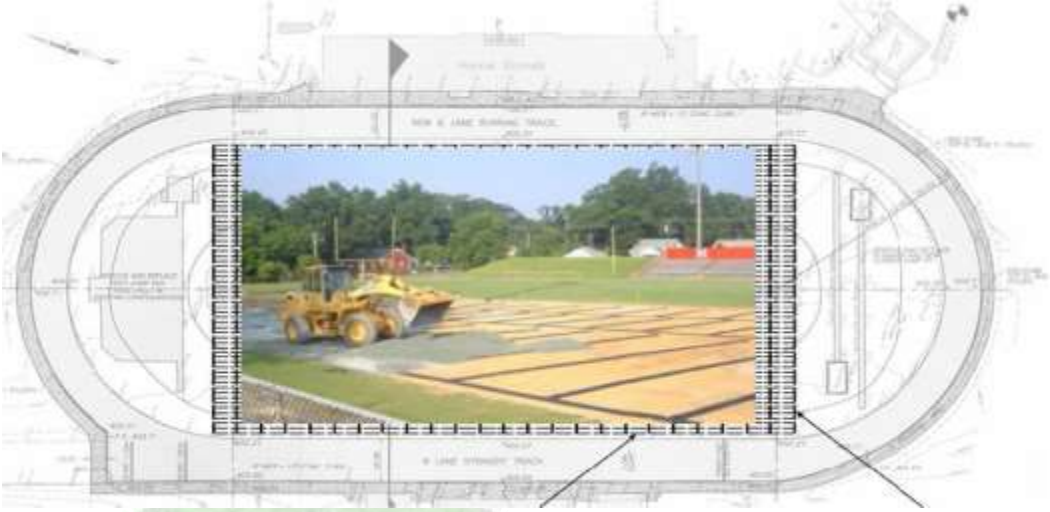
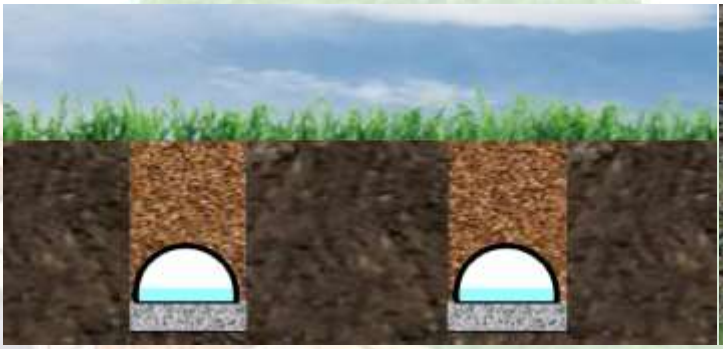
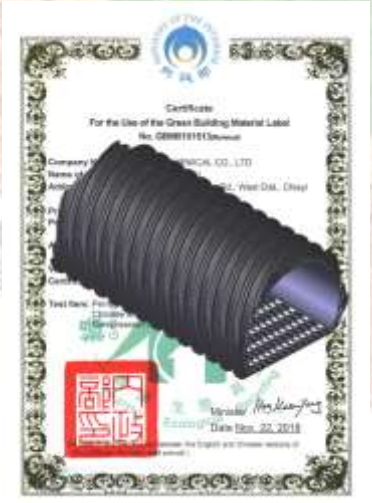
AMPS-Sports field drainage design technical Data







ECO-MESH

Foreword

The importance of sportsfield drainage

In addition to the drainage of the surface, the drainage system of the sports turf is also very important. The soil needs to be mainly sandy soil with water permeability, and the coarse sand layer under the sand must also have a suitable percolation drainage system and a gravel-grade cushion (enlarged water-permeable area), which will quickly ooze the water. It is discharged from the water pipe, so that it will not be muddy. Especially the grass is the most afraid of being trampled in the water. In addition to the potholes, the grass itself has a high damage rate.

The drainage system of the sports field is the most important foundation project of the sports field. Its main functions are: it can ensure the discharge of excess water, ensure that there is no water in the sports field; block the groundwater rise and the salinity hazard.

The design of the drainage system and the principle of material selection are mainly designed according to the local natural rainfall, rainfall frequency and rainfall intensity, so as not to affect the good growth of the competition and turfgrass due to the accumulation of water. There are the following types of drainage methods.

Surface drainage method:

Appropriate surface slope and slope for surface drainage, the field from the center point to the periphery of the four sides generally have a slope of 0.5 ‰ to 2.0 ,, also has a certain drainage effect.

Underground drainage method:

Ditch drainage system: The ditch depth of the pipe is generally 25~50cm, and the distance between the drain pipes is generally about 5~20m. The flow direction of the pipeline and the slope of the motion field are about 45o, the drop of the drainage channel is between 10‰20‰, and the water flow rate is generally 85l/h.

Due to the large size of the stadium, the rainwater from the surrounding stands will also flow into the site and the site will be used as soon as possible after the rain. Therefore, the IAAF stipulates: “When the artificial sports ground is completely flooded, the ground at any position after 20 minutes of drainage The accumulated water should not exceed the depth of the ground structure of the sports field. It can be seen that the drainage of the site is very important in the construction of the sports field. The drainage method adopts “excretion and drainage combined with drainage, and the seepage speed is lower than the ground runoff velocity.

The whole stadium is divided into three drainage areas: the first area is the grandstand and its surroundings, and the surface runoff is mainly used to discharge surface water into the drainage ditch; the second area is the track race itself and the semi-circle field at the north and south ends; the third area is the sports field. And buffer zone.

Special position drainage

In the stadium drainage design, the field is often overlooked, such as high jump (far) bunker, under the springboard, shot (disc) venue, pole vault venue. The bunker can be separately drained by the Rainfall Conservation Module System, and the other locations can be drained through the drain pipe and the drain pipe.

Conclusion

Water supply and drainage design is an important part of the stadium design, and the quality of the water supply and drainage directly affects the standard level of the entire stadium.

Arched Mesh pipe provides the most economical and simple method for permeable drainage

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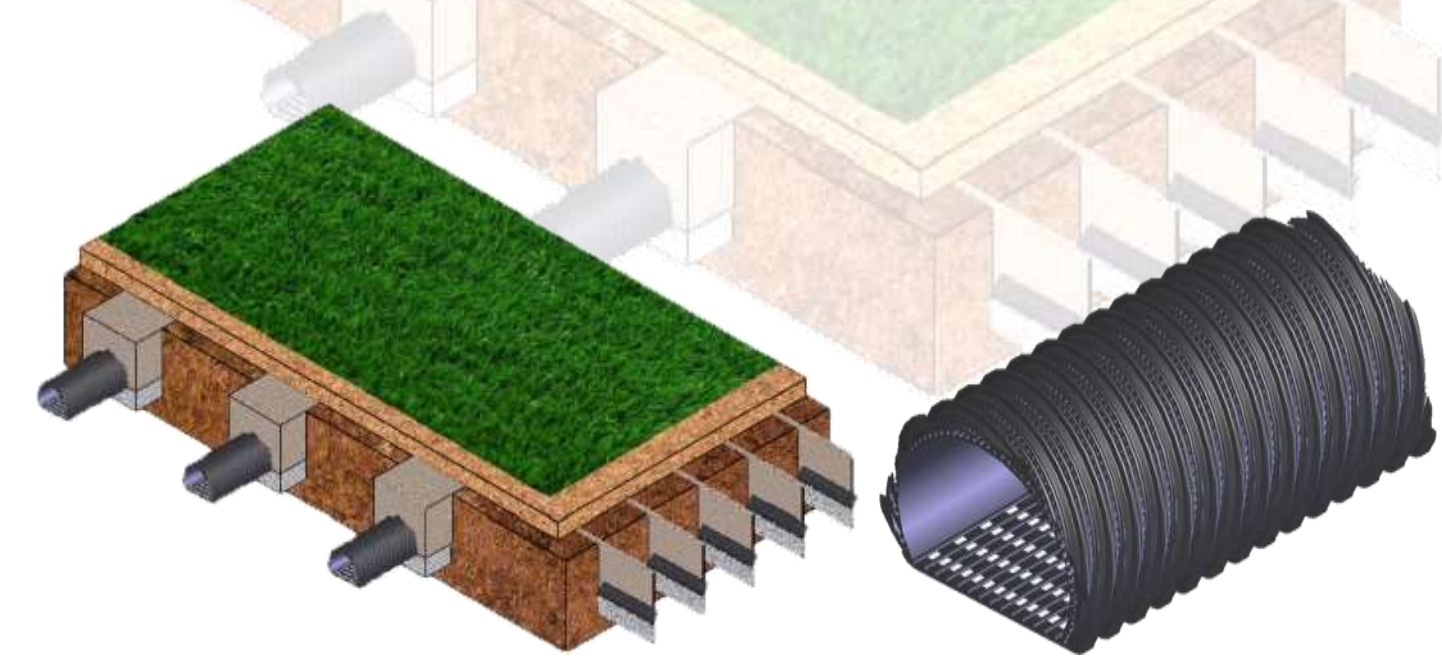


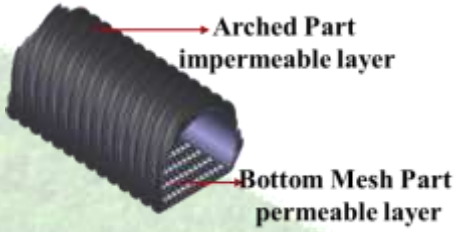
A. Arched Mesh Pipe Description

A-1. Arched Mesh pipe manufacturing principle

The Arched Mesh Pipe is made of high-density polyethylene (HDPE), and the three-dimensional thread and surrounded by a mesh structure, which is integrally extruded and formed. The three-dimensional thread mesh structure of the pipe body has high pressure resistance, light weight, toughness, acid and alkali resistance, corrosion resistance, and not easy to be broken. It is a low-cost, easy-to-construct, high-efficiency, high-valued and permeable material.

