FORT COLLINS IRRIGATION SYSTEM PLANNING TOOLBOX

Irrigation Standards

Design Guidelines

A. An Irrigation Designer, certified by the Irrigation Association, or someone approved by the City of Fort Collins Parks Division is required to provide irrigation design services.

B. In keeping with the City of Fort Collins sustainability goals, the irrigation system must be designed for maximum efficiency and water-conservation.

C. Irrigation design must follow the City of Fort Collins Parks Department Standard Irrigation Details and Specifications in conjunction with these section standards.

D. All projects containing turf, planting beds, raised planters or planter pots are required to be irrigated by an automatic irrigation system.

E. Irrigation system design for any irrigation system owned, operated, and/or maintained by Parks Department must be reviewed and approved by the City of Fort Collins Parks Department.

F. Irrigation design must meet all applicable laws, codes, ordinances, rules and regulations. Conform to requirements of reference information listed below, except when more stringent requirements are specified.

1. American Society for Testing and Materials (ASTM) – Specifications and test methods.
2. Underwriters Laboratories (UL) – UL wires and cables.
3. American Society of Safety Engineers (ASSE) – Performance requirements for backflow preventers/assemblies.
4. Uniform Plumbing Code
5. City of Fort Collins Electrical Code

G. Irrigation design work includes, but is not limited to the following:

1. Controller, either stand-alone or with data communication link to Fort Collins Parks Department central control system.
2. Pipe, valves, fittings, sprinklers, drip, sensors, and control wiring.
3. Water connections including meter and backflow prevention assemblies.
4. Raw water delivery system (e.g. ditch to pond) including pipe, metering, controls.
5. Irrigation storage pond.
6. Irrigation storage pond lining.
7. Irrigation pump and pump intake system.
8. Irrigation pond aeration system.

H. Irrigation water supply and taps:

1. Non-potable water should be used when available.
2. Non-potable irrigation systems should have a back up tap (potable or otherwise) when feasible.
3. All water supply sources including non-potable water and metering requirements must be approved by the Parks Department.
4. New irrigation systems must have a separately metered water supply and not be connected to a building water supply. Variances to this rule should approved by Parks Manager.
5. Existing irrigation systems may be connected to a building water meter. In certain cases, the building connection may remain, but possibly will require the addition of a sub-meter and/or flow sensor.

6. Irrigation taps should be separate from the restroom tap so sewer charges are not incurred on irrigation water.
7. Separate irrigation taps are preferred for Facility grounds projects. If a separate tap is not feasible, the Facility grounds irrigation system must have the ability for flow monitoring independent from any building usage.
8. Tap Sizing:
    - For most parks, irrigation system must be designed to irrigate the site within a 40-hour (5 days per week, 8 hours per day) weekly watering window. Drip may be excluded from this water window because it can be run during daytime hours.
    - For Event Parks or Event Areas, irrigation system must be designed to irrigate the site within a 24 hour (3 days per week, 8 hours per day) peak season watering window.
    - High priority zones must be sized for the maximum capacity of the backup tap (where applicable).
    - Shared water systems (such as with PSD) should be thoughtfully prepared and agreed upon by both Parks and PSD management.
    - When potable water is used, allotments need to be compared with water budgets and mainline break factor (based on mainline size).

I. Design Requirements:

1. Flow sensing is required for all irrigation systems and must be able to accurately read the full range of design flow rates. Coordinate exact flow sensor/hydrometer model with Parks Department during design.
2. Two-wire system is preferred; however, a conventional wired system should be considered when less than 30 zones. Two-wired is required if the system is anticipated to be expanded in the future.
3. HDPE pipe for mainline pipes is preferred and required for special circumstances (mature trees, distribution, street crossings, stream crossings, etc.)
4. The irrigation system must be designed to provide full coverage (turf) and matched precipitation rates (turf and seed).
5. Mainline piping must be sized based on flow demands (gpm's): Velocities must not exceed 5.0 feet per second.
6. All mainlines should be looped whenever possible.
7. All mainlines must have tracing wire.
8. Lateral piping must be sized based on flow demands (gpm's). Velocities must not exceed 5.0 feet per second.
9. Lateral piping smaller than 1-inch is not permitted.
10. Sprinkler bodies with built-in check valves and pressure regulation should be used when available.
11. Sprinkler bodies with built-in check valves must be used for all areas adjacent to walkways and at the bottom of berms and pond areas.
12. Sloped areas must have separate zoning for sprinklers at the higher elevations from those at the lower elevation
13. Areas with different exposures must be zoned separately.
14. Shrub/perennial beds must be zoned separately from turf areas.

15. Drip Irrigation:
    - Point source (punch-in) drip irrigation must be used for all shrub/perennial beds, unless Parks Department approves of a different method of irrigation (inline drip, sprays, etc.)
        - Consider the use of zone control valves (manual ball valves) when a drip remote control valve feeds multiple shrub beds. Zone control valves provide isolation capabilities for maintenance and repairs.
        - ¾" polyethylene tubing must be used (other sizes are not permitted).
        - Drip tubing length must be designed to provide adequate pressure for uniform coverage throughout each zone.
        - Pressure compensating drip emitters must be used.
        - Flow rate should not exceed 15 GPM.
        - Flush valves must be installed at the ends of all drip tubing runs.
        - Sloped areas, where drip is used, should have lateral check valves in appropriate locations
16. Native Grass Irrigation:
    - Anticipated to be turned off after establishment.
    - Irrigation system design for native grass areas must be designed as permanent in-ground irrigation systems and utilize same equipment as turf areas.
    - Sprinkler spacing can be stretched to a maximum of 60% of full coverage.
    - Consider precipitation rates of irrigation heads and impacts to seeding, especially in sloped conditions.
17. Tree Irrigation:
    - Trees in native grass areas must be irrigated on separate zones from the native grass.
    - Trees must be on their own zones (not combined with shrub/perennial zones).
18. Principles of Xeriscape should be utilized in the design of the irrigation system.
19. The blowout fitting for winterization downstream of the backflow should be 1½" for mainlines 3" or larger and 1" for mainlines 2 ½" and smaller.
20. No valves located on <u>any</u> sports fields.
21. Ballfield hose hookups with 1 ½" swing joints for ballfield on both sidelines.
22. Zones on ballfields should be independent to allow watering for seed or sod just to affect one field.
23. The distribution uniformities for spray sprinklers should be 0.60 and rotor sprinklers should be 0.70. Lower DU's are acceptable for native grass areas. Contractor is responsible for hiring a 3rd party to field audit the post-construction completed irrigation system (see standard irrigation construction specifications).
24. Irrigation Storage Pond:
    - Coordinate available water rights with necessary City Departments.
    - Minimum <u>usable</u> pond volume: 3 days of irrigation storage (more if possible, but depends on water rights – Coordinate with necessary City Departments)
    - Pond must be lined (synthetic or clay). Coordinate type with necessary City Departments.
    - If using a synthetic pond liner, side slopes of pond must be no steeper than 4:1 for the first 12 feet, then no steeper than 3:1 to the bottom. Coordinate pond edge, safety shelf/bench, slopes and pond edge treatments with necessary City Departments.
    - Aeration system to turn the pond over four times within 12 hours.

25. Irrigation Pump Station:
    - Coordinate pump station design with City of Fort Collins Parks Department.
    - Size to irrigate site within appropriate water window. See “Tap Sizing” above.
    - Must include automatic filter with appropriate screen size.

J. Drawing Requirements:

1. Title block with name of project, sheet name, company identification including address, phone number, name of person preparing the plan and date.
2. Scale (20-scale or 30-scale preferred)
3. North arrow
4. Legend and notes
5. Installation details
6. Joint restraint plan
7. Hydrozone plan
8. Peak Season Irrigation Schedule (see Table 1). Including zone number, irrigation type (spray, rotor, drip, etc.), plant type (turf, shrubs, native seed, trees, etc.), applied depth (in), flow (gpm), area (sf), precipitation rate (in/hr), run time (minutes), and required pressure (psi). Drip flows must be provided.
9. Controller Data Input Chart (see Table 2). The columns labeled precipitation rate, slope and microclimate may be left blank to be completed on the as-built drawings.
10. Pressure Calculation Worksheet (see Table 3). Show that the point-of-connection design pressure, minus the possible system pressure losses (for the worst case zone), is greater than or equal to the designed sprinkler operating pressure. Worst case zone must be identified.
11. Water budget and allotment
12. Labeling address and account numbers of all existing taps

Standard Irrigation Equipment/Materials

A. Irrigation Controller:

1. Controller: WeatherTrak ET Pro3. Coordinate exact model and features with Parks Department during design.
2. Enclosure: Coordinate exact enclosure with Parks Department during design
3. Conventional or Two-Wire: Coordinate with Parks Department during design
4. Number of Stations: per design and allow for 2-4 open terminals for future expansion/troubleshooting
5. Data Communication: Coordinate communication method with Parks Department during design.
6. Flow Sensing/Monitoring: Coordinate with Parks Department during design. Flow sensor should be sized for reading flow on as many valves and/or flow ranges as possible.
7. Weather Sensors: Coordinate with Parks Department during design
8. Multiple controllers and/or multiple points-of-connection may require additional hardware or communications (coordinate with Parks Department during design)

B. Piping:

1. Mainline Pipe:
   - PVC Class 200 SDR-21 (NSF approved)
     - 2.5-inch and smaller:
       - Solvent Weld Belled End
       - PVC Sch 80 Fittings
     - 3-inch and larger:
       - Rubber-ring joint
       - Leemco ductile iron fittings.
       - Use Leemco restrained service tees for mainline 2-inch and larger.
   - HDPE 4710 DR-9 (200 PSI) or DR-11 (160 PSI) pipe and fittings, butt-fusion.
2. Lateral/Manifold Pipe: PVC Class 200 SDR-21 (NSF approved), Solvent Weld Belled End with PVC Schedule 40, Type 1 fittings.
3. Drip Tubing:
   - 3/4-inch polyethylene pipe (NSF approved), SDR pressure rated pipe, only as approved for drip applications.

C. Winterization Assembly:

1. Per standard details

D. Backflow Preventer:

1. 2.5-inch and smaller: Febco 825YA
2. 3-inch and larger: Febco 880V

E. Master Valve (normally closed):

1. 2-inch and smaller: Rain Bird PEB/PESB
2. 2.5-inch and larger: Griswold 2030

F. Flow Sensor:

1. 2.5-inch and smaller:
   - Hydropoint FlowHD - Plastic
   - CST FSI Series
2. 3-inch and larger:
   - Hydropoint FlowHD - Iron

G. Hydrometer:

1. HydroPoint Flow3
2. Netafim

H. Blow Out Assembly:

1. Per standard details

I. Quick Coupling Valves:

1. Rain Bird 5RC

J. Isolation Gate Valves:

1. 1.5-inch and smaller: Nibco T-113K
2. 2-inch and larger: Leemco LMV Series

K. Air Vacuum Relief Valves:

1. Waterman AV-150

L. Manual Drain Valves:

1. Per standard details

M. Remote Control Valve Assembly:

1. Potable water: Rain Bird PEB.
2. Raw or Non-Potable water: Rain Bird PESB
3. No valves smaller than 1 inch.
4. Ductile iron gasketed lateral swivel tee system: LEEMCO (LT Series tee, LV-Series angle valve and LMNP Series adapter). Refer to standard details.

N. Drip Remote Control Valve Assembly:

1. Potable water: Rain Bird PEB.
2. Raw or Non-Potable water: Rain Bird PESB
3. No valves smaller than 1 inch.
4. Filter/Pressure Regulator: Rain Bird XCZ-100-PRB
5. Ductile iron gasketed lateral swivel tee system: LEEMCO (LT Series tee, LV-Series angle valve and LMNP Series adapter). Refer to standard details.

O. Valve Boxes:

1. Valve box color to be green in turf, brown in shrub beds.
2. Remote control valve assemblies: Jumbo valve box.
3. Drip remote control valve assemblies: Jumbo valve box.
4. Isolation gate valve assemblies: 10-inch round valve box.
5. Quick coupling valve assemblies: 10-inch round valve box.
6. Air vacuum relief valve assemblies: Jumbo valve box.
7. Flow sensor assemblies: Standard valve box.
8. Master valve assemblies: varies depending on assembly size.
9. Hydrometer assemblies: varies depending on assembly size.
10. Drip zone control valve assemblies: 10-inch round valve box.
11. Drip flush cap assemblies: 6-round valve box.
12. Drip flush valve assemblies: Standard valve box.
13. Swing check valve assemblies: Standard valve box.

14. Wire splices: 10-inch round valve box.

P. Sprinkler Heads:

1. Spray Sprinklers: Rain Bird SAM-PRS. Minimum 6" riser height.
2. Rotor Sprinklers: Areas larger than 30' wide use Rain Bird 5006-SAM-PLUS-PRS-SS, Rain Bird Falcon 6504-SS, Rain Bird 8005-SS and Hunter I-40. Use field fabricated swing joints. 6-inch minimum pop-up height.

Q. Drip Irrigation:

1. Point Source Drip:
   - Rain Bird Xeri-bug emitters
2. Inline Drip:
   - Rain Bird or Netafim
3. Inline Drip for Trees:
   - Tree rings. Refer to standard details
4. In pots
   - Refer to standard details

R. Tree Irrigation:

1. Inline Drip for Trees:
   - Tree rings. Refer to standard details
2. Trees in Tree Grates:
   - Root Watering System. Refer to standard details.

S. Conventional Low Voltage Electrical Control Wiring:

1. Electrical Control Wire – AWG UF UL approved No. 14 gauge direct- burial copper wire for all control wires, and No. 14 gauge direct-burial copper wire for all common wires.
2. Wire connections 3M DBR/Y-6 splice kit

T. Two-Wire Cable:

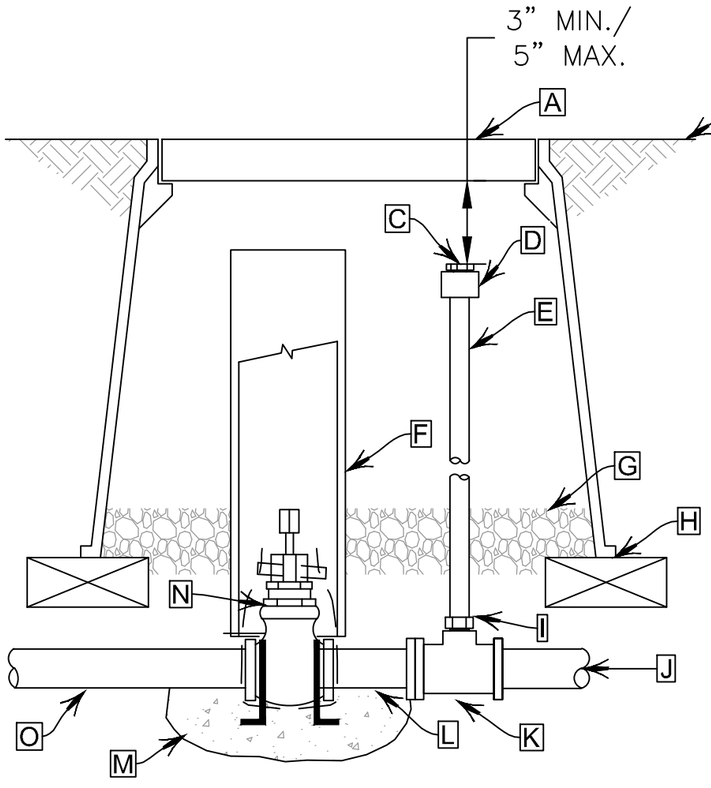
1. Must be approved by control system manufacturer. For WeatherTrak ET Pro3 control system, use Coleman Cables #51452; Paige Electric P7072D, P7296D, P7350D, and P7354D; Regency 14/2 and 12/2 Maxi Cable; Toro Decoder Cable; or Hunter Decoder Jacketed Service Wire DEC12/2BE and DEC14/2BE
2. Wire connections 3M DBR/Y-6 splice kit.

U. Flow Sensor Cable

1. Must meet manufacturer recommendation (typically shielded)
2. Flow sensor & master valve cable installed in conduit and weatherproof junction box

V. Sleeving:

1. Pipe and wire must be in separate sleeves.
2. Ductile iron, PVC or HDPE under all paved surfaces. Consider HDPE sleeving where possible. Coordinate with necessary City Departments.
3. Mark crossings in concrete
4. Size sleeving per standard specifications.



A. 12" STANDARD VALVE BOX WITH COVER
B. FINISH GRADE/TOP OF MULCH
C. 1/4" THREADED PVC CAP
D. 1/2" COPPER REDUCING MALE ADAPTER
E. 1/2" COPPER PIPE (LENGTH AS REQUIRED)
F. 6" PVC CL 200 PIPE (LENGTH AS REQUIRED)
G. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
H. BRICK (1 OF 2)
I. 2" DIELECTRIC UNION AND COPPER REDUCER BUSHING
J. DUCTILE IRON PIPE TO BACKFLOW PREVENTION ASSEMBLY (LENGTH AS REQUIRED)
K. DUCTILE IRON MJ TAPPED TEE W/ 2" OUTLET
L. MAINLINE PIPE
M. THRUST BLOCK
N. ISOLATION GATE VALVE ASSEMBLY W/ MJ ENDS REFER TO ISOLATION GATE VALVE (3" AND LARGER) ASSEMBLY.
O. SERVICE/MAINLINE PIPE

NOTES:
1. FURNISH NOMINAL PIPE AND FITTING SIZES IDENTICAL WITH NOMINAL TAP SIZE UNLESS OTHERWISE NOTED.
2. PROVIDE ALL NECESSARY JOINT RESTRAINTS AND THRUST BLOCKING PER SPECIFICATIONS.
3. ASSEMBLY TO BE USED TO WINTERIZE ONLY THE BACKFLOW PREVENTER ASSEMBLY.

WINTERIZATION (POTABLE) ASSEMBLY (3" AND LARGER)

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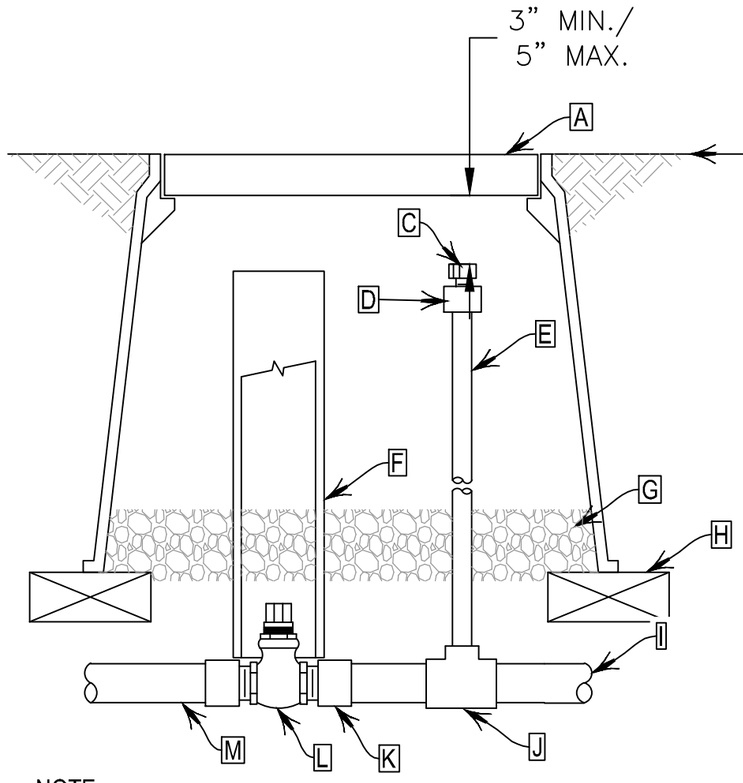
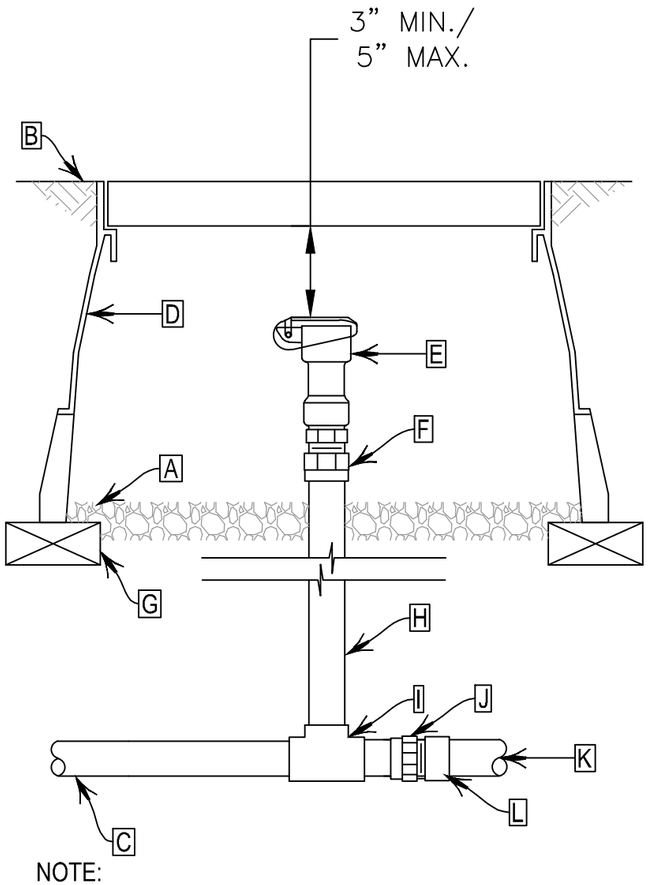


A. JUMBO VALVE BOX WITH COVER
B. FINISH GRADE/TOP OF MULCH
C. 1/4" THREADED BRASS CAP
D. 1/2" REDUCING MALE ADAPTER
E. 1/2" COPPER TYPE K (LENGTH AS REQUIRED)
F. 6" PVC CL 200 PIPE (LENGTH AS REQUIRED)
G. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
H. BRICK (1 OF 4)
I. COPPER PIPE TO BACKFLOW PREVENTION ASSEMBLY (LENGTH AS REQUIRED)
J. COPPER TEE
K. COPPER MALE ADAPTER (1 OF 2)
L. CURB STOP VALVE WITH COPPER SERVICE, THREAD BOTH ENDS
M. COPPER PIPE TO EXISTING COPPER PIPE OUTSIDE EXISTING WATER METER

NOTE:
1. FURNISH NOMINAL PIPE AND FITTING SIZES IDENTICAL WITH NOMINAL TAP SIZE UNLESS OTHERWISE NOTED.
2. THIS ASSEMBLY IS INTENDED TO BE USED FOR WINTERIZATION OF BACKFLOW PREVENTION ASSEMBLY, FLOW SENSOR, HYDROMETER AND MASTER VALVE ONLY.

WINTERIZATION (POTABLE) ASSEMBLY (2.5" AND SMALLER)

N.T.S.



A. 3" MIN. DEPTH OF 3/4" WASHED GRAVEL
B. FINISH GRADE/TOP OF MULCH
C. COPPER PIPE AT FROST FREE DEPTH FROM POINT-OF-CONNECTION
D. 12" STANDARD VALVE BOX WITH COVER
E. QUICK COUPLING VALVE
F. COPPER MALE ADAPTER
G. BRICK (1 OF 4)
H. COPPER PIPE (SIZED TO MATCH NOMINAL QUICK COUPLING VALVE INLET SIZE, LENGTH AS REQUIRED)
I. COPPER TEE
J. COPPER FEMALE ADAPTER
K. PVC MAINLINE PIPE
L. SCH 40 PVC MALE ADAPTER

NOTE:
1. TRANSITION TO MINIMUM BURIAL DEPTH DOWNSTREAM OF WINTERIZATION ASSEMBLY.

BLOWOUT ASSEMBLY (1.5" AND SMALLER) (POTABLE - BACKFLOW IN BUILDING)

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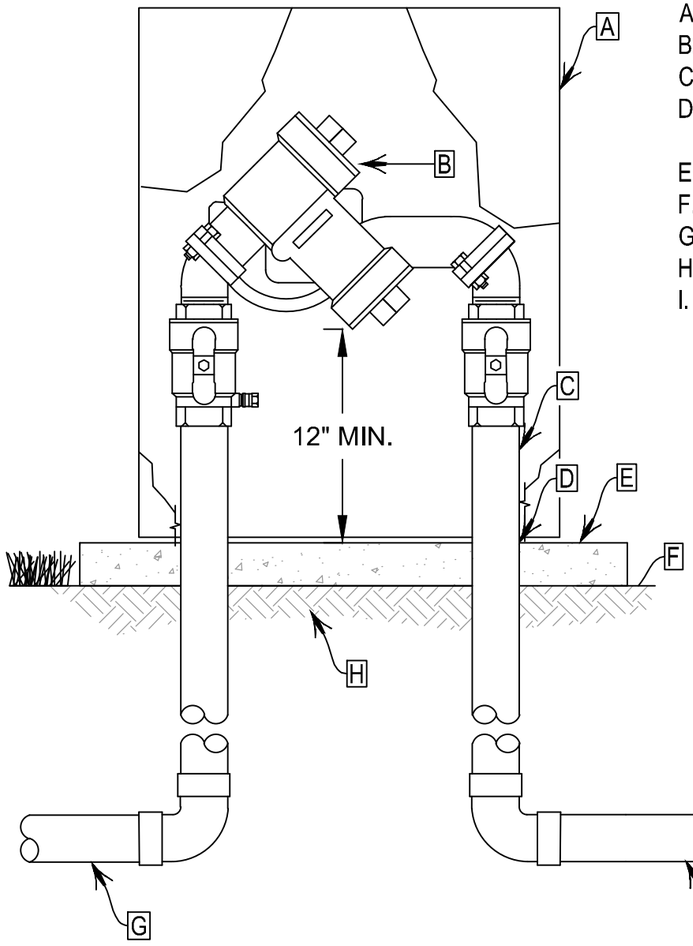

A. BACKFLOW PREVENTER ENCLOSURE (SIZE AS NEEDED)
B. BACKFLOW PREVENTION DEVICE
C. TYPE K COPPER PIPE (TYPICAL) (LENGTH AS REQUIRED)
D. WRAP PIPE AT PENETRATION WITH 1/4-INCH FELT OR SLEEVE WITH CLASS 200 PVC
E. 4-INCH CONCRETE BASE (USE 3000 PSI CONCRETE)
F. FINISH GRADE/TOP OF MULCH
G. TYPE K COPPER PIPE
H. COMPACTED SUBGRADE
I. PVC MAINLINE

NOTES:
1. FURNISH FITTINGS AND PIPING SIZED IDENTICALLY WITH NOMINAL BACKFLOW PREVENTION DEVICE.
2. QUICK COUPLING ASSEMBLY IS TO BE USED FOR WINTERIZATION OF IRRIGATION SYSTEM.

