

The following standard specification is intended to be edited according to the specifics of the project. Brackets [] and areas shaded in gray [e.g. format] indicate requirements that are optional depending upon the type of system being provided or per instructions associated with the [] and project requirements. Consult with University's Representative and campus stakeholders.

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Design Professional to check for coordination with LEED requirements, University's Sustainability Initiative and Model Water Efficient Landscape Ordinance for applicable requirements.

SECTION 32 84 00 PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY DESCRIPTION

A. Scope of Work

1. Provide irrigation systems as shown on the Drawings and described herein.

B. Related Work

1. Division 26 - Electrical: Power connection for controller.

1.2 SUBMITTALS

A. Material List

1. Complete manufacturer's technical data and installation instructions shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.

B. Record Drawings

1. The original record drawings shall be submitted to the University's Representative for approval prior to making the controller chart. Refer to Section 01 78 39 Project Record Documents.
2. Drawings shall include dimensions from two permanent points of reference such as building corners, sidewalks, or road intersections for the location of the following items:
 - a. Connection to existing water lines.
 - b. Connection to existing electrical power and splice locations.
 - c. Relocated existing equipment.
 - d. Gate valves.
 - e. Routing of sprinkler pressure lines.
 - f. Sprinkler locations
 - g. Sprinkler control valves.
 - h. Routing of control wiring.
 - i. Quick coupling valves.
 - j. Other related equipment as directed by the University's Representative.

C. Controller Charts

1. Controller charts shall be prepared by Contractor.
2. Provide one controller chart for each controller supplied.
3. The chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow when rolled up.
4. The chart shall be a reduced drawing of the actual as-built system and shall be readable when reduced.
5. The chart shall be a black line print and different colors shall be used to indicate the area of coverage for each station.
6. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 10 mils if required by University's Representative.

7. As-built record drawings and controller charts shall be completed and approved prior to final inspection of the irrigation system.

D. Operation and Maintenance Manuals

1. Contractor shall prepare Operation and Maintenance Manuals in accordance with Section 01 78 00 Close-out Submittals.
 - a. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.
 - b. Catalog and parts sheets on all major material and equipment items installed under this contract (not necessary for campus standard irrigation equipment).
 - c. Guarantee statement.
 - d. Complete operating and maintenance instructions on all major equipment.

E. Equipment to be Furnished

1. Furnish the following tools:
 - a. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve provided on this project.
 - b. Two keys for each automatic controller.
 - c. Two quick coupler keys and matching hose swivel per project.
2. This equipment shall be furnished to University before final inspection can occur. Evidence that the University has received material must be provided to University's Representative.

1.3 QUALITY ASSURANCE

- A. Manufacturer's directions and detailed drawings shall be followed in all cases where points are not shown in the Drawings and Specifications.
- B. Drawings are generally diagrammatic and indicative of the work to be installed and do not show all offsets, fittings, sleeves, and other parts which may be required. Contractor shall carefully investigate the structural and finished conditions affecting all work and plan accordingly, furnishing such fittings, and other appurtenances as may be required to meet such conditions.. The Work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- C. Before commencing irrigation system installation, Contractor shall resolve obstructions, grade differences or discrepancies in area dimensions that might not have been considered in engineering and shown on the Drawings.

1.4 COORDINATION AND SCHEDULING

- A. Contractor shall notify University's Representative in advance for the following observation meetings, according to the time indicated, and shall provide documentation to University's Representative that the following meetings occurred and their outcome.
 1. Pre-job conference - 7 days.
 2. Sleeve inspection – 48 hours.
 3. Pressure supply line installation and testing - 48 hours.
 4. Automatic controller installation - 48 hours.
 5. Control wire installation - 48 hours.
 6. Lateral line and sprinkler installation - 48 hours.
 7. Flushing of lines – 48 hours.
 8. Coverage test (prior to any planting installation) - 48 hours.
 9. Final inspection - 7 days.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. PVC Pressure Main Line Pipe and Fittings

