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.

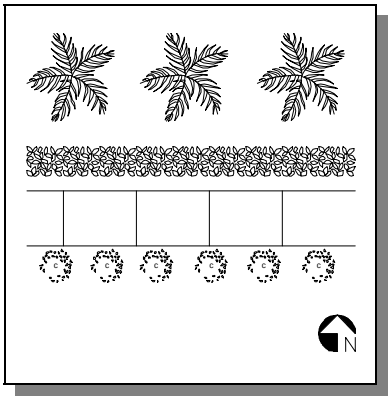
- Designing similar areas into a zone and not mixing dripper output and dripperline spacing is just like sprinkler design.

- 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

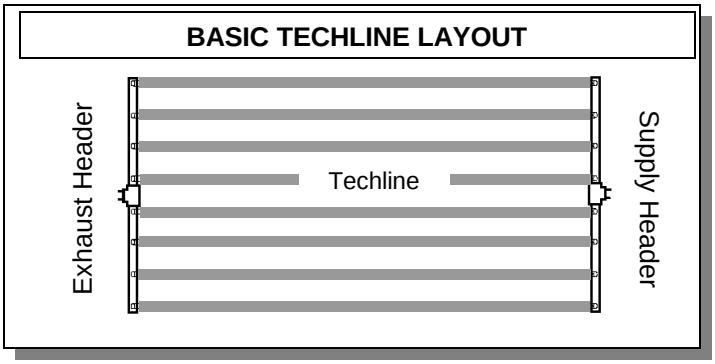
**Maximum Spacing Recommendations:*
Following these spacing guidelines, dripper flow selection can be increased if desired by the designer.

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).



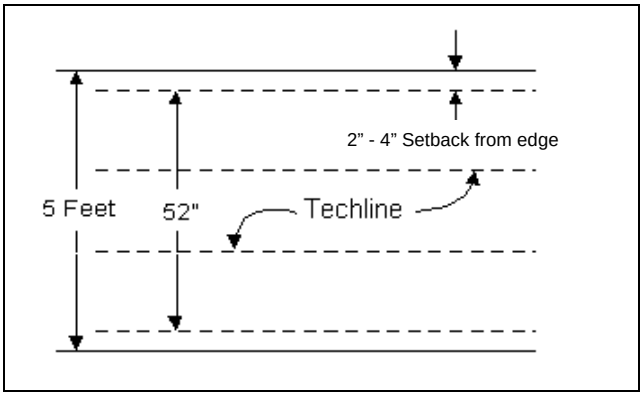
BASIC DESIGN STEPS (Continued)

• 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

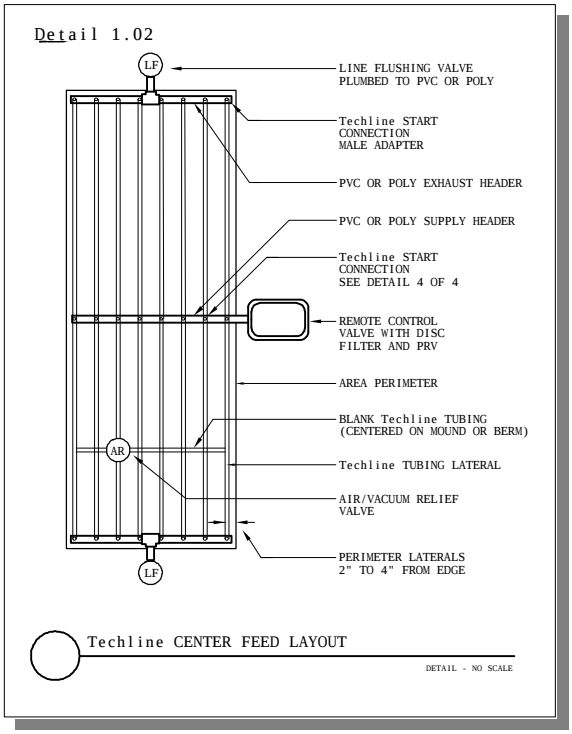
MAXIMUM LENGTH OF A SINGLE TECHLINE LATERAL

	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.



