GOLF COURSE DESIGN BY

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Irrigation Project Specifications

General, Installation, System Components and Material specifications for the new golf construction project.

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PART 1 - GENERAL

1.1 GENERAL TERMS

A. CONTRACT - Whenever the word "Contract" occurs, it shall mean the agreement between the Contractor and the SWEET ONION GOLF AUTHORITY REPRESENTATIVE by which the Contractor agrees to accept compensation for the performance of the work as shown or described in the Contract and the SWEET ONION GOLF AUTHORITY REPRESENTATIVE agrees to compensate the Contractor for the work.

The Contract shall be comprised of, but not limited to, the following documents: (a) the signed agreement, (b) the Specifications, (c) the irrigation plans or drawings and details.

B. SWEET ONION GOLF AUTHORITY REPRESENTATIVE - Whenever the word "SWEET ONION GOLF AUTHORITY REPRESENTATIVE" occurs, it shall mean the persons whose names or corporate identity or combination of both appear in the proposal form and the Contract. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE may designate a representative, to be known as the Irrigation designer, to represent him in his dealings with the Contractor.

C. IRRIGATION DESIGNER - The Irrigation designer will work with the Contractor as the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's representative. He shall have authority to inspect the work to ascertain whether the work is being performed or has been completed in accordance with the requirements of the Contract and shall be named later, as agreed upon by the Contractor and the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

D. CONTRACTOR - Whenever the word "Contractor" occurs, it shall mean the firm or individual assigned the overall responsibility of providing the finished working irrigation system.

E. WORK - Whenever the word "Work" occurs, it shall mean the improvement herein described, in whole or in part; also, the material, labor and the use of devices necessary to execute the completion of said improvements. All of which shall be in full compliance with the terms and intent of the Plans and Specifications.

F. PLANS AND SPECIFICATIONS - Whenever the terms "Specifications" occur, it shall mean all drawings, written instruction, and materials authorized by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE pertaining to the work.

G. MATERIALS - All materials needed to install the Irrigation System and components, as per Specifications, unless specifically indicated as being furnished by others, must be furnished by the Contractor under this contract. All irrigation components shall be

purchased from one supplier; this is for the SWEET ONION GOLF AUTHORITY REPRESENTATIVE to have one point of contact for the manufacturer's warranty.

H. EXTRA WORK - The term "Extra Work" as used herein refers to and includes work required by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE, which involves changes or additions to the project that are required by the Specifications, and addenda, if any, attached to and made part of the contract.

I. SUPPLIER - Whenever the word "Supplier" occurs, it shall mean the firm who is providing the materials to the Contractor for installation. The Supplier shall be responsible to be in good standing and capable of supplying all necessary materials to keep the job installation flowing and shall also employ qualified factory trained service technicians capable of servicing the system during and after the warranty period.

a.) Due to the Service and support needs over the life of the system the SWEET ONION GOLF AUTHORITY REPRESENTATIVE has pre-negotiated discounts and purchase prices for materials required for this project with Central Turf & Irrigation Supply. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE shall purchase the materials from Central Turf & Irrigation Supply and supply them to the Contractor for use in the construction.

J. GENERAL INTENTION - It is the declared and acknowledged intention and meaning of the Contract, to provide and secure an installed irrigation system, complete and ready for use in strict accordance with the manufacturer's recommended procedures, standard industry practices and as described herein and referenced in the Plans and Specifications.

1.2 SUMMARY

A. This Section includes an Irrigation system including piping and fittings, valves and valve boxes, swing joints and sprinklers, quick coupler valves, air release and drain valves, radios, controls, power wiring if applicable and control wiring.

B. The Contractor shall furnish all necessary materials, labor and equipment required to complete the work of installing the irrigation system in accordance with the contract plans and specifications herein.

C. Restore all damage to existing facilities, lawn areas, other surfaces or utilities to original or better condition, as required by these operations.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum water coverage as per sprinkler placement on the Irrigation Design.

B. Minimum working pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:

1. Pressure Piping: HDPE DR 13.5 pipe as Specified.
2. Circuit Piping: DR 13.5 pipe as Specified.

1.4 CONTRACTOR QUALIFICATIONS

A. REFRENCE LIST - A list of at least three (3) past projects similar in scope to this project must be provided with the bid on this form or on Bidder's Company letterhead. References must be projects installed within the last four (4) years, and must include name of project, city, and state, contact person, phone, and email address (if available), description of work performed and completion date.

B. EXPERIENCE - Contractor shall be a firm engaged in the full-time installation of this type of HDPE system with at least five (5) years' successful experience.

C. DISQUALIFICATION - If references are blank and there is no separate listing on Bidder's Company letterhead, it will be assumed the bid is incomplete and will automatically be rejected. If references are incomplete or fraudulent the bid will automatically be rejected.

1.5 CONTRACTOR'S RESPONSIBILITY

A. The Plans and Specifications do not necessarily set forth every item or detail required to complete the work. Details missing from the plans or specifications shall not be construed as relieving the Contractor from furnishing all labor, materials, equipment, service, or transportation necessary to obtain an operable system. The best prevailing installation practices and methods shall be used.

B. Before bidding on the project, the Contractor shall visit the site and shall be thoroughly familiar with the work to be performed. Any questions which may arise regarding the Plans, Specifications, job site, procurement of the work, or any other matter about the completion of the work and the manner of payment therefore shall be clarified in writing prior to the submission of the proposal.

C. The contractor is responsible for researching what is needed and bring to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's attention any federal, state, and local laws, regulations and permits that may affect cost, progress, performance, or furnishing of the Work.

D. The Contract shall be for a complete and operating system. The payment shall be on the basis set forth in the proposal form. The submission of the proposal form shall be evidence that the Contractor has considered all contingencies which may occur during the construction thereof, and that these are amply covered within the lump sum price which has been proposed.

E. It shall be the responsibility of the Contractor to ensure that all items furnished fit the space available. He shall make all necessary field measurements to ascertain space requirements, including those for connections, and shall order such sizes and shapes of equipment as shall, in the final installation, suit the true intent and meaning of the Plans, Specifications and Contract.

F. Where equipment requiring different arrangement of connections from those shown in the plans is approved by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the intent of the Plans, Specifications and Contract, and to make all changes in the work required by the different arrangement in the connections.

G. PAYMENT BONDING – Optional Bidder must submit a bid with written notice if they are able to secure sufficient bonding should SWEET ONION GOLF AUTHORITY REPRESENTATIVE require payment bond on this project for materials and labor. Written notice shall include bond agency name, address, and local contact. Failure to acknowledge eligibility of payment bond may disqualify the bidder and the bid may not be accepted; additionally, should SWEET ONION GOLF AUTHORITY REPRESENTATIVE decide to exercise a payment bond, Contractors unable to secure a bond will automatically be disqualified.

1.6 SWEET ONION GOLF AUTHORITY REPRESENTATIVE'S RESPONSIBILITY

A. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE will secure all necessary local, state, and federal approvals for the Plans and Specifications. Where these approvals require the issuance of a permit, the SWEET ONION GOLF AUTHORITY REPRESENTATIVE will secure these permits or reimburse the Contractor for his expenses in securing these permits.

B. Following the execution of the Contract by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE, written notice to proceed shall be given to the Contractor and he shall begin and prosecute the work regularly and uninterrupted thereafter to secure completion of the work.

C. For payment requests throughout the project, payments shall be complete and within an agreed upon schedule. Final payment shall be within 30 days after all punch lists are completed to the satisfaction of the Plans and Specifications.

D. The Irrigation designer, as representative of the SWEET ONION GOLF AUTHORITY REPRESENTATIVE, shall have authority to suspend the work, wholly or in part, for such periods as he may deem necessary because of unsuitable weather, or such conditions as might be considered unfavorable to the prosecution of the work.

E. The Irrigation designer shall have the authority to make changes in the work, involving extra costs, but not inconsistent with the purposes of construction.

1.7 SUBCONTRACTING

A. The contractor may utilize the services of qualified subcontractors on those parts of work which, under normal contracting practices, are performed by subcontractors specializing in the class of work.

B. The Contractor shall not award any work to any subcontractor without prior written approval by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE. Approval shall not be considered until the Contractor submits to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE a written statement concerning the proposed award to the subcontractor.

C. The Contractor shall be fully responsible to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by the subcontractors.

1.8 INSURANCE, LEGAL RESPONSIBILITIES & PUBLIC SAFETY

A. Prior to starting work under this Contract, the Contractor shall secure and maintain such insurance from an insurance company authorized to write insurance in the state in which the work is to be executed, as to protect himself, his subcontractors, and the SWEET ONION GOLF AUTHORITY REPRESENTATIVE from claims for bodily injury, death, or property damage which may arise from operations under the Contract. The Contractor shall file a certificate of insurance with the SWEET ONION GOLF AUTHORITY REPRESENTATIVE. Each insurance policy shall contain a clause providing that the policy will not be canceled by the insurance company without thirty days' written notice to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

B. Workmen's Compensation and Employers Liability Insurance shall be secured and maintained as required by the state in which the work is to be executed.

C. The amounts of the insurance shall not be less than the following for Contractor and in addition any subcontractors or agencies:

1. PUBLIC LIABILITY, BODILY INJURY AND PROPERTY DAMAGE INSURANCE shall provide for payment of the following:

    (a.) Injury or death of one person, $5,000,000

    (b.) Injuries to multiple people in a single incident, $5,000,000

2. AUTOMOBILE OR TRUCK PUBLIC LIABILITY, BODILY INJURY AND PROPERTY DAMAGE INSURANCE shall provide for payment of the following:

    (c.) Injury or death of one person, $5,000,000

    (d.) Injury to multiple people in a single incident, $5,000,000

D. The Contractor shall additionally indemnify and save harmless the SWEET ONION GOLF AUTHORITY REPRESENTATIVE from and against all losses and all claims, demands, payments, suits, actions, recoveries, and judgments of every nature and description brought or recovered against the Contractor by reason of any negligence on the part of the Contractor or its agents or employees under the terms of this contract. And in the case any action is brought against the SWEET ONION GOLF AUTHORITY REPRESENTATIVE or any of its agents or employees under the terms of this contract, the Contractor shall assume full responsibility for the defense thereof, and upon their failure to do so on proper notice. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE reserves the right to defend such action and to charge all costs thereof to the Contractor.

E. The Contractor shall additionally name the SWEET ONION GOLF AUTHORITY REPRESENTATIVE as co-insured by all insurance policies noted above. Each shall have a non-cancellation clause providing a minimum of ten days' prior written notice given to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE in the event of cancellation.

1.9 ASSIGNMENT OF CONTRACT

A. No assignment of this Contract, or any part thereof, will be recognized unless such assignment has had the prior written approval of the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

1.10 PAYMENTS

A. The successful BIDDER will present to SWEET ONION GOLF AUTHORITY REPRESENTATIVE no less than two weeks prior to start a mobilization payment not to exceed twenty percent (20%) of the total labor price and additionally an estimated added material payment that will be reconciled after bulk delivery date and quantities are established.

B. The supplier of materials will deliver all the materials at the beginning of the project based on the BIDDER's refined list of materials. The BIDDER will present to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE an invoice for full payment within 10 business days.

C. For the remainder of the project the BIDDER shall request payment by the last Friday of each month for the percentage of the project completed and any additional materials received since the previous payment request. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE will pay the contractor within 10 business days of receipt of the payment request.

D. The BIDDER and SWEET ONION GOLF AUTHORITY REPRESENTATIVE agree to repeat this process until ninety percent (90%) of the agreed to Contract price with all executed DEDUCTS and ADDERS included is reached, at which point the remainder will be paid

within 10 days of A.) the project being complete and B.) A walk through and punch list(s) has been completed per Design and Specification requirements.

E. The Contractor shall supply both a Sales Tax Certificate and an Affidavit and Waiver of Lien for materials for final payment when requested to do so by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

F. If Contractor payments to Supplier become delinquent, and upon written request by Supplier, checks for materials may be issued from the SWEET ONION GOLF AUTHORITY REPRESENTATIVE as two-party checks between the Contractor and Supplier until Contractor's payments are brought to current.

1.11 CHANGE ORDERS

A. Upon agreement of the SWEET ONION GOLF AUTHORITY REPRESENTATIVE and the Contractor, without invalidating the Contract, these parties may, in writing, make changes by altering, adding to, or deducting from the work, with the Contract sum being adjusted accordingly.

B. The value of any such work or change shall be determined in one or more of the following ways:

1. By estimate and acceptance in a lump sum.
2. By unit prices agreed upon.
3. By cost and percentage.
4. By cost and a fixed fee.

