

**SECTION 32 84 00
PLANTING IRRIGATION**

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contractor is responsible for providing stand-alone, programmable, fully automatic controllers that have the capability at a later date to be upgraded and connected to a central control system and operate as satellite controllers. (The central control system and upgrade to satellite controllers is NOT covered under this work.) Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the fully functional irrigation controllers, and warranty as shown on the drawings, the installation details, and as specified. Other items of work specifically included are:

1. Procurement of all applicable licenses, permits, and payment of required fees.
2. Warranty period services.
3. Initial set-up and programming of the controllers per Contracting Officer's Representative (COR) direction.
4. Training of cemetery staff on system operation, programming, and maintenance.

1.2 DEFINITIONS (RESERVED)

1.3 RELATED WORK

A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

B. Submittals: SECTION 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.4 QUALITY ASSURANCE

A. Irrigation Contractor:

1. Irrigation Contractor must have demonstrated, using persons directly employed by the Contractor, experience with the construction of at least five (5) irrigation systems having centralized control systems

with hardwired or radio communication and electrically operated remote control valves.

2. Irrigation Contractor must be licensed in the State of //(Fill in the name of State where the project is located)//.

B. Equipment Manufacturer:

1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
2. There is a permanent service organization, maintained or trained by the manufacturer, which will render satisfactory service within 24 hours of receipt of notification that service is requested.
3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.

C. Products Criteria:

1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 - a. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
 - b. Components are compatible with each other and with the total assembly for the intended service.
3. Nameplates: Nameplate bearing manufacturer's name or identification trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

D. System Requirements:

1. Layout work as closely as possible to drawings. Drawings are diagrammatic to the extent of the location of the controllers, which may have been adjusted for clarity of the drawings. Locations of remote control valves are schematic.

2. The contractor is expected to reuse existing irrigation control wire. However, when the condition of the wire is such that it would cause the system to become unusable, new control wire shall run at boundaries of graves, thru designated utility lanes or beside roadways so that any gravesite may be opened in the future without disruption of the irrigation system.
 3. Irrigation control wires and power wires, when necessary (see D.2), shall be run in trenches as typical for industry standards.
 4. Unless noted otherwise and when necessary (see D.2), all control wires and power wires shall be run in sleeves or conduit where installed beneath any site hardscape materials.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.
- F. Completely program controllers according to master irrigation schedule as per COR direction. The contractor shall run through the program to verify set-up and zone control valves are fully operational.
- G. Follow manufacturer's instructions for installation.
- H. Manufacturer of Control Systems to certify Control System is complete, including all related components, and totally operational. Submit certificate to COR.

1.5 SUBMITTALS

- A. Make submittals and provide number of copies per Specifications Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Materials List: Include all materials and products that are part of the control system including, but not limited to: electrical components and control system components. Quantities of materials need not be included.
- C. Manufacturers' Literature and Data: Submit manufacturers' catalog cuts and specifications for equipment to be included in the project work.

- D. Shop Drawings: Complete detailed layout shop drawings covering controls; location and mounting details of electrical control equipment; complete wiring diagram showing routes and wire sizes; wiring details and source of current; and connections to existing services. Do not start work before final shop drawing approval.
- E. Testing: Submit a proof of testing report following completion of each test listed in Part 1 of these specifications. Unless otherwise noted, include name of test, date of test, name of the individual completing the test, name of the company completing the test and a summary of the test results. If system fails test, document any and all retests until system passes test.
- F. Maintenance and Operation Instructions: Submit information listed in Part 3 of these specifications.
- G. Name and address of a permanent service organization maintained or trained by the manufacturers that will as a result of determined warranty work, or after warranty period following execution of a service contract for this facility, render satisfactory service within 24 hours of receipt of notification that service is requested.

1.8 CODES AND REGULATIONS

- A. Work and materials will be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code, and applicable laws and regulations of the governing authorities.
- B. When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.
- C. If quantities are provided either in these specifications or on the drawings, these quantities are provided for information only. It is the Contractor's responsibility to determine the actual quantities of all material, equipment, and supplies required by the project and to complete an independent estimate of quantities and wastage.

1.9 TESTING

- A. Notify the COR three days in advance of testing.

- B. Operational Test:
 - 1. Activate each remote control valve in sequence from each new controller manually at the controller. Manual operation on the valves from the bleed valve on the remote control valve is not an acceptable method of activation. The COR will visually observe operation.
 - 2. Repeat test(s) until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to the Owner.

