

SECTION 02810 IRRIGATION SYSTEMS

PART 1 - GENERAL

- 1.1 **WORK INCLUDED** - Work of this Section generally includes provisions for the installation of an underground irrigation system including the following:
- A. Static pressure verification and coordination of irrigation system installation with landscape material installation.
 - B. Trenching, stockpiling excavation materials, refilling and compacting trenches.
 - C. Complete irrigation system including but not limited to piping, valves, fittings, heads, controllers and wiring, and final adjustments to insure complete coverage.
 - D. Water connections.
 - E. Replacement of unsatisfactory materials.
 - F. Clean-up, inspections, and approval.
 - G. Tests.
- 1.2 **RELATED SECTIONS**
- A. Examine all sections related to project work.
- 1.3 **REFERENCES**
- A. Perform Work in accordance with requirements of Conditions of the Contract and Division 01 - General requirements as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.
 - B. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.
 - 1. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.
 - 2. Underwriters Laboratories (UL) - UL Wires and Cables.
- 1.4 **QUALITY ASSURANCE**
- A. **Installer Qualifications** - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project, and financial stability, submit if requested by Consultant, prior to contract award the following:

1. List of 3 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
 - a. Name of project.
 - b. Location.
 - c. Owner.
 - d. Brief description of work and project budget.
2. Current company financial statement.

B. Special Requirements:

1. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related Work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.
2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
3. Coordination With Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.
4. Damage To Other Improvements - Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Consultant, Contractor's Superintendent, and Installer.

1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

1.5 SUBMITTALS - Prepare and make submittals in accordance with conditions of the Contract.

A. Shop Drawings - Submit Shop Drawings if noted on construction drawings, include a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate detail to accurately portray intent of construction.

B. Record Drawings (As-Built):

1. At onset of irrigation installation secure mylar sepia of original irrigation design from Owner. At the end of every day, revise prints for Work accomplished that day in red ink. As-built sepia shall be brought up-to-date at the close of the working day every Friday by a qualified draftsman. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-builts.

Upon completion of Project, submit for review, prior to final acceptance, final set of as-built mylar sepia's. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items:

2.
 - a. Connection to existing water lines.
 - b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).
 - c. Sprinkler control valves.
 - d. Quick coupling valves.
 - e. Drain valves.
 - f. Control wire routing if not with pressure mainline.
 - g. All gate valves.
 - h. Other related equipment as directed.
3. Owners Representative will not certify any pay request submitted by the Contractor if the as-built drawings are not current, and processing of pay request will not occur until as-builts are up-dated.

C. Operation Instructions - Submit 3 written operating instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.

1. Controller Charts:
 - a. Do not prepare charts until record (as-built) drawings have been reviewed by Consultant.
 - b. Provide one controller chart for each automatic controller installed.
 - 1) Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - 2) Chart shall be blueline print of actual "as-built" system, showing area covered by that controller.
 - c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.
 - d. Following review of charts by Consultant, they shall be hermetically sealed between two layers of 20 mm thick plastic sheet
 - e. Charts shall be completed and reviewed prior to final review of irrigation system.

1.6 DELIVERY, STORAGE, AND HANDLING - Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

A. Handling of PVC Pipe - Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat

so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.7 JOBSITE CONDITIONS:

A. Protection of Property:

1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.
2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

B. Existing Trees:

1. All trenching or other Work under limb spread (dripline) of any and all evergreens or deciduous material shall be done by hand or by other methods so as to prevent damage to root system.
2. Prune any branches of trees to be preserved which may be damaged by construction.
3. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.

C. Protection and Repair of Underground Lines:

1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground line from damage. If damage does occur, all damage shall be repaired by Utility Owner. All costs of such repairs shall be paid by Contractor unless other arrangements have been made.
2. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities which were not staked are encountered and damaged by Installer, they shall be repaired by Owner at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

D. Replacement of Paving and Curbs - Where trenches and lines cross existing roadways,

paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.

1.8 **WARRANTY/GUARANTY:** - Manufacturer shall warrant materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guaranty workmanship for similar period.

