Introduction

This manual provides a complete package of all information necessary to design, specify and maintain a Netafim low-volume irrigation system.

Why Use Techline?

Designers work with Netafim Techline for several reasons. They include:

- Many designs can be done with a calculator, using easy-to-follow formulas. This greatly reduces design time.
- Plants grow 50%+ faster and use ½ of the water of an overhead irrigation system. (Subsurface drip irrigation (SSDI) is typically 90%+ efficient vs. 30% - 70% with overhead irrigation)
- Vandalism is greatly reduced
- Maintenance costs are greatly reduced
- Fertigation and chemigation are easy-to-accomplish with Techline
- Windy conditions do not pose a problem for dripperline
- Slopes are easy to design, creating maximum efficiency
- Odd-shaped areas and long, narrow areas are no problem with Techline
- Water droplets on delicate plants are eliminated
- Reduced water usage allows for larger areas to be zoned together
- Systems with low pressure or limited supply are no problem
- Water window issues are eliminated because Netafim Techline systems can often be operated anytime, day or night
- Staining and bleaching caused by overhead irrigation is eliminated
- Slipping and tripping hazards caused by the overspray of above grade sprinklers are eliminated
- Spray on buildings and at-grade windows is eliminated
- Graywater applications, often illegal with overhead irrigation, are typically legal with dripperline systems

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NETAFIM USA
ADVANCING THE SCIENCE OF IRRIGATION

TECHLINE DESIGN MANUAL

FOR

SUBSURFACE AND ON-SURFACE IRRIGATION INSTALLATIONS

FOREWORD

PURPOSE:

To cover the basics of design, installation, and maintenance of Techline Integral Dripperline utilizing the “Grid” layout method to produce a complete wetted area. This type of design is intended for subsurface applications but can be applied to on-surface installations as well.

This manual includes design steps, technical data, design layouts, as well as some design and installation details and checklists.

OVERVIEW:

- Netafim is the world leader in drip irrigation. Since 1965 Netafim has pioneered the science of subsurface, on-surface and point source drip irrigation and manufacturing. Serving more than 70 countries worldwide, sales in 1999 will exceed of $300 million.

- Techline has been used successfully in landscape since 1987 in North America. It has been field tested at the Center for Irrigation Technology in Fresno, California since 1989.

- Landscape Architects, Contractors, Nurserymen and Designers recognize the benefit of using low volume and drip irrigation for new plantings, because of its accelerated plant growth compared to overhead spray and rotor irrigation. Couple the growth proliferation with the dramatic savings of water and drip becomes a technology that is being demanded by customers.

- With Netafim landscape products, architects, designers, and contractors have a new, highly sophisticated way of solving client and installation problems by bringing high quality drip and subsurface components to growing plants, trees, shrubs, groundcover, and yes, even turf!

DESIGN CRITERIA:

- Designing with Techline follows many of the same rules as designing with standard overhead irrigation.

- Point of connection, static and operating pressures, flow rates, and type of materials being irrigated are the same.

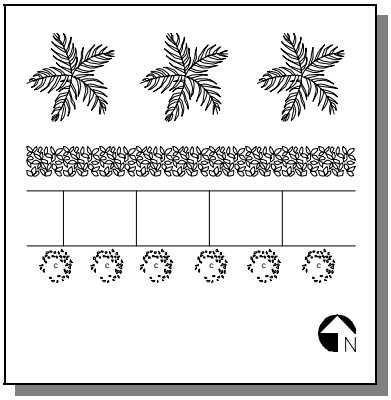
- Designing similar areas into a zone and not mixing dripper output and dripperline spacing is just like sprinkler design.

- The essential differences include knowing the type of soil you are working with, and the use of a “grid” layout in the design.

BASIC DESIGN STEPS

Site Survey:

- Obtain or draw a scaled plan of the site to be irrigated. Identify all slopes on the plan.
- Identify type of soil (sand, loam, or clay).
- Determine plant materials to be irrigated, i.e. turf, groundcover, shrubs, plants, and trees.



Point of Connection:

- Type of water, i.e. potable, well, pump, effluent, etc.
- Pressure & Volume Available - Static and operating tests.

Table # 1 **TECHLINE ROW SPACING RECOMMENDATION TABLES***

	TURF			SHRUB & GROUNDCOVER		
	Clay Soil	Loamy Soil	Sandy Soil	Clay Soil	Loamy Soil	Sandy Soil
Dripper Flow	0.4 GPH	0.6 GPH	0.9 GPH	0.4 GPH	0.6 GPH	0.9 GPH
Dripper Interval	18”	12”	12”	18”	18”	12”
Techline Lateral Spacing	18” - 22”	18” - 22”	12” - 16”	18” - 24”	18” - 24”	16” - 20”
Burial Depth	Bury evenly throughout the zone to a maximum of 6”			On-surface, or bury evenly throughout the zone to a maximum of 6”		
Application Rate (in/hr)	.29 -.23	.64 - .48	1.44 -1.08	.29 - .21	42 - .35	1.08 - .87
Time to Apply 1/4” of water (minutes)	52 - 65	23 - 31	10 - 14	52 - 71	36 - 43	14 - 17

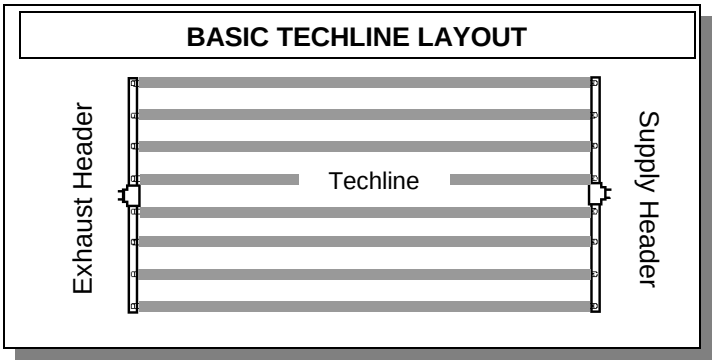
**Maximum Spacing Recommendations:*
Following these spacing guidelines, dripper flow selection can be increased if desired by the designer.

TECHLINE LAYOUT:

- Select the correct dripper flow rate, dripper interval, and row spacing from Table #1, based on type of soil and what you are irrigating.

BASIC LAYOUT:

- The Supply Header delivers water to each row of Techline.
- The Exhaust Header forms a continuous loop system so all rows of Techline are being supplied from both ends. This interconnection of the piping network comprises the term “Grid layout.” This evens out flow, and allows for much easier repairs of line breaks.
- Headers should be indented 2”-4” from hardscapes and planting areas.
- Headers may be PVC, Polyethylene or in some cases Techline or Netafim Blank Tubing (Techline without drippers). Headers must be sized to accommodate the flow of the zone without exceeding 5 feet per second velocity. (Zone Water Requirement calculations can be found on page 6).



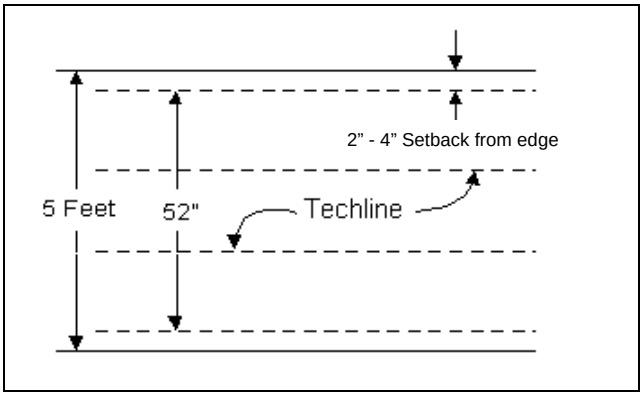
BASIC DESIGN STEPS (Continued)

• Techline can be used for supply and exhaust headers for zones of up to 5 GPM flow.
• Lay out Techline beginning 2”- 4” from the edge of hardscapes, and move across the area with equal row spacing which does not exceed the recommendations of Table #1. (The 2” setback will help provide enough moisture to prevent heat damage to plant material generated by hardscape). Note: Start rows 2” away from hardscapes such as asphalt and 4” away from planting beds.

How to Calculate Equal Techline Row Spacing

Example:

- 5 feet x 12 inches = 60 inches
- 60 inches - (2 x 4 inches) = 52 inches
- Follow recommended Techline Row Spacing for this example, assume 18 inches from Table #1.
- 52” / 18” = 2.89 spaces between Techline rows
- 2.89 is not a whole number, so round up the next whole number which is 3 (spaces)
- Add 1 (one) to the number of spaces to determine the number of Techline rows. Then. . .
- Determine equal spacing between Techline rows
  52 inches / 3 = **17.3 inches**



Length of Techline Rows:

• As with overhead irrigation, friction losses through pipe determine how long a length of Techline can be.
• You do not need to go through friction loss calculations on the actual Techline runs. It has already been done for you .

• Table #2 shows the maximum length of one Techline lateral within a zone. The chart will also help you determine what the operating pressure of the zone needs to be. For instance, if you have a run of 12”, 0.6 GPH Techline that is 312 feet long, you would need 25 PSI to have it operate properly. If the run of Techline was between 313 and 365 feet, you would need 35 PSI. How much Techline you can incorporate into a zone is a function of the capacity of supply. *Note: We will discuss how to regulate your pressure in the Pressure Regulating Valve section on page 8.*

Table # 2

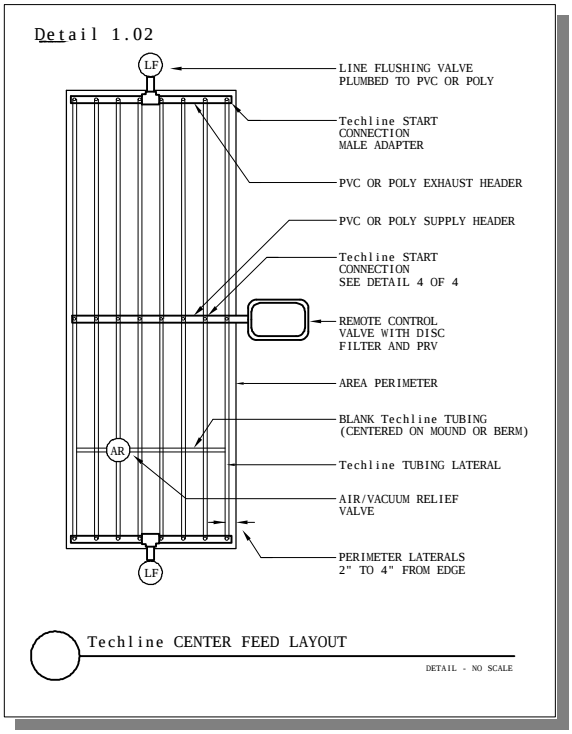
MAXIMUM LENGTH OF A SINGLE TECHLINE LATERAL

	Techline Dripper Spacing							
Inlet Pressure PSI	12”			18”			24”	
15	292	233	175	410	322	247	405	309
25	397	312	238	558	438	335	553	423
35	466	365	279	656	514	394	649	497
45	520	407	311	732	574	439	725	555
Dripper Flow Rate	**0.4**	**0.6**	**0.9**	**0.4**	**0.6**	**0.9**	**0.6**	**0.9**

• You can increase the length of the runs by center-feeding the zone. By doing so, you can have a length of Techline as called out in the chart going in <u>each</u> direction, effectively doubling the maximum length.

BASIC DESIGN STEPS (Continued)

• Once you have laid out the zone, note the pressure you will need somewhere on the design. We will need to have this value later to properly size the Pressure Regulating Valve.



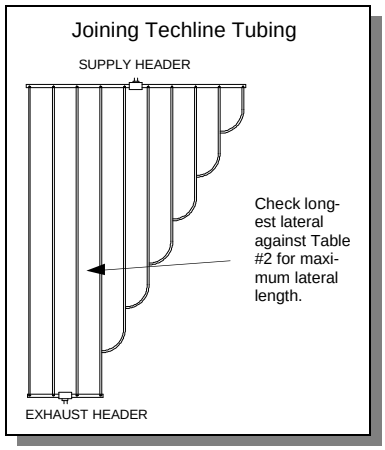
Center Feed Layouts:

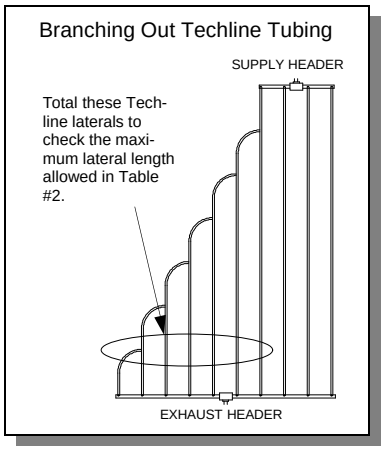
• Where layout flexibility exists, it is recommended that Center Feed layouts be used. This allows for the most even flow of water through the zone.

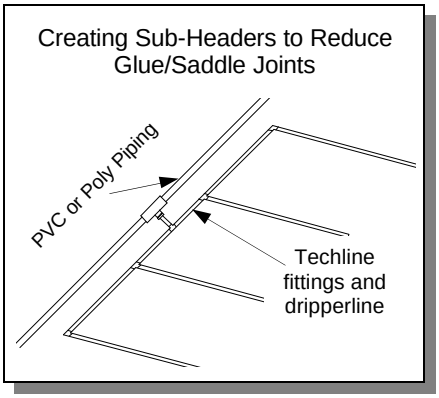
• Center Feed layouts also allow you to maximize the lengths of Techline that can be run.

OTHER PIPING LAYOUTS:

• When branching out, or joining Techline, one of two rules apply. **Rule #1**– When branching out Techline from the supply header, total all "branched out" dripperline and check the sum against the maximum lateral length in Table #2. **Rule #2**– When joining dripperline laterals from the supply header, check only the longest lateral against the maximum allowable in Table #2.







• To reduce the number of glue joints, saddles or insert fittings in a header, transition to Techline and Techline fittings to make up sub-headers, making sure to follow the guideline of a maximum of 5 GPM in the "sub-header" zone.

BASIC DESIGN STEPS (Continued)

Zone Water Requirements:

• Once you have laid out the Techline, you need to identify how many drippers there are, and their total output. This will help you determine mainline, submain and supply/exhaust header sizing, valve, filter, and regulator selection.

How to Calculate Total Flow within a Zone of Techline

- Calculate the **total Feet of Techline** in the Zone
- Multiply **Total Feet x 12" = Total inches of Techline**
- Divide **Total inches of Techline / Dripper Spacing = Number of Drippers**
- Multiply **Number of Drippers x Dripper Flow Rate (GPH) = Total GPH Flow**
- Divide **Total GPH Flow / 60 = Total Gallons per minute in Zone**

Example:
10 Rows of Techline each 100 Feet long. Dripper Spacing 18", .6 GPH.

100' x 10 = 1,000 Feet
1,000' x 12" = 12,000"
12,000" / 18" = 667 Drippers
667 Drippers x .6 GPH = 400 GPH Total Flow
400 GPH / 60 = 6.67 GPM Flow in the Zone

Table # 3 **Techline Flow per 100 Feet Chart**

Dripper Spacing	0.4 GPH Dripper		0.6 GPH Dripper		0.9 GPH Dripper	
	GPH	GPM	GPH	GPM	GPH	GPM
12"	40.00	0.67	61.00	1.02	92.00	1.53
18"	26.672	0.44	41.00	0.68	61.00	1.02
24"			31.00	0.51	46.00	0.77

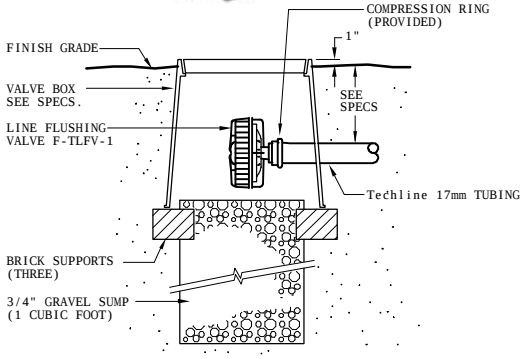
• Table #3 shows an easier method of calculating total zone flow. Total the quantity of Techline (in hundreds of feet) in your design and multiply that figure by the corresponding dripperline GPM to get an estimate of zone flow.

Line Flushing Valves:

• Line Flushing Valves are used to provide a cleansing action in the Techline each time the zone is turned on. The ability of the Line Flushing Valve to dump water allows the velocity of water inside the Techline to increase momentarily during turn-on. This action moves sediments out of the system through the Line Flushing Valve.

• Place a Line Flushing Valve (one per 15 GPM of zone flow) as far away from the source as possible. This will typically be somewhere along the exhaust header. Note: Where Center Feed layouts are used, install one Line Flushing Valve on each exhaust header.

Netafim Line Flushing Valve TLFV-1



• Line Flushing Valves should be buried in a valve box with a gravel sump adequate to drain approximately 1 gallon of water.

• Rule of Thumb: Install the Line Flushing Valve in an inconspicuous area as far away from the source as possible.

BASIC DESIGN STEPS (Continued)

Air/Vacuum Relief Valves:

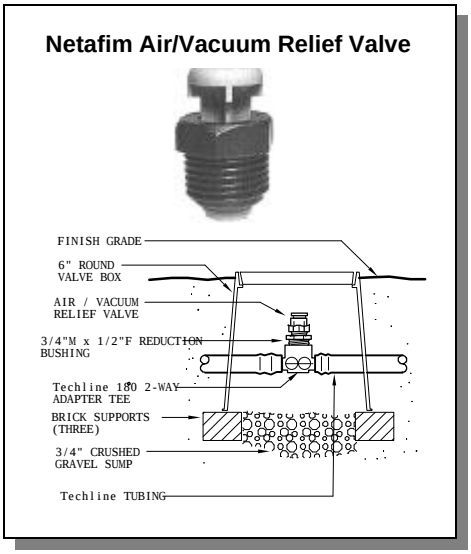
• Air/Vacuum Relief Valves are used for two reasons:

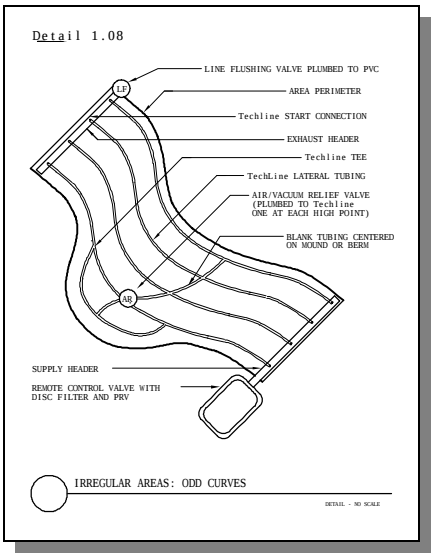
1. To freely allow air into a zone after shutdown. This ensures a vacuum doesn't draw debris into the Techline.

2. To provide a means of releasing air from the Techline when the zone is turned on, thus eliminating air pockets.

• Air/Vacuum Relief Valves are installed at the highest point(s) of a subsurface Techline zone.

•To ensure all rows of Techline can take advantage of the Air/Vacuum Relief Valve, ***install it on a line perpendicular to the Techline rows***. This may be an exhaust header, or a special lateral connecting all the rows of Techline such as going over a berm.





Disc Filter Sizing:

• Disc Filters are normally installed immediately downstream of the remote control valve. See *Techline Design Details #3.03.* Their purpose is to filter out debris in the water supply.

• Netafim disc filters incorporate a non-collapsing stack of flat grooved discs that capture contaminants. They are easily removed from the filter body and flushed clean under a faucet or in a pail of clean water.

• Disc filters come in a variety of sizes and filtering capacities.

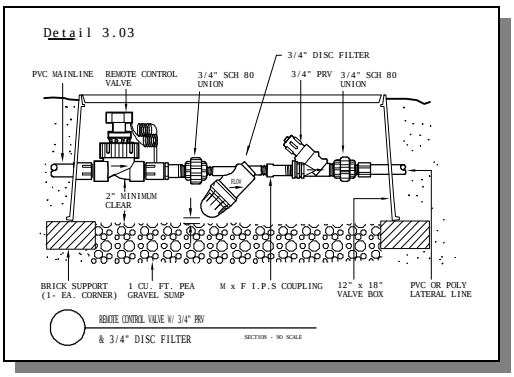
• Rule of Thumb: Use 140 mesh filters for Techline designs, and you will be well protected. Techline requires 120 mesh filtration, but since there is no price difference between the two filters, the use of a finer filter offers a little more protection.

•Refer to "DISC FILTER SIZING CHART" Table #4 on page 16 to properly size the filter.

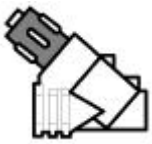
BASIC DESIGN STEPS (Continued)

Pressure Regulators:

- Pressure Regulating Valves (PRV) reduce the operating pressure so the Techline zones operate between 15 and 45 PSI.
- They are installed immediately downstream of the disc filter and remote control valve. Often all three components are in the same valve box.
- To select the correct PRV choose the model that has the correct flow range for the Total Zone Flow.



Flow Selection for PRV



Red Top Model "LF" 0.5 to 5.0 GPM

Black Top Model "HF" 3.5 to 20.0 GPM

Netafim PRV Valve

- To select the correct pressure rating select one of the following:

1. If you used the Maximum Techline Lateral length chart, use a PRV with the same pressure rating as you used for your lateral length calculations.

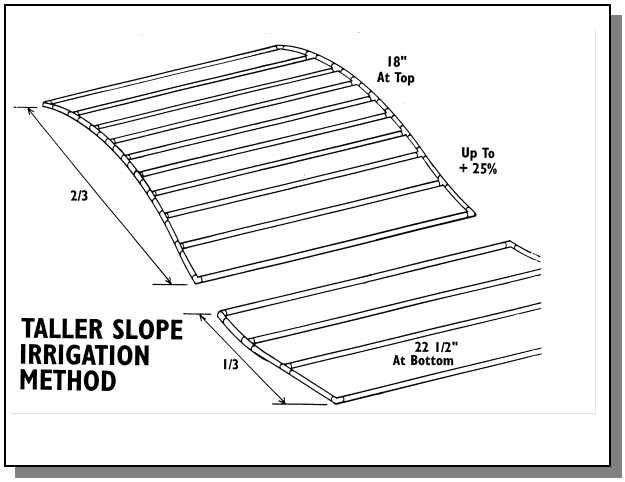
OR

2. If the your lateral length is less than the 15 PSI Inlet Pressure recommendation from the chart, use a 15 PSI Regulator. Note: In either case, if the PRV is remote from the supply header remember to adjust for any friction loss that occurs in the piping to the supply header.

BASIC DESIGN STEPS (Continued)

Slopes:

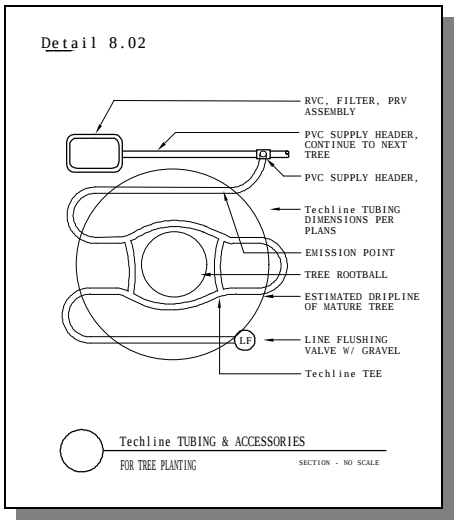
- Techline should be Installed perpendicular to slopes (more than 4%)
- Slopes present special circumstances because of how water moves through soil.
- In slope applications, run the Techline perpendicular to (across) the slope.
- In the upper 2/3 rd's of the slope, space the Techline per TABLE #1, Page 3.
- In the lower 1/3 of the slope, increase the distance between rows by 25%.
- In conditions where the elevation change is greater than 10', zone the two areas separately.



- Installations such as long medians usually have a slope of 1% to 4%. In these cases you may wish to use inline check valves to prevent drainage of the water inside the piping network to the lower elevations.

Trees:

- It is important to provide trees with adequate water at the rootball, while also planning for the tree's needs as it grows.



- A loop of Techline close to the rootball, with more Techline surrounding the estimated drip line of the tree when mature will provide sufficient water. *SEE Detail 8.02.*

BASIC DESIGN STEPS (Continued)

Pressure & Flow Checks:

- One of the best means of ensuring a Techline zone is operating properly is to test the pressure at regular intervals.
- By taking a pressure reading while the zone is running, and recording the pressure, you can conclude that the zone is working as installed.
- Take the reading as far away from the source as possible to ensure that pressures throughout the rest of the zone are at least that high.
- If readings are lower than normal, a line break, clogged filter, dirty remote control valve, clogged PRV, or reduced line pressure are possible causes.
  Note: Always take the readings at the same time of day, from the same spot. This reduces the chance of faulty readings due to other factors.
- If a water meter is available, check the flow of each zone as the system operates.
- Record the information using the System Inspection Checklist provided in the maintenance section of this manual. Then on an annual basis check the system's performance to that standard.

10 – F – 01
Operation/Pressure Indicator

- **See when the system is running**
- **Check pressure**

At 10 P.S.I. The indicator flag rises to indicate system operation and the minimum pressure to operate the system.

Calculating Precipitation Rates:

- Method #1 – See "Techline Row Spacing Recommendation", Table # 1, on page 3, and refer to the row "Application Rate (in/hr). This method is correct if you laid out the zone exactly as the Techline Lateral Spacing dimensions that are shown.
- Method #2 – If there was some variation in your design (for instance, where we had to decrease the distance between the rows as our earlier example), then rely on the formula stated in this example. The results proves a precipitation rate much like many rotors. Precipitation rates of rotors, fixed sprays and Techline can calculate to be the same in many situations. It is possible to mix Techline with sprinklers in these cases, as long as all the principles of Techline installation are adhered to i.e. Dripperline selection is based on soil type, filters, regulators, flush valve, air vents are used. *Note: Some professionals however believe that because of the dramatic differences in irrigation efficiency between Techline and sprinklers that they should not use them in combination.*

Techline Application Rate

$$\text{Application Rate (InchesperHour)} = \frac{231.1 \times \text{Dripper Flow Rate (GPH)}}{\text{Dripperline Row Spacing (Inches)} \times \text{Techline Dripper Spacing (Inches)}}$$

Example:
Dripperline Row Spacing = 17.3" apart
Techline Dripper = 18" spacing
Dripper Flow Rate = .6 GPH

$$\frac{231.1 \times .6\,(GPH)}{17.3\,(Inches) \times 18\,(Inches)} = .45 \quad Inches\ per\ Hour$$

SPECIAL APPLICATIONS & TIPS

Parking Lot Islands:

- Since many islands are small, consider tying several of them together on the same zone.
- Once you have determined that the conditions of the islands are similar enough to interconnect them, design each for the same precipitation rate by using the same Techline and spacing.
- Use one remote control valve, disc filter and PRV at the source, but install a separate Air/Vacuum Relief Valve (if the zone is subsurface) and Line Flushing Valve on each island.
- Connections between the islands should be PVC, or as called out by the designer or local codes.

Electrical Grounding:

- The effectiveness of electrical grounding is dependent on the soil and its moisture content. In moist soil, grounding is far more effective than in dry soil.
- One method of ensuring moist soil is to install a length of Techline along the unclad copper wire. Often this wire is fed from the controller location into the fairway at a preset depth. The Techline is installed in the usual method. Run it from a separate station if possible.
- The Techline can be installed along the grounding wire, or above it. Simply ensure that the Techline is creating a wetted area across the length of the ground wire.