- C. Control System Grounding:
 - 1. Test all new controllers for proper grounding of control system with installed grounding equipment that creates grounding resistance readings of 5 ohms or less or higher levels not to exceed 15 ohms, if acceptable by equipment manufacturer without equipment warranty invalidation. Test results must meet or exceed control system manufacturer's requirements for acceptance, while maintaining equipment warranty.
 - 2. Replace defective wire, grounding rod or appurtenances. Repeat the test until the manufacturer's requirements are met. Add grounding rods as needed, bond all rods together.
 - 3. If the test is acceptable, the individual completing the test must document the results of the grounding test on the inside of each controller door using a permanent marker and via a written report submitted to the COR. Documentation should include controller name or number, date of test, name or initials of the individual completing the test, and the ohms resistance to ground.

1.11 WARRANTY AND REPLACEMENT

- A. The purpose of the warranty is to ensure that the Government receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.
 - 1. Warranty materials, equipment, and workmanship against defects for a period of one year from Final Acceptance by COR. Repair damage to

the premises caused by construction or a defective item. Make repairs within 24 hours of notification from COR.

2. Replace damaged items with identical materials and methods per contract documents or applicable codes. Make replacements at no additional cost to the contract price.
3. Warranty applies to originally installed materials and equipment and replacements made during the Warranty period.

1.12 GENERAL CONSTRUCTION REQUIREMENTS

- A. Coordinate construction of irrigation system with COR or Cemetery Staff. Coordinate temporary shut-down of existing system with Cemetery Staff prior to construction. Disturbance to cemetery operations must be minimized. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Cemetery.
- B. To minimize interference of construction activities with flow of Cemetery traffic, comply with the following:
 1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
- C. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COR, in arranging construction schedule to cause the least possible interference with cemetery activities in actual burial areas. Construction noise during the interment services shall not disturb the service. Trucks and workmen shall not pass through the service area during this period:
 1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day,

- Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these dates.
2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat condition.
- D. Protection Of Existing Vegetation, Structures, Equipment, Utilities, And Improvements: The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, that are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree pruning compound as directed by the COR.
1. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor. **(FAR 52.236-9)**
- E. Restoration: Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

1. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
2. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.

F. Disposal and Retention: Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall become property of the Contractor and be removed by Contractor from Cemetery:

G. Temporary Toilets: Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Cemetery. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

PART 2 - PRODUCTS

2.1 QUALITY

- A. Use new materials without flaws or defects.

2.2 SUBSTITUTIONS

- A. Unless noted otherwise, use specified equipment. COR must approve equipment prior to construction. The Contractor through written request prior to purchase or installation may request substitutions to the approved equals listed herein. Changes and associated costs to accommodate alternative equipment are Contractor's.

2.3 SPRINKLER IRRIGATION COMPONENTS

A. Low Voltage Control Valve Wire:

1. Wire: Solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, but in no case less than No. 14.
2. Splicing Materials: Epoxy waterproof sealing packet.
3. Low voltage controller cable: Multi-strand cable, Underwriters Laboratories Inc. approved for direct burial in ground. Size and type of wire shall be in accordance with manufacturer's recommendations.

2.4 CONTROL SYSTEM COMPONENTS

A. Automatic Control Equipment—Independent Controllers:

1. Overall Control Concept. The electric automatic control system shall consist of multiple independent controllers which operate individual remote control valves in accordance with timing schedules programmed into the independent units. The number of units and location of the installations are shown on the drawings. The new controllers shall be Rain Master Evolution DX2 or equivalent.
2. The Control System consists of Independent controllers, and all accessories necessary to operate the irrigation system. All of these components shall be a standard package.
3. Select station configuration per controller based upon current number of used stations/zones as listed on the drawings.
4. Enclosures shall be weather resistant and mountable on a building, exterior enclosure wall, or on other vertical surfaces. The door seal material shall be UL listed. The enclosure shall not be the pedestal type.
5. Independent controllers shall have the following characteristics:
 - a. 12 independent programs with 8 start times, individual station control, or a combination of each. Manual start of independent programs: Start any program independent of the scheduled start time and water day.
 - b. The station watering time can be set from one (1) minute to 24 hours programmable in one (1) minute increments.
 - c. The controller shall be able to increase or decrease all station runtimes on a percentage basis. Water budget per program from 0