Arched Mesh Pipe–Pipe Structure

The half-moon type is an impermeable layer and the flat part is a mesh-permeable layer.



A-2. Arched Mesh Pipe Drainage Features

Most of the traditional water-permeable pipes are provided with slots in the upper part. As the inlet water, there is no opening in the lower part. Therefore, the soil particles inevitably penetrate into the pipe along with the influent water flow, and gradually accumulate around the outer pores of the pipe. Blocked.

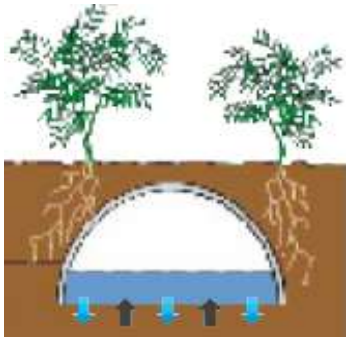
Traditional underground drain

Traditional construction method

The Arched Mesh Pipe adopts a half-moon type design. The half-moon type is an impermeable layer, and the plane part is a mesh-shaped permeable layer. When the plane is buried, the plane part is a mesh-shaped permeable layer downward, and the water flow enters the water conduit from bottom to top, excluding the soil. Saturated water, so that the soil particles naturally precipitate due to gravity, so that they will not flow into the water conduit along with the water, and will not cause siltation in the water conduit, but the mesh-like permeable layer facing downwards can also enter the water, also causing water absorption. After that, when moisture enters, the pressure difference naturally exerts a pumping effect on the moisture in the soil, and is discharged outward by gravity flow, further generating a negative pressure inside the soil, and greatly increasing the drainage efficiency.

Arched Mesh Pipe The principle of separating gravity from water and soil is used, which does not require non-woven fabrics and other filter materials to avoid clogging, ecological engineering construction, long service life, and the best permeable drainage materials for solving underground drainage pipe blocking problems.

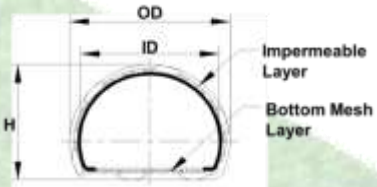
The Arched mesh Pipe has no filtered water layer to hinder the permeable and drainage phenomenon, and the drainage function is particularly good.



The Arched Mesh Pipe excludes saturated water in the soil layer, the mesh pipe does not block, and the ecological engineering method is constructed.
It is the best underground collection of drainage materials.

A-3. Arched Mesh Pipe Specifications

Arched Mesh Pipe Specifications



Size		ID*OD*H	Pitch	Length
Diameter	Code	±3.0%mm	±3.0%mm	m
2"	HPT-50A	50*62*54	11.5mm	5m
2½"	HPT-65A	63*76*70	12.5mm	5m
3"	HPT-75A	79*92*82	12.5mm	5m
4"	HPT-100A	96*114*94	12.5mm	5m
6"	HPT-150A	149*167*136	14.0mm	5m
8"	HPT-200A	193*216*170	14.5mm	5m
10"	HPT-250A	239*267*197	15.0mm	5m
12"	HPT-300A	290*318*223	15.5mm	5m

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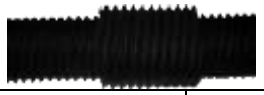
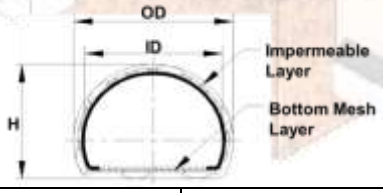
Arched Mesh Pipe straight connector specifications





Connector		ID*OD*H	Pitch	Length
Diameter	Code	±3.0%mm	±3.0%mm	cm
2"F	HPF-50A	63*76*70	12.5mm	12cm
2½"F	HPF-65A	79*92*82	12.5mm	12cm
3"F	HPF-75A	96*114*94	12.5mm	15cm
4"F	HPF-100A	112*128*112	12.5mm	20cm
6"F	HPF-150A	168*188*158	14.5mm	25cm
8"F	HPF-200A	217*240*193	14.5mm	30cm
10"F	HPF-250A	268*290*220	15.0mm	35cm
12"F	HPF-300A	320*344*245	15.5mm	40cm

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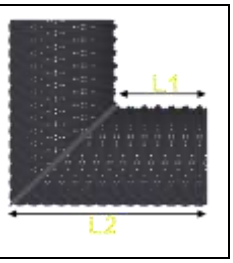
Arched Mesh Pipe Profiled joints Specifications

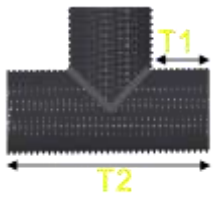
Arched Mesh Pipe L-connector Specifications

Size		ID*OD*H	Pitch	L1	L2
Diameter	Code	±3.0%mm	±3.0%mm	mm	mm
2"F	HPF-50L	63*76*70	12.5mm	72	148
2½"F	HPF-65L	79*92*82	12.5mm	72	161
3"F	HPF-75L	96*114*94	12.5mm	90	195
4"F	HPF-100L	112*128*112	12.5mm	120	250
6"F	HPF-150L	168*188*158	14.5mm	150	333
8"F	HPF-200L	217*240*193	14.5mm	180	420
10"F	HPF-250L	268*290*220	15.0mm	210	500
12"F	HPF-300L	320*344*245	15.5mm	240	584



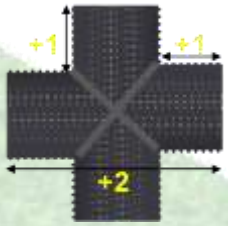
Arched Mesh Pipe T-connector Specifications

Size		ID*OD*H	Pitch	T1	T2
Diameter	Code	±3.0%mm	±3.0%mm	mm	mm
2"F	HPF-50T	63*76*70	12.5mm	72	220
2½"F	HPF-65T	79*92*82	12.5mm	72	233
3"F	HPF-75T	96*114*94	12.5mm	90	285
4"F	HPF-100T	112*128*112	12.5mm	120	370
6"F	HPF-150T	168*188*158	14.5mm	150	483
8"F	HPF-200T	217*240*193	14.5mm	180	600
10"F	HPF-250T	268*290*220	15.0mm	210	710
12"F	HPF-300T	320*344*245	15.5mm	240	824



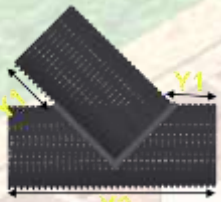
Arched Mesh Pipe +-connector Specifications

Size		ID*OD*H	Pitch	+1	+2
Diameter	Code	±3.0%mm	±3.0%mm	mm	mm
2"F	HPF-50+	63*76*70	12.5mm	72	220
2½"F	HPF-65+	79*92*82	12.5mm	72	233
3"F	HPF-75+	96*114*94	12.5mm	90	285
4"F	HPF-100+	112*128*112	12.5mm	120	370
6"F	HPF-150+	168*188*158	14.5mm	150	483
8"F	HPF-200+	217*240*193	14.5mm	180	600
10"F	HPF-250+	268*290*220	15.0mm	210	710
12"F	HPF-300+	320*344*245	15.5mm	240	824



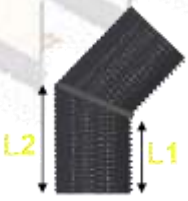
Arched Mesh Pipe Y-connector Specifications

Size		ID*OD*H	Pitch	Y1	Y2
Diameter	Code	±3.0%mm	±3.0%mm	mm	mm
2"F	HPF-50Y	63*76*70	12.5mm	72	251
2½"F	HPF-65Y	79*92*82	12.5mm	72	270
3"F	HPF-75Y	96*114*94	12.5mm	90	328
4"F	HPF-100Y	112*128*112	12.5mm	120	424
6"F	HPF-150Y	168*188*158	14.5mm	150	559
8"F	HPF-200Y	217*240*193	14.5mm	180	699
10"F	HPF-250Y	268*290*220	15.0mm	210	830
12"F	HPF-300Y	320*344*245	15.5mm	240	966



Arched Mesh Pipe L45^0-connector Specifications

Size		ID*OD*H	Pitch	L45-1	L45-2
Diameter	Code	±3.0%mm	±3.0%mm	mm	mm
2"F	HPF-50L45	63*76*70	12.5mm	72	103
2½"F	HPF-65L45	79*92*82	12.5mm	72	109
3"F	HPF-75L45	96*114*94	12.5mm	90	133
4"F	HPF-100L45	112*128*112	12.5mm	120	174
6"F	HPF-150L45	168*188*158	14.5mm	150	226
8"F	HPF-200L45	217*240*193	14.5mm	180	279
10"F	HPF-250L45	268*290*220	15.0mm	210	330
12"F	HPF-300L45	320*344*245	15.5mm	240	382



Arched Mesh Pipe D-plug Specifications

Size		ID*OD*H	Pitch	D1
Diameter	Code	±3.0%mm	±3.0%mm	mm
2"F	HPF-50D	63*76*70	12.5mm	72
2½"F	HPF-65D	79*92*82	12.5mm	72
3"F	HPF-75D	96*114*94	12.5mm	90
4"F	HPF-100D	112*128*112	12.5mm	120
6"F	HPF-150D	168*188*158	14.5mm	150
8"F	HPF-200D	217*240*193	14.5mm	180
10"F	HPF-250D	268*290*220	15.0mm	210
12"F	HPF-300D	320*344*245	15.5mm	240