Techline Above and Below Grade:

Techline is designed to be used in a variety of ways. It can be laid on the surface, (it's UV resistant!) held in place with Techline Staples (TLS6), it can be laid on the surface and covered with mulch, or it can be buried below grade. Note: When using Techline above grade with staples, ensure that enough staples are used to firmly hold the Techline in place, especially in freezing climates. The looser the soil, the more staples you will need. Rule of Thumb: One staple every 3' - 5' and two for every time you change the direction of a Techline lateral, even if a mulch cover is being used. Note: When burying Techline in a turf application, it is important to maintain a consistent depth of anywhere up to 6".

TECHNICAL DATA

Techline Selection Charts

The following charts are guidelines to determine which Techline products to choose for different plantings and applications.

Trees, Shrub Beds and Ground Cover Applications

	Clay Soil	Loamy Soil	Sandy Soil
Dripper Flow	0.4 GPH	0.6 GPH	0.9 GPH
Dripper Interval	18”	18”	12”
Techline Lateral Spacing	18” - 24”	18” - 24”	16” - 20”
Burial Depth	On-Surface, or bury evenly throughout the zone to a maximum 6”		
Application Rate (in/hr)	.29 - .21	.42 - .35	1.08 - .87
Time to Apply 1/4” of water (minutes)	52 - 71	36 - 43.	14 –17

Turf Applications

	Clay Soil	Loamy Soil	Sandy Soil
Dripper Flow	0.4 GPH	0.6 GPH	0.9 GPH
Dripper Interval	18”	12”	12”
Techline Lateral Spacing	18” -22”	18” - 22”	12” - 16”
Burial Depth	Bury evenly throughout the zone to a maximum 6”		
Application Rate (in/hr)	.29 -.23	.64 - .48	1.44 - 1.08
Time to Apply 1/4” of water (minutes)	25 –65	23 –31	10 –14

TECHNICAL DATA

Design Formulas

Formula 1.1

$$\text{Application Rate (Inches per Hour)} = \frac{231.1 \times \text{Dripper Flow Rate (GPH)}}{\text{Dripperline Row Spacing (Inches)} \times \text{Dripper Spacing (Inches)}}$$

in which:
Application Rate is = Inches per Hour
Dripper Flow Rate = Gallons per Hour flow of one Dripper
Dripper Spacing = Spacing in inches of Drippers inside Tubing
Dripperline Row Spacing = Inches between Techline laterals

Formula 1.2

$$\text{Number of Drippers in a Zone} = \frac{\text{Total Dripperline} \times 12}{\text{Dripper Spacing}}$$

in which:
Number of Drippers = number of drippers
Total Dripperline Length = Length of all Dripperline in a Zone in FEET
Dripper Spacing = Spacing in inches of Drippers inside Tubing

Formula 1.3

$$\text{Flow per Zone} = \frac{\text{Number of Drippers} \times \text{GPH}}{60}$$

in which:
Flow per Zone = Total gallons per minute
Number of Drippers = Number of drippers
GPH = Gallons per Hour flow of one Dripper

Formula 1.4

$$\text{Estimated Total Zone Flow (GPM)} = \left(\frac{\text{Irrigated Area (squarefeet)} \times 144}{\text{Dripper Spacing (inches)} \times \text{Dripperline Spacing (inches)}}\right) \times \text{Dripper Flow (GPM)} \div 60$$

In which:
Estimated Total Zone Flow = Gallons per Minute in Zone
Irrigated Area = Total Area in square feet
Dripper Spacing = Distance between Drippers in Dripperline in Inches
Dripperline Spacing = Distance between Dripperline in Inches
Dripper Flow = Flow of one Dripper in Gallons per Hour

Formula 1.5

$$\text{Estimated Total Length of Dripperline} = \frac{\text{Irrigated Area} \times 12}{\text{Dripperline Spacing (inches)}}$$

In which:
Estimated Total Length of Dripperline = Total of Dripperline in a Zone
Irrigated Area = Total Area in Square Feet
Dripperline Spacing = Distance between Dripperline in Inches

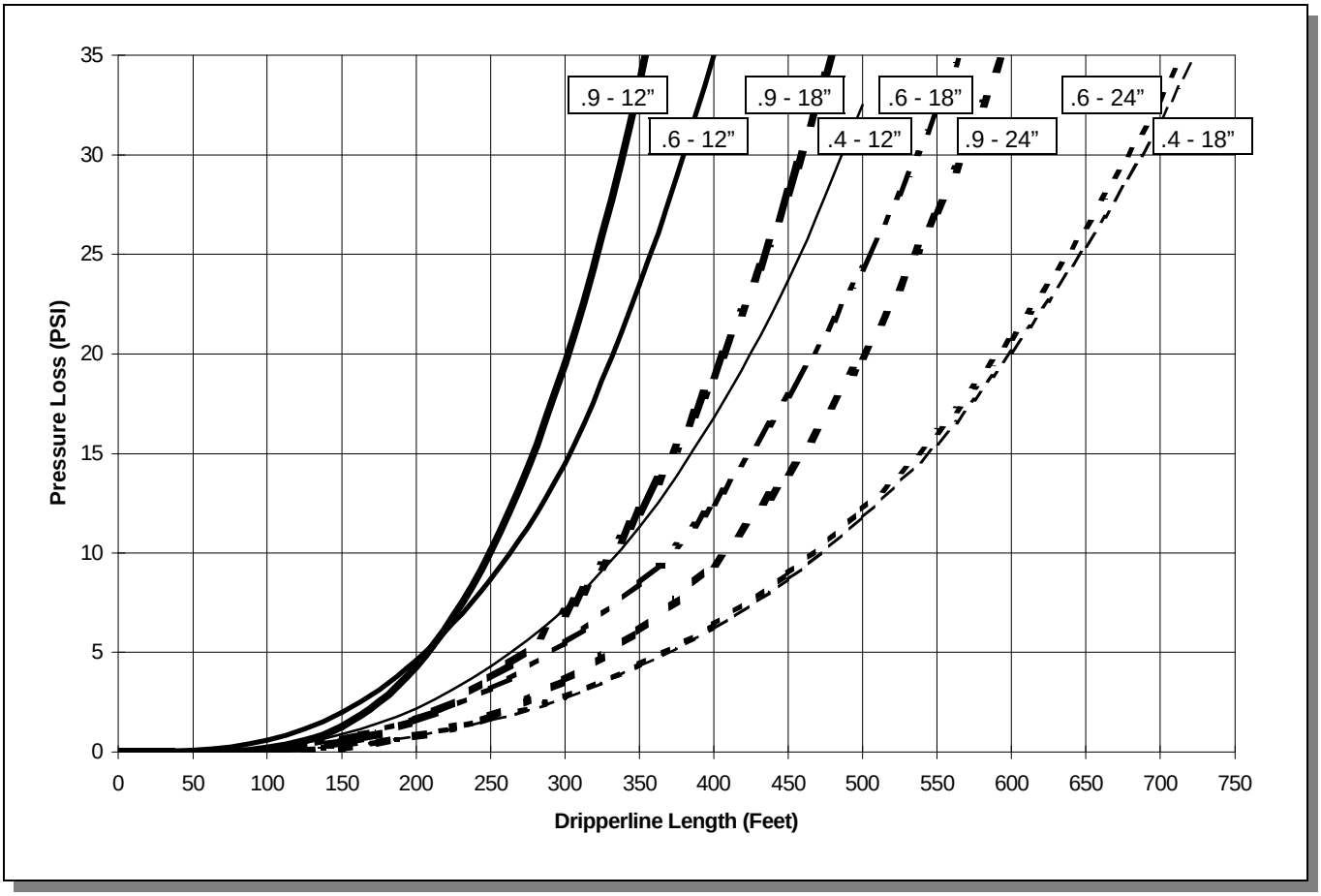
TECHNICAL DATA

Table # 2

MAXIMUM LENGTH OF A SINGLE TECHLINE LATERAL

	Techline Dripper Spacing							
Inlet Pressure	12”			18”			24”	
15	292	233	175	410	322	247	405	309
25	397	312	238	558	438	335	553	423
35	466	365	279	656	514	394	649	497
45	520	407	311	732	574	439	725	555
Dripper Flow	**0.4**	**0.6**	**0.9**	**0.4**	**0.6**	**0.9**	**0.6**	**0.9**

Dripperline Length vs. PSI Loss



TECHNICAL DATA

Techline Application Rate Tables

0.4 GPH Dripper Flow
in Inches per Hour

	Techline Row Spacing										
Dripper Spacing	**12”**	**13”**	**14”**	**15”**	**16”**	**17”**	**18”**	**19”**	**20”**	**22”**	**24”**
12”	0.64	0.59	0.55	0.51	0.48	0.45	0.43	0.41	0.39	0.35	0.32
18”	0.43	0.40	0.37	0.34	0.32	0.30	0.29	0.27	0.26	.0.23	0.21

0.6 GPH Dripper Flow
in Inches per Hour

	Techline Row Spacing										
Dripper Spacing	**12”**	**13”**	**14”**	**15”**	**16”**	**17”**	**18”**	**19”**	**20”**	**22”**	**24”**
12”	0.98	0.90	0.84	0.78	0.73	0.69	0.65	0.62	0.59	0.53	0.49
18”	0.65	0.60	0.56	0.52	0.49	0.46	0.44	0.41	0.39	.036	0.33
24”	0.49	0.45	0.42	0.39	0.37	0.35	0.33	0.31	0.29	0.27	0.24

0.9 GPH Dripper Flow
in Inches per Hour

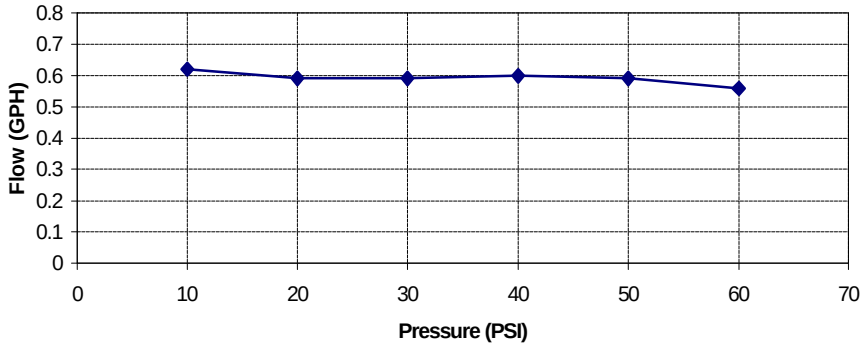
	Techline Row Spacing										
Dripper Spacing	**12”**	**13”**	**14”**	**15”**	**16”**	**17”**	**18”**	**19”**	**20”**	**22”**	**24”**
12”	1.48	136	1.27	1.16	1.11	1.04	0.98	0.93	0.89	0.81	0.74
18”	0.98	0.91	0.84	0.79	0.74	0.69	0.66	0.62	0.59	0.54	0.49
24”	0.74	0.68	0.63	0.59	0.55	0.52	0.49	0.47	0.44	0.40	0.37

Techline Tubing Chart
Flow per 100 Feet

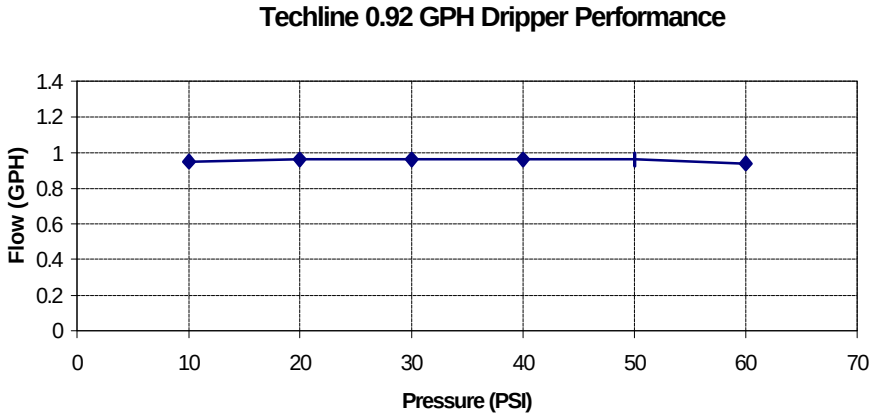
	0.4 GPH Dripper		0.6 GPH Dripper		0.9 Gph Dripper	
Dripper Spacing	**GPH**	**GPM**	**GPH**	**GPM**	**GPH**	**GPM**
12”	40.00	0.67	61.00	1.02	92.00	1.53
18”	26.672	0.44	41.00	0.68	61.00	1.02
24”			31.00	0.51	46.00	0.77

TECHNICAL DATA

Techline Dripper Performance



Reprinted from California Agricultural Technology Institute (CIT) test 12/05/90



Reprinted from California Agricultural Technology Institute (CIT) test 12/05/90

TECHNICAL DATA

Techline Model Number Designation

Specifying Information

TLDL - X - XX XX

Techline Dripperline	Dripper Flow rate	Dripper Spacing	Coil Length
	4 0.4 GPH	12”	01 100 feet
	6 0.6 GPH	18”	025 250 feet
	9 0.9 GPH	24”	10 1000 feet

	0.4 GPH			0.6 GPH			0.9 GPH		
	100 Feet	250 Feet	1000 Feet	100 Feet	300 Feet	1000 Feet	100 Feet	300 Feet	1000 Feet
Dripper Spacing									
12”	TLDL4-1201	TLDL4-12025	TLDL4-1210	TLDL6-1201	TLDL6-12025	TLDL6-1210	TLDL9-1201	TLDL9-12025	TLDL9-1210
18”	TLDL4-1801	TLDL4-18025	TLDL4-1810	TLDL6-1801	TLDL6-18025	TLDL6-1810	TLDL9-1801	TLDL9-18025	TLDL9-1810
24”	Not Available	Not Available	Not Available	TLDL6-2401	TLDL6-24025	TLDL6-2410	TLDL9-2401	TLDL9-24025	TLDL9-2410
Blank	TLDL001	TLDL0025	TLDL010						

Techline Dripper Flow Passage and Filtration Recommendation

Dripper Flow	Depth	Width	Length	Minimum Filtration
0.4 GPH	0.044”	0.044”	0.760”	120 Mesh
0.6 GPH	0.048”	0.048”	0.610”	120 Mesh
0.9 GPH	0.052”	0.052”	0.610”	80 Mesh

Techline Tubing Dimension

Inside Diameter	Outside Diameter	Wall Thickness
0.570 Inches	0.660 Inches	0.045 Inches

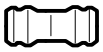
Techline Minimum Bending Radius

Bending Radius = 7 Inches

Detail E.01

Techline TLELL
Elbow

Detail E.02

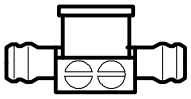


Techline TLCOUP
Coupling

Detail E.03

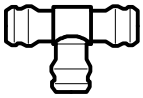
Techline TL075MA
Male Adapter

Detail E.04



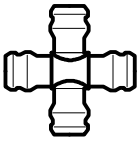
Techline TL075FTEE
Two-way Adapter Tee

Detail E.05



Techline TLTEE
Tee

Detail E.06



Techline TLCROSS
Cross

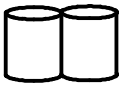
Detail E.07

Techline TLW075MA
“V” 2-way Adapter

Detail E.08

Techline TLPLUG
Dripper Plug Ring

Detail E.09

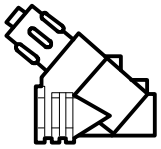


Techline TLFIG8
Line End

Detail E.10

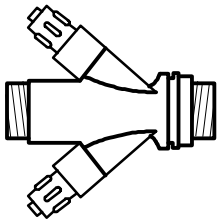
Techline TLTUBEADP
Micro-Tubing Adapter

Detail E.11



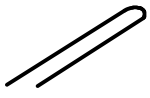
Techline 3/4” PRV
Pressure Regulating Valve

Detail E.12



Techline 1 1/2” PRV
Pressure Regulating Valve

Detail E.13

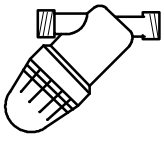


Techline TLS6
6” Wire Staple

Detail E.14

Techline TLSOV
Shut-Off Valve
(Barb x Barb)

Detail E.15



Techline 3/4” Disk Filter

Detail E.16

Techline TLAVRV
Air/Vacuum Relief Valve

TECHNICAL DATA

Techfilter™

Filters are an integral part of every drip system. No system should be designed or assembled without proper filtration. The primary function is to filter out contaminants that could plug the small orifices of the drippers. Netafim's Techfilter serves a secondary purpose of protecting against roots invading the system.

Triflurex® is incorporated into the replaceable disk ring assemblies inside the filter housing. When water passes through the filter, a very low concentration of Trifluralin (parts per billion level) is transmitted throughout the system. The operation of this technology provides very precise and even distribution of Trifluralin through the piping network which will inhibit root growth into the dripper outlets. No other uses or claims are made for the use of this product beyond the protection of the system from root intrusion.

Techfilter Installation and Mounting Instructions

The installation of the Techfilter is no different than any other filter. It is advisable to install the filter so the filter rings are easily removed for periodic cleaning of contaminants and replacement of the rings at the end of their effectivity. The filter should be mounted so the cover can be easily disassembled and the ring set, when removed, will not drop dirt or particle contaminants back into the filter body. Do not install the filter in direct sunlight.

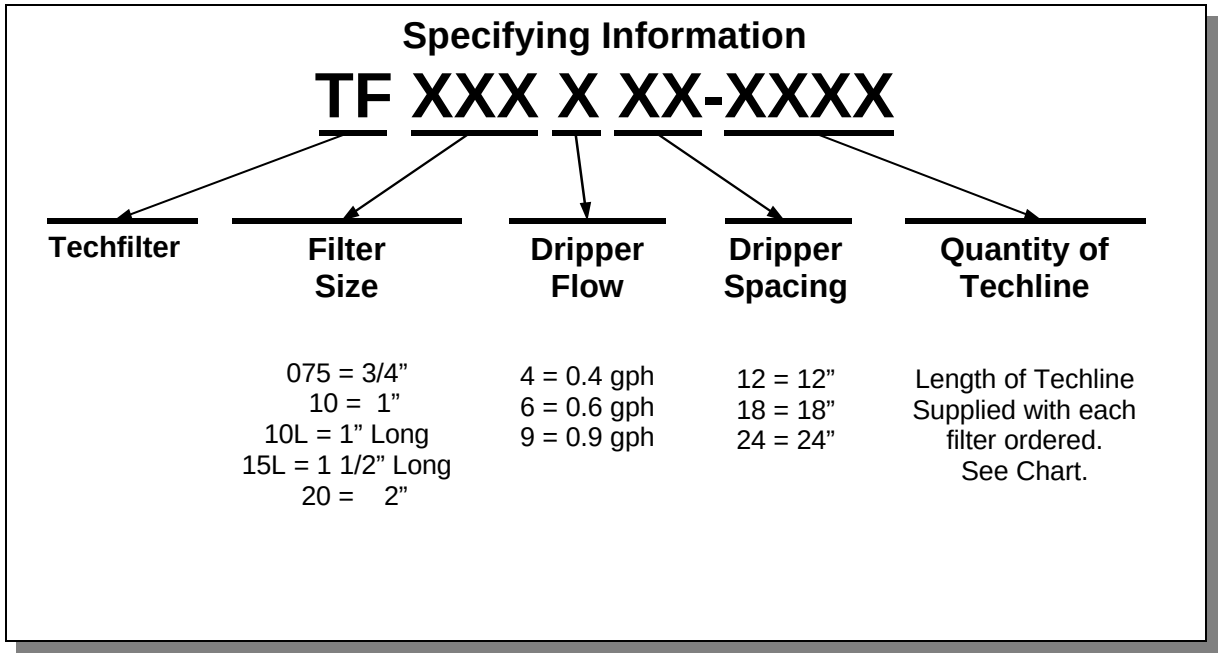
Effective Use and Replacement Guidelines

The Techfilter can effectively protect the system from root intrusion for 200 hours of use, but not longer than 2 years of service. We recommend the replacement of the filter cartridge following the above guidelines.

Triflurex® is manufactured by Agan Chemical Manufactures Ltd.

TECHNICAL DATA

Techfilter Model Number Designation



Min & Max Feet of Techline for Each Filter Size

			0.4 GPH		.6 GPH			.9GPH		
Model	Flow GPM		12"	18"	12"	18"	24"	12"	18"	24"
3/4" Short	Min	1	143	213	98	114	196	65	98	130
	Max	7	1000	1489	686	795	1373	458	686	909
1" Short	Min	3	429	638	294	341	588	196	294	390
	Max	22	3143	4681	2157	2500	4314	1438	2157	2857
1" Long or 1 1/2" Long	Min	8	1143	1702	784	909	1569	523	784	1039
	Max	40	5714	8511	3922	4545	7843	2614	3922	5195
2" Super	Min	14	2000	2979	1373	1591	2745	915	1373	1818
	Max	90	12857	19149	8824	10227	17647	5882	8824	11688

Example - If your Techline zone has 1125’ of .6 GPH - 12” Techline, use 1” short model

TECHNICAL DATA

Techfilter Model Number Descriptions

	Filter Size					Dripper Flow			Dripper Spacing			Techline Rolls Supplied		
Model Number	3/4"	1"	1" Long	1 1/2" Long	2"	0.4 gph	0.6 gph	0.9 gph	12"	18"	24"	100 Feet	250 Feet	1000 Feet
TF075912-100	x							x	x			1		
TF075918-100	x							x		x		1		
TF075924-200	x							x			x	2		
TF075612-100	x						x		x			1		
TF075618-200	x						x			x		2		
TF075624-200	x						x				x	2		
TF075412-100	x					x			x			1		
TF075418-200	x					x				x		2		
TF10912-200		x						x	x			2		
TF10918-300		x						x		x		3		
TF10924-400		x						x			x	4		
TF10612-300		x					x		x			3		
TF10618-350		x					x			x		1	1	
TF10624-600		x					x				x	1	2	
TF10412-400		x				x			x			4		
TF10418-600		x				x				x		1	2	
TF10L912-500			x					x	x				2	
TF10L918-800			x					x		x		3	2	
TF10L924-1000			x					x			x			1
TF10L612-800			x				x		x			3	2	
TF10L618-900			x				x			x		4	2	
TF10L624-1600			x				x				x	1	2	1
TF10L412-1100			x			x			x			1		1
TF10L418-1700			x			x				x		2	2	1
TF15L912-500				x				x	x				2	
TF15L918-800				x				x		x		3	2	
TF15L924-1000				x				x			x			1
TF15L612-800				x			x		x			3	2	
TF15L618-900				x			x			x		4	2	
TF15L624-1600				x			x				x	1	2	1
TF15L412-1100				x		x			x			1		1
TF15L418-1700				x		x				x		2	2	1
TF20912-900					x			x	x			4	2	
TF20918-1400					x			x		x		4		1
TF20924-1800					x			x			x	3	2	1
TF20612-1400					x		x		x			4		1
TF20618-1600					x		x			x		1	2	1
TF20624-2800					x		x				x	3	2	1
TF20412-2000					x	x			x					2
TF20418-3000					x	x				x				3

TECHNICAL DATA

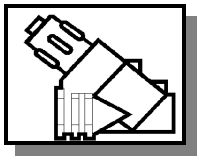
Pressure Regulators

Specifying Information

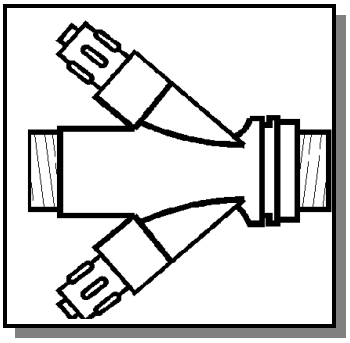
PRV XXX XF XX

PRV	XXX	XF	XX
Pressure Regulator Valve	075 3/4” 150 1 1/2”	(3/4” Models Only) LF .5 to 5.0 GPM HF 3.5 to 20.0 GPM	Regulated Pressure 15 PSI 20 PSI 25 PSI 35 PSI 45 PSI 50 PSI

Model Number	Description	Cap Color	Spring Color
3/4” LF Series (Red Top)			
PRV075LF15	3/4” Regulator 15 PSI .5 - 5.0 GPM	Red	Blue
PRV075LF20	3/4” Regulator 20 PSI .5 - 5.0 GPM	Red	Steel
3/4” HF Series (Black Top)			
PRV075HF15	3/4” Regulator 15 PSI 3.5 - 20.0 GPM	Black	Blue
PRV075HF20	3/4” Regulator 20 PSI 3.5 - 20.0 GPM	Black	Steel
PRV075HF25	3/4” Regulator 25 PSI 3.5 - 20.0 GPM	Black	Yellow
PRV075HF35	3/4” Regulator 35 PSI 3.5 - 20.0 GPM	Black	Red
PRV075HF45	3/4” Regulator 45 PSI 3.5 - 20.0 GPM	Black	White
1 1/2” Series			
PRV15015	1 1/2” Regulator 15 PSI 7.0 - 40.0 GPM	Black	Blue
PRV15020	1 1/2” Regulator 20 PSI 7.0 - 40.0 GPM	Black	Steel
PRV15025	1 1/2” Regulator 25 PSI 7.0 - 40.0 GPM	Black	Yellow
PRV15035	1 1/2” Regulator 35 PSI 7.0 - 40.0 GPM	Black	Red
PRV15045	1 1/2” Regulator 45 PSI 7.0 - 40.0 GPM	Black	White



3/4” Series



1 1/2” Series

TECHNICAL DATA

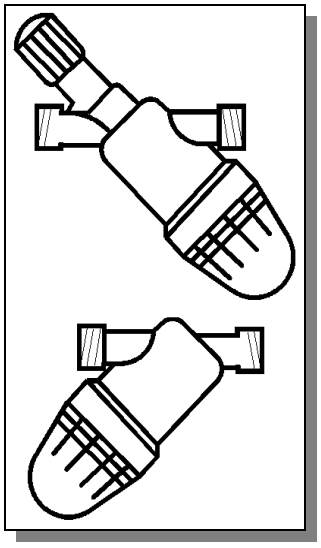
Disc Filters

Specifying Information

DXx XXX-XXX

DF	Disc Filter	075	3/4”	080 Mesh
DFV	Disc Filter with Valve	100	1”	120 Mesh
		150	1 1/2”	140 Mesh
		150L	1 1/2” Long	200 Mesh
		200	2”	

Model Number	Description	Disk Color
3/4” Disc Filters		
DF075-080	3/4” Disc Filter 80 Mesh	Yellow
DF075-120	3/4” Disc Filter 120 Mesh	Red
DF075-140	3/4” Disc Filter 140 Mesh	Black
DFV075-080	3/4” Disc Filter w/Valve 80 Mesh	Yellow
DFV075-120	3/4” Disc Filter w/Valve 120 Mesh	Red
DFV075-140	3/4” Disc Filter w/Valve 140 Mesh	Black
1” Disc Filters		
DF100-080	1” Disc Filter 80 mesh	Yellow
DF100-120	1” Disc Filter 120 Mesh	Red
DF100-140	1” Disc Filter 140 Mesh	Black
1 1/2” Disc Filter		
DF150-080	1 1/2” Disc Filter 80 mesh	Yellow
DF150-120	1 1/2” Disc Filter 120 Mesh	Red
DF150-140	1 1/2’ Disc Filter 140 Mesh	Black
1 1/2” Long Disc Filter		
DF150L-080	1 1/2” Long Disc Filter 80 Mesh	Yellow
DF150L-120	1 1/2” Long Disc Filter 120 Mesh	Red
DF150L-140	1 1/2” Long Disc Filter 140 Mesh	Black
2” Disc Filter		
DF200-080	2” Disc Filter 80 mesh	Yellow
DF200-120	2” Disc Filter 120 Mesh	Red
DF200-140	2” Disc Filter 140 Mesh	Black



3/4” Series

TECHNICAL DATA

Recommended Disc Filter Sizing

Filter Size	3/4"	1" & 1 1/2"	1 1/2" Long	2"
Filter Volume (cubic inches)	5.8	26.8	31.7	75
Filtration Area (square inches)	24.8	49	61.4	148
Flow Rate (GPM)	Friction Loss in P.S.I.			
5	0.56			
10	1.99	0.78		
17	5.62	1.73		
20		2.34	0.69	
30		5.20	1.30	
40		9.53	2.42	0.69
50			3.90	0.87
60				1.17
70				1.56
80				1.99
90				2.51
100				3.03
110				3.68
120				4.33

Table #4
Losses shown are for 140 Mesh filtration element tested in potable water.