BACKFLOW ASSEMBLY (2.5" AND SMALLER)

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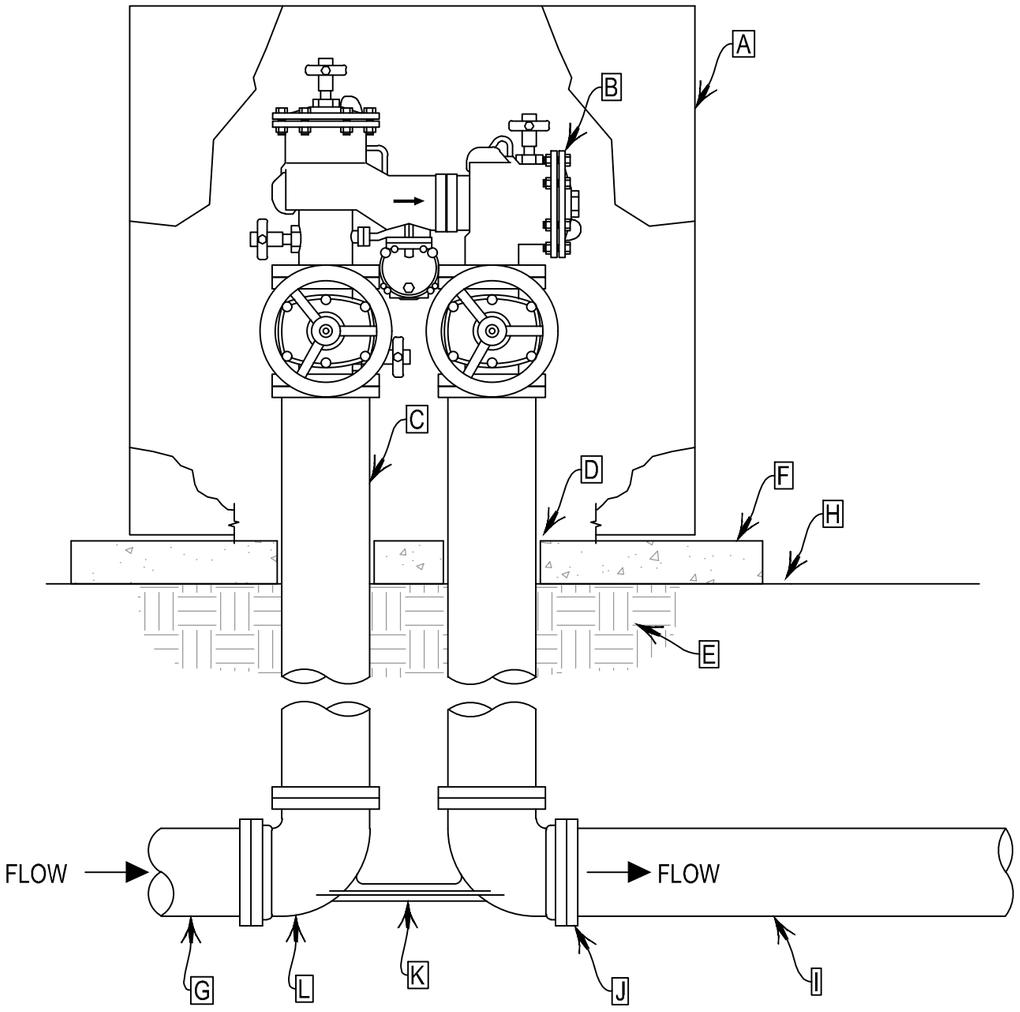

A. BACKFLOW PREVENTER ENCLOSURE (SIZE AS NEEDED)
B. FLANGED MOUNTED REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTOR WITH OPTIONAL VALVE SETTER (MJ X FL)
C. FLANGED STEEL PIPE SECTION (LENGTH AS REQUIRED,1 OF 2)
D. WRAP PIPE AT PENETRATION WITH 1/4" FELT OR SLEEVE WITH CLASS 200 PVC
E. COMPACTED SUBGRADE
F. 4" CONCRETE BASE (USE 3000 PSI CONCRETE)
G. DUCTILE IRON PIPE FROM WINTERIZATION ASSEMBLYFINISHED GRADE
H. FINISH GRADE
I. PVC MAINLINE
J. USE TRANSITION GASKET
K. VALVE SETTER (MJ X FL, SUPPLIED WITH BACKFLOW DEVICE)
L. MECHANICAL JOINT FITTING WITH GLAND

NOTES:
1. EXTEND CONCRETE BASE MINIMUM 6" BEYOND ENCLOSURE.
2. FURNISH NOMINAL SIZE PIPE AND FITTINGS TO NOMINAL SIZE OF BACKFLOW PREVENTER.
3. INSTALLATION OF BACKFLOW PREVENTER SHALL COMPLY WITH ALL APPLICABLE LOCAL AND STATE CODES.
4. SUBMIT SHOP DRAWINGS SPECIFYING ENCLOSURE SIZE AND SHOWING RELATIVE LAYOUT OF EQUIPMENT.

BACKFLOW ASSEMBLY (3" AND LARGER)

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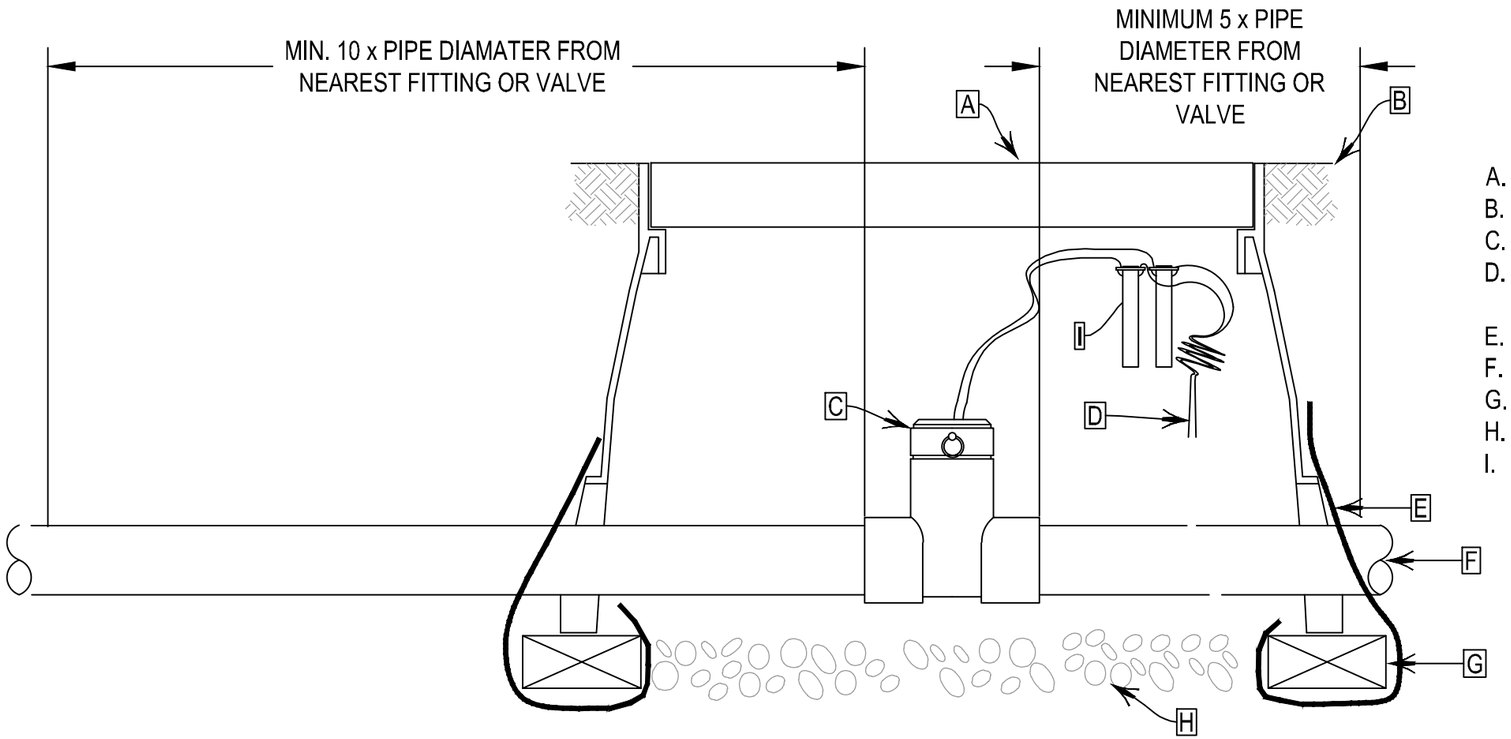

A. 12" VALVE BOX WITH COVER
B. FINISH GRADE/TOP OF MULCH
C. FLOW SENSOR
D. SHIELDED PE-39 COMMUNICATION CABLE TO CONTROLLER
E. FILTER FABRIC
F. MAINLINE PIPE
G. BRICK (1 OF 4)
H. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
I. WIRE SPLICE (REFER TO SPECIFICATIONS)

NOTES:
1. ALLOW 10 PIPE DIAMETERS UPSTREAM AND 5 PIPE DIAMETERS DOWNSTREAM OF STRAIGHT RUN OF PIPE TO ACHIEVE PROPER FLOW REGIME.
2. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
3. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
4. INSTALL SO THAT GRAVEL IS ONLY IN CONTACT WITH BOTTOM OF SENSOR ASSEMBLY.

FLOW SENSOR ASSEMBLY (2.5" AND SMALLER)

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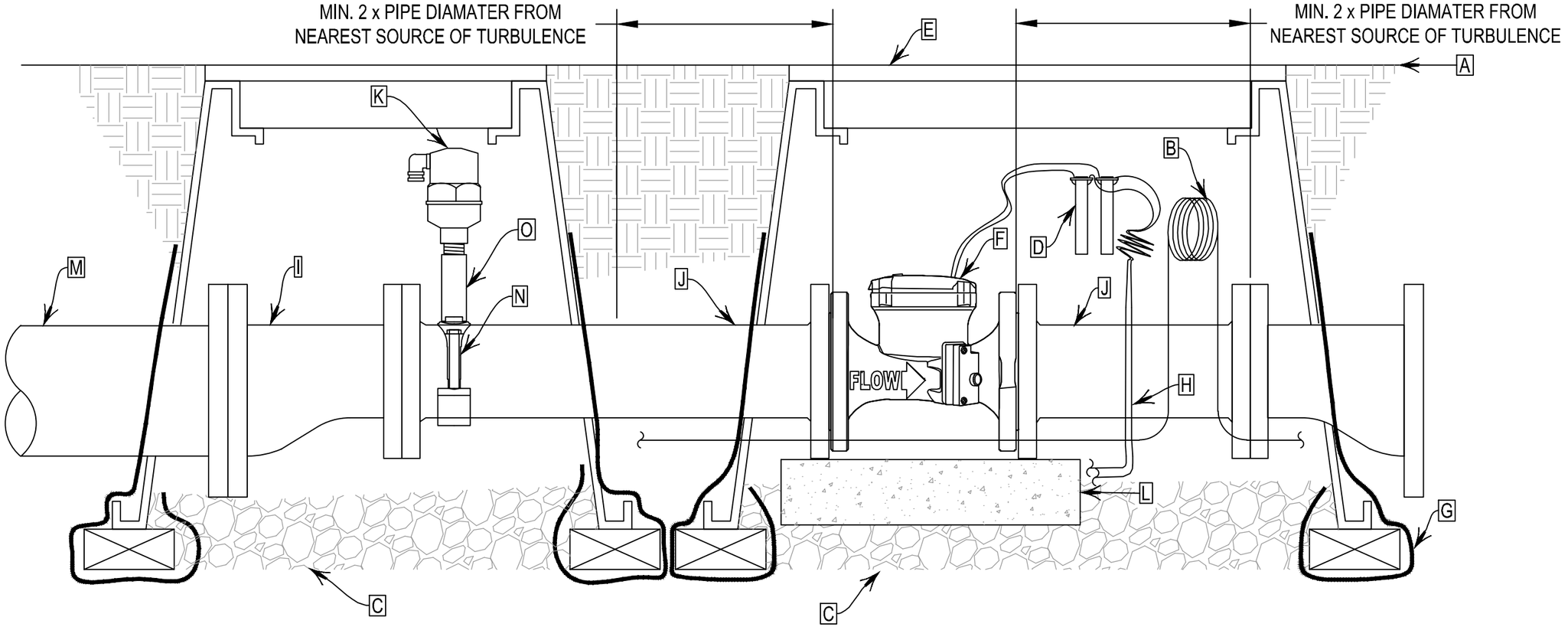

NOTES:

1. INSTALL SENSOR PER MANUFACTURER'S SPECIFICATIONS.
2. A MINIMUM LENGTH OF 2 PIPE DIAMETERS UPSTREAM AND DOWNSTREAM BETWEEN SENSOR AND FITTINGS IS REQUIRED FOR PROPER OPERATION OF SENSOR. .
3. SUPPORT VALVE BOX WITH ONE BRICK UNDER EACH CORNER.

A. FINISH GRADE
B. TRACING WIRE
C. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
D. WIRE SPLICE (REFER TO SPECIFICATIONS)
E. VALVE BOX WITH COVER. (SIZE VALVE BOX SO THERE IS A MINIMUM OF 6" OF CLEARANCE ON ALL SIDES OF SENSOR.) ADD EXTENSIONS AS REQUIRED
F. FLOW SENSOR (REFER TO LEGEND FOR MODEL)
G. FILTER FABRIC
H. SHIELDED PE-39 COMMUNICATION CABLE TO CONTROLLER
I. ECCENTRIC REDUCER (SIZE AS REQUIRED, 2 TOTAL)
J. FLANGED DUCTILE IRON SPOOL FITTING (LENGTH AS NECESSARY, 2 TOTAL)
K. AIR/VACUUM RELIEF VALVE
L. CONCRETE PAVER CENTERED UNDER SENSOR FOR SUPPORT
M. MAINLINE PIPE
N. SERVICE SADDLE
O. PVC RISER

FLOW SENSOR ASSEMBLY (3" AND LARGER)

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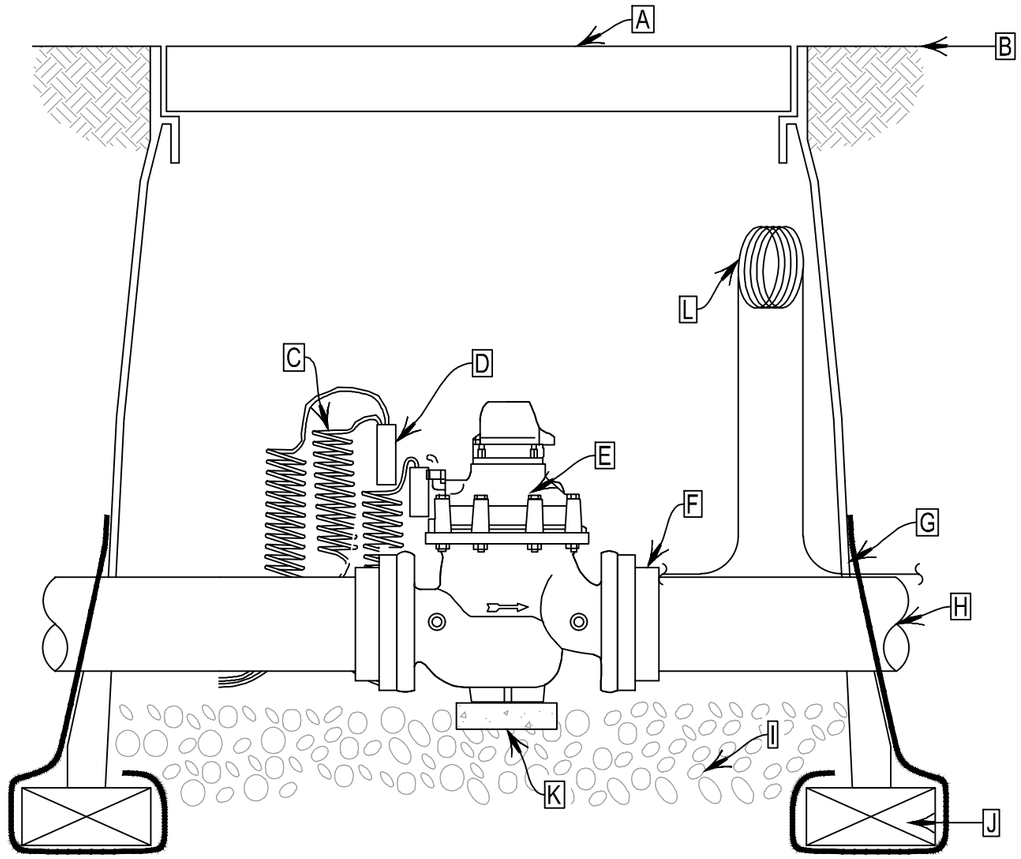

A. 12" STANDARD VALVE BOX WITH COVER
B. FINISH GRADE/TOP OF MULCH
C. 30" LENGTH OF COILED WIRE
D. WIRE SPLICE (REFER TO SPECIFICATIONS)
E. HYDROMETER
F. RESTRAINED FLANGE ADAPTER EBAA IRON SERIES 2100 FOR 3" FLANGED, PVC FIPT FITTING FOR THREADED HYDROMETER ASSEMBLIES (1 OF 2)
G. FILTER FABRIC
H. PVC MAINLINE
I. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
J. BRICK (1 OF 4)
K. CONCRETE SUPPORT
L. TRACING WIRE

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
5. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID.
6. INSTALL SO THAT GRAVEL / CONCRETE IS ONLY IN CONTACT WITH BOTTOM OF VALVE ASSEMBLY. DRAIN PLUGS MUST BE ACCESSIBLE.

HYDROMETER ASSEMBLY

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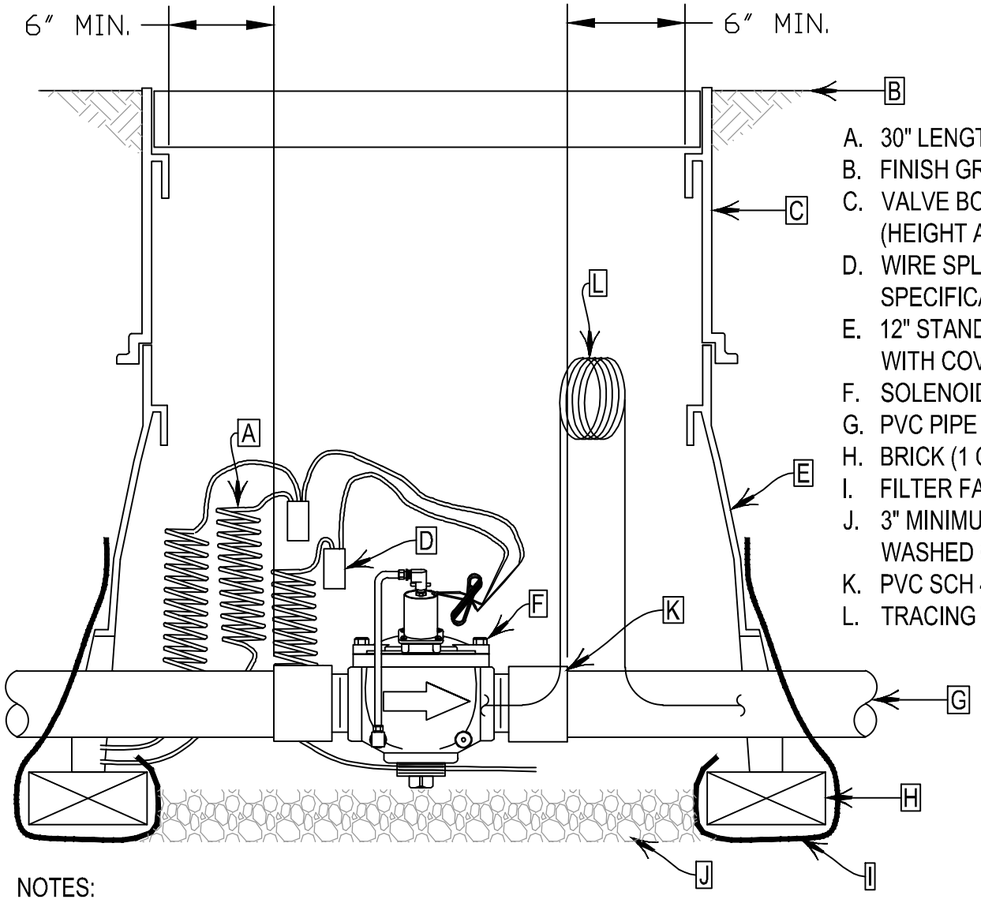
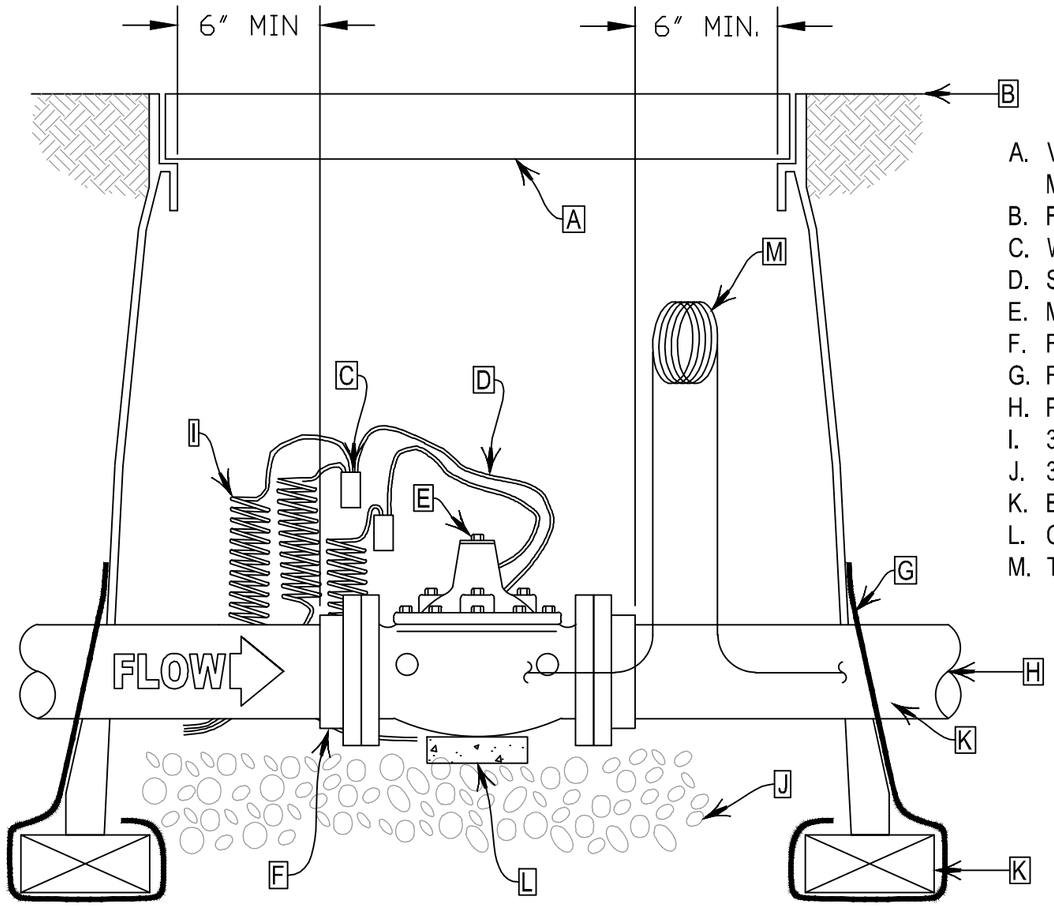


A. 30" LENGTH OF COILED WIRE
B. FINISH GRADE
C. VALVE BOX EXTENSION (HEIGHT AS REQUIRED)
D. WIRE SPLICE (REFER TO SPECIFICATIONS
E. 12" STANDARD VALVE BOX WITH COVER
F. SOLENOID VALVE
G. PVC PIPE
H. BRICK (1 OF 4)
I. FILTER FABRIC
J. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
K. PVC SCH 40 MALE ADAPTER
L. TRACING WIRE

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
5. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID.
6. INSTALL SO THAT GRAVEL IS ONLY IN CONTACT WITH BOTTOM OF VALVE ASSEMBLY.

MASTER VALVE ASSEMBLY (2" AND SMALLER)

N.T.S.



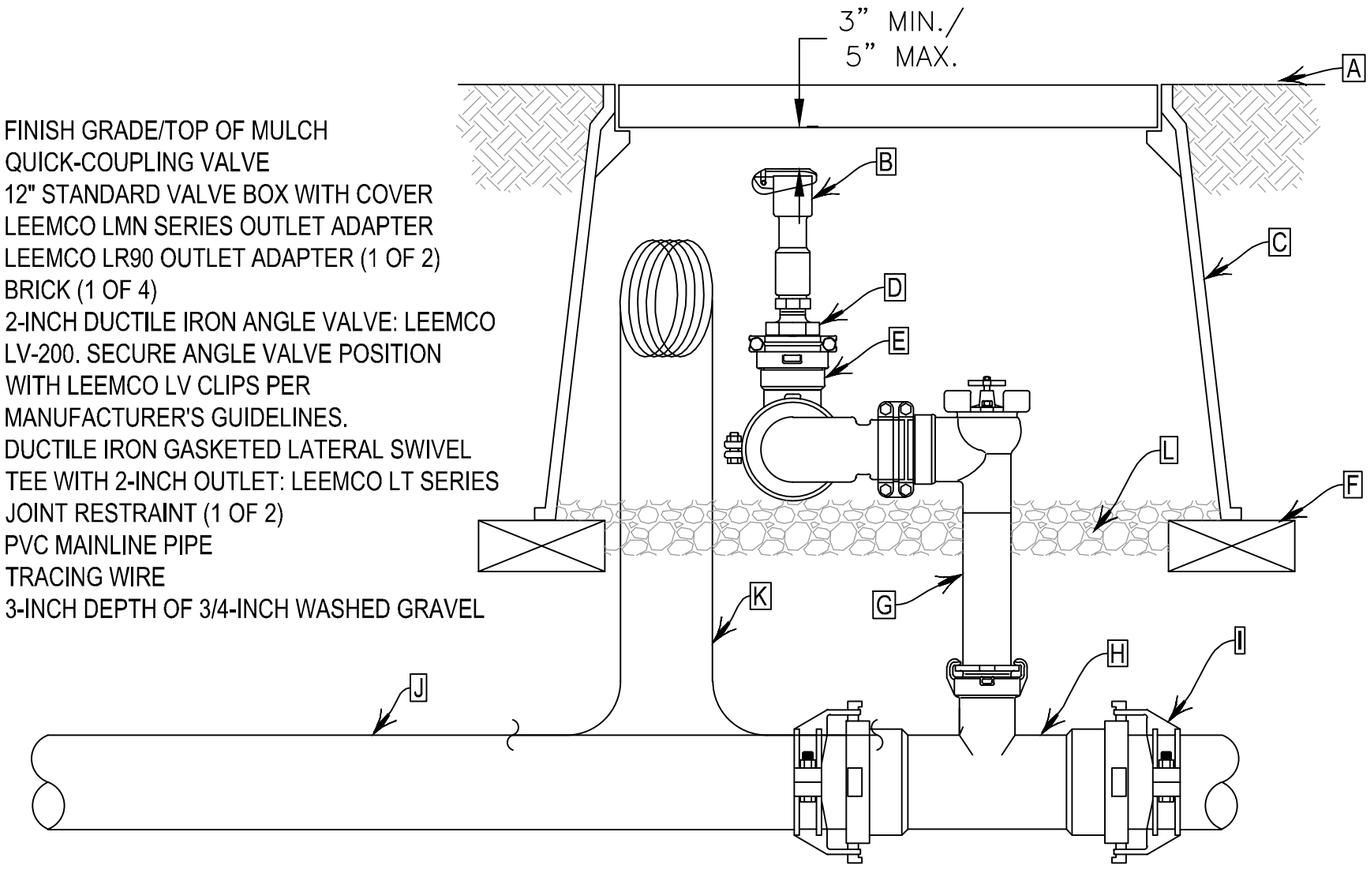
A. VALVE BOX WITH COVER (SIZE TO ALLOW FOR A MINIMUM OF 6" OF SPACE ON ALL SIDES)
B. FINISH GRADE
C. WIRE SPLICE (REFER TO SPECIFICATIONS)
D. SOLENOID WIRES
E. MASTER VALVE
F. FL X MJ DUCTILE IRON W/ RESTRAINTS (1 OF 2)
G. FILTER FABRIC
H. PVC MAINLINE
I. 30" LENGTH OF COILED WIRE
J. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
K. BRICK (1 OF 4)
L. CONCRETE SUPPORT BLOCK
M. TRACING WIRE

NOTES:
2. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE A MINIMUM CLEARANCE OF 6" ABOVE ASSEMBLY.
3. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE MASTER VALVE.
4. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER MASTER VALVE TO ALLOW ACCESS TO SOLENOID.
7. INSTALL SO THAT GRAVEL IS ONLY IN CONTACT WITH BOTTOM OF VALVE ASSEMBLY.

MASTER VALVE ASSEMBLY (2.5" AND LARGER)

N.T.S.