1. Pressure main line piping for sizes 4 inches and larger shall be C-900 with mechanical joints.
2. Pressure main line piping smaller than 4 inches inside sleeves, shall be PVC Schedule 40.
3. Pressure main line piping for sizes 3 inches and smaller shall be PVC Schedule 40 with solvent welded joints and with Schedule 80 fittings.
4. Pipe shall be made from NSF approved Type I, Grade I PVC compound conforming to ASTM resin specification D1785. All pipe shall meet requirements as set forth in Federal Specification PS-21-70.
5. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM test procedure D2466.
6. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be Christy's Red Hot Blue Glue, or equal.
7. All PVC pipe must bear the following markings and shall be visible upon installation.
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. Schedule or class.
 - d. Pressure rating in PSI.
 - e. NSF (National Sanitation Foundation) approval.
 - f. Date of extrusion.
8. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable Iron Pipe Size (IPS) schedule and NSF seal of approval.

B. PVC Non-Pressure Lateral Line Piping

1. Non-pressure buried lateral line piping shall be PVC schedule 40 with solvent-welded joints.
2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM resin specification D1784. All pipe shall meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.
3. Except as noted above, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in these specifications.
4. For all sprinkler head installations use schedule 80 thread nipples and risers, and schedule 40 fittings.

C. PVC Sleeves:

1. PVC sleeves shall be Schedule 40 with solvent weld joints. Install sleeves at 24 inches depth to top of pipe. Backfill sleeve trench with sand. Depth exception may be considered at concrete walks with prior approval by University's Representative.

D. Brass Pipe and Fittings

1. Where indicated on the Drawings, use red brass threaded pipe.
2. Fittings shall be red brass conforming to Federal Specification #WW-P-460.

2.2 VALVES

A. Gate Valves

1. Gate valves 3 inches and larger shall be 125 lb. Static Water Pressure (SWP) bronze gate valve with screw-in bonnet, non-rising stem, solid wedge disc, threaded ends and a bronze or malleable iron handwheel. With a 2" operating nut.
2. Gate valves 2-1/2 inches and smaller shall be manufactured by Nibco, Aqua, Matco, or equal, 200 psi Water Oil Gas (WOG), 125 SWP, Screw-in bonnet, solid wedge.

B. Quick Coupling Valves

1. Quick coupling valves shall have a brass two-piece body designed for working pressure of 125 PSI operable with quick coupler.
2. Key size and type shall be as shown on Drawings.

3. Quick coupling valves shall be manufactured by Hunter (HQ44 – AW), Rainbird (44-LRC), Buckner (QB44) or equal.
4. All quick coupling valves without integral stabilizers shall be equipped with cast ductile iron anti-rotation devices or anchors that attached to the base of the valve and can be secured by a single bolt, and shall be manufactured by Leemco (LS-120, LS-150), Harco (82201, 82202) or equal .

C. Electrical Remote Control Valves

1. Electric control valves shall have a manual flow adjustment.
2. Provide one control valve box for each electric control valve.
3. Electric Remote Control Valves shall be manufactured by Hunter (ICV Series), Irritrol (Century Series), or equal.
4. Pressure regulating modules as required for pressure reduction on new or existing valves manufactured by, Hunter (Accu-Sync), Irritrol (Omni Reg), or equal, as noted on Drawings.
5. For pipe connections to valve bodies use Teflon tape material. Pipe dope shall not be used.

D. Associated Valves

1. Y-Strainer brass 80 mesh with brass gate valve to blow-out screen.
2. Above ground Y-strainers shall be metal.
3. Y-strainer shall be same size as water supply.
4. Gate valves 3 inches and smaller shall be brass.