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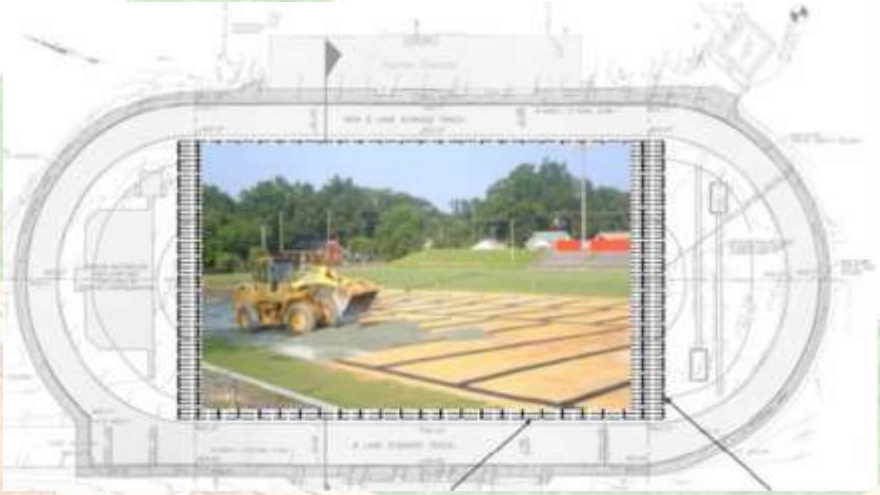
B. Sportsfield drainage design

B-1. Arched Mesh Pipe- Sportsfield drainage and water-saving irrigation characteristics

The Arched Mesh Pipe drainage system does not block, saving construction costs and filter material costs, and is the best material for water retention and drainage in the sportsfield base.

Arched Mesh Pipe, when the permeable layer is buried, the water flow from the bottom to the upper into the water conduit, directly using the natural gravity phenomenon to produce soil water separation effect, so that the soil particles naturally precipitate due to gravity, will not block the drainage layer, the mesh pipe management is not Will block and lose drainage.

The playground area is large, the watering system is difficult to set up, and the infiltration Arched Mesh Pipe can be used as a sports field irrigation system.



B-2. Arched Mesh Pipe Drainage Capacity

Arched Mesh Pipe Theoretical Drainage Capacity

Flow rate $V = \frac{1}{n} R^{2/3} S^{1/2}$ Flow volume $Q = A \frac{1}{n} R^{2/3} S^{1/2}$ (=A x V)	V	:	Flow rate (m/sec)
	Q	:	Flow volume (m^3/sec)
	D	:	Pipe diameter (m)
	n	:	Roughness coefficient
	R	:	Hydraulic radius (m)
	S	:	Hydraulic slope (%)
	A	:	Sectional area of the flow (m^2)

Arched Mesh Pipe flow rate calculation table (non-full flow d)

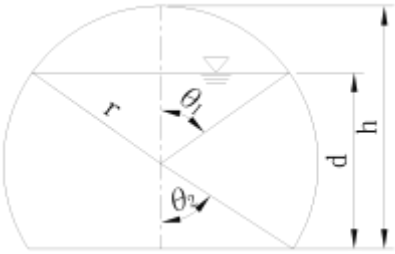
Flow volume (m^3/sec) $$Q = \frac{1}{n} \times R^{\frac{2}{3}} \times S^{\frac{1}{2}} \times A = \frac{1}{n} \times r^{\frac{8}{3}} \times S^{\frac{1}{2}} \times \alpha$$

Flow rate (m/sec) $$V = \frac{1}{n} \times R^{\frac{2}{3}} \times S^{\frac{1}{2}} = \frac{1}{n} \times r^{\frac{2}{3}} \times S^{\frac{1}{2}} \times \beta$$

其中$$\alpha = \frac{(\pi - \theta_1 - \theta_2 + \sin\theta_1 \cos\theta_1 + \sin\theta_2 \cos\theta_2)^{\frac{5}{3}}}{(2(\pi - \theta_1 - \theta_2 + \sin\theta_2))^{\frac{2}{3}}} \beta = \frac{(\pi - \theta_1 - \theta_2 + \sin\theta_1 \cos\theta_1 + \sin\theta_2 \cos\theta_2)^{\frac{2}{3}}}{(2(\pi - \theta_1 - \theta_2 + \sin\theta_2))^{\frac{2}{3}}}$$

Arched mesh pipe αβ comparison table of different water depth ratios

d/h	2"		3"		4"		6"		8"	
	α	β	α	β	α	β	α	β	α	β
0.50	0.958	0.611	0.904	0.597	0.896	0.594	0.932	0.604	0.836	0.579
0.55	1.095	0.631	1.029	0.616	1.019	0.614	1.062	0.624	0.949	0.597
0.60	1.229	0.648	1.151	0.632	1.139	0.630	1.190	0.640	1.058	0.613
0.65	1.358	0.662	1.268	0.645	1.255	0.642	1.313	0.653	1.163	0.625
0.70	1.479	0.672	1.378	0.654	1.363	0.652	1.429	0.663	1.261	0.634
0.75	1.589	0.678	1.477	0.660	1.461	0.658	1.533	0.669	1.349	0.639
0.80	1.684	0.680	1.562	0.662	1.545	0.660	1.623	0.671	1.424	0.641
0.85	1.759	0.678	1.629	0.660	1.610	0.657	1.694	0.669	1.483	0.639
0.90	1.807	0.669	1.670	0.651	1.651	0.649	1.738	0.660	1.519	0.631
0.95	1.814	0.652	1.676	0.635	1.656	0.632	1.744	0.644	1.523	0.615
1	1.691	0.598	1.563	0.583	1.546	0.581	1.627	0.591	1.422	0.566



Q= Flow volume (m^3/sec)
r=Pipe radius (m)
n= Roughness coefficient
S= Hydraulic slope
V= Flow rate (m/sec)

a Arched Mesh Pipe theory (maximum) displacement (S=1) (d/h=0.95)				b Hydraulic slope comparison table Hydraulic slope (S→S1/2)			
Pipe diameter	ID (mm)	Theoretical displacement (m^3/sec)		*S*	$S^{1/2}$	*S*	$S^{1/2}$
2"	47	0.0064		1/50	0.1414	1/500	0.0447
3"	74	0.0158		1/100	0.1000	1/600	0.0408
4"	98	0.0327		1/200	0.0707	1/800	0.0354
6"	148	0.1038		1/250	0.0632	1/900	0.0333
8"	197	0.1916		1/300	0.0577	1/1000	0.0316
				1/400	0.0500		

Maximum displacement =(a) Theoretical displacement x (b) $S^{1/}$

Arched Mesh Pipe Flow Rate and Flow Volume

Arched Mesh Pipe Flow Rate & Flow Volume (water depth d / Pipe diameter high h = 0.6 non-full flow) roughness coefficient n = 0.015

DIA.	Slope	1/50	1/100	1/200	1/250	1/300	1/400	1/500	1/600	1/700	1/800	1/900	1/1000
2"	Flow rate m/sec	0.52	0.37	0.26	0.23	0.21	0.18	0.16	0.15	0.14	0.13	0.12	0.12
	Flow Volume L/sec	0.61	0.43	0.31	0.27	0.25	0.22	0.19	0.18	0.16	0.15	0.14	0.14
3"	Flow rate m/sec	0.65	0.46	0.32	0.29	0.27	0.23	0.21	0.19	0.17	0.16	0.15	0.15
	Flow Volume L/sec	1.53	1.08	0.77	0.69	0.63	0.54	0.48	0.44	0.41	0.38	0.36	0.34
4"	Flow rate m/sec	0.78	0.55	0.39	0.35	0.32	0.28	0.25	0.22	0.21	0.19	0.18	0.17
	Flow Volume L/sec	3.18	2.25	1.59	1.42	1.30	1.12	1.01	0.92	0.85	0.79	0.75	0.71
6"	Flow rate m/sec	1.04	0.74	0.52	0.47	0.43	0.37	0.33	0.30	0.28	0.26	0.25	0.23
	Flow Volume L/sec	10.01	7.08	5.01	4.48	4.09	3.54	3.17	2.89	2.68	2.50	2.36	2.24
8"	Flow rate m/sec	1.20	0.85	0.60	0.54	0.49	0.43	0.38	0.35	0.32	0.30	0.28	0.27
	Flow Volume L/sec	18.83	13.31	9.41	8.42	7.69	6.66	5.95	5.44	5.03	4.71	4.44	4.21
10"	Flow rate m/sec	1.36	0.96	0.68	0.61	0.56	0.48	0.43	0.39	0.36	0.34	0.32	0.30
	Flow Volume L/sec	32.02	22.64	16.01	14.32	13.07	11.32	10.13	9.24	8.56	8.01	7.55	7.16
12"	Flow rate m/sec	1.50	1.06	0.75	0.67	0.61	0.53	0.47	0.43	0.40	0.37	0.35	0.33
	Flow Volume L/sec	47.97	33.92	23.99	21.45	19.58	16.96	15.17	13.85	12.82	11.99	11.31	10.73

Arched Mesh Pipe Flow Rate & Flow Volume (water depth d / Pipe diameter high h = 0.75 non-full flow) roughness coefficient n = 0.015