TECHNICAL DATA

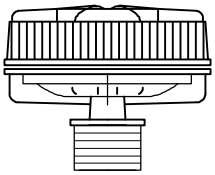
Pressure Regulator Selection Chart

	Preset Pressure Rating				
Flow Rate (GPM)	**15 PSI**	**20 PSI**	**25 PSI**	**30 PSI**	**45 PSI**
0.5 - 5.0 (LF Series)	3/4”	3/4”			
3.5 - 20.0 (HF Series)	3/4”	3/4”	3/4”	3/4”	3/4”
7.0 - 40.0	1 1/2”	1 1/2”	1 1/2”	1 1/2”	1 1/2”

Techline Line Flushing Valves

Specifying Information

Model Number	Description
TLFV-1	Barbed Fitting Inlet
TL050MFV-1	1/2” IPS Inlet

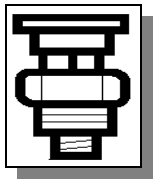


TL050MFV-1

Air Vacuum Relief Valve

Specifying Information

Model Number	Description
TLAVRV	Air / Vacuum Relief Valve



RECOMMENDED INSTALLATION INFORMATION

Techline is designed for use in landscape applications under turfgrass or other groundcover, trees and shrubs, and where these conditions are present:

- Curved, angular, or narrow landscape features
- Landscape features that are terraced or include elevation changes
- Specialty plantings where water on petals is undesirable
- High traffic and/or liability areas
- Sites subject to vandalism
- High wind areas
- System operation time constraints
- Sites where overspray onto hardscapes or automobiles is undesirable
- Virtually any area where an irrigation design problems exist.

METHODS OF INSTALLATION INCLUDE:

1. Techline may be installed at grade using soil staples to hold the dripperline in place, spaced 3 to 5 feet apart, and with a 4 to 6 inch covering of mulch.
2. Techline may be buried 4 to 6 inches below grade by:
   a. Trenching,
   b. Laying out the dripperline on a sub-grade 4 inches lower than the specified final grade, and then backfilling to the final grade,
   c. Using a vibratory plow. Care should be taken when using this method, as pulling the dripperline through the soil may stretch it. It is preferable to use an appropriate attachment to the vibratory plow which allows the dripperline to be “laid-in” behind the point/blade.
   d. Using an insertion shank fastened to a tool bar on the back of a tractor, . Several insertion shanks may be used at once, spaced at the desired Techline spacing along the tool bar, allowing for multiple laterals to be installed simultaneously. The number of insertion shanks used depends upon site conditions, and the size of the tractor.

What ever installation method is used, it is recommended that a Netafim Techline system be installed utilizing a “grid” layout. There are many benefits, both horticulturally and from a maintenance standpoint, that make a “grid” installation highly recommended. However, Techline may be installed as a single or “snaked” line when a grid installation is not justified, such as hedgerows.

In any turfgrass area where aeration may occur, the minimum recommended depth is 6 inches, with aeration depth not to exceed 4”.

RECOMMENDED INSTALLATION INFORMATION

Techline is 0.57" I.D. polyethylene tubing with continuously self-flushing, pressure compensating drippers fused to the inside wall of the tubing. Two dripper flow rates are available: .61 gph and .92 gph, with spacings of 12, 18, or 24 inches between drippers. Techline is available in 100', 250', or 1,000' rolls.

The drippers are designed to regulate flow from 7 to 70 psi, with a maximum of 45 psi when using Techline insert fittings without clamps. When installing Techline in situations where the working pressure exceeds 45 psi, stainless steel clamps are necessary.

The choice of Techline dripperline, dripper flow, and Techline lateral spacing depends on:

The soil type (clay, loam, or sand)
The type of plant material
Other site conditions, such as slopes or berms

Deciding whether to install Techline above grade or below grade should be determined by site conditions, customer concerns, and maintenance issues.

INSTALLATION CHECKLIST

Project:

Date:

1. Assemble and install remote control valve, filter, and pressure regulator as indicated in Netafim detail(s) _____.
2. Assemble and install supply header as indicated in Netafim detail(s) _____. Tape or plug all open connections.
3. Assemble and install exhaust header as indicated in Netafim detail(s) _____. Tape or plug all open connections.
4. Install Techline laterals beginning at the start connection(s) indicated in Netafim detail(s) _____. Type and layout of Techline laterals are to be installed as specified, and/or as indicated in Netafim detail(s) _____. Tape or plug all open ends.
5. Install an air vacuum relief valve at the point of highest elevation in the zone as indicated in Netafim detail(s) _____.
6. Make all Techline-to-fitting connections while flushing the system. Make connections as indicated in Netafim detail(s) _____.
7. While flushing, connect Techline laterals to the exhaust header as indicated in Netafim detail(s) _____.
8. Install line flushing valve(s) as indicated in Netafim detail(s) _____.
9. Install other Netafim accessories as indicated in Netafim detail(s) _____.
10. Operate and inspect the system. Record system data for historical record. Use Netafim System Inspection Checklist, and Troubleshooting and Maintenance Checklist.

PREVENTIVE MAINTENANCE

Introduction

When designed and installed properly, Netafim Techline and Techlite irrigation systems offer the designer, contractor and system owner very high quality equipment, unparalleled performance, system reliability, and low maintenance. As with any irrigation system, it is important that it be designed according to the manufacturer's specifications and installed according to the designer's specifications. This guide will help properly maintain a Netafim Techline system, and provide troubleshooting tips. Please contact Netafim Customer Service at 1-888-NETAFIM with additional questions.

Disc Filters

Disc filters must be inspected and cleaned periodically.

The filter should be inspected monthly after installation, and then more or less frequently based on those observations.

To clean the disks, unscrew the bottom portion of the plastic housing or unlatch the band, exposing the spindle on which the discs are stacked. The spindle is held in place by snap-fit. To remove the discs, pull on the spindle. No special tools are needed. The discs can be cleaned in a bucket of water, or by spraying with a hose. The discs are stacked loosely on the spindle, and are easily separated for thorough removal of debris.

Commercial installations should include pressure gauges or facilities to connect pressure gauges immediately upstream and downstream of the filter. This allows personnel to determine when the filter needs to be cleaned by observing the pressure differential between the upstream and downstream gauges.

Filters should be cleaned when the pressure loss across the filter is between 5 and 10 PSI, or when the downstream pressure falls below the designed working pressure of the system. Record the pressure differential between the gauges when the system is installed as a reference for determining periodic inspection and cleaning.

Line Flushing Valves

Netafim Line Flushing Valves eliminate the need for periodic manual flushing. The flush valve flushes approximately 1 gallon of water each time the zone is turned on. Observe the flushing operation at each line flushing valve at the beginning of each irrigation season to ensure that flushing is occurring properly.

If the line flushing valve does not seal, (continues to flush) disassemble the flush valve. Inspect all components, cleaning or replacing all components, and reassemble. You should be able to blow and draw air through the dripper that is at-

PREVENTIVE MAINTENANCE

tached to the diaphragm, and the diaphragm should be free of any rips or tears.

Damage may occur if the flush valve has been subjected to higher than recommended pressure (>57 PSI).

If manual flush valves or flush ports have been installed in lieu of line flushing valves, they should be opened and the system flushed three (3) times each irrigation season until the flowing water is visibly clean. The zone may need to be flushed more frequently depending on the water source.

Flushing is also recommended anytime the system has been repaired.

System Inspection

A physical inspection of the zone is recommended after installation, at the beginning of each season, after any landscape planting, or after any maintenance that requires digging deeper than the installed depth of the Techline or Techlite.

System inspections include:

- Observe the flushing operation of all line flushing valves. Check the pressure at the flush valves and compare to the last maintenance inspection. The minimum pressure should be at least 10 PSI, and the maximum pressure should not exceed 57 PSI. (Refer to the Netafim Landscape products catalog for maximum and minimum pressures for Techlite zones.)
- Inspect the zone while it is operating, looking for excessively wet or dry areas that might indicate leaks. If a leak is found, and the system is installed as a grid or closed loop system, water will flow from both sides of the break. With the zone still on, allow the running water to flush any debris clear, and repair the leak with the appropriate fitting.
- Check the operational flow of each zone to see if it coincides with the designed or initial flow of the zone. Higher flow could indicate a leak. Locate any wet areas and repair. Lower than expected flows could indicate clogged drippers or kinked dripperline tubing.

A historical record of the system should be kept. Recorded data should include:

- Type of Techline or Techlite installed (dripper flow and spacing)
- Techline/Techlite lateral spacing
- Depth of the Techline/Techlite if buried
- Initial zone flows and pressures
- Initial pressures at the flush points

WINTERIZATION

Techline and Techlite dripperlines are self-draining. Each time the zone shuts down, some water drains out of the tubing. Winterization is required as a good maintenance practice because every zone contains components that **must** be winterized to ensure they do not freeze and break.

Winterization - Manual

If compressed air is not used to winterize the system:

- A drain port must be installed at **all** low points in the zone. These ports may be a tee or elbow with a threaded plug, or a Netafim TLSOV or FIG8 which, when opened, will allow water to drain. If Netafim Line Flushing Valves are installed, disassemble and leave open.
- If the zone is a grid or closed loop system, the supply and exhaust headers may contain a significant amount of water because they are either blank Techline/Techlite tubing, PVC, or poly pipe. It is important to provide drain ports for these components.
- If the zone has laterals that dead-end and are not connected to an exhaust header, the lateral ends should be opened to drain at the lowest point(s).
- The disc filter should be disassembled, and the discs removed to allow any water to exit. Leave the filter assembly disassembled in the event that some water remains in the zone. In zones where elevation is a concern, install a drain port upstream of the filter to ensure as much water is drained as possible.
- Follow manufacturer instructions for any non-Netafim components, including remote control valves.

Winterization - Compressed Air

Follow the same initial procedure for a Techline/Techlite zone as with a zone of sprinklers.

- Techline fittings are rated to 45 PSI without clamps, so the air pressure must be adjusted according. It is air *volume*, not pressure that is effective when winterizing in this manner. (12mm Techlite fittings are rated at 30 PSI and 8mm Techlite fittings are rated at 25 PSI.)
- The Pressure Regulating Valve, which is normally installed in the valve box along with the zone valve and filter, **does not** regulate air pressure. Air pressure should be regulated to according to the dripperline being used.
- The drain ports (a fitting with a threaded plug, NETAFIM TLSOV, FIG8, or Netafim Line Flushing Valve), normally installed as far away from the water source of the zone as possible, must be open. Unscrew and disassemble any Techline Line Flushing Valves.
- With all drain ports open, compressed air should be applied until no water is seen exiting the zone.
- All drain ports should be left open.

TROUBLESHOOTING

Excessively Wet Soil

1. In an excessively wet area, carefully dig up the Techline tubing with the system operating, and inspect for damage. If a leak is found, expose the tubing and cut through the tubing, cleaning the break. If the zone is a grid or closed loop, water should be flowing from both sides of the break, flushing any debris. (If water is not flowing from both sides of the break, another leak may be present). With the water running, insert a Netafim coupling or other appropriate fitting. Inspect for a proper fit and re-fill the area. No clamps are necessary under 45 PSI.
2. If a wet area is at the bottom of a slope or mound, and no leak is found, the wet area may be due to subsurface leaching. Expose the lowest dripper(s) at the bottom of the slope, and plug them with Netafim Dripper Plug Rings (TLDPLUG). If it is necessary to eliminate an entire Techline lateral, cut the lateral just beyond the supply and exhaust headers, and close the pressurized ends with a Netafim Figure Eight Line End (TLFIG8). The eliminated lateral can then be left in place, or removed.
3. Localized wet areas are sometimes caused by shallow soils covering ledge or other impervious layers. The soil problem should be corrected, drippers eliminated, or reduced in number.
4. Wet areas can also be the result of leaking fittings. Expose the fitting to see if it is cracked or defective. Replace as necessary. If the fitting is sound, but appears to have worked loose, check to see that pressure in the zone does not exceed 45 PSI for Techline or per catalog specs for Techlite.

Please note:

- Netafim Techline fittings are designed to be used without clamps when operating pressures are under 45 PSI. Higher pressures will cause the fittings to work loose. If the pressure is over 45 PSI, check that a pressure regulator has been installed. If one is present, make sure that it is designed to work with the GPM flow you have in the zone, and that it is designed to reduce pressure to 45 PSI or less.
- Netafim Techline fittings are the only fittings recommended for use with Techline. Other types of fittings may appear to fit, but may not be suitable for the dimensions of Techline tubing, or certain operating pressures.

TROUBLESHOOTING

Excessively Dry Soil

Dry soil areas in a properly designed and installed system usually occur when the operating pressure of the Techline zone is below 7 PSI. In this case:

- Check the filter and clean as necessary
- Check the remote control valve to make sure it is operating properly, and that the flow control (if present) is open
- Verify that all components meet the design parameters of the zone
- Check the historical record of initial and subsequent pressure readings, Techline type and spacings, and controller run times.

Dry areas can also occur when dripperline laterals have become kinked or when there are upstream leaks.

If debris intrusion caused by an upstream break between the filter and the dripperline occurs, drippers could become blocked temporarily, causing dry spots dry areas. If this occurs:

- Repair the leak
- Disassemble all Line Flushing Valves (or open all line ends and flush ports)
- Run the zone until all debris is purged
- Reassemble the Line Flushing Valves and operate the system, checking random drippers for proper operation
- If the pressure at the flush valves is higher than the historical record indicates, some drippers may still be clogged

Repeat the above procedure until the readings match historical records.

SYSTEM MAINTENANCE & TROUBLE-SHOOTING CHECKLIST

FILTER MAINTENANCE

Check Filter ❒

If pressure gauges are present: Upstream _____PSI Downstream _____

- A pressure differential of 5 PSI indicates that the filter must be cleaned. Remove disc stack and rinse with water and replace.

The frequency of this procedure depends upon the water source. Check monthly until a more accurate maintenance schedule can be determined.

Recommended filter maintenance interval: _____

FLUSH POINT

Check Automatic Flush Valve Operation ❒

- The Netafim Line Flushing Valve should flow approximately 1 gallon and seal.
- The Netafim Line Flushing Valve should be at the point of lowest pressure within the zone.

Pressure at Flush Valve: ____PSI

Compare to historical data. There should be a minimum of 10 PSI and no more

SYSTEM OBSERVATIONS

Controller Run Times Checked ❒

- Compare the controller runtimes and frequency to the application rate for Techline at the spacing used. If the amount of water in inches/hour is insufficient or exceeds the requirement of the plant, adjust accordingly, Also compare the rate flow per zone with the historical record, using a stop watch at the water meter.

Check lines during system operation. Wet spots in unwanted areas may indicate a leaky fitting or a cut in the Techline. Dry areas may be the result of a

Wet areas observed ❒

Check for Fitting Leak ❒

Check for Techline Break ❒

Dry areas observed ❒

Line ends/flush points opened and system flushed ❒

Project:	Date:	Inspected by:

Refer to the Netafim Troubleshooting and Maintenance Guide for Additional Information. Netafim Customer Service (888) NETAFIM (638-2346)

SYSTEM MAINTENANCE & TROUBLE-SHOOTING CHECKLIST

SITE INFORMATION:

Soil type
Plant material(s)
Slope orientation
Water type
Working pressure
Rate of flow

SPECIFICATION:

Techline dripper spacing
Dripper flow rate
Techline dripperline spacing
Total zone flow
Zone valve size
Pressure rating
Flow rating: LF ___ HF ___
Supply and exhaust header size
Application rate (inches per hour) _____

CALCULATIONS:

SYSTEM INSPECTION CHECKLIST

Techline Dripper Spacing	12"	❑	18"	❑	24"	❑
Techline Lateral Spacing	12"	❑	18"	❑	24"	❑
Dripper Flow Rate	.4 gph	❑	.6 gph	❑	.9 gph	❑

On Surface Installation ❑ Sub-surface Installation ❑ Depth Below Grade ____"

Pressure Regulator Type

3/4" ❑ .5 gpm flow (Red Cap)

3/4" ❑ 5-20 gpm flow (Black Cap)

15 psi ❑ 20 psi ❑ 25 psi ❑ 35 psi ❑ 45 psi ❑

Disk Filter Size	3/4"	❑	1"	❑	1 ½	❑	2"	❑
Disc Filter Mesh	80	❑	120	❑	140	❑	200	❑

Operating Pressure _____	**Pressure:** 1.Flush Valve _____	2.Flush Valve _____ (if used)

Controller Data

	Run Time	X/Week	Flow
Station #			
Station #			
Station #			
Station #			

Project:	Date:	Inspected by:

Use the reverse of this sheet for additional comments/notes. Attach as-built plan.
Netafim Irrigation Customer Service (888) NETAFIM (638-2346).

Performance Specification Samples

TECHLINE™
SELF-CLEANING, PRESSURE COMPENSATING DRIPPERLINE

Description

Techline is a low volume dripperline with integral and evenly spaced pressure compensating drippers at specified intervals in three discharge rates (0.4, 0.6 & 0.9 gallons per hour [GPH]). Techline is available in 100', 250' and/or 1,000' coils. Techline Blank Tubing is available in 100', 250' and/or 1,000' coils.

Construction

Techline shall consist of nominal sized one-half inch (½") inch low-density linear polyethylene tubing with internal pressure compensating, continuously self-cleaning, integral drippers at a specified spacing, (12", 18", or 24" centers) or blank tubing without drippers. The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.67 inches and an inside diameter (I.D.) of 0.57 inches. Individual pressure compensating drippers shall be welded to the inside wall of the tubing as an integral part of the tubing assembly. These drippers shall be constructed of plastic with a hard plastic diaphragm retainer and a self-flushing/cleaning elastomer diaphragm extending the full length of the dripper.

Operation

The drippers shall have the ability to independently regulate discharge rates, with an inlet pressure of seven to seventy (7-70) pounds per square inch (PSI), at a constant flow and with a manufacturer's coefficient of variability (Cv) of 0.03. Recommended operating pressure shall be between 15-45 PSI. The dripper discharge rate shall be 0.4, 0.6, or 0.9 gallons per hour (GPH) utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The drippers shall continuously clean themselves while in operation. The dripperline shall be available in 12", 18" and 24" spacing between drippers unless otherwise specified. Techline pipe depth shall be _____ unless otherwise specified. Maximum system pressure shall be 45 PSI. Filtration shall be 120 mesh or finer. Bending radius shall be 7".

For on-surface or under mulch installations, 6" metal wire staples (TLS6) shall be installed 3'-5' on center, and two staples installed at every change of direction.

Techline shall be Netafim Model Number TLDL -___-__-____. The Techline Blank Tubing shall be Netafim Model Number TLDL-0___.

Performance Specification Samples

TECHLITE™ 17mm
NON-PRESSURE COMPENSATING DRIPPERLINE

Description

Techlite 17mm is a low volume dripperline with integral and evenly spaced drippers at specified intervals in two nominal discharge rates (0.5 & 1.0 gallons per hour [GPH] @15 PSI.) Techlite 17mm dripperline is available in 100', 250' and/or 1,000' coils. Techlite 17mm Blank Tubing is available in 100', 250' and/ or 1,000' coils.

Construction

Techlite 17mm dripperline shall consist of nominal sized one-half inch (½") low-density linear polyethylene tubing with internal, integral non-pressure compensating drippers at a specified spacing (12" or 18" centers) or blank tubing without drippers. The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.67 inches and an inside diameter (I.D.) of 0.57 inches. Individual drippers shall be constructed of plastic and shall be welded to the inside wall of the tubing as an integral part of the tubing assembly.

Operation

The drippers shall have nominally rated flow rates at 15 pounds per square inch (PSI). Recommended operating pressure shall be between 12-45 PSI. The nominal dripper discharge rate shall be 0.5 or 1.0 gallons per hour (GPH) utilizing a turbulent flow path. The dripperline shall be available in 12" and 18" spacing between drippers unless otherwise specified. Techlite 17mm dripperline shall be installed on-surface or under mulch. Maximum system pressure shall be 45 PSI. Filtration shall be 120 mesh or finer. Bending radius shall be 7".

6" metal wire staples (TLS6) shall be installed 3'-5' on center, and two staples shall be installed at every change of direction.

Techlite 17mm dripperline shall be Netafim Model Number T17__-____. Techlite 17mm Blank Tubing shall be Netafim Model Number TLDL-0___.

Performance Specification Samples

TECHLINE and TECHLITE 17mm (0.57”) FITTINGS

Description

Techline and Techlite 17mm fittings shall be constructed in one of the following end configurations:

Barbed insert fittings only,
Male pipe threads (MPT) with barbed insert fittings, or
Female pipe threads (FPT) with barbed insert fittings.

Construction

All fittings shall be constructed of molded brown plastic having a nominal outside dimension (I.D.) of 17mm (0.57”). Female and male threaded ends shall be capable of mating to standard PVC pipe with tapered threads.

Operation

Techline and Techlite 17mm fittings shall be mated with Netafim Techline and/or Techlite 17mm dripperline by pushing the fitting into the tubing while twisting side to side until the tubing abuts to either adjoining tubing or a fitting stop.

Techline/Techlite 17mm fittings shall be Netafim model numbers TLTEE, TLCOUP, TL2W075MA, TLELL, TLCROS, TL050MA, TL075MA, & TL075FTEE.

Performance Specification Samples

TECHLITE™ 12mm
NON-PRESSURE COMPENSATING DRIPPERLINE

Description

Techlite 12mm is a low volume dripperline with integral and evenly spaced drippers at specified intervals in two nominal discharge rates (0.6 & 0.9 gallons per hour [GPH] @ 25PSI.) Techlite 12mm dripperline is available in 100', 250' and/or 1,000' coils. Techlite 12mm Blank Tubing shall be available in 100' and 2,000' coils.

Construction

Techlite 12mm dripperline shall consist of low-density linear polyethylene tubing with internal, integral non-pressure compensating drippers at a specified spacing (12" or 18" centers) or blank tubing without drippers. The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.48 inches and an inside diameter (I.D.) of 0.42 inches. Individual drippers shall be constructed of plastic and shall be welded to the inside wall of the tubing as an integral part of the tubing assembly.

Operation

The drippers shall have nominally rated flow rates at 25 pounds per square inch (PSI). Recommended operating pressure shall be between 12-30 PSI. The nominal dripper discharge rate shall be 0.6 or 0.9 gallons per hour (GPH) utilizing a turbulent flow path. The dripperline shall be available in 12" and 18" spacing between drippers unless otherwise specified. Techlite 12mm dripperline shall be installed on-surface or under mulch. Maximum system pressure shall be 30 PSI. Filtration shall be 120 mesh or finer. Bending radius shall be 4".

6" metal wire staples (TLS6) shall be installed 3'-5' on center, and two staples shall be installed at every change of direction.

Techlite 12mm dripperline shall be Netafim Model Number T12__-___. Techlite 12mm Blank Tubing shall be Netafim Model Number T1200-0__.

Performance Specification Samples

TECHLITE 12mm (0.42") FITTINGS

Description

Techlite 12mm fittings shall be constructed in one of the following end configurations:

Barbed insert fittings only,
Male pipe threads (MPT) with barbed insert fittings, or
Female pipe threads (FPT) with barbed insert fittings.

Construction

All fittings shall be constructed of molded black plastic having a nominal outside dimension (I.D.) of 12mm (0.42"). Female and male threaded ends shall be capable of mating to standard PVC pipe with tapered threads.

Operation

Techlite 12mm fittings shall be mated with Netafim Techlite 12mm dripperline by pushing the fitting into the tubing while twisting side to side until the tubing abuts to either adjoining tubing or a fitting stop.

Techlite 12mm fittings shall be Netafim model numbers MLTEE, MLCOUP, MLELL, ML050ELMA, ML075ELMA, ML050MTEE, ML075MTEE, ML050MA, ML075MA, and MLTLADP.

Performance Specification Samples

TECHLITE™ 8mm
NON-PRESSURE COMPENSATING DRIPPERLINE

Description

Techlite 8mm is a low volume dripperline with integral and evenly spaced drippers at specified intervals in one nominal discharge rate (0.25 gallons per hour [GPH] @ 10 PSI.) Techlite 8mm dripperline is available in 100' and/or 1,000' coils. Techlite 8mm Blank Tubing is available in 100' and 1,000' coils.

Construction

Techlite 8mm dripperline shall consist of low-density linear polyethylene tubing with internal, integral non-pressure compensating drippers at a specified spacing (6" or 12" centers) or blank tubing without drippers. The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.26 inches and an inside diameter (I.D.) of 0.24 inches. Individual drippers shall be constructed of plastic and shall be welded to the inside wall of the tubing as an integral part of the tubing assembly.

Operation

The drippers shall have a nominally rated flow rate of 0.25 GPH at 10 pounds per square inch (PSI). Recommended operating pressure shall be between 5-25 PSI. The nominal dripper discharge rate shall be 0.25 gallons per hour (GPH) utilizing a turbulent flow path. The dripperline shall be available in 6" and 12" spacing between drippers unless otherwise specified. Techlite 8mm dripperline shall be installed on-surface or under mulch. Maximum system pressure shall be 25 PSI. Filtration shall be 120 mesh or finer. Bending radius shall be 2".

6" metal wire staples (TLS6) shall be installed 3'-5' on center, and two staples shall be installed at every change of direction.

Techlite 8mm shall be Netafim Model Number T803-____. Techlite 8mm Blank Tubing shall be Netafim Model Number T800-0__.

Performance Specification Samples

TECHLITE 8mm (0.24") FITTINGS

Description

Techlite 8mm fittings shall be constructed in one of the following end configurations:

Barbed insert fittings only, or
Female pipe threads (FPT) with barbed insert fittings.

Construction

All fittings shall be constructed of molded black plastic having a nominal outside dimension (I.D.) of 8mm (0.24"). Female threaded ends shall be capable of mating to standard PVC pipe with tapered threads.

Operation

Techlite 8mm fittings shall be mated with Netafim Techlite 8mm dripperline by pushing the fitting into the tubing while twisting side to side until the tubing abuts to either adjoining tubing or a fitting stop.

Techlite 8mm fittings shall be Netafim model numbers SLTEE, SLCOUP, SL050FA, and SL050FTEE.

Performance Specification Samples

TECHFILTER®

Description

Techfilter is the incorporation of a disc filter and a chemical root intrusion preventer (trifluralin) with a required amount of Techline dripperline. Techfilter is available in 5 filter sizes, (3/4", 1", 1" Long, 1½" Long, and 2") 3 dripper flow rates, (0.4, 0.6, and 0.9 GPH) and a specific amount of Techline with each Techfilter ordered. The mesh rating is 120, and maximum system pressure is 140 PSI.