C. No extra work shall be performed until the SWEET ONION GOLF AUTHORITY REPRESENTATIVE and the Contractor have agreed on the change and both parties sign the change order.

1.12 PAYMENT DISPUTES

A. The BIDDER and SWEET ONION GOLF AUTHORITY REPRESENTATIVE agree that if a dispute arises that cannot be resolved between the parties; the SUPPLIER of materials will be called in to arbitrate a resolution that is fair and equitable to the intent of the design and specification documents. If an agreement cannot be reached it will be settled in court in the state where the property physically resides.

1.13 INTERRELATION OF DOCUMENTS

A. The Contractor shall always keep at the site of the work one copy of the approved Plans, Specifications, or change orders for use in guidance of the work and for reference purposes by the Irrigation designer.

1.14 RIGHT OF WAY

A. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE will furnish the necessary rights of way for the work and attain all lawful authority that may be necessary for approved crossing or occupation of any streets or alleys, etc. upon which the Contract work will be performed.

1.15 PRIVATE AND PUBLIC PROPERTY

A. In no case shall the Contractor remove fences or buildings or trespass in any way upon private property without first having entered into a written agreement with the property SWEET ONION GOLF AUTHORITY REPRESENTATIVE for such privileges and has submitted a copy of the same with the SWEET ONION GOLF AUTHORITY REPRESENTATIVE. Such agreement shall contain a provision whereby the Contractor is given the right to remove or level down any unsightly pile or piles of material from excavation placed thereon by virtue of said agreement between the Contractor and the property SWEET ONION GOLF AUTHORITY REPRESENTATIVE. The Contractor shall take all proper precautions to preserve all adjacent public and private property and shall protect all land and monuments and property markers until the same have been properly referenced. Where the construction operation necessarily interferes with access to adjoining private property, the Contractor shall provide other suitable means of access.

1.16 ORDINANCES, REGULATIONS, CODES, PERMITS AND INSPECTIONS

A. The Contractor is obligated to comply with all regulations, ordinances, and codes governing the type of work he is doing on the job site.

B. The Contractor is responsible for all permitting associated with the work included under the Contract which is required by the authorities of jurisdiction. Permit fees shall be paid for by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

C. If the authorities of the jurisdiction require inspection at said points of the installation, the Contractor shall arrange for, and be present at, any such inspection. Inspection fees shall be paid for by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

D. If the Specifications for this project conflict with existing ordinances, regulations, or codes, the conflict shall be noted in writing by the Contractor to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE and any necessary changes in work shall follow the previously established procedure for change orders.

E. Specifically relating to electrical power sources, the SWEET ONION GOLF AUTHORITY REPRESENTATIVE shall be responsible for the supply and installation costs of all transmission lines, poles, meters, disconnects, transformers or other equipment necessary that are not provided by the local power utility.

1.17 UNDERGROUND UTILITIES

A. It shall be the Contractor's responsibility to inform the proper Utility Authority (i.e. gas, electric, telephone, cable TV, water authorities, etc.) of work being done on the course. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE will locate, and stake all known underground structures in the field to include all cable and conduits, water lines and drainage lines, etc.

B. All underground utilities so marked which are disturbed or damaged by the Contractor's operations shall be repaired by competent and qualified specialists at the Contractor's expense. Such repairs shall be made under the direction of the Irrigation designer. Unknown and unmarked utilities disturbed or damaged by the contractor's operations shall be repaired by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE at the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's expense. However, because of the ease in which a common drainage line (i.e., 4 inch perforated) can be repaired, as opposed to excavating it by hand, the SWEET ONION GOLF AUTHORITY REPRESENTATIVE will, rather than mark the same, furnish the Contractor with all the materials required to repair the lines as they are cut; and for which the Contractor will not be entitled to any additional compensation.

1.18 BIDDING SUBMITTALS, include:

A. Contractor’s Qualifications as laid out in these specifications include reference list and company experience.

B. Supplier’s Qualifications: Submit on Supplier letter head the supplier of materials address, employee staff, service staff and qualifications showing they have the necessary people and infrastructure to support this project and their ability to support the project with adequate inventory and delivery capabilities.

C. Product Data: Include pressure rating, rated capacity, settings, and electrical data of selected models for the following:

1. Hunter Industries PILOT Central Computer and Controllers. Include wiring diagrams.
2. Weather Station if applicable
3. PILOT Decoder Hub with 2-wire modules
4. Hunter Industries Sprinklers and swing joints.
5. Valves of all types. Include aboveground and underground; general-duty, manual, pressure reducing, air and vacuum release, and quick coupler types.
6. Valve boxes.
7. HDPE Piping materials
8. Fittings include PVC, HDPE, ductile Iron, steel, and brass.
9. Pump Stations, booster stations and any related appliances for moving water.

1.19 CLEAN UP AND DISPOSAL OF WASTE MATERIALS

A. During the progress of the work the Contractor shall keep the premises clear of all debris. Upon completion of the work, the Contractor shall remove all equipment and unused materials and shall leave the premises in a neat and clean condition.

B. The contractor is responsible for handling the removal and transportation of unsuitable excavated material, including rock, roots, and foreign debris to designated disposal areas on the property as identified by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

C. The material is to be stockpiled or spread as directed by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

D. Contractor is responsible to coordinate and bear the cost to remove from site and legally dispose of trash and debris because of packaging, delivery and/or installation of the system.

E. The contractor is responsible to maintain any keep clear any disposal routes designated by SWEET ONION GOLF AUTHORITY REPRESENTATIVE and upon completion restore routes to any pre-determined or preconstruction condition.

1.20 DRAWING OF RECORD

A. The Contractor is responsible for documenting in 8.5 x 11 (or larger) tablet note form a journal of installation information and present copies of that journal weekly to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE and Supplier for the duration of the project. Scanned copies are preferred. The information is to include, but not limited to; measurements between heads, laterals, directional line fittings, splice locations, quick coupler locations, air release valves, drain valve locations and mainline isolation valve locations. Sketches of routing of pipe, crossings of existing wires, drainage, drain tiles, telemetry wires, existing water lines, and any other unique findings during the installation of the system.

1.21 GPS DRAWING OF RECORD

A. Details of the GPS data collection provided by the Contractor or Supplier are as follows.

1. Record Drawings shall provide an accurate record of the actual location of installed irrigation components and course features as recorded by a GPS system as further defined below.
2. GPS Provider shall generate base sheet and Record Drawing and pump station buildings, paths, all installed irrigation components, etc.) by GPS measurement. An upgraded version of the installation plans is not acceptable.
3. Drawings shall indicate the location, type and size of pipe, valves, remote control valves, sprinkler heads, and quick coupling valves. Indicate measurements

relative to the two nearest heads for each isolation, drain, remote control, and air release valves.

4. Drawings shall also indicate controllers, power, telephone, and communication wire runs, and splices in these cables. Indicate wire size and type. Designate the location of the end of each known spare 24V wire, and splices other than those associated with VIH sprinklers, remote control valves, or field controllers. Designate satellite and control station numbers in accordance with the pattern specified by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's Representative. Indicate measurements relative to the two nearest heads for each wire splice contained in valve boxes.
5. Appropriately named AutoCAD blocks, including separate blocks and layers representing each sprinkler type and nozzle set used in the system, shall represent each of the respective components. Block and layer names shall be consistent with irrigation industry standard naming conventions as approved by engineer. The layer names shall also incorporate some form of prefix that specifically separates various groups of layers alphabetically by general type (course features, sprinklers, electrical, utilities, other mechanical items, etc.).
6. In addition, all symbols used shall have a similar appearance to those used within the irrigation design itself.
7. The CAD drawing shall be configured to plot at a scale of 1” = 100' at a standard width of 36”. If rotation of the drawing area is required for plotting, the point of rotation shall be identified on the drawing and noted as to the specific angle of rotation. If segmentation of the drawing area is required for plotting, this shall be accomplished with the use of multiple viewports in ACAD paper-space. Under no circumstances is it acceptable to break the model drawing into separate sections.
8. Once the record drawing has been completed in CAD, a minimum of two-color copies shall be plotted of each sheet in the set. These plotted copies shall be delivered to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's engineer. Any changes, concerns and/or other required modifications shall be noted on one of the copies and returned to the GPS Provider. If the number of modifications is substantial, at the discretion of the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's Representative, the GPS Provider may be required to repeat this process before final approval is given.
9. After all modifications have been completed and has had final approval of the Record Drawing by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's and Contractor's Representative, the AutoCAD drawing shall be formatted in such a way as to facilitate conversion to the PILOT Central Control Mapping Application.
10. This process shall include, but not be limited to the following:

    a.) All Splines converted to Polylines.

    b.) All base sheet specific areas constructed as closed totally encompassing polylines (the segment lengths of which are of small enough as to allow

proper representation of all close radius turns from within the irrigation mapping application)

c.) All hatched areas removed from drawing.

d.) All multi-line text converted to single line text.

e.) All satellite attributes are filled with appropriate control information i.e.: Group, Satellite, etc.

f.) All sprinkler attributes are filled with appropriate control information i.e.: Group, Satellite, Station, and Area, Etc.

g.) All solenoid valve attributes are filled with appropriate control information i.e.: Group, Satellite, Station, and Area, Etc.

h.) Perform all other related modifications required by specific irrigation mapping application manufacturer to import all GPS data.

11. GPS Provider is responsible for converting the GPS data file to the proper format for use with the Irrigation Mapping Application and providing complete interactive mapping. The GPS Provider is responsible for creating and coloring the map, transferring it into the Irrigation Mapping Application, adding control elements (Sprinklers, Switches, Satellites, Sensors, Etc.) to the map and linking all databases to the map.
12. The irrigation map shall be structured as follows:

a.) All base sheet and record drawing layer areas added to map as polygons, filled and colored appropriately.

b.) All base sheets and record drawing line objects areas added to map and colored appropriately.

c.) All base sheets and record drawing text objects areas added to map and colored appropriately.

d.) All Sprinklers added and linked to irrigation control software.

e.) All Solenoid Valves added and linked to irrigation control software.

f.) All Decoder Hubs were added and linked to irrigation control software.

g.) All Sensors added and linked to irrigation control software.

h.) All other base sheets and record drawing objects added to map and colored appropriately.

i.) All point items defined by symbols are substantially like those used in the irrigation design and in the AutoCAD drawing file.

13. After the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's engineer approves Record Drawings, Irrigation Programming, and Irrigation Map development the GPS Provider shall at a minimum, provide the following:

a.) 2 copies of colored plots of each sheet in record drawing - 36” x required length - Scaled to 1” =100' on 24# paper

b.) 1 Laminated color copy of each sheet in record drawing - 36” x required length - Scaled to 1” =100'

c.) 2 sets of laminated copies of individual holes broke-out on 8.5” x 14” paper
d) 2 Thumb drives containing the following.

1.) Final approved record drawing prior to any map conversion preparation in AutoCAD .dwg. (Version to be determined by SWEET ONION GOLF AUTHORITY REPRESENTATIVE)

2.) Final approved record drawing after map preparation in both AutoCAD .dwg. (Version to be determined by SWEET ONION GOLF AUTHORITY REPRESENTATIVE)

3.) All final approved Irrigation Mapping application data

d.) One Thumb drive shall be sent to SWEET ONION GOLF AUTHORITY REPRESENTATIVE and one to Contractor.

1.22 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Corporation regularly engaged in the manufacture of irrigation materials, and products required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. Contractor’s Qualifications: Firm with a minimum of 5 years of successful installation experience on projects of similar size and scope as specified product. The contractor shall have experience in installing and fusing HDPE pipe, 2-wire, or standard control irrigation systems. Provide a minimum of five (5) references of previous projects of like size and scope.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of sprinkler piping components and are based on specific types and models indicated. Other manufacturers’ products with equal performance characteristics may be considered. Refer to Division 1 Section “Substitutions.”

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Comply with requirements of utility supplying water and authorities having jurisdiction for preventing backflow and back siphonage.

F. Comply with ASTM F 645, "Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems."

G. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.

H. The contractor has engaged in the installation of HDPE pipe and the Irrigation designer has been certified in the installation of HDPE pipe.

I. The Irrigation designer must have a commanding understanding and use of the English language.

1.23 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare materials according to the following:

1. Ensure that materials including wire, sprinklers, swing joints, fittings, and valves are dry and internally protected against dust, moisture, and corrosion.
2. Protect metal and plastic components against damage to threaded ends and flange or fused faces.
3. Set materials in the best position for handling. Set materials in the best packaging to prevent rubbing and rattling that can damage epoxy coating, paint, flanges, or fused faces.