- to 300%, minimum, in 1% increments for adjustment of program runtimes.
- d. The watering days for each program shall be able to be based on at least a 14-day schedule, skip-a-day routine, and 31-day schedule.
 - e. The Manual test mode shall allow users to automatically advance from station to station using manual run time while displaying valve solenoid electrical current for each station as well as station flow in GPM.
 - f. Manually entered program. Allows user to enter a one-time program to be run immediately or scheduled for later in the day. The manual program is independent of automatic programs and shall start only one time.
 - g. The controller shall the ability to select cycle and soak.
 - h. The program shall allow for a rapid programming of a block of stations with the same watering time.
 - i. The controller shall be furnished with a real time clock that retains the actual time during power outages.
 - j. The controller shall be furnished with a non-volatile memory that retains the program(s) during power outages or seasonal shutdowns.
 - k. The controller shall be furnished with a built-in remote control capability (i.e. jack).
 - l. The controller shall be UL approved.
 - m. The controller shall have built-in transient protection.
 - n. The controller shall have a built-in amperage meter to accurately measure and diagnose valve solenoid electrical problems.
 - o. The controller shall be furnished with automatic field wire fault detection, report the fault, and move to the next programmed station.
 - p. The controller shall be able to be upgraded later (e.g. via a radio kit) to receive schedule instructions from and to send logs of operation to a central control system via wireless communication. (The radio/wireless kit and central controller is NOT part of this work.)

PART 3 - EXECUTION

3.1 INSPECTIONS AND REVIEWS

- A. The Contractor shall verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the COR prior to beginning work.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

- A. Utility Locates ("Call Before You Dig"): It is not expected that any digging or excavation is necessary; however, when it is determined by the contractor that any digging is necessary and the COR approves, arrange for and coordinate with local authorities the location of all underground utilities, and with cemetery maintenance personnel.
- B. Repair any underground utilities damaged during construction. Make repairs at no additional cost to the contract price.
- C. Install and maintain safety fencing around all unattended excavation. Place safety signs adjacent to construction area roadway to the satisfaction of the COR.
- D. All excavations must be backfilled by the end of each workday. Do not leave any open trenches overnight, on weekends or on holidays.
- E. If trenching operation restricts access to a burial section, provide plywood and safety fencing across open trench to allow access to burial section. Provide access to the satisfaction of the COR.
- F. Excavated material is generally satisfactory for backfill. Backfill will be free from rubbish, vegetable matter, frozen materials, and stones larger than 2-inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to pipe will be free of sharp objects that may damage the pipe.
- G. Dress backfilled areas to original grade. Remove excess backfill to on-site location as directed by the COR.

- H. Where utilities conflict with trenching, contact the COR for trench depth adjustments.
- I. Minimum cover: 450 mm (18-inches) over control wire when not in common trench with mainline or lateral piping. (distance from top of control wire to finish grade)
- J. Survey monuments:
 - a. Protect markers during construction.
 - b. If a survey marker is disturbed during construction, the Contractor is responsible for replacing the marker. The Contractor must hire a licensed surveyor to resurvey the location of the marker and replace it in the proper location.

3.3 INSTALLATION OF CONTROL SYSTEM COMPONENTS

- A. Control Units:
 - 1. Install control units at location(s) shown in the drawings.
 - 2. Install electrical connections per control system manufacturer's recommendations.
 - 3. Lightning protection: Follow manufacturer's recommendations regarding lightning protection.
 - 4. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with the identification number (see drawings) of the remote control valve to which the control wire is connected.
 - 5. Connect control wire to the corresponding control unit terminal.
 - 6. Install permanent receiver for hand held radio if not factory installed.
- B. Power Wire:
 - 1. Utilize existing power wire unless determined that the condition of the wire is unusable. Install with a minimum number of field splices. If a power wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate all splices in a separate 300 mm (12-inch) standard valve box. Coil 600 mm (2 feet) of wire in valve box. Brand "WS" in 50 mm (2-inch) high by 5 mm (3/16-inch) deep letters on valve box lid.

2. Green wire shall be used as the common ground wire from power source to all controllers. White shall be the common (neutral) wire. All wiring is to be NEC Code compliant.
3. When determined by the Contractor and approved by the COR, new power wire must be installed parallel with and below mainline pipe. Install wire a minimum 50 mm (2-inches) below top of PVC mainline pipe. Encase wire not installed with PVC mainline pipe in electrical conduit with a continuous run of warning tape placed in the backfill, 200 - 250mm (8-10 inches) below the ground surface, directly over the wiring.
4. Surface mount wire installed above grade in a professional manner with routing approved by the COR.
5. Connect wire to power source.