DIA.	Slope	1/50	1/100	1/200	1/250	1/300	1/400	1/500	1/600	1/700	1/800	1/900	1/1000
2"	Flow rate m/sec	0.54	0.39	0.27	0.24	0.22	0.19	0.17	0.16	0.15	0.14	0.13	0.12
	Flow Volume L/sec	0.79	0.56	0.40	0.35	0.32	0.28	0.25	0.23	0.21	0.20	0.19	0.18
3"	Flow rate m/sec	0.68	0.48	0.34	0.30	0.28	0.24	0.21	0.20	0.18	0.17	0.16	0.15
	Flow Volume L/sec	1.97	1.39	0.98	0.88	0.80	0.70	0.62	0.57	0.53	0.49	0.46	0.44
4"	Flow rate m/sec	0.81	0.57	0.41	0.36	0.33	0.29	0.26	0.23	0.22	0.20	0.19	0.18
	Flow Volume L/sec	4.08	2.88	2.04	1.82	1.66	1.44	1.29	1.18	1.09	1.02	0.96	0.91
6"	Flow rate m/sec	1.09	0.77	0.55	0.49	0.45	0.39	0.34	0.31	0.29	0.27	0.26	0.24
	Flow Volume L/sec	12.90	9.12	6.45	5.77	5.27	4.56	4.08	3.72	3.45	3.22	3.04	2.88
8"	Flow rate m/sec	1.26	0.89	0.63	0.56	0.51	0.44	0.40	0.36	0.34	0.31	0.30	0.28
	Flow Volume L/sec	23.99	16.97	12.00	10.73	9.80	8.48	7.59	6.93	6.41	6.00	5.66	5.37

10"	Flow rate m/sec	1.42	1.01	0.71	0.64	0.58	0.50	0.45	0.41	0.38	0.36	0.34	0.32
	Flow Volume L/sec	40.62	28.72	20.31	18.17	16.58	14.36	12.85	11.73	10.86	10.16	9.57	9.08
12"	Flow rate m/sec	1.56	1.10	0.78	0.70	0.64	0.55	0.49	0.45	0.42	0.39	0.37	0.35
	Flow Volume L/sec	60.61	42.86	30.30	27.10	24.74	21.43	19.17	17.50	16.20	15.15	14.29	13.55

Arched Mesh Pipe Flow Rate & Flow Volume (water depth d / Pipe diameter high h = 0.8 non-full flow) roughness coefficient n = 0.015

DIA.	Slope	1/50	1/100	1/200	1/250	1/300	1/400	1/500	1/600	1/700	1/800	1/900	1/1000
2"	Flow rate m/sec	0.55	0.39	0.27	0.24	0.22	0.19	0.17	0.16	0.15	0.14	0.13	0.12
	Flow Volume L/sec	0.84	0.59	0.42	0.38	0.34	0.30	0.27	0.24	0.22	0.21	0.20	0.19
3"	Flow rate m/sec	0.68	0.48	0.34	0.30	0.28	0.24	0.22	0.20	0.18	0.17	0.16	0.15
	Flow Volume L/sec	2.08	1.47	1.04	0.93	0.85	0.74	0.66	0.60	0.56	0.52	0.49	0.47
4"	Flow rate m/sec	0.82	0.58	0.41	0.36	0.33	0.29	0.26	0.24	0.22	0.20	0.19	0.18
	Flow Volume L/sec	4.31	3.05	2.15	1.93	1.76	1.52	1.36	1.24	1.15	1.08	1.02	0.96
6"	Flow rate m/sec	1.09	0.77	0.55	0.49	0.45	0.39	0.35	0.32	0.29	0.27	0.26	0.24
	Flow Volume L/sec	13.65	9.65	6.83	6.11	5.57	4.83	4.32	3.94	3.65	3.41	3.22	3.05
8"	Flow rate m/sec	1.26	0.89	0.63	0.56	0.51	0.45	0.40	0.36	0.34	0.31	0.30	0.28
	Flow Volume L/sec	25.33	17.91	12.67	11.33	10.34	8.96	8.01	7.31	6.77	6.33	5.97	5.66
10"	Flow rate m/sec	1.43	1.01	0.71	0.64	0.58	0.50	0.45	0.41	0.38	0.36	0.34	0.32
	Flow Volume L/sec	42.83	30.29	21.42	19.16	17.49	15.14	13.55	12.37	11.45	10.71	10.10	9.58
12"	Flow rate m/sec	1.56	1.11	0.78	0.70	0.64	0.55	0.49	0.45	0.42	0.39	0.37	0.35
	Flow Volume L/sec	63.85	45.15	31.92	28.55	26.07	22.57	20.19	18.43	17.06	15.96	15.05	14.28

Arched Mesh Pipe Flow Rate & Flow Volume (water depth d / Pipe diameter high h = 1 full flow) roughness coefficient n = 0.015

DIA.	Slope	1/50	1/100	1/200	1/250	1/300	1/400	1/500	1/600	1/700	1/800	1/900	1/1000
2"	Flow rate m/sec	0.48	0.34	0.24	0.22	0.20	0.17	0.15	0.14	0.13	0.12	0.11	0.11
	Flow Volume L/sec	0.84	0.60	0.42	0.38	0.34	0.30	0.27	0.24	0.23	0.21	0.20	0.19
3"	Flow rate m/sec	0.60	0.42	0.30	0.27	0.24	0.21	0.19	0.17	0.16	0.15	0.14	0.13
	Flow Volume L/sec	2.08	1.47	1.04	0.93	0.85	0.74	0.66	0.60	0.56	0.52	0.49	0.47
4"	Flow rate m/sec	0.72	0.51	0.36	0.32	0.29	0.25	0.23	0.21	0.19	0.18	0.17	0.16
	Flow Volume L/sec	4.31	3.05	2.16	1.93	1.76	1.52	1.36	1.24	1.15	1.08	1.02	0.96
6"	Flow rate m/sec	0.96	0.68	0.48	0.43	0.39	0.34	0.30	0.28	0.26	0.24	0.23	0.22
	Flow Volume L/sec	13.69	9.68	6.84	6.12	5.59	4.84	4.33	3.95	3.66	3.42	3.23	3.06
8"	Flow rate m/sec	1.11	0.79	0.56	0.50	0.45	0.39	0.35	0.32	0.30	0.28	0.26	0.25
	Flow Volume L/sec	25.29	17.89	12.65	11.31	10.33	8.94	8.00	7.30	6.76	6.32	5.96	5.66
10"	Flow rate m/sec	1.26	0.89	0.63	0.56	0.51	0.45	0.40	0.36	0.34	0.31	0.30	0.28
	Flow Volume L/sec	42.70	30.19	21.35	19.09	17.43	15.10	13.50	12.33	11.41	10.67	10.06	9.55
12"	Flow rate m/sec	1.38	0.98	0.69	0.62	0.56	0.49	0.44	0.40	0.37	0.35	0.33	0.31
	Flow Volume L/sec	63.55	44.94	31.78	28.42	25.94	22.47	20.10	18.35	16.98	15.89	14.98	14.21

B-3. Arched Mesh Pipe Permeability

Water retention ability to penetrate the base configuration design value calculation

Arched Mesh Pipe theoretical water permeability

$Q_{hp} = A_{id} x k \; x \; t$

Q_{hp}：Arched Mesh Pipe theoretical water permeability

A_{id} ：Arched Mesh Pipe area

K：Soil permeability coefficient or final infiltration rate

t ：Rainfall delay reference value

Soil permeability coefficient k_{Soil}

k：The soil permeability coefficient (m/s) is determined by the soil within 2 m of the surface layer. Drilling investigation should be carried out first, and the "uniform classification" of the soil within 2 m of the surface of the drilling result should be substituted into Table 13 to obtain the k value; if the drilling survey is not met without the need of drilling survey, the topsoil can be judged by experience. Possible soil quality, and substituted into Table 14 to obtain the k value.

Base final infiltration rate f

f：The final infiltration rate (m/s) of the base, the final infiltration rate refers to the value when the rainwater is absorbed by the soil at the time of rainfall. It should be infiltrated in the field or determined by the soil within 2m of the surface. . Drilling investigation should be carried out first, and the "uniform classification" of the soil within 2 m of the surface of the drilling results should be substituted into Table 13 to obtain the f value; if the drilling survey is not required according to law, the surface soil may be judged by experience. Soil quality, and substituted into Table 14 to obtain the f value.

Unified soil classification and soil final infiltration rate f and permeability coefficient k comparison table

Soil classification	Particle size D10 (mm)	Unified soil classification	Final infiltration rate *f*(m/s)	Soil permeability coefficient *k* (m/s)
Bad grade gravel	0.4	GP	10^{-3}	10^{-3}
Good grade gravel		GW	10^{-4}	10^{-4}
Mud gravel		GM		
Clay gravel		GC		
Bad grade sand		SP	10^{-5}	10^{-5}
Good grade sand	0.1	SW		
Muddy sand	0.01	SM	10^{-6}	10^{-7}
Clay sand		SC		
Mud clay	0.005	ML	10^{-7}	10^{-8}
clay	0.001	CL		10^{-9}
High plastic clay	0.00001	CH		10^{-11}
Note: Different soils belonging to the same soil uniform classification will have errors due to the tightness and composition. This table is based on the objective of the assessment, but its minimum value, which makes the assessment results more conservative and credible.				

