

TYPICAL IRRIGATION SPECIFICATIONS FOR SMALL TURF APPLICATIONS (NON-RESIDENTIAL)

These specifications have been compiled by the **Landscape Ontario Irrigation Commodity Group**. They are intended to be guidelines only for designing or specifying an irrigation system.

These specifications should not be constructed in whole or in part as absolute specifications.

The reader uses this material at his or her own risk.

Where particular products or manufacturers have been mentioned, it is for the purpose of description or example only. Equivalent products and other manufacturers should be considered as viable alternatives.

An initiative of:



**SUPPLY AND INSTALL AUTOMATIC TURF SPRINKLER SYSTEM
TENDER SUBMISSION FORM (sample)**

DATED _____

In accordance with the terms of the Tender Specifications forming part of this submission, My/our price for performing the work as described in the specifications is as follows:

LUMP SUM FIXED PRICE

(Please quote in words and numerals)

Construction Schedule

Anticipate date of commencement _____

Anticipated date of completion _____

I/We hereby certify that the above shall be strictly adhered to if we are awarded this contract.

In witness whereof the parties hereto have executed this Agreement under their respective corporate seals and by the hands of their proper officers thereunto duly authorized

SIGNED SEALED AND DELIVERED

In the presence of) _____

) for: _____

)

)

)

SMALL TURF IRRIGATION SPECIFICATIONS

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SECTION A: DESCRIPTION AND SCOPE OF THE WORK

A.1 GENERAL DESCRIPTION

The term “Small Turf Irrigation,” refers to underground lawn sprinkler systems that utilize a water source measuring up to and including two inches in diameter.

A.2 SCOPE OF THE WORK

The work consists of installing a complete underground lawn sprinkler system to efficiently irrigate the areas identified in the accompanying proposal. Plumbing and electrical work shall conform to the prevailing codes, and unless specified otherwise, the construction of the sprinkler system shall include the furnishing, installing and testing of all irrigation equipment, along with the restoration of the site to its original condition.

SECTION B: GENERAL CONDITIONS

B.1 PURPOSE OF THE SPECIFICATIONS

It is the intention of these specifications together with the accompanying drawing to furnish clear documentation:

- Indicating delegation of responsibilities between the Irrigation Contractor (known hereafter as the Contractor) and the Client.
- Indicating extent of irrigation coverage.
- To provide a description of typical conditions that contractors must meet in order to fulfill an irrigation system contract.
- Indicating typical equipment specifications that enable the user to identify the function and performance of sprinklers and related equipment.
- To serve as an aid to the architect or engineer who may be required to provide such information as part of a design package.

B.2 UTILITIES

The Client shall make the Contractor aware of all public utilities servicing the property, and provide written notation pertaining to all private utilities located on the property.

The Contractor shall notify the utility companies and arrange for cable locations prior to the commencement of any work, and shall be responsible for any damage to the public and private utilities described above.

B.3 CLIENTS AUTHORIZED REPRESENTATIVE

The Client shall designate or appoint one (1) person as his Authorized Representative to work with the Contractor.

The Contractor shall be notified in writing of the name and address of this duly appointed representative. This person shall have full authority to approve work performed by the Contractor, make field changes that are deemed necessary and approve estimates submitted by the Contractor for payment.

B.4 PROTECTION OF WORK AND PROPERTY

The Contractor shall maintain adequate protection of all his work from damage and shall protect the Client’s and adjacent property from injury or loss arising from this contract.

B.5 EXAMINATION AND VERIFICATION OF THE DRAWING AND SITE

Sprinkler lines shown on the drawing are essentially diagrammatic. Locations of all sprinkler heads, valves, piping, wiring and related equipment shall be established by the Contractor at the time of construction. Spacing of the sprinkler heads or turf valves are shown on the drawings, and shall be exceeded only with the permission of the Client or his Authorized Representative.

It shall be the Contractor's responsibility to report to the Client's Authorized Representative any deviations between drawings, specifications and the site. Failure to do so prior to the installing of equipment and resulting in replacing, and/or relocation equipment, shall be done at the Contractor's expense.

