUPPLIER
8. Company specializing in performing the Work of this section with minimum 10 years’ experience and approved by chemical manufacturer.
9. Personnel using biocide products shall have a New Mexico Department of Agriculture (NMDA) pesticide applicator license.
	1. QUALITY ASSURANCE
10. Biocide products shall be registered with the EPA, with the registration number clearly shown on drum labels.
11. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
12. PRODUCTS
	1. PRODUCT OPTIONS AND SUBSTITUTIONS
		1. Alternate products may be accepted; follow Section 01 2500, Substitution Procedures.
		2. A single water treatment supplier shall provide treatment chemicals and chemical feed/chemical control equipment.
	2. MATERIAL SAFETY DATA SHEETS
13. Maintain on site Material Safety Data Sheets (MSDS) for chemical products.
	1. SYSTEM CLEANER
		1. Manufacturer: Garratt-Callahan.
		2. Treatment Chemical: Formula 248L, alkaline liquid blend of phosphates, silicates, iron oxide chelants, dispersants, and surface active agents.
	2. CLOSED LOOP WATER TREATMENT (heating hot water and chilled water)
14. Manufacturer: Garratt-Callahan.
15. Chemical Pot Feeder: See Specification 23 2113, Hydronic Piping.
16. Treatment Chemical: Formula 1015L, corrosion and scale inhibitor based on phosphorate and orthophosphate. Furnish 1 year’s supply.
	1. OPEN COOLING TOWER WATER TREATMENT

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Refer to Mechanical Drawings [ST-D30GEN-1](http://engstandards.lanl.gov/Dwgs_Details.shtml#mechanical), Open Cooling Tower Water Treatment Flow Diagram (Guidance). Latest at time of issuance is included in Attachment A for information.

Refer to Attachment A, *Open Cooling Tower Water Treatment Equipment* [*and Schematic]* for a list of components for this application. Edit list as required to match the specific application. Transfer Attachment A to Drawings for Bill of Materials.

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* + 1. Manufacturer: Garratt-Callahan.
		2. See Bill of Materials on Drawings.
		3. See Attachment A for Open Cooling Tower Water Treatment Equipment
	1. STEAM BOILER WATER TREATMENT

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Consult with the FOD Facility Engineer and chemical supplier for type of chemical feed and control equipment required for the steam boiler water treatment system.

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1. Manufacturer: Garratt-Callahan.
2. Treatment Chemical: Formula 1152 boiler water treatment, liquid all-polymeric scale corrosion inhibitor. Furnish 1 year’s supply.
3. EXECUTION
4. INSTALLATION

Subcontractor shall furnish water treatment system supplied by the water treatment manufacturer and install per manufacturer’s recommendation.

1. TEST and INSPECTION
2. Perform piping pressure test before water treatment to avoid possible discharge of chemicals due to pipe or joint failure during a pressure test. Refer to Section 22 0813, *Testing Piping Systems*.
3. Inspect field-assembled components and equipment installation, including piping and electrical connections.
4. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
5. PRE-OPERATION CLEANING (Open Cooling Tower and Closed loop chilled water and heating hot water systems)
6. Prior to startup, clean system with Formula 248L, following the written procedures furnished by the chemical supplier.
7. Ensure water filters, instrumentation, gages, flow transmitters, and similar items are removed or protected. Provide a temporary bypass or plugs as required.
8. For additions and minor modifications to existing systems, isolate additional/modified sections with suitable pipe bypasses, and circulate clean water to flush large deposits. (This may involve using a mobile pumping/tank system.) Drain to a suitable location, follow 01 3545 Water Discharge Requirements. Refill piping with cleaning chemical, and circulate for 24 hours. Drain system again, and flush with clean water. Repeat clean water flush until cleaning chemicals are removed.
9. For minimal modifications to a piping system, the pipe flushing/cleaning activity may be omitted, with permission of the System Engineer or the Design Engineer. In this case, the piping shall be cleaned internally prior to installation.
10. Draw a clean, lintless cloth saturated with [trichloroethylene, cleaning solvent] through the pipe. Continue until the cloth is not discolored by dirt.
11. Finally, draw a clean, dry, lintless cloth through the pipe.
12. DEMONSTRATION
13. Furnish [two] [eight] [ ] hour training course for operating personnel, instruction to include installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start-up of systems.
14. CHEMICAL SUPPLIER WATER TREATMENT SERVICE PROGRAM
	* 1. Provide consulting services for a period of 1 year from the time of startup which shall include:
15. Installation and startup recommendations.
16. Field water analysis and recommendations.
17. Quarterly lab analysis on treated systems for metals, microorganisms, and standard analysis.
18. Training of plant personnel in proper feed and control.
19. Minimum monthly service calls.
20. Log sheets and record forms.