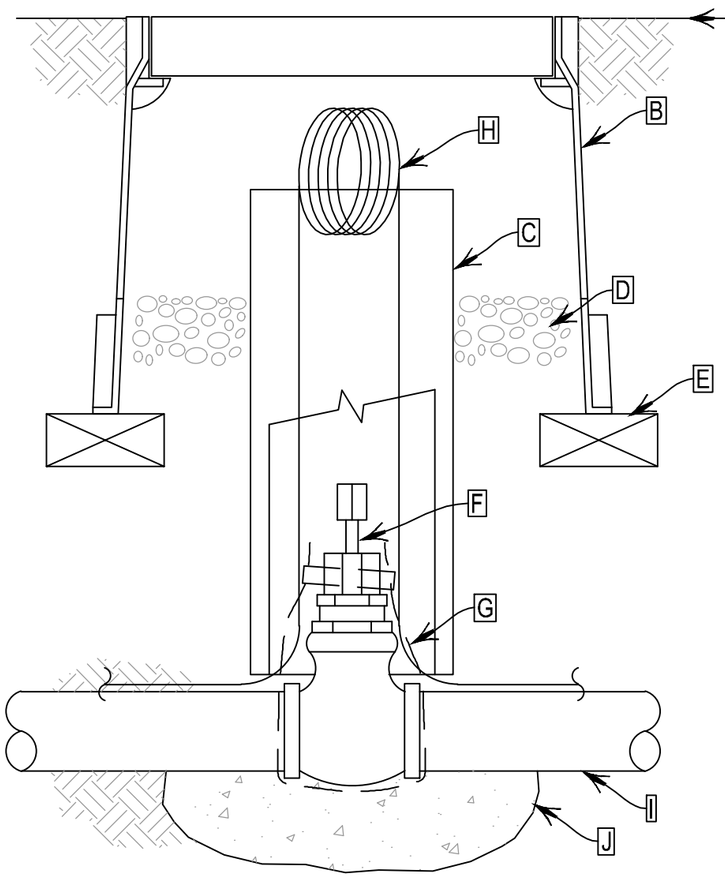
A. FINISH GRADE/TOP OF MULCH
B. QUICK-COUPLING VALVE
C. 12" STANDARD VALVE BOX WITH COVER
D. LEEMCO LMN SERIES OUTLET ADAPTER
E. LEEMCO LR90 OUTLET ADAPTER (1 OF 2)
F. BRICK (1 OF 4)
G. 2-INCH DUCTILE IRON ANGLE VALVE: LEEMCO LV-200. SECURE ANGLE VALVE POSITION WITH LEEMCO LV CLIPS PER MANUFACTURER'S GUIDELINES.
H. DUCTILE IRON GASKETED LATERAL SWIVEL TEE WITH 2-INCH OUTLET: LEEMCO LT SERIES
I. JOINT RESTRAINT (1 OF 2)
J. PVC MAINLINE PIPE
K. TRACING WIRE
L. 3-INCH DEPTH OF 3/4-INCH WASHED GRAVEL



NOTES:
1. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE.
2. INSTALLATION HEIGHT OF QUICK COUPLER VALVE IN VALVE BOX MUST ASSURE PROPER OPERATION OF QUICK COUPLER KEY.

BLOW OUT ASSEMBLY (2" AND LARGER)

N.T.S.

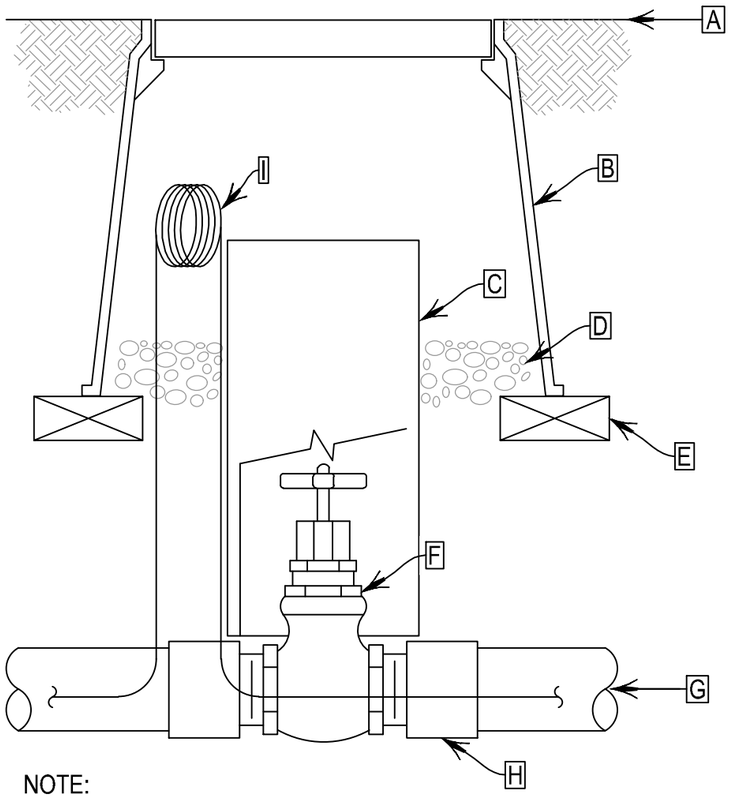


A. FINISH GRADE/TOP OF MULCH
B. 10" VALVE BOX WITH COVER
C. 6" PVC CL 200 PIPE (LENGTH AS REQUIRED)
D. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
E. BRICK (1 OF 2)
F. BELL X BELL SELF-RESTRAINED, RESILIENT WEDGE GATE VALVE
G. 3 MIL. PLASTIC WRAP WITH TAPED ENDS
H. TRACING WIRE
I. PVC MAINLINE
J. CONCRETE SUPPORT BLOCK USE A MINIMUM OF 3 CUBIC FEET OF CONCRETE

NOTES:
1. NOMINAL SIZE OF GATE VALVE TO MATCH NOMINAL MAINLINE SIZE.
2. INSTALL A 4" THICK CONCRETE PAD BELOW VALVE WITH NO. 4 REBAR WHEN USING PUSH ON TYPE VALVES.
3. RESILIENT WEDGE GATE VALVE MAY HAVE EITHER MECHANICAL JOINT OR PUSH-ON GASKETED ENDS. THE OPERATOR IS A 2" SQUARE-WRENCH NUT.
4. ANCHOR ISOLATION VALVE TO CONCRETE BY BENDING REBAR OVER EACH END OF VALVE AND EXTENDING A MINIMUM OF 6" INTO CONCRETE SUPPORT BLOCK.
5. WRAP VALVE ENDS AND BODY IN 3 MIL. PLASTIC PRIOR TO POURING CONCRETE.
6. CONCRETE SUPPORT BLOCK IS TO BE POURED UNDER ISOLATION GATE VALVE. THE ISOLATION GATE VALVE IS NOT TO BE SET IN THE CONCRETE.

ISOLATION GATE VALVE ASSEMBLY (2" AND LARGER)

N.T.S.



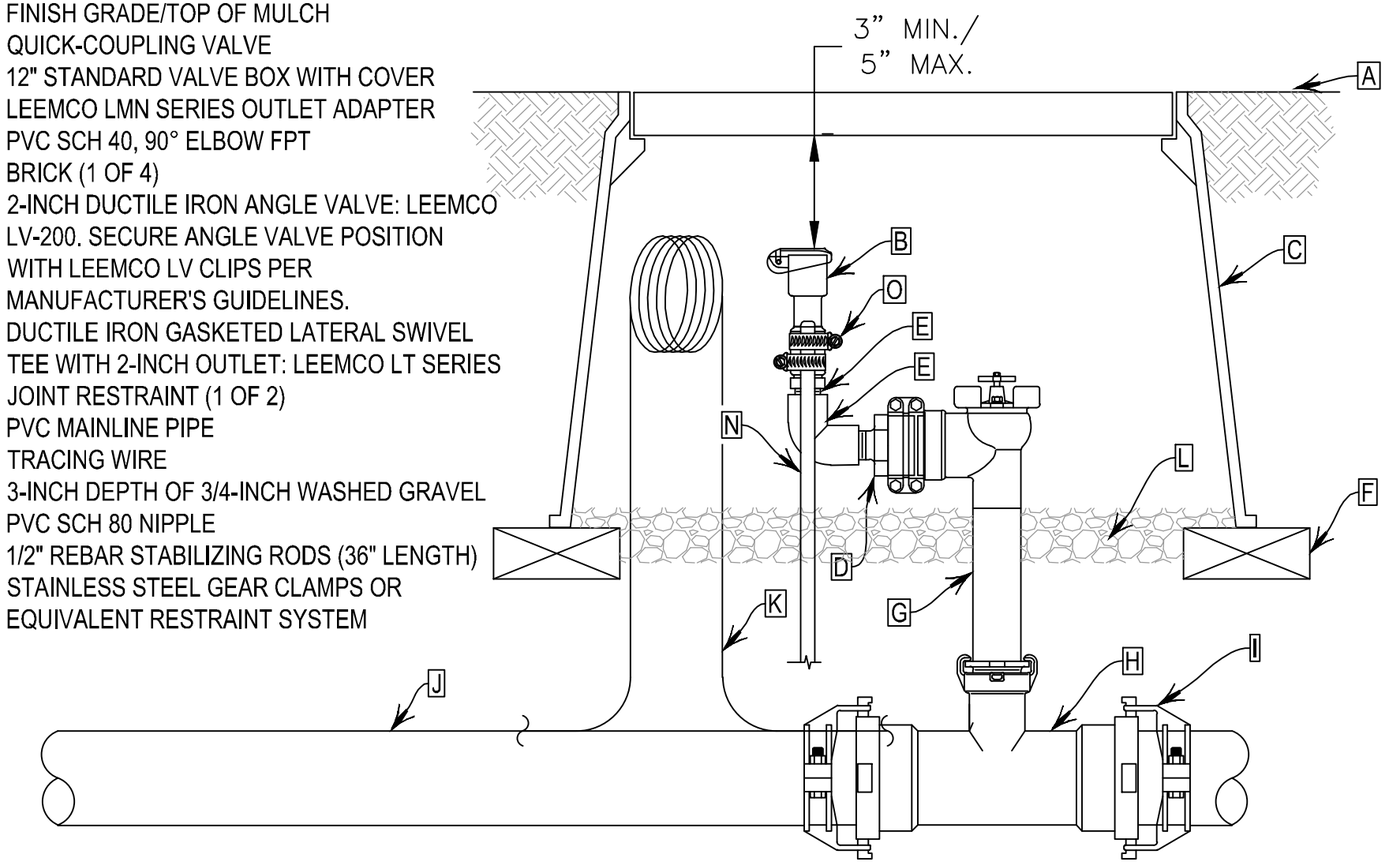
A. FINISH GRADE/TOP OF MULCH
B. 10" ROUND VALVE BOX WITH COVER
C. 6" PVC CL 200 PIPE (LENGTH AS REQUIRED)
D. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
E. BRICK (1 OF 2)
F. THREADED BRONZE GATE VALVE WITH SOLID WEDGE, NON-RISING STEM
G. PVC MAINLINE
H. PVC SCH 40 MALE ADAPTER (1 OF 2)
I. TRACING WIRE

NOTE:
1. NOMINAL SIZE OF GATE VALVE TO MATCH NOMINAL MAINLINE SIZE.

ISOLATION GATE VALVE ASSEMBLY (1.5" AND SMALLER)

N.T.S.

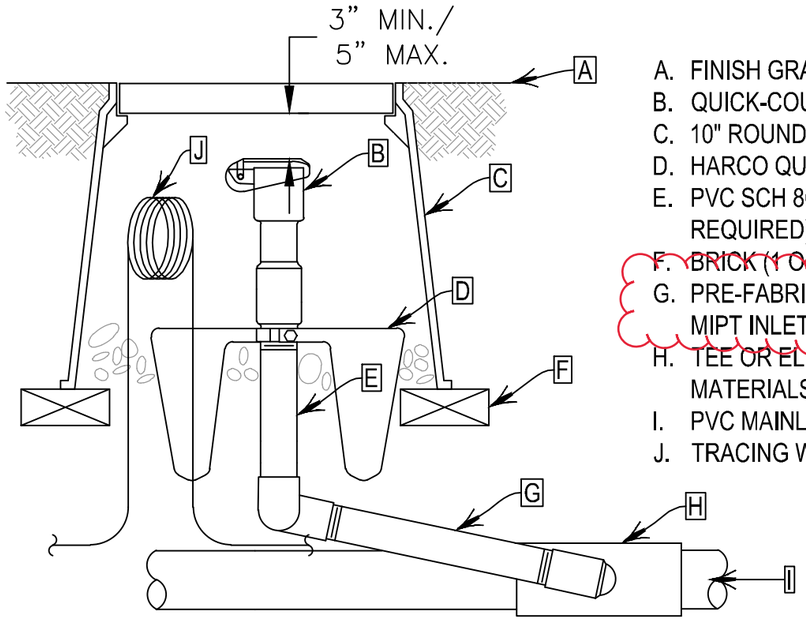
A. FINISH GRADE/TOP OF MULCH
B. QUICK-COUPLING VALVE
C. 12" STANDARD VALVE BOX WITH COVER
D. LEEMCO LMN SERIES OUTLET ADAPTER
E. PVC SCH 40, 90° ELBOW FPT
F. BRICK (1 OF 4)
G. 2-INCH DUCTILE IRON ANGLE VALVE: LEEMCO LV-200. SECURE ANGLE VALVE POSITION WITH LEEMCO LV CLIPS PER MANUFACTURER'S GUIDELINES.
H. DUCTILE IRON GASKETED LATERAL SWIVEL TEE WITH 2-INCH OUTLET: LEEMCO LT SERIES
I. JOINT RESTRAINT (1 OF 2)
J. PVC MAINLINE PIPE
K. TRACING WIRE
L. 3-INCH DEPTH OF 3/4-INCH WASHED GRAVEL
M. PVC SCH 80 NIPPLE
N. 1/2" REBAR STABILIZING RODS (36" LENGTH)
O. STAINLESS STEEL GEAR CLAMPS OR EQUIVALENT RESTRAINT SYSTEM



NOTES:
1. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE.
2. INSTALLATION HEIGHT OF QUICK COUPLER VALVE IN VALVE BOX MUST ASSURE PROPER OPERATION OF QUICK COUPLER KEY.

QUICK COUPLING ASSEMBLY (2" AND LARGER)

N.T.S.

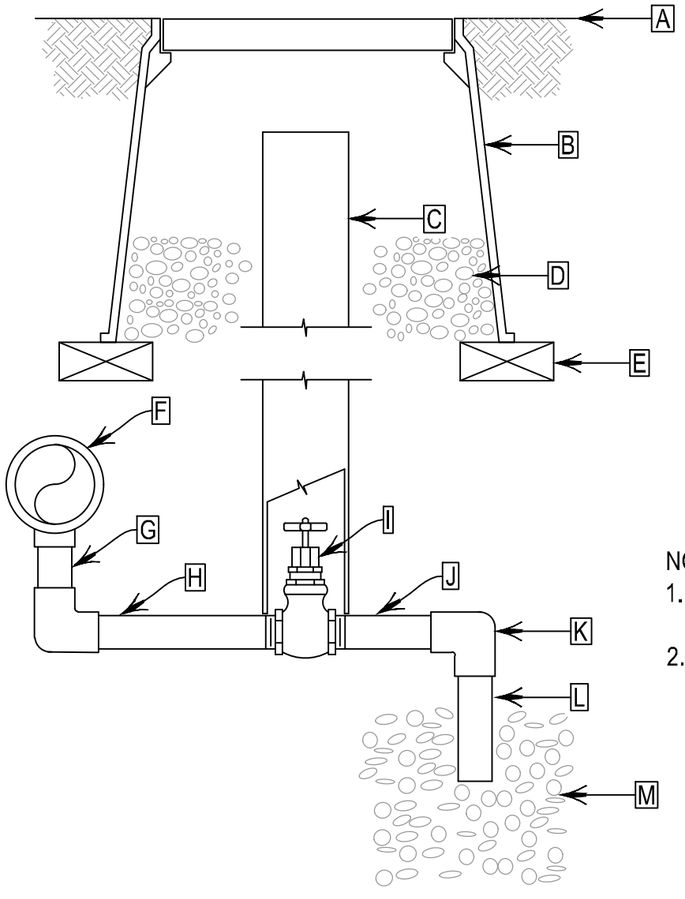


A. FINISH GRADE/TOP OF MULCH
B. QUICK-COUPLING VALVE
C. 10" ROUND VALVE BOX WITH COVER
D. HARCO QUICK COUPLER ANCHOR
E. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
F. BRICK (1 OF 2)
G. PRE-FABRICATED UNITIZED SWING JOINT 1" MIPT INLET X SOC OUTLET
H. TEE OR EL. SEE SPECIFICATIONS FOR MATERIALS
I. PVC MAINLINE PIPE
J. TRACING WIRE

NOTES:
1. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE.
2. INSTALLATION HEIGHT OF QUICK COUPLER VALVE IN VALVE BOX MUST ASSURE PROPER OPERATION OF QUICK COUPLER KEY.
3. INSTALL SWING JOINT LAY ARM BETWEEN 30° AND 45° OF LATERAL PIPE IN ORDER TO ABSORB DOWNWARD IMPACT.

QUICK COUPLING VALVE ASSEMBLY (1.5" AND SMALLER)

N.T.S.

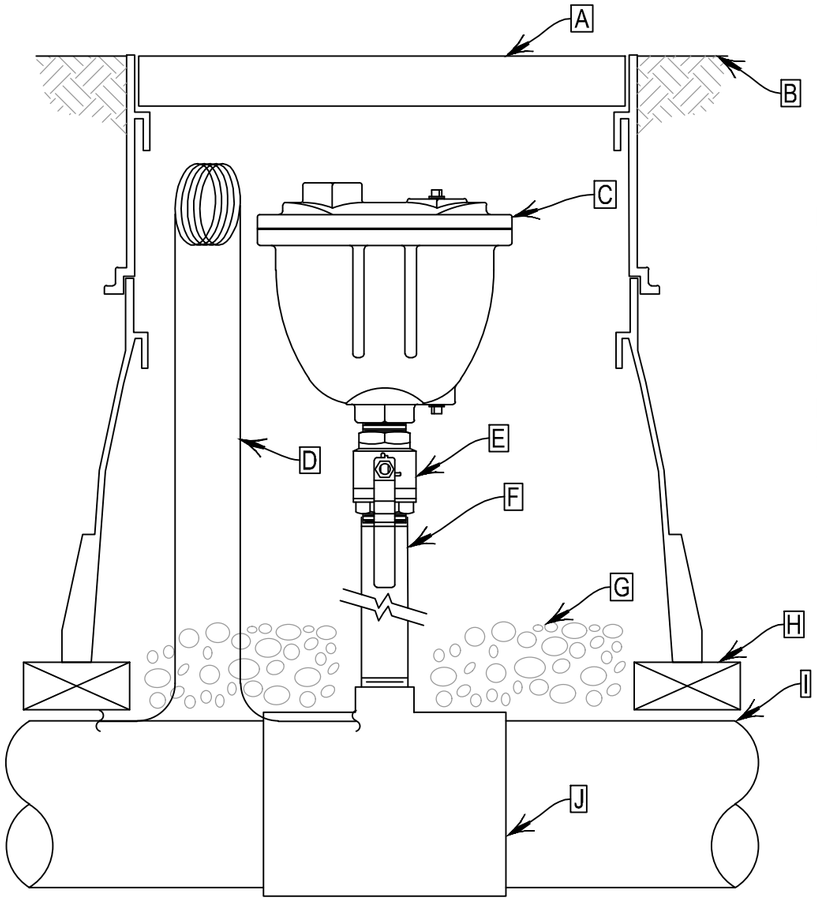


A. FINISH GRADE/TOP OF MULCH
B. 10" ROUND VALVE BOX WITH COVER
C. 4" PVC CL 200 PIPE (LENGTH AS REQUIRED)
D. 6" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
E. BRICK (1 OF 4)
F. TEE OR EL ON LATERAL PIPE
G. PVC SCH 40 PIPE (LENGTH AS REQUIRED)
H. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
I. 1" THREADED BRONZE GATE VALVE WITH CROSS HANDLE, SOLID WEDGE
J. PVC SCH 80 TOE NIPPLE (4" LENGTH)
K. PVC SCH 80 EL (1 OF 2)
L. PVC SCH 40 PIPE (4" LENGTH)
M. SUMP OF 3 CUBIC FEET OF 3/4" WASHED GRAVEL

NOTES:
1. SLEEVE TO BE SET SQUARE OVER GATE VALVE TO ALLOW FOR OPERATION OF VALVE WITHOUT BINDING.
2. FURNISH APPROPRIATE HANDLE AND KEY TO MATCH GATE VALVE.

MANUAL DRAIN VALVE ASSEMBLY (FOR LARGE SITES W/ ELEVATION CHANGE)

N.T.S.

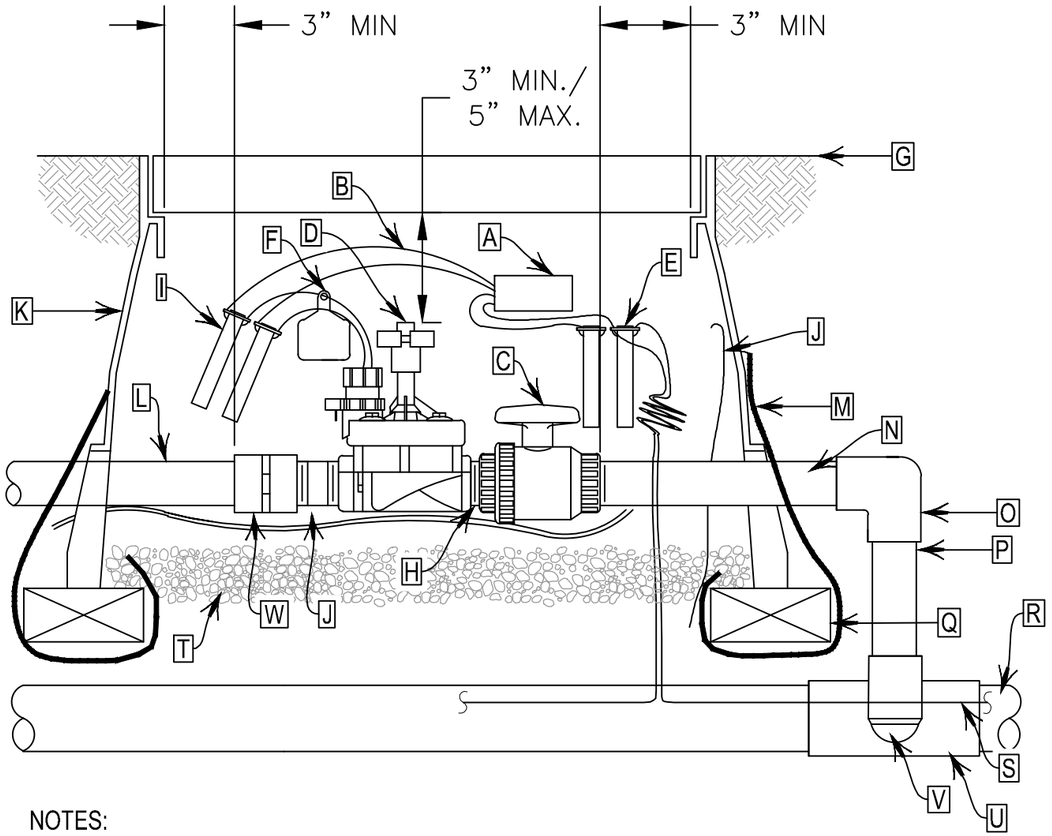


A. JUMBO VALVE BOX WITH EXTENSION AND COVER (HEIGHT AS REQUIRED)
B. FINISH GRADE/TOP OF MULCH
C. AIR VACUUM RELIEF VALVE
D. TRACING WIRE
E. BRASS BALL VALVE (SIZE 2")
F. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)
G. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
H. BRICK (1 OF 4)
I. PVC MAINLINE PIPE
J. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS

NOTES:
1. OPEN BALL VALVE IN ASSEMBLY 1/4 TURN UNTIL IRRIGATION SYSTEM IS FULLY CHARGED WITH WATER.
2. CLOSE VALVE DURING WINTERIZATION AND OPEN 1/2 TURN AFTER WINTERIZATION OF SYSTEM TO PROTECT VALVE DURING FREEZING WEATHER.

AIR VACUUM RELIEF VALVE ASSEMBLY

N.T.S.



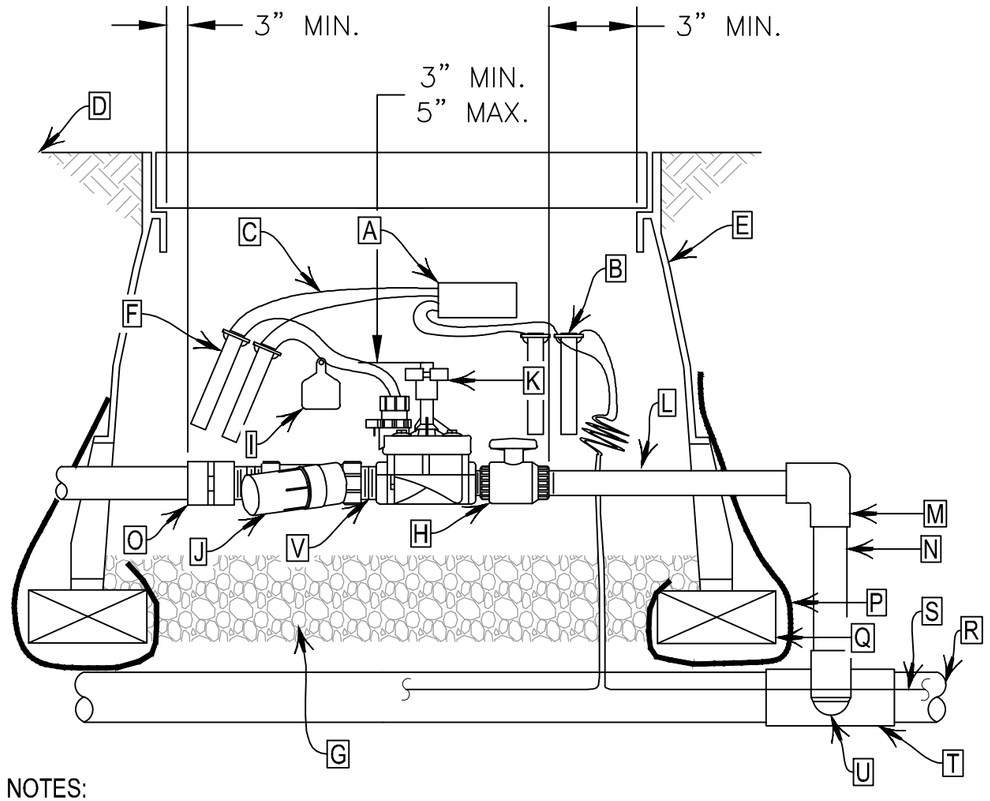
NOTES:

1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
7. COIL 3-FEET OF WIRE FOR EACH DECODER FOR SERVICE PURPOSES.

A. DECODER
B. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
C. PVC BALL VALVE
D. REMOTE CONTROL VALVE
E. WIRE SPLICE FROM TWO-WIRE CABLE TO DECODER (1 OF 2, REFER TO SPECIFICATIONS)
F. CHRISTY ID TAG
G. FINISH GRADE
H. PVC SCH 80 CLOSE NIPPLE
I. WIRE CONNECTOR FROM DECODER TO SOLENOID VALVE (1 OF 2)
J. PVC SCH 80 NIPPLE
K. 12" STANDARD VALVE BOX WITH COVER
L. PVC LATERAL PIPE
M. FILTER FABRIC
N. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
O. PVC SCH 40 EL
P. PVC SCH 40 PIPE (LENGTH AS REQUIRED)
Q. BRICK (1 OF 4)
R. PVC MAINLINE
S. TWO-WIRE CABLE
T. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
U. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS
V. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED, HIDDEN) AND PVC SCH 40 EL
W. PVC SCH40 FEMAIL ADAPTER

REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 1.5" AND SMALLER) (TWO-WIRE SYSTEM)

N.T.S.