B.6 ORDINANCES AND REGULATIONS

All local and municipal Rules and Regulations relating to any portion of this work are hereby incorporated into and made a part of these specifications and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above mentioned regulations or requirements, and where a conflict may occur the regulations of the governing code shall be adhered to. However, when these specifications and/or drawings call for or describe materials, workmanship or construction of a better quality, higher standard or larger size, these specifications and/or drawings shall take precedence over the requirements of said Rules and Regulations.

B.7 MATERIALS AND WORKMANSHIP

Whenever any material is specified by name and/or number thereof, such specifications shall be deemed to be used for the purpose of facilitating a description of the materials and establishing quality, and shall be deemed and construed to be followed by the words "or approved equal."

No substitutions will be permitted which have not been submitted for prior approval by the Client's Authorized Representative. All materials shall be new and without flaws or defects and shall be the best of their class and kind. Sufficient descriptive literature and/or samples must be furnished for any materials submitted as "equal" substitutes. All materials shall be guaranteed for a period of one (1) year against material defects and workmanship.

All materials and equipment shall be installed in a neat and workmanlike manner. The Architect or the Client's Authorized Representative reserves the right to direct the removal and replacement of any items which in their opinion shall not present an orderly and reasonable neat or workmanlike appearance, provided such an item can be properly installed in such an orderly way by the usual methods in such work. Such removal and replacement shall be done, when directed in writing at the Contractor's expense without additional cost to the Client.

B.8 PERMITS AND INSPECTIONS

Any permit for the installation or construction of any of the work included under this contract, which is required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He/she shall also arrange for and pay all costs in connection with any inspections and examinations required by these authorities. In all cases, where inspection of the sprinkler system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Client's authorized Representative, the Contractor shall notify the Client's Authorized Representative of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of the failure of the Contractor to have the required inspections shall be performed at the Contractor's expense.

B.9 ELECTRICAL SUPPLY AND CONTROLLER LOCATION

The Client and the Contractor shall mutually agree on the location of the irrigation controller. The Client is responsible for providing a 110-volt power supply within ten feet of the controller location.

B.10 BACKFLOW PREVENTION

Where the water supply is to be taken from a potable water service, the Contractor shall supply and install an adequate backflow or anti-siphon continuous pressure device at the source, in agreement with the local plumbing code. The Contractor should make himself familiar with the local municipal Plumbing Code within the area of the contract. Some municipalities now require permits and inspections.

It is the responsibility of the Contractor to advise the Client on the need for a back flow preventer and the reasons why the Client may wish to arrange for another party (i.e. plumber) to cut into the potable water system and leave the irrigation Contractor with a tie-in access.

It must be remembered that if access is made directly with the potable water system a safety device must be installed.

B.11 WATER SOURCE

All interior piping and all visible exterior piping shall be type "M" copper. If condensation is considered to be detrimental to the adjacent interior areas, the copper piping shall be installed with ¾" pipe insulation. It is the responsibility of the irrigation Contractor to properly grout and waterproof the exterior wall of the building at the point of penetration.

If a booster pump is required, the pump shall be isolated from any copper piping by means of dielectric unions and shall have isolation valves on both the inlet and discharge sides.

If the water source is to be provided from a reservoir or pond, etc., the irrigation pump does not require any potable water backflow prevention devices. (See section E.1, Irrigation Pumps)

B.12 CHANGES OR ADDITIONAL WORK

The Client, may, without invalidating the original contract, order such changes or additions as may from time to time be deemed desirable or necessary. In so doing, the contract price shall be adjusted to the mutual agreement of the Contractor and the Client, with all work being done under the conditions of the original contract except for such adjustment in price and in extension of time as may be necessary. The Contractor shall bring such a change to the attention for the Client's Authorized Representative and they shall together work out an agreeable change, which may be necessitated by deviations in construction from original plans by other contractors on the job. Any change in price brought about by such deviations in construction over original plans by other contractors shall be agreed upon by both the Contractor and the Client before work proceeds.

B.13 UNCLASSIFIED EXCAVATION

Excavation shall be unclassified and shall include all materials encountered, except all materials or matter that cannot be excavated by normal mechanical excavation means shall be brought to the attention of the Client's Representative and an adjustment in price agreed upon before excavation of these areas proceeds. When additional backfill material is needed to replace rock and/or other unsuitable materials, it shall be the Client's responsibility and expense to supply such materials, for backfill, to the irrigation Contractor, at the site locations designated by the Contractor.