Construction

Filter: The filter shall be a multiple disc filter with trifluralin incorporated into the replaceable disk ring assembly inside the filter housing. The disc filter body shall be molded of black plastic with male pipe threads for both inlet and outlet. The disc filter shall be capable of periodic servicing and replacement of the chemically-treated disk ring set by unscrewing a threaded cap or unlatching the band.

Dripperline: The drippers shall have the ability to independently regulate discharge rates, with an inlet pressure of seven to seventy (7-70) pounds per square inch (PSI), at a constant flow and with a manufacturer's coefficient of variability (Cv) of 0.03. Recommended operating pressure shall be between 15-45 PSI. The dripper discharge rate shall be 0.4, 0.6, or 0.9 gallons per hour (GPH) utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The drippers shall continuously clean themselves while in operation. The dripperline shall be available in 12", 18" and 24" spacing between drippers unless otherwise specified. Techline pipe depth shall be _____ unless otherwise specified. Maximum system pressure shall be 45 PSI.

Operation

When water passes through the filter, a very low concentration of trifluralin (parts per billion) is transmitted throughout the Techline piping network. This provides for precise and even distribution of trifluralin throughout the piping network and effectively inhibits root growth into the dripper outlets.

The trifluralin-treated filter ring set shall be replaced every two (2) years, or two hundred (200) hours of operation, whichever occurs first.

The Techfilter system shall be Netafim Model Number TLF_____-____.

Performance Specification Samples

LINE FLUSHING VALVE

Description

Line Flushing Valves are used to reduce sediment build-up in Techline/ Techlite and to pass sediment or debris that has not been captured by the disc filter.

Construction

The Line Flushing Valve shall be constructed of brown molded plastic with one of the following end configurations:

½" MPT
Insert inlet w/collar

Operation

The Line Flushing Valve shall operate at the beginning of the irrigation cycle as the system begins to pressurize, and flush approximately one gallon of water at 57 PSI maximum, or 1.5 PSI minimum. ***Note:*** Permanent damage could occur to the Line Flushing Valve if incoming pressure exceeds 57 PSI. Netafim Pressure Regulators are recommended even with pressure regulating remote control valves, since these valves tend to allow full line pressure for a brief period of time before pressure regulation occurs.

Line Flushing Valves are to be installed below grade, as detailed, in a valve box to allow for periodic inspection and are to be installed in one of two ways:

- Vertically: Dome portion facing upward, installed on a 90 degree elbow.
- Horizontally: Dome portion facing sideways.

One (1) Line Flushing Valve shall be installed for every fifteen (15) GPM of zone flow, and shall be installed at a point as far away from the source (typically on an exhaust header) as possible.

The Line Flushing Valve shall be Netafim Model Number TL_____.

Performance Specification Samples

AIR/VACUUM RELIEF VALVE

Description

The Air/Vacuum Relief Valve serves two purposes:

- To evacuate air from the Techline laterals during system start-up and,
- To prevent a vacuum from occurring after the remote control valve has closed, thus avoiding debris intrusion into the drippers.

Construction

The Air/Vacuum Relief Valve shall be constructed of black and/or grey plastic with a ½" male pipe thread capable of mating with a threaded PVC reduction bushing or ½" FPT fitting.

Operation

Subsurface Techline design and installation techniques require that air/vacuum relief valves be installed at the highest elevation in each zone (some zones may require more than one) in order to expel air and relieve vacuum. In a zone where the highest elevation occurs between the intake and exhaust headers (such as a mound or berm), an air/vacuum relief lateral shall interconnect the Techline dripperlines to avoid the necessity of installing one air/vacuum relief valve on each Techline lateral. Air/vacuum relief valves can be installed below grade in valve boxes to allow for periodic inspection.

The Air/Vacuum Relief Valve shall be Netafim Model Number TLAVRV.

Performance Specification Samples

PRESSURE REGULATOR

Description

The purpose of the Pressure Regulator is to control downstream pressure at or below the specified system operating pressure. Unregulated pressures in excess of the recommended operating ranges can diminish and disable line flushing valves or cause the integrity of the Techline/Techlite fittings connection to weaken and/or fail.

Construction

The Pressure Regulator shall be a Netafim spring-operated piston-type regulator with an externally accessible regulation unit that can be serviced without removing the valve body from the piping. The body shall be molded of black plastic with a combination of male/female pipe threaded inlet and outlet. Removable and interchangeable springs shall be color-coded to denote varying pressure ranges.

Operation

The Pressure Regulator shall have a built-in indicator that indicates when it is operating. It shall be able to respond immediately to any inlet pressure variation. The regulator shall be capable of regulating 15 PSI, 20 PSI, 25 PSI, 35 PSI, or 45 PSI in its ¾" "HF" and 1½" configurations. It shall be capable of regulating 15 PSI or 20 PSI in its ¾" "LF" configuration.

The Pressure Regulator shall be a Netafim Model Number PRV _____.

Performance Specification Samples

DISC FILTER

Description

The purpose of the Disc Filter is to capture and retain water-transported debris or sediments that could reduce the efficiency of the Techline/Techlite drippers.

Construction

The filter shall be a multiple disc filter with color-coded filter elements indicating the mesh size of the element being used. The discs shall be constructed of chemical-resistant thermoplastic for corrosion resistance.

The disc filter body shall be molded of black plastic with male pipe threads for both inlet and outlet. The disc filter shall be capable of periodic servicing by unscrewing a threaded cap or unlatching the band. The ¾" DFV model shall have an integral manual shut-off valve.

Disc filter ring color-coding shall be: Yellow (80 Mesh), Red (120 Mesh), Black (140 Mesh), or Green (200 Mesh).

Operation

Installation of the Disc Filter shall be as detailed. Disc filters can be installed downstream of the remote control valve to allow for periodic servicing when the remote control valve is not operating. It can be installed upstream of the remote control valve if the disc filter is specified with manual shut-off valve or when a line size shut-off valve is also specified to allow for periodic servicing with a pressurized main line. Recommended installation of disc filters shall be below grade positioned in a valve box large enough to remove the disk filter cap and internal disc element. A gravel sump in the bottom of the valve box is recommended to drain water during periodic maintenance.

The Disc Filter shall be a Netafim Model Number DF _____.

Performance Specification Samples

DRIPPER PLUG RING

Description

The Netafim Dripper Plug Ring is a pre-formed plastic ring with a rounded inside plug that can be used to plug a Techline/Techlite 17mm dripper outlet.

Construction

The Dripper Plug Ring shall be constructed of black molded plastic of a diameter slightly larger than the outside diameter of the Techline/Techlite 17mm tubing. The circular design is open on one end to enable it to be slipped over the tubing. Within the interior of this ring (opposite the open end) is a rounded plug made to press-fit into the water outlet of the dripper to prevent water emission.

Operation

Slip the Dripper Plug Ring over the Techline tubing and push the plug into the tubing outlet hole until it seats securely in the hole.

The Dripper Plug Ring shall be Netafim Model Number TLDPLUG.

Performance Specification Samples

DRIPPER MICRO-TUBING ADAPTER

Description

The Netafim Dripper Micro-Tubing Adapter is a pre-formed plastic saddle with a micro-tubing adapter outlet that can be attached over a Techline/Techlite 17mm dripper outlet. This allows for water to be moved via micro-tubing to a specific area away from the dripperline location.

Construction

The Dripper Micro-Tubing Adapter shall be constructed of black molded plastic and shall have the ability to be tightened over the Techline/Techlite 17mm dripper outlet hole. It shall have an outlet fitting capable of accepting 0.160" x 0.220" micro-tubing.

Operation

The Dripper Micro-Tubing Adapter shall fit over the Techline/Techlite 17mm dripper outlet hole and be squeezed until the fitting is securely attached to the tubing. Insert 0.160" x 0.220" micro-tubing onto the outlet end of the fitting and place the micro-tubing adjacent to the area to be irrigated.

The Dripper Micro-Tubing Adapter shall be Netafim Model Number TLMTUBEADP.

Performance Specification Samples

STAINLESS STEEL CLAMPS
(for operating pressures in excess of recommendations)

Description
Stainless steel clamps are used to secure Techline/Techlite to barbed insert fittings. Clamps shall be manufactured by "Oetiker" and shall be one "ear" type. Nominal size that is recommended for use with Techline/Techlite 17mm is 13/16", Part No. 210SS.

Construction
Oetiker clamps shall be constructed of 304 AISI stainless steel. Clamps shall be one "ear" type and formed with a "dimple", allowing for thermal expansion and contraction properties without loosening the clamp.

Interior clamp wall shall be smooth to prevent crimping or pinching of tubing. Wall thickness of clamps shall be .0236" (0.6 mm) with an overall band width of ¼" (7 mm).

Operation
Stainless steel clamps are used to secure Techline over barbed insert fittings when design-operating pressures exceed 45 PSI. Clamps are to be slipped over the tubing before being fitted to barbed insert fittings. Place the clamp between the first and second ridge of the barbed insert fittings. Crimp the "ear" of the clamp tightly with an Oetiker pincer tool. Crimp twice to ensure proper seating.

Performance Specification Samples

MOPC –
MULTIPLE OUTLET, PRESSURE COMPENSATED DRIPPER MANIFOLD

Description
MOPC is a low volume, six outlet drip manifold in three discharge rates (0.5, 1.0 & 2.0 GPH per dripper.) It is available with either a ½" MPT outlet top (including a threaded cap) to accommodate connections of two or more dripper manifolds, or in a non-stackable version. Both versions come with a ½" FPT inlet base.

Construction
MOPC shall consist of 6 pressure-compensating, continuous self-flushing drippers permanently installed in a thermoplastic housing. The MOPC housing shall be brown in color, and have a ½" FPT inlet base. The top of the MOPC housing shall have either a ½" MPT threaded top with cap for stacking additional MOPC's, or a flat, non-stackable top. Individual drippers shall be constructed of plastic, and utilize a pressure differential mechanism with EPDM diaphragms that continually regulate each dripper's flow rate. Drippers shall be mounted horizontally into the manifold to provide a low profile for on-surface installations. Individual drippers shall be color-coded within the MOPC body (Red - 0.5 GPH, Grey - 1.0 GPH, or Green - 2.0 GPH), and be designed to be closed off by inserting plastic shutoff pins into the barbed outlet to block unneeded outlet(s). The shut-off pins shall be able to be removed and reinserted into the drippers without damage or modification to either component. Manifold body shall have a built-in secondary filter. Barbed outlets shall accept 0.160" x 0.220" micro-tubing to supply water to specific areas. MOPCS shall have the ability to have additional MOPC or MOPCS units installed on top, or any other device that has a ½" FPT base and does not have a flow rate in excess of 4½ GPM.

Operation
The MOPC shall have the ability to regulate discharge rates with an inlet pressure of seven to sixty pounds per square inch, (7 - 60 PSI) at a constant flow and with a manufacturer's coefficient of variability (Cv) of 0.03. Recommended operating pressure shall be 10 - 40 PSI. The individual dripper discharge rates shall have nominal flow rates of 0.5 GPH (gallons per hour) 1.0 GPH or 2.0 GPH utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The drippers shall continuously clean themselves while in operation. The drippers shall have a built-in 1.5 PSI check valve. The MOPC shall be installed above grade, at grade, or below grade. Filtration shall be 120 mesh or finer.

MOPC shall be Netafim Model Number MOPC____.

NETAFIM BID SPECIFICATIONS SAMPLES

02810 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. The following related items of work included under other sections:
   1. Earthwork - Section 02200
   2. Water Distribution - Section 02660
   3. Landscape - Section 02900

1.02 SUMMARY

A. The work required under this Section consists of furnishing all labor materials, equipment, services and related items necessary to complete all irrigation system work, and all related work, complete as indicated on the drawings or specified herein.

B. The major items of work include, but are not limited to the following:
   1. Verify underground utility locations.
   2. Removal, protection and/or restoration of all existing improvements.
   3. Trenching and backfilling.
   4. Furnishing and installing a fully operational automatically controlled irrigation system, including all mains, laterals, fittings, quick coupling valves, gate valves, and drain valves, backflow preventer, etc.
   5. Testing of system and making it operative.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing irrigation systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms who have successfully completed execution of a minimum of five (5) contracts involving the installation of irrigation and piping work similar in size and scope to that required for this project. Such experience should be able to be demonstrated through references.

C. Codes and Standards:
   1. Comply with all applicable state and local ordinances and codes.
   2. All materials and work shall meet the requirements of the A.W.W.A., A.S.S.E. and the USC Foundation for Cross Connection Control.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for irrigation system materials and products.

B. Record Drawings: At project closeout, submit record drawings of in-

NETAFIM BID SPECIFICATIONS SAMPLES

stalled irrigation system piping and products, in accordance with requirements of Division 1.

C. Maintenance Data: Submit maintenance data and parts lists for irrigation system materials and products. Include these data, product data, shop drawings and record drawings in maintenance manual, in accordance with requirements of Division 1.

1.05 UTILITIES AND PROTECTION

Existing Utilities:

1. Contractor shall acquaint himself/herself with all site conditions. Should utilities not shown on the plans be found during excavations, contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage there to arising from his/her operations subsequent to discovery of such utilities not shown on plan.
2. Contractor shall necessary adjustments in the Layout as may be required to connect the existing stubouts. Should such stubs not be located exactly as shown, Contractor may be required to work around existing conditions at no increase in cost to the Owner.

1.06 PERMITS AND FEES

Obtain all permits and pay required fees to any governmental agency having jurisdiction over the work. Inspections required by local ordinances during the course of construction shall be arranged as required. On completion of the work, satisfactory evidence shall be furnished to Owner to show that all work has been installed in accordance with the ordinances and code requirements.

1.07 DRAWINGS, SPECIFICATIONS AND DETAIL SHEETS

Scale and Dimensions:

1. Consider drawings and specifications as being compatible and therefore work called for by one and not the other shall be furnished and installed as though called for by both. When discrepancies exist between scale and dimension or between the work to be accomplished by each trade, they shall be called to the Project Consultant's attention immediately. The Project Consultant's decision regarding such discrepancies shall be final and binding.
2. Where diagrams have been made to show piping connections, etc., Contractor is cautioned that these diagrams must not be used for obtaining lineal runs or number and type of fittings.
3. All measurements shall be verified at the site. Drawings may not be exactly to scale.

1.08 PIPING ARRANGEMENT

Suggestions for changes in location of piping, etc., advisable in the opinion of the Contractor, shall be submitted to the Project Consultant for approval before proceeding with the work, with written assurance that such changes will not cause any extra cost on their part or alteration of design requirements.

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1.09 GUARANTEE

A. Guarantee all work done for one (1) year from date of acceptance against all defects in material, equipment and workmanship. Guarantee shall cover repair of damage to any part of the premises resulting from leaks, or other defects in material, equipment and workmanship to the satisfaction of the Owner. Repairs, if required, shall be done promptly, at no cost to the Owner.

B. Guarantee will include spring start-up and winterizing of system within the one (1) year time and development of approved water application schedule. Winter damage due to improper winterization is the responsibility of the Contractor.

C. All repairs and servicing required under the guarantee period shall be made under the observation of the maintenance crew to help train them in the proper operation and repair of the system.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings and capacities as indicated. Where not indicated, provide proper selection as determine by Installer to comply with installation requirements.
2. All materials throughout the system shall be new and in perfect condition.

B. Piping: Provide pipes of one of the following materials of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

1. Polyvinyl Chloride (PVC): Sized as shown on the drawings. All PVC pipe shall be continuously and permanently marked with manufacturer's name, material and schedule or type. Pipe shall conform to U.S. Department of Commerce Commercial Standard CS 256-63, or latest revision. All PVC pipe shall be SDR 21.
2. Fittings: Schedule 40, polyvinyl chloride (PVC) weight as manufactured by Spears or approved equal. Solvent weld or insert fittings are acceptable. No saddle type clamping or fittings shall be used. Fittings to conform to ASTM D-2466.

C. Valves:

1. Gate/Drain Valves: Shall be sized for mains. The valves shall be all bronze solid wedge, screw bonnet rated at 200 WOG.
2. Quick Coupling Valves: Shall be as noted on drawings and shall be 1" brass with locking top, and located up stream of all remote control valves.
3. Remote Control Valves: Electrically operated solenoid valves installed in valve boxes of appropriate size and type for valves specified with manual shut-off valve to match pipe size.

D. Dripperline and Integral Dripperline Components:

The dripperline shall be Techline pressure compensating dripperline or Techlite 17mm, 12mm, or 8mm non-pressure compensated dripperline

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as manufactured by Netafim Irrigation, Inc. Dripper flow rate and spacing shall be as indicated on drawings.

1. Techline/Techlite 17mm, 12mm or 8mm Fittings: All Techline/ Techlite connections shall be made with approved Techline/ Techlite insert fittings.
2. Soil Staples (TLS6): All on-surface/under mulch Techline/Techlite installations shall be held in place with Techline Soil Staples spaced evenly every 3' to 5' on center, and with two staples on each change of location.
3. Line Flushing Valves: All Techline/Techlite systems shall be installed with Netafim Automatic Line Flushing Valves as indicated on drawings.
4. Air/Vacuum Relief Valves: Each independent subsurface irrigation zone shall be installed with an Air/Vacuum Relief Valve at the zone's highest point(s).
5. Pressure Regulator: A pressure regulator shall be installed at each zone valve or on the main line to ensure operating pressures do not exceed system requirements. The pressure regulator shall be a Netafim Pressure Regulator. Model number as indicated on drawings.
6. Disc Filter: A disc filter shall be installed at each zone valve or on the main line to ensure proper filtration. The filter shall be a Netafim Disc Filter. Model number and mesh as indicated on drawings.

D. Reduced Pressure Backflow Prevention Units: Reduced pressure backflow prevention units shall be provided as indicated on drawings and shall be in compliance with local codes. Febco 825Y or approved equal.

F. Solvent Cement: Compatible with PVC pipe and or proper consistence ASTM D-2564.

G. Control Wires: 24-Volt solid wire, UL approved for direct burial in ground. Minimum wire size shall be 18 gauge. All wire to be Paige wire or approved equal.

H. Expansion Curls: Expansion curls shall be provided within three (3') feet of each wire connection to solenoid and at least every three hundred (300') feet in length. (Expansion curls are formed by wrapping at least five (5) turns of wire around a rod or pipe 1" or more in diameter, then withdrawing the rod).

I. Sleeves for Control Wires: Under all walks and paving and where indicated on drawings, PVC 1220-160 PSI pipe or galvanized heavy wall steel conduit. Minimum size 1½" I.D.

J. Sleeves for Irrigation Pipe: Under all walks and paving and where indicated on drawings, Schedule 80 PVC pipe or as otherwise approved by the Project Consultant. To be two (2) times the O.D. of sleeved pipe.

K. Valve Boxes: Valve boxes shall be of appropriate size and type for valves specified, or as otherwise indicated on the drawings. All valve boxes in roadways or sidewalks shall be cast iron construction with locking lid. All valve boxes to have 6" pea gravel; with blocking, and wrapped with filter fabric.

L. Drains: Air hose connections of approved design shall be provided for

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winterizing at several locations so that the entire system can be drained by blowing it out with compressed air. The compressor shall be capable of varying pressures.

M. Rubber Hose: A quantity of two (2) approved heavy duty rubber hoses, 100 feet long, for use with quick coupling valves shall be furnished by the Contractor.

PART 3 - EXECUTION

3.01 INSPECTION

General: Examine areas and conditions under which irrigation system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF IDENTIFICATION

General: Maintain all warning signs, shoring, barricades, flares and red lanterns as required by safety orders of the Division of Industrial safety and local ordinances.

3.03 INSTALLATION OF PIPING AND FITTINGS

A. Excavating and Trenching:

1. The Contractor shall perform all excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins. The contractor shall trench, each day, only as much as required for that day's work.
2. Trenches shall be made wide enough to allow minimum of two (2") inches between parallel pipe lines. Trenches for pipelines shall be made of sufficient depth to provide minimum cover from finish grade as follows:
   a. 15" minimum cover over main lines.
   b. 12" minimum cover over control lines from controller to valves.
   c. 4" – 6" cover over dripperline.

B. Pipe and Assembly:

1. Install remote valves where shown and group together where practical. Place valves no closer than six (6") inches to walk edges, buildings and walls. Locate all valve boxes in planting beds unless otherwise directed or noted.
2. No pipe shall be laid when, in the opinion of the Project Consultant, trench or weather conditions are unsuitable. When pipe laying is not in progress, the open ends of the installed pipe shall be closed by approved means to prevent entrance of trench water and other foreign material into the line(s). Enough backfill shall be placed in the center sections of the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and re-laid.
3. PVC pipe and fittings shall be solvent welded using solvents and methods as recommended by the manufacturer of the pipe, except where screwed connections are required. Pipe and fittings

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shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.

4. Pipe may be assembled and welded on the surface. Snake pipe from side to side in the trench to allow for expansion and contraction.
5. Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings using plastic male adapters.

C. Dripperline Installation:

1. Install all dripperline as indicated on drawings. Use only Teflon tape on all threaded connections.
2. Clamp Techline/Techlite fittings with Oetiker clamps when operating pressure exceeds specific dripperline fitting requirements.
3. When installing Techline/Techlite dripperline on-surface, install soil staples as listed below:
   a. Sand Soil - One staple every three (3') feet and two (2) staples on each change of direction (tee, elbow, or cross).
   b. Loam Soil - One staple every four (4') feet and two (2) staples on each change of direction (tee, elbow, or cross).
   c. Clay Soil - One staple every five (5') feet and two (2) staples on each change of direction (tee, elbow, or cross).
4. Cap or plug all openings as soon as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
5. Thoroughly flush all water lines before installing valves and other hydrants.
6. Test in accordance with Paragraph on Hydrostatic Tests.

F. Automatic Controllers: Connect remote control valves to controller in a logical sequence to correspond with specification of the Owner or Project Consultant.

G. Automatic Control Wiring:

1. Install control wires, sprinkler mains and laterals in common trenches whenever possible.
2. Install control wires at least six (6") inches below finish grade and lay to the side and below main line. Provide expansion curls as described herein.
3. Control wire splices will be allowed only in runs more than five hundred (500') feet. Connections of all underground wires shall by the use of wire nuts, covered with waterproof splice for each wire per installation instructions provided by the manufacturer, or as otherwise required by local ordinance.
4. All wires passing under existing or future paving, construction, etc., shall be encased in plastic or galvanized steel conduit extending at least twelve (12") inches beyond edges of paving or constructions.

H. Backfilling and Compacting:

1. After the system is operating, and required tests and inspections have been completed, backfill excavations and trenches with clean soil free of rubbish.

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2. Backfill for all trenches, regardless of type of pipe covered, shall be compacted to minimum ninety (90%) percent density.
3. Compact trenches in areas to be planted by thoroughly flooding the backfill.
4. Dress off all areas to finish grades.

3.04 FIELD QUALITY CONTROL

Hydrostatic Test:

1. Request the presence of the Owner and/or Project Consultant at least forty-eight (48) hours in advance of testing.
2. Testing to be accomplished at the expense of the Contractor, and in the presence of the Owner.
3. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
4. Apply a continuous and static water pressure of sixty (60) PSI when welded plastic joints have cured at least twenty-four (24) hours and with the risers capped as follows:
   a. Main lines and sub mains to be tested for one (1) hour.
   b. Lateral lines to be tested for one (1) hour.
5. Repair leaks resulting from tests.
6. The lines shall then be retested until satisfactory.

3.05 INSTRUCTIONS

After completion and testing of the system, the Contractor will instruct the Owner's personnel in the proper operation and maintenance of the system.

3.06 PROTECTION

Contractor shall be responsible for work until finally inspected, tested and accepted. After delivery, and before and after installation, protect work against theft, injury or damage. Protect open ends of work with temporary covers or plugs during construction, to prevent entry of obstruction material.

END OF SECTION 02810

NETAFIM BID SPECIFICATIONS SAMPLES

Netafim Bid Specifications

Sample Only

Section 02905

PART 1

1. **SUBMITTALS** *(fill in the appropriate paragraph number)*
Submit (qty) copies of manufacturer's catalog cuts or current catalog of the following listed items:

1._._ Manufacturer's Catalog Data
a. Dripperline
b. Barbed insert fittings
c. Disc filter
d. Pressure regulators
e. PVC or Poly pipe
f. Line flushing valves
g. Air/Vacuum relief valves
h. Stainless steel clamps
i. Remote control valves
j. PVC threaded and inserts fittings
k. Metal ground stakes
(add or subtract to the following list as necessary)

1._ **SPARE PARTS**
Upon completion of the installation, turn over the following spare parts and specialty tools to the owner's authorized representative. Include with the following quantities of items a list of each part with appropriate part number (for ordering replacement products) and local supply store of where these parts can be purchased.

- (1) Plastic handled 5mm and/or 8mm punch depending on size of holes made
- (10') of dripperline for each dripper interval and discharge rate
- (10') of blank dripperline tubing if used
- (6) barbed couplings
- (6) barbed 90° elbow fittings
- (6) barbed tee fittings
- (6) 180° 2-way adapter tees
- (6) male adapters w/3/4" FPT
- (1) spare filter element of the mesh size indicated on the irrigation legend
- (1) line flushing valve
- (2) regulator springs of the color and regulating pressure indicated on the irrigation legend
- (6) dripper plug rings

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- (6) dripper micro-tubing adapters

PART 2. MATERIALS

2.1 PIPING MATERIALS

2.1.1 Dripperline with Pressure Compensating Emitters

Dripperline shall be of nominal sized one-half (½") inch low density, ultra-violet-resistant, linear polyethylene tubing with internal pressure-compensating, continuous self-cleaning, integral drippers at a specified interval. The tubing shall be brown in color and shall conform to an outside diameter (O.D.) of 0.66" and an inside diameter (I.D.) of 0.57". The dripperline shall be capable of a discharge rate of 0.4, 0.6 or 0.9 gallons per hour (GPH) between operating pressures of 7-70 PSI for each individual dripper.

The individual continuous self-cleaning, pressure compensating drippers shall be welded to the inside of the tubing wall. The drippers shall be constructed of three individual pieces:

1) a black-colored dripper containing a filtration system on the inlet side,
compensation cell, and recessed chamber with a water outlet,
2) a hard plastic diaphragm retainer with color denoting discharge rate, with chamfered edges and a recessed groove in the center extending the full length of the diaphragm and,
3) a flexible black elastomer diaphragm that allows pressure to build up within the chamber to purge sediment or other debris that may not have been captured by the disc filter.

Dripper spacings shall be available in the following on-center intervals - 12", 18", and 24".

2.1.1a Dripperline with Non-Pressure Compensating Emitters

Dripperline shall be low density, linear, ultra-violet-resistant, polyethylene tubing with internal non-pressure compensating integral drippers at a specified interval. The tubing shall be brown in color and shall conform to an outside diameter (O. D.) and an inside diameter (I.D.) as follows:

17mm dripperline – 0.67" O.D., 0.57" I.D.
12mm dripperline – 0.48" O.D., 0.42" I.D.
8mm dripperline – 0.26" O.D., 0.24" I.D.

The dripperline shall be capable of individual dripper discharge rates in gallons per hour (GPH) as follows:

17mm - 0.5 or 1.0 GPH @ 15PSI
12mm - 0.6 or 0.9 GPH @ 25PSI

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8mm - 0.3 GPH @ 10 PSI

The individual drippers shall be welded to the inside of the tubing wall. Dripper spacings shall be available as follows:

17mm – 12" or 18"
12mm – 12" or 18"
8mm – 6" or 12"

2.1.2 Barbed Insert Fittings

All barbed insert fittings shall be constructed of molded, ultra-violet-resistant, brown colored plastic (17mm) or black colored plastic (12mm and 8mm) having a nominal inside dimension (I.D.) as follows:

17mm - 0.57"
12mm - 0.42"
8mm - 0.24"

Each fitting shall have a minimum of two ridges or barbs per outlet with a raised barb nearest the fitting outlet. All fittings shall be of one manufacturer and shall be available in one of the following end configurations:

- barbed insert fittings,
- male pipe threads (MPT) with barbed insert fittings, or
- female pipe threads (FPT) with barbed insert fittings.