Soil final infiltration rate f and permeability coefficient k simple comparison table

Soil quality	sandy soil	Silt Soil	Clay Soil	High plastic clay
Final infiltration rate f (m/s)	10^{-5}	10^{-6}	10^{-7}	10^{-7}
Soil permeability coefficient K(m/s)	10^{-5}	10^{-7}	10^{-9}	10^{-11}

Arched Mesh Pipe each meter of water permeate theory

Coefficient k	DIA.	The bottom is not covered with sand	Laying sand on the bottom (Increase in area 20cm)
Final infiltration rate (10^{-6} m/s)	2"	0.1793 L/hr·m	0.8993 L/hr·m
	3"	0.2592 L/hr·m	0.9792 L/hr·m
	4"	0.3420 L/hr·m	1.0620 L/hr·m
	6"	0.5173 L/hr·m	1.2373 L/hr·m
	8"	0.6851 L/hr·m	1.4051 L/hr·m
Soil permeability coefficient (10^{-7} m/s)	2"	0.0179 L/hr·m	0.0899 L/hr·m
	3"	0.0259 L/hr·m	0.0979 L/hr·m
	4"	0.0342 L/hr·m	0.1062 L/hr·m
	6"	0.0517 L/hr·m	0.1237 L/hr·m
	8"	0.0685 L/hr·m	0.1405 L/hr·m

B-4. Arched Mesh Pipe Compressive strength

Compressive strength : Buried trench Arched Mesh Pipe, in addition to the vertical direction external force, but also to resist the soil pressure side

Soil pressure calculation and compressive strength

1. Soil pressure **P_1(t/m²)**

Vertical Soil pressure (H=2m or less) $P_1=rH$

Vertical Soil pressure and lateral pressure (H=2m or more) $P_1=C_d*r*B$

Soil pressure coefficient in trench type $C_d=\frac{1}{2K\tan\phi}(1-e^{-2K\tan\phi\frac{H}{B}})$

2. Load **P_2(t/m²)**

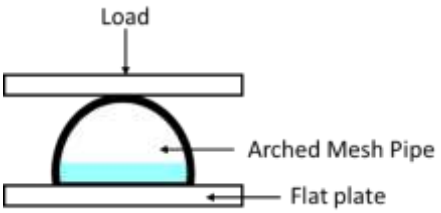
$P_2=\alpha\cdot q\ (1+i)$

3. Total pressure **P(t/m²)**

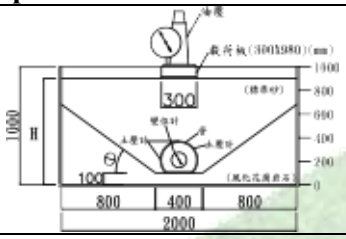
$P=P_1+P_2$

r (t/m3) : Soil unit volume weight
Ø : Internal friction angle buried in soil
K : Soil pressure coefficient
K=(1-sinØ)/(1±sinØ)
C_d : groove coefficient
e : Natural logarithme=2.71818
α : No load groove factor
I : Wheel pressure shock rate
q (t) : Wheel to ground load
B (m) : Ditch bottom width
H (m) : Backfill depth

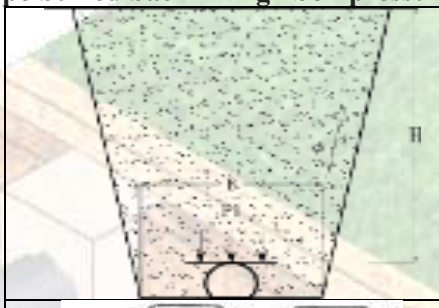
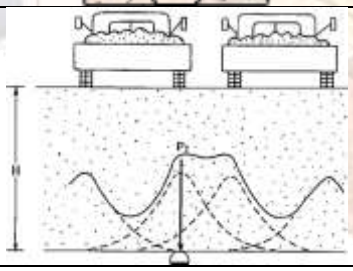
Arched Mesh Pipe vertical compression test method

	Test method: Place the Pipe between two plates and compress it at a constant speed. Pipe inner diameter reduced by 10% 20% load Compressive strength = load / bore diameter difference Standard Test for Tube Compressive Strength to ASTM D2412-02。

Compressive deformation rate test

	Pipe outer diameter deformation rate ε $\varepsilon = \frac{(D - D')}{D} X100$ D (mm) : Standard caliber D' (mm) : Pipe deformation caliber

Pipe buried backfill high Soil pressure wheel pressure reference table

	**P_1** : Soil pressure **ø↗** : The greater the angle of the ditch side, the greater the downward force of the Soil pressure **B** : The smaller the bottom area of the trench, the greater the pressure on the tube
	**H :** The deeper the depth of the buried pipe, the smaller the load on the pipe

Backfill soil pressure wheel pressure height reference table

pressure	Soil pressure P_1 (t/m³)					Wheel pressure P_2 (t/m³)				Mobile Impact P		
condition	Groove width B (m)					T-14		T-20		I	α	
Backfill H	B=0.5	B=0.8	B=1	B=1.25	B=1.5	1car	2 car	1 car	2 car	No load	1 car	2 car
0.3	0.54	B=0.5m H<2.0m， Soil pressure is only affected by soil depth				15.68	15.68	22.04	22.04	0.4	2.0	2.0
0.4	0.72					10.98	11.52	15.68	16.46		1.4	1.47
0.5	0.90					8.23	9.41	11.76	13.44		1.05	1.20
0.6	1.08					6.66	7.68	9.52	10.98		0.85	0.98
0.8	1.44					4.39	5.72	6.27	8.18		0.56	0.73
1.0	1.8					3.14	4.47	4.48	6.38		0.40	0.57
1.2	2.16					2.20	3.53	3.14	5.04		0.28	0.45
1.5	2.7					1.80	2.67	2.58	3.81		0.23	0.34
2.0	3.6					1.16	1.67	1.66	2.40	0.3	0.16	0.23
2.5	2.00	2.62	2.89	3.14	3.32	0.87	1.24	1.25	1.77		0.12	0.17
3.0	2.11	2.86	3.20	3.14	3.76	0.60	0.87	0.86	1.25	0.2	0.09	0.13

The minimum backfill height

Minimum backfill height when tube deformation rate is less than 10%

Size	Arched Mesh Pipe			
Load	T-14*2	T-20*2	T-14*1	T-20*1
2"	0.3m	0.4m		
3"	0.4m	0.5m	0.3m	0.4m
4"	0.5m	0.6m	0.3m	0.5m
6"	0.6m	0.7m	0.4m	0.5m
8"	0.7m	0.8m	0.4m	0.5m

B-5. Arched Mesh Pipe diameter and pipe inclination angle

Slope determination

The pipe inclination (water flow direction) is determined by the topography and the mesh pipe flow rate, and the slope of the pipe is designed according to the terrain condition and the slope of the surface.
Mesh pipe water flow speed range: The mesh pipe flow rate (0.2m/sec) or more can remove the deposits in the pipe, and the mesh pipe flow rate (1.0m/sec) or more may cause vibration.

Arched Mesh Pipe Piping slope requirement：

Diameter	50	65	100	150	200
Minimum piping inclination **0.2m/sec**	**1/600**	**1/850**	**1/1510**	**1/2470**	**1/3630**
Minimum pipe inclination **1.0m/sec**	**1/25**	**1/35**	**1/60**	**1/100**	**1/145**

Pipe diameter decision (main pipe)

The design of the displacement of the pipe diameter is (inlet water * safety rate).
Arched Mesh Pipe water input calculation, including rainfall, water permeability, surface drainage area of the mesh pipe, time and range of water accumulation.

Discharge calculation formula

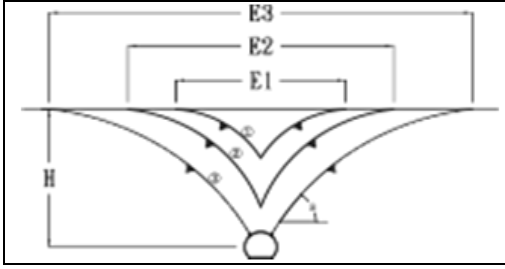
$Qt=\frac{1}{360}x(1-C)xIxAxFs$	Q_t(m²/sec) : Design displacement F_s(-) : Design safety rate I(mm/hr) : Rainfall intensity C(-) : Runoff coefficient A(ha) : Drainage area

Pipe diameter and drainage calculation

Qn=A·V $=\frac{1}{n}xD8/3xS1/2x\alpha$ $\quad \alpha=\frac{AR^{2/3}}{D^{8/3}}=f(\frac{h}{D})$	V(m/sec): Water flow rate inside the mesh pipe R(m) : Mesh pipe length (=D/4) S(-) : Hydraulic slope Q_n(m³/sec) : **Flow Volume** A(m²) : Sectional area of the mesh pipe D(m) : Pipe diameter (ID)

B-6. Arched Mesh Pipe Buried depth and spacing

Time variation of groundwater drainage



Groundwater surface 1 2 3 change and time relationship
Drainage pipe influence range E1 E2 E3
H : Mesh Pipe buried depth
B : Groundwater surface angle

Arched Mesh Pipe Buried depth and spacing (General design)

Soil quality	Particle size below 0.02mm weight ratio %	Mesh pipe buried depth and spacing (m)			
		0.8	1.0	1.2	1.4
Heavy clay	100~75	6.0~8.0	6.5~8.5	7.0~9.0	7.5~9.5
Ordinary clay	75~60	8.0~9.0	8.5~10.0	9.0~11.0	9.5~11.5
Clay loam	60~50	9.0~10.0	10.0~11.5	11.0~12.5	11.5~13.5
Common loam	50~40	10.0~12.5	11.5~13.0	12.5~14.5	13.5~16.0
Sandy loam	40~25	11.5~14.5	13.0~17.0	14.5~19.5	16.0~22.0
Loamy sand	25~10	14.5~18.0	17.0~22.0	19.5~26.0	22.0~30.0
Sand Soil	<10	>18.0	>22.0	>26.0	>30.0

The annual average rainfall is calculated from 600~650mm

Arched Mesh Pipe Buried depth and spacing (Purpose design)

Purpose	Soil	Depth (m)	Spacing (m)
Sportfield track	Material such as slag	0.4	3
Sportfield	Sandy soil structure	0.4	5~10
School Sportfield	Ordinary soil	0.5~1.0	8~20
Golf Course (Green)	Ordinary soil	0.4~0.8	5~15
Golf Course (Fairway)	Ordinary soil	0.5~1.2	2~20
football field	Sandy loam	0.4~1.2	3~10
Baseball field	Ordinary soil	0.5~1.0	8~20
Park square	Ordinary soil	0.5~1.0	8~20
Material yard	Ordinary soil	0.5~1.0	5~15
Courtyard	Ordinary soil	0.2~0.5	3~8

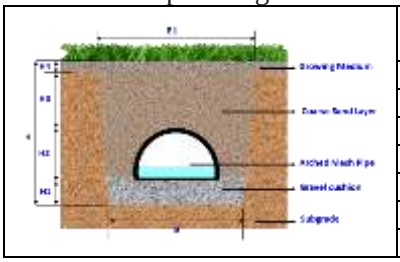
Generally, the buried pipe spacing is 10 to 15 times the depth of the buried pipe.