B. Material must be Stored in the following manner:

1. Do not remove end protectors covering threads unless necessary for inspection; then, reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.
3. Inside storage of pipe shall be elevated above grade. Do not exceed structural capacity of floor when storing inside.
4. Outside storage of pipe shall be kept from direct sunlight and resulting damage. Tarps shall be provided as required. Pipe must be supported to prevent sagging, bending or damaging pipe when using fork loaders for lifting and transport.
5. Protect flanges, fittings, and specialties from damage, moisture, and dirt. The project engineer or SWEET ONION GOLF AUTHORITY REPRESENTATIVE's representative may reject any proposed product deemed not capable or suitable for installation. All material shall be new no used material accepted.

1.24 PROJECT CONDITIONS

A. Investigate and determine water supply, water pressure, and flow characteristics after the pump system.

B. Site Information: Reports on subsurface condition investigations made during design of Project, when available, are for informational purposes only; data in such reports are not intended as warranties of accuracy or continuity of conditions (between soil borings). THE SWEET ONION GOLF AUTHORITY REPRESENTATIVE assumes no responsibility for interpretations or conclusions drawn from this information.

C. It shall be the Contractor's responsibility to inform the proper Utility Authority (i.e., Gas, electric, telephone, cable TV, water authorities, etc.) of work being done at the construction site. The contractor will be responsible for contacting the applicable State one call system prior to starting the project. The SWEET ONION GOLF AUTHORITY REPRESENTATIVE will locate, and stake all known underground structures in the field to include all cable and conduits, water lines and drainage lines, etc. All underground utilities so marked which are disturbed or damaged by the Contractor's operations shall be repaired by competent and qualified specialists at the Contractor's expense. Such repairs shall be made under the direction of the Irrigation designer. Unknown and unmarked utilities disturbed or damaged by the contractor's operations shall be repaired by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE at the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's expense.

1.25 SEQUENCING AND SCHEDULING

A. Coordinate irrigation sprinkler piping with work specified in Division 2 Section "clearing and reseeding."

B. Coordinate irrigation sprinkler piping with sub-drain system and utility work.

1.26 ORDINANCES, REGULATIONS, CODES, PERMITS AND INSPECTIONS

A. The Contractor is obligated to comply with all regulations, ordinances, and codes governing the type of work he is performing on the job site. Permits needed for the work included under the Contract which are required by the authorities of jurisdiction, shall be obtained by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE,

B. If the authorities of Local, County or State jurisdiction require inspection at said points of the installation, the Contractor shall arrange for, and be present at, any such inspection and operation of any or all sprinkler zone stations.

C. If the Specifications for this project conflict with existing ordinances, regulations, or codes, the conflict shall be noted in writing by the Contractor to the SWEET ONION

GOLF AUTHORITY REPRESENTATIVE and any necessary changes in work shall follow the previously established procedure for change orders.

1.27 CONTRACTOR'S GUARANTEE

A. It shall be the responsibility of the Contractor to warranty the work for a minimum period of (1) one-year from the date of final acceptance by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

B. During this period the Contractor shall be liable for the following:

1. Perform all repairs and/or corrections, which may result from inferior workmanship or defective material.
2. Repair disturbed area found to have settled more than ½ inch from its original grade. These areas shall be re-leveled by the contractor at his expense. (Natural spring areas excluded).
3. The Contractor will guarantee all sprinkler heads to be level to grade for a period of one year from the date of completion. Any heads that settle or heaved during the warranty period shall be reset at the Contractor's expense.
4. Repair of any leaks or system malfunctions in the irrigation system.
5. Cleaning sediment resulting from the contractor's construction activities from any or all valve boxes.
6. Adjusting all sprinklers with the correct arc and nozzle height adjustment.
7. Adjustment of electric valves to the correct pressure settings and adjustment of the valve operation settings.
8. Programming the Hunter PILOT Decoder Hub(s) to correct run times.

C. Winterization of the system for the first winter season following the completion and final acceptance of the system as well as winterization of any parts of the system needing to be protected should installation span over winter months.

D. Spring startup of the system for the first spring start up following completion and final acceptance of the system as well as any startups of any parts of the system needing to be started up should installation span over winter into the spring.

E. Emergency repairs, when necessary, may be made by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE without relieving the Contractor of his guaranteed obligation.

F. If the Contractor does not respond to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's request for repair work within 10 days, the SWEET ONION GOLF AUTHORITY REPRESENTATIVE may proceed with such necessary repairs and charge the Contractor for all expenses incurred in the repair work.

1.28 TRAINING OF MAINTENANCE PERSONNEL

A. Upon completion of the work and acceptance by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE, the Supplier and Contractor shall be responsible for jointly training the maintenance personnel in the operation and maintenance of the system. The Supplier and Contractor shall furnish copies of all available parts lists, troubleshooting lists, specification sheets, winterization and start up procedures as per the manufacturer and catalog sheets and an as built to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE prior to final payment.

B. The Supplier and Contractor shall provide reasonable training to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE at no additional charge for the first year. The year shall commence on the central warranty coverage starting date. Should further training be necessary later, training will be provided at prices in effect at the time of training.

1.29 COMPLETION AND FINAL ACCEPTANCE

A. When the work has been completed, the Contractor shall notify the SWEET ONION GOLF AUTHORITY REPRESENTATIVE, and arrangements shall be made for a final inspection of the work. Prior to this inspection, the Contractor shall remove from the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's property all temporary structures, rubbish and waste materials resulting from the operation. After the final inspection, but before a final payment, the Contractor shall remove all the construction equipment, tools, and supplies from the property of the SWEET ONION GOLF AUTHORITY REPRESENTATIVE. No final payment shall be made prior to clean up, final inspection and removal of construction equipment.

1.30 FINAL INSPECTION

A. Within ten (10) days of the Contractor's notice that the installation is complete and satisfactory pressure testing as per manufacturer's specifications has been completed, the SWEET ONION GOLF AUTHORITY REPRESENTATIVE will inspect the installation and either give final acceptance or prepare a "punch list" of unacceptable items which must be corrected by the Contractor. Upon correction of the "punch list" items by the Contractor, SWEET ONION GOLF AUTHORITY REPRESENTATIVE shall give final acceptance and make final payment to Contractor.

PART 2 - INSTALLATION, SYSTEM COMPONENTS, AND MATERIALS

NOTE: All major irrigation components (Pilot Computer Central, Pilot Decoder Hubs, GT800 Series sprinkler heads, sensors, electric valves, and quick coupler valves) shall be manufactured by Hunter Industries. Hybrid systems (systems with multiple manufacturers' products) will NOT be approved or accepted as an alternate.

2.1 GENERAL

A. Install HDPE pipe, wire, valves, Hunter GT800 Series sprinklers, Pilot Decoder Hubs and all other appurtenances in strict accordance with the manufacturers recommended procedures, standard industry practices and the Plans and Specifications.

2.2 ORDER OF WORK AND PLAN PROCEDURE

A. It shall be to the advantage of both the Contractor and the SWEET ONION GOLF AUTHORITY REPRESENTATIVE for the Contractor to plan his work to interfere as little as possible with daily activities. The Contractor is to notify the SWEET ONION GOLF AUTHORITY REPRESENTATIVE as to the work schedule for the next day, to best schedule daily activities.

2.3 STAKE OUT

A. The Contractor, SWEET ONION GOLF AUTHORITY REPRESENTATIVE, or Irrigation designer, and Supplier shall stake out all proposed sprinkler heads, quick coupler, valve locations and pipelines prior to trenching operations. The location of said items shall conform in general with the locations shown on the plans. The location of the flags will be checked by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE prior to trenching. Of particular importance is the location of sprinkler heads where prevailing winds, surface slope and special ground conditions must be taken into consideration. The final location of all sprinklers must be approved by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's representative. Any discrepancy with sprinkler count shall be brought to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE and Supplier's attention.

B. Contractor will be responsible to cup cut sod, flip over install whisker and paint with color coordinating ground spray paint for Sprinkler and Quick Coupler locations after hole is completely staked.

2.4 SALVAGE OF EXISTING MATERIALS

A. The Contractor is responsible to remove abandoned controllers and controller components in a safe manor. Care should be taken to keep the components in operational condition.

B. The Contractor is responsible to remove abandoned sprinklers and quick coupler valves. Cut pipes shall be filled with expanding foam spray to eliminate ground settling over time. Ground repair shall be performed with similar care as to ground repair around new sprinklers and valves.

C. The contractor will be responsible for collecting and handing off to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE the removed components.

2.5 IRRIGATION SYSTEM CENTRAL CONTROL

A. The Pilot Network refers to the entire Hunter Golf irrigation control system, including the Pilot Command Center, Field Interface, and Integrated Hubs. The Pilot Command Center consists of the central computer and software necessary to manage golf course irrigation. The software will arrive already loaded on a dedicated compact computer along with the latest Windows® operating system. All necessary supporting utilities and drivers are also preloaded. An internet connection is required to obtain remote technical support from Hunter and accept Pilot Command Center Software (CCS) updates. A clean, climate-controlled indoor environment is required to ensure reliable operation of the central computer.

B. The computer shall be connected to an indoor, wall-mounted Pilot Field Interface via USB connection. The Field Interface takes the local output from the computer and communicates this information over long distances to the controllers or Integrated Hubs that are connected to the irrigation valves.

C. The Field Interface shall come with 8' (2.5 m) of USB cable. It's designed to operate within close range of the central computer. The Field Interface has its own screen and user interface. These features are only used during setup and diagnostics; they are not used for irrigation control functions.

1. A Field Interface is always required to link the central computer to the Integrated Hubs. Most systems require just one Field Interface. To reach the Integrated Hubs, the Field Interface may be loaded with up to two types of communications:
2. Hardwire cable
3. Narrowband (UHF) radio
4. Field Interfaces are available as complete, pretested units. See the following chart for configurations:

D. MultiTalk™ Technology

With proprietary MultiTalk Technology, the Pilot Network provides more flexibility than any other system in the industry. MultiTalk capabilities include utilizing:

1. Multiple wire methods by combining Integrated Hubs and Field Controllers on the same system.
2. Multiple communication technologies by switching between wireless and hardwired communication on the same system.
3. Multiple remote-control options with the handheld StraightTalk™ Maintenance Radio and free PilotFCP Utility Program, which allows you to schedule basic programs remotely from a computer or tablet.
4. Multiple frequencies in wireless modules to repeat the signal and forward communications to controllers in remote locations on the course.

E. Communication Options

F. There are two main types of communication options to connect the central computer and the Integrated Hubs throughout the setting.

1. Hardwired communications offer reliable, secure communications with in-ground cable.
2. Wireless communications offer trenchless connections and reduce the chances of system damage due to lightning. Wireless communications require a site survey in advance to determine antenna selection and placement. Not all terrain is suitable for wireless connection.

G. Hardwired Communications

1. In a hardwired system, physical wiring links each controller or Integrated Hub to the Field Interface. A Pilot Network may be wired from the Field Interface to the first controller, from there to the next controller, and so on to connect all controllers.
2. A single run of hardwire cable to the field is referred to as a “leg” of communications. Some systems may require more than one leg. Legs can be split at communication modules only to go in multiple directions.
3. Hunter supplies GCBL cable for these connections. GCBL conveys 20 mA loop communications from the Field Interface to the controllers. Each controller is connected to the next by a single run of cable. The cable does not need to be looped back to the Field Interface. The wiring just stops at the last controller in any run of cable.

H. Hardwire Communication Module

I. Any device (Field Interface, Field Controller, or Integrated Hub) that will communicate via hardwire cable requires a PILOT-HWR Hardwire Communication Module. At least one PILOT-HWR must be installed in the Field Interface to connect to Integrated Hubs or controllers via GCBL. Install at least one PILOT- HWR in each additional device that will be part of the communications link. Each PILOT-HWR has an input for hardwire from a preceding device. Each PILOT-HWR can support up to two outputs to the field to continue to other devices. There is no practical limit to the number of controllers that can be connected in a leg of communication.

1. Installers can also split a leg of communication into two different directions at the PILOT-HWR by using the two outputs to go separate ways.
2. Never T-splice GCBL cable in the middle of the cable run. Splitting the wire into multiple legs will divide the communication signal strength, causing communication failures. This is a violation of the signal specification.
3. Hardwire runs may only be split at the PILOT-HWR communication module in a controller.
4. To allow more than two output paths, it is possible to have more than one PILOT-HWR in a device. A controller with two PILOT-HWR modules could accept one input and split the signal into four separate outputs at any given controller.

Jj.