E. Flow Sensor and Master Valve

1. Flow sensor and master valve assemblies shall be by Rain Master, or equal and must operate with controller. Install both units after brass gate valve and Y-strainer at point of water connection. The master valve shall be main line-sized for project and have the capacity to have additional systems added on in the future. The flow sensor may be line-sized or smaller, as shown on Drawings. This maximizes flow management capabilities to reduce water window times and improve efficiency

2.3 BACKFLOW PREVENTION UNITS

- A. Backflow prevention units shall be of size and type indicated on the Irrigation Drawings. Install backflow prevention units in accordance with irrigation details.
- B. Backflow prevention devices shall only be used on University domestic water lines. These devices shall not be installed on utility water lines.

2.4 WIRING

- A. Irrigation Control Wiring: Copper direct burial sprinkler wire, sized according to length of the run, minimum 14 gauge (white common, red primary lead, blue for spares). Run extra wires for future valves at the ends of all main line runs (see Drawings – 4 wires minimum).
- B. Electrical Dry Connection. Spears DS -400, pre-filled dri-splice connector with crimp sleeves; DRYCONN #10222 waterproof connectors by King Innovations (#22 to #12 AWG), or equal. Waterproof under-ground wire connections.
- C. Communication Cable: All communication wire for controllers and sensors shall be installed in electrical conduit not less than 1 inch.

2.5 AUTOMATIC CONTROLLERS

- A. Automatic controllers shall be RainMaster Evolution DX-SA6-RM4-8-48, Radio-kit/Ev-ant-FD-kit/DX-flow/PMR-kit with radio and flow sensor boards, separate ground rod kit, surge arrestor (per manufacturers specifications), and stainless steel pedestal cabinet, or equal, no known equal. Controller shall fully communicate and integrate with University's existing system;

Design Professional to select from the following for project

1. [Dome antenna (within one mile of Grounds Division's central computer)]
2. [High gain antenna (for controllers installed greater than one mile)]
3. Provide one hand held Pro Max remote per controller.
4. All controllers shall be installed with a radio set to the UC Davis frequency of 485.075 MHz.
5. If there are more than 48 stations on a site, the controllers may be hard wired together with communication wire and do not need separate radios or antennas.
6. Controllers shall not be placed within 15 feet of buildings that could cause radio interference.

2.6 MAIN LINE SHUT OFF BOX

- A. Install main line shut off valve at point of connection in a Christy concrete G5 traffic box for Main Line Shut Off Valves with "water" labeled lid, or equal.

2.7 CONTROL VALVE BOXES

- A. Use 10 by 10-1/4 inch round box for all gate valves, Carson Industries #910-12B with green bolt down cover, or equal. Extension sleeve shall be PVC- 6 inch minimum size.
- B. Use 9 1/2 by 16 by 11 inch rectangular box for all electrical control valves, Carson Industries 1419-13B with green bolt down cover, or equal.

2.8 SPRINKLER HEADS

- A. All sprinkler heads on any one system (zone) shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the Drawings and specified.
- B. Large rotors shall be pop-ups with stainless steel risers and check valves, have a screw adjustment and shall be manufactured by Hunter (I40-06-SS), Rainbird (8005-SS), or equal.
- C. Medium rotors shall be pop-ups with stainless steel risers and internal check valves, have a screw adjustment and shall be manufactured by Hunter (I-20-06-SS, I-20-12), or equal. Size per Drawings.
- D. Spray heads shall be manufactured by Hunter (PROS--06/12-CV-PRS30 with standard MPR nozzles unless otherwise noted), Rainbird (1812/1806/1804-PRS-SAM with standard MPR nozzles unless otherwise noted), or equal. Variable arc nozzles are to be used only when specifically approved by the University's Representative.
- E. Low precipitation rate, multi-stream nozzles shall be Hunter MP Rotator series, or equal, and shall be used with 40 psi pressure regulating heads (Hunter PROS-06/12-PRS40-CV-MP1000/2000/3000, 3500 and SR800) or equal.
- F. Double Swing Joint Assembly: These shall be fabricated in accordance with the detail. Use Schedule 80 PVC threaded nipples and risers and Schedule 40 fittings, see detail.
- G. Bubbler heads shall be Rainbird 1300A-F with screens, or Hunter AFB, or equal.
- H. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.