2.1.3 Non-Pressure PVC Pipe

Class 200 PVC

Non-pressure (downstream of the remote control valve) PVC pipe shall be rigid, un-plasticized polyvinyl chloride PVC 1220, (Type 1, Grade 2), conforming to ASTM D 1785. Pipe shall have the following markings continuously along one side of the pipe:

- pipe O.D.
- type and grade
- NSF rating
- burst pressure rating
- product standard ps-21-70 & ASTM number
- date of manufacture

2.1.4 PVC Insert and Threaded Fittings

All PVC fittings shall be un-plasticized polyvinyl PVC I, or PVC II material for threaded or slip fitting tapered socket solvent weld fittings. The type of plastic material and schedule size shall be indicated on each fitting or coupling with raised or recessing markings. Fittings and couplings shall comply with the following specifications:

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	Socket Fittings		Threaded Fittings	
Schedule 40	ASTM D2466	Schedule 40	ASTM D2464
Schedule 80	ASTM D2467	Schedule 80	ASTM D2464

2.2 LINE FLUSHING VALVE

The line flushing valve shall be constructed of brown molded plastic and shall be a normally open hydraulic valve which flushes based on volumetric quantities of water. Inlet and outlet configurations shall be of one of the following configurations:

- ½" MPT, or
- barbed insert fitting with collar

The line flushing valve shall be serviceable by removing a threaded cover from a base, exposing the internal components. The internal components of the line flushing valve shall consist of:

- a molded diaphragm retainer,
- a high density plastic flush regulator, and
- a diaphragm 2" in diameter.

The line flushing valve shall be capable of automatically operating during initial system pressure build-up to discharge approximately one gallon of water. One line flushing valve shall be used for each 15 GPM of zone flow, and be able to operate at 57 PSI maximum, or 1.5 PSI minimum pressure at line ends.

2.3 PRESSURE REGULATOR VALVES

The pressure regulator valve(s) shall be a spring-operated piston type with an externally accessible regulation unit that can be serviced without removing the valve from the system. The valve shall be constructed from molded black plastic with six different colored tops with interchangeable springs denoting different pressure regulation and flow ranges. The regulator shall have a built-in indicator that shows when the proper outlet pressure is reached. Operating ranges for the valves shall be from 15-50 PSI in 5-PSI increments. Inlet and outlet ports of the valve shall be a combination of male/female threads.

2.4 DISC FILTER

The disc filter body shall be molded of black plastic with male pipe threads (MPT) for both the inlet and outlet ports. A threaded cap on one end of the body shall be capable of periodic servicing by unscrewing the cap or releasing the latched band from the main filter body. On one ¾" model, a manual shut-off valve shall be co-molded to the opposing end of the removable cap as part of the main body. This device shall be capable of closing off the inlet port so the disc element can be removed when the main line is still pressurized.

The filter elements shall be disc-type. The disc-type filter rings shall be color-coded and available in one of four colors denoting filtration of 80, 120, 140, or 200 mesh.

NETAFIM BID SPECIFICATIONS SAMPLES

2.5 AIR/VACUUM RELIEF VALVES

Air/vacuum relief valves shall be constructed of grey and/or black plastic with an internal sliding poppet valve that is capable of venting air or preventing vacuum. The main body shall have a 1/2" male pipe thread (MPT). Operating pressure range for the air/vacuum relief valve shall be 7 PSI minimum to 140 PSI maximum.

2.6 STAINLESS STEEL CLAMPS

Tubing clamps shall be constructed to 304 AISI stainless steel and shall be one "ear" type. This "ear" shall be capable of being pinched with a pinching tool to secure the tubing around the barbed insert fitting. Interior clamp wall shall be smooth to prevent crimping or pinching of tubing. Wall thickness of clamps shall be .0236" (0.6 mm) with an overall band width of ¼" (7 mm).

PART 3 - EXECUTION

3.1 STAKING

Lateral Dripperline Layout

Verify existing field dimensions of the area to be irrigated with the irrigation plans for accuracy. Begin dripperline layout 2" away from hard surfaces; i.e., concrete sidewalks, curbs, asphalt, and/or undefined edges; i.e., shovel-cut headers, and 4" away from softscape transitions. Mark tubing intervals on the ground with flags, paint, or some other method that can be maintained throughout the installation.

3.2 INSTALLATION

3.2.1 Piping Installation

3.2.1.1 Methods of Installing Dripperline

Dripperline can be installed in one of the four following methods:

1. Over-excavation: Over-excavate the entire area to a depth of 4" – 6" below finish grade. Plant all specimen trees and shrubs 15 gallon size and larger, then place dripperline at the row spacing interval indicated on the plans.
2. Pipe Pulling: Where ground disruption is to be minimized, pneumatic tire, pipe-pulling machinery shall be used. Potholes shall be used at the ends of each run for making connection to supply and exhaust headers of rigid PVC pipe or polyethylene pipe.
3. Trenching: Hand or mechanically trench to the pipe depth indicated on the plans or in these specifications and backfill flush with finish grade. Avoid mechanically trenching within the dripline of existing trees. Hand-trench around existing tree roots when roots of 2" and larger are encountered. Remove all rock 1½" and larger when excavating and remove from site. Do not backfill trenches with rock that will come in direct contact with tubing or rigid PVC piping.

NETAFIM BID SPECIFICATIONS SAMPLES

4. On-Grade Installation: For on-surface or under mulch installation, place tubing at the lateral spacing indicated on the plans and place soil staples on 3'-5' intervals depending on terrain. Do not install tubing on surface without soil staples. Backfill with mulch or topdressing as noted in the Section 029__, "Landscaping".

3.2.1.2 Polyvinyl Chloride Pipe (PVC)

3.2.1.2.1 Solvent-Welded Joints
Shall conform to ASTM D2855

3.2.1.2.2 Threaded Joints
Full-cut with a maximum of three threads remaining exposed on pipe and nipples. Make threaded joints tight without recourse to wicks or filters, other than polytetrafluoroethylene (Teflon) tape. Avoid over-tightening of PVC-threaded connections.

3.2.1.2.3 Placement of Rigid PVC Piping
Install pipe in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Install pipes at temperatures over 40° F. Pipe markings shall face upward out of the trench whenever possible.

3.2.1.2.4 Dripperline
Dripperline can be installed with the water outlets facing up, down, or sideways. In irregular areas, some water outlets could end up too close to fixed improvements and may have to be capped off with a dripper plug ring.

3.2.2 Cover
Install underground piping horizontally and as evenly as possible to a maximum depth of 6", unless otherwise specified. (Typical pipe depth is 4" unless periodic aeration is anticipated, and then pipe depth should be lowered to 6".)

3.2.3 Barbed Insert Fittings
Connect dripperline to barbed insert fittings by pushing the tubing on and over both barbs of the fitting until the tubing has seated against another piece of tubing or has butted against another portion of the barbed fitting. For water pressures in excess of the 45 PSI, or the maximum stated system pressure for the dripperline, whichever is less, use stainless steel clamps as noted in paragraph 3.2.4, "Pipe Clamping" on all barbed fittings.

3.2.4 Pipe Clamping
When design operating pressure exceeds 45 PSI, or maximum stated system pressure for the dripperline, whichever is less, stainless steel pipe clamps shall

NETAFIM BID SPECIFICATIONS SAMPLES

be used. Slip clamps over tubing before slipping tubing over barbed insert fitting. Place clamp between the first and second ridge of the barbed fittings and crimp the "ear" of the clamp tightly. Crimp the "ear" twice to ensure proper seating.

3.2.5 Pressure Regulators

Install a pressure regulator below grade, in-line with, and downstream of the remote control valve. Whenever possible, place the pressure regulator in the same valve box to allow for periodic inspection. Place the regulator with the arrow (molded into the side of the body) pointing in the direction of the flow of water. Provide straight piping on the outlet side of regulator for a dimension not less than three lengths of the overall body dimension.

3.2.6 Remote Control Valves

Install remote control valves level and below grade with a minimum of 4" clearance to the top of the inside of the valve box cover. The arrow cast or molded into the side of the remote control valve should be pointing in the direction of the flow of water. Place a minimum of 1 cubic foot of ¾" gravel in the bottom of the valve box before backfilling with native soil around the exterior of the valve box. Support the four corners of the valve box with a common red brick (wood blocks tend to decay and allow valve boxes to settle over time) on each corner. At finish grade, the top of the valve box shall be 2" above surrounding grades in turf areas or in shrubs where a mulch layer is specified.

3.2.7 Disc Filter

Install the disc filter, horizontally level, below grade, and either before or after the remote control valve as indicated in the installation details. The position of the disc filter in the valve box shall be off-center to allow for removal of the disc element for periodic servicing. Refer to the installation details for the size of the valve box. Include a minimum of 1 cu. ft. of ¾" gravel in the bottom of the valve box. Valve box support and placement shall conform to the installation methods described in paragraph 3.2.5, "Remote Control Valve".

3.2.8 Air/Vacuum Relief Valve

Install the air/vacuum relief valve below grade and at the highest elevation(s) within each zone of subsurface dripperline. Depending on the site conditions and tubing layout, more than one air/vacuum relief valve may be required. Place the valve in a round valve box with a locking cover and a sump of 1 cubic foot of ¾" gravel as noted on the details. Additional Techline Blank Tubing may be necessary when placing Techline dripperline on mounds or berms with more than a 3' elevation difference. Techline, or Techline Blank Tubing shall be connected perpendicular to the dripperline with barbed tees and crosses from the lowest elevation of dripperline to the highest point of the mound berm where the

NETAFIM BID SPECIFICATIONS SAMPLES

air/vacuum relief valve is located. The air/vacuum relief lateral serves to collect and transport trapped air bubbles or relieve vacuum in lower elevation dripperline parallel to the dripperline located at the highest point in the system. Locate an air/vacuum relief lateral for each berm (high point) in the zone.

3.2.9 Flushing

Prior to backfilling and before connection of the line flushing valves, flush the entire system to remove any dirt or sediment that may have entered the system during the installation.

3.2.10 Line Flushing Valve

Install the line flushing valve(s) below grade at the hydraulic termination point(s) in each system, normally at the point farthest away from the source. Locate in a valve box with the top of the line flushing valve facing horizontally or vertically. Include a minimum of 1 cubic foot of ¾" gravel in the bottom of the valve box. Valve box support shall conform to the installation methods described in paragraph 3.2.5 "Remote Control Valve".

3.2.11 Testing

Prior to backfilling, open the remote control valve and operate each circuit to check for leakage around both barbed and threaded PVC fittings. Make necessary corrections to stop leaks.

3.2.12 Retest

Retest those systems where leaks were corrected before commencing backfilling operations.

END OF SECTION

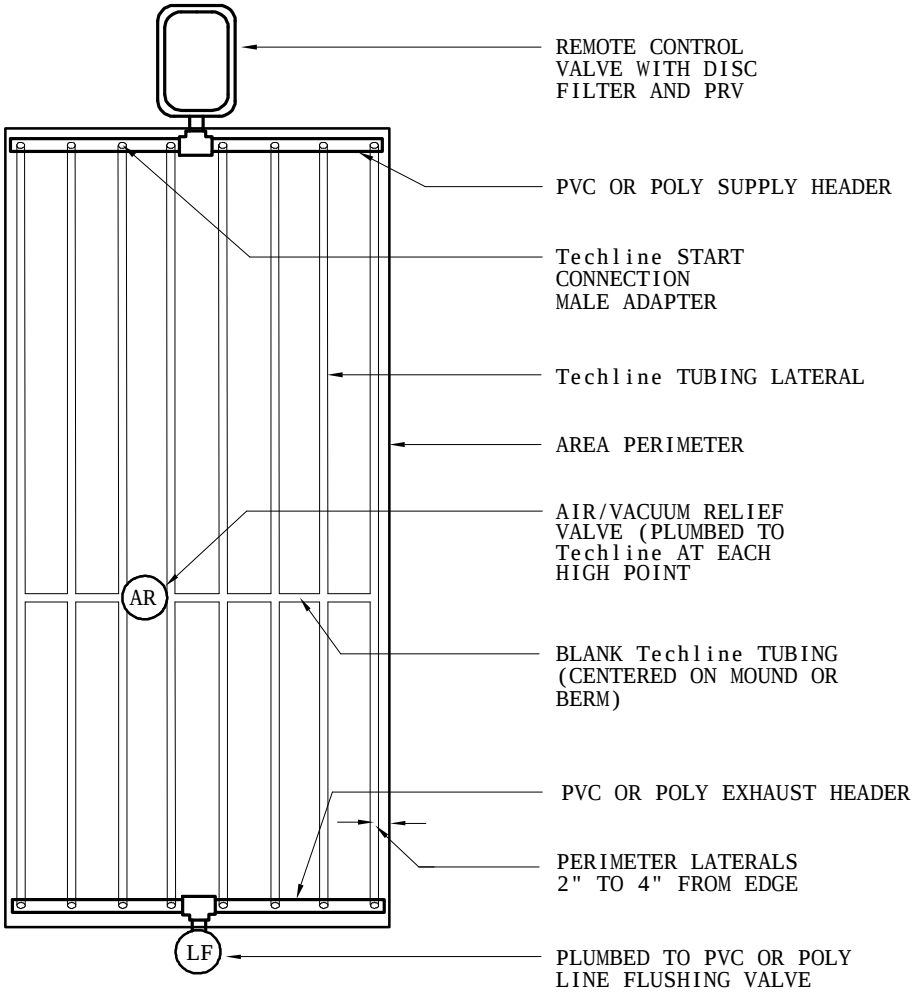
TECHLINE DESIGN DETAILS

TABLE OF CONTENTS - DESIGN DETAIL DRAWINGS (1 of 2)

TECHLINE DESIGN DETAILS

TABLE OF CONTENTS - DESIGN DETAIL DRAWINGS (2 of 2)

Detail 1.01

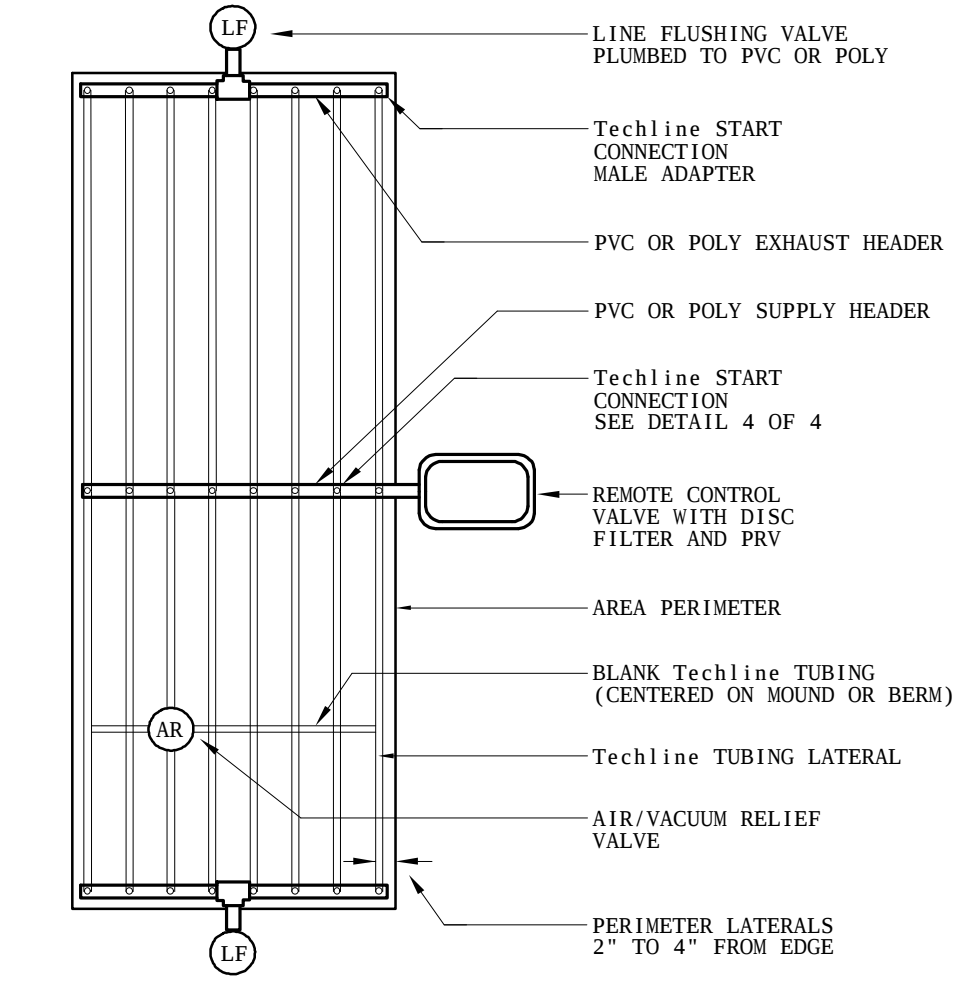


Techline END FEED LAYOUT

DETAIL - NO SCALE

Techline “END FEED” Layout

Detail 1.02

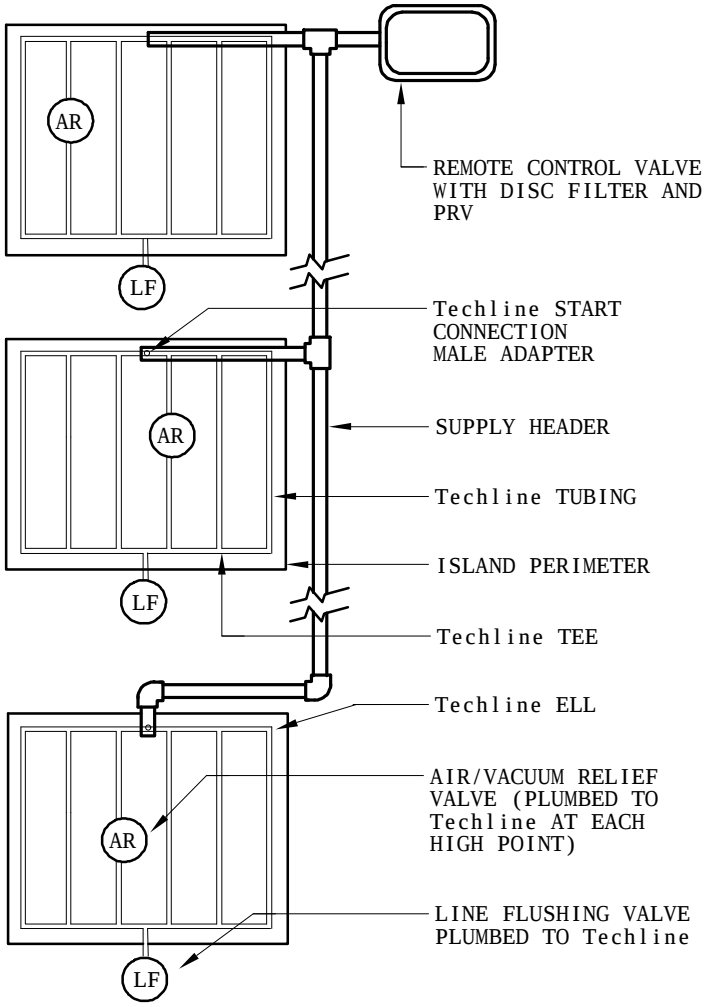


Techline CENTER FEED LAYOUT

DETAIL - NO SCALE

Techline “CENTER FEED” Layout

Detail 1.03

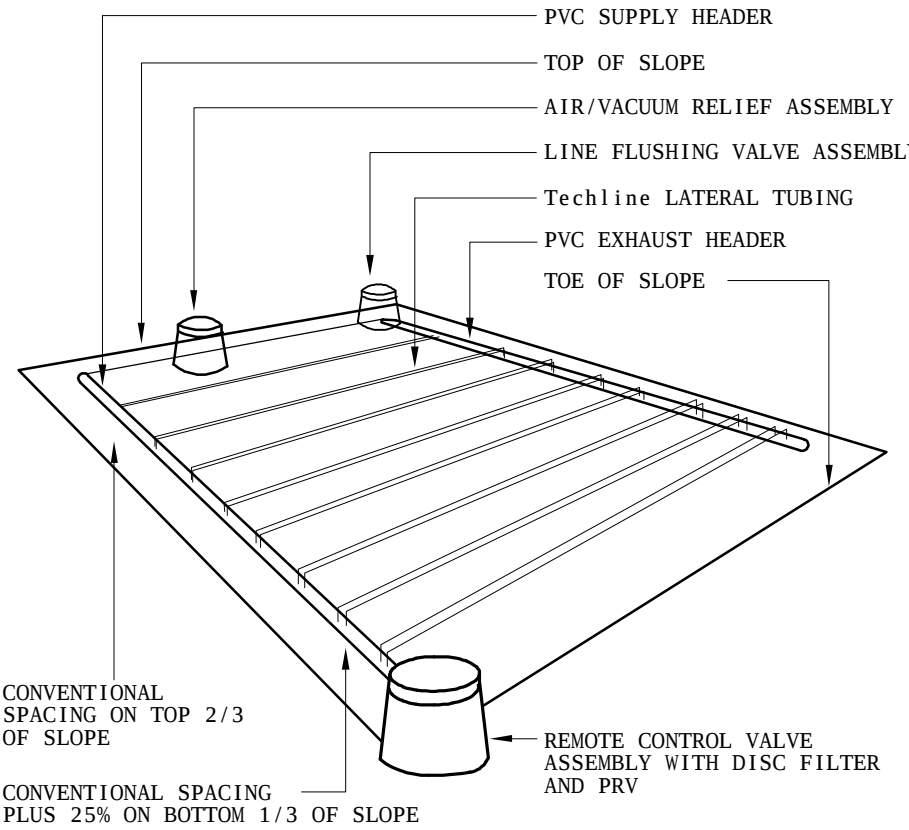


Techline ISLAND LAYOUT

DETAIL - NO SCALE

“PARKING LOT ISLAND” Layout Option 1

Detail 1.04



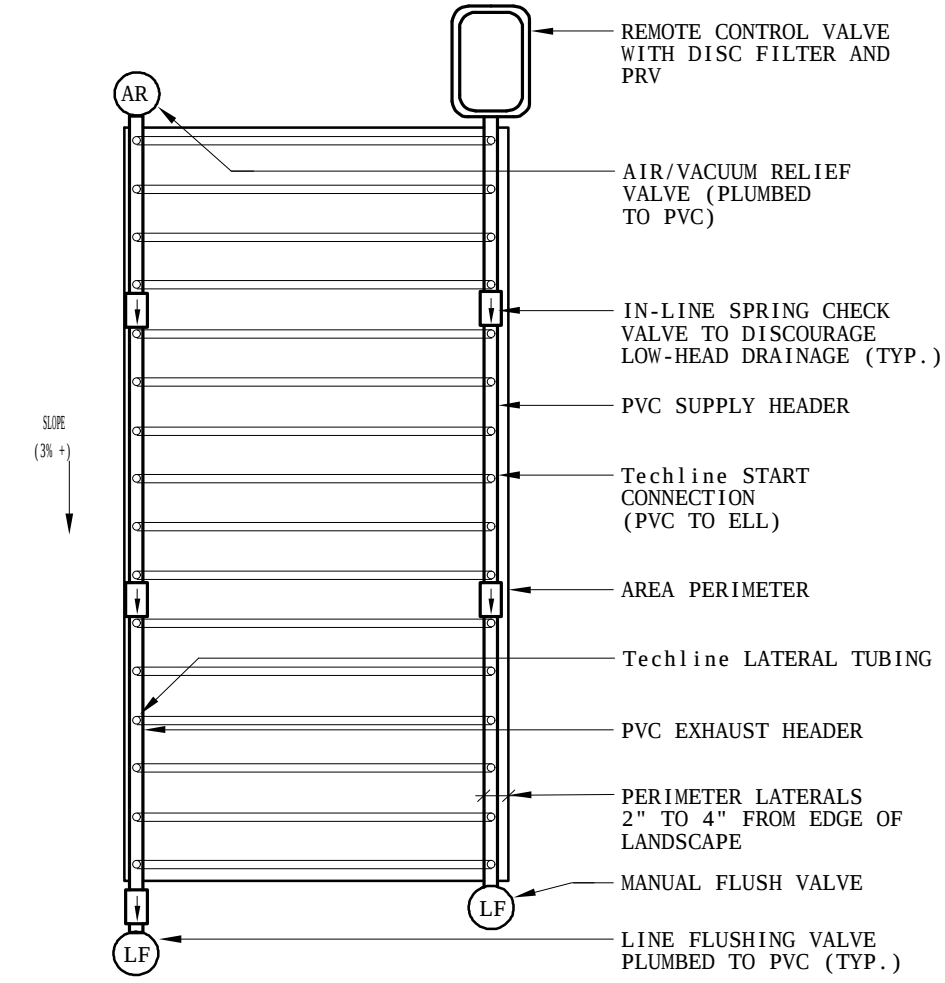
NOTE:
ALIGN Techline LATERALS PARRALLEL TO THE CONTOURS OF THE SLOPE