It shall also be the Client's responsibility to dispose of the unsuitable materials removed from the trench that cannot be used in the backfill operations, unless the foregoing is otherwise agreed upon by the Client and the Contractor.

B.14 INSURANCE

The Contractor shall maintain in force Public Liability and Automobile Insurance with Bodily Injury limits of \$ _____ and Property Damage Limits of \$ _____ for the duration of this Contract. This Contract will be submitted and insured for contractual liability. Certificates of Insurance in companies acceptable to the Client will be submitted and accepted prior to the commencement of work.

B.15 TIME OF COMPLETION

Where a specified time of completion is so designated in the Contract, all delays caused by any act of neglect by the Client or Client's Representative or by other contractors in the construction of the project of which this work is a part, changes ordered or necessitated by deviations in the general construction or schedule of other contractors on the project, inclement weather conditions, Acts of God and acts beyond the control of the Contractor such as strikes, fire, lockouts, unusual delays in shipments; shall not be cause for delay in payment of estimates as presented and shall be considered as Bona Fide causes for extensions of time. The Client and the Contractor shall agree on reasonable extension of time. If the Client is delayed in completion of part or parts of the project so that the irrigation Contractor must leave the job and return at a later date to complete his installation, payments for work completed and material delivered shall not be held back, and extensions of time for completion of work shall be granted if needed. The Client shall reimburse the irrigation Contractor for any expense incurred due to these delays unless otherwise herein specified.

B.16 WINTERIZATION

All irrigation systems located in freezing climates must be drained to avoid damage. This may be accomplished by:

- (i) Properly grading all piping to designated low points, with manual drain valves installed in valve boxes having a gravel drainage sump.
- (ii) Utilizing an air compressor, with the installation of the required adaptor to the irrigation mainline as part of the initial construction.

The Contractor is responsible for the supply and installation of the appropriate winterizing provision (access) (i, or ii) and shall complete the winterizing operation the first year as part of his initial construction contract.

B.17 GUARANTEE

It shall be the Contractor's responsibility to insure and guarantee complete coverage of the areas shown on the drawings to be irrigated, without excessive overthrow onto streets, driveways and buildings. The Contractor shall also guarantee the satisfactory operation of the entire system and the workmanship and restoration of the area. The entire system shall be guaranteed to be complete and perfect in every detail for a period of one year from the date of its acceptance, and the Contractor HEREBY AGREES to repair or replace any such defects occurring within that year, free of expense to the Client.

B.18 AS-BUILT DRAWINGS

Upon completion of his work, the Contractor shall prepare an as-built drawing of the system indicating:

- sprinkler model and location
- pipe size and location
- automatic valves model and location
- winterizing adaptor location (if applicable)

- wire or control tube location
- controller location
- main shut-off valve and any isolation valve locations
- dimensioned location of buried sleeves

The as-built drawing need not be drawn to scale but must be proportionally and diagrammatically correct. The Contractor shall retain the original drawing in his files and submit two copies to the Client.

SECTION C: INSTALLATION

C.1 EXCAVATION AND BACKFILL

i) Trenching

Trenches for sprinkler lines and wiring shall be of sufficient width minimum of six inches (6") permit proper handling and installation of the pipe and fittings.

The first four inches (4") of backfill materials over the pipe shall be free of stone or any foreign objects greater than ¾ inch diameter. The top six inches (6") of backfill shall be free of rocks over one inch, or trash. Piping less than 1 1/2" inches in diameter shall have a minimum cover of ten inches. Piping greater than 1 1/2" inches in diameter shall have a minimum of fifteen inches. Any road crossings shall have a minimum eighteen inches of cover.

The backfill shall be thoroughly compacted in six inch lifts, and evened off with a minimum one inch of top soil.

In rock areas, the trenching depth shall be two inches below normal trench depth, to allow for placement of selected fill.

All trenches that are opened during any particular working day shall be closed and backfilled the same day.

ii) Pulling

Where soil conditions allow the pipe depths of cover described above to be met, the irrigation piping may be directly installed without trenching by use of a vibratory plough. The feed blade must be equipped with a minimum bullet diameter of 1 ½ times the outside diameter of the pipe to be installed.