2.9 LINE SOURCE SUB SURFACE DRIP IRRIGATION SYSTEMS

- A. Sub-surface drip tubing with 17 mm fittings, type noted on Drawings.

1. Sub-surface drip tubing with in-line, pressure compensating emitters. Emitter and row spacing per Drawings. Hunter PLD, Rainbird XFS, or equal.
 2. Sub-surface drip tubing with in-line, pressure compensating emitters, factory wrapped with polypropylene fleece. Emitter and row spacing per Drawings. Hunter PLD-ESD, or equal.
- B. Drip Zone Valve Assembly: Valve kit including filter (minimum 120 mesh screen) and pressure regulator, Hunter ICZ or equal.
- C. Automatic flush valve with identification tag, compression tee, min. 24" coil of blank tubing, and flush cap. Install in 10" valve box at furthest point from remote control valve.
- D. Air/Vacuum relief valve installed at highest point of each station with compression tee, and flush cap, in an 8" valve box - Rainbird ARV, or equal.
- 2.10 DEEP ROOT WATERING TUBES
- A. Deep Watering Tube: 3" or 4" diameter semi-rigid polyethylene mesh tube (10 inch, 18 inch, 24 inch or 36 inch) with adjustable bubbler. Construct assembly as shown in details or use Hunter RZWS or equal, size per Drawings.
- 2.11 REMOTE CONTROL VALVE IDENTIFICATION TAGS
- A. 2-1/4 by 2-3/4 inch yellow polyurethane with valve number embossed on tag, as manufactured by Christy's Irrigation I.D. Tags, (714) 771-4142, or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing Utilities Drawings for existing utility locations.
- B. Refer to 1.4 Coordination and Scheduling for additional inspection requirements.

3.2 PREPARATION

- A. Physical Layout
1. Prior to installation, Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, and layout of drip tubing.
 2. All piping and tubing layout shall be approved by University's Representative prior to installation.
- B. Water Supply
1. Point of Connection (POC): Install flow sensor and master valve assemblies after brass gate valve. The sizes of master valve and flow sensors to be main line-sized or larger for project and have the capacity to have additional systems added on in the future.
 2. Electrical Supply
 - a. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the Drawings.

3.3 INSTALLATION

- A. Trenching
1. Provide a minimum cover of 18 inches for all pressure supply lines.
 2. Provide a minimum cover of 12 inches for all non-pressure pvc lines.
 3. Provide a minimum cover of 4" for all drip tubing.
 4. Provide a minimum cover of 18 inches for all control wiring.
- B. Backfilling

1. No backfilling shall occur until University's Representative visually inspects and approves piping layout in trenches.
2. A fine granular material backfill shall be initially placed on all lines. No foreign matter larger than 1/2 inch in size will be permitted in the initial backfill. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from 4 inch or greater clods of earth or 1/2 inch or greater stones, gravel or other debris. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
3. Flooding of trenches will be permitted only with approval of the University's Representative.
4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments at no additional cost to the University.

C. Trenching and Backfill Under Paving

1. Trenches located under areas where paving (asphaltic concrete or concrete), will be installed shall be backfilled with sand (a layer 6 inches below the pipe and 3 inches above the pipe) and compacted in layers to 95 percent compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm condition, not prone to settling. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, as part of the sprinkler Work, cap and pressure test all piping under paving prior to the paving Work.
2. Piping under existing walks shall be done by jacking, boring or hydraulic driving where possible. Where any cutting or breaking of sidewalks or concrete is necessary permission shall be obtained from the University's Representative. No hydraulic driving will be permitted under concrete paving. Concrete paving shall be replaced back to nearest control joint. See Section 01 73 20 Cutting and Patching.
3. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Pipe Assemblies

1. PVC pipe, drip tube, and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
2. On PVC to metal connections, Contractor shall work the metal connections first. Pipe tape shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters or machined PVC schedule 80 pipe nipples into which the pipe may be welded.
3. Do not install multiple assemblies in plastic sleeves.
4. Use fittings to change pipe directions. Do not deflect pipe beyond manufacturer's recommendations.
5. Do not install joints in sleeves or under pavement if length is less than 20 feet. Where pipe length exceeds 20 feet, use minimum number of joints.
6. Install PVC piping and fittings without tension on the fittings. Pipes should be inserted squarely and fully into socket of the fittings.