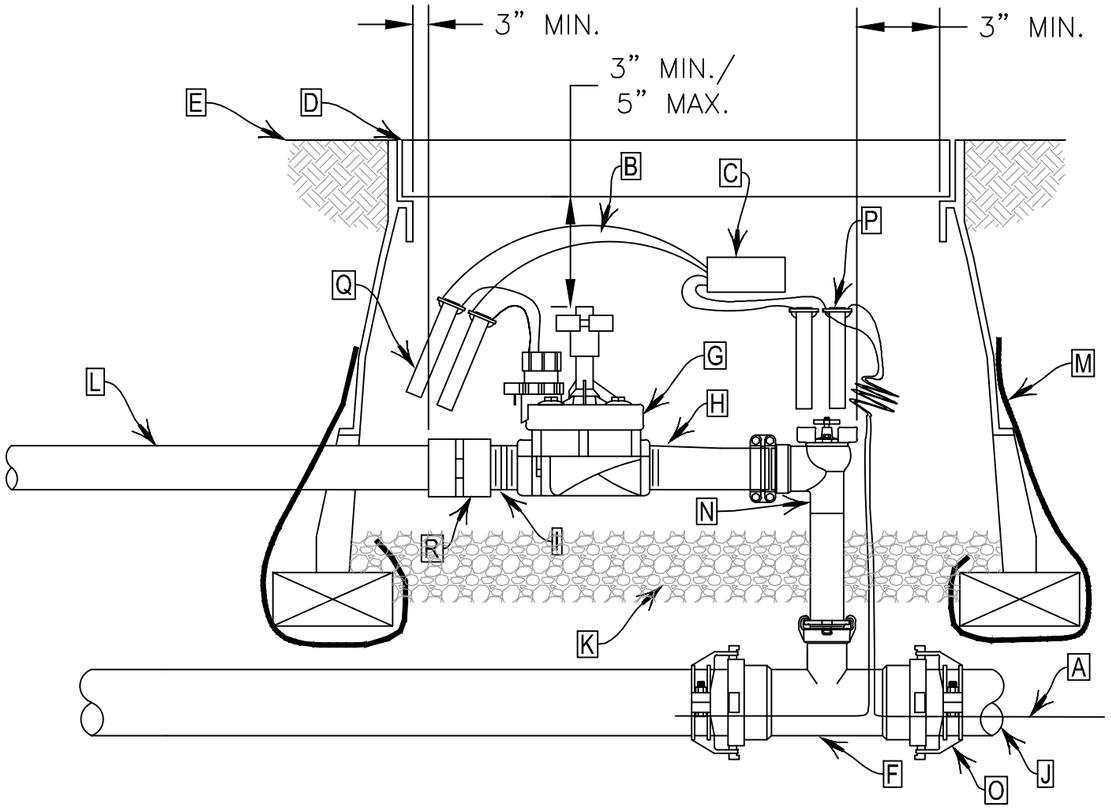
NOTES:

1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID, AND PROPER OPERATION OF BALL VALVE.
7. COIL 3-FEET OF WIRE FOR EACH DECODER FOR SERVICE PURPOSES.

A. DECODER
B. WIRE CONNECTOR FROM TWO-WIRE CABLE TO DECODER (1 OF 2)
C. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
D. FINISH GRADE/TOP OF MULCH
E. JUMBO VALVE BOX WITH COVER
F. WIRE SPLICE FROM DECODER TO SOLENOID VALVE (1 OF 2, REFER TO SPECIFICATIONS)
G. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
H. PVC BALL VALVE
I. CHRISTY I.D. TAG
J. FILTRATION AND PRESSURE REGULATING DEVICE
K. REMOTE CONTROL VALVE
L. PVC SCH 80 TOE NIPPLE
M. PVC SCH 40 EL
N. PVC SCH 40 PIPE (TYPICAL) (LENGTH AS REQUIRED)
O. PVC SCH 40 FEMALE ADAPTER
P. FILTER FABRIC
Q. BRICK (1 OF 4)
R. PVC MAINLINE
S. TWO-WIRE CABLE
T. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS
U. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED, HIDDEN) AND PVC SCH 40 EL
V. PVC SCH 80 NIPPLE (1 OF 2)

DRIP REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 1.5" AND SMALLER) (TWO-WIRE SYSTEM)

N.T.S.

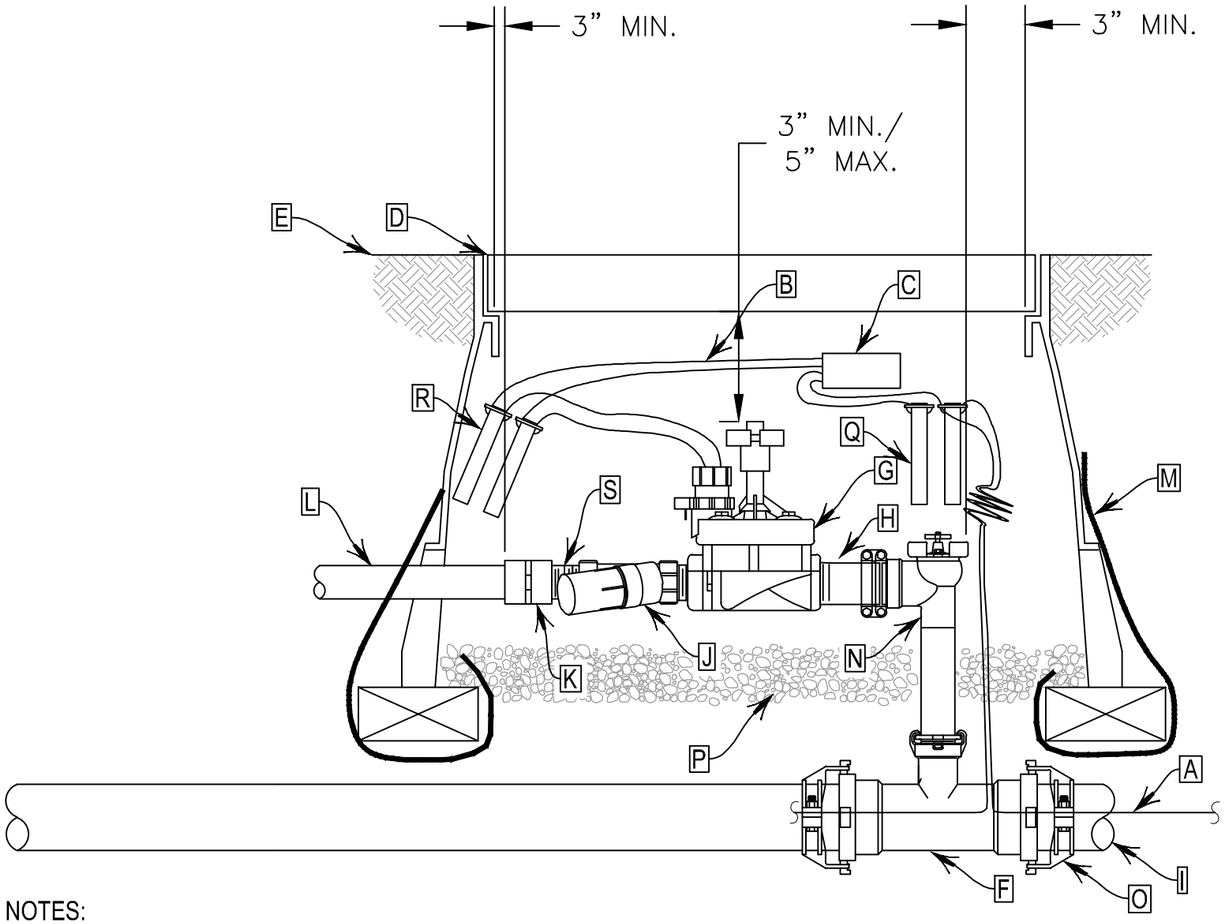


A. TWO-WIRE CABLE
B. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
C. DECODER
D. JUMBO VALVE BOX WITH LID
E. FINISH GRADE
F. DUCTILE IRON GASKETED LATERAL SWIVEL TEE WITH 2-INCH OUTLET: LEEMCO LT SERIES
G. REMOTE CONTROL VALVE
H. LEEMCO LMNP SERIES ADAPTER. OUTLET SIZE TO MATCH REMOTE CONTROL VALVE SIZE.
I. PVC SCH 80 NIPPLE
J. PVC MAINLINE PIPE
K. 3-INCH DEPTH OF 3/4-INCH WASHED GRAVEL
L. PVC LATERAL PIPE
M. FILTER FABRIC
N. 2-INCH DUCTILE IRON ANGLE VALVE: LEEMCO LV-200. SECURE ANGLE VALVE POSITION WITH LEEMCO LV CLIPS PER MANUFACTURER'S GUIDELINES.
O. JOINT RESTRAINT (1 OF 2)
P. WIRE SPLICE FROM TWO-WIRE CABLE TO DECODER (1 OF 2, REFER TO SPECIFICATIONS)
Q. WIRE CONNECTOR FROM DECODER TO SOLENOID VALVE (1 OF 2)
R. PVC SCH40 FEMALE ADAPTER

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
7. INSTALL SO THAT NO GRAVEL IS IN CONTACT WITH VALVE ASSEMBLY.
8. COIL 3-FEET OF WIRE FOR EACH DECODER FOR SERVICE PURPOSES.

REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 2" AND LARGER) (TWO-WIRE SYSTEM)

N.T.S.

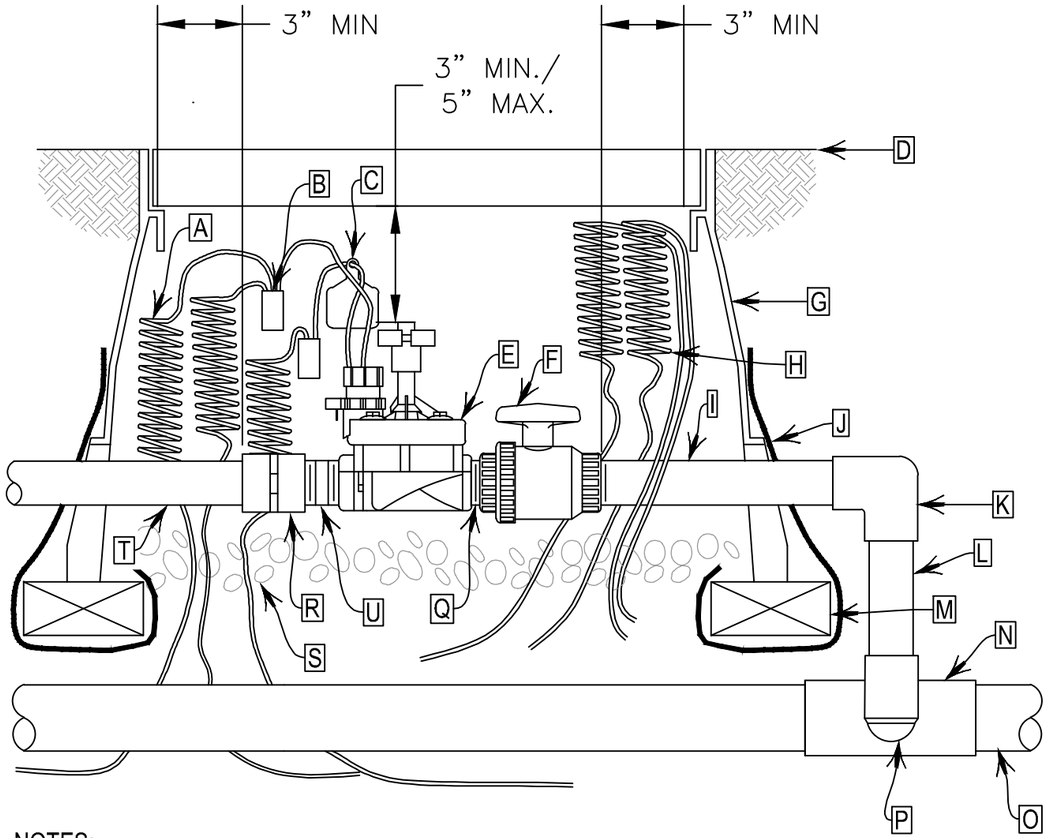


A. TWO-WIRE CABLE
B. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
C. DECODER
D. JUMBO VALVE BOX WITH LID
E. FINISH GRADE
F. DUCTILE IRON GASKETED LATERAL SWIVEL TEE WITH 2-INCH OUTLET: LEEMCO LT SERIES
G. REMOTE CONTROL VALVE
H. LEEMCO LMNP SERIES ADAPTER. OUTLET SIZE TO MATCH REMOTE CONTROL VALVE SIZE.
I. PVC MAINLINE PIPE
J. FILTER/PRESSURE REGULATION DEVICE
K. PVC SCH 40 FEMALE ADAPTER
L. PVC MANIFOLD PIPE
M. FILTER FABRIC
N. 2-INCH DUCTILE IRON ANGLE VALVE: LEEMCO LV-200. SECURE ANGLE VALVE POSITION WITH LEEMCO LV CLIPS PER MANUFACTURER'S GUIDELINES.
O. JOINT RESTRAINT (1 OF 2)
P. 3-INCH DEPTH OF 3/4-INCH WASHED GRAVEL
Q. WIRE SPLICE FROM TWO-WIRE CABLE TO DECODER (1 OF 2, REFER TO SPECIFICATION).
R. WIRE SPLICE FROM DECODER TO SOLENOID VALVE (1 OF 2, REFER TO SPECIFICATIONS)
S. PVC SCH 80 NIPPLE (1 OF 2)

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
7. INSTALL SO THAT NO GRAVEL IS IN CONTACT WITH VALVE ASSEMBLY.
8. COIL 3-FEET OF WIRE FOR EACH DECODER FOR SERVICE PURPOSES.

DRIP REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 2" AND LARGER) (TWO-WIRE SYSTEM)

N.T.S.

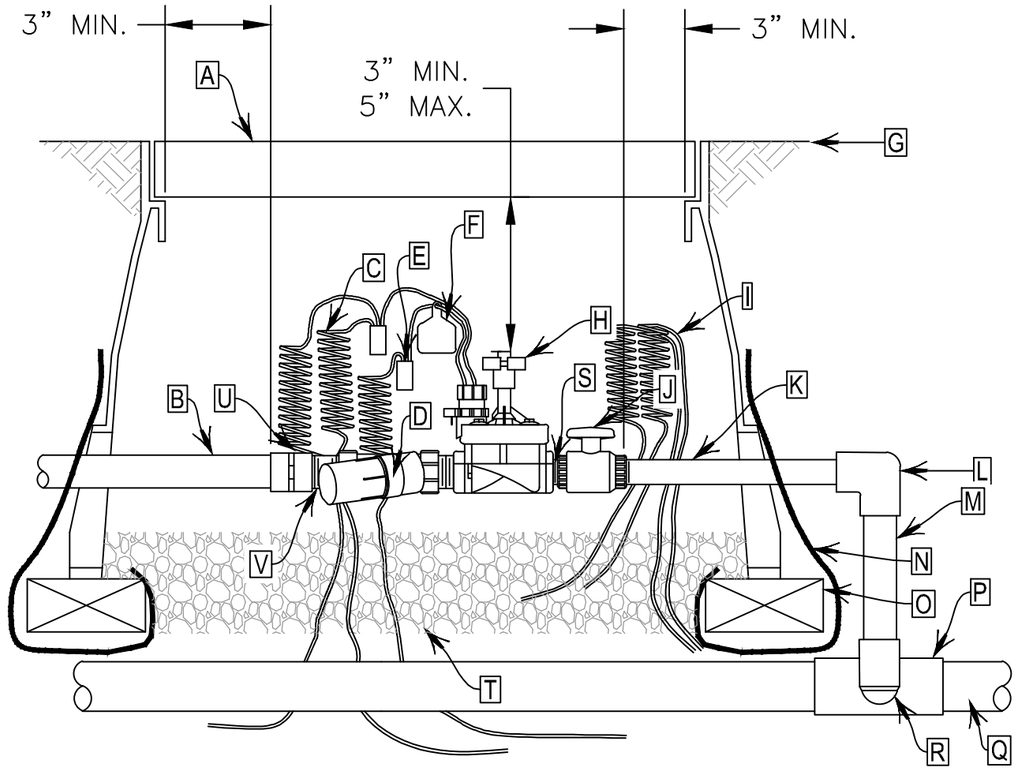


A. 30" LENGTH OF COILED WIRE
B. WATERPROOF CONNECTION (1 OF 2)
C. CHRISTY ID TAG
D. FINISH GRADE
E. REMOTE CONTROL VALVE (SIZED AS SHOWN ON DRAWINGS)
F. PVC BALL VALVE
G. 12" STANDARD VALVE BOX WITH COVER
H. SPARE WIRE
I. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
J. FILTER FABRIC
K. PVC SCH 40 EL
L. PVC SCH 40 PIPE (LENGTH AS REQUIRED)
M. BRICK (1 OF 4)
N. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS
O. PVC MAINLINE
P. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED, HIDDEN) AND PVC SCH 40 EL
Q. PVC SCH 80 CLOSE NIPPLE
R. PVC SCH 40 FEMALE ADAPTER
S. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
T. PVC LATERAL PIPE
U. PVC SCH 80 NIPPLE

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.

REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 1.5" AND SMALLER) (TRADITIONAL WIRED)

N.T.S.

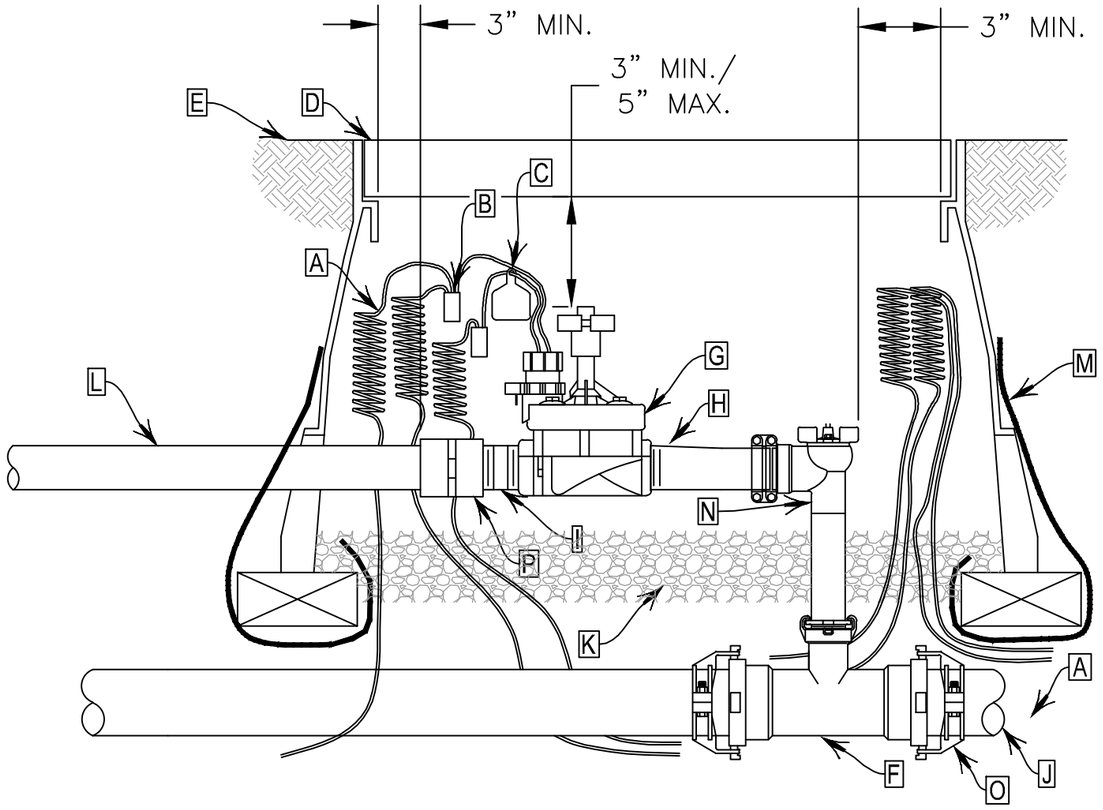


A. JUMBO VALVE BOX WITH COVER
B. PVC MANIFOLD PIPE
C. 30" LENGTH OF COILED WIRE
D. FILTRATION/PRESSURE REGULATION DEVICE
E. WATERPROOF CONNECTION (1 OF 2)
F. CHRISTY ID TAG
G. FINISH GRADE/TOP OF MULCH
H. REMOTE CONTROL VALVE
I. SPARE WIRE
J. PVC BALL VALVE
K. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
L. PVC SCH 40 EL
M. PVC SCH 40 PIPE (LENGTH AS REQUIRED)
N. FILTER FABRIC
O. BRICK (1 OF 4)
P. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS
Q. PVC MAINLINE
R. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED, HIDDEN) AND PVC SCH 40 EL
S. PVC SCH 80 CLOSE NIPPLE
T. 3" MINIMUM DEPTH OF WASHED PEA GRAVEL
U. PVC SCH 40 FEMALE ADAPTER
V. PVC SCH 80 NIPPLE

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.

DRIP REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 1.5" AND SMALLER) (TRADITIONAL WIRED)

N.T.S.

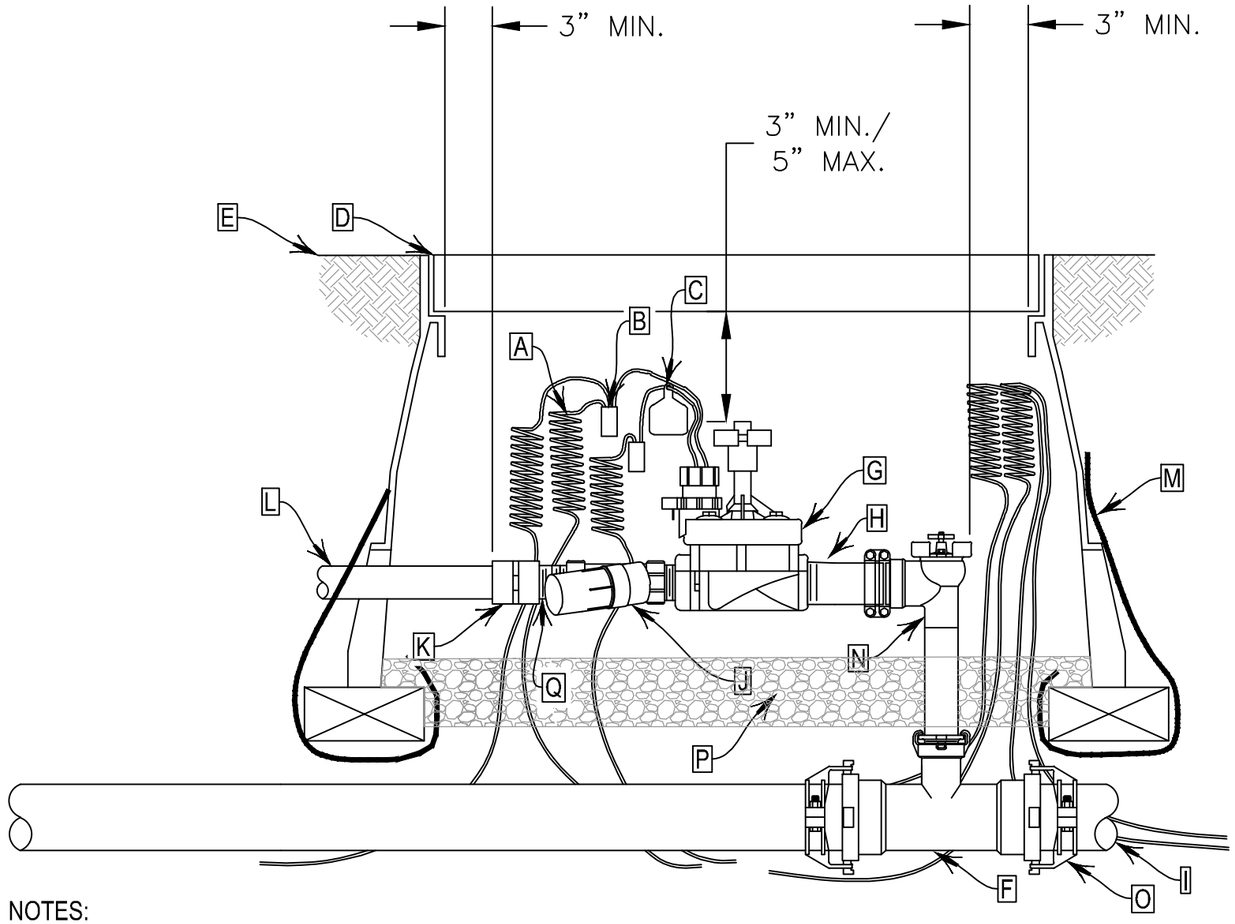


A. 30" LENGTH OF COILED WIRE
B. WATERPROOF CONNECTION (1 OF 2)
C. CHRISTY ID TAG
D. JUMBO VALVE BOX WITH LID
E. FINISH GRADE
F. DUCTILE IRON GASKETED LATERAL SWIVEL TEE WITH 2-INCH OUTLET: LEEMCO LT SERIES
G. REMOTE CONTROL VALVE
H. LEEMCO LMNP SERIES ADAPTER. OUTLET SIZE TO MATCH REMOTE CONTROL VALVE SIZE.
I. PVC SCH. 80 NIPPLE
J. PVC MAINLINE PIPE
K. 3-INCH DEPTH OF 3/4-INCH WASHED GRAVEL
L. PVC LATERAL PIPE
M. FILTER FABRIC
N. 2-INCH DUCTILE IRON ANGLE VALVE: LEEMCO LV-200. SECURE ANGLE VALVE POSITION WITH LEEMCO LV CLIPS PER MANUFACTURER'S GUIDELINES.
O. JOINT RESTRAINT (1 OF 2)
P. PVC SCH40 FEMALE ADAPTER

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
7. INSTALL SO THAT NO GRAVEL IS IN CONTACT WITH VALVE ASSEMBLY.

REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 2" AND LARGER) (TRADITIONAL WIRED)

N.T.S.

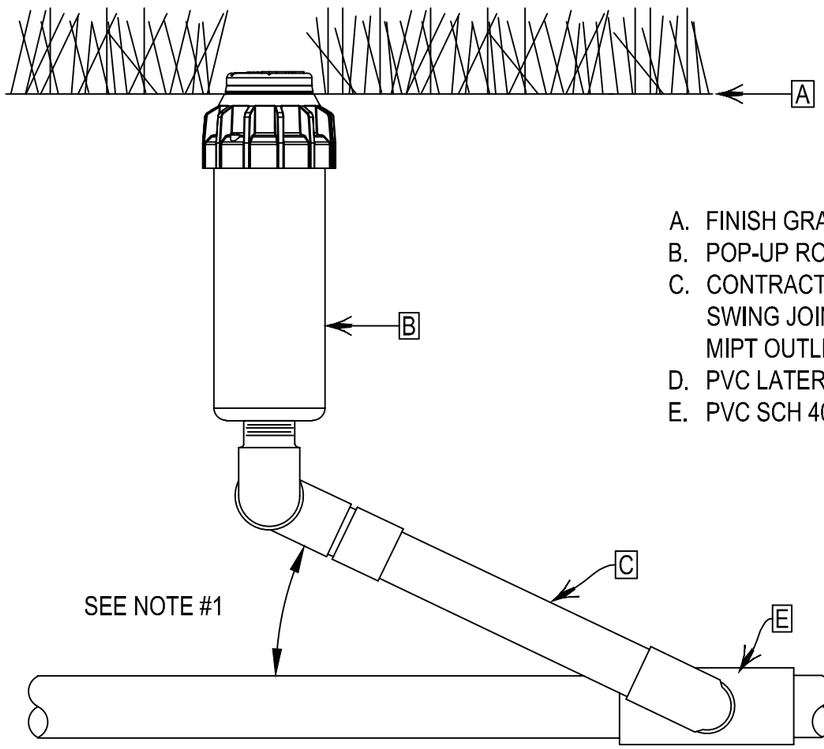


A. 30" LENGTH OF COILED WIRE
B. WATERPROOF CONNECTION (1 OF 2)
C. CHRISTY ID TAG
D. JUMBO VALVE BOX WITH LID
E. FINISH GRADE
F. DUCTILE IRON GASKETED LATERAL SWIVEL TEE WITH 2-INCH OUTLET: LEEMCO LT SERIES
G. REMOTE CONTROL VALVE
H. LEEMCO LMNP SERIES ADAPTER. OUTLET SIZE TO MATCH REMOTE CONTROL VALVE SIZE.
I. PVC MAINLINE PIPE
J. FILTER/PRESSURE REGULATION DEVICE
K. PVC SCH 40 FEMALE ADAPTER
L. PVC MANIFOLD PIPE
M. FILTER FABRIC
N. 2-INCH DUCTILE IRON ANGLE VALVE: LEEMCO LV-200. SECURE ANGLE VALVE POSITION WITH LEEMCO LV CLIPS PER MANUFACTURER'S GUIDELINES.
O. JOINT RESTRAINT (1 OF 2)
P. 3-INCH DEPTH OF 3/4-INCH WASHED GRAVEL
Q. PVC SCH 80 NIPPLE (1 OF 2)

NOTES:
1. USE VALVE BOX EXTENSION AS NECESSARY TO ACHIEVE MINIMUM DIMENSIONS ABOVE ASSEMBLY.
2. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.
4. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
5. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
6. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
7. INSTALL SO THAT NO GRAVEL IS IN CONTACT WITH VALVE ASSEMBLY.