Arched Mesh Pipe buried depth and spacing considerations

1. The depth of the mesh pipe must be shallower than the average depth of the water table.
2. The depth of the mesh pipe must be deeper than the root depth of the plant (avoiding the net tube below the large plant).
3. In areas where water is easy to accumulate, the interval between the mesh pipe should be tighter.
4. The dry place must be kept quickly. The depth of the mesh pipe must be shallow and the interval should be dense.
5. When the permeable layer material has good water permeability, the interval between the mesh pipes can be larger.

B-7. Arched Mesh Pipe Design Reference

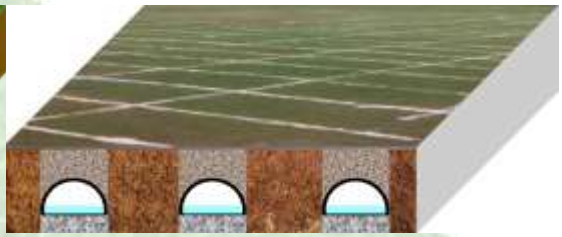
Arched Mesh Pipe Design Reference- Sportsfield



管徑	B (cm)	B1 (cm)	H (cm)	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
2"	25	30	41	5	6	25	5
3"	25	30	43	5	8	25	5
4"	25	30	44	5	9	25	5
6"	30	35	49	5	14	25	5
8"	37	42	62	5	17	35	5
10"	45	50	65	5	20	35	5
12"	50	55	68	5	23	35	5

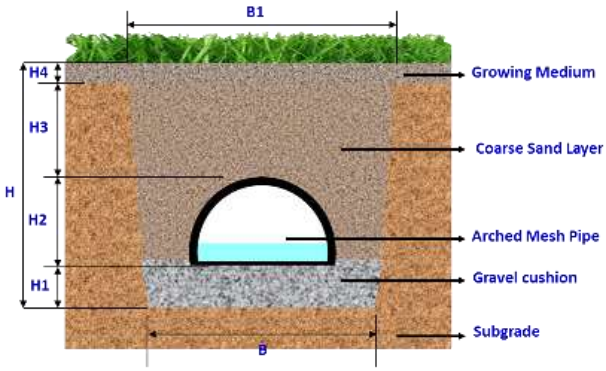
C. Arched Mesh Pipe-Sportsfield drainage design

C-1. Arched Mesh Pipe Sportsfield drainage design plan



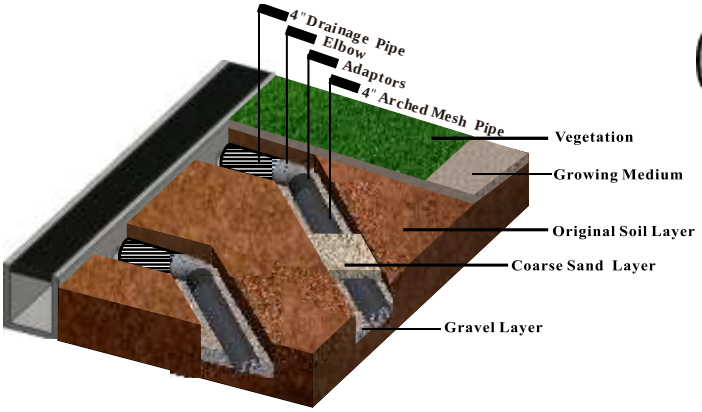
Fishbone water drainage design

Sportsfield ground drainage icon



管徑	B (cm)	B1 (cm)	H (cm)	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
4"	25	30	35	5	9	16	5

Arched Mesh Pipe sportsfield drainage embedding icon



Arched Mesh Pipe sportsfield drainage buried pipe connection diagram

C-2. Arched Mesh Pipe sportsfield drainage materials

4"Arched Mesh Pipe

Arched Mesh Pipe		ID*OD*H ±3.0%mm	Gap ±3.0%mm	Length m
Type	Code			
4"	HPT-100A	96*114*92	12.5mm	5m

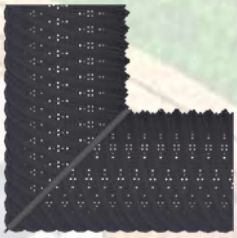
4" Arched Mesh Pipe straight connector

Arched Mesh Pipe		ID*OD*H ±3.0%mm	Gap ±3.0%mm	Length m
Type	Code			
4"F	HPF-100A	115*130*108	12.5mm	20cm

4"Drain Pipe

Drain Pipe		±3.0%mm	
Type	Code	ID	OD
4"P	SPC-100C	106mm	114mm

4" Semicircular round adapter

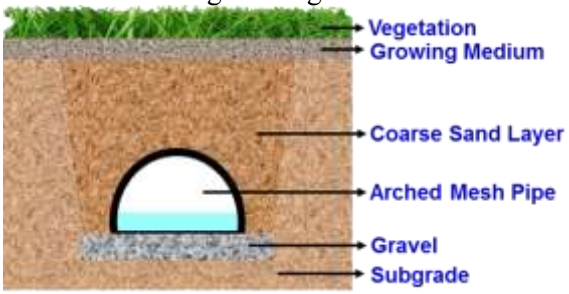


4"45° elbow

4" mesh pipe plug

Sportsfield drainage soil medium

In addition to the surface water discharge, the drainage system of the turf in the sports field is also very important. The soil needs to be mainly sandy soil with water permeability, and the sand-grading layer under the sand must also have a suitable percolation drainage system, so that the water that is infiltrated is quickly discharged from the water conduit, so as not to have The phenomenon of muddy, especially the grass is the most afraid of being trampled in the water, in addition to the pits, the grass itself has a high damage rate.



Turf

In countries where sports are prevalent, the choice of turf species is highly valued. The grass of good quality grows down, and its stems are shorter, and the leaves are slender. The well-maintained turf is like being placed on a long-haired carpet and is very resistant to treading. It is a pity that most of the domestically introduced varieties from foreign countries are grass species that grow fast but are not resistant to stepping on, or else the weather is wrong. The more suitable native grass species in China is commonly known as the "Double Grass" variety, which is often planted in golf courses. It is characterized by slender leaves and flattening resistance. It is also a top grade for the grassland, but its reproduction is slow, and The collection of the seeds of Dou Liucao is not easy and cannot be widely promoted. In terms of domestic climate, it is still more suitable for the Bermuda series. In the past, the stadium often used Bermuda 419 as the top grade. In 1997, the Bermuda porch was planted at the Kaohsiung Zhongzheng Stadium. It is currently growing well and can meet the requirements of international competition. The turf trimming frequency should be trimmed 3 to 5 times a week. Every time you cut grass, you should not reduce the blade of grass by more than one-third. It is best to use a hob-type lawnmower to cut grass. Of course, in addition to proper facilities, it must be carefully maintained. In the case of insufficient maintenance personnel and incorrect concepts in the domestic venues, no matter how well planned, such as regular watering, grass cutting, fertilization, soil replenishment, Pothole repair, avoiding heavy vehicles, avoiding excessive frequency, etc., are issues that cannot be ignored.

Grass layer

Surface runoff drainage, the ground to do 0.5 ~ 2.0% slope. In addition, an annular drainage gully is arranged on the inner side of the runway to exclude the surface water in the runway and the field, and the ground level of the site is required to be uniform and the drainage gradient is uniform. Drainage ditch and drainage ditch, a silt well is set every 30m to clean the mud.

Sand soil layer (root growth layer)

Laying in the drainage system should provide a stable and suitable water infiltration rate to the upper growth layer, which requires the material used to reach a suitable particle size range, and acts as a bridge for the drainage between the upper and lower layers. The pipeline system can only play an effective role. The physical indicators of the sand layer should meet the following requirements: 35% to 55% of total porosity, 15% to 30% of venting pores, 15% to 25% of capillary pores, and water permeation rate is generally per hour. 15 mm to 30 mm, accelerating to 30 mm to 60 mm per hour, and organic matter should be between 1% and 5%.

Sand layer (nutritive soil layer) main performance indicators: ideal soil bulk density of 1.4g / cm3, acceptable range of 1.2 ~ 1.4 g / cm3; pH ideal value of 6 ~ 6.5, acceptable range of 5.5 ~ 8.0; soil sodium Content Na/100g soil, exchangeable sodium (ESP)<15; N, P, K, organic matter level: effective N should be 30~40ppm, effective P should be 25~30ppm, effective K should be 100~150ppm, organic matter level It should be between 3% and 5%, water seepage rate: 150~300mm/h (ideal value) in areas with large rainfall, frequent high and high intensity, no more than 600mm/h, and the general regional standard is 20~60mm/h. The amount of non-capillary voids is 12% to 18%, and the amount of capillary voids is 15% to 21%.

Coarse Layer

This layer is composed of coarse sand and fine gravel (particle size 1mm~4mm).

The upper sand layer plus the middle coarse sand layer, and then to the bottom gravel layer, so that the water will form a relatively stable water holding surface during the movement of the bed, only when the water saturation reaches a certain level, the water After the gravity action breaks through the surface tension of the water, the water begins to move downward from the upper root growth layer through the intermediate coarse sand layer, and finally passes through the gravel layer to reach the hole of the drainage pipe. The ability to form such a stable water-holding surface is required for a high-quality flat bed in a sports field lawn, so that the flat bed not only has good water holding performance, but also provides moisture required for lawn growth, and has excellent drainage performance to ensure normal use of the sports field.

Gravel Layer

The particle size is 5mm~10mm.

