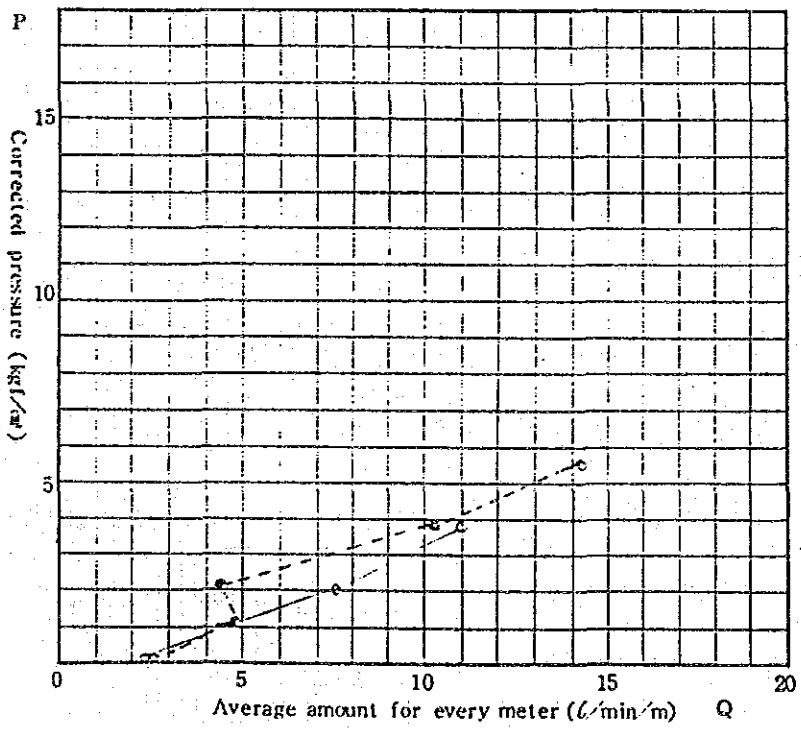
Lugeon Test Data Sheet

Stage No. 1

Location	Main Dam	Name of hole	D - 2	Depth (m)	10.0~15.0	Length of test section (m)	5.0
Water Level (m)	0.6	Hight of gauge (m)	0.5	Length of rod (m)	10.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	12/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.1	0.1	12 11	13 11	9 12	11 12	12 11	11.4	2.3
1.0	0.4	1.1	18 24	25 25	26 26	26 25	25 26	24.6	4.9
2.0	1.1	2.0	38 38	38 39	37 38	37 38	38 37	37.8	7.6
4.0	2.2	3.9	55 55	56 54	54 56	55 56	56 55	55.2	11.0
6.0	3.7	5.7	70 72	71 70	70 71	72 70	71 71	70.8	14.2
4.0	2.0	3.9	53 51	53 51	52 52	53 50	52 50	51.7	10.3
2.0	0.3	2.1	23 20	22 24	20 22	20 23	23 21	21.8	4.4
1.0	0.4	1.1	25 24	25 23	25 24	24 25	24 24	24.3	4.9
0.0	0.1	0.1	15 13	15 1	14 15	14 14	13 15	12.9	2.6



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	21.9
Maximum pressure (kgf/cm²)	5.7
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

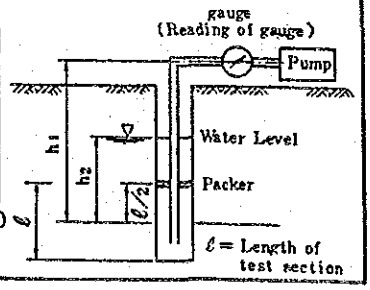
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

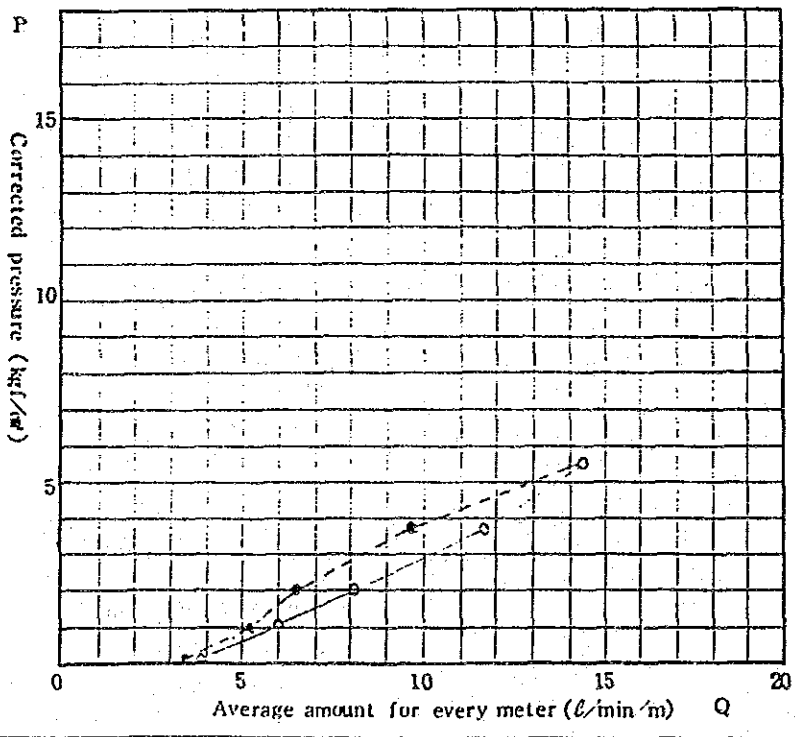


Lugeon Test Data Sheet

Stage NO. 2

Location	Main Dam	Name of hole	D - 2	Depth (m)	15.0~20.0	Length of test section (m)	5.0
Water Level (m)	1.0	Hight of gauge (m)	-0.5	Length of rod (m)	15.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	14/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.4	0.1	21 19	21 29	20 8	19 20	19 19	19.5	3.9
1.0	1.0	1.1	31 29	29 28	29 29	29 29	30 37	30.0	6.0
2.0	1.8	2.0	34 38	51 43	30 46	36 41	41 43	40.3	8.1
4.0	3.8	3.8	62 59	60 58	60 59	60 57	59 57	59.1	11.8
6.0	5.7	5.6	70 73	72 73	71 72	73 73	73 72	72.2	14.4
4.0	2.6	3.9	50 49	49 50	49 49	53 49	45 49	49.2	9.8
2.0	1.2	2.0	33 32	32 33	33 33	34 32	32 32	32.6	6.5
1.0	0.7	1.1	27 24	26 26	26 26	27 26	26 26	26.0	5.2
0.0	0.3	0.1	18 17	18 17	17 18	17 17	18 18	17.5	3.5



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	25.0
Maximum pressure (kgf/cm²)	5.6
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

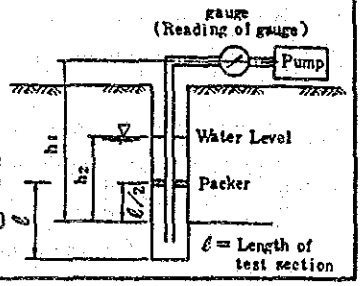
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

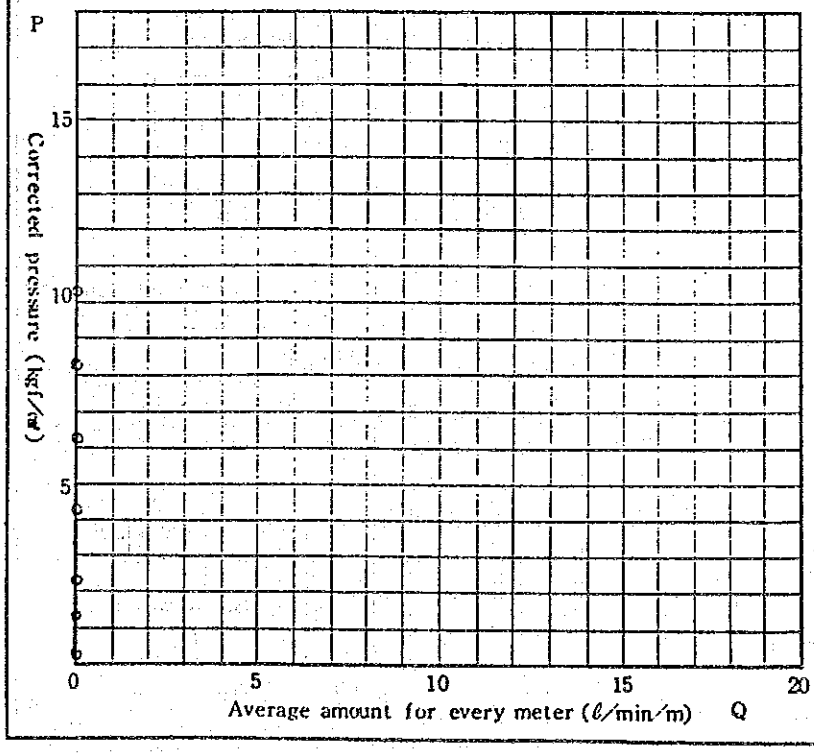


Lugeon Test Data Sheet

Stage No. 3

Location	Main Dam	Name of hole	D - 2	Depth (m)	20.0~25.0	Length of test section (m)	5.0
Water Level (m)	1.1	Hight of gauge (m)	0.5	Length of rod (m)	20.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	15/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
1.0	0.0	1.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
2.0	0.0	2.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
4.0	0.0	4.2	0	0	0	0	1	0.1	0.0
			0	0	0	0	0		
6.0	0.0	6.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
8.0	0.0	8.2	0	0	0	0	1	0.1	0.0
			0	0	0	0	0		
10.0	0.0	10.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
8.0	0.0	8.2	0	0	0	0	1	0.1	0.0
			0	0	0	0	0		
6.0	0.0	6.2	0	0	0	1	0	0.1	0.0
			0	0	0	0	0		
4.0	0.0	4.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
2.0	0.0	2.2	0	0	1	0	0	0.1	0.0
			0	0	0	0	0		
1.0	0.0	1.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
0.0	0.0	0.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		