PILOT-DH INTEGRATED HUB POWER			
Type	Distance	Module	Requirements
Hardwire cable	10,000' (3,000 m) between each device	PILOT-HWR	GCBL communications cable
Narrowband radio	2 mi (3.5 km)	PILOT-MOD-UHF	UHF antenna, government license

J. Narrowband (UHF/VHF) Radio Communications

1. Narrowband radios use modern wireless radios to communicate. These radios require a government license to operate in almost every country in the world. They offer significant flexibility and reduced cost in system design, when and where they are practical. Pilot radios are “narrowband,” which means they conform to modern 12.5 kHz bandwidth regulations. Pilot radios are available in various frequency ranges. Their effective range is approximately 2 mi (3.5 km), depending on terrain conditions. Buildings and hills may significantly reduce this coverage.
2. Narrowband Radio Modules

   a.) Any Field Interface, Field Controller, or Integrated Hub that will use narrowband radio communications requires a PILOT-MOD-UHF Communication Module and an appropriate antenna.

   b.) To connect to Integrated Hubs or controllers via radio, at least one PILOT-MOD-UHF plus an antenna must be installed in the Field Interface. One PILOT-MOD-UHF and an antenna must also be installed in each additional

   c.) Field Controller or Integrated Hub that will be part of the communications network.

   d.) Narrowband radio systems normally broadcast from and to the Field Interface to all controllers in the system individually. The signals are not relayed from one controller to the next. The Field Interface talks directly to each radio controller in turn.

NARROWBAND RADIO SPECIFICATION	
Frequency range	450 to 470 MHz (primary); 400 to 440 MHz and 150 to 174 MHz available for select markets
Bandwidth	12.5 kHz
Output power	2 W, default setting (1 to 5 W with extended lead times)
Antenna connection	Female BNC

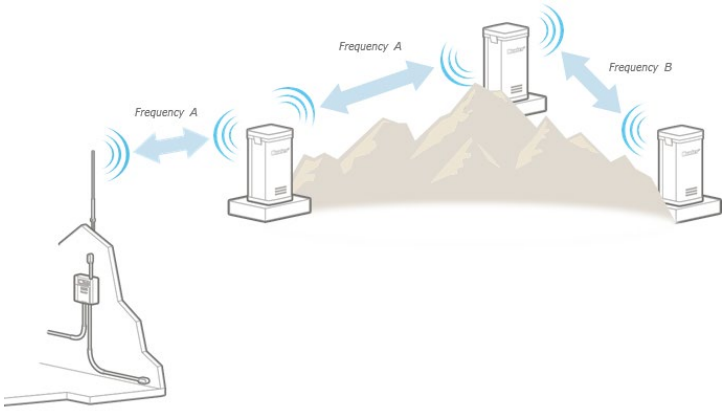
K. Site Surveys and Antenna Options

1. All radio installations require a site survey in advance of actual installation. This is performed by a qualified technician at the actual site. The site survey determines which locations are suitable and which antennas are required. Hunter offers several types of narrowband UHF antennas for golf project installations.
2. Hunter antenna options are available in the 450 to 470 MHz range. Equivalents in other frequency ranges (For appropriate international markets) are available through local professional radio dealers. It is always the designer's responsibility to understand local regulations and licensing requirements for radio installations.

L. Utilizing Multiple Frequencies

1. With MultiTalk Technology, multiple frequencies can be used to relay the signal to remote locations on the course. In the example below, Frequency A is used to communicate from the Pilot Field Interface to the first two controllers. A second UHF communication module, programmed with Frequency B, is installed in the second controller. It forwards the signal to the third controller behind the hill that's blocked from receiving Frequency A. This flexibility improves performance and makes future expansion easier.

PILOT INTEGRATED HUB POWER			
Type	Model	Description	Requirements
Field Interface base antenna	RA5M	5' (1.5 m) fiberglass mast, omnidirectional	RG850NFNF or custom length of 50 Ω antenna cable
Pedestal lid antennas	IMMS-ANT2	Stealth lid-mounted internal antenna	N/A (antenna, cable, mounting plate included in part)
Specialty long range	RA3F, RA6F	Yagi directional antenna	RG850NFNF or custom length of 50 Ω antenna cable

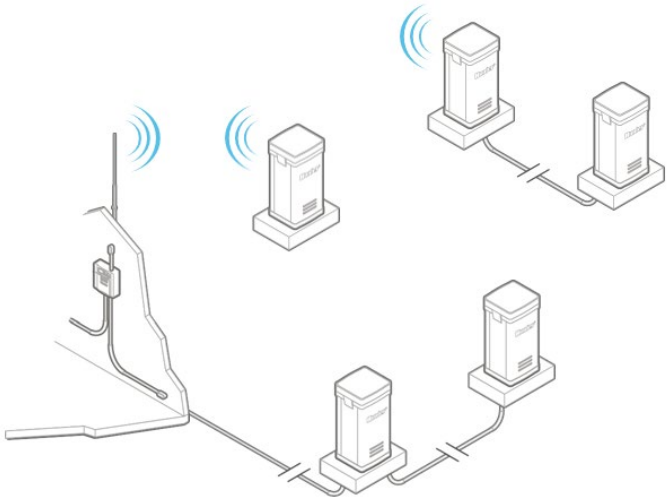


2. Hardwire and Radio Combination

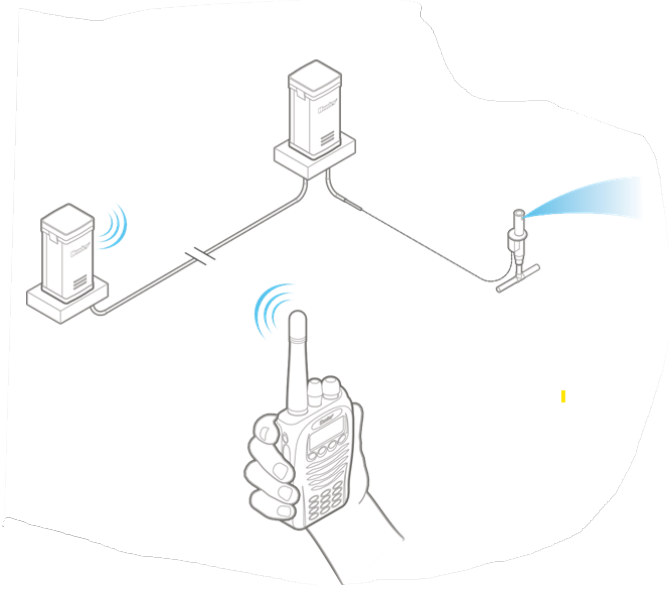
a.) Radio may be combined with hardwired communications in certain installations. The Field Interface has two communication slots. To operate

different areas, the Field Interface can accommodate both hardwire (PILOT-HWR) and radio (PILOT-MOD- UHF).

b.) Systems may be hardwired up to a certain point. Then radio can be added to move past a fixed obstacle such as a lake or road. This technique may only be used up to two times per hardwired leg. It requires PILOT-MOD- UHF modules and antennas in the controllers using the radio link. The Field Interface would not require a radio and antenna in this configuration.



3. Maintenance Radio



a.) All Hunter Pilot Network systems can use Maintenance Radio remote control with legally licensed UHF radios (Hunter model TRNR, specify frequency). Controllers with PILOT-MOD-UHF radio communications can be addressed directly with StraightTalk™ Technology. No additional steps are required.

b.) Controllers with PILOT-HWR hardwired communications may be addressed via any radio-equipped Field Interface or controller. At least one device in the system must have a legally licensed narrowband radio (PILOT-MOD-UHF) for Maintenance Radio to be used. The Maintenance Radio remote can then address any other controller in the system.

2.6 PILOT CENTRAL CONTROL – PILOT DECODER HUB

A. The decoder hub shall be housed in a lockable, weather-resistant plastic pedestal. The hub shall be completely solid state with tactile keys on a membrane overlay for programming and shall be fully illuminated for low light operations. The hub shall include an optional password setting for security purposes.

B. The hub shall store all irrigation schedules in non-volatile, field resident memory and shall not be dependent on the central computer to irrigate or to create or edit watering schedules.

C. The hub shall have a minimum of [250, 500, 750 or 999] decoder addresses using up to four decoder output modules. The hub shall supply sufficient power to activate up to 20 standard Hunter golf solenoids simultaneously per decoder output module and up to 120 solenoids in a fully loaded hub.

D. Each decoder output module shall be equipped with heavy duty lightning protection as a standard feature and shall be equipped with replaceable automotive style fuses. Each hub shall be furnished with spare fuses in a holder designed for this purpose, immediately above the output modules.

E. All hub components shall be replaceable with no tool other than a standard #2 Phillips screwdriver, which shall be furnished and stored within the controller lid.

F. Each controller shall have a copper clad steel ground lug and shall be grounded in accordance with ASIC specifications to a minimum of 10 Ohms or less.

G. The hub shall have a keypad-selectable identification number, variable schedule lengths from one to 32 days, 64 independent schedules (which are automatic and can operate in series, parallel, or independent of each other).

H. The hub shall have 64 automatic schedules with maximum station run times of at least 6 hours. The hub shall have seasonal adjustment which scales scheduled runtimes from 1% to 300%.

I. The hub shall include a rain shutdown feature which can prevent automatic operation for 1 to 31 days or indefinitely.

J. The hub keypad shall permit local editing of decoder/station assignments, both for initial setup and for editing decoders after subsequent repairs or replacement. The

keypad shall permit assignment of stations to up to 64 “blocks” of up to 10 stations each, so that a single run time may be assigned to groups of stations for simultaneous activation.

K. The hub shall permit direct programming of decoder addresses via an onboard programming port.

L. Additional specifications for Standalone hubs:

M. The hub shall be upgradable after initial installation to either hardwire or wireless central communications, with the addition of a communications module.

N. Additional specifications for Hardwire Communications:

O. The hub shall feature hardwire communications to provide true two-way communications with the central computer. The communications link shall be over GCBL cable, two twisted pair, 18 AWG solid copper, foil-shielded with drain wire and PVC jacket (or GCBLA armored cable), and no other cable shall be acceptable. The communications circuitry shall include transmit and receive LEDs for the individual hub, and all communications between the hub and the central computer.

P. The hub shall have the ability to respond to remote Maintenance Radio commands received by the central interface and relayed over the hardwire communications path.

Q. The hub shall be Hunter Golf Model PILOTDH ___ [station size, communication option].

Additional specifications for Radio Communications:

R. The hub shall be radio-equipped for communications to the central computer. The radio shall be an (FCC/DOC) type-accepted UHF transceiver of not more than 2 Watts power output to provide true two-way communications with the central computer and Maintenance Radio, in full compliance with governmental standards and regulations. The radio antenna shall be integral to the hub pedestal and shall not protrude above the top plane of the hub, to prevent damage. The communications circuitry shall include transmit and receive LEDs for the individual hub, active carrier LED showing all transmissions on the frequency, and a valid DTMF LED showing Straight Talk™ Maintenance Radio commands. The radio hub shall feature a keypad-activated transmit test tone of 5 seconds duration for diagnostics.

S. The hub shall automatically include direct Straight Talk™ Maintenance Radio capability for activation of stations or programs from a portable radio. Maintenance Radio operations shall not require the central computer to function and shall operate whenever the hub is powered, regardless of the central’s status.

T. An FCC or equivalent international license is required to operate all radio-equipped hubs. The license shall be obtained and presented with the order for the radio hardware.

2.7 SPRINKLER HEADS – HUNTER TTS800 SERIES 1.5" SPRINKLERS

A. The Sprinklers MUST BE Totally Top Serviceable. Decoders, solenoids, pressure regulation must be accessible and serviced from the TOP of the head. NO digging must occur to service these items.

B. Parts and Material

1. TTS800 Series Sprinkler Body

   a.) The main body is made of ABS. The threaded insert is a gray colored PVC in ACME style to prevent over tightening or damage to swing joints or the sprinkler bodies.

   b.) The Sprinkler body shall contain a pre- installed two-wire decoder module version (D), or come as a check-o-matic version (COM).

2. Dimensions

   a.) The diameter is 7.25" and the height is 12.25" The inlet threads are female 1.5" ACME.

C. Warranty

1. Hunter Industries warrantees this product to be free of defects in materials or workmanship under normal use for a period of five (5) years from the original date of manufacture. If a defect in a Hunter Industries product is discovered during the applicable warranty period, Hunter Industries will repair or replace, at its option, the product, or the defective part. This warranty does not extend to repairs, adjustments, or replacement of a Hunter product or part that results from misuse, negligence, alteration, modification, tampering, or improper installation and/or maintenance of the product. This warranty extends only to the original installer of the Hunter product. Hunter's warranty applies only to products installed as specified and used as intended for irrigation purposes. Hunter's warranty shall be limited to defects in materials and workmanship during the warranty period, and shall not extend to situations in which the product was subjected to improper design, installation, operation, maintenance, application, abuse, improper electrical current, grounding, service other than by Hunter Industries authorized agents, operating conditions other than that for which it was designed, or in systems using water containing corrosive chemicals, electrolytes, sand, dirt, silt, rust or agents that otherwise attack and degrade

plastics. Hunter Industries' warranty does not cover component failures caused by lightning strikes, electrical power surges or unconditioned power supplies.