DRIP REMOTE CONTROL VALVE ASSEMBLY (MAINLINE 2" AND LARGER) (TRADITIONAL WIRED)

N.T.S.

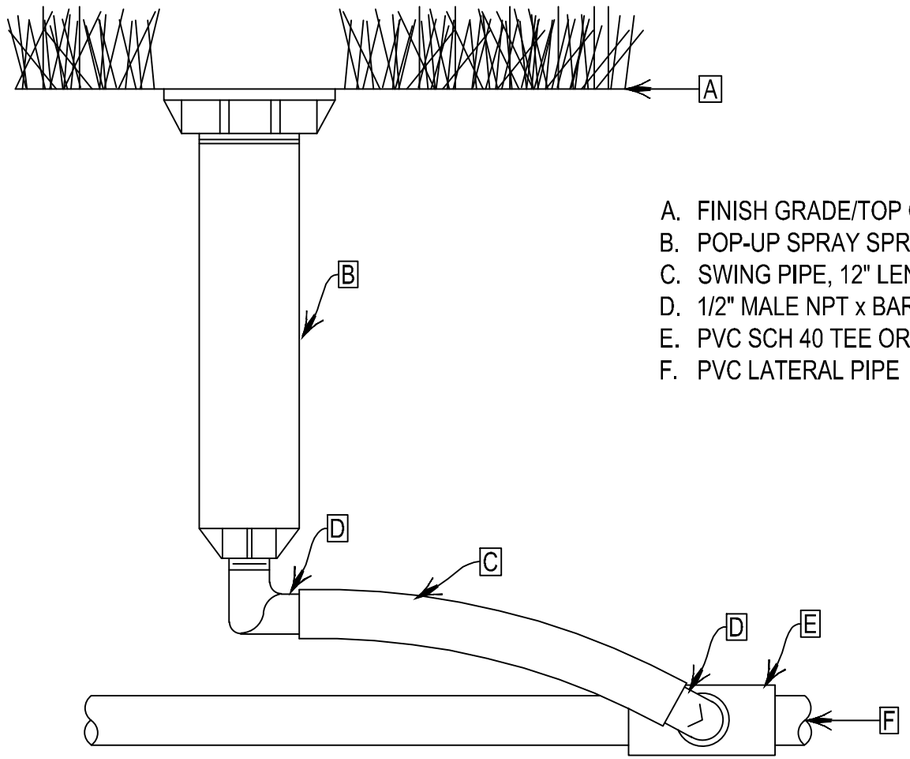


A. FINISH GRADE
B. POP-UP ROTOR SPRINKLER
C. CONTRACTOR FABRICATED SWING JOINT MIPT INLET x MIPT OUTLET
D. PVC LATERAL PIPE
E. PVC SCH 40 TEE OR EL

NOTE:
1. INSTALL SWING JOINT LAY ARM BETWEEN 30° AND 45° OF LATERAL PIPE TO ABSORB DOWNWARD IMPACT.

POP-UP ROTOR SPRINKLER ASSEMBLY

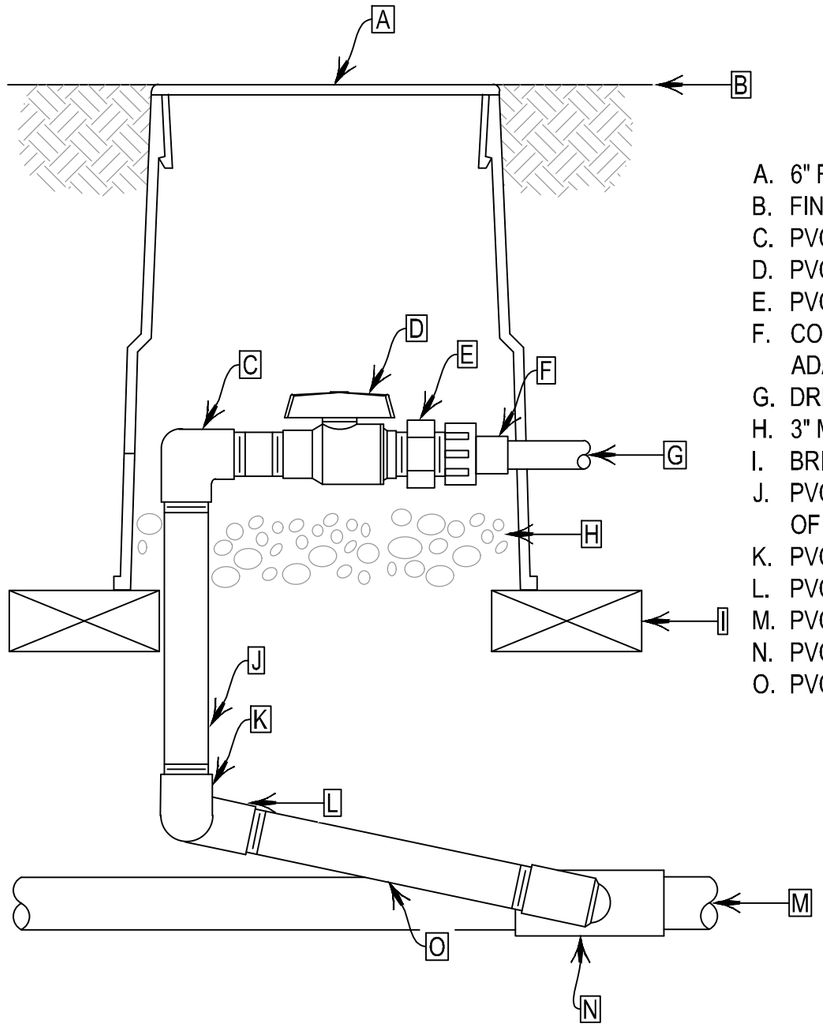
N.T.S.



A. FINISH GRADE/TOP OF MULCH
B. POP-UP SPRAY SPRINKLER
C. SWING PIPE, 12" LENGTH
D. 1/2" MALE NPT x BARB EL
E. PVC SCH 40 TEE OR EL
F. PVC LATERAL PIPE

POP-UP SPRAY SPRINKLER ASSEMBLY

N.T.S.

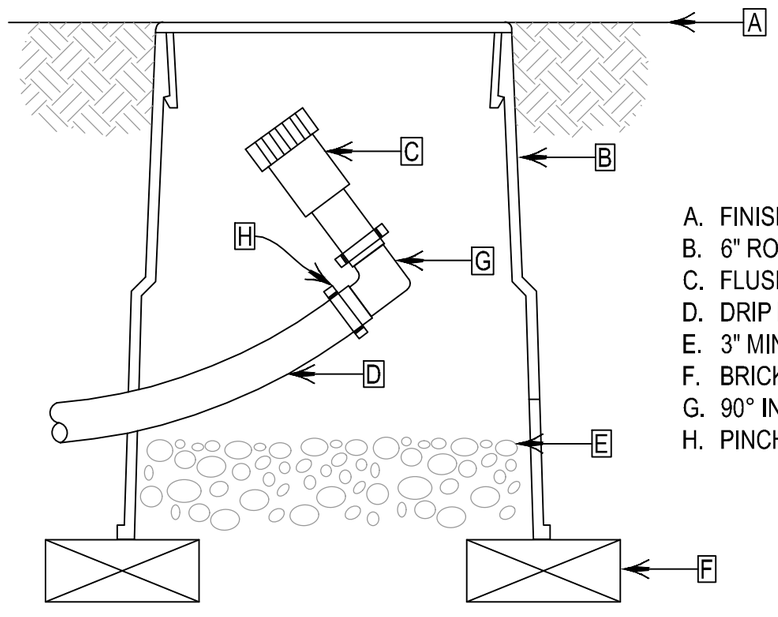


A. 6" ROUND VALVE BOX WITH COVER
B. FINISH GRADE/TOP OF MULCH
C. PVC SCH. 40 EL
D. PVC BALL VALVE
E. PVC SCH. 40 TRANSITION NIPPLE (MIPTxMHT)
F. COMPRESSIONxFEMALE HOSE SWIVEL ADAPTER
G. DRIP LATERAL PIPING
H. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
I. BRICK (1 OF 2)
J. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED, 1 OF 2)
K. PVC SCH 40 EL
L. PVC SCH 40 STREET EL (1 OF 2)
M. PVC DRIP MANIFOLD PIPE
N. PVC SCH 40 TEE OR EL
O. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)

NOTE:
1. INTENT IS FOR ISOLATION OF DRIP BEDS OR AREAS

ZONE CONTROL VALVE ASSEMBLY

N.T.S.



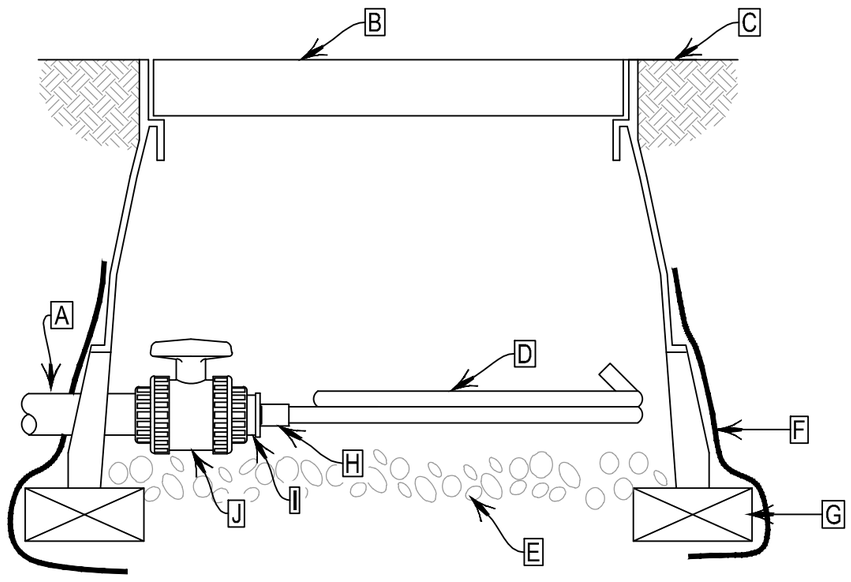
A. FINISH GRADE/TOP OF MULCH
B. 6" ROUND VALVE BOX WITH COVER
C. FLUSH CAP WITH HOSE THREAD CAP
D. DRIP IRRIGATION LATERAL
E. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
F. BRICK (1 OF 2)
G. 90° INSERT FITTING
H. PINCH CLAMP (1 OF 2)

NOTE:
1. INSTALL FLUSH CAP ASSEMBLY AT THE END OF EACH DRIP LATERAL SEGMENT.

FLUSH CAP ASSEMBLY

N.T.S.

A. PVC PIPE
B. 12" STANDARD VALVE BOX WITH COVER
C. FINISH GRADE/TOP OF MULCH
D. FLEXIBLE VINYL IRRIGATION HOSE: AQUARIUS BRANDS 5/8" FLEX VINYL IRRIGATION HOSE
E. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
F. FILTER FABRIC
G. BRICK (1 OF 4)
H. SCH 40 PVC HOSE FITTING: MIPT X HOSE FITTING
I. SCH 40 PVC REDUCER BUSHING FITTING (SPIG X FIPT)
J. TRUE UNION PVC BALL VALVE

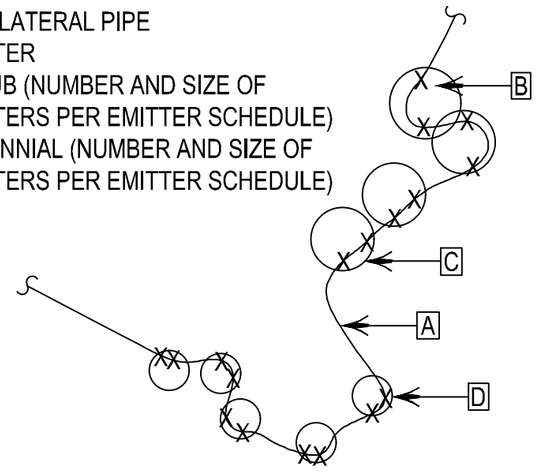


NOTES:
1. NOMINAL SIZE OF BALL VALVE TO MATCH NOMINAL LATERAL SIZE.
2. USE FOR FLUSHING AND WINTERIZATION OF DRIP LATERAL.
3. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX.

PVC FLUSH VALVE ASSEMBLY

N.T.S.

A. DRIP LATERAL PIPE
B. EMITTER
C. SHRUB (NUMBER AND SIZE OF EMITTERS PER EMITTER SCHEDULE)
D. PERENNIAL (NUMBER AND SIZE OF EMITTERS PER EMITTER SCHEDULE)



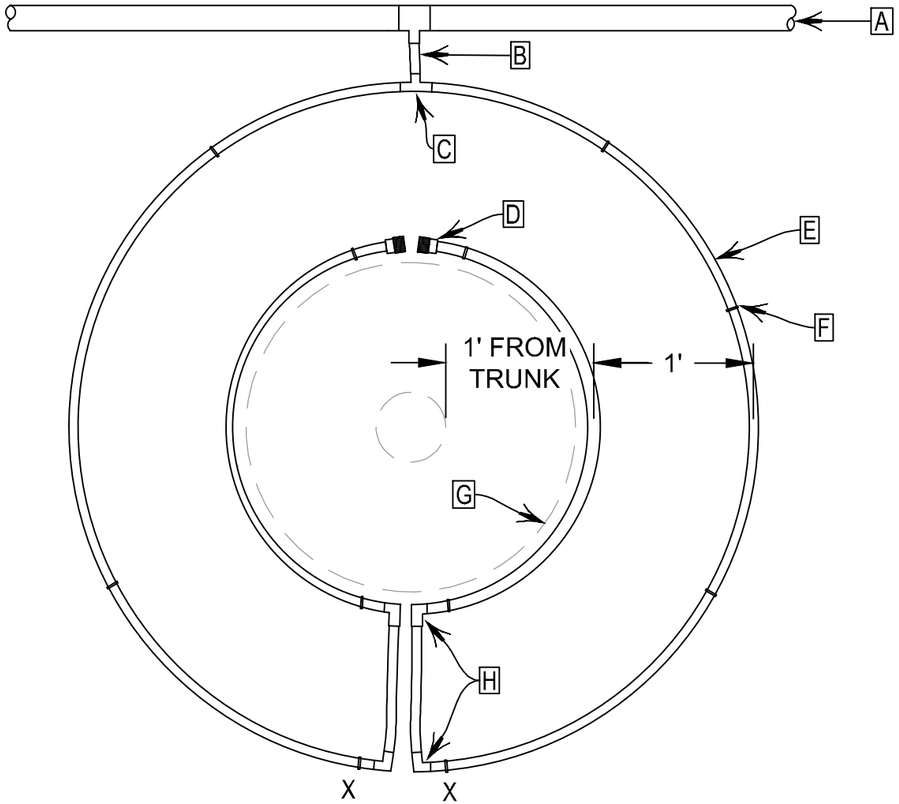
EMITTER SCHEDULE

PLANT TYPE	EMITTERS PER PLANT	GPH PER OUTLET	TOTAL GPH PER PLANT
5 GAL. LOW SHRUBS	2 SINGLE	1 GPH	2 GPH
1 GAL. LOW SHRUBS	2 SINGLE	1/2 GPH	1 GPH
1 GAL. LOW GROUND COVER/PERENNIAL	2 SINGLE	1/2 GPH	1 GPH
5 GAL. MEDIUM SHRUBS	2 SINGLE	2 GPH	4 GPH
1 GAL. MEDIUM SHRUBS	2 SINGLE	1 GPH	2 GPH
1 GAL. MEDIUM GROUND COVER/PERENNIAL	2 SINGLE	1 GPH	2 GPH

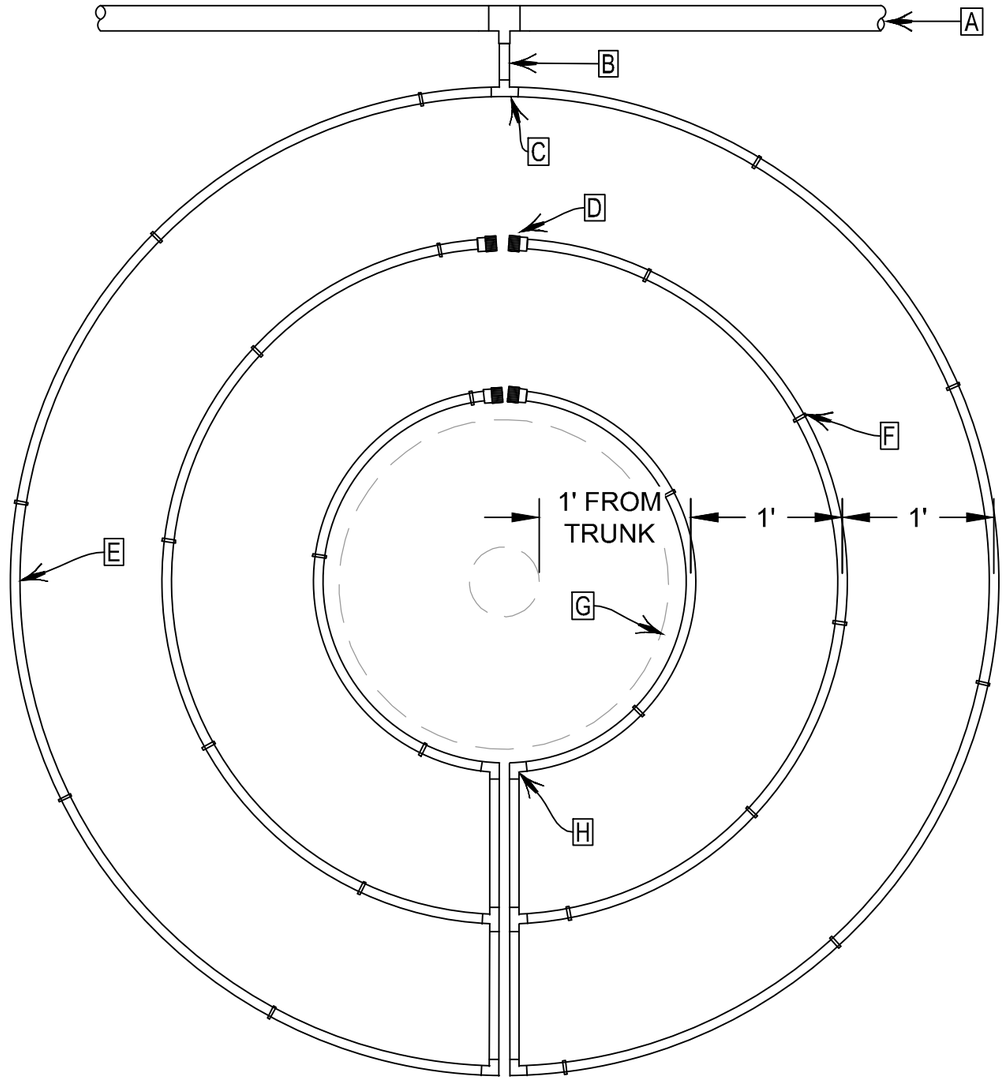
NOTE:
1. ALL EMISSION POINTS TO BE LOCATED ON THE UPHILL SIDE OF PLANT MATERIAL.
2. PLACE EMITTERS AT A LOCATION TO NOT SATURATE PLANT ROOTS, LOCATE EMITTERS JUST OFF THE EDGE OF THE ROOT BALL.
3. REVIEW PLANT MATERIAL HEALTH 1 MONTH AFTER INSTALLATION AND ADJUST EMITTER SIZE AND QUANTITY PER CITY FORESTRY DIRECTION.

DRIP EMITTER PLACEMENT DETAIL

N.T.S.



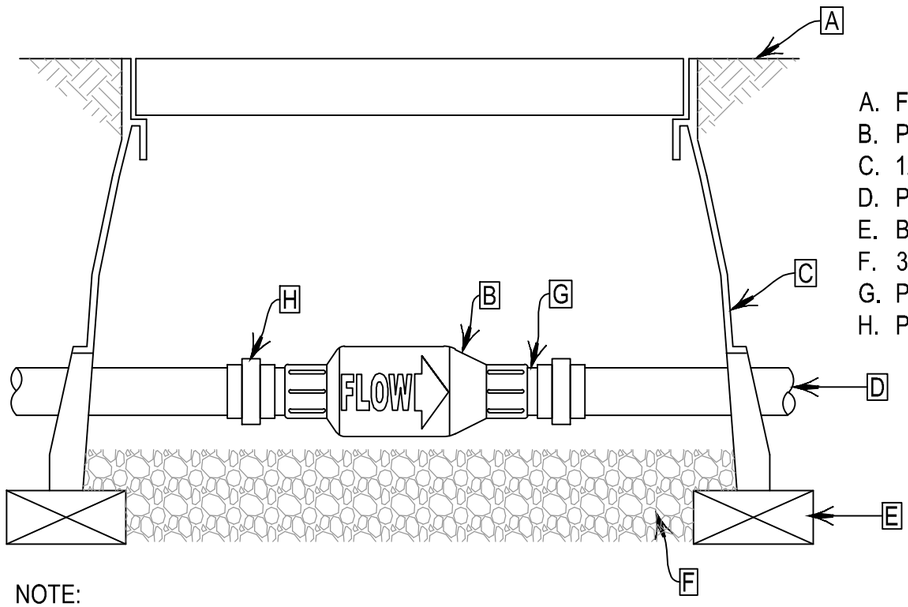
A. PVC PIPE
B. 3/4" POLYETHYLENE TUBING: RAIN BIRD XBS BLACK STRIPE PIPE
C. EASY FIT COMPRESSION TEE: RAIN BIRD MDCFTEE (QTY AS REQUIRED)
D. EASY FIT REMOVABLE FLUSH CAP: RAIN BIRD MDCFCAP (QTY AS REQUIRED)
E. LANDSCAPE DRIPLINE TUBING: RAIN BIRD DRIPLINE MODEL XFCV-06-12 (0.6 GPH/EMITTER)
F. TIE DOWN STAKE: RAIN BIRD TDS-050 W/BEND (QTY AS REQUIRED)
G. TREE ROOTBALL
H. EASY FIT COMPRESSION ELBOW RAIN BIRD MDCFEL (QTY AS REQUIRED)



NOTE:
1. CONTRACTOR SHALL INSTALL ALL DRIP TUBING IN TURF AND NATIVE AREAS 2-3" BELOW GRADE.
2. DIAMETER OF DRIPLINE RINGS ARE DEPENDANT ON TREE CANOPY SIZE.
3. CONTRACTOR SHALL CUT DRIP TUBING AT POINT "X" AND INSTALL FLUSH CAP AS TRUNK DIAMETER INCREASES.
4. APPROXIMATE FLOW PER ASSEMBLY IS 0.23 GPM FOR THE 2-RING ASSEMBLY AND .43 GPM FOR THE 3-RING ASSEMBLY.

DRIP TREE RING ASSEMBLY

N.T.S.

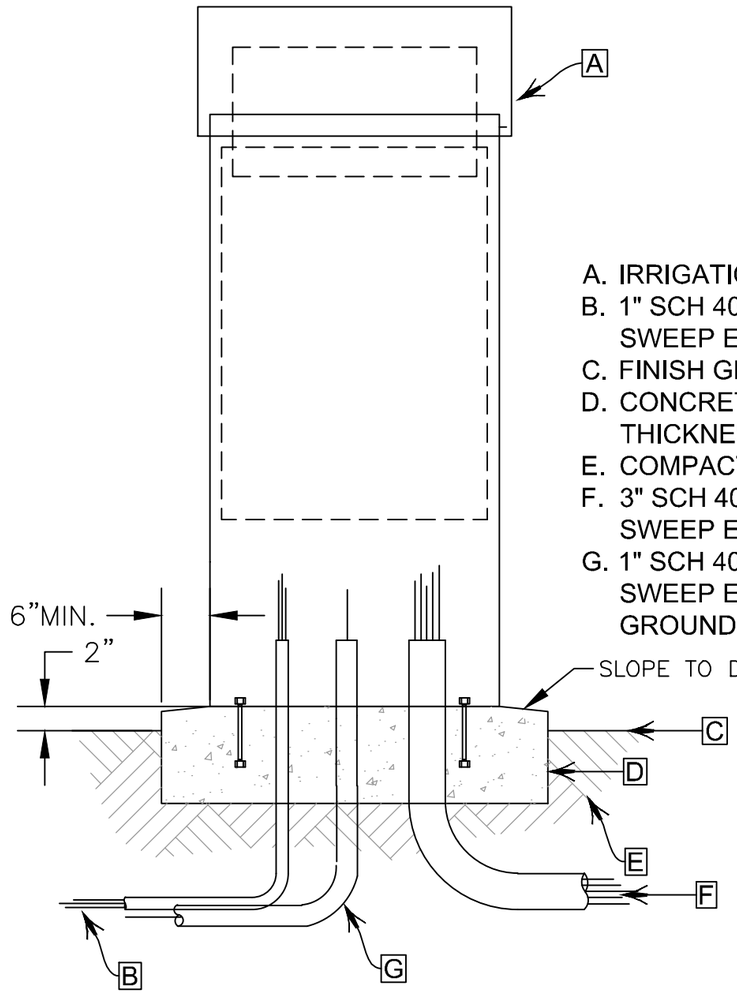


A. FINISH GRADE
B. PVC SWING CHECK VALVE
C. 12" STANDARD VALVE BOX WITH COVER
D. PVC LATERAL PIPE
E. BRICK (1 OF 4)
F. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
G. PVC SCH 80 CLOSE NIPPLE (1 OF 2)
H. PVC SCH 40 UNION (1 OF 2)

NOTE:
1. NOMINAL SIZE OF CHECK VALVE TO MATCH NOMINAL SIZE OF LATERAL PIPE.

SWING CHECK VALVE ASSEMBLY

N.T.S.