Lugeon value (Lu)	0.0
Calculated Lugeon Value (Lu')	—
Maximum pressure (kgf/cm²)	10.2
Critical pressure (kgf/cm²)	—

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

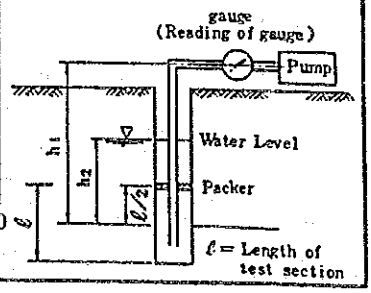
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

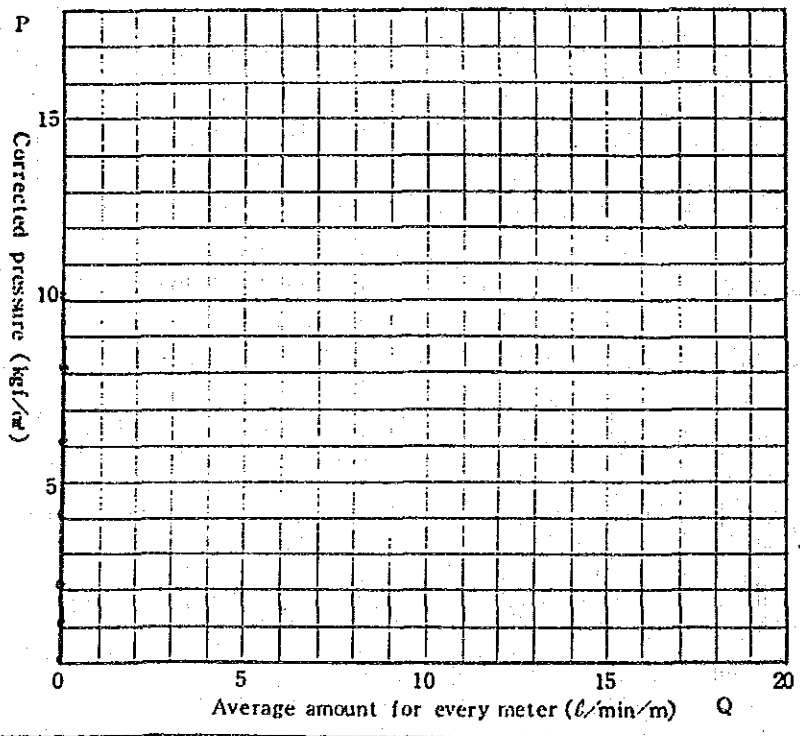


Lugeon Test Data Sheet

Stage No. 4

Location	Main Dam	Name of hole	D - 2	Depth (m)	25.0~ 30.0	Length of test section (m)	5.0
Water Level (m)	0.7	Hight of gauge (m)	0.5	Length of rod (m)	25.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	16/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.1	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
1.0	0.0	1.1	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
2.0	0.0	2.1	0	0	1	0	0	0.1	0.0
			0	0	0	0	0		
4.0	0.0	4.1	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
6.0	0.0	6.1	1	0	0	0	0	0.2	0.0
			1	0	0	0	0		
8.0	0.0	8.1	0	0	0	0	0	0.1	0.0
			0	1	0	0	0		
10.0	0.0	10.1	0	0	1	0	0	0.3	0.1
			0	1	0	0	1		
8.0	0.0	8.1	0	0	0	0	1	0.1	0.0
			0	0	0	0	0		
6.0	0.0	6.1	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
4.0	0.0	4.1	1	0	0	0	0	0.1	0.0
			0	0	0	0	0		
2.0	0.0	2.1	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
1.0	0.0	1.1	0	1	0	0	0	0.1	0.0
			0	0	0	0	0		
0.0	0.0	0.1	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		



Lugeon value (Lu)	0.1
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

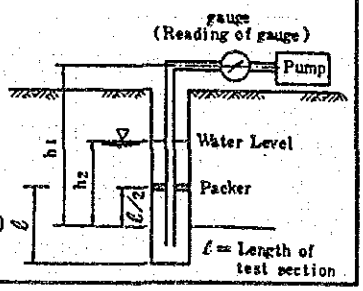
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

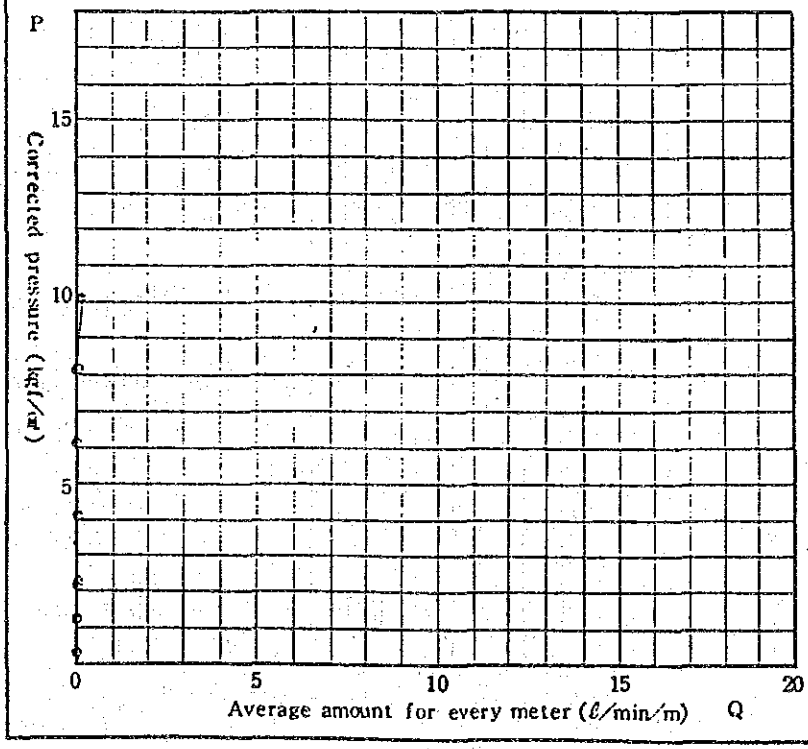


Lugeon Test Data Sheet

Stage No. 5

Location	Main Dam	Name of hole	D - 2	Depth (m)	30.0~35.0	Length of test section (m)	5.0
Water Level (m)	1.0	Hight of gauge (m)	0.5	Length of rod (m)	30.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	17/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
1.0	0.0	1.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
2.0	0.0	2.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
4.0	0.0	4.1	0	0	0	1	0	0.2	0.0
			0	0	0	0	1		
6.0	0.0	6.1	0	0	0	0	0	0.1	0.0
			1	0	0	0	0		
8.0	0.0	8.1	0	1	0	0	0	0.2	0.0
			0	0	1	0	0		
10.0	0.0	10.1	1	0	0	1	0	0.3	0.1
			1	0	0	0	0		
8.0	0.0	8.1	0	0	0	0	0	0.1	0.0
			1	0	0	0	0		
6.0	0.0	6.1	0	0	0	0	0	0.1	0.0
			0	1	0	0	0		
4.0	0.0	4.1	0	0	0	0	0	0.1	0.0
			0	1	0	0	0		
2.0	0.0	2.1	0	0	0	0	0	0.1	0.0
			0	0	0	0	1		
1.0	0.0	1.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
0.0	0.0	0.2	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		



Lugeon value (Lu)	0.1
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

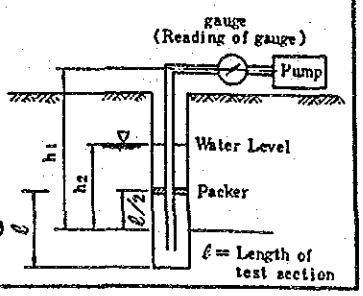
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