Techline SLOPE FEED LAYOUT

DETAIL - NO SCALE

Techline “SLOPE LAYOUT” - Option 1

Detail 1.05



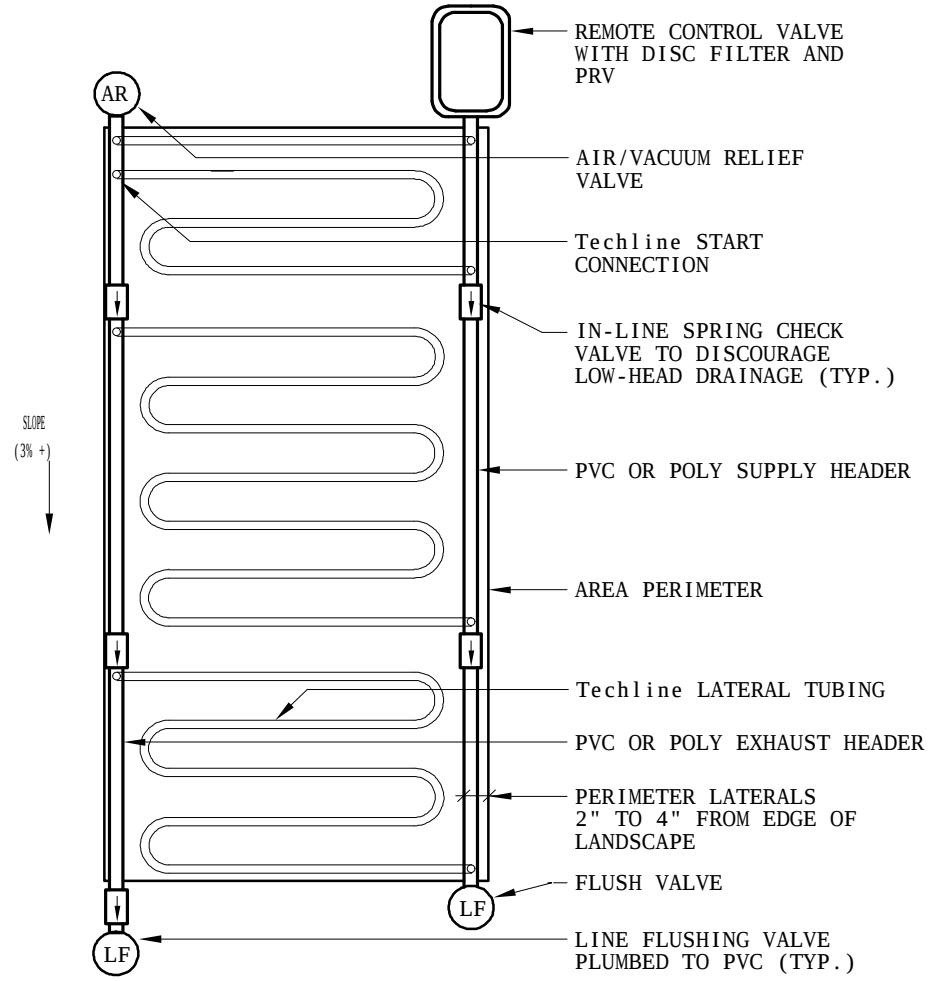
Techline MEDIAN ISLAND, DOWN SLOPE

OPTION ONE

DETAIL - NO SCALE

Techline “SLOPE LAYOUT” - Option 1

Detail 1.06



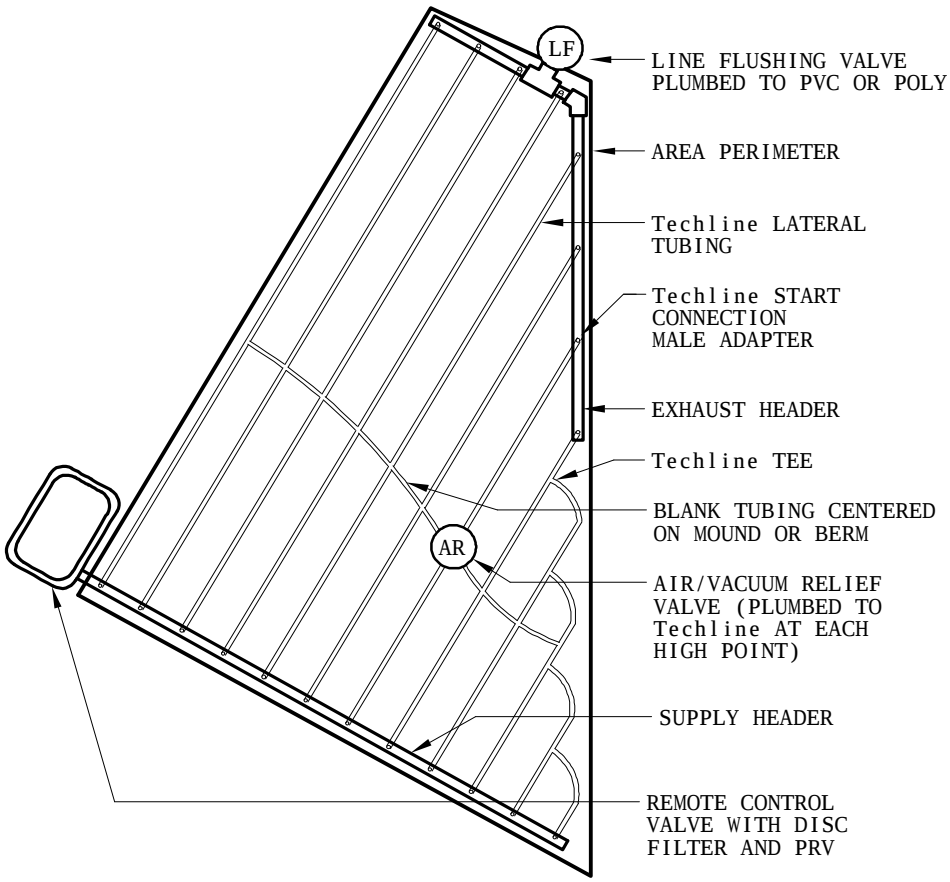
Techline MEDIAN ISLAND, DOWN SLOPE

OPTION TWO

DETAIL - NO SCALE

Techline “SLOPE LAYOUT” - Option 2

Detail 1.07

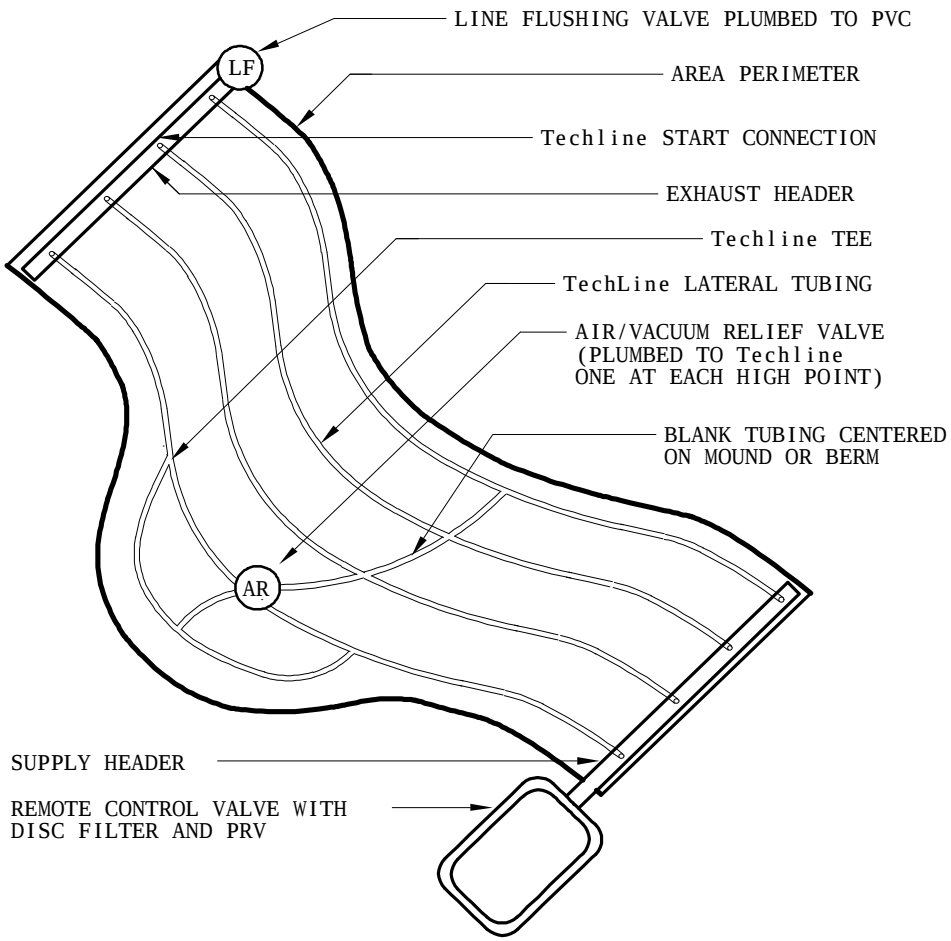


IRREGULAR AREAS: TRIANGULAR

DETAIL - NO SCALE

“IRREGULAR AREA” - Triangular Area

Detail 1.08

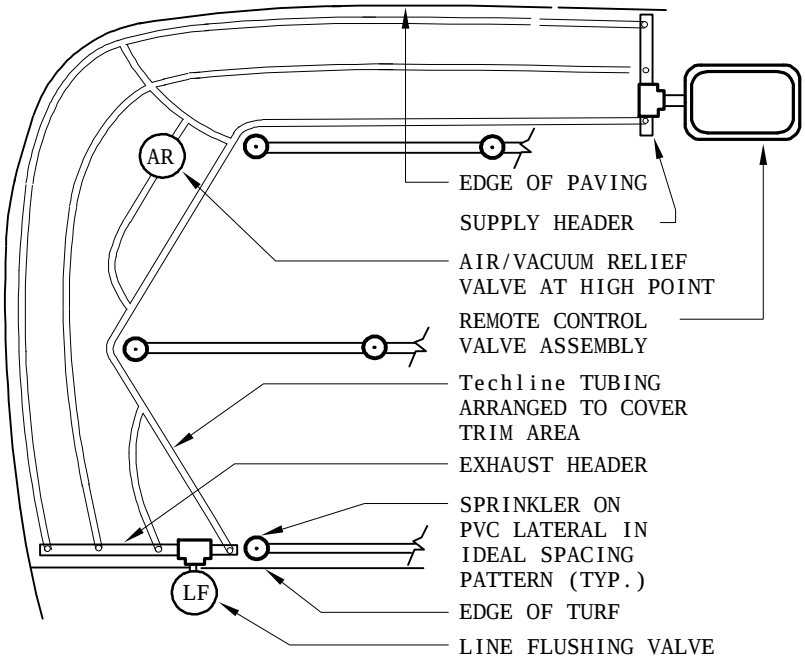


IRREGULAR AREAS: ODD CURVES

DETAIL - NO SCALE

“IRREGULAR AREA” - Odd Curves

Detail 1.09



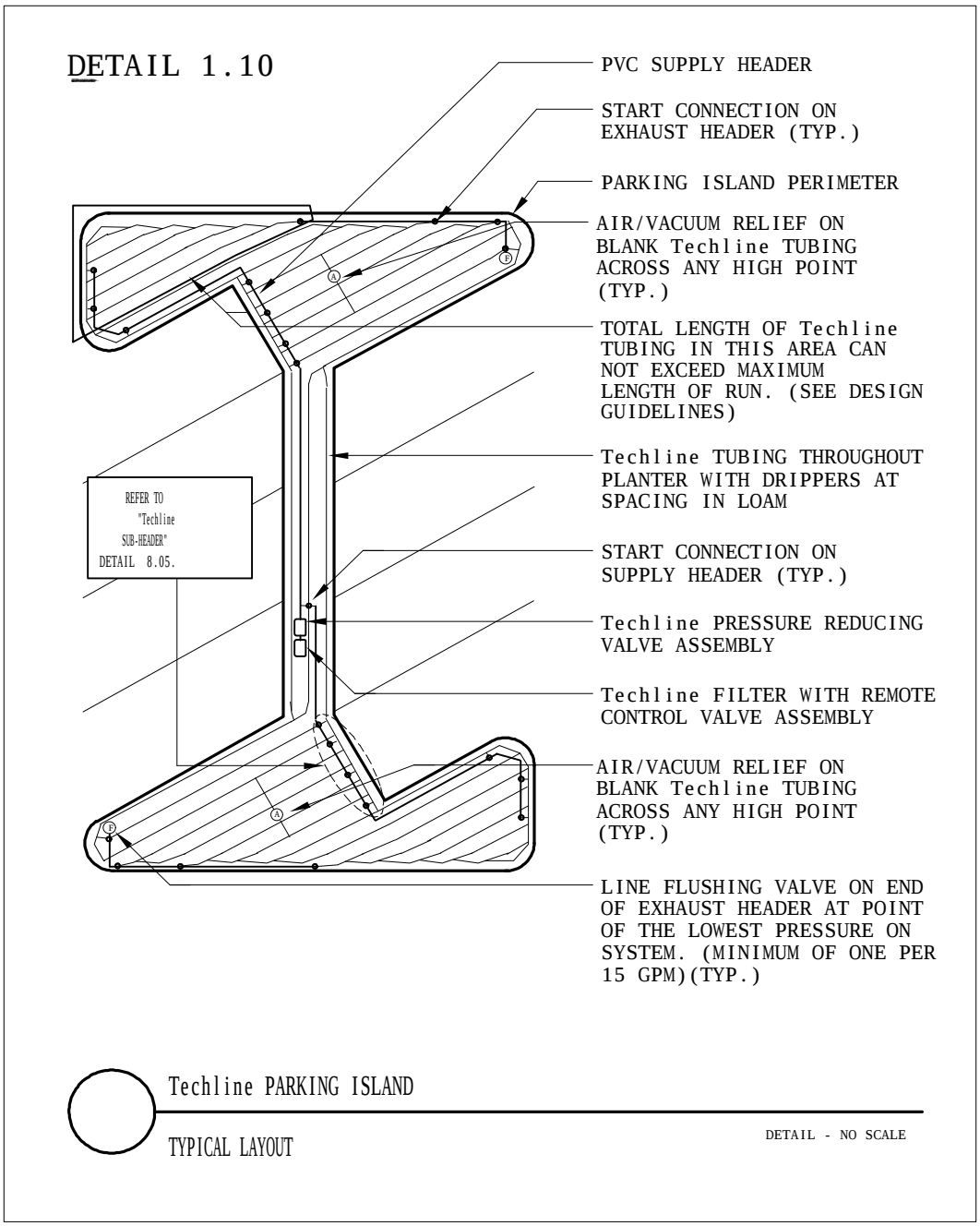
NOTES TO DESIGNER

1- IN THIS EXAMPLE, IDEAL SPACING IS MAINTAINED FOR THE SPRINKLER SYSTEM W/ OUT DISTORTION, WHILE THE HEADS ARE SET AWAY FROM THE PAVING EDGE TO AVOID OVERSPRAY
2- BLANK Techline TUBING IS USED TO JOIN THE LATERALS ACROSS THE HIGH SPOT TO ENHANCE THE FUNCTION OF THE AIR/VACUUM RELIEF VALVE.

PLAN - NO SCALE

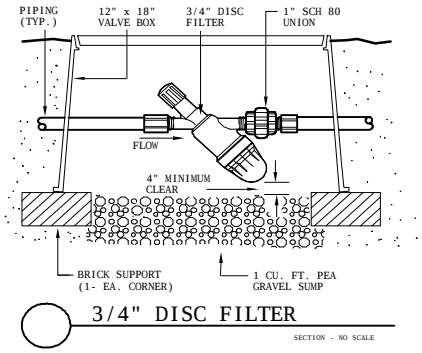
DETAIL - NO SCALE

“Techline Perimeter for Sprinklers” Layout



“PARKING LOT ISLAND” Layout Option 2

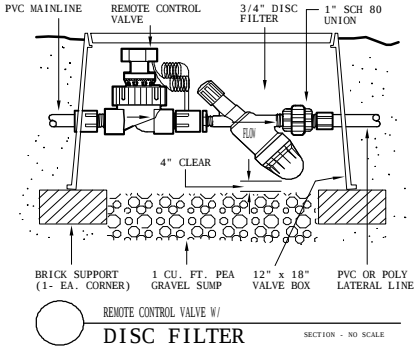
Detail 2.01



3/4" DISC FILTER

SECTION - NO SCALE

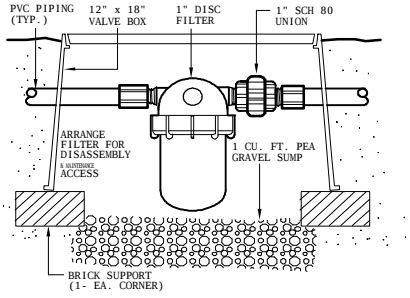
Detail 2.02



REMOTE CONTROL VALVE W/
DISC FILTER

SECTION - NO SCALE

Detail 2.03

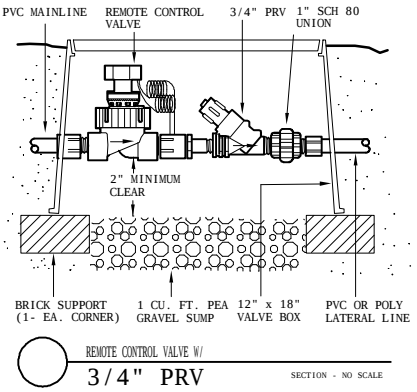


1" DISC FILTER

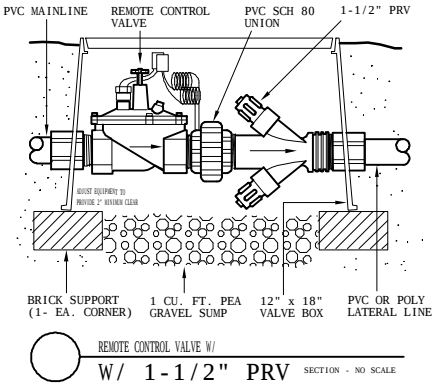
SECTION - NO SCALE

Filter Connections in Valve Box

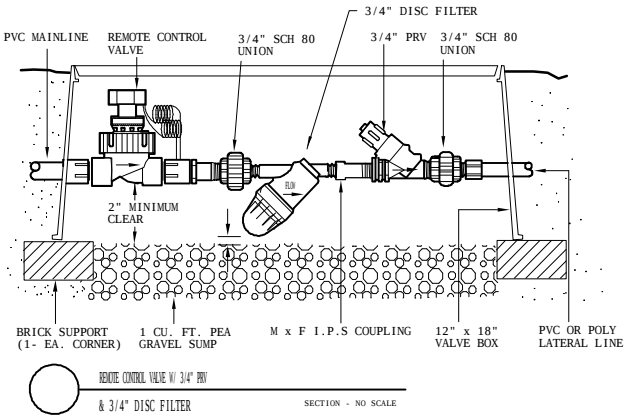
Detail 3.01



Detail 3.02

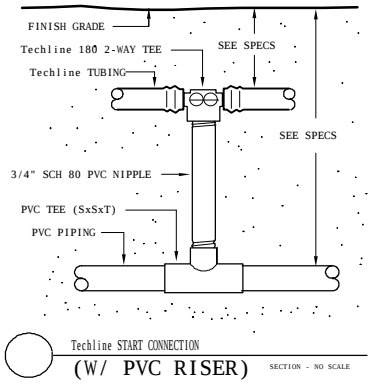


Detail 3.03



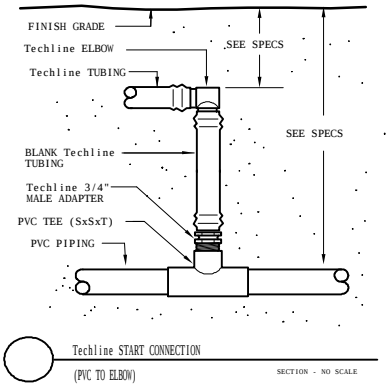
Remote Control Valve Connections

Details 4.01



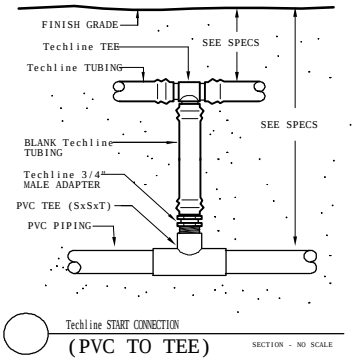
Techline START CONNECTION
(W/ PVC RISER) SECTION - NO SCALE

Details 4.02



Techline START CONNECTION
(PVC TO ELBOW) SECTION - NO SCALE

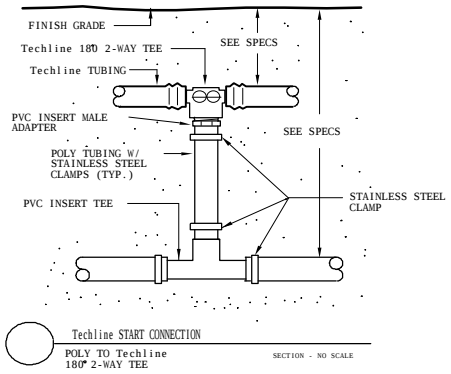
Details 4.03



Techline START CONNECTION
(PVC TO TEE) SECTION - NO SCALE

Techline Start Connections

Details 4.04



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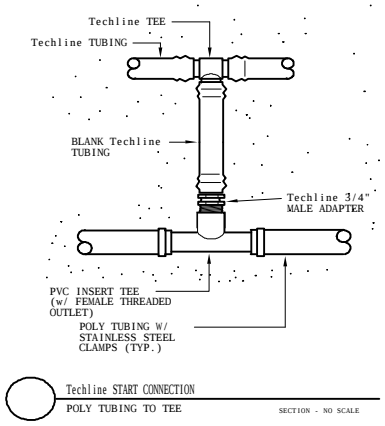

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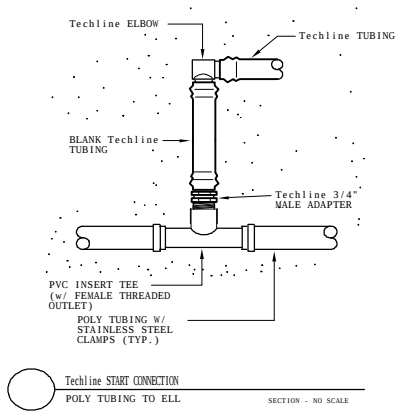
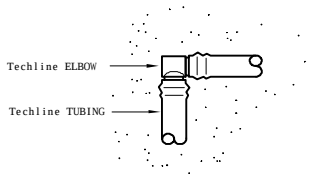


Techline Start Connections

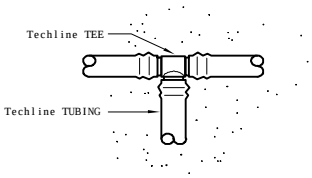
Details 5.01



Techline ELBOW

SECTION - NO SCALE

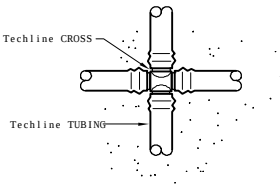
Details 5.02



Techline TEE

SECTION - NO SCALE

Details 5.03

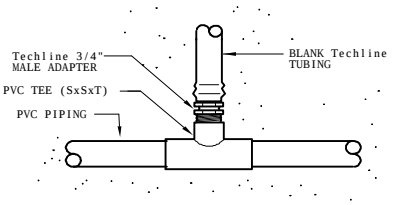


Techline CROSS

SECTION - NO SCALE

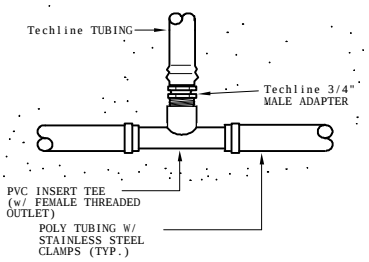
Techline Fitting Connections

Details 5.04



Techline START CONNECTION
(PVC TO TEE)
SECTION - NO SCALE

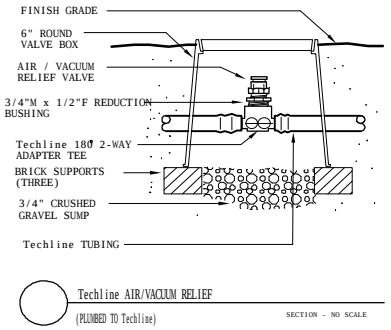
Details 5.05



Techline START CONNECTION
POLY TUBING TO TEE
SECTION - NO SCALE

Techline Start Connections

Detail 6.01



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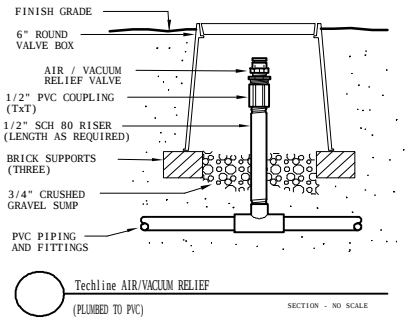
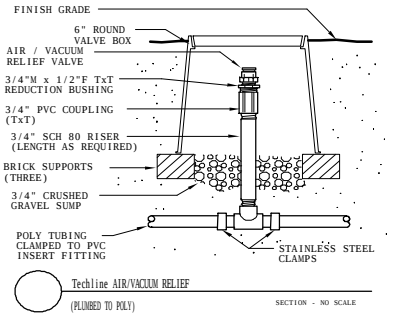
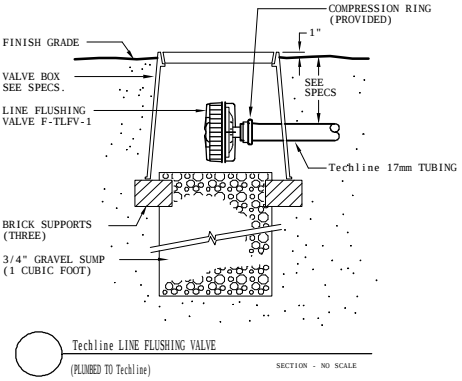


Detail 6.03



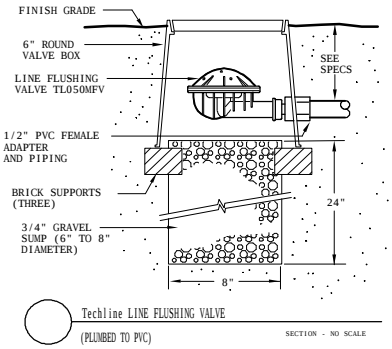
A/VRV In Valve Box

Detail 7.01

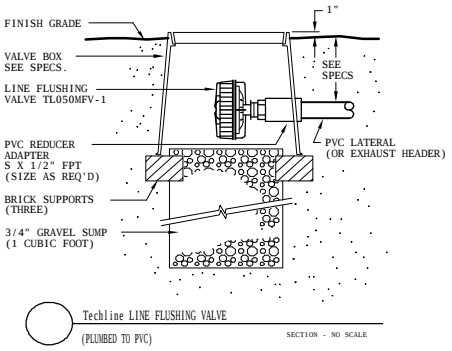


Obsolete – Historical Reference Only

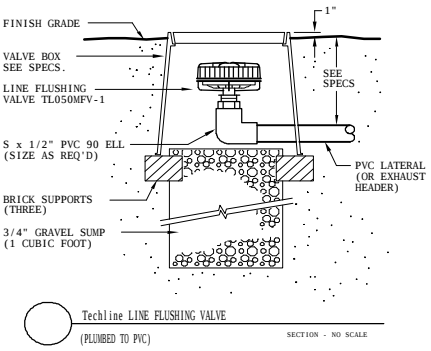
Detail 7.02



Detail 7.02A

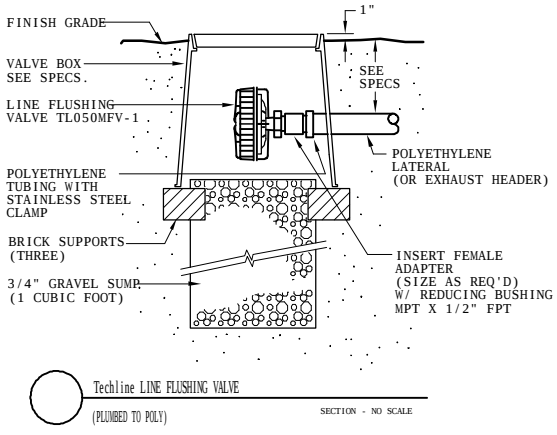


Detail 7.02B



Line Flushing Valve in Valve Box

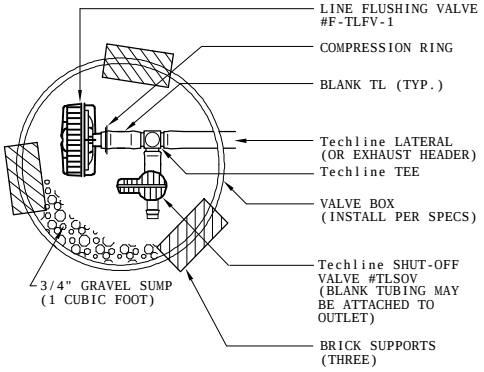
Detail 7.03



Techline LINE FLUSHING VALVE
(PLUMBED TO POLY)