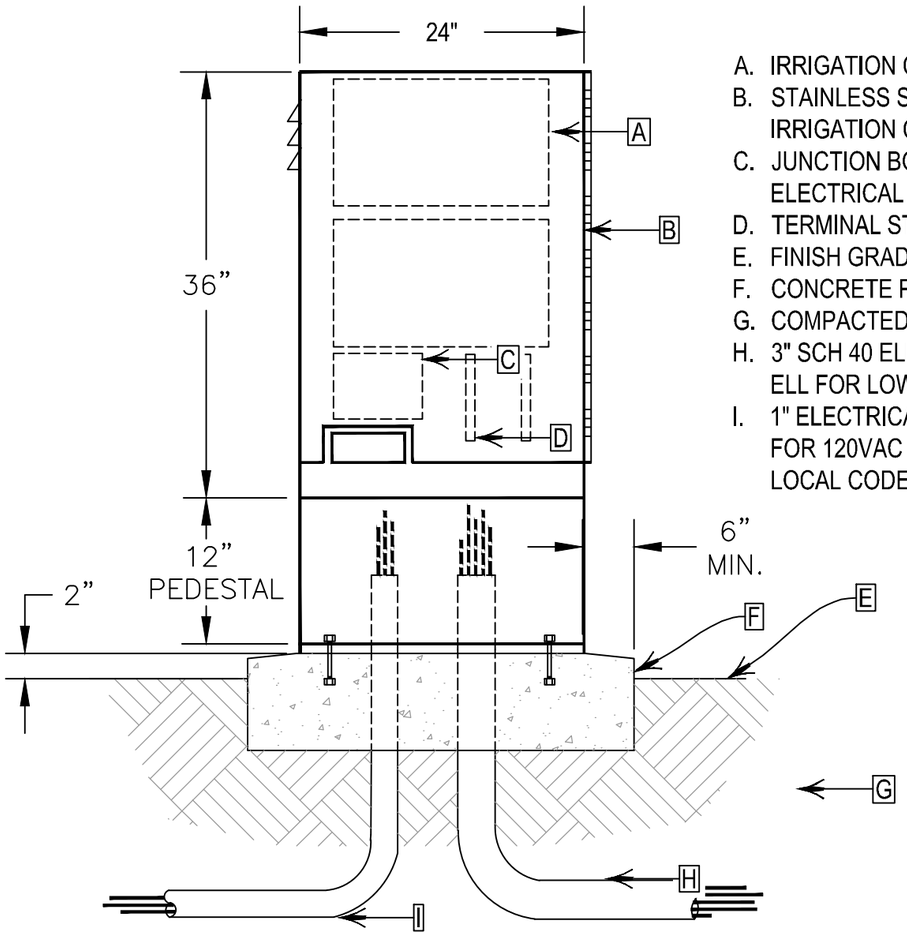


A. IRRIGATION CONTROLLER ASSEMBLY
B. 1" SCH 40 ELECTRICAL CONDUIT AND SWEEP EL FOR ELECTRICAL SERVICE
C. FINISH GRADE
D. CONCRETE PAD (6" MINIMUM THICKNESS)
E. COMPACTED SUBGRADE
F. 3" SCH 40 ELECTRICAL CONDUIT AND SWEEP EL FOR CONTROL WIRING
G. 1" SCH 40 ELECTRICAL CONDUIT AND SWEEP EL FOR ELECTRICAL GROUNDING

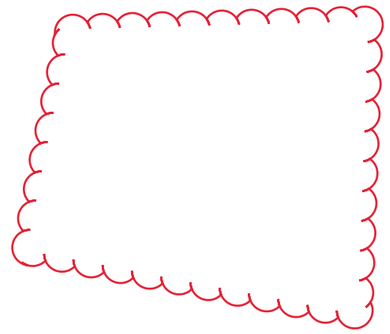
NOTE:
1. PROVIDE PRE-WIRED U.L. LISTED CONTROLLER ASSEMBLY.

IRRIGATION CONTROLLER ASSEMBLY (FLIP TOP PEDESTAL MOUNT)

NTS



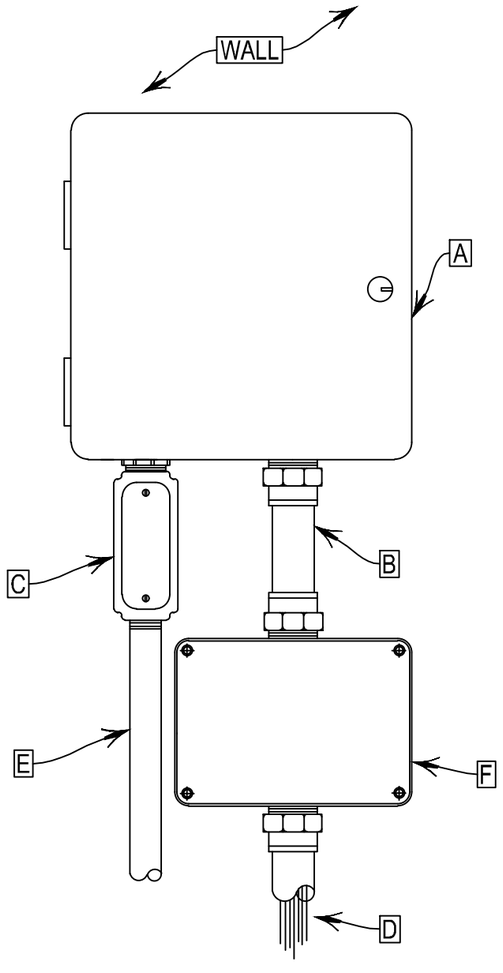
A. IRRIGATION CONTROLLER
B. STAINLESS STEEL ENCLOSURE FOR IRRIGATION CONTROLLER
C. JUNCTION BOX WITH DISCONNECT FOR ELECTRICAL SERVICE
D. TERMINAL STRIPS FOR CONTROL WIRING
E. FINISH GRADE
F. CONCRETE PAD (6" MINIMUM THICKNESS)
G. COMPACTED SUBGRADE
H. 3" SCH 40 ELECTRICAL CONDUIT AND SWEEP ELL FOR LOW VOLTAGE WIRING
I. 1" ELECTRICAL CONDUIT AND SWEEP ELL FOR 120VAC ELECTRICAL SERVICE PER LOCAL CODES



NOTE:
1. PROVIDE PRE-WIRED U.L. LISTED CONTROLLER ASSEMBLY.
2. PAINT ENCLOSURE WITH TWO COATS OF RUST INHIBITING PAINT.

IRRIGATION CONTROLLER ASSEMBLY (PEDESTAL MOUNT)

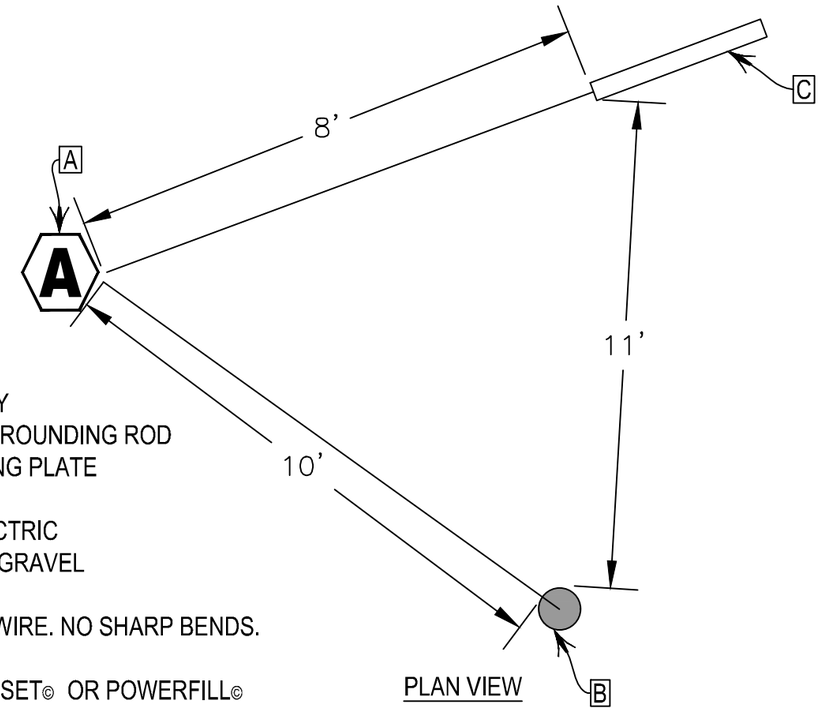
N.T.S.



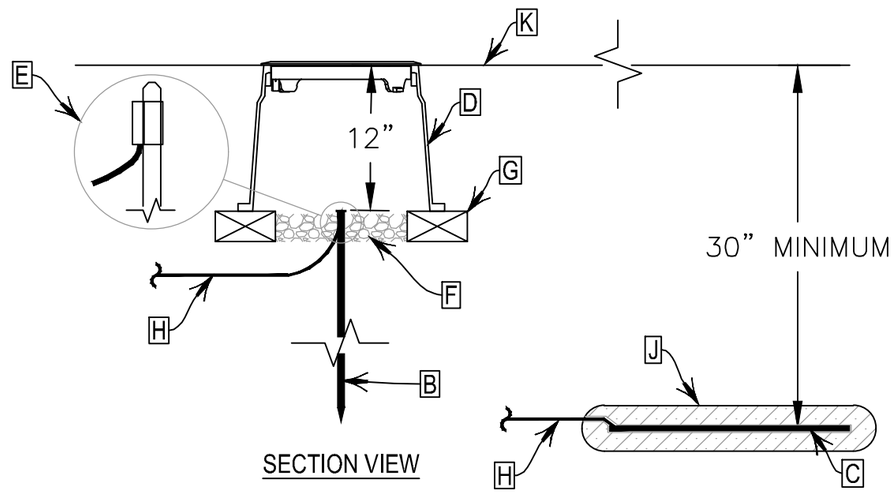
A. IRRIGATION CONTROLLER INDOOR WALL MOUNT
B. 2" PVC SCH 40 CONDUIT AND FITTINGS
C. JUNCTION BOX
D. WIRES TO REMOTE CONTROL VALVES
E. 1" PVC SCH 40 CONDUIT AND FITTINGS TO POWER SUPPLY
F. JUNCTION BOX (ONLY REQUIRED FOR CONVENTIONALLY WIRED SYSTEMS WITH MORE THAN 24 ZONES). SIZE AS NECESSARY.

IRRIGATION CONTROLLER ASSEMBLY (WALL MOUNT)

N.T.S.



A. IRRIGATION CONTROLLER ASSEMBLY
B. UL LISTED 5/8" X 10' COPPER-CLAD GROUNDING ROD
C. UL LISTED 4" X 8' COPPER GROUNDING PLATE
D. 10" ROUND VALVE BOX WITH COVER
E. CADWELD CONNECTION: PAIGE ELECTRIC
F. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
G. BRICK (1 OF 4)
H. #6 AWG INSULATED SOLID COPPER WIRE. NO SHARP BENDS.
I. SPHERE OF INFLUENCE
J. EARTH CONTACT MATERIAL, POWERSET© OR POWERFILL© DEPENDING ON SOIL CONDITIONS
K. FINISH GRADE



CONTROLLER GROUNDING DETAIL

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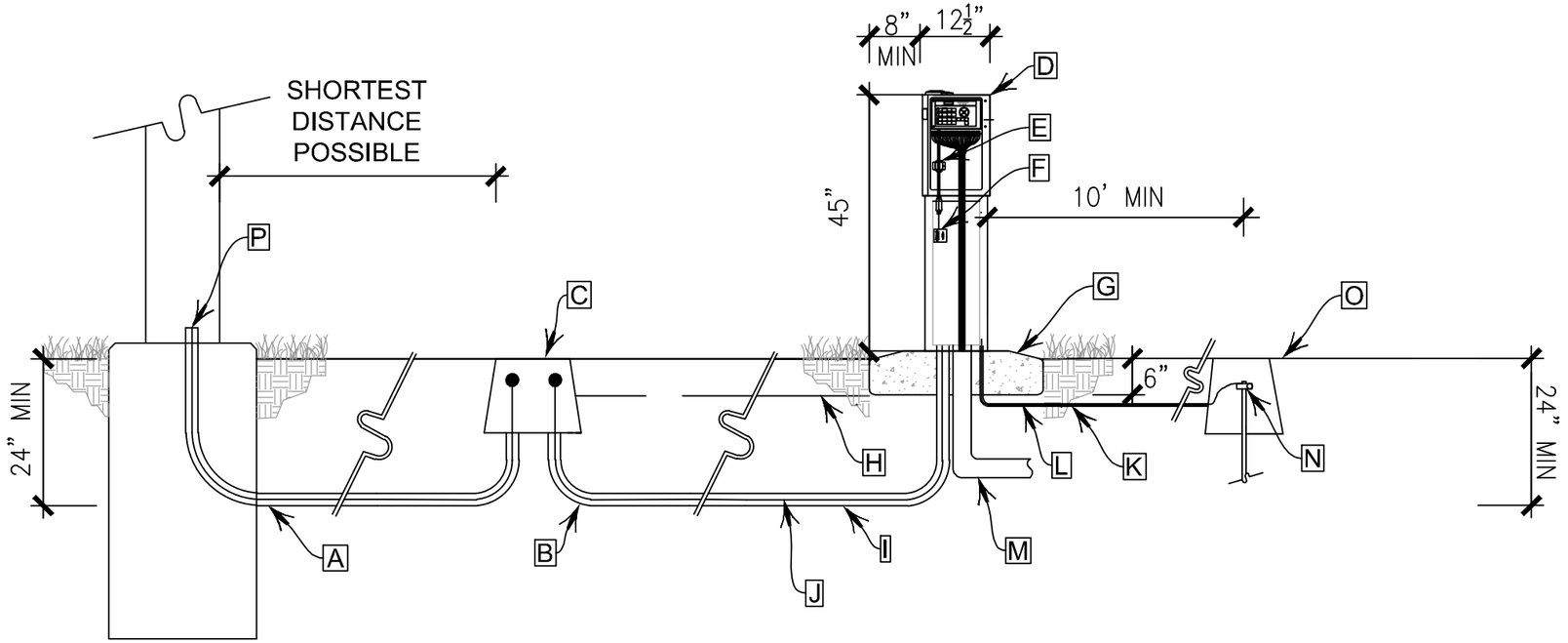


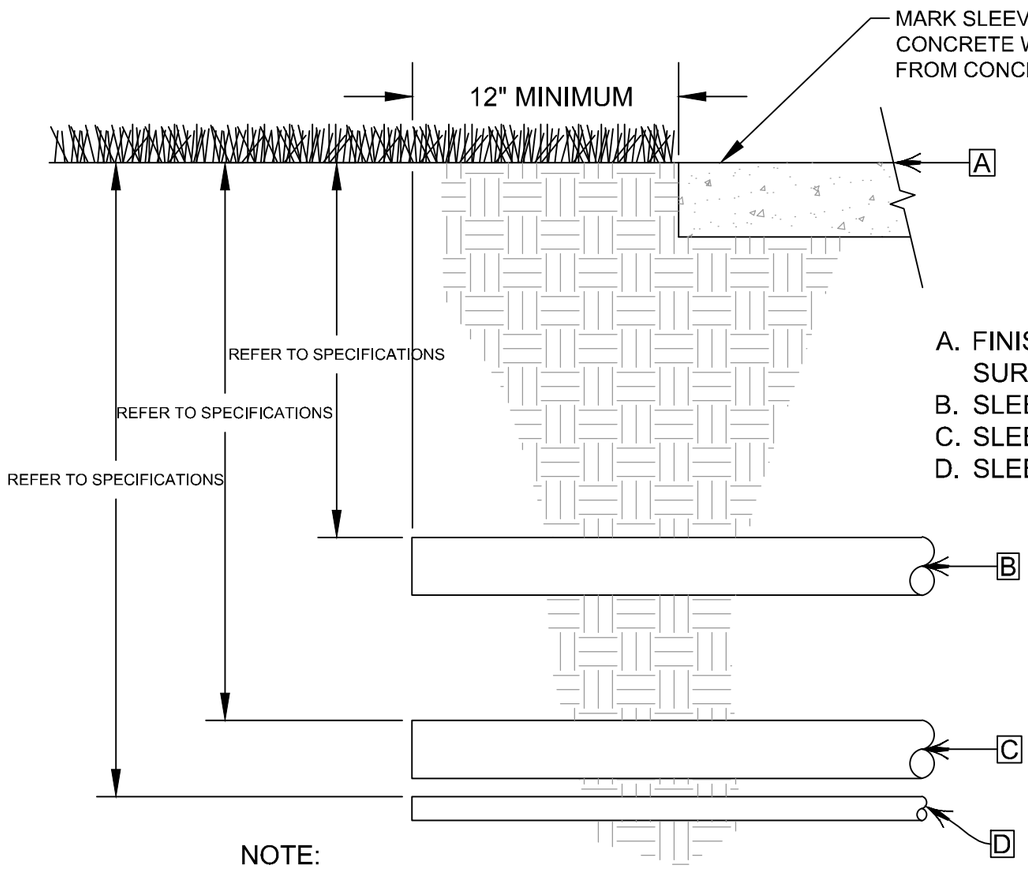
A. 120V CONNECTION. SLEEVE IF POSSIBLE
B. PVC SWEEP ELL
C. ELECTRICAL BOX BY CITY
D. CONTROLLER CABINET
E. TRANSFORMER
F. FUSE DISCOONECT (5 AMP FUSE WITH ON/OFF SWITCH)
G. SLOPE TO DRAIN
H. WARNING TAPE
I. CONDUIT (SCHED. 80)
J. CONTROLLER POWER
K. 1.5" PVC SWEEP ELL
L. #6 BARE COPPER WIRE TO BRONZE CLAMP
M. 3" PVC SWEEP ELL AND CONDUIT FOR CONTROL WIRES
N. COPPER CLAD GROUNDING ROD ($\frac{5}{8}$" X 8') PAIGE ELECTRIC PART #182007 IN BOX
O. FINISHED GRADE
P. POWER SOURCE

LIGHT AND POWER WORK	LANDSCAPE CONTRACTOR WORK

NOTES:
1. LIGHT AND POWER TO SET BOX AND POWER. NOTIFY CITY PROJECT MANAGER IF POWER EXCEEDS 240V AND/OR IF SOURCE POWER IS LESS THAN 24" DEEP.
2. INSTALL CONTROLLER CABINET, GROUNDING AND FUSE DISCONNECT
3. KEEP FUSE DISCONNECT OFF AND INSTALL ELECTRICAL CONNECTION TO ELECTRICAL BOX
4. CONTACT LIGHT AND POWER TO CONNECT POWER SOURCE TO CONTROLLER POWER
5. CONFIRM WIRING CONFIGURATION AT TRANSFORMER IN IRRIGATION CONTROLLER BASED ON POWER SOURCE VOLTAGE
6. TURN ON POWER AT FUSE DISCONNECT
7. CONTACT PARKS WITH SERIAL NUMBER AND SIM CARD NUMBER ON CONTROLLER

CONTROLLER POWER DETAIL

N.T.S.

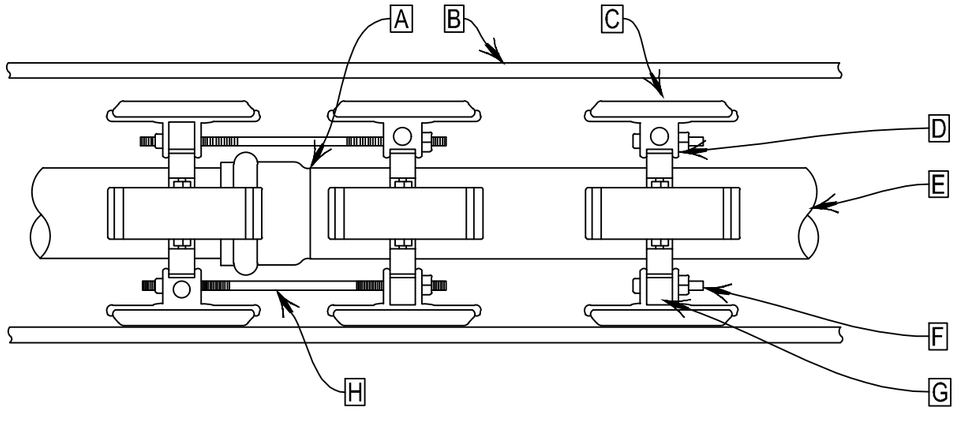


A. FINISHED GRADE OF PAVED SURFACE
B. SLEEVE FOR LATERAL PIPE
C. SLEEVE FOR MAINLINE PIPE
D. SLEEVE FOR WIRING

NOTE:
1. INSTALL SLEEVE SO THAT ITS LOWEST ELEVATION OCCURS AT ONE OR BOTH ENDS - NOT ALONG ITS LENGTH.

SLEEVE DETAIL

N.T.S.

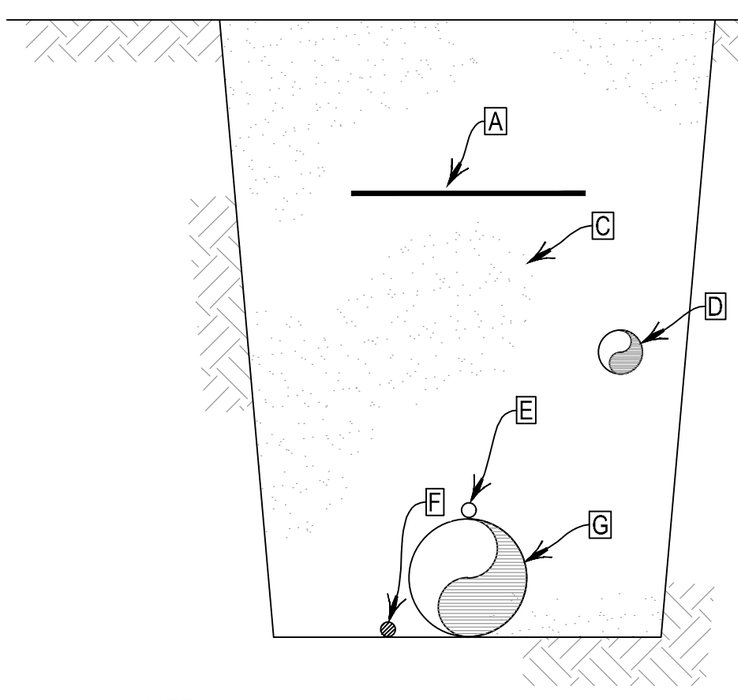


A. MAINLINE PIPE JOINT
B. SLEEVE
C. RUNNERS
D. RUNNER SUPPORTS
E. MAINLINE PIPE
F. CLAMPING BOLTS/NUTS
G. RESTRAINER BODY
H. RESTRAINING RODS/NUTS

NOTE:
1. PROVIDE RESTRAINED CASING SPACERS AT ALL PIPE BELL JOINTS AND NO MORE THAN 10' APART PER CASING SPACER MANUFACTURER'S RECOMMENDATION.

RESTRAINED CASING SPACER DETAIL

N.T.S.



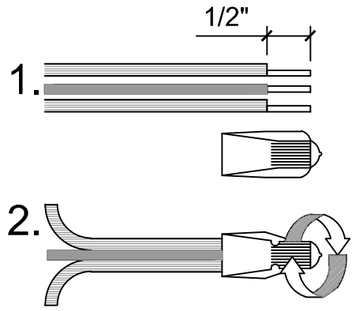
A. WARNING TAPE
B. FINISH GRADE
C. BACKFILL
D. LATERAL PIPE
E. TRACING WIRE
F. CONTROL OR TWO-WIRE CABLE
G. MAINLINE PIPE

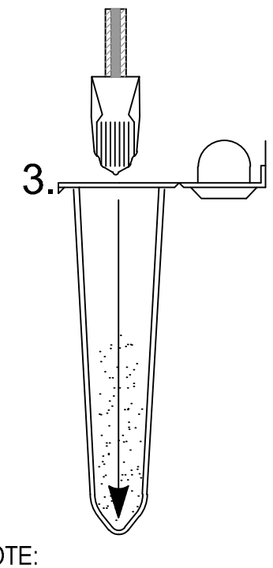
NOTE:
1. REFER TO IRRIGATION SPECIFICATIONS FOR COVERAGE DEPTH TO BURIED PIPE AND WIRE.

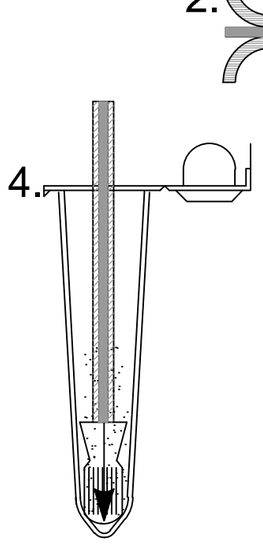
TRENCH DETAIL

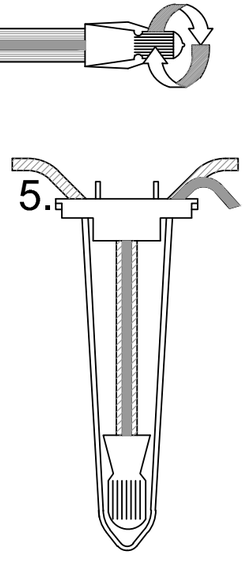
N.T.S.

1. STRIP ENDS OF WIRE
2. SECURE WIRES INTO WIRE NUT
3. INSERT WIRE NUT INTO GEL-FILLED TUBE
4. POSITION WIRES INTO CHANNELS
5. CLOSE SPLICE KIT FOR SECURED SEAL





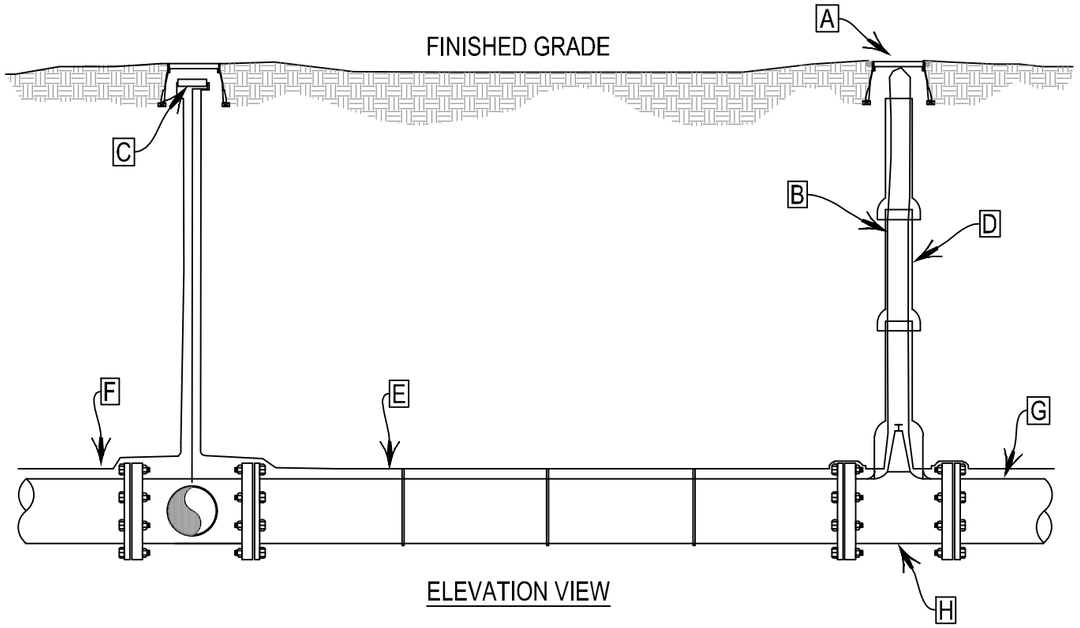




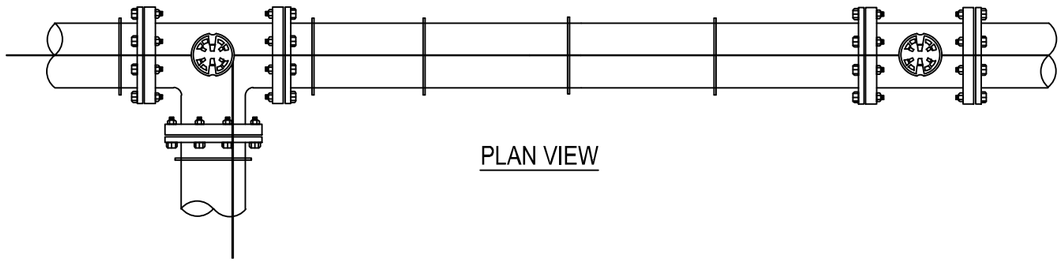
NOTE:
1. VISUALLY CHECK THAT CONNECTOR IS BELOW LOCKING "FINGERS".

WIRE SPLICE DETAIL

N.T.S.