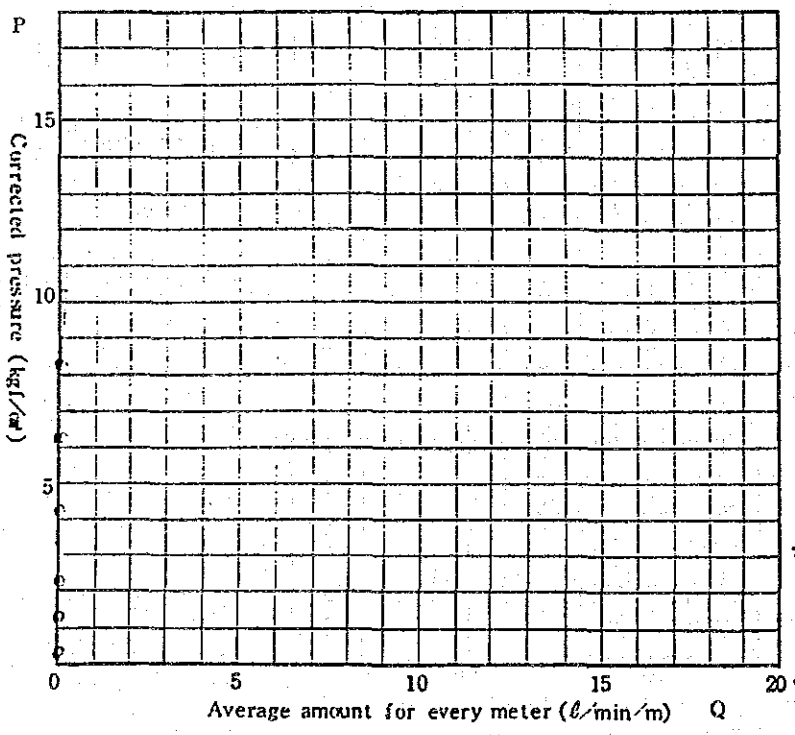


Lugeon Test Data Sheet

Stage No. 6

Location	Main Dam	Name of hole	D - 2	Depth (m)	35.0~40.0	Length of test section (m)	5.0
Water Level (m)	1.0	Hight of gauge (m)	1.5	Length of rod (m)	36.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	19/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.3	0	0	0	0	0	0.0	0.0
			0	0	0	0	0		
1.0	0.0	1.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		
2.0	0.0	2.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		
4.0	0.0	4.2	0	0	0	0	1	0.2	0.0
			0	0	0	0	1		
6.0	0.0	6.2	0	1	0	0	1	0.3	0.1
			0	0	0	0	1		
8.0	0.0	8.2	0	0	0	1	0	0.2	0.0
			0	1	0	0	0		
10.0	0.0	10.2	0	1	0	1	0	0.4	0.1
			0	1	0	0	1		
8.0	0.0	8.2	0	0	1	0	0	0.2	0.0
			0	1	0	0	0		
6.0	0.0	6.2	0	0	1	0	0	0.2	0.0
			0	0	0	0	1		
4.0	0.0	4.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		
2.0	0.0	2.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		
1.0	0.0	1.2	0	0	0	0	0	0.1	0.0
			0	0	0	0	1		
0.0	0.0	0.2	1	0	0	0	0	0.1	0.0
			0	0	0	0	0		



Lugeon value (Lu)	0.1
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.2
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

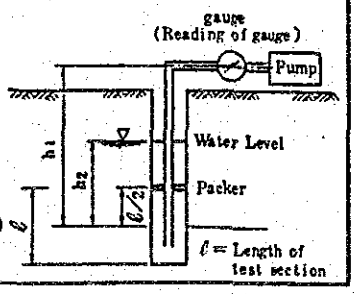
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

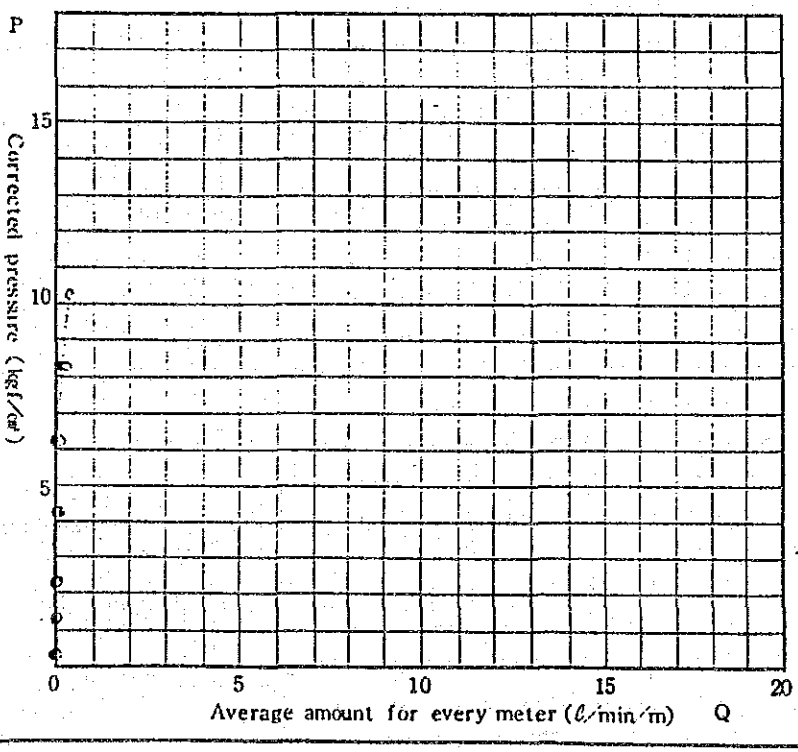


Lugeon Test Data Sheet

Stage No. 7

Location	Main Dam	Name of hole	D - 2	Depth (m)	40.0~45.0	Length of test section (m)	5.0
Water Level (m)	1.2	Hight of gauge (m)	0.5	Length of rod (m)	40.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	21/9

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		
1.0	0.0	1.2	0	1	0	0	0	0.2	0.0
			1	0	0	0	0		
2.0	0.0	2.2	0	0	0	1	0	0.2	0.0
			0	0	0	1	0		
4.0	0.0	4.2	0	0	0	0	1	0.1	0.0
			0	0	0	0	0		
6.0	0.0	6.2	0	1	0	0	0	0.3	0.1
			1	0	0	1	0		
8.0	0.0	8.2	0	1	0	1	1	1.1	0.2
			4	1	1	0	2		
10.0	0.0	10.2	2	2	1	2	2	1.7	0.3
			2	1	1	2	2		
8.0	0.0	8.2	2	1	0	0	0	0.6	0.1
			1	0	1	0	1		
6.0	0.0	6.2	0	0	1	0	0	0.2	0.0
			0	0	0	1	0		
4.0	0.0	4.2	0	0	0	1	0	0.3	0.1
			0	0	1	0	1		
2.0	0.0	2.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		
1.0	0.0	1.2	0	0	0	0	0	0.1	0.0
			0	1	0	0	0		
0.0	0.0	0.2	0	0	0	0	0	0.1	0.0
			0	0	1	0	0		



Lugeon value (Lu)	0.3
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.2
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

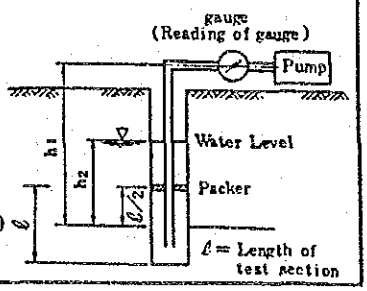
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

