Capillary Concrete drainage pipe and base

The subgrade must be firmly compacted and a minimum slope of 1% must be ensured throughout the base to an excavated trench in the subgrade, containing a perforated drainage pipe encased in a gravel envelope.

The trench must be placed in the lowest point of the base and should stop where the face of the bunker exceeds a slope of 5%. Great care must be taken to ensure that the trench follows the absolute valley of the bunker floor. Any water collecting hollows to even the slightest degree will hold water and possibly cause the sand to get too wet.

Trench with drainage pipe to exit location to be spaced at the following separation:

- 1-2% fall - every 5 meters or 16 feet
- 2-5% fall - every 10 meters or 33 feet
- Above 5% fall, no drain line required if drain lines are present at lower levels

Trenches should be excavated to allow a minimum of 1 inch of gravel surrounding the pipe. Additionally, the gravel should extent no less than 3 inches above the crown of the pipe to protect the pipe from crushing during installation work. The gravel should also be left 2-4 inches below the surrounding subgrade to allow for a thicker layer of Capillary Concrete on top of the trench. This means that for a 4-inch pipe, the trench should be 6 inches wide and 10 inches deep. As with other subsurface drain line trenches, the trench bottom should be firmed, smooth and have a uniform grade.

The gravel selected for filling of the trench should be USGA specifications for gravel sizing in putting greens. This is achieved by testing the bunker sand and the gravel to ensure that the smallest 15% of the gravel particles must have diameters no more than 5 times greater than the largest 15% of the bunker sand particles.

Pipe should be a minimum of 4 inches and on larger bunkers over 2 000 ft2 based on a drainage coefficient of 4 inches per hour in a drainage chart to avoid pressurization which can damage the system. Corrugated or smooth walled plastic pipe are both suitable pipe choices, but must be installed with a minimum of 0,5% fall to the outlet. A minimum flow velocity of at least 1,5 feet per second must be obtained to achieve self-cleaning of the pipe. Panel pipe set vertically in a trench containing an aggregate envelope can be used and require a narrower trench and less gravel over the crown of the pipe. In no cases should a geotextile fabric be used where water has to pass through the fabric prior to entering the pipe. As with every other subsurface drainage system, a bunker drainpipe must lead to a positive and protected outlet.