- A. Settling of backfilled trenches which may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.
- B. Expenses due to vandalism before substantial completion shall be borne by Contractor.
- C. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.9 **MAINTENANCE:**

- A. Winterization - include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Consultant. Reopen, operate, and adjust system malfunctions accordingly during April of following season within 3 days of notification by Owner.

1.10 **EXTRA STOCK** - In addition to installed system furnish the following items to Owner:

- A. 10 Pop-up spray heads with nozzles of each type used.
- B. 4 Rotor heads of each type used.

PART 2 - PRODUCTS

2.1 **MATERIALS:**

A. General Piping:

- 1. Pressure Supply Lines (downstream of backflow prevention units) - Class 200 PVC BE (1" - 2 1/2") and Class 160 PVC RT (3" and larger).
- 2. Non-pressure Lines - Class 200 PVC BE.
- 3. PVC Sleeving - Class 160 PVC.

B. Copper Pipe and Fittings:

- 1. Copper Pipe - Type K, hard tempered.
- 2. Fittings - Wrought copper, solder joint type.
- 3. Joints - Soldered with solder, 45% silver, 15% copper, 16% zinc, and 24% cadmium and solidus at 1125~F and liquids at 1145~F.

C. Brass Pipe and Fittings:

1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
2. Fittings - Medium brass, screwed 125 pound class.

D. Plastic Pipe and Fittings:

1. Identification Markings:
 - a. Identify all pipe with following indelible markings:
 - 1) Manufacturer's name.
 - 2) Nominal pipe size.
 - 3) Schedule of class.
 - 4) Pressure rating.
 - 5) NSF (National Sanitation Foundation) seal of approval.
 - 6) Date of extrusion.
2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
 - a. Fittings - Standard wright, Schedule 40, injection molder PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
 - 1) Threads - Injection molded type (where required).
 - 2) Tees and ells - Side gated.
 - b. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
 - c. Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings.
3. Gasketed End Pipe - Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1, Grade 1.
 - a. Fittings (3" and larger) - Ductile iron, grade 70-55-05 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
 - b. Gaskets - Factory installed in pipe and fittings, having a metal or plastic support within gasket or a plastic retainer ring for gasket.
 - c. Lubricant - As recommended by manufacturer of pipe fittings.

E. Gate Valves:

1. Gate Valves for 3/4 inch through 2-1/2 Inch Pipe - Brass construction; solid wedge, IPS threads, and non-rising stem with wheel operating handle.
2. Gate Valves for 3 Inch and Larger Pipe - Iron body, brass or bronze mounted AWWA gate valves with a clear waterway equal to full nominal diameter of valve; rubber gasket or mechanical joint-type only. Valves shall be able to withstand a continuous working pressure of 150 psi and be equipped with a square operating nut.

F. Quick Coupling Valves - Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover. Key size and type as shown on Drawing.

G. Valve Boxes:

1. Gate Valves, Drip Line Blow-out Stubs, and Wire Stub Box - Carson #910-12, Brooks #1100, box as detailed.
2. 3/4 inch through 2 inch Control Valves - Carson #1419-13B, Brooks #1419 box.
3. Drip Valve Assemblies - Carson #1320-13B as detailed.

H. Electrical Control Wiring:

1. Low Voltage:
 - a. Electrical Control Wire - AWG UFUL approved No. 14 direct burial copper wire or larger, if required to operate system as designed.
 - b. Wire Colors:
 - 1) Control Wires - Red.
 - 2) Common Wires - White.
 - 3) Master Valve Wires - Blue.
 - 4) Spare Control Wires - Black.
 - 5) Spare Common Wires - Yellow.
 - c. If multiple controllers are utilized, and wire paths of different controllers cross each other, both common and control wires from each controller shall be different colors approved by Consultant.
 - d. Control Wire connections and splices shall be made with 3M direct bury splice, Rain Bird Pentite connectors, or similar dry splice method.
2. High Voltage - Type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.

I. Automatic Controller - Size and type shown on Drawings; mounted as detailed.

J. Electric Control Valves - Size and type shown on Drawings having manual flow adjustment (except drip valves) and manual bleed nut.