SECTION - NO SCALE

Detail 7.04

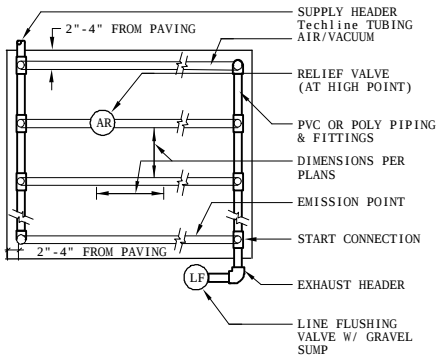


Techline LINE FLUSHING VALVE
W/ SHUT-OFF VALVE

SECTION - NO SCALE

Line Flushing Valve in Valve Box

Detail 8.01

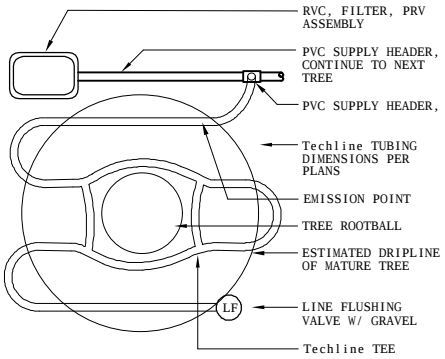


Techline TUBING & ACCESSORIES

SAMPLE LAYOUT

SECTION - NO SCALE

Detail 8.02



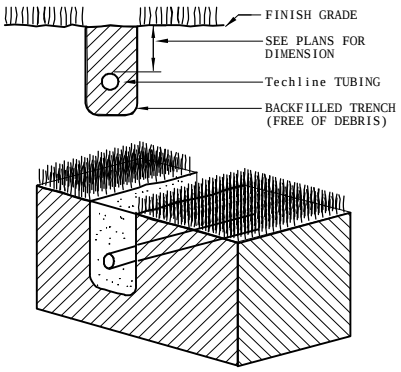
Techline TUBING & ACCESSORIES

FOR TREE PLANTING

SECTION - NO SCALE

Techline Sample Layout & Tree Planting

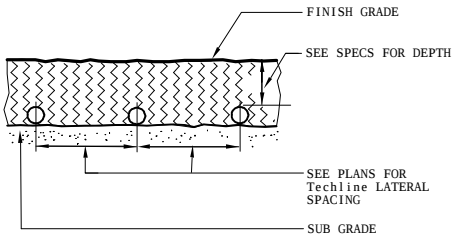
Detail 8.03



Techline TRENCHING

NO SCALE

Detail 8.04

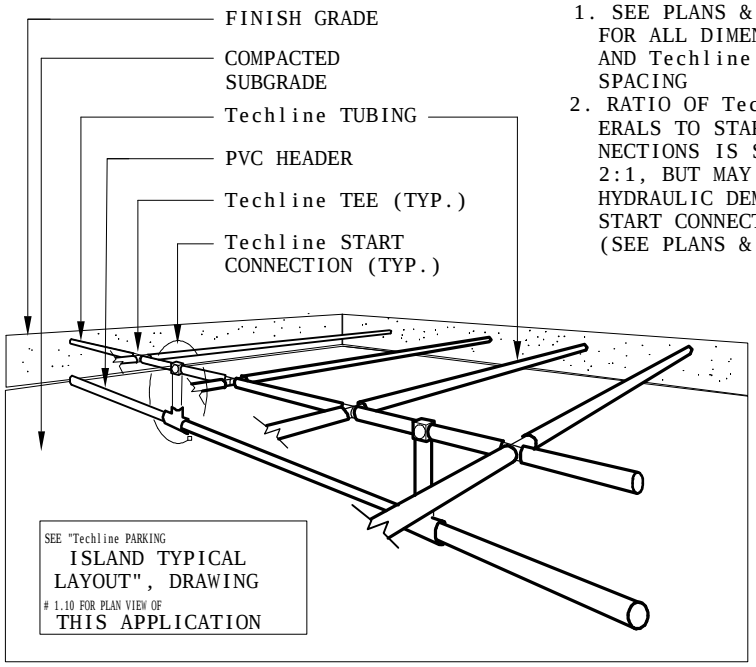


Techline SUBGRADE INSTALLATION

NO SCALE

Techline Trenching Sideview & Subgrade

Detail 8.05



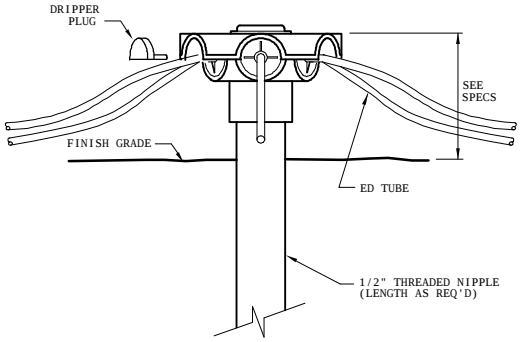
NOTES:
1. SEE PLANS & LEGEND FOR ALL DIMENSIONS AND Techline LATERAL SPACING
2. RATIO OF Techline LATERALS TO START CONNECTIONS IS SHOWN AT 2:1, BUT MAY VARY PER HYDRAULIC DEMAND ON START CONNECTION. (SEE PLANS & LEGEND)

Techline SUB-HEADER INSTALLATION

NO SCALE

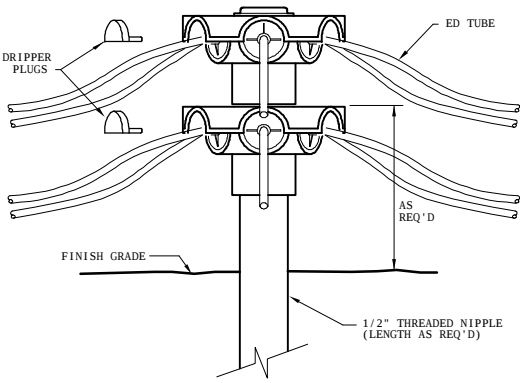
Techline Sub-Header Installation

Detail 9.01



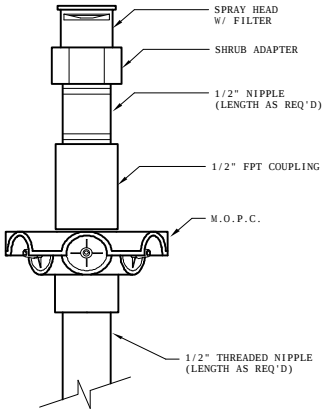
M.O.P.C.
ABOVE GRADE INSTALLATION
DETAIL - NO SCALE

Detail 9.02



M.O.P.C. & M.O.P.C.S.
ABOVE GRADE INSTALLATION
DETAIL - NO SCALE

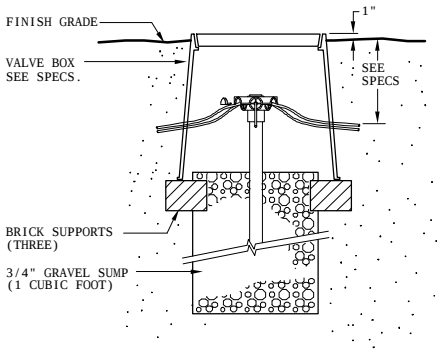
Detail 903



M.O.P.C.S. WITH SHRUB MOUNT SPRAY HEAD
DETAIL - NO SCALE

MOPC Above Grade

Detail 9.04

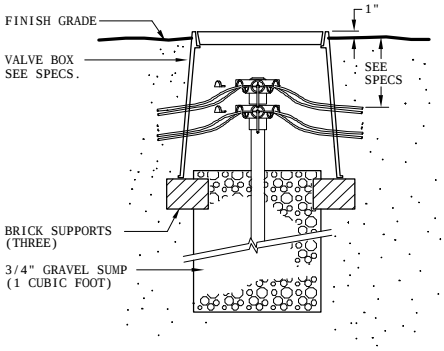


M.O.P.C.

BELOW GRADE INSTALLATION

SECTION - NO SCALE

Detail 9.05



M.O.P.C. & M.O.P.C.S.

BELOW GRADE INSTALLATION

SECTION - NO SCALE

MOPC in Valve Box

Detail E.01

Techline TLELL ELBOW

DETAIL - NO SCALE

Detail E.02

Techline TLCOUP COUPLING

DETAIL - NO SCALE

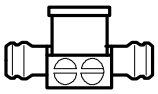
Detail E.03

Techline TL075MA MALE ADAPTER

3/4" MPT

DETAIL - NO SCALE

Detail E.04

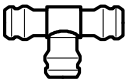


Techline TL075FBTEE TWO-WAY ADAPTER TEE

3/4" FPT

DETAIL - NO SCALE

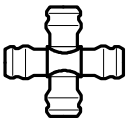
Detail E.05



Techline TLTEE TEE

DETAIL - NO SCALE

Detail E.06



Techline TLCROSS CROSS

DETAIL - NO SCALE

Detail E.07

Techline TL2607SMA "Y" 2-WAY ADAPTER

3/4" MPT

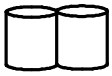
DETAIL - NO SCALE

Detail E.08

Techline TLDPLUG DROPPER PLUG RING

DETAIL - NO SCALE

~~Detail~~ E.09



~~Techline TLFIGS FIGURE 8 LINE END~~

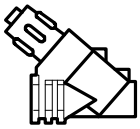
~~DETAIL - NO SCALE~~

~~Detail~~ E.10

~~Techline TLPRESS WATER HOSE VIEW SAMPLE~~

~~DETAIL - NO SCALE~~

~~Detail~~ E.11

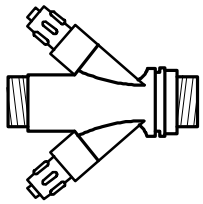


~~Techline 3/4" PRESSURE REGULATOR~~

~~DETAIL - NO SCALE~~

Fittings, Components, PRV

Detail E.12



Techline 1-1/2" PRESSURE REGULATOR

DETAIL - NO SCALE

Detail E.13

Techline TL6 WIRE STAPLE (6")

DETAIL - NO SCALE

Detail E.14

Techline TLSOV SHUT-OFF (BARB 1 BARB)

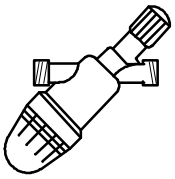
DETAIL - NO SCALE

Detail E.16

Techline TLAVRV AIR/VACUUM RELIEF VALVE

DETAIL - NO SCALE

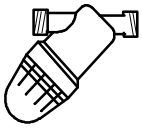
Detail E.17



Techline 3/4" THRU 1" DISC FILTER

DETAIL - NO SCALE

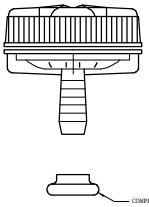
Detail E.15



Techline 1-1/2" THRU 2" DISC FILTER

DETAIL - NO SCALE

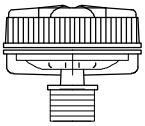
Detail E.18



Techline F-TLFV-1 W/ BARBED FITTING

DETAIL - NO SCALE

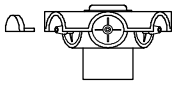
Detail E.19



Techline TLFSOMFV-1
W/ 1/2" MPT FITTING

DETAIL - NO SCALE

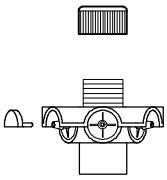
~~Detail~~ E20



M.O.P.C

DETAIL - NO SCALE

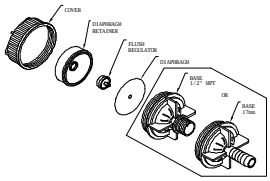
~~Detail~~ E21



M.O.P.C's
STACKABLE BUFFER

DETAIL - NO SCALE

~~Detail~~ E22



~~Techline LINE FLUSHING VALVE~~
EXPLODED VIEW

NO SCALE

Fittings, PRV, Line Flushing Valve, Filter, A/VRV, MOPC

TECHLINE IN TURFGRASS

Techline has been used successfully in turf grass for over 9 years.

It is in the 6th year of extensive tests at the Center for Irrigation Technology (CIT) in Fresno, California with the intiation of subsurface irrigation feasibility beginning in 1989.

It is a popular choice in high traffic areas, such as parks, and has even been used
successfully in composition tennis courts.

The CIT tests were designed to test the ability of subsurface irrigation to grow turf, as well as recommending emitter rates as well as spacings. The results have shown that irrigating with dripperlines below the surface can be an effective method for growing turf, regardless of the climate.

Why use Techline in Turf? The following are several places where using Techline makes good sense:

1. Turf areas in medians. The issue here includes getting roadways wet, and possibly creating
   a slipping hazard, or other hazards to vehicle traffic.
2. Turf close to ground level windows. Wet windows, even if not called out as an issue, are.
3. Turf in narrow strips. The ability to irrigate areas with less water is important in long narrow areas where either getting the water is hard, or zoning the area is difficult.
4. Turf areas in locations like auto dealers, where wetting cars or other outdoor displays is not desirable.
5. High wind, or constant wind.
6. Areas where sprinkler heads sticking up is a liability. Even the best sprinklers on the market can stick up.
7. Turf areas where vandalism is a potential.
8. Odd shaped areas close to a building. Many building designs have shapes that make it hard to irrigate with overhead sprinklers. Installing Techline and moving away from the building before installing rotors can help make the design easier.
9. Areas where staining of buildings or hardscapes can occur. Iron in the water for instance can stain concrete or brick.
10. Bleaching of hardscapes such as wooden fences.
11. Steep slopes, where overhead watering could cause wash outs.
12. Odd shaped areas where standard irrigation cannot be easily employed.
13. Locales where cost of water is too expensive for standard overhead irrigation. (SSDI is typically 90 % + efficient vs. 50 % -60 % with overhead irrigation).
14. Graywater application or fertigation applications where throwing watering is illegal.

TECHLINE IN TURFGRASS

Tips for using Techline in a sodded lawn:

1. Follow catalog recommendations for turf
2. Bury the Techline 4" below final grade. In areas where mechanical aeration will be used, bury the Techline 6" below final grade.
3. When installing the sod, it is imperative that the final grade is smooth, ensuring that the sod makes solid contact with the soil.
4. Thoroughly wet the sod with overhead irrigation, and roll the sod with a hand roller to ensure good contact.
5. Set the zone to run as required, and keep those wetted from above until the roots establish. Once you cannot pull the edges of the sod up, you can discontinue overhead watering.
6. Irrigate daily.

Tips for using Techline in a seeded lawn:

1. Follow above recommendations.
2. Discontinue overhead watering when entire area shows sprouting.

ACID TREATMENT OF DRIP IRRIGATION

By NETAFIM Research and Development Department

GENERAL

Treatment with acid is mainly needed to dissolve precipitates of lime (calcium carbonate) formed in the irrigation system. It might be used to clean the drippers' water passages from other mineral deposits like ferric oxides. This does not treat algae and other organic matter problems.

TYPE OF ACID:

To save money, concentrated and inexpensive technical acids should be used, such as concentrated technical hydrochloric, nitric of sulfuric acid. Phosphoric acid, applied as fertilizer through the drip system, might, under certain conditions, act also as a preventive measure against the formation of precipitates.

SAFETY PRECAUTIONS:

Contact of the acid with the skin can cause burns. Contact with eyes could be extremely dangerous. During treatment, and especially when filling containers with acid, wear protective goggles, clothes and boots. Follow the instructions on the Material Safety Data Sheet (M.S.D.S.) attached to the delivered acid.

PROBLEMS OF CORROSION:

Polyethylene and PVC tubes are resistant to acid.

Aluminum, steel (with or without inner concrete coating) and asbestos-cement pipes are damaged by corrosion. In every case, resume normal water flow through the system after completion of treatment for at least one hour in order to flush any remaining acid. The importance of flushing cannot be over emphasized when the pipes used are particularly sensitive to corrosion.

METHOD OF OPERATION:

Acid can be applied through the drip-irrigation system by a fertilizer pump resistant to acids or by conventional control head with a fertilizer tank.

APPLICATION OF ACID BY FERTILIZER PUMP:

The goal of acid treatment is to lower the pH level of the water in the irrigation system to values between two to three for a short time (twelve - fifteen minutes). This is achieved by injection of a suitable quantity of acid into the system.

ACID TREATMENT OF DRIP IRRIGATION

INSTRUCTIONS:

1. Clean the filters.
2. Flush the system with clean water as follows: flush the main pipes, then the distribution pipes and finally the drip laterals. Use the highest pressure possible for flushing. Deactivate the pressure regulators and flush the laterals, a few at a time. (Netafim pressure regulators can be deactivated by Pressure Regulator Annulers.) REMEMBER! Effective flushing with clean water will prevent blockages during treatment.
3. Ascertain the discharge of the water from the system through which the acid will be injected, and the discharge of the fertilizer pump.
4. Calculate the required amount of acid that should be injected into the system in order to get 0.6% of acid concentration in the irrigation water.
5. Inject the acid into the system within fifteen minutes only after the system has reached maximum operation pressure.

NOTE: Acids suitable to be injected in 0.6% concentrations are:

Nitric acid	60%
Phosphoric acid	75%-85%
Sulfuric acid	90%-96%
Hydrochloric acid	30%-35%

It seems as if the most economical acids are sulfuric acid (battery acid) and hydrochloric acid (swimming pool acid).

CALCULATION METHOD:

The injection rate of the acid to the treated zone can be figured in the following way:
{FLOW IN G.P.M.} X {0.36} = {INJECTION RATE IN G.P.H.}
For example:
Flow = 100 g.p.m.
100 x 0.63 36 g.p.h.

1. Question: What amount of acid (in gallons) is required?

Answer: Since the acid should be injected for only fifteen minutes, the total gallons of acid to be used will always be a fourth of the injection rate.
For example: 36:4 = 9 gallons.

NOTE: Under certain conditions, i.e., hard water with a very high pH, there might be a need to raise the acid concentrate in the system to 1%. Please consult a Netafim Representative prior to such a treatment.

IRRIGATION SCHEDGULING

California Department of Water Resource, Division of Local Assistance

CIMIS IRRIGATION SCHEDULING

Good irrigation management is required for efficient and profitable use of water for irrigating agricultural crops and turfgrass. A major part of any irrigation management program is the decision-making process for determining irrigation dates and/or how much water should be applied to the field for each irrigation. This decision-making process is referred to as irrigation scheduling.

The following is a short description of the water budget method of irrigation scheduling, and how to use CIMIS ETo to help determine irrigation schedules.

Water Budget Method

The water budget method is simply an accounting procedure similar to the bookkeeping required to balance a checking account. If the balance on a given date and the amounts of transactions are known, the balance can be calculated at any time. In addition, the time when all funds would be withdrawn can be determined so that an overdraft is avoided.

For irrigation scheduling, soil water content is balanced. The amount of water that is lost as crop evapotranspiration (ETc) is analogous to writing checks. The water that enters the soil reservoir (as rain or irrigation) is analogous to depositing funds in a checking account. By keeping records of these transactions, it is possible to know how much water is in the soil reservoir at anytime.

The initial balance can be determined by direct observation or assessed after a thorough wetting of the soil by irrigation or winter rains. Daily quantities of ET are depleted until the soil water has been reduced to a desired level. At that point an irrigation should be applied with a net amount equivalent to the accumulated ET losses since the last irrigation. The soil profile is thus recharged to full capacity, and the cycle begins again. If full recharge is not desired or not possible, the new balance can be determined from the net irrigation amount or by field observations. This method, however, may not work well at locations where contributions to crop ET from a water table or other source cannot be quantified.

Field capacity is the quantity of water stored in a soil volume after drainage of gravitational water. Only a portion of the water content can be potentially removed from a volume of soil by a crop and this quantity is called "available water". The amount of available water within the crop root zone at any given time is often called "soil moisture reservoir". Unfortunately, only a fraction of the reservoir is readily available to the crop without water stress.

A major goal in good irrigation management is to prevent yield reducing crop water stress by maintaining the soil water content above a certain level. This is

IRRIGATION SCHEDGULING

done by keeping track of soil water content and knowing how dry the soil can get before yield reducing crop stress will occur (referred to as the yield threshold depletion or YTD). The value of the YTD is mainly dependent upon the crop sensitivity to stress and root density. The ultimate choice of how much water to deplete before an irrigation is made by the irrigation manager and may depend on cultural practices, labor, water deliveries or other considerations. YTD is simply a limit for soil moisture depletion.

Crop water use can be calculated with reference evapotranspiration (ETo) from CIMIS and a crop coefficient (Kc) as ETc = ETo x Kc. These ETc estimates can be used to determine day by day soil water depletions from field capacity and thus can be used to schedule irrigations. Table 1 is a sample of how a water budget would be calculated for a seed alfalfa field with a YTD of 2.6 inches.

TABLE 1. Water budget scheduling example for seed alfalfa with a yield threshold depletion (YTD) of 2.6 inches.

Date	Effective Rainfall (inches)	Irrigation (inches)	Crop ET (inches)	Available Water (inches)
July 1			2.50	
2	0	0	.30	2.20
3	0	0	.19	2.01
4	0	0	.22	1.79
5	0	0	.28	1.51
6	0	0	.25	1.26
7	0	0	.26	1.00
8	0	0	.28	0.72
9	0	0	32	0.40
10	0	0	.36	0.04
11	0	2.50	.40	2.14
12	0	0	.22	1.92
13	.42	0	.11	2.23
14	.25	0	.15	2.33
15	0	0	.25	2.08

The budget record begins on July 1 with the total water content at field capacity. On each day, ETc is added to the depletion on the previous day to obtain a new depletion value. A net of 2.50 inches was applied on July 11 because the depletion from field capacity was going to exceed 2.6 inches on July 12. Effective rainfall, or amount of rainfall that contributes to the the soil reservoir on July 13 and 14 was recorded and the depletion was adjust accordingly.

IRRIGATION SCHEDGULING

Irrigation System Efficiency

The water budget method of irrigation scheduling can be used to determine when an irrigation should occur and how much water to replenish. It does not by itself determine how much water should be applied through the irrigation system or how long the irrigation system should be operated to apply the water. Determining the amount of water to actually apply through the irrigation system is done by dividing the amount of water required to replenish the soil reservoir by the efficiency of the irrigation system. Water that runs off the field or percolates below the root zone due to no uniformity of the irrigation system does not contribute to the soil reservoir. For example, if 30 percent of the water applied runs off the field or percolate below the root zone, the irrigation efficiency is 70 percent and the required applied water for the July 11 irrigation would be:

2.50 inches / 0.70 = 3.57 inches

Therefore, the grower should apply a depth of approximately 3.6 inches to replenish the soil reservoir over the entire field. Any application of water over 3.6 inches would result in either excess runoff or percolation below the root zone.

Determining the efficiency of an irrigation can only be done accurately by a system evaluation during an irrigation. Depending on the design, maintenance and management of an irrigation system, the efficiency can vary substantially. There are several government agencies and private consultants who can perform these evaluation

Normal Year Irrigation Schedules

A good planning tool for an irrigation manager is a normal year irrigation schedule. This is an irrigation schedule for a specific field and crop that is based on historial weather data. This schedule can be developed before the irrigation season and can be used to estimate when irrigations will most likely be needed during the season.

A normal year schedule can be updated during the irrigation season using current ETo information. This will result in changes in irrigation dates or amounts that reflect current conditions. For example, lower than normal ETo values would result in either more time before the next irrigation or a smaller amount of required water for the same irrigation date. This updating can be done on paper or by using a computer system.

Determining How Many Point Source Drippers to Use

While dripperline technology is now a more frequently used method of irrigating, there are still instances where point source drippers are designed or specified for large plants and trees.

Determining the number of drippers to use is frequently a function of using hard-to-find formulas, which few people want to do.

While soil, climate, and location factors should always be considered in determining the actual number and location of drippers, this chart will give you a close estimate of how many 1 GPH drippers to use.

Feel free to contact us any time you have questions. Call 1-888-NETAFIM,
or visit us on the web at www.netafim-usa.com.

QUICK ANSWER GUIDE

Welcome to the Netafim-USA Landscape Division Quick Reference Guide. This guide is designed to answer some of the most frequently asked questions.

We recommend that all sales and counter team members review this and that a copy be kept with all sales people and on the counter.

Why Sell Netafim Landscape Products?

- Netafim is the number 1 drip and low volume irrigation products manufacturer in the world
- Netafim is the 2nd largest irrigation company in the world
- Netafim opened the first commercial drip products factory, and created commercial viability for drip technology
- Netafim is the only company with a complete line of continuous, self-flushing products
- Netafim products are very high quality, coming to Landscape from Agriculture, where the applications are more severe, and where the products have been used for a number of years.

What Will I Be Selling?

Most of your sales will be Netafim dripperline products, among them Techline and Techlite, as well as the products that support them.

You will also be selling point source drippers, Netafim's Aquanet DC valves, Motorola AC and DC controllers, moisture sensing and control equipment, as well as a full line of filtration equipment.

What is Techline?

Techline is polyethylene pipe with drippers attached to the inside wall of the pipe. It is used in:

- Planting beds,
- Shrubs and groundcover,
- Turfgrass,
- Plants that shouldn't have water on the leaf or flower, such as roses,
- Retrofits of fixed spray and bubbler zones,
- Irregular shaped areas,
- Slopes,
- Vandal prone areas,
- Water window issue areas,
- Areas where water can cause staining or bleaching,
- At-grade windows,
- Low pressure or low volume areas,
- Car dealerships or parking lots where overspray is not allowed, and
- Areas where the soil is too hard to dig in

QUICK ANSWER GUIDE

In short, anywhere you can use fixed sprays and rotors and many places where you can't.

What is Techlite?

Techlite is non-pressure compensating dripperline and is used for on-surface applications.

It is available in 17mm, 12mm, and 8mm. These sizes allow the user to choose the correct size for the area being irrigated, allowing for a cost-effective and easy-to-install on-surface system.

Because Techlite is non-pressure compensating, it is only used on-surface. Its purpose is to help you compete effectively with the broad variety of low cost dripperline products available. Techlite's competitive price ensures that a sale isn't lost to price.

Are Techline and Techlite Easy to Install?

Yes. The Netafim Landscape catalog has 3 charts on page 5 for choosing and applying Techline. They show which model of Techline to use, how far apart rows should be, what the application rate is, and how long to irrigate to apply ¼" of water. Charts also show you how long a length of Techline can be as well as what the flow rates per 100' in both GPH and GPM are.

A frequently used type of Techline is TLDL6-18025. This is Techline dripperline (TLDL) using the .6 GPH emitter with the drippers spaced 18" apart. The "025" means the roll of dripperline is 250' long. On page 5 you will see that this model will be most often used in loam soil for shrubs and groundcover.

Over 60% of the time contractors will lay the Techline (or Techlite) on-surface, put soil staples in the ground to hold it down (one for every 5' in clay, 4' in loam, and 3' in sand and 2 staples on each tee, elbow or cross) and cover it with mulch. You can also bury Techline evenly down to about 6".

Whether the contractor uses Techline or Techlite, he/she will have installed a better way to irrigate. And without having to trench or dig in the area, contractors save valuable time and money, which translates to greater profits and increased jobs won.

How Far Can I Run Lengths of Techline?

A long way! The chart on page 5 called "Techline Maximum Length of Laterals" shows how far a length of Techline can be, (similar charts are available for Techlite on pages 8 – 10) as well as how much pressure it takes to make that length of Techline run properly. This chart also acts as a friction loss chart, and helps the contractor or designer easily determine what pressure the PRV should have.

QUICK ANSWER GUIDE

It is important to remember that the lengths shown are for *each row of Techline, **not** the combined length of all of the Techline in the grid.* If you have enough water, you can have any number of rows of Techline connected with supply and exhaust headers.

How Far Can I Run Lengths of Techlite?

Refer to the charts on pages 8 - 10 in the catalog to determine the maximum length of run. The maximum lengths of Techlite will be less in zones where Techlite runs uphill from the source. In zones where Techlite runs downhill from the source, run lengths increase.

We have determined the maximum length of the Techlite as a function of how much water the last dripper puts out vs. how much water the drippers closet to the source put out.

Our charts are based on the last dripper putting out 90% of the first dripper. Run lengths of Techlite may be longer than the guidelines chart, but there will be more than a 10% difference in dripper flows at the end of the line.