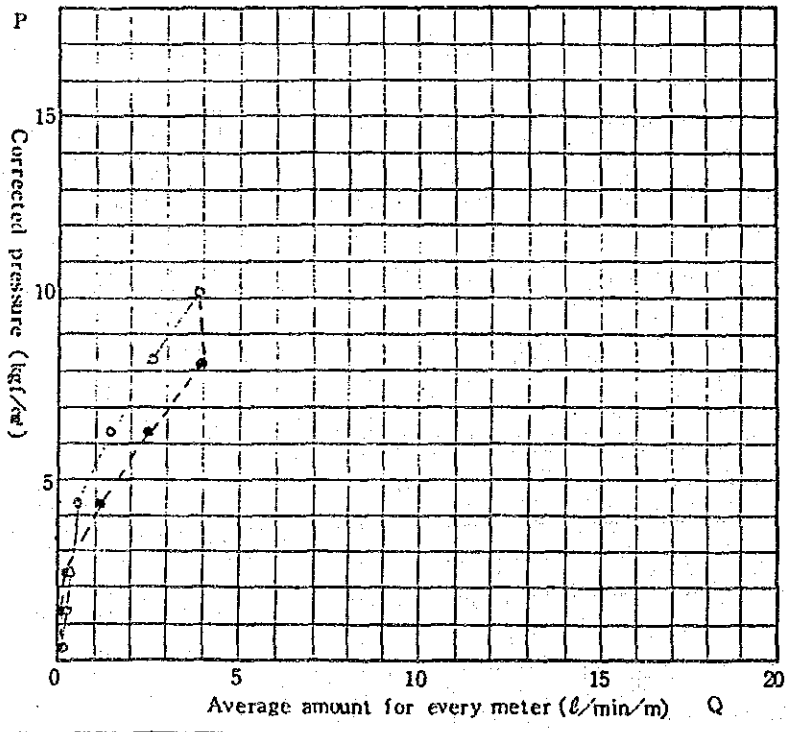


Lugeon Test Data Sheet

Stage No. 8

Location	Main Dam	Name of hole	D - 2	Depth (m)	45.0~50.0	Length of test section (m)	5.0
Water Level (m)	1.3	Hight of gauge (m)	1.3	Length of rod (m)	46.3	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	23/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.3	0	0	1	0	0	0.3	0.1
			1	0	0	1	0		
1.0	0.0	1.3	1	0	0	1	0	0.8	0.2
			1	1	1	1	2		
2.0	0.0	2.3	2	1	1	2	1	1.5	0.3
			1	2	2	1	2		
4.0	0.0	4.3	4	3	3	3	4	3.4	0.7
			3	4	3	3	4		
6.0	0.2	6.2	5	6	6	7	7	7.0	1.4
			8	9	10	1	11		
8.0	0.6	8.2	11	12	13	12	14	13.3	2.7
			13	13	14	15	16		
10.0	1.2	10.1	17	17	18	9	20	19.3	3.9
			22	21	23	22	24		
8.0	1.3	8.1	21	21	20	21	21	20.1	4.0
			21	20	20	18	18		
6.0	0.5	6.2	17	16	7	14	13	12.5	2.5
			13	12	11	11	11		
4.0	0.1	4.3	9	8	7	6	6	5.4	1.1
			5	4	4	3	2		
2.0	0.0	2.3	2	1	1	1	2	1.2	0.2
			1	1	1	1	1		
1.0	0.0	1.3	1	1	1	1	0	0.7	0.1
			1	1	1	0	0		
0.0	0.0	0.3	1	0	0	1	1	0.4	0.1
			0	0	0	1	0		



Lugeon value (Lu)	3.9
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

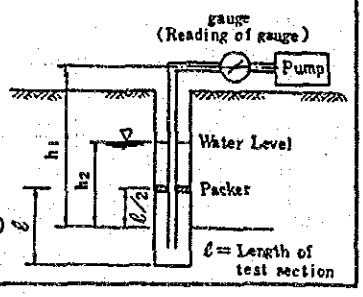
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

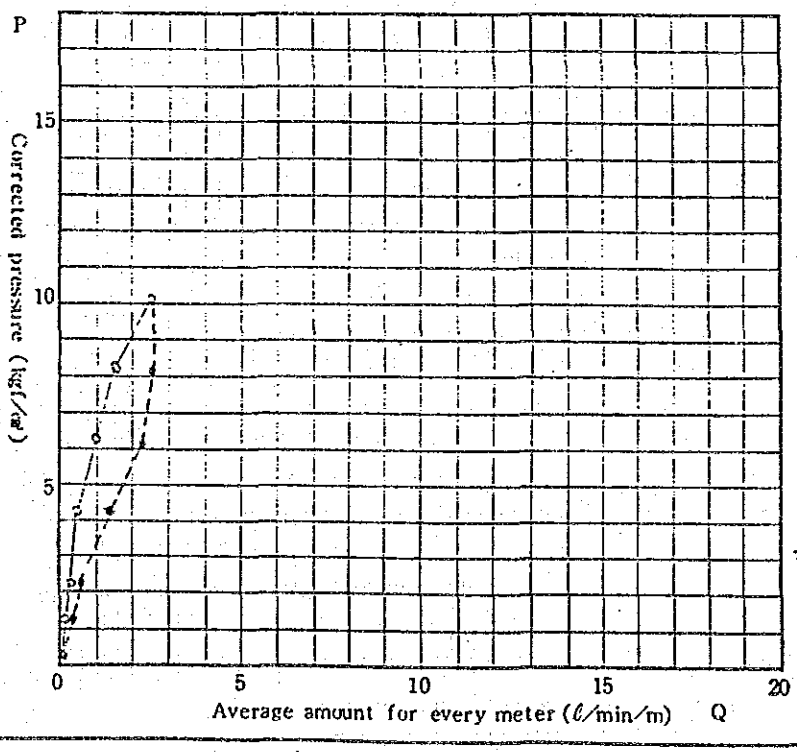


Lugeon Test Data Sheet

Stage No. 9

Location	Main Dam	Name of hole	D - 2	Depth (m)	50.0~55.0	Length of test section (m)	5.0
Water Level (m)	1.4	Hight of gauge (m)	0.5	Length of rod (m)	50.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	26/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.2	1	0	0	0	0	0.4	0.1
			1	0	1	0	1		
1.0	0.0	1.2	0	1	1	0	1	0.7	0.1
			1	0	1	1	1		
2.0	0.0	2.2	2	1	1	1	2	1.7	0.3
			1	2	3	1	3		
4.0	0.0	4.2	2	3	3	3	2	2.7	0.5
			3	3	2	3	3		
6.0	0.1	6.2	4	4	5	4	5	4.8	1.0
			5	5	5	6	5		
8.0	0.2	8.2	7	7	7	7	8	7.5	1.5
			7	8	8	8	8		
10.0	0.6	10.1	10	11	11	12	13	12.9	2.6
			13	14	14	15	16		
8.0	0.6	8.1	15	14	14	13	13	13.1	2.6
			13	12	13	12	12		
6.0	0.4	6.1	12	12	11	12	11	11.0	2.2
			11	10	11	10	10		
4.0	0.1	4.2	9	8	8	7	6	6.3	1.3
			6	6	5	4	4		
2.0	0.0	2.2	4	3	3	3	3	3.0	0.6
			3	3	3	2	3		
1.0	0.0	1.2	3	2	2	2	1	1.6	0.3
			1	2	1	1	1		
0.0	0.0	0.2	1	0	1	0	1	0.5	0.1
			0	1	0	1	0		



Lugeon value (Lu)	2.6
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

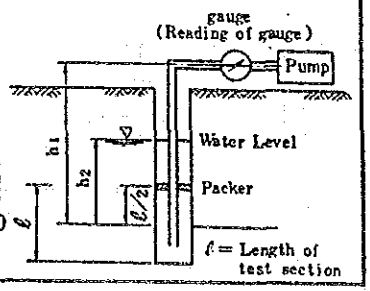
γ_w: Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

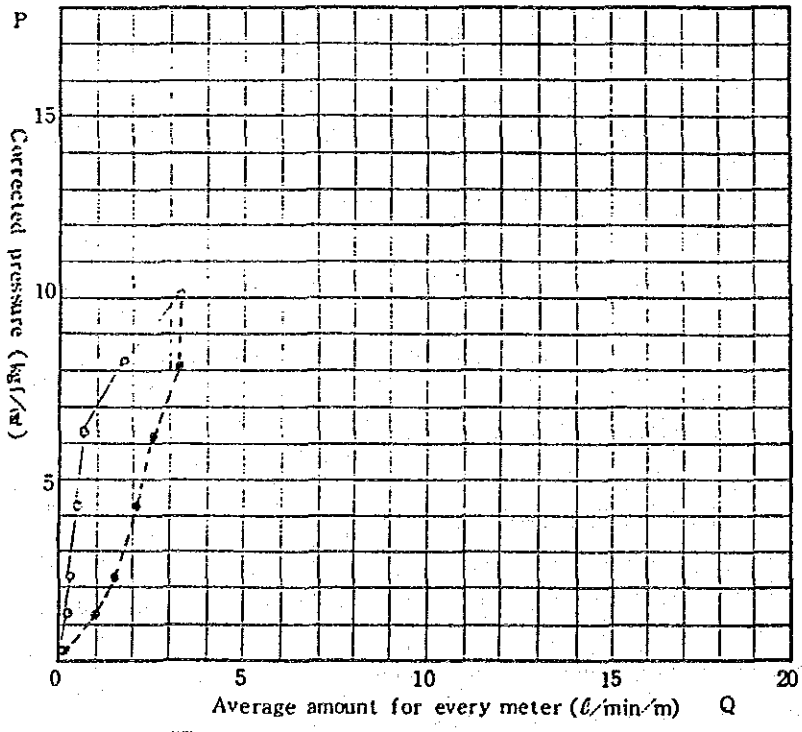


Lugeon Test Data Sheet

Stage No. 10

Location	Main Dam	Name of hole	D - 2	Depth (m)	55.0~60.0	Length of test section (m)	5.0
Water Level (m)	1.45	Hight of gauge (m)	0.5	Length of rod (m)	55.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	27/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.2	1	0	0	0	1	0.4	0.1
			1	0	1	0	0		
1.0	0.0	1.2	1	1	1	1	1	1.2	0.2
			2	1	1	2	1		
2.0	0.0	2.2	1	2	1	1	2	1.3	0.3
			1	1	2	1	1		
4.0	0.0	4.2	2	2	2	2	3	2.5	0.5
			2	3	3	3	3		
6.0	0.1	6.2	3	4	3	4	4	4.0	0.8
			4	4	5	4	5		
8.0	0.3	8.2	6	7	7	7	8	9.1	1.8
			9	10	11	13	13		
10.0	1.0	10.1	14	15	15	16	17	16.0	3.2
			18	18	8	19	20		
8.0	1.0	8.1	17	16	16	16	16	15.8	3.2
			15	16	16	15	15		
6.0	0.7	6.1	15	15	15	14	14	13.6	2.7
			13	13	13	12	12		
4.0	0.4	4.2	12	11	11	11	11	10.7	2.1
			10	11	10	10	10		
2.0	0.3	2.2	10	9	9	8	9	8.6	1.7
			9	9	8	8	7		
1.0	0.1	1.2	6	7	6	6	6	5.1	1.0
			5	4	4	4	3		
0.0	0.0	0.2	2	1	2	1	1	0.9	0.2
			1	0	1	0	0		



