

1. LINE

1) 수평곡관에 사용시

□ 설계조건

- ▷ 관 경 = 350 mm
- ▷ 주철곡관 = 90 °
- ▷ 작용수압(p, 사용수압+수격압) = 7.5 kg/cm²
- ▷ 토사의 단위중량(ω t) = 0.0016 kg/cm³
- ▷ 토사의 내부마찰각(φ) = 25 °
- ▷ 상재토피(h1) = 100 cm
- ▷ μ : 관과 흙의 마찰계수 0.4 (표4참조)

1. 관에 작용하는힘(P)

$$P = 2 * p * A * \sin(\theta/2)$$

여기서, P : 수압에 의해 곡관부에 작용하는 힘(kg)

A : 단면적 = $\pi/4 * D^2$ (cm²)

D : 외경(cm)

2. 주변마찰력의 합력(Fs)

$$Fs = 2\sin(\theta/2) * L * fs \quad (\text{kg})$$

fs(단위길이당 마찰저항력) = $\mu * \omega t * Hc * \pi * D$

Hc : 관중심까지의 토피

cm

3. 직관의 수동토압합력(Fn)

$$Fn = 2 * \cos(\theta/2) * Lp * fn * 1/2$$

fn단위길이당 수동토압저항력

$$fn = 1/2Cc' * \omega t * (h2^2 - h1^2) * R$$

Cc' (수동토압계수) : $Cc' = \tan^2(45^\circ + \phi/2)$

2.46

R : 원형단면감소율(1/2)

L : 이형관에 접합한 직관의 최소길이

4. 저항길이(L)

$$L' \geq \frac{Sf * p * A * \sin(\theta/2)}{\sin(\theta/2) * \mu * \omega t * Hc * \pi * D + 1/4 * \cos(\theta/2) * Cc' * \omega t * (h2^2 - h1^2) * R}$$

관경 mm	외경 mm	외압		특수압류의 발출지지력	저항력(kg)		최소길이 L(cm)
		P(kg)	P*안전율		Fs	Fn	
80	98	800	1,000	3,771	671	429	230
100	118	1,159	1,448	5,467	973	622	274
125	144	1,727	2,158	8,143	1,449	927	330
150	170	2,407	3,008	11,349	2,020	1,291	385
200	222	4,105	5,131	19,353	3,445	2,203	491
250	274	6,254	7,817	29,482	5,248	3,356	593
300	326	8,853	11,066	41,734	7,430	4,751	689
350	378	11,902	14,877	33,666	9,989	6,387	782
400	429	15,331	19,163	43,363	12,867	8,227	869
450	480	19,193	23,991	54,286	16,108	10,300	952
500	532	23,577	29,471	66,685	19,787	12,652	1,033
600	635	33,590	41,987	95,007	28,191	18,026	1,185
700	738	45,371	56,713	128,328	38,078	24,348	1,325
800	842	59,059	73,823	111,363	49,566	31,694	1,457
900	945	74,392	92,990	140,276	62,434	39,923	1,578
1000	1,048	91,493	114,366	155,269	76,786	49,100	1,691
1100	1,144	109,022	136,277	164,460	91,498	58,507	1,789
1200	1,255	131,205	164,006	185,553	110,116	70,412	1,896

2. 수직곡관 또는 정자관 사용시

$$p * A \leq \frac{F_s}{S_f}$$

$$L \geq \frac{S_f * p * D}{4 * \mu * w t * H_c}$$

관경 mm	외경 mm	외압		특수압륜의 발출지지력	주변마찰력 Fs	최소길이 L(cm)
		P(kg)	P*안전율			
80	98	565	706	3,771	706	342
100	118	820	1,025	5,467	1,025	408
125	144	1,221	1,526	8,143	1,523	491
150	170	1,702	2,127	11,349	2,125	573
200	222	2,903	3,628	19,353	3,625	731
250	274	4,422	5,527	29,482	5,524	882
300	326	6,260	7,825	41,734	7,821	1,026
350	378	8,416	10,520	33,666	10,518	1,164
400	429	10,840	13,550	43,363	13,545	1,293
450	480	13,571	16,963	54,286	16,957	1,417
500	532	16,671	20,838	66,685	20,827	1,538
600	635	23,751	29,688	95,007	29,689	1,765
700	738	32,082	40,102	128,328	40,099	1,974
800	842	41,761	52,201	111,363	52,178	2,169
900	945	52,603	65,753	140,276	65,748	2,350
1000	1,048	64,695	80,868	155,269	80,859	2,518
1100	1,144	77,090	96,362	164,460	96,361	2,665
1200	1,255	92,776	115,970	185,553	115,932	2,823

구경별 수압에 의하여 관에 작용하는 힘

(단위:kgf)

관경	외경(mm)	Hc	90°	45°	22.5°	11.25°	T자관
80	98	104.90	800	432	220	110	565
100	118	105.90	1,159	627	320	160	820
125	144	107.20	1,727	934	476	239	1,221
150	170	108.50	2,407	1,302	664	333	1,702
200	222	111.10	4,105	2,221	1,132	569	2,903
250	274	113.70	6,254	3,384	1,725	866	4,422
300	326	116.30	8,853	4,791	2,442	1,227	6,260
350	378	118.90	11,902	6,441	3,283	1,649	8,416
400	429	121.45	15,331	8,297	4,229	2,125	10,840
450	480	124.00	19,193	10,387	5,295	2,660	13,571
500	532	126.60	23,577	12,759	6,504	3,268	16,671
600	635	131.75	33,590	18,178	9,267	4,656	23,751
700	738	136.90	45,371	24,554	12,517	6,289	32,082
800	842	142.10	59,059	31,962	16,294	8,186	41,761
900	945	147.25	74,392	40,260	20,524	10,312	52,603
1000	1,048	152.40	91,493	49,515	25,242	12,682	64,695
1100	1,144	157.20	109,022	59,002	30,079	15,112	77,090
1200	1,255	162.75	131,205	71,008	36,199	18,187	92,776