In each of the above operations, the Contractor is responsible for keeping the interior of pipes free from dirt, and debris, and for restoring the site to its original condition, including responsibility for damage to existing trees, shrubs, and structures, along with settlement of trenches within the warranty period.

Generally, piping under concrete or asphalt shall be installed by jacking, boring or hydraulic driving. Where any cutting or breaking of sidewalks, concrete work and/or asphalt is necessary, it shall be removed and replaced by the Contractor. Permission to cut or break sidewalks, concrete and/or asphalt shall be obtained from those having proper jurisdiction. Where piping on the drawing is shown under paved areas but running parallel and adjacent of planted areas or turf areas, the intent of the drawings is that the pipe be installed in the planted or turf areas.

C.2 PLASTIC PIPE

i) P.V.C.

One inch (1") or smaller shall be Class 200 (SDR21)

One and a quarter inch (1 ¼") or above shall be Class 160 (SDR26) or approved equivalent.

Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturers, along with the installation of concrete thrust blocks where the pipe changes direction.

Plastic pipe shall be cut with a hand saw or hack saw with the assistance of a square inch sawing vice, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

All plastic to plastic joints shall be solvent-weld joints or slip seal joints. Only the solvent recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturers and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

All plastic to metal joints shall be made with female plastic adaptors.

The solvent weld joints shall be made in the following manner:

1. Thoroughly clean the mating pipe and fitting with a clean dry cloth.
2. Clean the mating surfaces with primer.
3. Apply a uniform coat of solvent to the outside of the pipe with an approved applicator.
4. Apply solvent to the fitting in a similar manner.
5. Re-apply a light coat of solvent to the pipe and quickly insert it into fitting.
6. Give the pipe or fitting a quarter turn to insure even distribution of the solvent and make sure the pipe is inserted to the full depth of the fitting socket.
7. Hold in position for 15 seconds.
8. Wipe off excess solvent that appears at the outer shoulder of the fitting.

Care should be taken so as not to use an excessive amount of solvent, thereby causing an obstruction to form on the inside of the pipe.

The joints shall be allowed to set at least 24 hours in normal conditions before pressure is applied to the system on PVC pipe.

ii) Polyethylene

Polyethylene pipe shall be of high, medium or low density with a minimum pressure rating of 75 psi.

The pipe ends shall be squarely cut and warmed if necessary to allow stress free installation of the insert fittings.

The fittings shall be secured with all stainless construction gear drive clamps. Stainless steel "squeeze" clamps may also be used. Half inch (1/2") stainless steel banding material may be used on two (2") inch pipe. Any piping under continuous pressure shall be double clamped.

All polyethylene (of 1/2" or larger) should be double clamped whether under continuous pressure or not.

C.3 SPRINKLERS AND TURF VALVES

The Contractor shall stake out the location of all sprinkler heads and turf valves prior to commencing installation, thereby allowing the client to verify all locations and give his approval. Spacing of the sprinkler heads and turf valves shall comply with the manufacturer's recommendations and drawings, and shall be exceeded only with permission of the client.

Heights of sprinkler heads and turf valves to be installed in areas where the turf has not yet been established shall be agreed upon by the Contractor and Client, prior to installation.

All sprinkler heads and turf valves shall be set perpendicular to finished grades unless otherwise designated on the drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas, shall be set to grade.

One half to one cubic foot minimum of 3/4" or 1" aggregate pea gravel shall be placed around each rotor pop-up sprinkler head when it is set to grade, for drainage of water from sprinkler case.

All sprinklers having adjustable pin nozzles, shall have the pins adjusted into the stream for proper and adequate distribution of the water over the coverage pattern of the sprinkler at such time as the system is finally completely checked out.

All nozzles on stationary pop-up sprinklers or stationary spray heads shall be tightened after installation. All sprinklers having an adjusting screw, adjusting stem or adjusting friction collars shall be adjusted on a lateral line or arcuate as required for the proper arc of coverage, radius, diameter and/or gallonage discharge.