ELEVATION VIEW



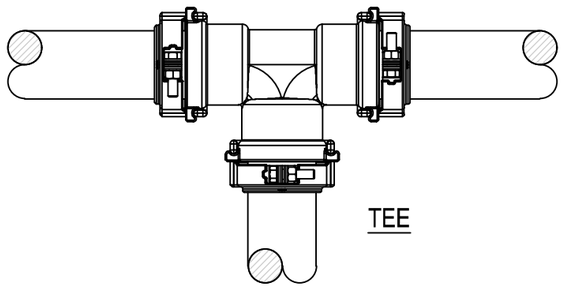
PLAN VIEW

A. 10" ROUND VALVE BOX (ONE OF TWO)
B. INSTALL TRACING WIRE TO THE TOP OF VALVE BOX
C. WATER PROOF CONNECTION (SEE SPECIFICATIONS)
D. PIPE SLEEVE SEE VALVE DETAIL
E. TAPE COPPER WIRE TO TOP OF PIPE EVERY 10 FT.
F. CONTINUOUS LOOP COPPER TRACING WIRE (SEE SPECIFICATIONS)
G. PVC PIPE
H. TYP. VALVE

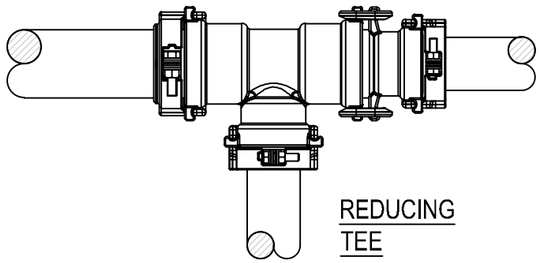
NOTES:
1. COPPER TRACING WIRE WILL START AT THE DOGLEG CONNECTION NEAR PUMP STATION AND WILL BE ROUTED WITH ALL MAINLINE PIPE.
2. SPLICE TRACING WIRE IN IRRIGATION MAINLINE COMPONENT VALVE BOXES WHEN POSSIBLE, OTHERWISE, PLACE SPLICE IN SEPARATE VALVE BOX.

TRACING WIRE DETAIL

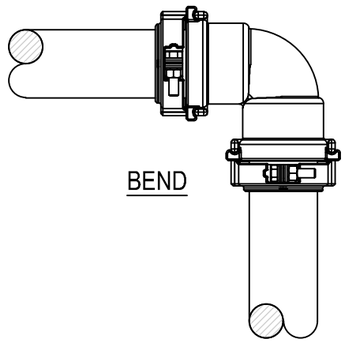
N.T.S.



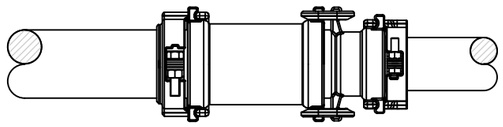
TEE



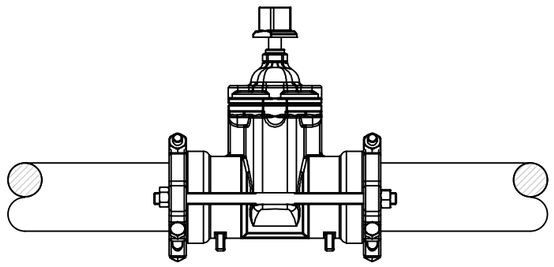
REDUCING
TEE



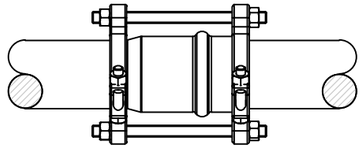
BEND



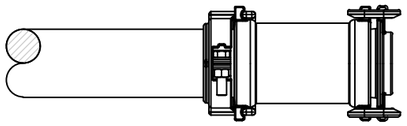
REDUCER



VALVE TO PIPE RESTRAINT
LEEMCO LG RESTRAINT SERIES



PIPE TO PIPE RESTRAINT
LEEMCO LB RESTRAINT SERIES



CAP OR DEAD END
ISOLATION VALVE

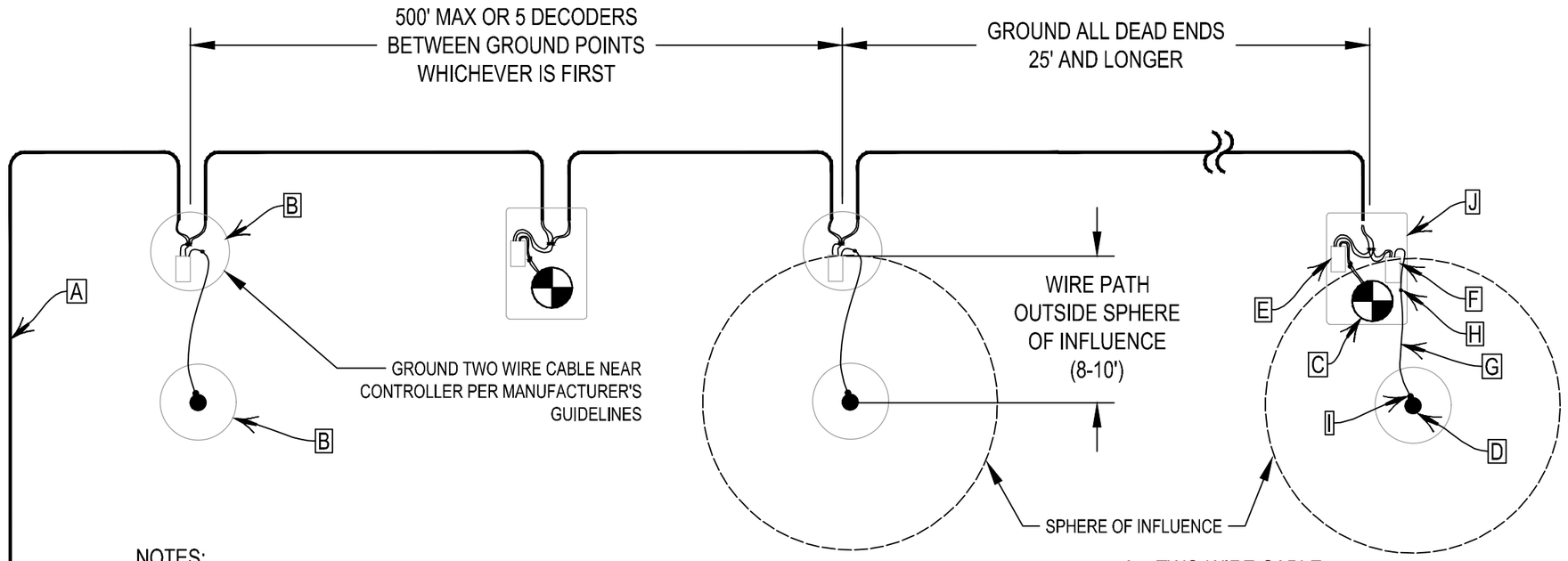
MINIMUM RESTRAINED LENGTH REQUIREMENT FOR EACH FITTING OR VALVE BELL							
PIPE SIZE	90 deg BEND	45 deg, 22.5 deg, 11.25 deg BEND	TEE	REDUCER	CAP OR DEAD END	VALVE	COUPLING/SERVICE TEE (SEE NOTE 4)
3" & 4"	20'	20'	20'	40'	60'	60'	NONE
6" & LARGER	40'	20'	20'	60'	80'	80'	NONE

NOTES:

1. THE RESTRAINT SCHEMES HERE ARE FOR SYSTEM PRESSURES UP TO 125 PSI. FOR HIGHER PRESSURES, CALL THE LEEMCO FACTORY.
2. EACH FITTING AND VALVE BELL MUST BE RESTRAINED TO THE LENGTH OF PIPE NOTED IN THE TABLE USING FITTING TO PIPE RESTRAINT, VALVE TO PIPE RESTRAINT, AND PIPE TO PIPE RESTRAINT AS REQUIRED.
3. PIPE JOINTS WITHIN THE RESTRAINED LENGTH REQUIREMENT MUST BE RESTRAINED WITH PIPE TO PIPE RESTRAINTS.
4. SERVICE TEES AND COUPLINGS WITHIN THE RESTRAINED LENGTH REQUIREMENT MUST BE RESTRAINED WITH FITTING TO PIPE RESTRAINTS.

JOINT RESTRAINT DETAIL

N.T.S.



NOTES:

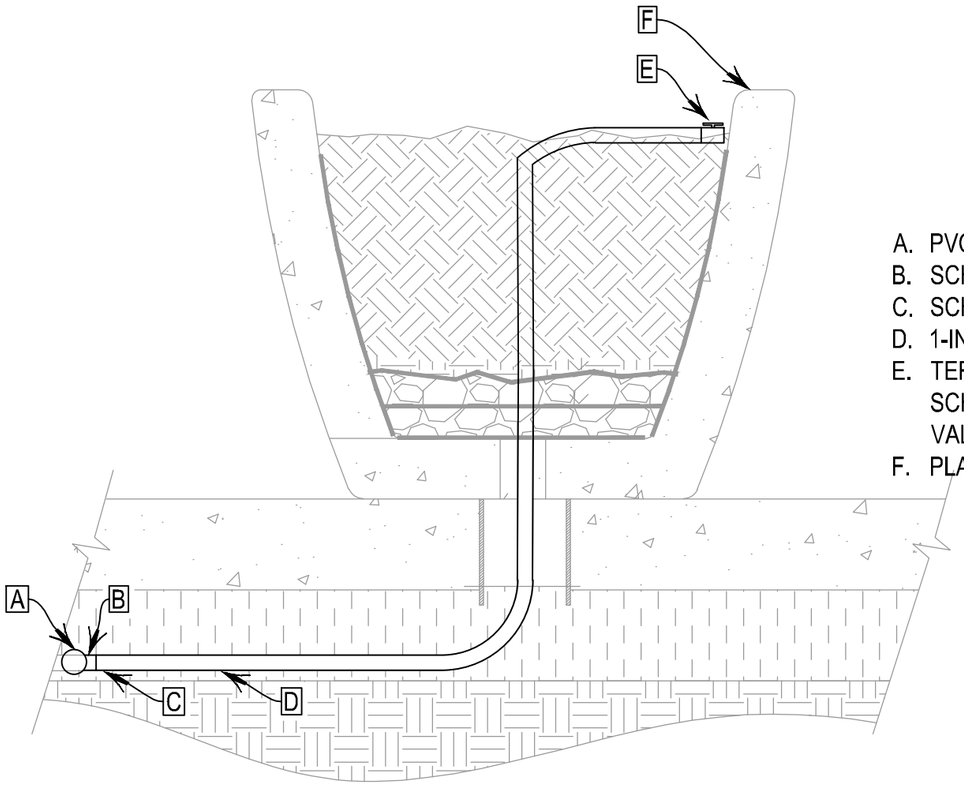
1. ALL WIRE CONNECTION SHALL BE MADE WITH APPROVED CONNECTORS.
2. MAKE ALL WIRE SPLICES IN VALVE BOXES.
3. LEAVE A MINIMUM OF 36" EXTRA WIRE AT ALL SPLICE POINTS.
4. TEST EARTH TO GROUND RESISTANCE AT ALL GROUND POINTS.
5. EARTH TO GROUND RESISTANCE MUST MEET OR EXCEED MANUFACTURER REQUIREMENTS.
6. INSTALL ALL GROUND ASSEMBLIES IN VALVE BOXES.
7. INSTALL GROUNDING EQUIPMENT AS INDICATED ON THE IRRIGATION DOCUMENTS AND AS RECOMMENDED BY THE MANUFACTURER.

A. TWO-WIRE CABLE
B. VALVE BOX (10" ROUND OR AS NECESSARY)
C. REMOTE CONTROL VALVE
D. 5/8" X 8' U.L. LISTED GROUND ROD
E. DECODER
F. LINE SURGE PROTECTOR
G. BARE AWG #10 COPPER WIRE
H. 3M DBR/Y-6 CONNECTION
I. BARE COPPER CONNECTION ("CADWELD")
J. REMOTE CONTROL VALVE ASSEMBLY

A

2-WIRE GROUNDING SCHEMATIC

N.T.S.

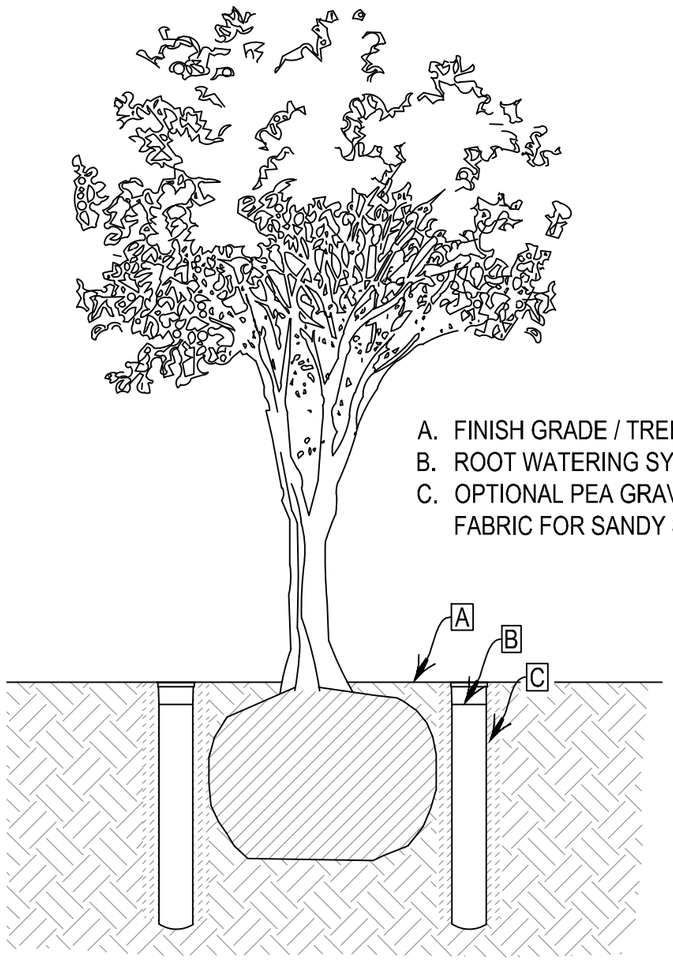


A. PVC LATERAL PIPE
B. SCH. 40 PVC TEE OR EL (SERVICE OUTLET)
C. SCH. 40 PVC BARB (FPT X BARB)
D. 1-INCH 160 PSI POLYETHYLENE
E. TERMINATE END OF POLYETHYLENE WITH SCH. 40 PVC BARB FITTING AND PVC BALL VALVE (FOR FLUSHING PURPOSES)
F. PLANTER POT (RE: LANDSCAPE)

NOTES:
1. SECURE BARB FITTINGS WITH STAINLESS STEEL PINCH CLAMPS.
2. CITY TO INSTALL EMITTERS AND DISTRIBUTION TUBING AS NECESSARY TO IRRIGATE PLANTS WITHIN POT.

PLANTER POT IRRIGATION DETAIL

N.T.S.

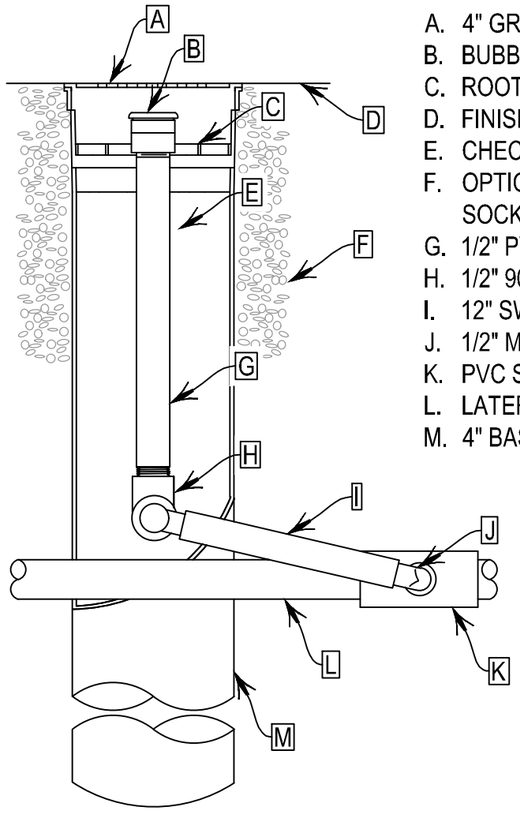


A. FINISH GRADE / TREE GRATE
B. ROOT WATERING SYSTEM
C. OPTIONAL PEA GRAVEL OR LANDSCAPE FABRIC FOR SANDY SOILS

NOTES:
1. POSITION UNIT WITH TOP EVEN WITH GROUND SURFACE.

TREES WITH ROOT WATERING SYSTEM
DETAIL

N.T.S.



A. 4" GRATE
B. BUBBLER
C. ROOT WATERING SYSTEM
D. FINISH GRADE
E. CHECK VALVE
F. OPTIONAL PEA GRAVEL OR SAND SOCK FOR SANDY SOILS
G. 1/2" PVC SCH 80 NIPPLE
H. 1/2" 90-DEGREE ELBOW
I. 12" SWING ASSEMBLY
J. 1/2" MALE NPT INLET
K. PVC SCH 40 TEE OR EL
L. LATERAL PIPE
M. 4" BASKET WEAVE CANISTER

ROOT WATERING SYSTEM ASSEMBLY

N.T.S.

DIVISION 2-SITE WORK

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SCOPE

Provide labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein. Items of work specifically included are:

A. Procurement of applicable licenses, permits, and fees.

B. Coordination of Utility Locates ("Call Before You Dig").

C. Demolition of existing irrigation components.

D. Sleeving for irrigation pipe and wire.

E. Connection of electrical power supply to irrigation control system.

F. Preparation of Record Drawings.

G. Winterization and Spring Start-up

H. Maintenance period.

1.2 RELATED WORK

A. Refer to drawings and installation details.

1.3 SUBMITTALS

A. The Contractor shall submit to the City of Fort Collins Representative one PDF copy of manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, communication system, valves, emitters, valve boxes, flow sensors, master valves, wire, wire connectors, gate valves, fittings, solvents, distribution tubing, air relief valves, wye filters, conduit, and all other types of fixtures and equipment which he proposes to install on the job. The submittal shall include the manufacturer's name, model number, equipment capacity and manufacturer's installation recommendation, if applicable, for each proposed item. The Contractor shall re-submit any rejected items until approvals are obtained. Resubmit only those items that were previously rejected or missing.

No partial submittal will be accepted. Submittals shall be neatly and logically organized for each piece of irrigation equipment. After the submittal has been

approved, substitutions will not be allowed except by written consent of the City of Fort Collins Representative.

B. Materials List: Include sleeving, pipe, fittings, mainline components, sprinkler and bubbler components, drip irrigation components, control system components, shop drawings and other components shown on drawings and installation details or described herein. Include pipe sealant, wire, wire connectors, ID tags, and other miscellaneous items. Quantities of materials need not be included.

C. Manufacturers' Data: Submit manufacturers' catalog cuts, specifications, and operating instructions for equipment shown on materials list.

D. Shop Drawings: Submit shop drawings called for in installation details. Show products required for proper installation, their relative locations, and critical dimensions. Note modifications to installation detail.

1.4 RULES AND REGULATIONS

A. Provide work and materials in accordance with latest edition of National Electric Code, Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws, regulations and codes of governing authorities.

B. When contract documents call for materials or construction of better quality or larger size than required by above-mentioned rules and regulations, provide quality and size required by contract documents.

C. If quantities are furnished either in specifications or on drawings, quantities are furnished for information only. It is Contractor's responsibility to determine actual quantities of material, equipment, and supplies required by the project and to complete independent estimate of quantities and wastage.

D. Notify engineer in writing prior to construction about discrepancies between contract documents and existing site conditions or manufacturer’s specific recommendations for use of their product.

E. Contractor is responsible for damage to site amenities during construction. Replace damaged items with identical materials of equal value to match existing conditions. Make replacements at no additional cost to contract price. Penalty for specific damage: as mutually agreed to by owner and contractor.

1.5 DEMOLITION

A. Remove existing sprinklers, valves, automatic controllers, and other irrigation components indicated on drawings. Remove items in manner that minimizes damage to components. Deliver only salvageable items to City of Fort Collins Representative. Dispose of other removed items.

B. Abandon existing irrigation pipe in place. If abandoned irrigation pipe is encountered during installation of new irrigation pipe, cut and remove two (2) feet of existing irrigation pipe on either side of new irrigation pipe.

C. Reuse existing control wiring. Cut existing control wiring at remote control valves and permanently label with existing station number. Remove existing control wiring from controller(s) and permanently label with existing station number. Protect existing control wiring during construction of new irrigation system.

1.6 TESTING

A. Schedule testing with City of Fort Collins Representative a minimum of three days in advance of testing.

B. Mainline pipe jointed with rubber gaskets or threaded connections may be subjected to pressure test at any time after partial completion of backfill. Allow irrigation pipe jointed with solvent-welded PVC joints to cure at least 24 hours before testing.

C. Subsections of mainline pipe may be tested independently, subject to review of Irrigation Engineer.

D. Provide clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.

E. Testing Documentation:

1. Submit a written report of all tests to Owner. Each test must list name of test, date of test, name of the individual completing the test, name of the company completing the test. Submit test documentation to Owner within three (3) days of completing test.
2. Hydraulic Pressure Test – Include starting and ending pressures. If pipe does not pass test, document reason for pressure loss.
3. Copper Tracing Wire – Include voltage reading for length of tested wire. If wire does not pass test, document reason for voltage failure.
4. Control System Grounding – Include identification of each grounding equipment by the remote control valve number and the ohms resistance to ground.

F. Hydrostatic Pressure Test:

1. Hydrostatic pressure test to be conducted for 2-½ inch and smaller solvent weld mainline pipe and all HDPE mainline pipe.
2. Purge air from mainline pipe before test. Attach pressure gauge to mainline pipe in test section.
3. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
4. Subject mainline pipe to hydrostatic pressure equal to 140 psi for two hours. Test with mainline components installed.
5. Observe pressure loss on pressure gauge. If pressure loss is greater than 5 psi, identify reason for pressure loss. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pressure loss is equal to or less than 5 psi.
6. Visually inspect irrigation pipe for leakage and replace defective pipe, fitting,

joint, valve, or appurtenance. Repeat test until pipe passes test.

7. Cement or caulking to seal leaks is prohibited.

G. Volumetric Leakage Test:

1. Volumetric leakage test to be conducted for 3-inch and larger gasketed mainline pipe.
2. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
3. Purge air from pipeline before test.
4. Subject mainline pipe to 140 psi for two hours. Maintain constant pressure.
5. Provide all necessary pumps, bypass piping, storage tanks, meters, 3-inch test gauge, supply piping, and fittings in order to properly perform testing.
6. Testing pump must provide a continuous 140 psi pressure to the mainline pipe. Allowable deviation in test pressure is 5 psi during test period. Restore test pressure to 140 psi at end of test.
7. Water added to mainline pipe must be measured volumetrically to nearest 0.10 gallons.
8. Use following table to determine maximum allowable volume lost during test:

Leakage Allowable (Gallons per (100 Joints) / Hour)

PIPE SIZE (INCHES)	Test Pressure (psi)								
	60	70	80	90	100	110	120	130	140
3”	0.31	0.34	0.36	0.38	0.41	0.43	0.44	0.46	0.48
4"	0.42	0.45	0.48	0.51	0.54	0.57	0.59	0.62	0.64
6"	0.63	0.68	0.73	0.77	0.81	0.85	0.89	0.92	0.96
8”	0.84	0.90	0.97	1.03	1.08	1.13	1.18	1.23	1.28
10"	1.05	1.13	1.21	1.28	1.35	1.42	1.48	1.54	1.60
12”	1.26	1.36	1.45	1.54	1.62	1.70	1.78	1.85	1.92

Note: Allowable Leakage calculated using $L = (ND\sqrt{P})/7400$ with

L = Allowable Leakage (gph)
N = Number of Joints
D = Nominal Diameter of Pipe (inches)
P = Average Test Pressure (psi)

9. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pipe passes test.
10. Cement or caulking to seal leaks is prohibited.
11. Contractor may sub-contract testing to pipeline testing company approved by Owner.

H. Operational Test:

1. Activate each remote-control valve in sequence from controller. Provide

either one additional personal with radio or use handheld remote to activate remote control valves from controller. Manually activating remote control valve using manual bleed mechanism at remote control valve is not an acceptable method of activation. City of Fort Collins Representative will visually observe operation, water application patterns, and leakage.

2. Replace defective remote control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.
3. Replace, adjust, or move water emission devices to correct operational or coverage deficiencies.
4. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.
5. Repeat test(s) until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to Owner.

I. Sensor Cable:

1. Test for leaks to ground per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
2. Test cable for continuity if cable is being installed for future expansion of the irrigation system.
3. Replace defective wire, underground splices, or appurtenances. Repeat test until manufacturer's guidelines are met.

J. Copper Tracing Wire:

1. Pass current through wire and demonstrate that wire is capable of locating all mainline pipe.
2. If wire will not pass current, locate break in circuit, repair or replace wire or splice, and test until tracer wire works in accordance for its intended use.

K. Control System Grounding:

1. Test for proper grounding of control system per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
2. Replace defective wire, grounding rods, grounding plates, or appurtenances. Repeat test until manufacturer's guidelines are met.

L. Sprinkler Performance Audit:

1. A sprinkler performance audit must be performed by a landscape irrigation auditor certified by the Irrigation Association (a non-profit industry organization dedicated to promoting efficient irrigation). The sprinkler audit must be performed by an auditor independent of the installation contractor and irrigation designer.
2. The audit must include measurement of distribution uniformity. Linking of zones may be acceptable and total number of zones to be audited must be coordinated with City of Fort Collins Parks Department Representative prior to beginning the auditing process. Minimum acceptable distribution uniformities must be 0.60 for spray sprinklers and 0.70 for rotor sprinklers.
3. The audit must measure the operating pressure for one sprinkler on each

zone to determine whether the zone meets pressure requirements.

4. A copy of the sprinkler performance audit must be submitted to and approved by the City of Fort Collins prior to issuance of a certificate of occupancy.

M. Control System Acceptance Test:

1. Upon completion of construction, City of Fort Collins Representatives will administer a System Acceptance Test.
2. Following construction completion and review by City of Fort Collins Parks Department Representative and/or Engineer, an evaluation period will begin. After 30 days of continuous service without major system problems, system will be accepted and guarantee/warranty period will begin. If at any time during 30-day evaluation period a major system problem occurs, the source of problem will be determined and corrected and 30-day evaluation period will start again. Equipment will not be accepted until System Acceptance Test is passed.
3. If successful completion of System Acceptance Test is not attained within 90-days following commencement of evaluation period, City of Fort Collins Representative has the option to request replacement of equipment, terminate the order or portions thereof, or continue with System Acceptance Test. These options will remain in effect until System Acceptance Test is successfully completed.
4. Final payment will be made after successful completion of System Acceptance Test.

N. Testing Review:

1. Failure of initial testing review will require additional review. Payment of costs, including travel expenses and site visits by City of Fort Collins Representative, for additional reviews that may be required due to non-compliance with the Construction Documents will be Contractor’s responsibility.

O. Field Mock Up:

1. Fabricate an on-site example of the following assemblies for demonstration prior to construction. The mock-ups must be presented to the City of Fort Collins Representative and meet approval prior to construction.
   a. Remote Control Valve Assembly: Mock-up is to include remote control valve, wire splices, two wire cable, and decoder.
   b. Decoder Grounding: Mock-up is to include decoder, wire splices, and grounding equipment.

1.7 CONSTRUCTION REVIEW

The purpose of on-site reviews by City of Fort Collins Representative is to periodically observe work in progress, Contractor's interpretation of construction documents, and to address questions with regard to installation.

A. Irrigation system installation must be monitored, inspected and approved by the City of Fort Collins Parks Department.

B. Schedule reviews for irrigation system layout or testing with City of Fort Collins Representative as required by these specifications.

C. Impromptu reviews may occur at any time during project.

D. A review will occur at completion of irrigation system installation and Project Record Drawing submittal.

1.8 GUARANTEE/WARRANTY AND REPLACEMENT

The purpose of guarantee/warranty is to ensure that Owner receives irrigation materials of prime quality, installed and maintained in thorough and careful manner.

A. Guarantee/warranty irrigation materials, equipment, and workmanship against defects for period of two years from formal written acceptance by City of Fort Collins Representative.

B. Fill and repair depressions. Restore landscape, utilities, structures and site features damaged by settlement of irrigation trenches or excavations. Repair damage to premises caused by defective items. Make repairs within seven days of notification from City of Fort Collins Representative.

C. Replace damaged items with identical materials and methods per contract documents or applicable codes. Make replacements at no additional cost to contract price.

D. Guarantee/warranty applies to originally installed materials and equipment, and replacements made during guarantee/warranty period.

PART 2 - MATERIALS

2.1 QUALITY

Use new materials without flaws or defects.