END OF SECTION

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Do not delete the following reference information:

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification Section 23 2500 Rev. 3, dated
June 22, 2018.

**Attachment A**

**Open Cooling Tower Water Treatment Equipment [and Schematic]**

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Is the Automated Chemical Monitoring and Feed sub-system required for Open Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below.

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| **I ) Automated Chemical Control/Monitoring and Injection Cabinet Sub-System** |
| **Item****#** | **Req’d****Y / N** | **Mfr. and Model ID** | **Description** | **Quantity** |
| 1 | Y | Advantage ControlsMegaTron ControllerModel:[MGCMPTF3ENOW] | MegaTron Controller:Microprocessor to monitor/control conductivity and pH.4-20 mA inputs and outputsInternal Components includeConductivity Control: Std Tower probe, TE-4AMake-Up Conductivity: Std make-up probe, DI-4ApH Control: Std Tower probe, TPE-21Temp: Std Temp probe, TC-1Feed Timers: quan=3Flow Switch: quan=1Options:4-20mA Inputs (N3-N8)4-20mA Outputs (03-06)Auxiliary flow meter inputs (W3, W6, W9)Operational characteristics includeDisplay: 240x128 Graphic LCDConductivity Control: 0-10,000 µS/cm scalepH: 0-14 scaleAccuracy: +/- 1%Pulse Feed Timer: water meter activated w/accumulator | 1 |
| 2 | Y | Advantage ControlsModel:[E-4A (w/E-30)] | Conductivity Probe (Assembly):Conductivity probe with signal wire, quick release style with fastener nut and o-ring, for 3/4-inch pipe insertion/application. | 2(1 spare) |
| 3 | Y | Advantage ControlsModel:[PE-21 (w/E-30-PH)] | pH Probe (Assembly):pH probe with signal wire, quick release style with fastener nut and o-ring, for 3/4-inch pipe insertion/application. | 2(1 spare) |
| 4 | Y/N | Advantage Controls Model: TC-1 (W/E-30) | Temperature Probe (Assembly)Temperature Probe (Assembly):Temperature probe with signal wire, quick release style with fastener nut and o-ring, for 3/4-inch pipe insertion/application. | 1 (spare) |
| 5 | Y | Garratt CallahanModel:98775K56 | Strainer:Bowl type strainer with a Type 304 stainless steel screen, black polypropylene head, and EPDM O-rings, with 3/4-inch NPT connections. Provide 50 mesh screen. Maximum operations: 150 psi and 70°F. | 2(1 spare) |
| 6 | Y | Advantage ControlsModel: [FLOW-2HT] | Flow Indicator:Stainless steel 3/4-inch NPT connection fittings, rated at 10-gpm maximum, and 320 psi at 200°F. Installation and operations is capable at any angle. | 2(1 spare) |
| 7 | Y | Advantage ControlsModel: FS-OC | Injection (Chemical) Tee:3/4-inche PVC tee with a 1/2-inch FNPT collar. Quick release style fastener nut. | 4 |
| 8 | Y | Advantage ControlsModel: N/A | Flow Switch:NOTE: Manufacturer supplied through Item 1 (MegaTron Controller) above  | N/A |
| 9 | Y | AshcroftModel:[631008AL02L100#(Type 1008A),]or equivalent equal | Pressure Gauge:Corrosion-resistant stainless steel case/ring. Gauge is manufacturer filled with glycerin. Connection is 1/4-inch NPT, with a 2.5 inch dial size and a dial range from 0 to 100 psi. | 2(1 spare) |