K. Sprinkler Heads - As indicated on Drawings. Fabricated riser units in accordance with details on Drawings - with riser nipples of same size as riser opening in sprinkler body.

L. Backflow Preventer - Existing.

PART 3 - EXECUTION

3.1 LANDSCAPE PLAN REVIEW AND COORDINATION - Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.

3.2 STATIC PRESSURE VERIFICATION - Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Consultant. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.

3.3 INSPECTION: - Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

A. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.

3.4 PREPARATION:

A. Staking shall Occur as Follows:

1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Consultant 48 hours in advance and request review of staking. Consultant will advise installer as to the amount of staking to be prepared. Consultant will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.
2. If Project has significant topography, freeform planting beds, or other amenities which could require alteration of irrigation equipment layout as deemed necessary by Consultant, do not install irrigation equipment in these areas until Consultant has reviewed equipment staking.

B. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.

C. Trenching - Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.

1. Clearances:
 - a. Piping 3 Inches and Larger - Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
 - b. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 7 inches.
 - c. Line Clearance - Provide not less than 6 inches of clearance between each line, and not less than 12 inches of clearance between lines of other trades.
2. Pipe and Wire Depth:
 - a. Pressure Supply Piping - 24 inches from top of pipe.
 - b. PVC Sleeving - 18 inches from top of pipe.
 - c. Non-pressure Piping (rotor) - 18 inches from top of pipe.
 - d. Non-pressure Piping (pop-up) - 12 inches from top of pipe.
 - e. Control Wiring - Side of pressure main.
 - f. Drip Tubing - 12 inches from top of pipe.
 - g. Emitter Tubing (Micro-tubing) - 8 inches from top of pipe.

3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.

3.5 INSTALLATION - Locate other equipment as near as possible to locations designated. Deviations shall be reviewed by Consultant prior to installation.

A. PVC Piping - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40~F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe laying is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.

1. Solvent Weld PVC Pipe - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.
2. Gasketed End Pipes:
 - a. Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (Johns-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.
 - b. Construct thrust blocks behind all gasketed fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact Consultant prior to placing thrust blocks, for observation of thrust block excavation and initial placement. Size thrust blocks based on tables below:

THRUST BLOCK SIZING GUIDE:

Thrust developed per 100 PSI pressure (lbs. force) for various fitting configurations.

Pipe Size	Fitting 90 deg. Elbow	Fitting 45 deg. Elbow	Valves, Tees Dead Ends
3	1,000	600	800
4	1,800	1,100	1,300

Approximate bearing strength of typical soils.

Soil Type	Lbs/ft 2
Mulch, Peat, etc.	0
Soft Clay	500
Sand	1,000
Sand and Gravel	1,500
Sand and Gravel with Clay	2,000
Sand and Gravel Cemented with Clay	4,000
Hard Pan	5,000

B. Control Wiring:

1. Low Voltage Wiring:
 - a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of pipe, or in separate trenches.
 - b. Bundle all 24 volt wires at 10 foot intervals and lay with pressure supply line pipe to one side of the trench.
 - c. Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every 500 feet. Form expansion loop by wrapping wire at least 8 times around a 3/4 inch pipe and withdrawing pipe.
 - d. Make all splices and E.C.V. connections using Rain Bird Pentite connectors or similar dry splice method.
 - e. Install all control wire splices not occurring at control valve in a separate splice valve box.
 - f. Install one control wire for each control valve.
 - g. Run two spare #14 AWG UFUL control wires and one common wire from controller pedestal to the end of each and every leg of mainline. Label spare wires at controller and wire stub box.
2. High Voltage Wiring for Automatic Controller:
 - a. Provide 120 volt power connection to automatic controller.
 - b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.

C. Automatic Controller:

1. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings.
2. Connect remote control valves to controller in numerical sequence as shown on Drawings.
3. Final location of controller shall be approved by Consultant prior to installation.
4. Each controller shall be a dedicated separate ground wire and grounding rod as detailed.
5. All above ground conduit shall be rigid galvanized with appropriate fittings. All below ground conduit shall be schedule 40 PVC.