C.4 SPRINKLER RISERS

All rotor pop-up sprinkler of 1" (or above) connection, or quick coupling valves (of 1" or above connection) shall have an adjustable riser assembly (double swing joint riser) assembled by the use of at least three standard 90 degree ells or tees as recommended by the sprinkler manufacturer and/or as shown on the drawings. These double swing joint risers shall be of schedule 40 galvanized steel pipe or schedule 40 PVC and fittings unless otherwise designated on the drawings. The horizontal nipple connected directly into the side outlet of the main line shall be a minimum of four inches (4") long. All other nipples of the swing joint rise shall be of length as required for proper installation of the sprinkler head, drain valve and/or automatic control valve. The swing joint riser shall be of proper pipe size as shown on the drawings.

All risers for shrub spray heads, bubble heads, etc. that are in shrub, ground cover or flower bed areas and planters, shall be Schedule 80 PVC pipe or Schedule 80 nipple, unless otherwise specified or shown on the drawings. The risers shall be of sufficient height as may be required so as not to cause any interruption of the stream from the sprinkler nozzle when the plant materials has reached its optimum growth. All risers for oscillating sprinklers set above grade shall be Schedule 80 PVC pipe or Schedule 80 nipples. Risers shall be securely braced by means of a supporting stake, anchor pipes below riser or concrete anchor on riser pipe below the surface, as may be required to securely stabilize the riser against any vibration when the sprinkler heads is in operation. Failure of the Contractor to provide such adequate stabilization shall be sufficient cause for the Client to reject the portion of the system and the Contractor shall correctly re-install this portion of the system to the satisfaction of the Client or Architect at his own expense without additional cost to the Client.

C.5 CONTROL VALVES

All control valves shall be installed in proper irrigation valves boxes, in such a manner as to readily permit servicing an operation. A six-inch (6") gravel sump shall be included in the excavation of each valve box. The location of the valve boxes shall be co-ordinated with the Client, so as not to interfere with the aesthetics of the project, or in the case of manual controls, expose the operator to sprinkler overthrow.

C.6 MOUNTING OF AN AUTOMATIC CONTROLLER

The location of the controller is to be negotiated between the Contractor and the Client, while still adhering to the manufacturer's recommendations.

The unit shall be installed as the manufacturer had intended, utilizing fasteners specifically designed for the application.

C.7 WIRING

All 110 volt wiring to the controllers shall be enclosed in P.V.C. electrical conduit or completed with BX cable. The unit is to be grounded in compliance with the manufacturer's recommendations and the local electrical code.

All visible low voltage wire shall be enclosed in P.V.C. electrical conduit. Direct burial wire may be trenched or placed in a common trench beneath "plastic" irrigation pipes, or laid with a vibratory plough (but not pulled), and must have a minimum cover of ten inches (10"). Provision must be made for expansion and contraction of all direct burial wire, including protection from foreign objects.

All electrical wire connections to remote control electrical valves and splices in the field shall be soldered or completed with a wire connector. This is a type designed specifically for in ground, low voltage, irrigation use.

C.8 CONTROL TUBING

All visible control tubing shall be enclosed in conduit. Control tubing may be trenched, or placed in a common trench beneath “plastic” irrigation piping, but must have a minimum cover of ten inches (10”). When more than one control tube is in a common trench, it shall be bundled and taped together every ten feet. Individual runs of control tubing may be laid with a vibratory plough, but not pulled.

The control tubing must be looped at each connection to an automatic valve, and provision must be made for expansion and contraction of all buried tubing, including protection from foreign objects.

C.9 PUMPS

See Section “E” on Special Conditions.

C.10 FLUSHING AND SET UP

Upon completion of each section or of the entire installation, and prior to assembly of nozzles and pop-up components, the control valves shall be opened and a full head of water used to flush out the system. Sprinkler assembly can then be completed, including all necessary adjustments and setup procedures.

C.11 SLEEVES

The irrigation pipe and wiring shall be protected at all sidewalk, roadway and creek bed crossings with a sleeve measuring 1 ½” diameter, or two sizes larger than the irrigation pipe, whichever is larger. Sleeving material at roadways and creek beds shall have eighteen inches (18”) of cover and walk ways twelve inches, (12’) respectively.