The gravel cushion laid on the drainage system and the entire bed base provides a stable and suitable water infiltration rate in the upper layer, which requires the material used to reach a suitable particle size range, and a drainage between the upper and lower layers. The role of the bridge, so that the drainage pipe system can play an effective role, to achieve such a requirement, the particle size of the lower layer sand should be five times the particle size of the upper layer

C-3. Arched Mesh Pipe buried depth and spacing considerations

1. The depth of the mesh pipe must be shallower than the average depth of the water table.
2. The depth of the mesh pipe must be deeper than the root depth of the plant (avoiding the net tube below the large plant).
3. In areas where water is easy to accumulate, the interval between the mesh pipe should be tighter.
4. The dry place must be kept quickly. The depth of the mesh pipe must be shallow and the interval should be dense.
5. When the permeable layer material has good water permeability, the interval between the mesh pipes can be larger.

C-4. Arched Mesh Pipe Physical indicators

Made of high-density polyethylene (HDPE) material, the material is tough and not easy to break.
The physical properties are as follows:

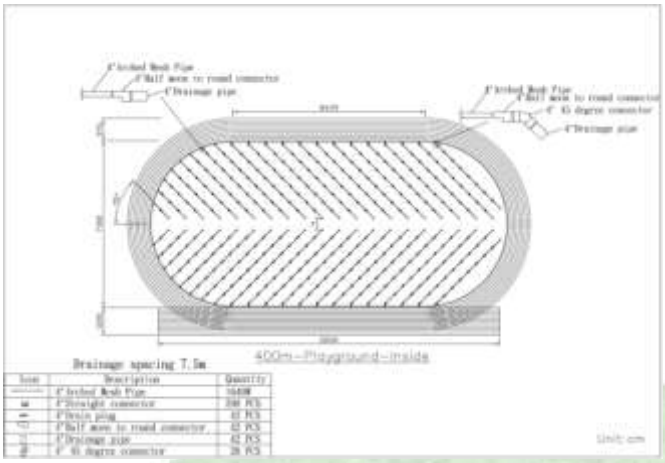
Inspection project	unit	Test method	Standard
Density	g/cm^3	ASTM 0792-13	> 0.940
Elongation	%	ASTM D638-14	> 300
Tensile strength	Kgf/cm^2	ASTM D638-14	> 180
Compressive strength (10% deformation)	Kgf/m	ASTM D2412	> 180



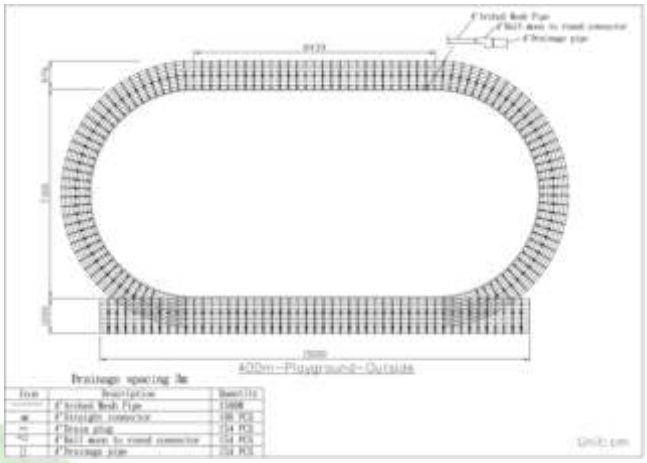

C-5. Sportsfield drainage design example

C-5-1. Arched Mesh Pipe-400 meters sportsfield drainage design diagram

400 m sportsfield floor plan - internal drainage spacing 7.5 m

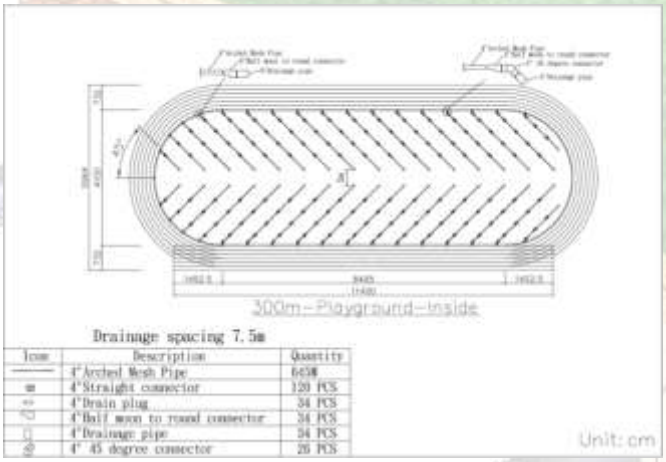


400 m sportsfield floor plan - runway drainage spacing 3.0 m

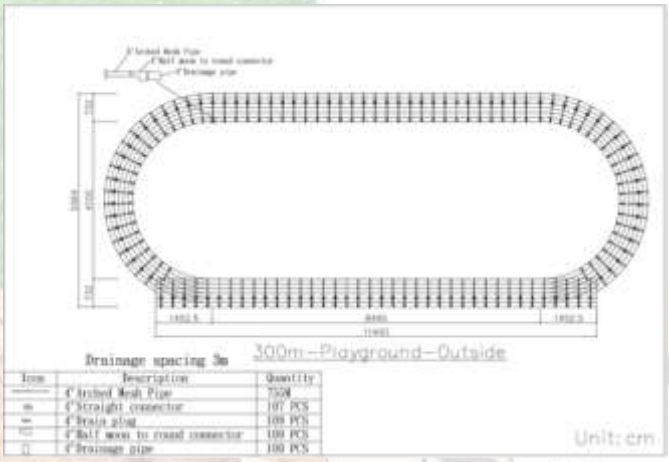


C-5-2. Arched Mesh Pipe-300 meters sportsfield drainage design diagram

300 m sportsfield floor plan - internal drainage spacing 7.5 m

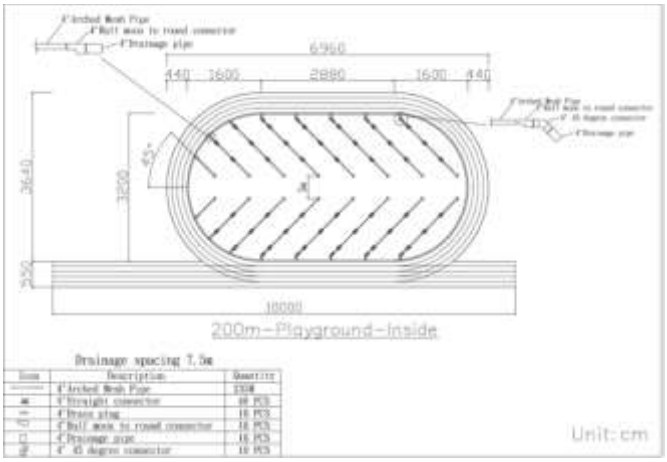


300 m sportsfield floor plan - runway drainage spacing 3.0 m

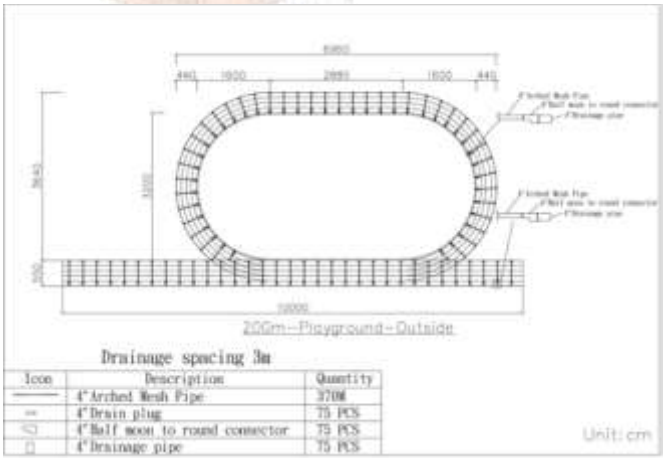


C-5-3. Arched Mesh Pipe-200 meters sportsfield drainage design diagram

200 m sportsfield floor plan - internal drainage spacing 7.5 m

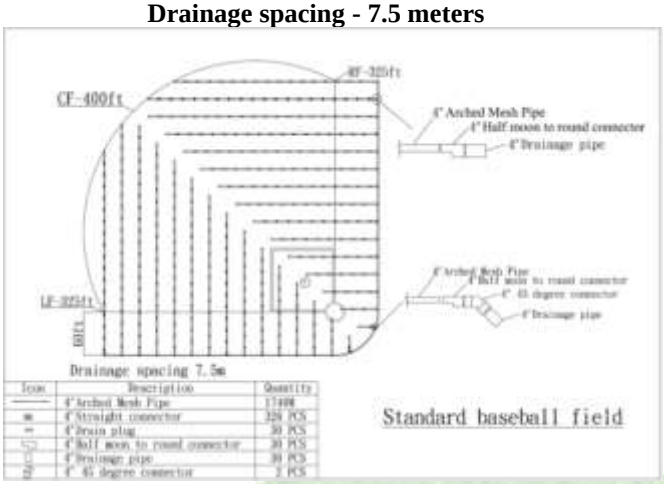


200 m sportsfield floor plan - runway drainage spacing 3.0 m



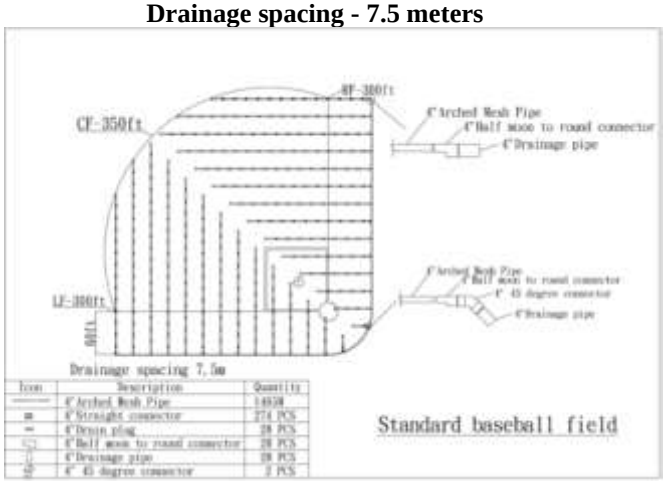
C-5-4. Arched Mesh Pipe- Baseball field drainage design diagram