Does Techline Have To Be Buried?

No. Many contractors install it on-surface and cover it with mulch. Techline is UV resistant. However, because it is pressure compensating, it can be buried evenly up to 6" deep.

Can Techlite Be Buried?

No. It is an on-surface product designed to be laid on-surface, typically under a mulch cover.

How Long Will Techline and Techlite Last?

Techline and Techlite are made from linear polyethylene, like many other products in the irrigation industry. There is no reason why they won't last as long as, and probably longer than any other component in the system.

Warranty

The warranty for all Netafim Landscape Division products is inside the back cover of the catalog.

The warranty for Techline and Techlite is in two parts. The poly pipe is warranted against environmental stress cracking for 7 years. The drippers are warranted for 2 years.

QUICK ANSWER GUIDE

Do I Need A Special Controller to Apply Enough Water?

No!!!!!!!! Look on page 5 of the catalog at the General Guidelines Chart. It shows that .6/18" Techline on 18" rows will put down .42" per hour. To apply an inch of water means running the zone for less than 2½ hours a week, which is just over 20 minutes a day.

Frequency of Watering:

Daily, or every other day. Once a soil profile is properly wetted, it should stay wetted. This keeps the soil stable, eliminates soil shrinking, and develops the deepest roots possible.

Can I Put Techline on a Zone With Sprays or Rotors?

While it is physically possible, it isn't recommended. Techline, Techlite and drip products have "irrigation efficiencies" that range from 80% in arid parts of the country, to 95% in cooler climates of the U.S. and Canada. This percentage equates to the amount of water reaching the root zone of the plant.

In contrast, overhead irrigation ranges from about 30% to 60%. The reasons why overhead is less efficient include:

- water that evaporates in the air before it hits the ground,
- water that hits the ground but dries on the leaf,
- run off,
- overspray,
- wind loss, and
- water that gets into the soil, but not to the root zone.

Because of these efficiency differences, data for fixed sprays and rotors in irrigation catalogs are overstated. To actually achieve the stated application rate in the catalog, run times must be increased. For example, if catalog specs say a rotor is applying 0.40 inches per hour, and you are in an area where efficiencies are about 50%, you are actually only delivering ½ (0.20") the water stated.

In the case of Techline subsurface irrigation, you may be applying water at a 95% efficiency, meaning that the actual water being delivered is only 5% less than what is stated.

Therefore, it can be difficult to equate catalog data for sprays and rotors to catalog data for Techline, and hence, place overhead and dripperline products on the same zone.

QUICK ANSWER GUIDE

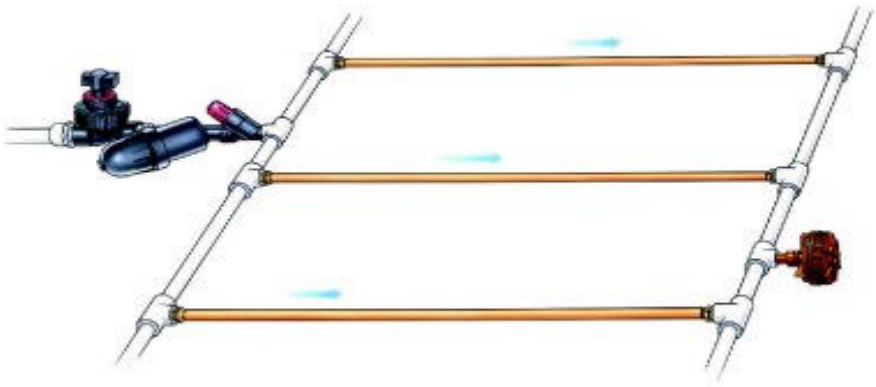
How Do I Calculate How Much Flow the Zone Has?

Page 5 of the catalog..."Flow Per 100 Feet".

Rules of thumb:

1. With .6/18" - About .68 GPM per 100' of Techline used
2. With .9/12" - About 1½ GPM per 100' of Techline used

What is a "Grid"?



Throughout our literature we show and discuss grids. Grids are simply a series of laterals of Techline tied together with Supply and Exhaust Headers.

We use grids, especially in subsurface applications to ensure that water flows through the zone from all directions (loops). (See "How Easy is it to Repair?")

Is it Necessary to Always Use A Grid?

No. However, using grids makes fixing breaks a snap. (See "How Easy is it to Repair?")

Also see The LITE Method

How is a Grid Put Together?

Most of our literature shows grids with Supply Headers and Exhaust Headers made from PVC. These headers are supply lines that feed rows of Techline in a zone. The Supply Header sends water down the Techline laterals, and the Exhaust Header completes the loop. These headers can just as easily be made from ¾" or 1" poly, Techline blank tubing (TLDL 001) or, they can be made from the regular Techline being used in the zone. *Using Techline or Techline Blank Tubing is especially advantageous in zones where the zone flow is under 5 GPM.*

QUICK ANSWER GUIDE

If Techline or Techline Blank Tubing is used for the grid's Supply and Exhaust Headers, it is possible to use Techline fittings without having to transition from Techline to PVC or poly. When the zone operates under 45 PSI, it also means that the contractor can use TL insert fittings without clamps.

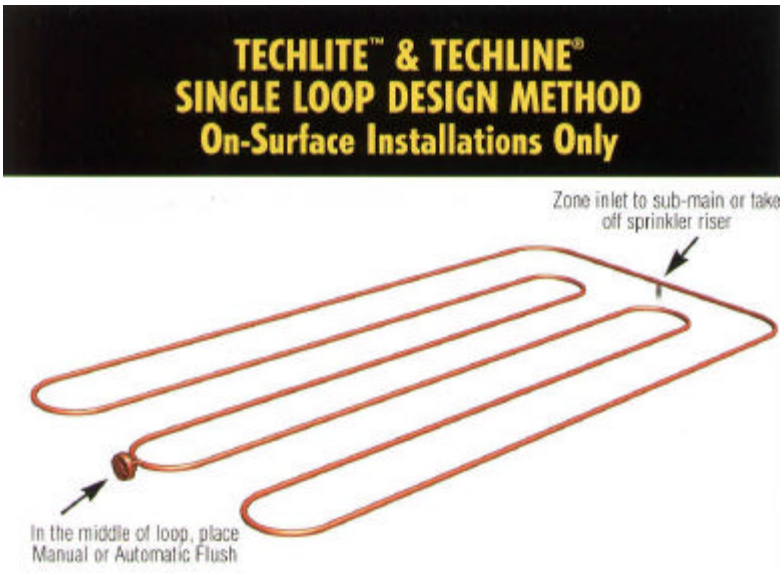
How Do I Choose the Correct Size Pipe for the Headers?

Our pipe sizing rules are the same as overhead irrigation. We believe that pipes should be sized so that velocities do not exceed about 5 feet per second.

Since Techline dripperline has an inside diameter of 0.57", it can move about 5 GPM at a velocity of not more than 5 FPS. That is why, if a zone of Techline does not require more than about 5 GPM, Techline or Techline Blank Tubing can be used for the headers.

Supply and Exhaust Headers are normally the same size and type of pipe.

The "LITE" Method:



In many on-surface applications we show Techlite or Techline snaking throughout a garden while only using 2 fittings. In other cases, a contractor may simply run Techline or Techlite along the front and back of a row of bushes. In these cases, the area does not require the use of headers. This type of on-surface layout is called the "LITE Method". Think of it as **"Labor Is Too Expensive"**, meaning that the installation time is greatly reduced, leading to greater installation efficiency and greater profits.

In other cases, a client may change plants in the garden frequently. In these instances Techline or Techlite can be snaked back and forth throughout the garden, allowing the client to move the dripperline as plantings change.

Do I Have to Use Techline or Techlite Fittings?

Techline fittings are designed to be used with Techline and 17mm Techlite dripperline without clamps under 45 PSI because of a special flared barb. Fittings for 12mm and 8mm Techlite are also available. With 12mm Techlite, no clamps are needed under 30 PSI; with 8mm Techlite, no clamps are needed under 25 PSI.

Though installation is quicker and less expensive with Techline or Techlite fittings, standard ½" poly insert fittings with clamps can be used, as well as Series 700 compression fittings with Techline and 17mm Techlite.

How Easy is Techline or Techlite to Repair?

Very easy!!!!! Fittings can be installed into tubing while the zone is running, making the repair of breaks quick, easy, and assured, since you can immediately see if it is repaired.

By using a grid layout, or the LITE Method, even if a break does occur, water can still flow to drippers downstream of the break. This helps keep the system operational, and minimizes the amount of debris that gets into the dripperline.

Once a repair is complete, most contractors simply disassemble the Line Flushing Valve, run the zone until the water comes out clean and free of debris, and reassemble the Line Flushing Valve.

Contractors should rely on grid layouts or the LITE Method to ensure the system runs optimally.

Techfilter:

Application: Techfilter is recommended for use with all new Techline subsurface installations.

Techfilter incorporates a chemical into the filter ring set of the disc filter. As water passes through the Techfilter, a very low dosage of the chemical trifluralin is transmitted throughout the Techline zone to all of the drippers. This technology provides very precise and even distribution of trifluralin throughout the piping network and effectively inhibits root growth into the dripper outlets. Proper application and use of Techfilter, including the required replacement of the filter ring set and registration of the warranty card with Netafim allows us to offer a 2-Year-to-Lifetime Warranty.

QUICK ANSWER GUIDE

Can Techfilter be Retrofitted Into an Existing Techline Subsurface System?

No. Netafim is required to sell Techfilter as a system. That is, the correct Techfilter and a required minimum number of feet of Techline must be purchased as a specific part number, at the same time.

How Do I Determine Which Techfilter to Use?

1. Determine which Techline you will be using from the General Guidelines Chart on page 5.
2. Go to the chart in the catalog at the top of page 7. This will show you which Techfilter to use based on the type of Techline and the number of feet of Techline in the zone.
3. Using the chart on the bottom of page 7, choose the correct model number to order.

What Other Components Are Used?

1. **Pressure Regulating Valves**

Application - Ensures the zone has constantly regulated outlet pressure.

PRV's are installed downstream of the remote control valve, or the remote control valve and filter, often in the same valve box.

Contractors will frequently install zones that use less than 5 GPM. (About 730 feet of .6/18", 500' of .9/18", or 1,000' of .6/24"). Therefore, many of the PRV's will be PRV075**LF**20 (Low Flow set at 20 PSI). See catalog page 15.

If zones are designed to flow between 3.5 GPM and 20 GPM, use the PRV075**HF**15, 25, or 45. The difference in which regulator to use refers to which Techlite dripperline is being used. If Techline is being used, it is usually easiest to use a 45 PSI regulator.

	LF15	LF20	HF15	HF25	HF35	HF45
Techline		x				x
17mm Techlite		x		x		
12mm Techlite			x		x	
8mm Techlite	x					

QUICK ANSWER GUIDE

Note: Always place the PRV downstream of the valve and filter. If you place a valve or filter downstream of the PRV, their friction loss(es) could cause the zone to lose needed pressure.

2. **A/VRV - Air/Vacuum Relief Valve**

Application – Subsurface Techline systems. Allows air to be expelled on zone turn-on, and allows clean air into the zone on shutdown. Protects drippers from drawing in contaminants or creating a vacuum.

Drippers release some water when the zone shuts off. This is normal, but it can lead to a vacuum. The A/VRV is installed at the zone's high point(s), and allows clean air into the zone.

On zone turn-on, the unit releases air so no air pockets exist.

3. **Line Flushing Valves**

Application - Automatic cleaning of the zone each time the zone is activated.

A Line Flushing Valve flushes about 1 gallon of water each time the zone comes on. It normally is buried in a 6" round valve box, with a bed of crushed stone under it to drain the water.

Because of potential sediment build-up inside the pipe, and because there could be particles in the pipe too large to exit through the drippers, the LFV flushes them each cycle.

Line Flushing Valves are normally installed at the far end of a zone because that is where the debris naturally moves to.

On zones with poly headers, or LITE Method installations on-surface, the TLFV-1 with the barbed insert is used most often. On jobs where the headers are made from PVC, the TL050MFV-1 unit with a ½" MPT thread is frequently used.

On very small zones, or where the flushing of about 1 gallon could cause flooding, a TLSOV (Techline Shut-off Valve) can be used. This is manually turned on and allowed to flush water several times a season. The TLFIG8 Line End can also be used.

QUICK ANSWER GUIDE

4. Filters

See the section on Filters

What About Pressure Requirements for Techline?

Get used to a new concept that will simplify your life. Techline pressure compensating dripperline emits water at the same rate whether the pressure is 7 PSI or 70 PSI. That is how we calculated the "Maximum Length of Laterals" chart on page 5.

The dripper housing contains a flexible diaphragm that regulates the pressure. It also helps release debris that gets into the dripper.

Using the guidelines on page 5, some drippers will have higher or lower pressures in the dripperline, but *THEY WILL ALL OPERATE THE SAME.*

What About Elevation Changes?

Elevation change, either up or down, is normally not a big concern.

Because pressure increases or decreases 0.433 PSI per foot of elevation change, a zone of Techline that has 20 feet of elevation change from the source will gain or lose 8.66 PSI, (20' x 0.433) not including the length of run friction losses. As long as the pressure stays between 7 - 70 PSI, the zone will operate properly.

Contractors should remember that long runs and elevation changes are cumulative, as with other methods of irrigation. Elevation changes that take pressure away will obviously shorten lengths of runs.

What About Low Pressure?

Remember the phrase " Techline - The Irrigation Problem Solver". Techline and Techlite are excellent products to use where pressures are too low to effectively run sprays or rotors.

Refer to the discussions above.

What About Well Systems, or Water From Ponds or Lakes?

Techline and Techlite can be used with various water supplies.

In some cases it may be necessary to have the water tested to ensure it does not have too much iron or other elements detrimental to the plants, trees, or turf.

QUICK ANSWER GUIDE

Techline and Techlite require a 120 mesh filter. 140 mesh filters are frequently used because they give an added measure of protection for the same price.

Unless other reasons exist, we recommend stocking either 120 mesh or 140 mesh, but not both. ¾" filters are a common size because they can support up to 13 GPM of zone flow.

Filter sizing and on-going maintenance is the key with well, lake or pond systems, but you should also be aware of any chemicals or compounds in the water.

What About Winterization?

The Netafim Preventive Maintenance handout offers specific information on winterizing procedures.

In general, we recommend blowing down the system with compressed air or simply use a gravity drain design. If compressed air is used, the pressure should be set no higher than the following:

Techline - 45 PSI
17mm Techlite - 45 PSI
12mm Techlite - 30 PSI
8mm Techlite - 25 PSI

Netafim Disc Filters:

Netafim filters are the finest filters in the world. The disc ring design ensures maximum straining area, and provides the longest time between cleanings of any filter on the market.

Most filters are a simple screen made from nylon or steel. The area of screening is only a few square inches, and when they are full of debris, they can restrict water flow, or collapse.

QUICK ANSWER GUIDE

Netafim filters have many times the straining area of simple screen-type filters because of the grooved disc design. They take much longer to load with debris, meaning the time between cleanings is dramatically increased. In fact, a Netafim ¾" filter has about 25 square inches of filtration area, and a 1" filter has 49 square inches! Even more important, the risk of the filter element collapsing is eliminated.

DF075-140 (below left) is a commonly sold unit. It has ¾" MPT threaded ends, and a 140 mesh ring set. Another ¾" filter frequently used is the DFV075-140 (below right). It has a shut-off valve for use as an emergency shut-off, as a means of cleaning the filter while the zone is under pressure, or simply to have a manual system.

How Do I Size a Filter for a Job?

Page 14 of the catalog has a chart showing how to size the filter based on flow of clean water. If you are working with lake water, well water, or other dirty sources, contact your Netafim Regional Sales Manager, or Netafim Customer Service toll free at 888.NETAFIM.

Where is The Filter Installed?

Filters are typically installed just downstream of the zone valve. Netafim filters have a max pressure rating of 120 PSI, and can be installed under constant pressure. If it is installed downstream of the valve, ensure it is upstream of the PRV.

What is the Correlation Between Mesh and Micron Size?

Technically there is no direct correlation. However, a certain mesh size does relate to the micron size of particles the filter catches.

The easy way to describe mesh - Think of a screen in a window or door. Mesh refers to how many vertical or horizontal strands of wire per square inch are used. The higher the mesh, the greater the number of strands that make up the screen and therefore the smaller the particles it can catch.

QUICK ANSWER GUIDE

Filter disk ring sets are color-coded to make it easy to determine mesh size.

Mesh	40	80	120	140	200
Micron	400	200	130	115	75
Filter Mesh Color	Blue	Yellow	Red	Black	Grey

How Often Should the Filter be Cleaned?

The easy answer is whenever it's dirty. The technical answer is whenever the pressure difference across it is 5 PSI or more. A contractor that is new to using Techline or Techlite may go back to a job every couple of months until he establishes how frequent disk cleaning needs to be. On many domestic systems, annual cleaning may suffice.

Backflushing a Netafim Filter:

When water is run backward through a Netafim disc filter, it can clean itself. This can be done manually or automatically, and eliminates the chance of not being cleaned often enough, especially in situations where odor or location may cause some reluctance to clean it.

When the water flow is reversed, the spring in the filter's cone is forced to compress. This allows the discs to separate slightly. With water flowing backward across the rings, debris is flushed free, and dumped to atmosphere.

How Large Do Netafim Filters Get?

Filters are available from ¾" through 12", and can filter up to 3,400 GPM. Call your Netafim RSM or Netafim Customer Service in Fresno if you need more information on the complete line of Netafim filters.

Point Source Products:

Netafim has an extensive selection of point source drippers in pressure compensating and non-pressure compensating models.

These drippers are typically used in:

- Wide spaced plantings,
- Containers
- Hanging baskets

The Tech Flow family of drippers are pressure compensating, have a built-in 5 PSI check valve and are available in a variety of styles.

The PC Jr family is a smaller version of the Tech Flow family with a 1.5 PSI check valve. Its small size makes it very inconspicuous.

The BD and WP families are non-pressure compensating drippers that are high quality, low cost solutions to point source applications.

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See catalog pages 20 and 21 for a complete review.

What Other Netafim Products Are Available to Us?

The entire line of Netafim products, including all Agricultural and Greenhouse products is available to Landscape distributors, *as long as the application is for landscape.* This includes Dorot valves from ¾" - 16" in all configurations, all filters and filter stations, media filters, spray stakes, and misting equipment.

It is always a good idea to check with us when you have a technical issue. Our Ag team, valve specialists and staff agronomists can help you through situations other companies are not equipped to solve.

Other Products Available:

1. Miracle Controller by Motorola:

Netafim offers 6, 9, and 12 station controllers in AC and DC. These controllers are designed, engineered and manufactured by Motorola, and offer customers the assurance of selling a high quality controller.

The DC controller requires no external power, and operates a sophisticated yet incredibly simple dirty water valve.

2. MSK:

The MSK is a standalone control system that operates a zone of sprinklers or dripperline without the need for a controller. It does this while measuring soil moisture on an on-going basis. If you have clients that are installing a system where no power exists, where there are no extra stations on a controller, or where extremely precise watering requirements exist, this product can solve the problem.

It operates for an entire season on one 9V alkaline battery.

3. PTW - Swing Pipe

Netafim sells 100' coils of PTW swing pipe. They are shrink-wrapped so a contractor can pull pipe from the center of the coil, and not have it unravel.

PTW swing pipe is dimensionally equal to other brands of pipe on the market, so all of the most popular fittings work with it.

QUICK ANSWER GUIDE

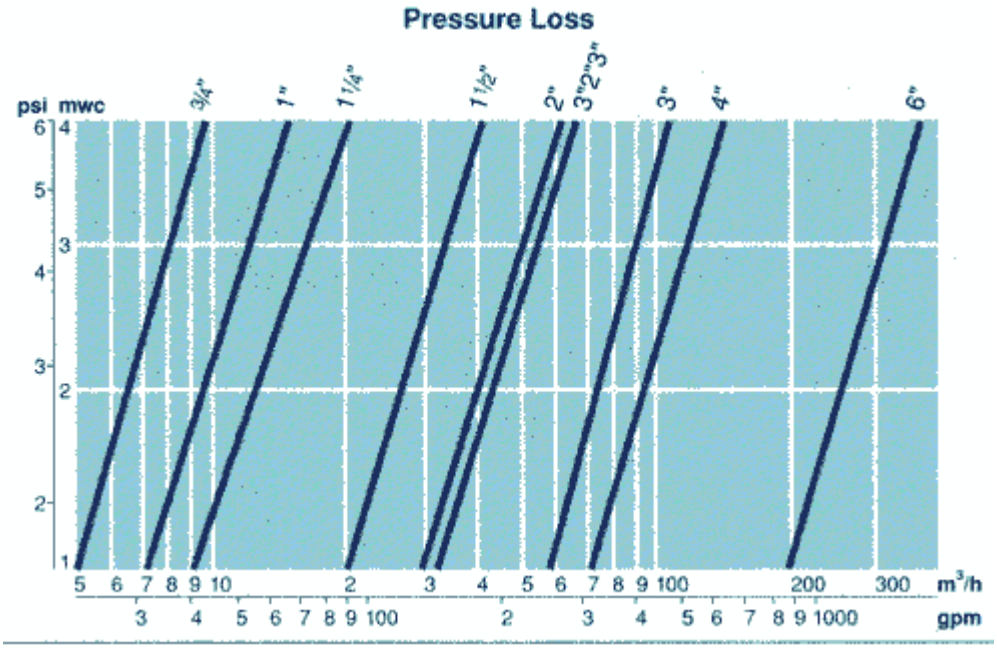
How Else Can Netafim Help Me?

1. Valves:

Netafim's valves are among the finest industrial valves in the world, with *friction losses lower than any valves currently in the landscape industry.*

They are available as:

- Manual
- 2-way
- 3-way
- Pressure reducing
- Pressure sustaining
- Quick reacting pressure relief
- Back flushing, and



- Surge anticipating

Valves range from ¾" - 16" in plastic, bronze, and epoxy-coated cast iron.

We can custom configure valves to your needs.

If you have a specific valve question, call us. We can help you through it.

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2. Marketing Support Materials:

A variety of materials, including:

- Catalog
- Price list
- Fact vs. Fiction Brochure
- Techline Design Manual
- Techfilter
- Sports Turf reprint showing Techline in turfgrass
- Store banners
- Product display headers
- Design details in .dwg and .dxf
- Sample Techline grid
- Seminar kits with samples of product for training needs
- PowerPoint disks
- Sample Bid and Performance Specs on disk
- Preventive maintenance instructions, troubleshooting and winterization instructions
- Project list
- Videos featuring:
  - Design, Maintenance and Installation
  - Techfilter, and
  - Fact vs. Fiction
- Web Page - An extensive web page on the Internet at **www.netafim-usa.com**. It has loads of information, including the complete catalog, order forms for more information, and an automatic calculator to quickly determine how much Techline to use.

Last But Not Least:

Your Netafim area manager can offer a significant amount of help as you develop and manage this side of your business.

Remember, this is the fastest growing segment of the Landscape irrigation industry. As such, you have a vested interest in becoming as proficient as possible in this type of irrigation, and Netafim products in particular.

NETAFIM USA
ADVANCING THE SCIENCE OF IRRIGATION

Typical Netafim Techline Layout – Tips and Recommendations

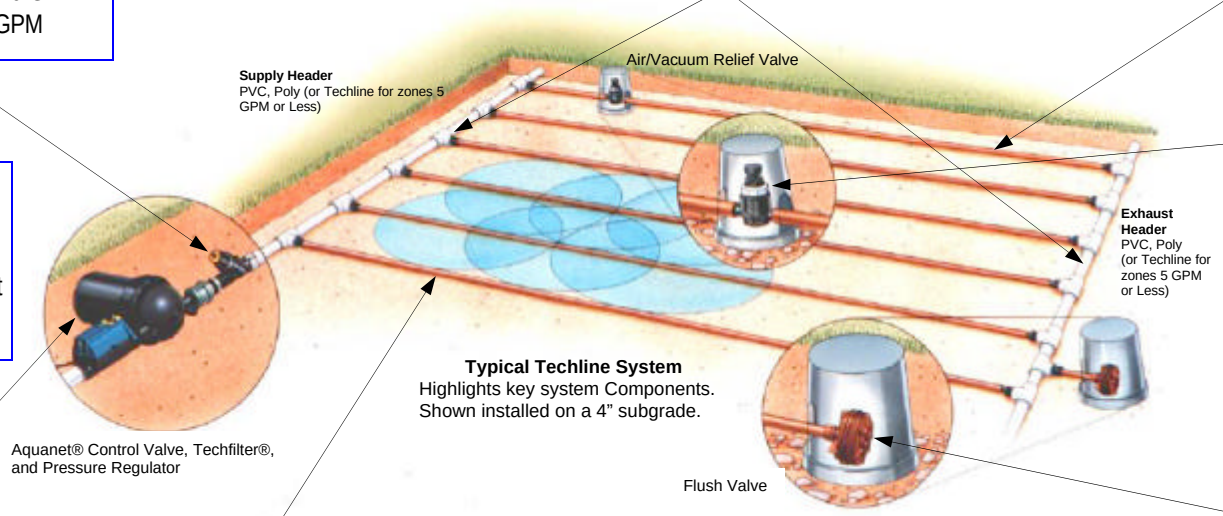
Techline can be installed on-surface, under mulch, or buried evenly up to 6".
***Use General Guidelines Chart** to select which Techline to use, and how far apart to space rows.*

Pressure Regulating Valve (PRV) - Install ***after*** the zone valve and filter.
- Use PRV075LF20 from 0.5 – 5.0 GPM
- Use PRV075HF45 from 3.5 – 20 GPM
- Use PRV15045 from 20 – 40 GPM

Supply & Exhaust Headers – Most often used in subsurface systems. They may not be necessary if Techline is laid on-surface. Use Techline, or Techline Blank Tubing for headers on zones under 5 GPM.

Start rows of Techline 2" from hardscapes and 4" from softscapes.

Estimating How Much Techline to Use - Multiply square footage of area x 12, and divide that number by how far apart the rows are (in inches).



Typical Techline System
Highlights key system Components.
Shown installed on a 4" subgrade.

A/VRV: Use on subsurface zones.
- Place A/VRV at high point(s) in zone.
- Place on a row of Techline or Techline Blank Tubing that is perpendicular to Techline rows. (Adjacent picture not accurate).

Filters – Can be placed before or after the zone valve.
- 3/4" Filter – Up to 13 GPM
- 1" Filter – Up to 22 GPM
- 1 1/2" Filter – Up to 35 GPM
- Use 120 or 140 Mesh
- Netafim sells a large variety of filters up to 3,600 GPM.

Staples – Use 1 **TLS6** staple for:
- Every 3' of Techline in sand, every 4' in loam, and every 5' in clay.
- Use 2 staples over each tee, elbow, or cross.
- ***Caution*** – Landscape fabric staples and other non-stainless steel staples rust away quickly, and are not recommended.

Fittings:
- Techline fittings are recommended. They are the fastest and most economical fittings to use, and do not require clamps at pressures under 45 PSI.
- 1/2" Poly insert fittings with clamps can be used.
- 700 Series compression fittings can be used.

Line Flushing Valves – Use one Line Flushing Valve for every 15 GPM of zone flow.
- TLSOV or TLFIG8 may be substituted.
- Normally placed along exhaust header or at the point farthest away from source.
- Install in a valve box with a gravel sump able to drain about 1 gallon of water.

For more information on Netafim products, call 1-888-NETAFIM, or www.Netafim-usa.com