SECTION D: MATERIAL

D.1 PIPE

i) Identification

All pipe shall be continuously and permanently marked with the following information: manufacturer’s name or trademark, size, schedule and type of pipe, working pressure at 21 degrees Celsius.

ii) Delivery

Plastic pipe shall be delivered to the site in unbroken bundles or rolls, packaged in such a manner as to provide adequate protection for the pipe ends either threaded or plain.

iii) P.V.C. Pipe and Fittings

P.V.C. pipe shall be class 160, SDR 26 direct burial pipe conforming to CS – 256-63 and shall be homogeneous throughout and free from visible cracks, dents, hole or foreign materials.

All plastic pipe fittings to be installed shall be schedule 40 moulded fittings manufactured for the same material as the pipe and shall be suitable for solvent weld, slip joint ring tight seal, or screwed connections. No fittings made of other material shall be used except brass saddle tees and crosses as hereinafter specified.

Slip fitting socket taper shall be so sized that a dry unsoftened pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. All threaded connections under pressure should be teflon taped or an equivalent substitute.

iv) Polyethylene Pipe and Fittings

All polyethylene pipe should be a minimum schedule 40-standard and use stainless steel clamps as described in Section C2(ii).

D.2 SPRINKLERS

Unless specified otherwise, sprinkler selection shall be limited to a recognized brand name manufacturer having several distributors in the contemplated work area.

Sprinkler heads shall be of the types and sizes with the diameter or radius of throw, pressure, discharge and other designations necessary to determine the types and sizes as indicated on the drawings. They shall be constructed of bronze, brass, stainless steel, and/or non-metallic materials as specified hereinafter, for each model sprinkler. All heads of a particular type and for a particular function in the system shall be of the same manufacturer and shall be marked with the manufacturer's name and identification, in such a position that they can be identified without being removed from the system.

D.3 AUTOMATIC CONTROL VALVES

All automatic valves shall be of current design and manufacturing date, and shall be 24-volt electric solenoid or hydraulically controller. They may be of P.V.C. plastic, cyclac or bras construction featuring slow opening and closing operation, with a manual bleed device.

D.4 AUTOMATIC CONTROLLERS

All automatic irrigation controllers shall be of current design and manufacturing date by a name brand manufacturer or irrigation supplier. They may be of solid state or electro-mechanical construction, to operate from a conventional 115 volt service.

The minimum features the unit shall offer are:

- Four stations of independent duration settings
- 24 hour clock
- Rainy weather shut-down mode, or an automatic device to be fitted to prevent watering during or just after a rain fall
- Seven or fourteen day calendar cycle
- Master valve or pump start circuit
- Have CSA or Ontario Hydro approval

D.5 WIRING

All 115 volt wiring shall conform to the local electrical codes.

All 24 volt control wire between the solenoid valves and the controllers shall be #14 gauge TWU-40° solid conductor, white jacket for the common wire, and coloured for the power wire. For runs less than 500 feet, and single valve operation, #16, #18 or #20 gauge multi-coloured and conductor wire may be used. If two controllers used, each unit must have its own common wire.

D.6 CONTROL TUBING

Control tubing shall be as supplied by the manufacturer of the automatic hydraulic valve, or as approved by that valve manufacturer.

D.7 MANUAL CONTROL AND ISOLATION VALVES

All manual valves shall be bronze gate valve construction, featuring a rising stem and minimum operating pressure of 125 psi. bronze full-port ball valves are also acceptable.

D.8 VALVE BOXES

All manual and automatic valves shall be enclosed in proper irrigation thermo plastic valve boxes, of size as required to permit "ease of access" for service purposes. The boxes shall feature locking or hinged covers, with an impregnated green colour. The term "ease of access" means that every solenoid and manual valve should have adequate access for all types of maintenance.

All valve access boxes shall be installed on a suitable base of gravel for proper foundation of box and easy leveling of box to proper grade, and also to provide proper drainage of the access boxes. All valve access boxes shall be provided with proper length and size extensions, wherever required, to bring the valve boxes level with the finish grade, unless specified to be buried below grade.

D.9 SLEEVES

Providing the sleeves are buried with selected fill to the minimum depths described in section C.11. Any approved plastic pipe material may be used. Separate sleeves must be provided for all electrical wiring.