C. Control Wire:

1. Utilize existing control wire unless determined that the condition of the wire is unusable. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 3 m (10-foot) intervals.
2. Control wiring may be chiseled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling and wire installation. Appropriate chisel must be used so that wire is fed into a chute on the chisel, and wire is not subject to pulling tension. Minimum burial depth must equal minimum cover previously listed.
3. Provide a 600 mm (24-inch) excess length of wire in an 200mm (8-inch) diameter loop at each 90 degree change of direction, at both ends of sleeves, and at 30 m (100-foot) intervals along continuous runs of wiring. Do not tie wiring loop. Coil 600mm (24-inch) length of wire within each remote control valve box.
4. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted.
5. Install spare control and common wires as directed on plans.
6. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in turf areas using a valve box that contains an irrigation valve assembly, or in a separate valve box.

- Use same procedure for connection to valves as for in-line splices.
If a separate valve box is used for wire splices, brand "WS" in 50 mm (2-inch) high by 5 mm (3/16-inch) deep letters on valve box lid.
7. Unless noted on plans, install wire parallel with and below mainline pipe.
 8. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill 150 mm (6-inches) above the wiring.
 9. Cap all exposed wire ends with wire nuts.
 10. Wiring from master controllers to satellites and stub-cuts for future extension shall be located in trench with new mains or in separate trench at back of curb, unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.
 11. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be the same.
 12. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
 13. Provide 300 mm (12 inch) expansion loops in wiring at each wire connection or change in wire direction. Provide 600 mm (24 inch) loop at remote control valves.
 14. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.

3.4 INSTALLATION OF OTHER COMPONENTS

A. Tools and Spare Parts:

1. Prior to the Review at completion of construction, provide operating keys, servicing tools, spare parts, and any other items indicated on the drawings.

B. Other Materials: Install other materials or equipment shown on the drawings or installation details that are part of the irrigation

system, even though such items may not have been referenced in these specifications.

3.5 MAINTENANCE AND OPERATION INSTRUCTIONS

- A. Maintenance and Operating Instructions: Prior to final acceptance, provide verbal instructions, for a period of not less than 4 hours, to the cemetery operating personnel. Provide Maintenance and Operating Instructions for the provided irrigation system in the form of manual(s) as follows:
1. Unless otherwise noted, provide irrigation operation and maintenance information in a 3-ring binder with table of contents and index sheet. Provide sections that are indexed and labeled. Provide the following information:
 2. Catalog cut sheets for control system, wire and wire connectors, ID tags, shop drawings, and all other irrigation equipment shown or described on the drawings and within these specifications.
 3. Manufacturer's Operation and Maintenance manuals.
 4. Manufacturer's Technical Service Bulletins.
 5. Manufacturer's Warranty Documentation.
 6. Recommended routine maintenance inspections for weekly, monthly and annual inspections and recommended actions for the inspections and a recommended method for recording the findings of the inspections.
 7. Predictive schedule for component replacement.
 8. Listing of technical support contacts.
 9. Operation and maintenance submittal package must be complete prior to being reviewed by the COR. Incomplete submittals will be returned without review.
 10. Provide a video of the training for the equipment provided for the project. A copy of the video training shall be provided to the cemetery on a DVD or via a web link. If the cemetery staff is not able to view the web training due to system limitations then the contractor shall provide a DVD of the training at no additional cost to the government. Training shall be suitable for refresher by the previously trained employees, or for use by new employees to learn the system equipment.
- B. Factory Support: Provide free factory support during normal business hours to answer any questions with regard to the usage of products.

3.6 TESTING, OPERATIONAL PERFORMANCE AND ACCEPTANCE

- A. Provide the testing as indicated in previous sections of the specifications.
- B. Demonstrate the operations of the systems as indicated in the project specifications.
- C. Acceptance shall be predicated upon a successful demonstration of the operation of the systems, as described, or demonstrating a fully functional system in automatic operation for a period of 7 days, whichever is more stringent.

3.7 CLEANUP

- A. Upon completion of work, remove from site all machinery, tools, excess materials, and rubbish. Restore site to normal or original condition.

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