E. Pipe Clearance: All pipes shall have a minimum clearance of 6 inches from each other and from lines of other Work. Parallel pipes shall not be installed directly over one another. No more than two pipes may be installed in a single trench.

F. High Voltage Wiring for Automatic Controller

1. Provide 120 volt power connection to the automatic controller.

G. Remote Control Valves

1. Install where shown on Drawings and details. When grouped together, allow at least 12 inches between valve box edges. Install each remote control valve in a separate valve box.
2. Each controller and station number shall be labeled at the valve with a 2-1/4 by 2- 3/4 inch yellow polyurethane I.D. tag attached to the control wire of the valve.
3. Set valve boxes perpendicular to adjacent walls and parallel to one another.
4. Thoroughly flush mainline before installing valves.
5. Install valve and box to maintain a minimum of 1 inch clear space between the top of the valve and the lid of the box.
6. Install valve box at the same level as soil grade, not above.

H. Control Wiring

1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
2. Where more than 1 wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.
3. An expansion curl shall be provided within 3 feet of each wire connection. Expansion curl at electric control valves shall be of sufficient length so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
4. All splices shall be made with electric dry connections. Use one splice per connector.
5. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of University's Representative.

I. Flushing of System

1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, the control valves shall be opened and a full head of water used to flush out the system.
2. Sprinkler head nozzles shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the University's Representative.
3. Flush drip systems before installation of flush and air relief valves, keep ends open.

3.4 EXISTING TREES

- A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall first discuss with the University Representative and get written permission for proposed trench route. Contractor shall use all possible care to avoid injury to trees and tree roots. Refer to Section 01 56 39 Tree & Plant Protection.

3.5 FIELD QUALITY CONTROL

A. Testing of Irrigation System

1. Contractor shall request the presence of the University's Representative in writing at least 48 hours in advance of testing. Testing of pressure mainlines shall occur prior to installation of electric control valves.
2. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight.
3. Sustain pressure in lines for not less than 2 hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.
4. All hydrostatic tests shall be made in the presence of University's Representative. No pipe shall be backfilled until it has been inspected, tested and approved in writing, including laterals.
5. Furnish necessary force pump and all other test equipment.
6. When the sprinkler or drip irrigation system is completed, perform a coverage test in the presence of the University's Representative, to determine if the water coverage for planting

areas is complete and adequate. This test shall be accomplished before any plants are planted.

B. Adjustment of the System

1. Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.
2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
3. All sprinkler heads shall be set perpendicular to finished grades unless otherwise shown on the Drawings.

- C. The entire sprinkler irrigation system shall be under full automatic operation for a period of 2 days prior to any planting. The University's Representative reserves the right to waive or shorten the operation period.

3.6 CLEAN-UP

- A. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down.

3.7 FINAL OBSERVATION PRIOR TO ACCEPTANCE

- A. Contractor shall operate each system in its entirety for the University's Representative at time of final observation. Any items deemed not acceptable by the University's Representative shall be reworked to the complete satisfaction of the University's Representative.
- B. The controller must be set up and under full automatic operation before final inspection can occur and maintenance period can begin.
- C. Controller charts and final as-built record drawings shall be submitted in both electronic form and as 1 full-size hard copy. Both must be provided to the University's Representative and approved before final inspection can occur and maintenance period can begin. Refer to 1.2. B. and C.
- D. Contractor shall show evidence to the University's Representative that the University has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

END OF SECTION 32 84 00