D. Function and Operation

1. Operating pressure

   a.) The operating pressure as regulated is from 50 to 100 psi. The max recommended pressure is 150psi.

   b.) The pressure loss across the valve with a flow of 53 GPM at 100 PSI dynamic at the sprinkler inlet must be no more than 15 psi. The inlet valve's rolling diaphragm must have a stroke suitable to provide minimal pressure loss with flows up to 60 GPM.

   c.) The check-o-matic version of the valve must have a minimum check height capability of 20 feet and a maximum check height capability of 25 feet.

2. Flow description

   a.) The sprinkler must be able to handle flows of 8.8 GPM – 57.9 GPM

   b.) The inlet valve must have a Filter Sentry contamination scrubbing device on the filter screen.

3. Nozzle operation

   a.) The rotors must have available twelve (12) interchangeable standard 22.5° trajectory nozzle sets and nine (9) 15° trajectory low-angle nozzle sets discharging 8.2 to 57.5 GPM (1.86 to 13.06 m3/hr; 31.0 to 217.7 l/min).

4. Internal ratcheting description

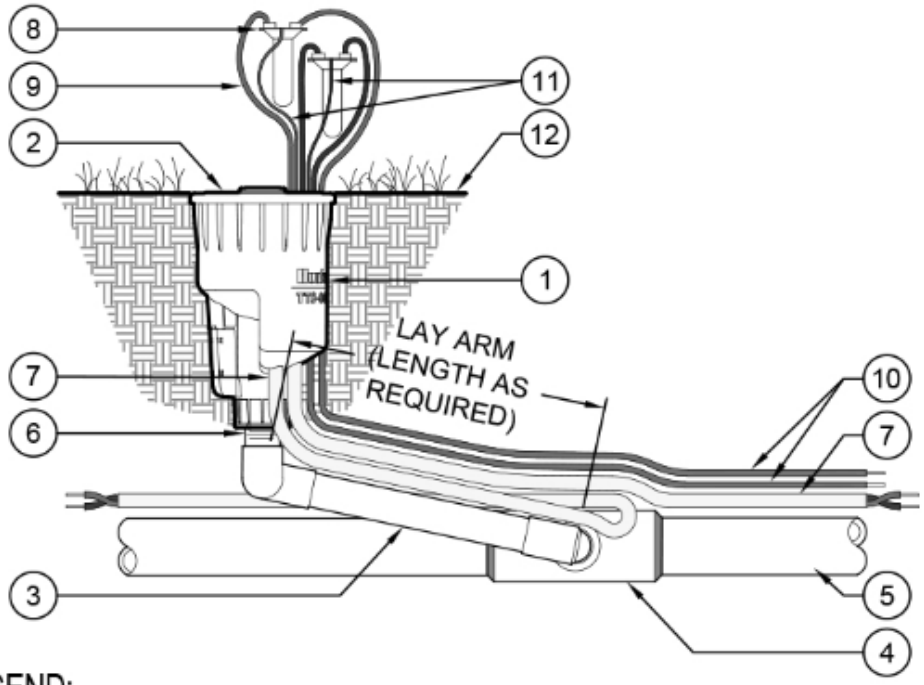
   a.) The Sprinkler must be available in dedicated part-circle (GT880) and adjustable part / full-circle (GT884 and GT885) options. The adjustment range is 60 degrees to full circle in all phases of installation (i.e., before installation, after installation while static, and after installation while in operation).

5. Serviceability

   a.) The pressure regulator, solenoid, and internal riser assembly MUST all be serviceable without de-pressurizing the system.

   b.) The inlet valve and other components in the flange are serviceable with the system de-pressured. The inlet valve's rock screen and cage part must be removable for field serviceability. The inlet valve must have a field replaceable VCD-seal assembly. The inlet valve screen must also be replaceable.

6. Installation of the GT880 series heads for 2-wire shall be as shown in diagram below:



DETAIL LEGEND:

1. TTS800-DD POP-UP ROTOR, 2-STATION DECODER
2. DECODER/SOLENOID ASSEMBLY INSIDE TTS COMPARTMENT
3. HUNTER SWING JOINT ASSEMBLY (HSJ). INSTALL SWING JOINT LAY ARM AT 30°- 45° ANGLE TO THE LATERAL LINE.
4. LATERAL LINE FITTING PER PLAN.
5. LATERAL LINE PER PLAN. SOIL DEPTH PER PLAN.
6. 1½" [40 mm] MALE ACME
7. HUNTER TWO-WIRE CABLE
8. WIRE SPLICE IN TTS COMPARTMENT
9. TWO-WIRE PATH
10. CONTROL WIRE TO SECOND ROTOR HEAD
11. DECODER WIRE
12. FINISHED GRADE

2.8 HIGH DENSITY POLYETHYLENE (HDPE) PIPE, VALVES, AND FITTINGS

A. GENERAL

1. SCOPE

a.) This section specifies high density polyethylene (HDPE) pipe, valves, and fittings, including acceptable fusion technique and practice, and safe handling and storage. Pipe description, specification, and meeting all applicable testing and material properties as described by the applicable standards referenced in this specification or as required within this specification.

2. MANUFACTURER REQUIREMENTS

1.) High density polyethylene (HDPE) pipe and fittings shall be manufactured in accordance with the following standards

2.) ASTM D3035 – ½ in through 24-in pipe

3.) ASTM F714 – 3-in through 54-in pipe

4.) AWWA C901 – 1/2 In. (13mm) through 3 In. (76 mm) pipe and tubing

5.) AWWA C906 – 4 In. (100 mm) through 63 In (1,600 mm) pipe and fabricated fittings

6.) ASTM D3261 – butt fusion fittings, saddles, and flange adapters

7.) ASTM F1055 – electrofusion couplings and saddles.

8.) ASTM F2206 – fabricated fittings

B. FUSION TECHNICIAN REQUIREMENTS

1. Each Fusion Technician shall be separately qualified to make each type of fusion joint. Fusion joint types are butt fusion, saddle fusion, electrofusion, and socket fusion. Only AquaFUSION® qualified technicians shall make fuses during initial construction and during the contractor warranty period. Qualification to make one type of fusion joint shall not qualify a Fusion Technician to make a different type of fusion joint.
2. Each Fusion Technician making butt fusion joints shall be qualified to make butt fusion joints in accordance with ASTM F2620. Qualification shall have occurred not more than 12 months before performing fusion joining on site in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing (bend-back test) in accordance with ASTM F2620. Prior to any fused HDPE pipe being installed in the trench, the contractor shall perform a bend back test (in accordance with ASTM F 2620). These tests shall be random. The fusion technician will not know in advance which of his/her

fusions will be tested. The completed test specimen shall be manually data logged (each will be marked clearly with name of technician, date, passed or failed written with a silver, metallic Sharpie marker). These completed test specimens will remain onsite for inspection of the irrigation consultant till the project is completed. Tests will be performed as follows, one test per diameter, per week, per technician.

3. Each Fusion Technician making saddle fusion joints shall be qualified to make saddle fusion joints in accordance with ASTM F2620. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.
4. Each Fusion Technician making electrofusion fitting joints shall be qualified to make electrofusion fitting joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure that are proved to be satisfactory by destructive testing in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.
5. Each Fusion Technician making socket fusion joints shall be qualified to make socket fusion joints in accordance with ASTM F2620. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.

C. APPROVED SUPPLIERS

1. Pipe and fitting suppliers shall be approved by the Irrigation Designer.

   a.) The following pipe manufacturers are approved:

      1.) AquaFuse®

   b.) The following fitting manufacturers are approved:

      1.) AquaFuse®

   c.) The following on-site qualification training are approved:

      1.) AquaFuse®

d.) The following mainline and isolation valves are approved:

1.) ControlFlo®

2.) AquaFuse®

D. WARRANTY

1. Pipe and fitting suppliers shall provide a twenty-five-year HDPE system warranty covering defects in product material and workmanship. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.
2. Fusion providers shall provide a one-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that shall provide for remaking defective butt fusion, saddle fusion, electrofusion, or socket fusion joints. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the installer of warranty responsibility for the full warranty term.

E. SUBMITTALS

1. The following information shall be submitted by pipe and fitting suppliers:

a.) Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer. A Certificate of Origin is required for all pipe not manufactured in the United States.

b.) Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer. A Certificate of Origin is required for all fittings not manufactured in the United States.

c.) Pipe and fitting product data indicating conformance with this specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.

d.) At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this specification and applicable pipe and fitting standards specified herein.

F. The following information shall be submitted by Fusion Providers.

1. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this specification.
2. Documentation of conformance with this specification and applicable standards, including written documentation regarding any intended variance from this

specification and applicable standards. This will include fusion joint warranty information and recommended project specific fusion parameters.

G. The following MANUAL AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:

1. Manual Datalogging for each fusion joint performed on the project, including joints that were rejected. Submittals of the Fusion Technician's joint reports are required as requested by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE or Engineer. Specific requirements of the Fusion Technician's joint manual datalogging shall include:
2. Fusion technician's name or initials
3. Date and exact time at completion of fusion process
4. Once the technician has completed this process, they are confirming that they followed all safety and fusion procedures for the fusion machine used.

H. 100% FUSED SYSTEM OF FITTINGS, VALVES, AND PIPE FOR RECLAIMED WATER, IRRIGATION WATER, OR POTABLE WATER.

1. PE4710 100% Fused System:

   a.) PE4710 100% Fused System Component material (compound) for all fittings (general and service), valves (mainline and lateral), and pipe shall be high density bimodal High-Performance polyethylene copolymer designed for extrusion of potable water, reclaimed water, industrial, and mining pipe. "PE4710 Fused System Component material (compound) shall have a PENT value at 2.4 MPa and 80 °C of >10,000 hours per ASTM F 1473 and It is listed by the Plastics Pipe Institute (PPI TR-4, as both PE 4710 and PE 100) and is certified to ANSI/NSF Standard 14, ANSI/NSF Standard 61, CSA B137.1 and CSA B137.4 and have Oxidative Resistance Classification of CC3".

   b.) All Fused PE4710 material (compound) shall conform to material requirements specified in pipe standard: ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906, fitting standard: AWWA C906 or ASTM D3261 or ASTM F2206 or ASTM F1055 as applicable for the pipe or fitting. PE4710 material (compound) shall meet the requirements of ASTM D3350 and shall meet or exceed Cell Classification 445574C and 445576C and is Certified NSF Standard 14 and/or Standard 61 for Potable Water Pipe and Fittings and have an Oxidative Resistance Classification of CC3.

   c.) PE4710 material (compound) shall have a hydrostatic design basis (HDB) rating at 140°F (60°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.

   d.) PE4710 pipe and fitting material (compound) in PE4710 pipe and fittings shall contain color and ultraviolet (UV) stabilizer meeting the requirements of Code C or E per ASTM D3350. Code C material shall contain 2 to 3 percent

carbon black to provide indefinite protection against UV degradation when material from the pipe is tested in accordance with ASTM D1603 or ASTM D4218. Code E material used for coextruded OD color stripes, or a coextruded ID color layer shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure. Coextruded color PE compound material shall be PE4710 pipe material compound, varying only by color and UV stabilizer.

e.) Clean rework materials derived from pipe production by the same manufacturer are acceptable as part of a blend with new material to produce new pipe provided that the rework material is the same PE4710 material designation as the new material (compound) to which it is added. Finished products containing rework material shall meet the requirements of this specification.

I. PE4710 pipe and butt fusion fittings shall have plain ends for butt fusion.

1. PE4710 pipe

a.) Nominal straight lengths of 3 inch and larger pipe shall be 40 ft. or 50 ft.

b.) Nominal coil lengths of 4-inch and smaller pipe shall be 500 ft. Longer or shorter coils such as 800 ft for 4-inch pipe, 1000 ft for 3-inch pipe, or 2000 ft for 2 inch or smaller pipe shall be acceptable. Pipe shall be black. Coextruded lavender or purple stripes or a coextruded lavender or purple layer shall be an acceptable option.

c.) Pipe shall be permanently marked using heated indent printing in accordance with ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906 as applicable for the pipe size including:

d.) Nominal size and sizing system, e.g., IPS or DIOD

J. DR or SDR

1. Standard Designation, ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906, material designation, and pressure rating or pressure class for water at 73°F.
2. Marking the Standard Designation on the pipe shall serve as the manufacturer's certification that the pipe has been manufactured, sampled, and tested and has been found to comply with the requirements of the standard.
3. The ASTM D3035 or ASTM F714 pipe pressure rating for water at 73°F shall be "PE4710 PRXXX" where XXX = pressure rating in psi
4. The AWWA C901 pipe pressure class for water at 73°F shall be "PE4710 PCXXX" where XXX = pressure class in psi.
5. The AWWA C906 pipe pressure class for water at 73°F shall be "PE4710 PCXXX " where XXX = pressure class in psi.