Lugeon value (Lu)	3.2
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

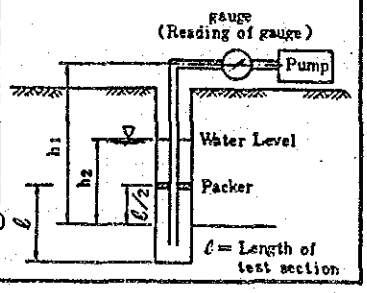
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

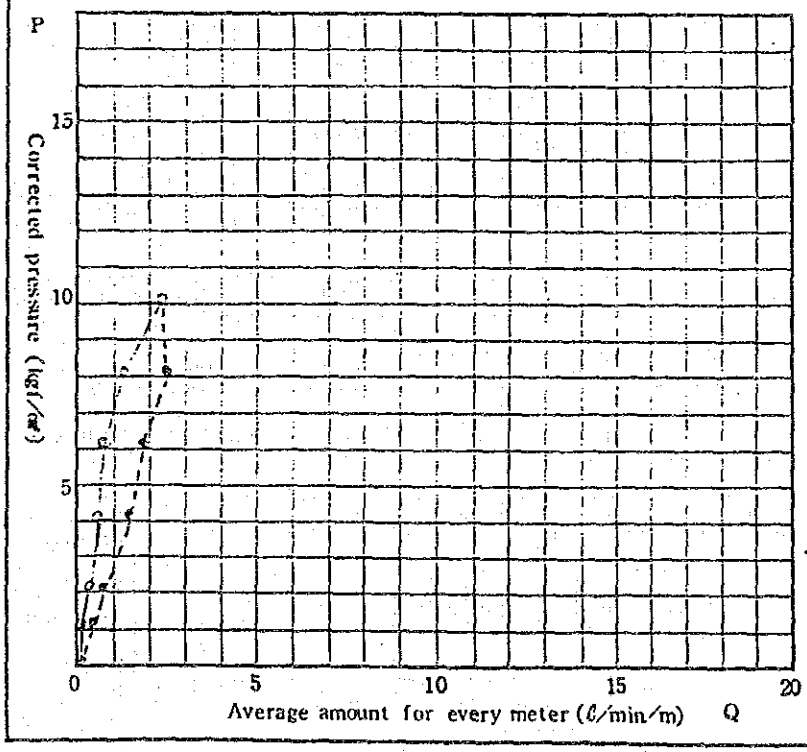


Lugeon Test Data Sheet

Stage No. 11

Location	Main Dam	Name of hole	D - 2	Depth (m)	60.0~65.0	Length of test section (m)	5.0
Water Level (m)	0.7	Hight of gauge (m)	0.5	Length of rod (m)	20.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	29/9

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.1	1	0	0	0	0	0.3	0.1
			1	0	1	0	0		
1.0	0.0	1.1	1	0	1	0	1	0.6	0.1
			0	1	0	1	1		
2.0	0.0	2.1	1	2	1	2	2	1.9	0.4
			2	2	3	2	2		
4.0	0.0	4.1	2	3	3	2	3	2.9	0.6
			3	3	3	4	3		
6.0	0.0	6.1	4	4	4	4	4	4.1	0.8
			4	4	5	4	4		
8.0	0.0	8.1	5	5	6	6	6	5.8	1.2
			6	6	6	6	6		
10.0	0.2	10.1	8	9	10	10	12	11.6	2.3
			13	12	13	14	15		
8.0	0.2	8.1	5	20	13	12	12	12.1	2.4
			12	12	11	12	12		
6.0	0.1	6.1	10	10	11	10	10	9.6	1.9
			9	10	9	9	8		
4.0	0.1	4.1	8	7	6	7	6	6.5	1.3
			6	7	6	6	6		
2.0	0.0	2.1	4	5	4	4	4	3.7	0.7
			3	4	3	3	3		
1.0	0.0	1.1	3	2	2	2	3	1.9	0.4
			2	2	1	1	1		
0.0	0.0	0.1	1	1	1	1	1	0.7	0.1
			1	0	1	0	0		



Lugeon value (Lu)	2.3
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

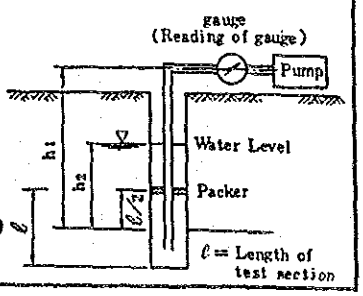
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

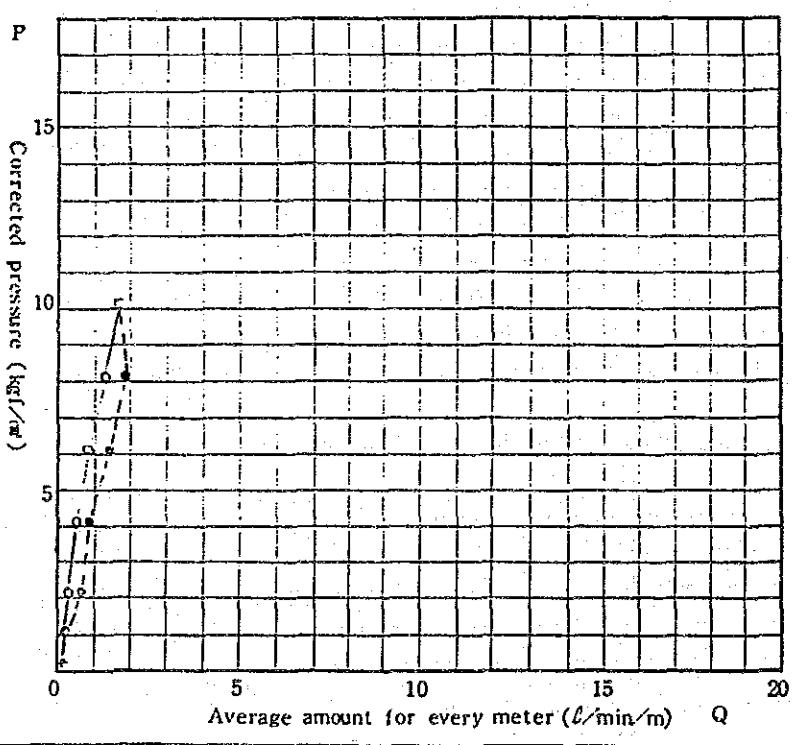


Lugeon Test Data Sheet

Stage No. 12

Location	Main Dam	Name of hole	D - 2	Depth (m)	65.0~ 70.0	Length of test section (m)	5.0
Water Level (m)	0.9	Hight of gauge (m)	0.5	Length of rod (m)	70.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	30/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.1	1	0	0	0	0	0.4	0.1
			0	1	1	1	0		
1.0	0.0	1.1	1	1	1	1	1	1.0	0.2
			1	1	1	1	1		
2.0	0.0	2.1	2	1	2	1	2	1.7	0.3
			1	2	2	1	3		
4.0	0.0	4.1	3	2	3	3	3	2.9	0.6
			3	3	3	3	3		
6.0	0.1	6.1	3	4	4	4	5	4.3	0.9
			4	5	4	5	5		
8.0	0.2	8.1	6	5	5	6	6	5.9	1.2
			6	6	6	7	6		
10.0	0.4	10.1	8	7	8	8	9	8.9	1.8
			9	10	9	10	11		
8.0	0.4	8.1	10	9	10	10	10	9.5	1.9
			9	10	9	9	9		
6.0	0.2	6.1	7	6	7	7	7	6.8	1.4
			7	6	7	7	7		
4.0	0.1	4.1	6	5	5	5	6	4.6	0.9
			3	4	4	4	4		
2.0	0.0	2.1	4	3	3	4	3	3.0	0.6
			3	2	3	3	2		
1.0	0.0	1.1	2	1	1	1	2	1.2	0.2
			1	1	1	1	1		
0.0	0.0	0.1	1	1	0	1	0	0.6	0.1
			1	0	1	0	1		