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| **II ) Bromicide Injection Sub-System**Is the Bromicide sub-system required for Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below. |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity**  |
| 10 | Y | Vector Industries, Inc.Model:[BIOMATE 2000-50] | Biocide Feeder:Feeder is designed with a see-through body, a bolt-down base, and constructed for 50-pounds chemical containment capacity. Inlet and outlet connections are 1-inch female NPT port, and a ½-inch female NPT port. Physical size is approximately 57-inches high.Accessories include:Pressure Relief Valve rated at 125 psiValve Kit | 1 |
| 11 | N | Advantage ControlsModel: [N/A] | Pressure Relief Valve (PRV):Rated at [125] psiNOTE: Manufacturer size and installed, PRV is included in Item 10 (Biocide Feeder) above | N/A |
| 12 | Y | Advantage ControlsModel: [FLOW-2HT] | Flow Indicator:Stainless steel 3/4-inch NPT connection fittings, rated at 10-gpm maximum, and 320 psi at 200°F. Installation and operations is capable at any angle. | 1 |
| 13 | Y | Advantage ControlsModel: [ ] | Back Check Valve:Polypropylene construction, rated at 120-psi at 75°F (max.).Size is [3/4-inch NPTM] | 1 |
| 14 | Y | NeptuneModel: [QC-PVC-50] | Injection Quill:For use to inject chemicals pumped from metering pumps, manufacturer installed spring-loaded check valve. Body construction is PVC. Rated for 150 psi at 100°F. Quill to be trimmed in field for injection pipes smaller than 4-inches. Connection size is 1/2-inch NPT. | 1 |
| 15 |  | Garratt CallahanProduct Name:Formula 314-T | Formula 314-T, Biocide:OxidizerUsed to remove algae, bacteria and similar biological materials.Packaged for shipment: Tablets in 50-pounds per pail. | 3 (pails) |
| 16 | Y | Garratt CallahanModel:8210G95(Series 8210) | Solenoid Valve:Valve is 2-way internal pilot operations, and is normally closed (NC) when the solenoid is de-energized. Construction is forged brass with 3/4-inch NPT connections, maximum pressure and temperature ratings are 150-psi and 180°F.Electrical rating is 120V AC. |  |

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| **III ) Chemical (Sulfite) Feed Injection Sub-System**Is the Chemical Feed sub-system required for Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below. |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity** |
| 17 | Y | Garratt CallahanChem-Feed Model:G62GC  | Chemical Containment Tank:Dual containment, high density polyethylene, UV resistant, with varying sizes of tank cover port openings (i.e: 8”, 2”, 1”, etc.). Rated to 140°F.Containment Capacity:65-gallons, with 77 gallon basinPhysical characteristics:25.5” x37”, 48 lbs | 1 |
| 18 | Y | Garratt CallahanPulsafeeder Model:LPK3 | Chemical Metering Pump:The pump is manufactured with adjustable manual stroke length and stroke rate capability.Operations and Features include:Pump Output (max.): [14 GPD] @ 100 psiStroke Frequency: 125 strokes/min (spm)Stroke Frequency Turn-Down Ration: 10:1Stroke Length Turn-Down Ratio: 10:1Tubing (clear) Connections: 1/4” ID, 3/8” OD115V (plug), 1.0 A, 60 Hz, 1 Ph, Average input power @ Max SPM: 130WNEMA 4X enclosureNOTE: Pump Size (and Model) can vary dependent on Cooling Tower loads/flows. | 1 |
| 19 | Y | NeptuneModel: QC-PVC-50 | Injection Quill:For use to inject chemicals pumped from metering pumps, manufacturer installed spring-loaded check valve. Body construction is PVC. Rated for 150 psi at 100°F. Quill to be trimmed in field for injection pipes smaller than 4-inches. Connection size is 1/2-inch NPT. Use only for injection into steel pipe | 1 |
| 20 | Y | Garratt CallahanProduct Name:Formula 159 | Formula 159, Oxygen Scavenger:Used for conductivity control in water blowdown applications. Used as a dechlorinator, and to reduce the concentration of dissolved solids.Packaged for shipment: Solution in 55-gallons drum | 5(55-gal drums) |