6. Extrusion production-record code
7. Manufacturer's Trademark or trade name "AquaFuse".

K. PE4710 fittings

1. PE4710 butt fusion, saddle fusion, electrofusion and fabricated fittings shall be manufactured from PE4710 material (compound) in accordance with this specification. All fittings molded and fabricated shall be manufactured in the U.S.A. and must be NSF-61 Approved and manufactured at a Factory Mutual (FM) approved facility that has been inspected and approved by FMRC and are audited frequently to ensure compliance and promote continuing improvement.
2. PE4710 fittings shall comply with ASTM D3261 for molded butt fusion and saddle fusion fittings, flange adapters and MJ adapters, or shall comply with ASTM F2206 or AWWA C906 for fabricated butt fusion fittings or shall comply with ASTM F1055 for electrofusion fittings.
3. PE4710 fittings shall comply with the marking requirements of ASTM D3261 for molded butt and saddle fusion fittings, flange adapters and MJ adapters or shall comply with the marking requirements of ASTM F2206 or AWWA C906 for fabricated
4. butt fusion fittings or shall comply with the marking requirements of ASTM F1055 for electrofusion fittings.
5. PE4710 fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.

L. SWING JOINT

1. Swing Joints shall have AquaFuse® thread inlet and modified stub ACME threads with elastomeric O-ring seals at each rotating joint and meets ASTM Standard F2768 (Standard Specification for Modified Stub ACME Thread Joint with Elastomeric Seal in plastic piping components). Each rotating joint shall be sealed with an elastomeric O-ring, installed pre-compressed in a sealing groove free of parting lines to prevent leakage as produced by CMF Global.

M. DUCTILE IRON MAINLINE VALVES: DUCTILE IRON RESILIENT SEATED GATE VALVE 250PSI IPS POLYETHYLENE PIPE ENDS SIZES 3" -12"

1. Valves shall conform to the latest revision of AWWA Standard C509/C515 covering resilient wedge (RS) gate valves for water supply service.
2. AWWA C509/C515 valves shall have an iron body, bonnet, and O-ring plate. The wedge shall be fully encapsulated with rubber.
3. The sealing rubber shall be permanently bonded to the wedge casting per ASTM D429.
4. Valves shall be supplied with O-ring seals at all pressure retaining joints. No flat gaskets shall be allowed.
5. The valve shall be non-rising stem (NRS), opened by turning left or right, and provided with either a 2" square operating nut or a hand wheel. The operating

nut and hand wheel shall be marked with the word “Open” and an arrow to indicate the direction to open.

6. Stems shall be cast copper alloy or stainless steel with an integral collar in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of the wedge.
7. All stems shall have two O-rings located above the thrust collar and one O-ring below. The upper stem O-rings shall be replaceable with valve fully opened and subjected to full pressure. The stems on 2”-12” or 63mm-315mm sizes shall also have a low torque thrust bearing located both above and below the stem collar to reduce friction during operation.
8. Waterway shall be smooth, unobstructed, and free of all pockets, cavities, and depressions in the seat area.
9. The body, bonnet, and O-ring plate shall be coated, both on the interior and the exterior, with fusion-bonded epoxy. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 certified.
10. Each valve shall have the maker’s name, the pressure rating, and the year in which it was manufactured cast into the body. Prior to shipment from the factory, each valve shall be hydrostatically pressure tested to the requirements of AWWA C509/C515.
11. AquaFuse® ControlFlo™ Valves shall have all component parts cast and assembled in the USA and shall be manufactured by the Clow Valve Company.

N. POLYETHYLENE MAINLINE VALVES: HIGH-PERFORMANCE PE4710 BALL VALVE WITH INTEGRATED BYPASS SIZES 4” -16”.

1. All valves shall be ball valve type constructed from High Density Polyethylene PE 4710 Full Port and manufactured in accordance with AWWA C901, AWWA C906, ASTM D2513, ASME B16.40, CFR 49 Part 192, and CSA B137.4.
2. All valves must be NSF-61 Certified.
3. Manufacturing facility must be ISO 9001 certified.
4. All valves must be serialized for complete material and process traceability.
5. Valve should maintain a bubble tight seal throughout the entire pressure and temperature range and provide blow-out proof stem and Seal design.
6. All valves must be PE4710 material both body and ends.
7. Valves 4” through 8” shall have standard 1/4 turn operator and integrated bypass.
8. Valves 10” through 16” shall have gear reduction operator and integrated bypass
9. Valves shall be temperature rated -20°F – 140°F Valve body must provide resistance to mechanical and thermal loads as supplied by AquaFuse®.

O. LATERAL ISOLATION VALVES: HIGH-PERFORMANCE PE4710 BALL VALVE WITH 360 DEGREE OPEN TO CLOSE OPERATION 2”-3”.

1. All valves shall be ball valve type constructed from High Density Polyethylene PE 4710 Full Port and manufactured in accordance with AWWA C901, AWWA C906, ASTM D2513, ASME B16.40, CFR 49 Part 192 and CSA B137.4.
2. Manufacturing facility must be ISO 9001 certified.
3. All valves must be NSF-61 Certified.
4. All valves must be serialized for complete material and process traceability.
5. Valve should maintain a bubble tight seal throughout the entire pressure and temperature range and provide blow-out proof stem and Seal design.
6. All valves must be PE4710 material both body and ends.
7. Operation must be 360 degree open to close.
8. Valves shall be temperature rated -20°F – 140°F Valve body must provide resistance to mechanical and thermal loads as supplied by AquaFuse® ControlFlo™.

P. FUSION JOINTS

1. Unless otherwise specified, PE4710 pipe and fittings shall be assembled in the field with butt fusion, saddle fusion or electrofusion joints. Electrofusion couplings can only be installed if pipe is prepared with a professional rotary scraper. ASTM F2620 and the pipe manufacturer's recommended procedure shall be observed for butt fusion and saddle fusion joints. ASTM F1290 and the electrofusion fitting manufacturer's recommended joining procedure shall be observed for electrofusion joints.
2. Field butt fusion, saddle fusion and electrofusion joints shall be made by Fusion Technicians that are qualified in accordance with this specification to make the specific fusion joint type.
3. Field fusion joints shall be recorded and documented in accordance with this specification.

Q. MECHANICAL CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS

1. Connections shall be defined in conjunction with the linking of project piping, as well as the tie-ins to other piping systems.

R. MECHANICAL AND COMPRESSION FITTINGS

1. Acceptable mechanical and compression fittings for use with PE4710 pipe and fittings shall be mechanical fittings that are qualified by the mechanical fitting manufacturer for use with HDPE pipe and fittings.
2. Mechanical and compression fittings for use with HDPE pipe shall provide restraint against longitudinal separation that is inherent to the design of the joint. Mechanical joints that do not provide restraint against pull-out or push-off are prohibited. An insert stiffener must be used to ensure long term restraint and watertight seal. Compression Fittings are to be used for REPAIRS ONLY.
3. Mechanical connections to non-HDPE devices and appurtenances shall be by bolted flange adapter or MJ adapter. Flange adapter and MJ adapter connections shall be assembled, installed, and tightened in accordance with

flange adapter or MJ adapter manufacturer's instructions. Flange bolt tightening shall be in accordance with PPI TN-38.

S. CONNECTION HARDWARE AND COATING

1. T-316 Stainless Steel with T-2000 Blue Nut (Finished Pattern) Bolts and nuts shall be T-316 stainless steel conforming to ASTM F593 for bolts and ASTM F594 for nuts. Bolts shall be threaded to conform to ANSI B 18.2.1, page C-1 for finished hex bolts. Nuts shall conform to ANSI B 18.2.2, page D-1. Nuts shall be finished with T-2000 coating system to minimize galling and ensure proper torque. Anti-seize compound shall not be utilized with the blue nuts. All bolt heads and nuts shall be hexagonal. Identification on the head of the bolt shall be T-316, 316, F593G or F593H.
2. T-Bolts shall be ASTM A242 weathering steel with minimum yield strength of 45,000 PSI. All T-Bolts & nuts shall be threaded in accordance with ANSI/ASME B1.1, Class 2A fit, with coarse-thread series. Heavy hex nuts shall be used. Bolt heads shall be in accordance with the dimensions of ANSI/AWWA C111 / A21.11-95. T-Bolts and nuts shall be coated with Tripac 2000 Blue or District approved equal.

T. EXECUTION

1. FUSION PROCESS

a.) GENERAL

1.) Butt and saddle fusion of PE4710 pipe and fittings shall be in accordance with ASTM F2620 and the manufacturer's recommended joining procedure.

2.) Electrofusion of PE4710 pipe and fittings shall be performed in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.

3.) PE4710 pipe and fittings shall be fused by qualified fusion technicians, as documented by the fusion provider. Training records for qualified fusion technicians shall be available to SWEET ONION GOLF AUTHORITY REPRESENTATIVE or Engineer upon request.

4.) As each fusion joint is constructed the contractor is required to perform MANUAL DATALOGGING on all fusions. This is written next to all fusions with a metallic ink marker (such as Sharpie or equivalent) that will include fusion technician's name or initials, date, and exact time at completion of fusion process. Once the technician has completed this process, they are confirming that they followed all safety and fusion procedures for the fusion machine used.

b.) JOINT RECORDING

1.) MANUAL DATALOGGING on all fusions. This is written next to all fusions with a metallic ink marker (such as Sharpie or equivalent) that will include fusion technician's name or initials, date and exact time at completion of fusion process. Once the technician has completed this process, they are confirming that they followed all safety and fusion procedures for the fusion machine used.

c.) CHECK LIST FOR CONTRACTORS

1.) All system components must be 100% fused with a Zero "0" allowable leakage rate for a minimum of 25 years and with a PENT value at 2.4 MPa and 80 °C of >10,000 hours per ASTM F1473 from the Pump Station connection to the Swing Joint assembly and no other alternatives shall be accepted.

2.) The fused components consist of the following:

3.) Fused lateral connection to swing joint- Rated at > 335 PSI Operating Pressure

4.) Fused gear operated lateral isolation valves – NSF/ANSI Standard 61 certified.

5.) Fused mainline valves - AWWA C550 and NSF/ANSI Standard 61 certified.

6.) Molded fittings thru 12" – FM Approved, AWWA, NSF/ANSI Standard 61 certified.

7.) Fabricated fittings 14" and larger - FM Approved, AWWA, NSF/ANSI Standard 61 certified.

8.) Pipe - FM Approved, AWWA, NSF/ANSI Standard 14 and 61 certified.

d.) SUBMITTALS

1.) The following information shall be submitted by the contractor or system supplier:

(e.) A Certificate of Analysis issued by the manufacturers Quality Assurance that confirms that the products in the "Check List For Contractors" section meets all requirements including a PENT value at 2.4 MPa and 80 °C of >10,000 hours per ASTM F 1473.

(f.) A Certificate of Origin is required for all products not manufactured in the United States.

2.9 EXCAVATION OF TRENCH

A. The Contractor will do all necessary excavation required for the proper installation of the system. All equipment used for excavation, as well as material handling and transportation are required to be equipped with rubber tires unless otherwise approved by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

B. Pipe Trenches are to be excavated to a depth sufficient to provide not less than SIXTEEN INCHES (16”) of covering over the pipe of 2” Diameter and Less and TWENTY-FOUR INCHES (24”) of cover for pipes of 3” to 8” Diameter and THIRTY INCHES (30”) of covering of 10” Diameter and larger as measured from the top of the barrel of the pipe to the surface grade. The trench is to be of sufficient width to allow soil to be tamped solidly under the pipe to provide firm continuous support and to allow for proper installation of pipe.

C. 120/240 Volt Wire Trenches are to be excavated to a depth sufficient to provide not less than TWENTY-FOUR INCHES (24”) of covering over the wire. The trench is to be of sufficient width to allow soil to be tamped solidly under the wire to provide firm continuous support and allow for proper installation of wire.

D. The bottom of the trench is to be graded to a line so that the pipe and wire, as nearly as possible, will have bearing for its full length. All rock and organic material shall be removed from the trench bottom prior to placing of pipe or wire. If rock is encountered in the excavation, the trench must be excavated an additional depth of six inches (3”) and filled with suitable material. There will be at least six inches (3”) of earth between the bottom and four inches (4”) between the sides of the pipe or wire and any rock. If unstable bedding material is encountered, it will be removed and replaced with suitable material supplied by the Contractor at no additional cost to the SWEET ONION GOLF AUTHORITY REPRESENTATIVE.