SECTION E: SPECIAL CONDITIONS

E.1 PUMPS

i) General

Irrigation pumps may be required to serve in a booster capacity or as the prime mover when the water source is a storage pond. etc.

In both circumstances, the Contractor shall verify the volume of water and electrical service available, then select the most efficient style (i.e. end-suction, centrifugal, submersible, etc.) and model to fulfill the irrigation requirements. Pump selection shall be restricted to quality name brand manufacturers with distributors and repair depots in the area. The pumps shall feature bronze impellers and centrifugal units shall permit the motor and impeller assembly to be quickly removed without disturbing the suction or discharge piping.

The pumps shall be equipped with necessary unions, isolation valves, and rains to make them a permanent year round installation, and where copper piping is used, di-electric unions must be employed.

Most "small turf" irrigation pumps will be required to operate on a single phase hydro, and consequently the irrigation Contractor should endeavour to work with the highest voltage and smallest horsepower unit possible, to avoid an excessively high electrical starting factor.

ii) Booster Pumps

When all stations of the irrigation controller are in use for a fully automatic pop-up system, the pump may be started from either a pump-start circuit on the controller, or a flow switch.

When available controller stations are left vacant, or for a manually operated pop-up system, only the flow switch starting mechanism is permitted.

For a turf valve system, the pump may be started either manually or with a flow switch. If the pump is to be started manually, a pressure relief by-pass safety feature is to be included.

Wiring of the pump and all related electrical switch-gear shall comply with the local electrical codes, including the installation of a disconnect within five feet of the pump

iii) Prime Mover

The irrigation pump shall be housed in a structure having a locking door and a gravel bed or concrete floor; is aesthetically acceptable; capable of providing weatherproof protection for any electrical components, and large enough to permit servicing of the pump.

The electrical disconnect shall be mounted within five feet of the pump unit, in such a fashion as to permit operation without reaching over the pump motor.

Buried concrete chambers should be avoided. A centrifugal pump shall be bolted to a concrete pump pad and Located as close as possible to the water source. The suction line may be constructed of aluminum tubing with compression fittings or specifically designed suction hose or Schedule 40 P.V.C., or Series 200 *SDR 21) P.V.C. or 100 psi Polyethylene pipe (the latter only when one of the first three are not possible or practical).

These suction pipes shall be equipped with foot valves and a 1/8" filtration screen or minimum six inches (6") in diameter.

The discharge side of the pump shall be equipped with a readily accessible priming port of largest possible diameter, a pressure gauge, and a manually operated flow control valve to assist in priming and avoiding water hammer. For dirty water applications, the mechanical seal should be replaced with a stuffing box seal.

A submersible pump application shall include a torque-arrester, a low-level cutout switch, and an electrical disconnect at the well head as described above. Submersible pumps are not to rest directly on the bottom of ponds or lakes, etc. The discharge piping shall be equipped with a pressure gauge and a manually operated flow control valve as described for the centrifugal pumps above.

A vertical turbine pump is to be bolted to a concrete pad, and include the disconnect arrangement, pressure gauge, and manually operated flow control valve as described above for the centrifugal pumps.

P.T.O. or engine drive pump installations shall include the filtration screen described above for centrifugal units with the foot valve becoming an optional component if a hand operated pump primer is installed.

The discharge side of the pump shall be equipped with the pressure gauge and manually operated flow control valve as described above for the centrifugal pumps.

SECTION F: TESTING AND OPERATION

F.1 TESTING

Flush all lines and ensure that all air is expelled from the system.

Inspect all visible piping, and walk all buried lines for any leakage.

If a pump is included, verify direction of rotation (if applicable), operating pressure, and any leakage.

Any repairs necessary to render the system in good working order shall be completed at this time, at the Contractor's expense, before final payment by the Client.

F.2 OPERATION

Verify all sprinkler settings, overlap, nozzle sizes, and operating pressures.

Adjust the flow control on automatic valves where necessary.

Program the controller into a logical sequence, and endeavour to accomplish heavy infrequent water cycles as opposed to light frequent settings.

Program each station to satisfy the watering requirements of the relevant plant material.

Provide the Client with printed material pertaining to the operation of the automatic controls pumps, isolation valves, activation and winterization procedures, which apply to the installation.

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