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| **IV ) Inhibitor Feed Injection Sub-System**Is the Inhibitor Feed sub-system required for Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below. |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity** |
| 21 | Y | Garratt CallahanChem-Feed Model:G62GC | Chemical Containment Tank:Dual containment, high density polyethylene, UV resistant, with varying sizes of tank cover port openings (i.e: 8”, 2”, 1”, etc.). Rated to 140°F.Containment Capacity:65-gallons, with 77 gallon basinPhysical characteristics:25.5” x37”, 48 lbs | 1 |
| 22 | Y | Garratt CallahanPulsafeeder Model:LPK3 | Chemical Metering Pump:The pump is manufactured with adjustable manual stroke length and stroke rate capability.Operations and Features include:Pump Output (max.): 14 GPD @ 100 psiStroke Frequency: 125 strokes/min (spm)Stroke Frequency Turn-Down Ration: 10:1Stroke Length Turn-Down Ratio: 10:1Tubing (clear) Connections: 1/4” ID, 3/8” OD115V (plug), 1.0 A, 60 Hz, 1 Ph, Average input power @ Max SPM: 130WNEMA 4X enclosureNOTE: Pump Size (and Model) can vary dependent on Cooling Tower loads/flows. | 1 |
| 23 | Y | NeptuneModel: QC-PVC-50 | Injection Quill:For use to inject chemicals pumped from metering pumps, manufacturer installed spring-loaded check valve. Body construction is PVC. Rated for 150 psi at 100°F. Quill to be trimmed in field for injection pipes smaller than 4-inches. Connection size is 1/2-inch NPT. | 1 |
| 24 | Y | Garratt CallahanProduct Name:Formula 159 | Formula 2011, Cooling Water Treatment:Used for minerals disposition control of corrosion, silica, calcification and scaling of process piping and heat load equipment (i.e: heat exchanger, etc.).Packaged for shipment: Solution in 55-gallons drum | 5(55-gal drums) |

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| **V ) Filter & Housing Water Filtration Sub-System**Is the Water Filtration sub-system required for Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below. |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity** |
| 25 | Y | Quantrol Filtration Products:Model: [QFP3BH2-304] | Bag (Filter) Housing:Used to remove dirt, scale and other contaminants from a cooling tower water application. Housing unit is constructed of 304 stainless steel, and a poly coat finish. Unit has a removable hydraulic lift lid for filter bags change-outs access, and Buna-N seals at the lid and basket, with differential/pressure drop ports. Constructed with heavy-duty support legs, flanged end connections, and rated for 150 psi.Operations and Features include:Unit connections: [ 4” flanged ends]Flow Rate: [ 600 ] gpm (nominal)Number of Baskets/Bags: [\_3\_ (#2 size bags)]Size (approx.): [ 25] inch dia, \_[66.5]\_ inches highWeight (dry, approx.): \_[590]\_ pounds | 1 |
| 26 | Y | Pentair IndustrialModel:[KE50K2S] | Filter Bags:Filter Bag Size is a #2 to accommodate the Quantrol Filtration Products bag filter housing, Model [QFP3BH2-304]. Bag filter fiber is of the felt polyester (KE) type, with a media rating of 50 microns, and rated at 200°F. | [12(6=Spare)] |
| 27 |  |  | Not Used |  |

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| **VI ) Treated Water Blowdown Pipe Sub-System**Is the Blowdown Pipe sub-system required for Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below. |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity** |
| 28 | Y | Carlon Meter Model: [C330EC] | Flow Meter:Meter is of the turbine type for water application, with totalizing and electric contact configurations. Maximum operating characteristics is 232 psi at 122°F, rated flange class is 150#. Register (display) option is U.S. gallons.Operations and Features include:Size: [ 3 ] inchUnit connections: FlangedContinuous Flow: [ 450 ] gpmFlow Range: [ 3 – 550] gpmElectrical rating: 24VAC | 1 |
| 29 | Y | Cla-Val Model: [136-01] | Control Valve (w/Solenoid):Valve is for water application and of the globe type, and constructed of ductile iron with Buna-N rubber synthetic rubber parts. Pressure Class 150, with a 200 psi maximum operating pressure differential. NEMA type 4 watertight solenoid control enclosure.Operations and Features include:Size: [ 3] inchUnit connections: ThreadedMax. Flow: [ 460] gpmActivation: Normally Closed (energize to OPEN)Electrical rating: 120V at 60Hz AC | 1 |
| 30 | Y | Kenics Model: [KMS] | Static MixerInline PVC motionless mixer with removable element, with flanged ends. Standard mixer configuration is 4 elements with a 1(dia.) to 1.5 pitch.(Calc. example: 2” pipe diax1.5x4=12 inches length, excludes flanges)Size: [3] inch, [12] inches length | 2 |