2.2 SUBSTITUTIONS

A. Use specified equipment, or pre-approved equal. Alternative equipment must be approved by City of Fort Collins Representative and Engineer prior to bidding. Changes and associated design costs to accommodate alternative equipment are Contractor's responsibility.

B. Pipe sizes referenced in the construction documents are minimum sizes and may be increased at Contractor's option.

2.3 SLEEVING

A. Provide sleeve beneath hardscape for irrigation pipe. Provide separate sleeve beneath hardscape for wiring bundle or two-wire cable.

B. Provide PVC Class 200 pipe with solvent welded joints OR Class 50 ductile iron pipe with mechanical joints OR SDR-11 HDPE for sleeving material beneath hardscape.

C. Sleeve sizing: A minimum of twice the nominal diameter of solvent-welded pipe or wiring bundle, or as indicated on drawings. Minimum 2-inch diameter for irrigation pipes. Sleeve diameter for gasketed pipe must accommodate outside diameter of joint-restraint casing spacers, refer to joint-restraint manufacturer's sizing recommendations.

D. Wires must be in separate sleeve from pipe. Minimum 2-inch diameter for wire sleeves.

E. Sleeves must have marker tape on upper side and both ends for future locates. Install per drawings and installation details.

2.4 PIPE AND FITTINGS

A. Mainline Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with integral belled end.
2. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241.
4. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe with nominal diameter greater than or equal to 3-inches. Use Gasketed pipe joints conforming to "Laboratory Qualifying Tests" section of ASTM D3139. Use gasket material conforming to ASTM F477. Use Leemco or approved equal rubber-gasketed deep bell ductile iron fittings conforming to ASTM A-536 and ANSI/AWWA C111/A21.11. Use lubricant approved by pipe manufacturer.
5. Use solvent weld pipe for mainline pipe with nominal diameter less than 3-inches. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by pipe manufacturer. Use solvent cement conforming to ASTM Standard D2564.
6. Mainline pipe within sleeves: Use solvent weld pipe for mainline pipe with nominal diameter 3-inches and smaller installed within sleeves. Use pipe equipped with factory installed reinforced gaskets for mainline pipe with nominal diameter of 4-inches and larger installed within sleeves. Provide restrained casing spacers where gasketed joints occur within sleeve.

B. HDPE Mainline Pipe and Fittings:

1. Use high density, extra high molecular weight polyethylene pipe (HDPE), extruded from material meeting the specifications of cell classification on PE 4710, ASTM standard D 3350, SDR 9, rated at 200 PSI or SDR 11, rated at 160 PSI, conforming to the dimensions and tolerances established by ASTM F714 for mainline pipe.

C. Lateral Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard

D1784, with integral belled end suitable for solvent welding.

2. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the cases where small nominal diameters are not manufactured in Class 200. No lateral pipe smaller than 1-inch diameter is permitted.

   Use solvent weld pipe for lateral pipe. Use UV radiation resistant Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.

3. For drip irrigation laterals downstream of zone control valves, use UV radiation resistant polyethylene pipe manufactured from Prime Union Carbide G-resin 7510 Natural 7 manufactured by Union Carbide or a Union Carbide Licensee with a minimum of 2-percent carbon black.

   Use PVC/compression line fittings compatible with drip lateral pipe. Use tubing stakes or landscape fabric staples to hold above-ground pipe in place.

D. Specialized Pipe and Fittings:

1. Copper pipe: Use Type "K" rigid pipe conforming to ASTM Standard B88. Use wrought copper or cast bronze fittings, soldered, flared mechanical, or threaded joint per installation details or local code. Use a 95-percent tin and 5-percent antimony solder.
2. Galvanized steel pipe: Use Schedule 40 conforming to ASTM Standard A53.Use galvanized, threaded, standard weight, malleable iron fittings.
3. Ductile iron pipe: Use Class 50 conforming to ANSI A21.51 (AWWA C151). Use minimum of Class 53 thickness pipe for flanged piping.
   Use mechanical joints conforming to ANSI A 21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) or flanged fittings conforming to ANSI/AWWA C110 and ANSI B16.1 (125#).
4. Use dielectric union wherever copper-based metal (copper, brass, bronze) is joined to iron-based metal (iron, galvanized steel, stainless steel).
5. Low Density Polyethylene Hose:
   a. Use pipe specifically intended for use as flexible swing joint.
      Inside diameter: 0.490$\pm$0.010 inch.
      Wall thickness: 0.100$\pm$0.010 inch.
      Color: Black.
   b. Use spiral barb fittings supplied by same manufacturer as hose.
6. Use stainless steel fasteners and rubber gaskets for flanged connections.
7. Use PVC Schedule 80 nipples and PVC Schedule 40 threaded fittings for threaded pipe connections.
8. Joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by pipe fitting or valve manufacturer.

E. Joint Restraint Harness:

1. Provide joint restraint harness components as recommended by pipe and fitting manufacturer and in accordance with accepted industry practices. For joint restraints on ductile iron pipe applications, use restraint components constructed of 60-42-10 ductile iron conforming to ASTM A536. For joint restraints on PVC pipe applications, use restraint components constructed of 60-42-10 ductile iron conforming to ASTM A536-80 and ASTM F1674-96.
2. Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials which are zinc plated or galvanized.
3. Restrained Casing Spacers: Provide Ford Uni-Flange Restrained Casings Spacers or equal. Use restrainer body and runner supports constructed of high strength ductile iron meeting ASTM A536 and grade 65-42-12. Use Connecting rods conforming to ASTM A242, ANSI/AWWAC111/A21.11. Use runners constructed of ultra high molecular weight polymer.

2.5 COPPER TRACING WIRE:

A. Use American Wire Gauge (AWG) No. 12-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial.

B. Color: Tracing wire must be of color different from that of any active two wire cable, control wire, or common wire. Wire color shall be continuous over entire length.

C. Splices: Use 3M DBR/Y-6 wire connector with waterproof sealant.

2.6 MAINLINE COMPONENTS

A. Winterization Assembly: according to local practice and in compliance with local code.

B. Backflow Prevention Assembly: according to local practice and in compliance with local code.

C. Master Valve Assembly: as presented in drawings and installation details.

D. Flow Sensor Assembly: as presented in drawings and installation details.

E. Hydrometer Assembly: as presented in drawings and installation details.

F. Blowout Assembly: as presented in drawings and installation details.

G. Isolation Gate Valve Assembly: as presented in drawings and installation details

H. Quick Coupling Valve Assembly: as presented in drawings and installation details.

I. Air-Vacuum Relief Valve Assembly: as presented in drawings and installation details.

J. Manual Drain Valve Assembly: assembly and gravel sump as presented in drawings and installation details.

2.7 SPRINKLER AND BUBBLER IRRIGATION COMPONENTS

A. Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals: as presented in drawings and installation details.

B. Sprinkler Assembly: as presented in drawings and installation details.

C. Bubbler Assembly: as presented in drawings and installation details.

2.8 DRIP IRRIGATION COMPONENTS

A. Remote Control Valve (RCV) Assembly for Drip Laterals: as presented in drawings and installation details.

B. Zone Control Valve Assembly: as presented in drawings and installation details.

C. Drip Emitter Assembly:

1. Use emitter device as presented in drawings and installation details.
2. Use flexible plastic distribution tubing to direct water from emitter outlet to emission point. Use distribution tubing compatible with emitters. Do not exceed five feet length between emitter and distribution tubing outlet. Use tubing stakes to anchor distribution tubing.

D. Flush Cap Assembly: as presented in drawings and installation details.

E. Inline Drip Tubing:

1. Tubing: Use UV resistant polyethylene drip tubing with integral pressure compensating drip emitters. Emitter spacing as noted in drawings and installation details. Use emitters that are pressure compensating from 7 to 70 PSI. Use tubing with O.D. of 0.67”, and I.D. of 0.57”. Use fittings compatible with inline drip tubing.
2. Blank Drip Tubing: Use UV resistant polyethylene blank drip tubing for exhaust manifold tubing, as noted in drawings and installation details. Use tubing with O.D. of 0.67”, and I.D. of 0.57”. Use fittings compatible with inline drip tubing. Use blank tubing from same manufacturer as Inline drip tubing.
3. Air and Vacuum Relief Valve: Provide air and vacuum relief valve assembly on inline drip lateral per drawings and installation details. Use air and vacuum relief valve compatible with inline drip tubing.CONTROL SYSTEM COMPONENTS:

A. Irrigation Controller Assembly:

1. As indicated on drawings and installation details.
2. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
3. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
4. Lightning protection: As presented in installation details.

B. Power Wire**:**

1. Use AWG #12, solid or stranded copper, Type UF single-conductor cable or multi-conductor with ground cable, UL approved for direct underground burial from power source to Controller Assembly.
2. Splices: Use 3M #82-A2 Series with Split Bolts or Butt Connectors for inline splices and 82-B1 or 90-B1 Series for wye splices.
3. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

C. Two Wire Cable From Controller to Decoders:

1. Use two wire cable, decoders, and surge devices per controller manufacturer's guidelines.
2. Splices: 3M DBR/Y-6 Wire Connector.
3. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

D. Low Voltage Control Wire (Traditional Wired System):

1. Use American Wire Gauge (AWG) No. 14-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial for individual control wires and spare control wires from the controller assembly to each remote control valve or stub-out location. Use American Wire Gauge (AWG) No. 12-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial for common ground wire and spare common wires from controller assembly to each remote control valve or stub-out location.
2. Color: Use white for common ground wire. Use easily distinguished colors for other control wires. Spare control wires shall be of color different from that of active control wire. Wire color shall be continuous over entire length.
3. Splices: Use 3M DBR/Y-6 wire connector.
4. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
5. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three

inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

E. Instrumentation:

1. As presented in the drawings and installation details.

2.10 OTHER COMPONENTS:

A. Tools and Spare Parts: Furnish operating keys, servicing tools, test equipment, spare parts and other items indicated in drawings and specifications.

B. Other Materials: Provide other materials or equipment shown on drawings or installation details that are part of irrigation system, even though items may not have been referenced in specifications.

PART 3 - EXECUTION

3.1 INSPECTIONS AND REVIEWS

A. Site Inspections:

1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities in writing to City of Fort Collins Representative prior to beginning work.
2. Commencement of work implies acceptance of existing site conditions.

B. Utility Locates ("Call Before You Dig"):

1. Arrange and coordinate Utility Locates with local authorities prior to construction.
2. Repair underground utilities that are damaged during construction. Make repairs at no additional cost to contract price.

3.2 LAYOUT OF WORK

A. Stake out irrigation system. Items staked include: backflow preventer, sprinklers, pipe, sleeves, control valves, manual drains, air/vacuum relief valves, controller assemblies, and isolation valves.

B. Irrigation System Layout Review: Irrigation system layout review will occur after staking has been completed. Notify City of Fort Collins Representative one week in advance of review. Modifications will be identified by City of Fort Collins Representative at this review.

C. Install irrigation components inside of project property lines.

D. Any deviation in layout of the irrigation system from the approved construction plans must be reviewed and approved by the City of Fort Collins Parks Department prior to installation.

3.3 EXCAVATION, TRENCHING, AND BACKFILLING

A. Excavate and install pipes at minimum cover indicated in drawings or specifications. Excavate trenches at appropriate width for connections and fittings.

B. Minimum cover (distance from top of pipe or control wire to finish grade):

1. Mainline pipe 4-inches and smaller: 24-inches to top of pipe.
2. Mainline pipe 6-inches and larger: 30-inches to top of pipe.
3. Electrical conduit: 24-inches to top of pipe.
4. Control wire: 2-inches offset from bottom of mainline pipe.
5. Sensor cable: 2-inches offset from bottom of mainline pipe.
6. Lateral pipe to sprinklers and bubblers: 14-inches to top of pipe.
7. Manifold pipe to drip system zone control valves: 12-inches to top of pipe.
8. Drip lateral pipe in turf downstream of drip system zone control valves: 12-inches to top of pipe.
9. Drip lateral pipe in planting beds downstream of drip system zone control valves: Secure to finish grade with approved tubing stakes. Install and test prior to installation of landscape fabric and mulch.
10. PVC UV radiation resistant lateral pipe: Secure to finish grade with approved tubing stakes.

C. Maintain at least 15-feet clearance from centerline of new trees.

D. Trenching around or near existing trees must be coordinated with the City of Fort Collins Forestry Department and must follow their requirements for trenching near existing trees.

E. PVC pipe must be installed in open trench. Pipe pulling is not allowed.

F. Backfill only after lines have been reviewed and tested.

G. Excavated material is generally satisfactory for backfill. Use backfill free from rubbish, vegetable matter, frozen materials**,** and stones larger than 2-inches in maximum diameter. Remove material not suitable for backfill. Use backfill free of sharp objects next to pipe.

H. Backfill buried pipe in either of the following manners:

1. Backfill and puddle lower half of trench. Allow to dry 24 hours. Backfill remainder of trench in 6-inch layers. Compact to density of surrounding soil.
2. Backfill trench by depositing backfill material equally on both sides of pipe in 6-inch layers and compacting to density of surrounding soil.
3. Leave all trenches slightly mounded to allow for settling.

I. Enclose pipe and wiring beneath roadways and hardscapes in separate sleeves. Minimum compaction of backfill for sleeves shall be 95 percent Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeves, "puddling", will not be permitted.

J. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.

K. Contact City of Fort Collins Representative for trench depth adjustments where utilities conflict with irrigation trenching and pipe work.

3.5 SLEEVING AND BORING

A. Provide sleeving at depth that permits encased pipe or wiring to remain at specified burial depth.

B. Extend sleeve ends twelve inches beyond edge of hardscape. Cap sleeve ends and mark with stakes. Provide rope or wire through sleeve and secure to stake at surface grade at each end for future sleeve location.

C. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

3.6 ASSEMBLING PIPE AND FITTINGS

A. General:

1. Keep pipe free from dirt and debris. Cut pipe ends square, deburr and clean as recommended by manufacturer.
2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.
3. Trenches may be curved to change direction or avoid obstructions within limits of the curvature of pipe. Curvature results from bending of pipe lengths. Do not exceed pipe and fitting manufacturer's allowable deflection at joints. Minimum radius of curvature and offset per 20-foot length of pipe-by-pipe size are shown in following table.

SIZE	RADIUS	OFFSET PER 20' LENGTH
1 ½"	25'	7'-8"
2"	25'	7'8"
2 ½"	100'	1'-11"
3"	100'	1'-11"
4"	100'	1'-11"
6"	150'	1'-4"
8"	200'	1'-0"
10"	250'	9"

12"	300'	8"

B. Mainline Pipe and Fittings:

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. PVC Rubber-Gasketed Pipe:
   a. Use pipe lubricant. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.
3. PVC Solvent Weld Pipe:
   a. Use primer and solvent cement. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.
   b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
   c. Snake pipe from side to side within trench.
4. Fittings:
   a. Use of cross type fittings is not permitted.
   b. Do not strike ductile iron fittings with metallic tools. Cushion blows with wood block or similar shock absorber.

C. HDPE Mainline Pipe and Fittings:

1. Join pipe lengths using butt-fusion technique as recommended by pipe manufacturer.
2. Join HDPE pipe to dissimilar pipe materials using HDPE (butt-fusion) x flange adapter with ductile iron back-up ring. Provide flanged transition fitting as required for connection to dissimilar pipe material.

D. Lateral Pipe and Fittings:

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. PVC Solvent Weld Pipe:
   a. Use primer and solvent cement. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.
   b. Cure for 30 minutes before handling and 24 hours before pressurizing or installing with vibratory plow.
   c. Snake pipe from side to side within trench.
3. Polyethylene (PE) Pipe:
   a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
   b. Snake pipe from side to side within the trench.
4. UV Radiation Resistant Polyethylene Pipe:
   a. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.
   b. Snake pipe from side to side within trench, on soil surface under landscape fabric, and hold in place with tubing stakes or landscape fabric

staples at fittings and at maximum intervals of every five feet along pipe routing. Do not compress or crimp pipe with stake, staple or other construction activity.

5. Fittings: Use of cross type fittings is not permitted.

E. Specialized Pipe and Fittings:

1. Copper Pipe:
   a. Use flux and solder. Join pipe in manner recommended by manufacturer and in accordance with local codes and accepted industry practices.
   b. Solder so that continuous bead shows around the joint circumference.
2. Galvanized Steel Pipe:
   a. Join pipe with Teflon-type tape or pipe joint compound in manner recommended by manufacturer and in accordance with accepted industry practices.
   b. Use factory-made threads whenever possible. Field-cut threads will be permitted only where necessary. Cut threads on axis using clean, sharp dies.
3. Ductile Iron Pipe: Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
4. Insert dielectric union or flange wherever copper-based metal (copper, brass, bronze) and iron-based metal (iron, galvanized steel, stainless steel) are joined.
5. Low Density Polyethylene Hose: Install hose and compatible fittings in manner recommended by manufacturer and in accordance with accepted industry practices.
6. Flanged connections: Install fittings, fasteners and gaskets in manner recommended by manufacturer and in accordance with accepted industry practices.
7. PVC Threaded Connections:
   a. Use only factory-formed threads. Field-cut threads are not permitted.
   b. Apply thread sealant in manner recommended by component, pipe and sealant manufacturers and in accordance with accepted industry practices.
   c. Use plastic components with male threads and metal components with female threads where connection is plastic-to-metal.

F. Joint Restraint Harness:

1. Use on pipe greater than or equal to 3-inch diameter or any diameter of rubber gasketed pipe. Use a joint restraint harness wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.
2. Use a joint restraint harness with transition fittings between metal and PVC pipe, where weak trench banks do not allow use of thrust blocks, or where extra support is required to retain fitting or joint.
3. Use restrained casing spacers for gasketed pipe routed through sleeving. Install harness in the manner recommended by the manufacturer and in accordance with accepted industry practices. Install self-restraining casing

spacers at all gasketed pipe bell joints and every 10-feet along the gasketed mainline pipe installed through sleeving. Provide correct number and type of restraints per manufacturer's requirements.

G. Installation of Copper Tracing Wire:

1. Install tracing wire as shown in the details.
2. Tape to top centerline of pipe as shown in the details with adhesive tape or plastic tie straps so that the wire remains in place during embedding and backfilling.
3. Bring tracing wire to the surface in all mainline component valve boxes as shown in the details.

3.7 INSTALLATION OF MAINLINE COMPONENTS

A. Winterization Assembly: Provide where indicated on drawings. Brand "WA" on valve box lid in 2-inch high letters.

B. Backflow Prevention Assembly: Provide where indicated on the drawings. Provide assembly so that its elevation, orientation, access, and drainage conform to manufacturer's recommendations and applicable health codes.

C. Master Valve Assembly: Provide where indicated on drawings. Brand "MCV" on valve box lid in 2-inch high letters.

D. Flow Sensor Assembly: Provide where indicated on drawings. Brand "FS" on valve box lid in 2-inch high letters.

E. Hydrometer Assembly: Provide where indicated on drawings. Brand "HM" on valve box lid in 2-inch high letters.

F. Blowout Assembly: Provide where indicated on drawings. Brand "BO" on valve box lid in 2-inch high letters.

G. Isolation Gate Valve Assembly: Provide where indicated on drawings. Install at least 12-inches from and align with adjacent walls or edges of paved areas. Brand "GV" on valve box lid in 2-inch high letters.

H. Quick Coupling Valve Assembly: Provide where indicated on drawings. Brand "QC" on valve box lid in 2-inch high letters.

I. Air-Vacuum Relief Valve Assembly: Install where indicated on drawings or nearest high point, not closer than 2-feet from nearest fitting. Brand "AV" on valve box lid in 2-inch high letters.

J. Manual Drain Valve Assembly: Provide where indicated on drawings or nearest low point in mainline piping. Brand "DV" on valve box lid in 2-inch high letters.

3.8 INSTALLATION OF SPRINKLER AND BUBBLER IRRIGATION COMPONENTS

A. Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals:

1. Flush mainline before installation of RCV assembly.

2. Provide where indicated on drawings. Use wire connectors and waterproof sealant to connect control wires to remote control valve wires. Provide connectors and sealant per manufacturer's recommendations.
3. Provide only one RCV to a valve box. Locate valve box at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Align grouped valve boxes in uniform patterns. Allow at least 12-inches between valve boxes. Brand controller letter and station number on valve box lid in 2-inch high letters.
4. Adjust RCV assembly to regulate downstream operating pressure.
5. Attach ID tag with controller station number to control wiring.

B. Sprinkler Assembly:

1. Flush lateral pipe before installing sprinkler assembly.
2. Provide per installation details at locations shown on drawings.
3. Locate rotary sprinklers 6-inches from adjacent walls, fences, or edges of paved areas.
4. Locate spray sprinklers 3-inches from adjacent walls, fences, or edges of paved areas.
5. Install sprinklers perpendicular to finish grade.
6. Provide appropriate nozzle or adjust arc of coverage of each sprinkler for best performance and uniform coverage.
7. Adjust radius of throw of each sprinkler for best performance and uniform coverage.
8. Sprinklers must be installed and maintained so no sprinklers spray onto any hardscape in such a way that they spray passing motorists or pedestrians. Sprinklers must be adjusted, wherever possible, to not overspray streetside sidewalks.

C. Bubbler Assembly:

1. Flush lateral pipe before installing bubbler assembly.
2. Provide bubbler assembly per installation details at locations shown or directed on drawings.

3.9 INSTALLATION OF DRIP IRRIGATION COMPONENTS

A. Remote Control Valve (RCV) Assembly for Drip Laterals:

1. Flush mainline pipe before installing RCV assembly.
2. Locate as shown on drawings. Connect control wires to remote control valve wires using wire connectors and waterproof sealant. Provide connectors and sealant per manufacturer's recommendations.
3. Provide only one RCV to valve box. Locate at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Align grouped valve boxes in uniform patterns. Allow at least 12-inches between valve boxes. Brand controller letter and station number on valve box lid in 2-inch high letters.
4. Arrange grouped valve boxes in rectangular patterns.

B. Zone Control Valve Assembly: Provide where indicated on drawings. Install at least 12-inches from and align with adjacent walls or edges of paved areas. Brand “ZCV” on valve box lid in 2-inch high letters.

C. Drip Emitter Assembly:

1. Locate as shown on drawings and installation details.
2. Flush lateral pipe before installing emitter assembly.
3. Cut emitter outlet distribution tubing square.
4. Use tools manufactured, and techniques recommended, by emitter manufacturer.
5. Make openings for barb-mounted emitters with emitter manufacturer's hole-punching tool**.**

D. Inline Drip Tubing: Install inline drip tubing components in strict accordance with tubing manufacturer details, guidelines, and recommendations.

E. Flush Cap Assembly: Provide at end of each drip irrigation lateral pipe as shown and directed on drawings and installation details. Install at least 12-inches from and align with adjacent walls or edges of paved areas. Brand “FC” on valve box lid in 2-inch high letters.INSTALLATION OF CONTROL SYSTEM COMPONENTS

A. Irrigation Controller Assembly:

1. Location of controller assembly as depicted on drawings is approximate; City of Fort Collins Representative will determine exact site location during sprinkler layout review. Install controller assembly and enclosure in accordance with controller manufacturer recommendations.
2. Lightning protection: as depicted on drawings and installation details.
3. Coordinate installation of electrical service in accordance with local codes. Provide primary surge protection arrestors on incoming power lines in accordance with controller manufacturer recommendations.
4. For traditional wired systems: Provide one valve output surge protection arrestor on each control wire and one for common wire.
5. For traditional wired systems: Connect control wires to corresponding controller terminal. Attach wire markers to ends of control wires inside controller assembly housing. Label wires with identification number (see drawings) of remote control valve to which control wire is connected.

B. Power Wire:

1. Minimize number of field splices. If power wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate splices in jumbo rectangular valve box. Coil 3-feet of wire in valve box.
2. Install power wire using open trenches. Use of a vibratory plow is not permitted.
3. Use green wire as common ground wire from power source to controller assembly.

4. Carefully backfill around power wire to avoid damage to wire insulation or wire connectors.
5. Install wire parallel with and below mainline pipe unless noted otherwise on plans. Install wire at depth required by local codes.
6. Provide continuous run of warning tape above power wire. Install warning tape six inches above wire. Encase power wire within electrical conduit where not installed in common trench with PVC mainline pipe.

C. Two Wire Cable from Controller to Decoder:

1. Route cable with mainline pipe. Install with minimum number of field splices.
2. Install cable using open trenches. Use of vibratory plow is not permitted.
3. Provide 24-inch excess length of wire in 8-inch diameter loop at each 90-degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tape or tie wiring loop. Coil 30-inch length of wire within each remote control valve box.
4. Carefully backfill around cable to avoid damage to wire insulation or wire connectors.
5. If cable must be spliced, make splice with specified wire connector, installed per manufacturer's recommendations. Locate splices in housing afforded by other control system components or separate 10-inch round valve box. Coil 3-feet of cable in valve box.
6. Install cable parallel with and offset from mainline pipe unless noted otherwise on plans.
7. Encase wiring within electrical conduit where installed above grade, and where not installed in common trench with PVC irrigation mainline pipe. OR Protect wire not installed with PVC mainline pipe with continuous run of warning tape placed in backfill six inches above wiring.

D. Low Voltage Control Wire:

1. Bundle control wires where two or more are in same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals. Do not tape wires together where contained within sleeving or conduit.
2. Provide 24-inch excess length of wire in 8-inch diameter loop at each 90-degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tape or tie wiring loop. Coil 30-inch length of wire within each remote control valve box.
3. Install common ground wire and one control wire for each remote control valve. Multiple valves on single control wire are not permitted.
4. If control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per manufacturer's instructions. Locate splice in valve box that contains irrigation valve assembly, or in separate standard rectangular valve box. Use same procedure for connection to valves as for in-line splices.
5. Install wire parallel with and below mainline pipe unless noted otherwise on plans.
6. Control wiring may be chiseled into soil utilizing vibratory plow device specifically manufactured for pipe pulling and wire installation. Use

appropriate chisel so that wire is fed into a chute on chisel, and wire is not subject to pulling tension. Meet or exceed minimum burial depth for wire as previously specified.

7. Encase wiring within electrical conduit where installed above grade, and where not installed in common trench with PVC irrigation mainline pipe. OR Protect wire not installed with PVC mainline pipe with continuous run of warning tape placed in backfill six inches above wiring.

E. Instrumentation:

1. Install per irrigation plans and installation details.

3.11 INSTALLATION OF OTHER COMPONENTS

A. Tools and Spare Parts: Prior to Review at completion of construction, supply to Owner operating keys, servicing tools, spare parts, test equipment, and other items indicated in General Notes on the drawings.

B. Other Materials: Provide other materials or equipment shown on drawings or installation details that are part of irrigation system, even though items may not have been referenced in specifications.

3.12 PROJECT RECORD (AS-BUILT) DRAWINGS

A. Document changes to design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until accurate “as-built” information is recorded.

B. Record pipe and wiring network alterations on a daily basis. Record work that is installed differently than shown on construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, of each irrigation system valve, each backflow prevention device, each controller assembly, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within valve box.

C. Obtain from City of Fort Collins Representative a reproducible copy of drawings and/or CAD data files prior to construction completion. Duplicate information contained on project drawings maintained on-site using pen or CAD. Label each sheet "Record Drawing".

D. Turn over “Record Drawings” to City of Fort Collins Representative. Completion of Record Drawings is required prior to final construction review at completion of irrigation system installation.

3.13 WINTERIZATION AND SPRING START-UP

A. Winterize irrigation system in fall following completion, or partial completion, of irrigation system construction. Start-up irrigation system in spring following completion, or partial completion, of irrigation system construction. Repair any damage caused in improper winterization at no additional cost to Owner. Coordinate winterization and start-up with landscape maintenance personnel.

3.14 MAINTENANCE

A. Maintain irrigation system for a duration of 30 calendar days from formal written acceptance by City of Fort Collins Representative. Make periodic examinations and adjustments to irrigation system components in order to achieve the most desirable application of water.

B. Following completion of Contractor's maintenance period, Owner will be responsible for maintaining system in working order during remainder of guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after landscape maintenance operation.

3.15 CLEANUP

A. Remove from site machinery, tools, excess materials, and rubbish upon completion of work.

END OF SECTION