E. Depths shall be as shown in the diagram below.

2.10 TRENCH RESTORATION - SOD REPLACEMENT

A. Trench lines will be restored as detailed above. Earth is not to be excessively mounded over the trenches but can be slightly crowned to allow for minor settling at the contractor’s discretion.

B. Contractor is to remove and replace sod over all trench lines and other excavated areas.

2.11 PIPE, FITTINGS AND ACCESSORIES

A. Pipe, fittings, and accessories shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition. If the coating or lining of any type of pipe or fitting is damaged, the repair shall be made by the Contractor, at his expense.

B. Pipe shall be carried into position, not dragged. The interior of the pipe, fittings and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging the open end or other approved methods. Before installation, the pipe shall be inspected for defects.

C. Cutting of the pipe shall be done in a neat and workmanlike manner. The edge shall be true and at right angles to the pipe. The end shall be reamed out to the original diameter of the pipe. Appropriate angle fittings must be used where the angle of pipe deflection is greater than five degrees off center.

D. Pipe, fittings, and accessories shall be carefully lowered into the trench with suitable equipment. Under no conditions shall any of the water main materials be dropped or dumped into the trench. Care should be taken to avoid abrasion of pipe coating. The full length of each section of pipe shall rest solidly upon the pipe bed with recesses excavated to accommodate coupling and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid.

E. When work is not in progress, open ends of pipe, fittings and accessories shall be securely closed so that no earth or other substances can enter.

F. Pipe ends left for future connections shall be valved, plugged, or capped. Where connections are made between the new work and existing mains, special fittings shall be used to suit the actual conditions. Standard methods are readily available for making connections to various types of pipe, either under pressure or in a dewatered condition. Where made under pressure, these connections shall be installed according to the recommendations of the manufacturer of the pipe being tapped.

G. The installation of steel couplings, cast iron couplings, mechanical joints and bolted joints shall be in accordance with the recommendations of the manufacturer.

H. Connections between different types of pipe, fittings and accessories shall be made with transition fittings recommended by the manufacturer.

I. During the installation of HDPE pipe the installer shall provide safeguards against the problem of contraction of the HDPE by “snaking” the pipe as much as possible in the trench according to manufacturer recommendations.

1. All pipe ends, inside of fittings and bell ends shall be completely cleaned with the recommended cleaner. The pipe shall be welded by butt fusion, socket fusion, or electrofusion. The process for these fusions shall be completed with the manufactures correct weld times. The pipe and fitting shall be promptly joined,

the pipe shall be pushed to the full extent of the fitting, and then the pipe shall set to a correct cooled down time. No excess welds will be accepted. All pipe, fittings and accessories shall be installed in accordance with recommendations of the pipe manufacturer.

2. There shall be no PVC pipe or fittings welded or glued if the temperature is below 37 degrees on that day. This does not apply to HDPE fusion which can be fused regardless of temperature if manufactures best practices are used for fusing and setting times.
3. The SWEET ONION GOLF AUTHORITY REPRESENTATIVEs represented has the right to ask that a maximum of 3 each welded connections be cut out to be tested. The contractor will not be responsible test costs. The contractor shall replace the test connections at no additional cost from the initial bid.

2.12 AIR RELEASE VALVES

A. Air/vacuum release valves shall be installed as directed by the Irrigation Designer. It shall be the responsibility of the SWEET ONION GOLF AUTHORITY REPRESENTATIVE and the Contractor to determine the best-suited location for the said valves. Valves shall be 1" and shall be as manufactured by CRISPIN Model # IC10P.

B. The valve shall be (1) one-inch air release valve. Each valve shall be installed in accordance with manufacturer's recommendations and shall be preceded with a (1) one inch 200 PSI brass or bronze gate valve with a "wye" strainer and blow off purge valve. The air/vacuum release valve and gate valve shall be housed together, below grade in a jumbo valve box with cover.

C. The valve boxes shall be cleaned out of any sedimentation that washes in during or post construction.

2.13 VALVE BOXES AND LIDS

A. Valve boxes or "access boxes" shall be of one manufacturer for the entire project and shall be of plastic as manufactured by Dura or NDS. In all cases boxes shall be green in color.

B. All jumbo, 6" round and 7" round box lids shall be green unless otherwise noted.

C. For easy identification all 10" round lids shall be color coded for the following uses:

1. Gate and isolation valve box lids shall be Green.
2. Quick Coupler valve box lids shall be Green.
3. All access boxes housing electrical splices, grounding or surge devices shall be Tan.

2.14 CART PATH CROSSINGS - OPEN CUT

A. Road surface is to be cut with a diamond blade cut saw of suitable size to cut through blacktop surface, prior to excavation and with straight cuts wide enough to provide access with excavation equipment.

B. Cut shall be wide enough to allow of excavation equipment to removed sub grade neatly and efficiently to a depth to allow no less than Sixteen inches (16”) of cover over pipe two inches (2”) in diameter and any wires; and twenty-four inches (24”) of cover over the HDPE pipe three inch (3”) in diameter to eight inch (8”); and thirty inches (30”) of cover for Pipes ten inches (10”) and larger.

C. Trenching, backfilling, and compacting shall conform to specifications as laid out in the TRENCHING section of this document including backfilling in 6” steps.

D. Wire crossing under cart paths shall be sleeved in a separate two-inch (2”) HDPE pipe sleeves and shall extend no less than 3 feet beyond either edge of the cart path.

E. Final backfill will be a minimum of 4” of ¾ modified stone or crusher run and compacted with a vibratory compactor. Final elevation of sub-grade shall match elevation of undisturbed adjacent path.

F. The path is to be repaved to match conditions prior to excavation.

2.15 ROAD CROSSINGS - OPEN CUT

A. Open cut road crossings shall be installed in strict coordination with all applicable agencies having jurisdiction. Road surface is to be cut with a diamond blade cut saw of suitable size to cut through blacktop surface.

B. Cut shall be wide enough to allow of excavation equipment to removed sub grade neatly and efficiently to a depth to allow no less than 24” of cover over the HDPE pipe sleeve while also allowing for a clean 3” grit or clear fill smoothed and compacted base for the HDPE DR 13.5 pipe sleeves.

C. HDPE pipe sleeve for Irrigation pipe shall be DR13.5 and shall extend a minimum of five feet (5’) beyond each side of the paved (or gravel) road surface.

D. HDPE pipe sleeve for Wiring shall be DR13.5 and shall extend a minimum of five feet (5’) beyond each side of the paved (or gravel) road surface.

E. Both ends of pipe sleeves shall be marked with a 10” Round valve box located directly above the end of the sleeve and flush with the ground.

F. Similar fill shall be used to compact the replaced sub grade material in 6” steps with a vibratory compactor being careful to build up and follow any crown of the road surface.

G. There shall be a minimum of 6” of modified stone compacted just below the level of blacktop and shall match to any crown of the road surface.

H. There shall be a minimum of four inches (4”) of blacktop installed in two layers of two inches (2”) thick with vibratory compaction of each layer. The finished height after compaction of the second layer shall match to that of the existing road surface.

I. Should the road surface be a gravel road, then more layers of modified stone shall be added and vibratory compacted to bring the gravel up to the existing road surface. This shall occur in no more than 3” of layering per compaction.

J. Road crossing shall be as shown below:

2.16 ROAD CROSSING - BORING

A. Bored road crossings shall be installed in strict coordination with all applicable agencies having jurisdiction.

B. Access holes shall be excavated on either side of the road no less than 5 feet from the edge of the road surface. The bore shall be made so there is no less than 24” of cover above top edge of HDPE pipe or sleeve.

C. HDPE pipe being bored shall be DR11 and shall extend a minimum of eight feet (8’) beyond each side of the paved (or gravel) road surface.

D. HDPE pipe sleeve for Wiring shall be DR11 and shall extend a minimum of eight feet (8’) beyond each side of the paved (or gravel) road surface.

E. A machined spool piece shall be used to transition from DR11 of bore to DR13.5 and shall be fused together using manufacturer’s best practices.

F. Both ends of pipe sleeves shall be marked with a 10” Round valve box located directly above the end of the sleeve and flush with the ground.

2.17 BRIDGE CROSSING - WOOD BRIDGE

A. Bridge crossings shall be installed using heavy galvanized tension bands in accordance with the sizing and spacing diagram shown below.

B. Galvanized bolts/lag bolts shall be installed into the wood beams of the bridge with suitable spacers (washers) so the pipe is “cradled” in the bands and not “cutting” into the pipe material.

C. HDPE fused 45-degree elbow fittings shall be used as needed to bring the pipe from the field in against the structure of the bridge and then out to the field on the opposing end of the bridge.

D. Fittings and pipe shall be fused at appropriate angles and in a fashion so there is no stress is on the pipe when it is pulled in against the bridge timber.

E. Schedule 80 PVC Electric conduit wire sleeve shall be installed above the HDPE pipe if possible and shall be installed with heavy grade - UV resistant zip ties according to the diagram below. As an alternate HDPE pipe can be used as a substitute of Schedule 80 PVC Electrical conduit.

2.18 BRIDGE CROSSING - CONCRETE BRIDGE

A. Bridge crossings shall be installed using heavy galvanized tension bands in accordance with the sizing and spacing diagram shown below.

B. Galvanized concrete expansion bolts shall be installed into the concrete structure of the bridge with suitable spacers (washers) so the pipe is “cradled” in the bands and not “cutting” into the pipe material.

C. HDPE fused 45-degree elbow fittings shall be used as needed to bring the pipe from the field in against the structure of the bridge and then out to the field on the opposing end of the bridge.

D. Fittings and pipe shall be fused at appropriate angles and in a fashion so there is no stress is on the pipe when it is pulled in against the bridge surface.

E. Schedule 80 PVC Electric conduit wire sleeve shall be installed above the HDPE pipe if possible and shall be installed with heavy grade - UV resistant zip ties according to the diagram below. As an alternate HDPE pipe can be used as a substitute of Schedule 80 PVC Electrical conduit.

2.19 BRIDGE CROSSING - STEEL - METAL BRIDGE

A. Bridge crossings shall be installed using heavy galvanized tension bands in accordance with the sizing and spacing diagram shown below.

B. Galvanized bolts, washers and nuts shall be installed into the steel beams of the bridge with suitable spacers (washers) so the pipe is “cradled” in the bands and not “cutting” into the pipe material.

C. HDPE fused 45-degree elbow fittings shall be used as needed to bring the pipe from the field in against the structure of the bridge and then out to the field on the opposing end of the bridge.

D. Fittings and pipe shall be fused at appropriate angles and in a fashion so there is no stress on the pipe when it is pulled in against the bridge surface.

E. Schedule 80 PVC Electric conduit wire sleeve shall be installed above the HDPE pipe if possible and shall be installed with heavy grade - UV resistant zip ties according to the diagram below. As an alternate HDPE pipe can be used as a substitute of Schedule 80 PVC Electrical conduit.

2.20 QUICK COUPLING VALVES

A. All quick coupler valves shall be installed on swing joints, in locations agreed upon by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's representative, Irrigation designer and installer. All quick coupler valves shall be housed in a 10" round valve box with cover unless otherwise directed by the SWEET ONION GOLF AUTHORITY REPRESENTATIVE's representative or Irrigation designer. A piece of 8-inch ADS Drain-pipe shall be located between Valve Box and Valve. Approximately 4 inches of Quikrete shall be poured into the bottom of the valve box and around the 1" PVC pipe stabilizer to secure the QCV.

B. Valve box lid shall be green in color and Quick Coupler shall be located so the stainless-steel lid can be flipped open and the key inserted and operated normally and without obstruction.

C. Any valves found to have settled, heaved, or not be housed in valve boxes shall be reset at the Contractor's expense.

D. All Quick Couplers shall be part number: HQ44RCAW, 1" ACME, as manufactured by Hunter Industries.

2.21 CONTROL WIRE, GROUNDING AND SPLICE INSTALLATION – DECODER HUB

A. 2-WIRE SCOPE

1. This specification covers jacketed cables containing two listed Golf Course Sprinkler wires, single conductor, suitable for direct burial, for operation up to 600 volts, and temperatures up to 60°C.
2. Inner Conductors:

    a.) Soft drawn bare copper meeting the requirements of ASTM specification B-3 or B-8. Insulation shall be low density high molecular weight polyethylene and a thickness of 0.045". The two conductors shall be twisted with a minimum lay of 4".