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| **VII ) Non-Potable Make-Up Water Pipe Sub-System**Is the Make-Up Water Pipe sub-system required for Cooling Tower Water Treatment? If “YES”, continue with components selection as identified below. |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity** |
| 31 | Y | Carlon MeterModel:[JSJ100-1 GPC] | Flow Meter:Meter is of the positive displacement type for water application, with totalizing and electric contact configurations. Maximum operating characteristics is 150 psi at 105°F. Register (display) option is U.S. gallons, with a gallons-per-contact (GPC) pulse setting.Operations and Features include:Size: [ 1 ] inchUnit connections: Threaded NPTContinuous Flow: [25] gpmFlow Range: [ 0.75 – 50] gpmElectrical rating: 24VAC | 1 |
| 32 | Y | Cla-ValModel:[136-01] | Control Valve (w/Solenoid):Valve is for water application and of the globe type, and constructed of ductile iron with Buna-N rubber synthetic rubber parts. Pressure Class 150, with a 200 psi maximum operating pressure differential. NEMA type 4 watertight solenoid control enclosure.Operations and Features include:Size: [ 1] inchUnit connections: Threaded NPTMax. Flow: [ 55]\_ gpmActivation: Normally Closed (energize to OPEN)Electrical rating: 120V at 60Hz AC | 1 |
| 33 | 1 | Multitrode Model: [0.2/1-10] | Level Sensing Probe:Level probe to be used in cooling water tower basin application. The probe shall be constructed with PVC tubing with molded sensor units at regular intervals along the probe. The probe is suspended on its own cable. The sensor will be stainless steel, each of the 10 sensors will be individually connected to a correspondingly numbered PVC/PVC flexible cable.Operations and Features include:Probe Length: [ 8 ] inchesNumber of Sensors: [ 1 ] Sensor Separation: [N/A]\_ inchesCable Length: [ 30-m (or 100-ft.)]Number of Sensors: [10 –M ( OR 33 FT.)]Minimum water level increment designations will be as follows (actual level heights will be determined and adjusted in the field):High Alarm (highest water level)High LevelLow LevelLow Alarm (lowest water level) | 5 (1= spare) |

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| **VIII) PIPE and FITTINGS SCHEDULE, MISCELLANEOUS** |
| **Item****#** | **Req’d****Y / N** | **Mfr. and****Model ID** | **Description** | **Quantity** |
| 34 | Y | N/A | Pipe:PVC, Schedule 80, ASTM D1785.Operations and Features include:Sizes: 1 inch 3/4 inch 1/2 inchLength: 20-feet (minimum) | 1(stick) |
| 35 | Y | Wheatland Tube Co.Model:None | Pipe:Steel pipe, Schedule 40, ASTM A53, Type F or Type B.Operations and Features include:Sizes:  [3] inch [1] inchLength: 20-feet (minimum) | 1(stick) |
| 36 | Y | N/A | Valve:Valve is a ball type. PVC Schedule 80 construction, ASTM F1970, with NPT end connections.Operations and Features include:Size: [3/4] inch | 6 |
| 37 |  | N/A | Valve:Valve is of the butterfly type, MSS SP-67, Ductile iron construction, lug style connections.Operations and Features include:Size: [3] inch | 4 |
| 38 | Y | AshcroftModel:1001008AL02L200#(Type 1008A),or equivalent equal | Pressure Gauge:Corrosion-resistant stainless steel case/ring. Gauge is manufacturer filled with glycerin. Connection is 1/4-inch NPT, with a 4-inch dial size and a dial range from 0 to 200 psi. | 4 |
| 39 | N | Advantage ControlsModel: R00268 | Tubing:PVDF (polyvinylidene fluoride) material, rated at a max. pressure of 250 psi at 250°F.Operations and Features include:Size: 3/8 inch | 1(100-ft roll) |
| 40 | N | Advantage ControlsModel: XXXxxx | Sample Valve/Port:Valve is a ball type. PVC Schedule 80 construction, ASTM F1790, with NPT end connections.Operations and Features include:Size: [1/4] inch | 8 |
| 41 | Y | N/A | Union:PVC Schedule 80 construction, with NPT end connections, ASTM D2464.Operations and Features include:Size: [3/4] inch | 12 |
| 42 |  | N/A | Coupling:PVC Schedule 80 construction, with sleeve-type end connections, ASTM D2464.Operations and Features include:Size: [3/4] inch |  |
| 43 |  | N/A | Elbow, 90-degrees:Standard radius, PVC Schedule 80 construction, with sleeve-type end connections, ASTM D2464.Operations and Features include:Size: [3/4] inch |  |
| 44 |  | N/A | Reducer:PVC Schedule 80 construction, ASTM D2464, with NPT connections.Operations and Features include:Size:  [1(F) x 3/4(M) ] inch [3/4(F) x 1/2(M)] inch [1/2(F) x 1/4(M)] inch |  |

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Remove the following Tower Schematic from spec template and provide latest from LANL Standards website in the drawing set.

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