Lugeon value (Lu)	1.8
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

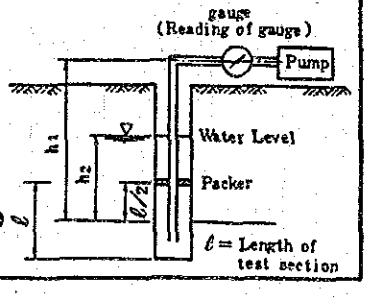
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

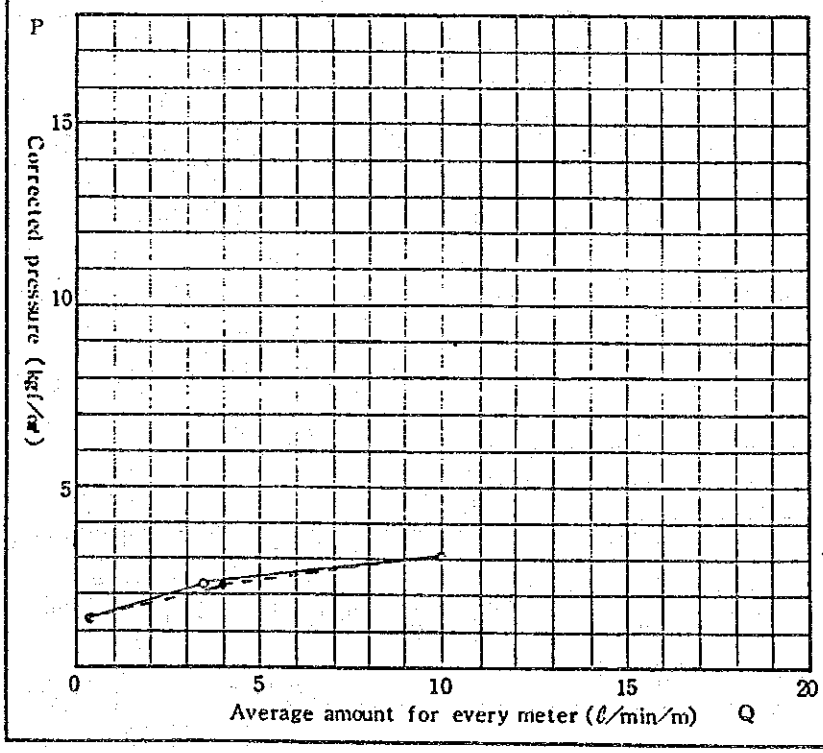


Lugeon Test Data Sheet

Stage No. 1

Location	Main Dam	Name of hole	D - 3	Depth (m)	10.0~15.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.5	Length of rod (m)	10.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	19/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.3	3	1	2	2	3	2.1	0.4
			2	3	2	1	2		
1.0	0.2	2.3	18	17	17	18	17	17.4	3.5
			16	18	18	17	18		
2.0	1.8	3.1	51	49	49	50	51	49.9	10.0
			50	50	49	50	50		
1.0	0.3	2.3	19	18	18	19	17	20.0	4.0
			18	19	37	18	17		
0.0	0.0	1.3	2	2	3	1	2	2.0	0.4
			2	3	2	2	1		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	27.4
Maximum pressure (kgf/cm²)	3.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

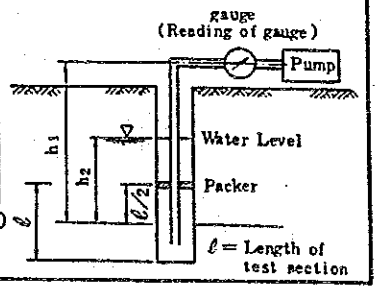
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

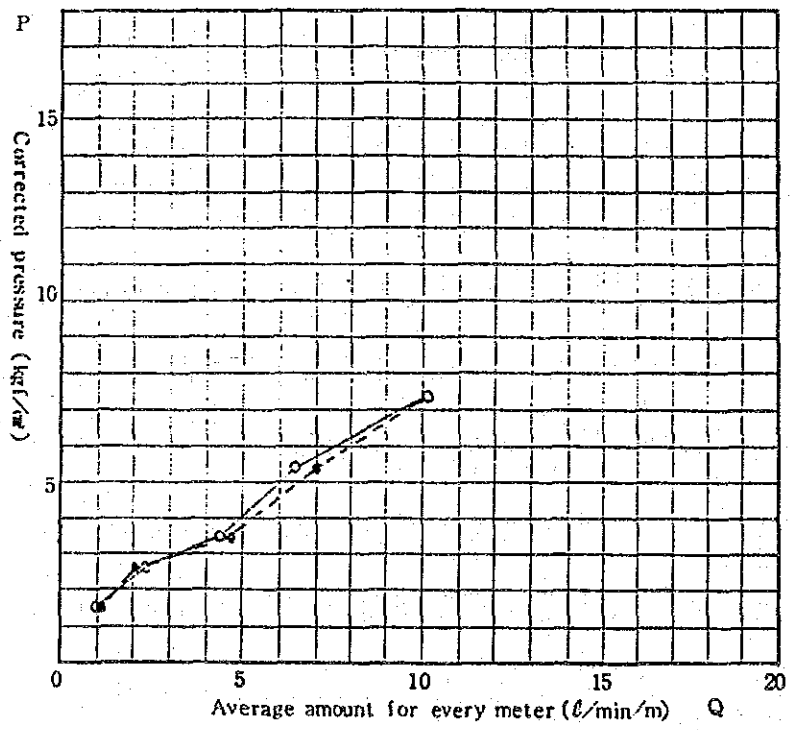


Lugeon Test Data Sheet

Stage No. 2

Location	Main Dam	Name of hole	D - 3	Depth (m)	15.0~20.0	Length of test section (m)	5.0
Water Level (m)	16.0	Hight of gauge (m)	1.3	Length of rod (m)	16.3	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	26/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.7	5	6	5	5	6	5.2	1.0
			6	5	5	4	5		
1.0	0.1	2.7	10	9	10	11	10	11.3	2.3
			11	14	13	12	13		
2.0	0.6	3.7	21	23	22	20	22	22.1	4.4
			23	20	22	25	23		
4.0	1.2	5.6	33	31	33	31	32	31.8	6.4
			31	32	34	30	31		
6.0	2.9	7.4	49	48	48	47	48	50.7	10.1
			49	50	61	54	53		
4.0	1.4	5.6	37	37	36	34	35	34.8	7.0
			36	37	34	31	31		
2.0	0.6	3.7	24	24	26	24	23	23.6	4.7
			21	25	23	22	24		
1.0	0.1	2.7	10	12	11	11	10	10.4	2.1
			11	11	10	9	9		
0.0	0.0	1.7	6	5	6	4	5	5.3	1.1
			6	5	6	5	5		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	14.3
Maximum pressure (kgf/cm²)	7.4
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

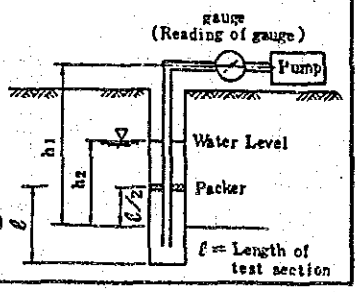
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

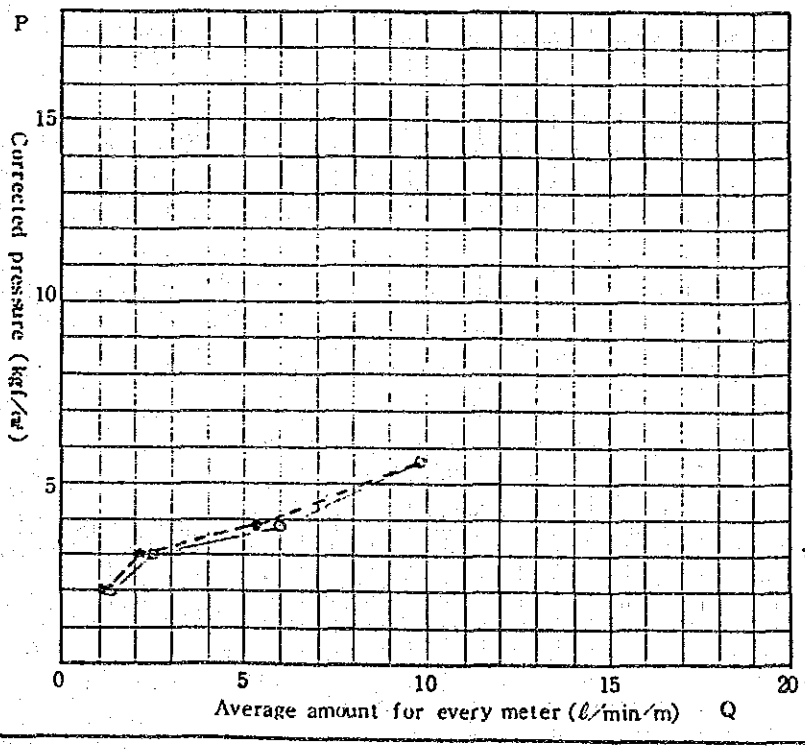


Lugeon Test Data Sheet

Stage No. 3

Location	Main Dam	Name of hole	D - 3	Depth (m)	20.0 ~25.0	Length of test section (m)	5.0
Water Level (m)	19.0	Hight of gauge (m)	1.5	Length of rod (m)	21.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	29/9