D. Electric Control Valves - Install cross-handle 3 inches below finished grade where shown on Drawings as detailed. When grouped together, allow at least 12 inches between valve box sides. Install each remote control valve in a separate valve box. Install individual valve box flush with grade.

E. Quick Coupling Valves - Install quick couplers on double swing-joint assemblies of Schedule 80 PVC pipe; plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees. Install quick coupling valves as detailed.

F. Drain Valves - Install manual drain valves at all low points in pressure supply line as detailed. Provide a three cubic foot drainage sump for each drain valve installed.

G. Valve Boxes:

1. Install one valve box for each type of valve installed as detailed. Valve box extensions are not acceptable except for master valves. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
2. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1 1/2 inches. Depth of branding shall be no more than 1/8 inch into valve box lid.

H. Gate Valves - Install where shown on Drawings as detailed.

I. Sprinkler Heads - Install sprinkler heads where designated on Drawings or where staked. Set to finish as detailed. Spacing of heads shall not exceed the maximum indicated on Drawing unless re-staked as directed by Consultant. In no case shall the spacing exceed maximum recommended by manufacturer. Install heads on double swing-joint risers of schedule 40 PVC pipe. Angled nipple relative to non-pressure line shall be no more than 45 degrees or less than 10 degrees. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. Consultant may request nozzle changes or adjustments without additional cost to the Owner.

J. Backflow Preventer - Existing.

K. Backfilling - Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review by Consultant. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Consultant.

1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.
2. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with OSHA regulations.
3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
 - a. Mechanical tamping.
 - b. Puddling or ponding. Puddling or ponding and/or jetting is prohibited within 20'-0" of building or foundation walls.

L. Piping Under Paving:

1. 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 or concrete paving.

2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).
3. Compact backfill material in 6" lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
4. Set in place, cap, and pressure test all piping under paving, in presence of Owner prior to backfilling and paving operations.
5. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.

M. Water Supply and Point of Connection - Water supply shall be extended as shown from water supply lines.

3.6 FIELD QUALITY CONTROL:

A. Flushing - After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthest valves. Cap risers after flushing.

B. Testing - Conduct tests in presence of Consultant. Arrange for presence of Consultant 48 hours in advance of testing. Supply force pump and all other test equipment.

1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
2. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
3. Leaks - Detect and repair leaks.
4. Retest system until test pressure can be maintained for duration of test.
5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.

C. Walk-Through for Substantial Completion:

1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for Consultant at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.

D. Walk-Through for Final Completion:

1. Arrange for Consultant's presence 48 hours in advance of walk-through.

2. Show evidence to Consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Operate each zone, in its entirety for Consultant at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Consultant shall be reworked to complete satisfaction of Consultant.
5. If after request to Consultant for walk-through for Final Completion of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Consultant to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

3.7 ADJUSTING - Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 7%.

- A. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Consultant, contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.
- B. All sprinkler heads shall be set perpendicular to finish grade unless otherwise designated.
- C. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.8 CLEANING - Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at not additional cost to Owner, all trash or debris generated by installation of irrigation system.

**IRRIGATION EQUIPMENT SPECIFICATIONS
EFFECTIVE FEBRUARY 1998**

Pop-up Spray Head	Rainbird 1804-SAM-PRS
Pop-up Spray Nozzle	Rainbird 1800 Brass Nozzle
Shrub Spray Head	Rainbird 1812-SAM-PRS
Gear Driven Rotor	Hunter I-25-ADS (35 to 45 feet) Hunter I-40 (Greater than 45 feet)
Control Valve	Irritol 700 Series
Controller	Toro Network 8000 Satellite Model 132-76-08
Quick Coupler Valve	Rainbird 44NP
Control Valve Boxes	Carson #1419-13B
Gate Valve Boxes	Carson #910-12
Wire Splice Boxes	Carson #910-12
Drip Valve Boxes	Carson #1320-13B
Communication Cable	Paige P7162DA

No substitutions will be allowed for the above equipment and all equipment shall be installed according to detail sheets.

END OF SECTION 02810