400 feet baseball field drainage diagram- spacing
Drainage spacing - 7.5 meters



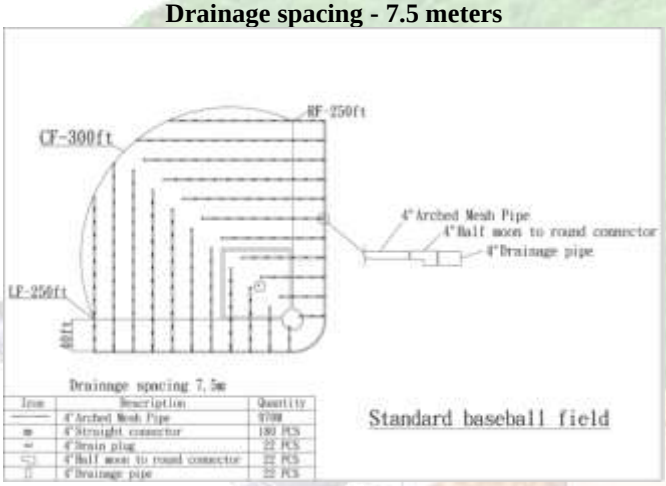
Icon	Description	Quantity
	4"Arched Mesh Pipe	17400
	4"Straight connector	326 PCS
	4"Drain plug	30 PCS
	4"Half moon to round connector	30 PCS
	4"Drainage pipe	30 PCS
	4" 45 degree connector	2 PCS

350 feet baseball field drainage diagram- spacing
Drainage spacing - 7.5 meters



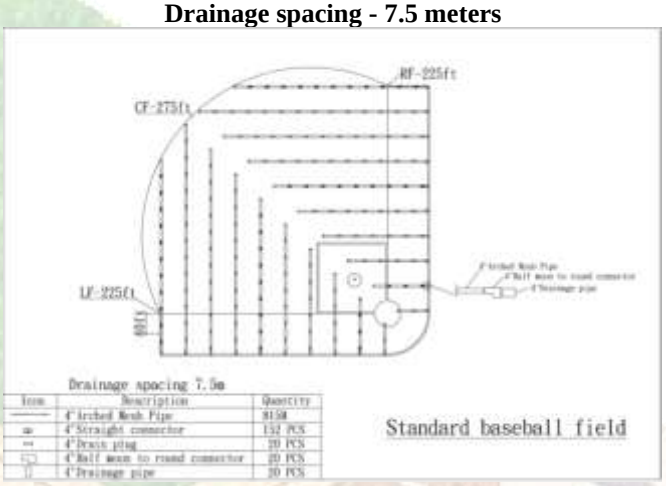
Icon	Description	Quantity
	4"Arched Mesh Pipe	14850
	4"Straight connector	274 PCS
	4"Drain plug	28 PCS
	4"Half moon to round connector	28 PCS
	4"Drainage pipe	28 PCS
	4" 45 degree connector	2 PCS

300 feet baseball field drainage diagram- spacing
Drainage spacing - 7.5 meters



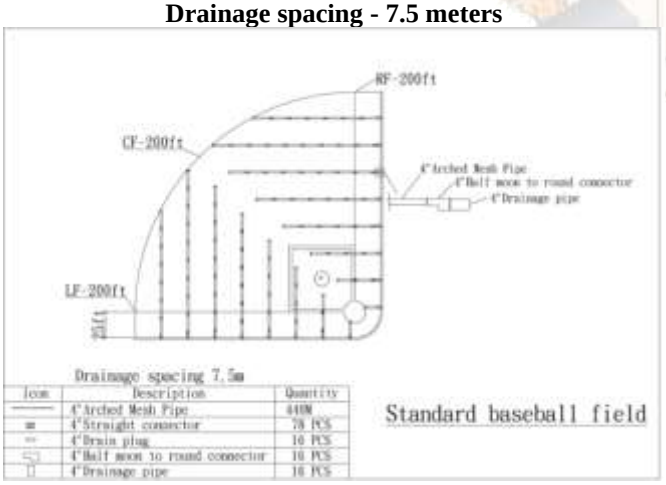
Icon	Description	Quantity
	4"Arched Mesh Pipe	9700
	4"Straight connector	180 PCS
	4"Drain plug	22 PCS
	4"Half moon to round connector	22 PCS
	4"Drainage pipe	22 PCS

275 feet baseball field drainage diagram- spacing
Drainage spacing - 7.5 meters



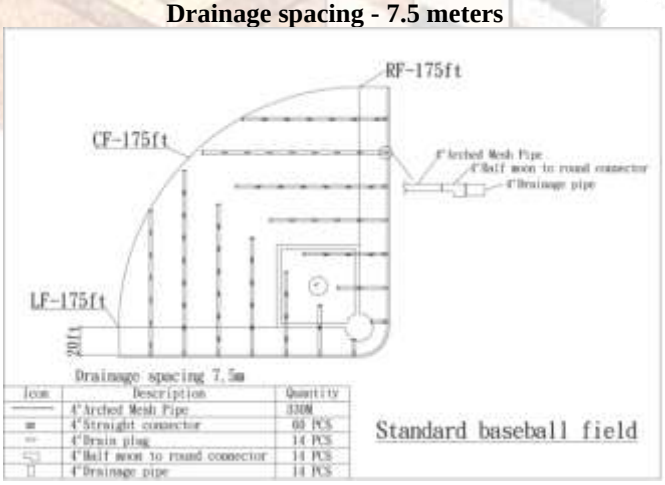
Icon	Description	Quantity
	4"Arched Mesh Pipe	8150
	4"Straight connector	152 PCS
	4"Drain plug	20 PCS
	4"Half moon to round connector	20 PCS
	4"Drainage pipe	20 PCS

200 feet baseball field drainage diagram- spacing
Drainage spacing - 7.5 meters



Icon	Description	Quantity
	4"Arched Mesh Pipe	4400
	4"Straight connector	78 PCS
	4"Drain plug	10 PCS
	4"Half moon to round connector	10 PCS
	4"Drainage pipe	10 PCS

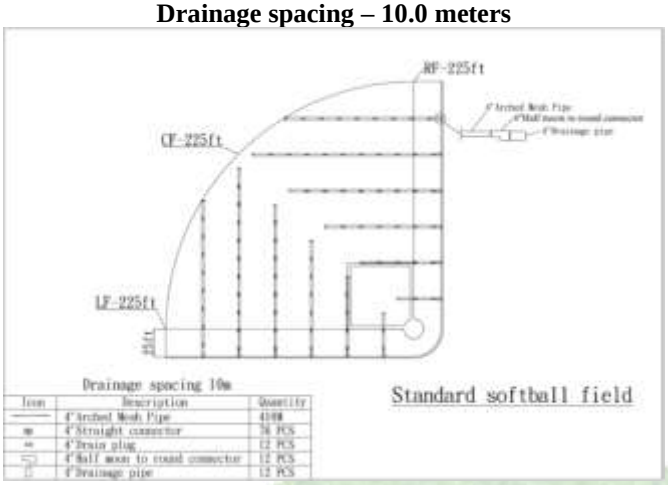
175 feet baseball field drainage diagram- spacing
Drainage spacing - 7.5 meters



Icon	Description	Quantity
	4"Arched Mesh Pipe	3300
	4"Straight connector	60 PCS
	4"Drain plug	14 PCS
	4"Half moon to round connector	14 PCS
	4"Drainage pipe	14 PCS

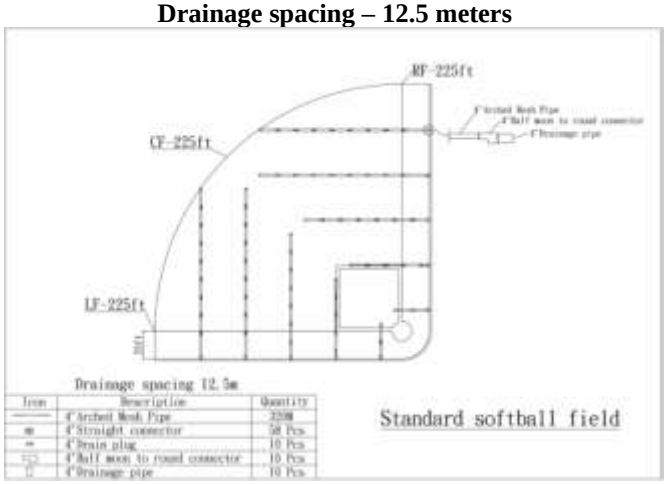
C-5-5. Arched Mesh Pipe – Softball Field Drainage Design Diagram

225 feet Softball field drainage
Drainage spacing – 10.0 meters



Icon	Description	Quantity
	4"Arched Mesh Pipe	4200
	4"Straight connector	36 PCS
	4"Drain plug	12 PCS
	4"Half moon to round connector	12 PCS
	4"Drainage pipe	12 PCS

225 feet Softball field drainage
Drainage spacing – 12.5 meters



Icon	Description	Quantity
	4"Arched Mesh Pipe	2200
	4"Straight connector	50 Pcs
	4"Drain plug	10 Pcs
	4"Half moon to round connector	10 Pcs
	4"Drainage pipe	10 Pcs