3. An optional Mylar tape may be used over the conductors.

4. A rip cord shall be placed directly below the outer jacket.
5. Overall jacket:

   a.) High density polyethylene with a thickness of 0.035". Available with different color jackets. The jacket shall be sufficiently round, and loose, to facilitate its removal when being stripped. Minimum inner diameters of the outer jacket:

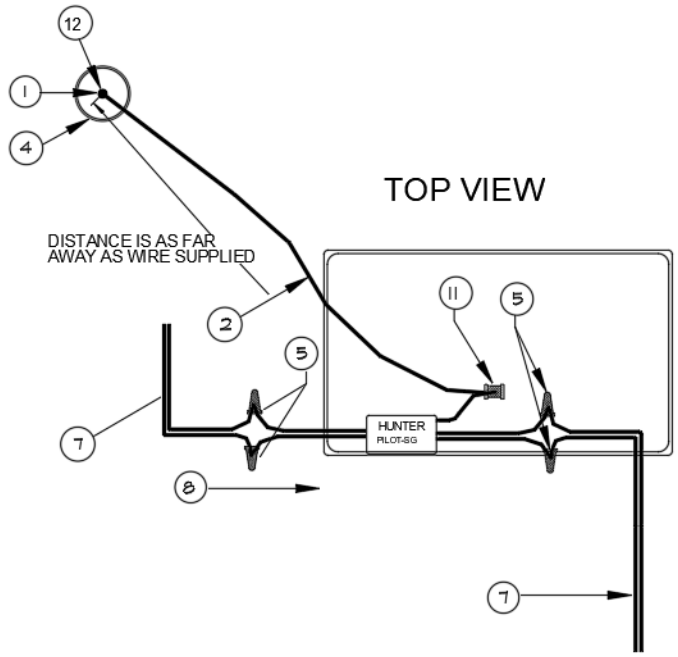
6. SPLICING RECOMMENDATIONS

   a.) Wire splices are the weak link of any electrical circuit. It is especially important to make proper joints in irrigation systems because the joints are exposed to wet and damp environments that can cause corrosion of the copper conductor, and premature failure. Splices to be made using Model DBR/Y-6, as manufactured by the 3M Company for 14 AWG 2 Conductors. For 12 AWG and splices of 4 to 6 conductors, splices to be made using Re-enterable connectors (Paige Specification P7408D).

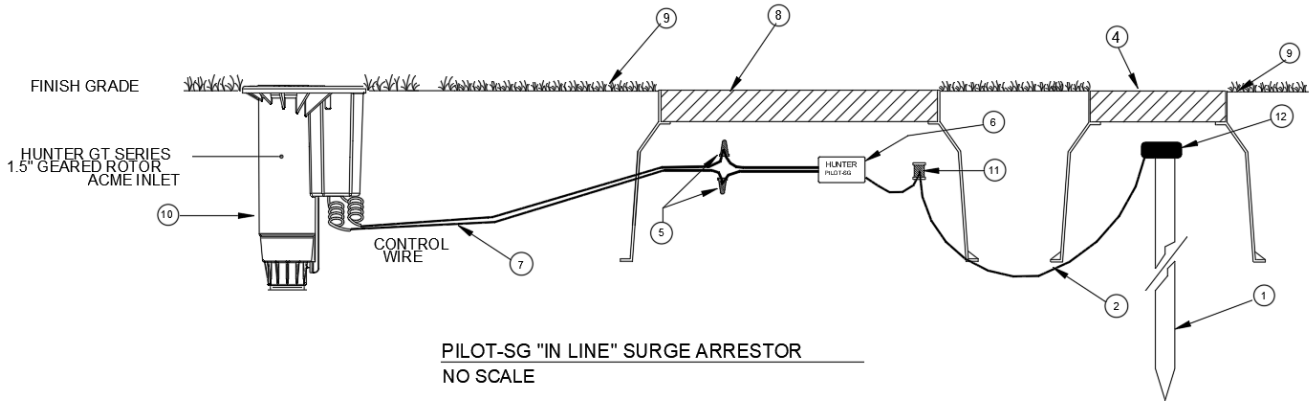
7. All integrated TWM GT800D rotors shall include two 3M DBRY-6 splices for connection to the two-wire path.
8. Integrated TWM systems require grounding with Pilot-SG surge suppressors coupled to an appropriate grounding plate or rod. Hunter recommends a minimum of one Pilot SG every thousand feet or 12 TWMs.
9. The Control Wire shall be 14 AWG solid copper conductor with PE insulation rated at 30 VAC minimum and carrying an embossed or printed Underwriters Laboratory file number indicating UL approval for direct earth burial installation.
10. All wire connections shall be done with 3M, DBR/Y-6 Connectors, which are UL listed under “UL 486D-direct burial” for wet or damp locations, 600 volts.

B. PILOT SG INSTALLATION W/GROUND ROD OR GROUND PLATE

1. See below diagrams below for inline surge installation of PILOT SG.
2. All end of line or change in direction (3-way or larger splices) must be grounded with a PILOT SG and associated ground rod or ground plate.



1. 8' x 5/8" UL COPPER CLAD GROUND ROD GROUND ENHNACEMENT MATERIAL RECOMMENDED.
2. DISTANCE OF SOLID COPPER GROUND WIRE IS AS FAR AWAY AS WIRE SUPPLIED (10' MINIMUM)
3. SOLDERED CONNECTION
4. 10" ROUND PLASTIC VALVE BOX
5. DBY/R-6 CONNECTOR
6. PILOT-SG "IN LINE" SURGE ARRESTOR
7. PILOT 2 WIRE PATH
8. PLASTIC VALVE BOX WITH COVER
9. FINISH GRADE
10. HUNTER GTSERIES ROTOR WITH PILOT-100 DECODER
11. SPLIT BOLT
12. CAD WELD CONNECTOR



PILOT-SG "IN LINE" SURGE ARRESTOR
NO SCALE

C. Do not yank, stretch, or excessively pull wire during installation. Provide a minimum of one foot of slack, in an expansion coil, in each 100 feet of wire. Lay wire on a firm, even bed in the trench, which shall support the wire its entire length.

D. At splice locations, provide sufficient slack to allow the splice to be raised a minimum of 24 inches above grade for inspection.

E. Take strict precautions to ensure that wires are not cut, scraped, or nicked during installation.

F. Do not lay wire above, or on top of, the pipe, except where pipe and wire are being vibratory plowed simultaneously.

G. Install the wire to the right side of the pipeline when facing in the direction of the water flow.

H. All wiring shall be buried to a depth of at least 16 inches (minimum) and to the depth of the pipe when a new pipe is installed. Wire splices shall be kept to an absolute minimum number.

I. NOTE: All wiring to be installed shall be sized and located as indicated on the wiring plans and/or described in the drawing notes and specifications.

J. Trenched wire installation - Wiring shall be laid along with and under the mainline with enough slack to avoid wire being pulled taut during backfill procedure. Provide a minimum of one foot of slack, in an expansion “bundle”, in each 100 feet of wire and at all changes in direction. Take strict precautions to ensure that wires are not cut, scraped, or nicked during installation.

K. Pulled wire installation - Wire shall be laid down via a suitable size wire chute and shall in no case be “pulled” in with pipe. Pipe and wire depth must be monitored closely to insure 16” of cover is always available.

L. Splice all wires to requirements of local wire code regulations or to the manufacturer’s Specifications, whichever is more restrictive.

M. Make all splices by baring a minimum of three-quarters inch of cooper conductor, twisting the leads together. Crimp sleeves, wire nuts, or brass service clamps are acceptable. Make the splice using wire nuts and connector kits in strict accordance with manufacturer’s recommendations during installation.

N. All in ground 24 VAC wire splicing shall be accomplished with UL approved 3M DBR/Y-6 splice kits installed per the manufacturer's instructions. A minimum of twenty-four inches (24”) of wire shall be left at all electric control valves and valve-in-head sprinklers to allow extraction of the solenoid from the valve box or ground without

cutting the wire. The extra wire shall be neatly coiled in the valve box or coiled up behind pilot valve tube (see detail).

O. At all splice locations including, mid wire run splices, wire size change locations, electric valve locations, and all in ground Tray Cable splices, contractor must provide sufficient slack to allow the splice to be raised a minimum of 24 inches above grade for inspection and locate them in a suitable valve box for future access.

P. Wire installation depths with and without pipe shall be as shown:

Q. All three direction in ground 2-wire splicing shall be installed in a 10" round valve box with sufficient wire coiled up to be able to raise the completed splice 24" minimum above grade for examination and service. Splices shall be made using 3M DBR/Y-6 splice kits in accrodance with manufacturers installation instructions. The feed 2 wire pair shall be labeled with Paige wire marker zip tied to feed.

R. All four direction in ground 2-wire splicing shall be installed in a 7" round valve box with sufficient wire coiled up to be able to raise the completed splice 24" minimum above grade for examination and service. Splices shall be made using Paige DBM14-4 splice kits in accrodance with manufacturers installation instructions. The feed 2 wire pair shall be labeled with Paige wire marker zip tied to feed as shown in diagram below:

S. Strict precautions must be taken to ensure that wires are not cut, scraped, or nicked during installation.

T. Do not lay wire above, or on top of, the pipe, except where pipe and wire are being vibratory plowed simultaneously.

U. Install the wire to the right side of the pipeline.

V. All wiring shall be buried to a depth of at least 16 inches (minimum) and to the depth of the pipe when a new pipe is installed. Wire splices shall be kept to an absolute minimum number.

W. Pulled wire installation - Wire shall be laid down via a suitable size wire chute and shall in no case be "pulled" in with pipe. Pipe and wire depth must be monitored closely to insure 16" of cover is always available.

X. NOTE: All wiring to be installed shall be sized and located as indicated on the wiring plans and/or described in the drawing notes and specifications.

Y. Trenched wire installation - Wiring shall be laid along with and under the mainline with enough slack to avoid wire being pulled taut during backfill procedure. Provide a minimum of one foot of slack, in an expansion "coil", in each 100 feet of wire and at all changes in direction. Take strict precautions to ensure that wires are not cut, scraped, or nicked during installation.

2.22 120 VAC POWER WIRING INSTALLATION AND SPLICING

A. All wiring shall be tray cable and three copper conductors with individual 600 VAC rated polyethylene (PE) or polyvinyl chloride (PVC) UF rated insulation and an outer jacket of polyethylene (PE)

B. All 120 VAC power wire shall be separated from each other by 12" if they are in the same trench. All valve wiring and/or Communication wiring shall be bundled, taped at minimum intervals of approximately 10' and laid in the trench to the side of the pipeline opposite the 120 VAC power wire.

C. All in ground 120 VAC Tray Cable wire splicing shall be accomplished with UL approved 3M DBR/Y-6 splice kits when size and rating allow. For larger sizes and splices 3M wire nuts, or bug connectors, then electrical tape, then submersed in 3M Epoxy Resin packs, or Using Paige DBM14-4 splice kits.

D. All in ground 120 VAC Tray Cable wire splicing shall be installed in a 10" round valve box with sufficient wire coiled up to be able to raise the completed splice 24" minimum above grade for examination and service.

2.23 240 VAC POWER WIRING INSTALLATION AND SPLICING

A. All wiring shall be tray cable and three copper conductors with individual 600 VAC rated polyethylene (PE) or polyvinyl chloride (PVC) UF rated insulation and an outer jacket of polyethylene (PE) All 240 VAC electric power wiring shall be installed in accordance with applicable electric installation codes.

B. All power cables for controllers and fan wires shall be "tray cable" in sizes as indicated on the drawings. Cable shall be UL Listed, type TC, 600 volts, with high dielectric PVC jacket and a THHN/THHWN nylon insulation and overall PVC jacket. All cable shall consist of a single jacketed three or four wire combination. Separate individual jacketed conductors will not be allowed. 8 gauge and larger (all black conductors). 10 gauge and smaller (multi-color conductors).

C. All 240 VAC power wire shall be separated from each other by 12" if they are in the same trench. All valve wiring and/or Communication wiring shall be bundled, taped at minimum intervals of approximately 10' and laid in the trench to the side of the pipeline opposite the 120 VAC power wire.

D. All in ground 240 VAC Tray Cable wire splicing shall be accomplished with UL approved 3M DBR/Y-6 splice kits when size and rating allow. For larger sizes and splices 3M wire nuts, or bug connectors, then electrical tape, then submersed in 3M Epoxy Resin packs, or Using Paige DBM14-4 splice kits.

E. All in ground 120 VAC Tray Cable wire splicing shall be installed in a 10” round valve box with sufficient wire coiled up to be able to raise the completed splice 24” minimum above grade for examination and service.

End of section