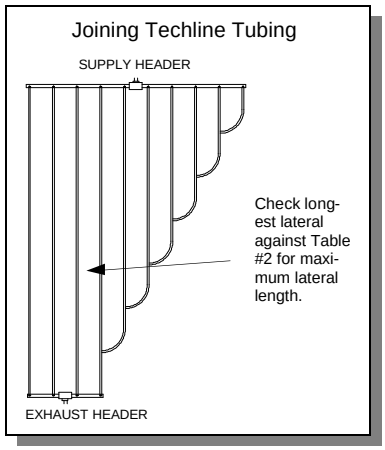
Center Feed Layouts:

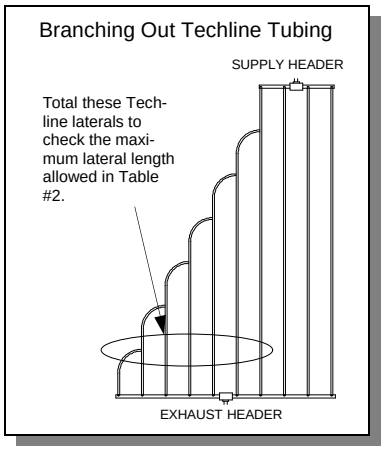
• Where layout flexibility exists, it is recommended that Center Feed layouts be used. This allows for the most even flow of water through the zone.

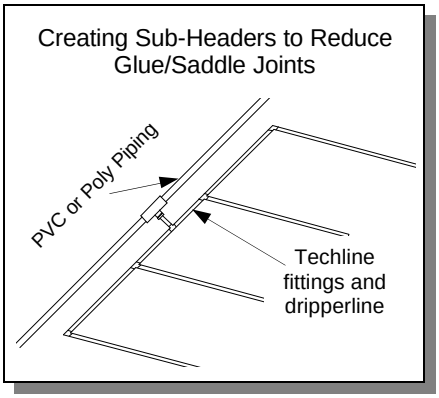
• Center Feed layouts also allow you to maximize the lengths of Techline that can be run.

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

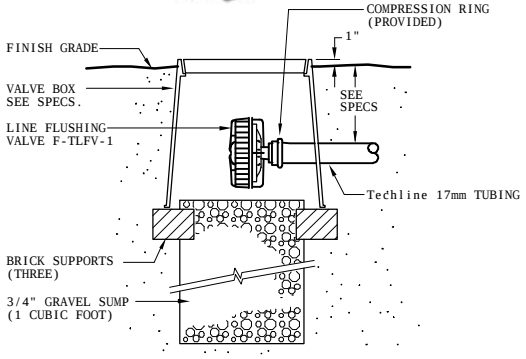
• Table #3 shows an easier method of calculating total zone flow. Total the quantity of Techline (in hundreds of feet) in your design and multiply that figure by the corresponding dripperline GPM to get an estimate of zone flow.

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:

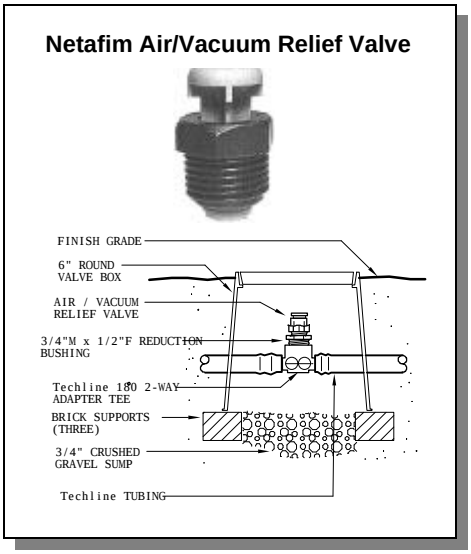
• Air/Vacuum Relief Valves are used for two reasons:

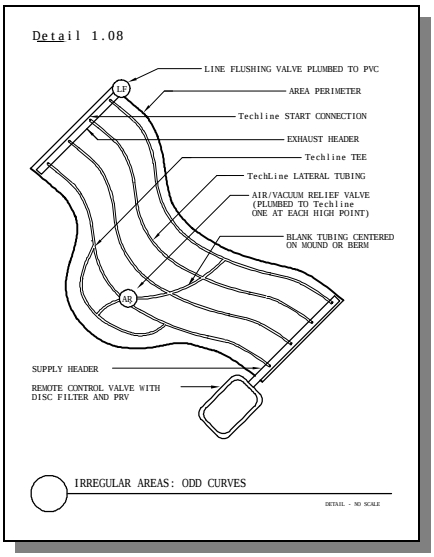
1. To freely allow air into a zone after shutdown. This ensures a vacuum doesn't draw debris into the Techline.

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.

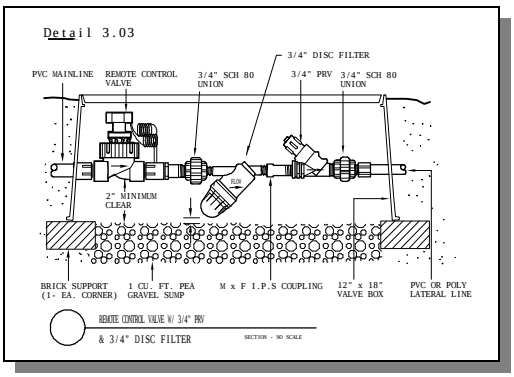
• Rule of Thumb: Use 140 mesh filters for Techline designs, and you will be well protected. Techline requires 120 mesh filtration, but since there is no price difference between the two filters, the use of a finer filter offers a little more protection.

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

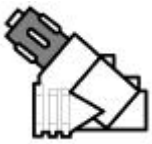
BASIC DESIGN STEPS (Continued)

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.

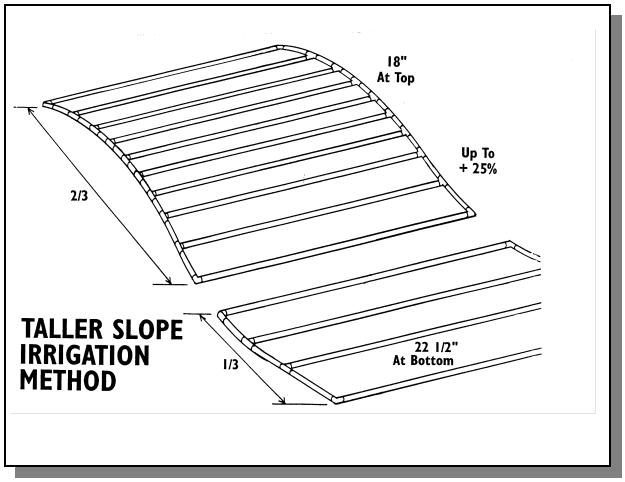
OR

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:

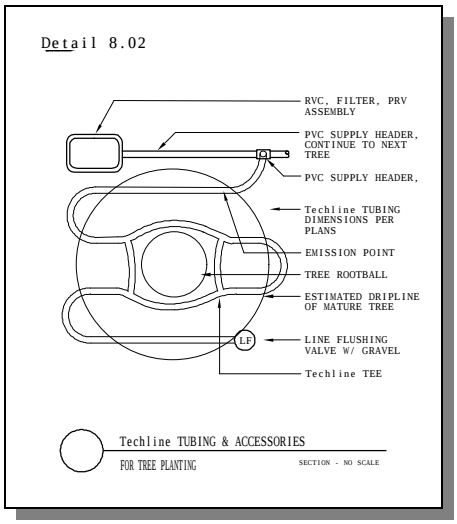
- Techline should be Installed perpendicular to slopes (more than 4%)
- Slopes present special circumstances because of how water moves through soil.
- In slope applications, run the Techline perpendicular to (across) the slope.
- In the upper 2/3 rd's of the slope, space the Techline per TABLE #1, Page 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".