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.1	2.0	5	6	6	7	6	6.1	1.2
			5	6	7	7	6		
1.0	0.2	3.0	13	12	12	13	12	12.3	2.5
			11	13	13	12	12		
2.0	1.4	3.9	30	29	30	29	31	30.2	6.0
			31	30	30	31	31		
4.0	3.7	5.7	51	49	49	50	50	49.6	9.9
			49	49	50	50	49		
2.0	1.1	3.9	28	27	26	27	27	26.7	5.3
			26	26	27	26	27		
1.0	0.2	3.0	11	11	12	11	10	11.0	2.2
			11	12	11	11	10		
0.0	0.0	2.0	5	5	6	5	6	5.7	1.1
			7	6	5	6	6		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	21.7
Maximum pressure (kgf/cm²)	5.7
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

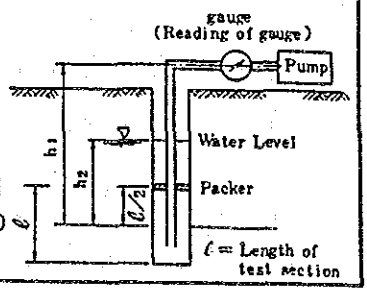
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

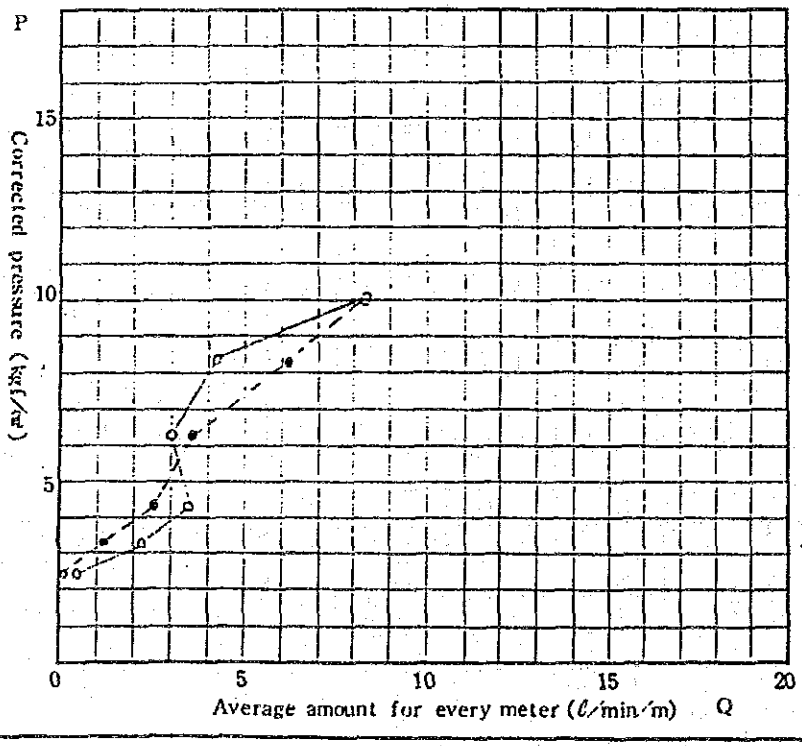


Lugeon Test Data Sheet

Stage No. 4

Location	Main Dam	Name of hole	D - 3	Depth (m)	25.0~30.0	Length of test section (m)	5.0
Water Level (m)	23.2	Hight of gauge (m)	0.5	Length of rod (m)	25.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer				Date	1/10

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.4	2	3	2	3	3	2.5	0.5
			2	2	3	3	2		
1.0	0.2	3.3	7	6	6	7	6	11.1	2.2
			55	6	6	7	5		
2.0	0.6	4.3	9	88	10	9	10	17.7	3.5
			10	11	11	9	10		
4.0	0.4	6.3	14	15	15	14	16	14.9	3.0
			15	15	16	14	15		
6.0	0.8	8.3	22	21	20	21	22	21.1	4.2
			20	20	21	22	22		
8.0	3.0	10.0	41	40	42	41	41	41.3	8.3
			40	41	42	43	42		
6.0	1.7	8.2	31	32	32	31	30	31.2	6.2
			33	32	31	30	30		
4.0	0.6	6.3	19	20	20	19	19	18.6	3.7
			18	18	19	17	17		
2.0	0.3	4.3	14	15	15	14	13	13.1	2.6
			13	14	12	10	11		
1.0	0.1	3.4	8	7	7	6	7	6.2	1.2
			6	5	5	6	5		
0.0	0.0	2.4	2	1	1	0	1	0.7	0.1
			1	0	0	1	0		



Lugeon value (Lu)	5.3
Calculated Lugeon Value (Lu')	–
Maximum pressure (kgf/cm²)	10.0
Critical pressure (kgf/cm²)	8.3

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

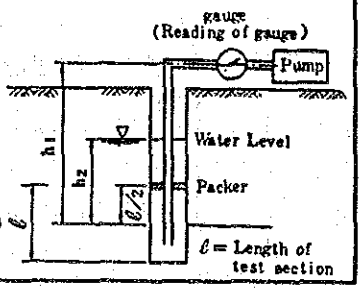
γ_w: Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

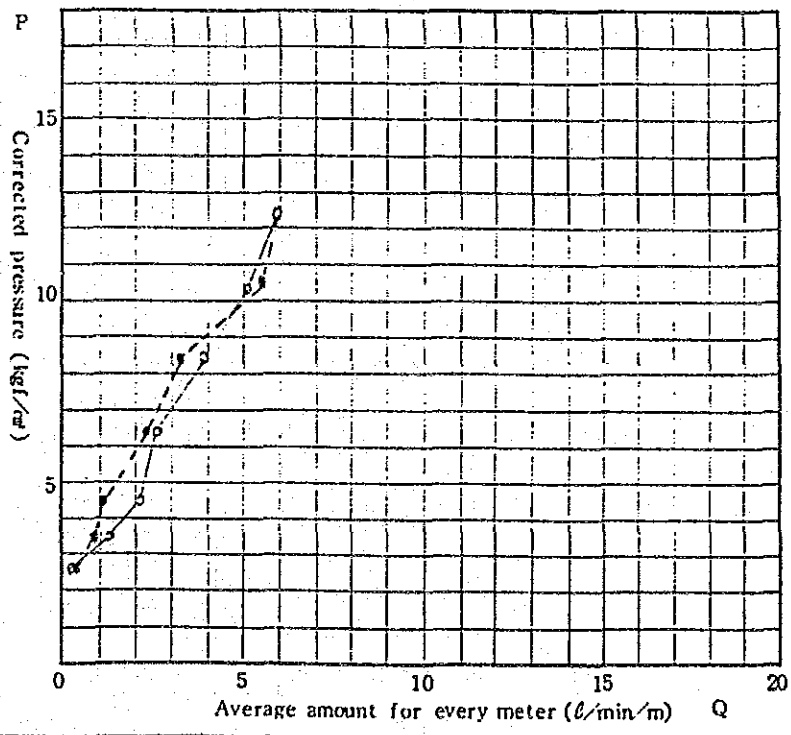


Lugeon Test Data Sheet

Stage No. 5

Location	Main Dam	Name of hole	D - 3	Depth (m)	30.0~35.0	Length of test section (m)	5.0
Water Level (m)	25.0	Hight of gauge (m)	0.8	Length of rod (m)	30.8	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	4/10

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.6	1	1	2	1	0	1.1	0.2
			1	1	2	1	1		
1.0	0.1	3.6	6	5	11	5	6	6.2	1.2
			6	5	6	6			
2.0	0.2	4.6	11	10	9	10	11	10.3	2.1
			10	10	11	10	11		
4.0	0.4	6.5	16	15	15	8	8	13.9	2.8
			16	15	15	16	15		
6.0	0.8	8.5	22	21	22	22	21	19.4	3.9
			22	21	21	10	12		
8.0	1.4	10.4	26	25	25	25	26	25.3	5.1
			25	25	26	25	25		
10.0	1.9	12.4	30	31	30	30	29	29.6	5.9
			29	30	29	29	29		
8.0	1.5	10.7	27	26	26	27	26	26.3	5.3
			27	27	26	26	25		
6.0	1.0	8.5	23	21	20	21	21	21.1	4.2
			22	21	21	21	20		
4.0	0.6	6.5	17	16	16	15	15	16.8	3.4
			15	16	15	13	30		
2.0	0.1	4.6	6	5	5	6	5	5.3	1.1
			5	5	6	5	5		
1.0	0.0	3.6	6	5	5	5	4	4.6	0.9
			4	5	4	4	4		
0.0	0.0	2.6	2	1	2	1	1	1.3	0.3
			2	1	1	1	1		



Lugeon value (Lu)	4.8
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	12.4
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

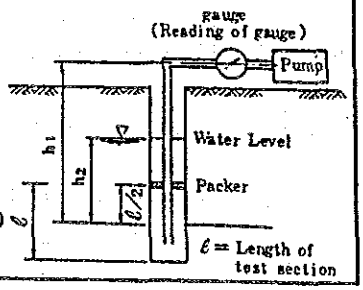
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

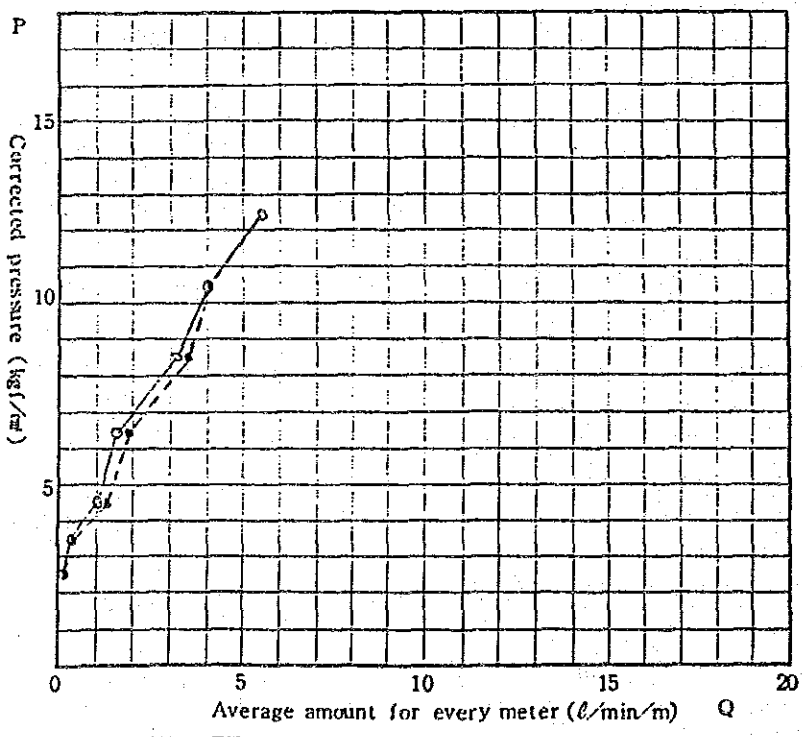


Lugeon Test Data Sheet

Stage No. 6

Location	Main Dam	Name of hole	D - 3	Depth (m)	35.0 ~40.0	Length of test section (m)	5.0
Water Level (m)	25.8	Hight of gauge (m)	0.5	Length of rod (m)	36.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	6/10

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.6	1	0	0	1	0	0.4	0.1
			1	0	0	0	1		
1.0	0.0	3.6	2	2	3	2	2	2.2	0.4
			3	2	2	2	2		
2.0	0.1	4.6	4	5	4	5	5	5.1	1.0
			6	5	6	6	5		
4.0	0.2	6.6	8	9	8	5	12	8.7	1.7
			8	9	9	10	9		
6.0	0.6	8.6	16	15	15	16	14	15.4	3.1
			15	16	16	15	16		
8.0	1.0	10.5	20	16	23	21	20	20.0	4.0
			19	19	21	20	21		
10.0	2.0	12.4	28	27	28	29	27	28.0	5.6
			28	28	27	29	29		
8.0	1.0	10.5	21	21	20	21	19	20.1	4.0
			20	20	21	19	19		
6.0	0.7	8.6	18	17	17	17	18	16.9	3.4
			16	16	17	17	16		
4.0	0.2	6.6	10	10	9	10	11	9.7	1.9
			9	9	10	10	9		
2.0	0.1	4.6	6	7	5	5	6	5.8	1.2
			5	6	7	5	6		
1.0	0.0	3.6	3	3	2	2	3	2.1	0.4
			1	2	2	1	2		
0.0	0.0	2.6	1	1	0	0	1	0.5	0.1
			0	1	0	1	0		



Lugeon value (Lu)	3.8
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	12.4
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

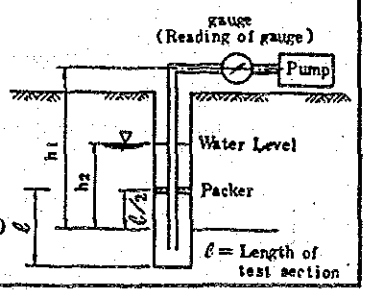
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

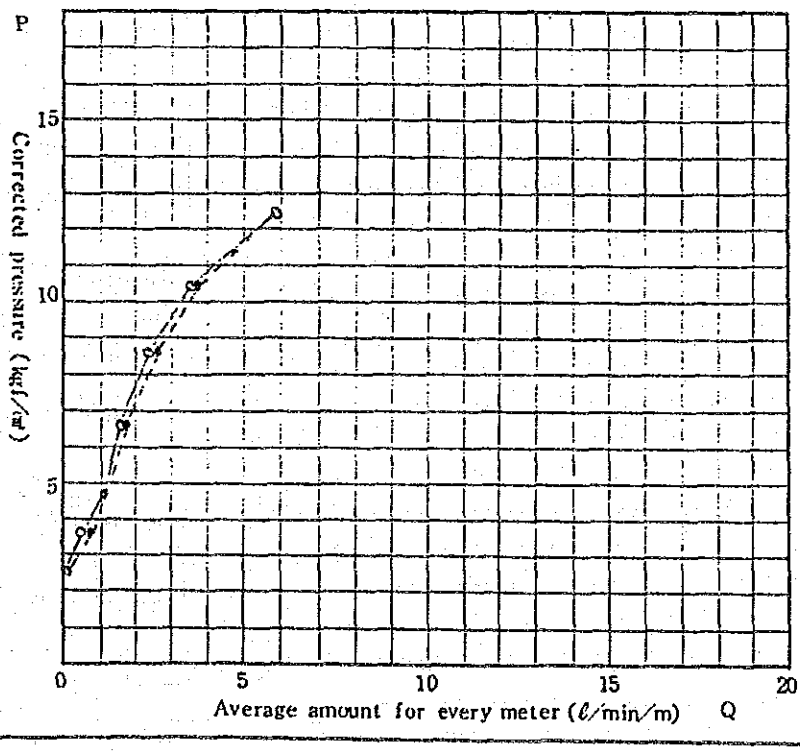


Lugeon Test Data Sheet

Stage No. 7

Location	Main Dam	Name of hole	D - 3	Depth (m)	40.0~45.0	Length of test section (m)	5.0
Water Level (m)	26.1	Hight of gauge (m)	1.0	Length of rod (m)	41.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	7/10

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.7	1	0	0	0	1	0.4	0.1
			0	1	0	0	1		
1.0	0.0	3.7	3	2	2	3	2	2.5	0.5
			3	3	2	2	3		
2.0	0.1	4.7	5	6	5	5	6	5.5	1.1
			6	6	5	6	5		
4.0	0.2	6.7	8	9	8	8	9	8.2	1.6
			8	7	8	8	9		
6.0	0.3	8.7	11	11	12	11	11	11.0	2.2
			10	12	10	11	11		
8.0	1.0	10.6	17	18	18	19	17	18.3	3.7
			18	19	19	20	18		
10.0	2.5	12.5	29	30	30	28	29	29.3	5.9
			29	30	30	29	29		
8.0	1.1	10.6	20	20	19	20	18	19.1	3.8
			19	20	19	18	18		
6.0	0.4	8.7	14	12	12	11	13	12.3	2.5
			12	12	13	12	12		
4.0	0.2	6.7	9	8	8	7	9	8.3	1.7
			8	8	9	8	9		
2.0	0.1	4.7	7	6	5	5	6	5.6	1.1
			7	5	5	6	4		
1.0	0.0	3.7	3	2	1	2	2	1.7	0.3
			1	2	2	1	1		
0.0	0.0	2.7	1	1	0	1	0	0.5	0.1
			1	0	0	1	0		



Lugeon value (Lu)	3.2
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	12.5
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

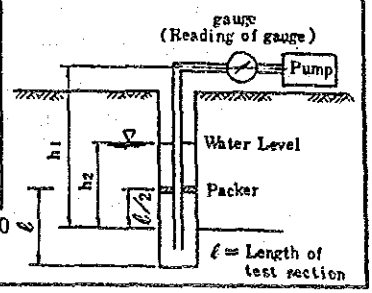
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

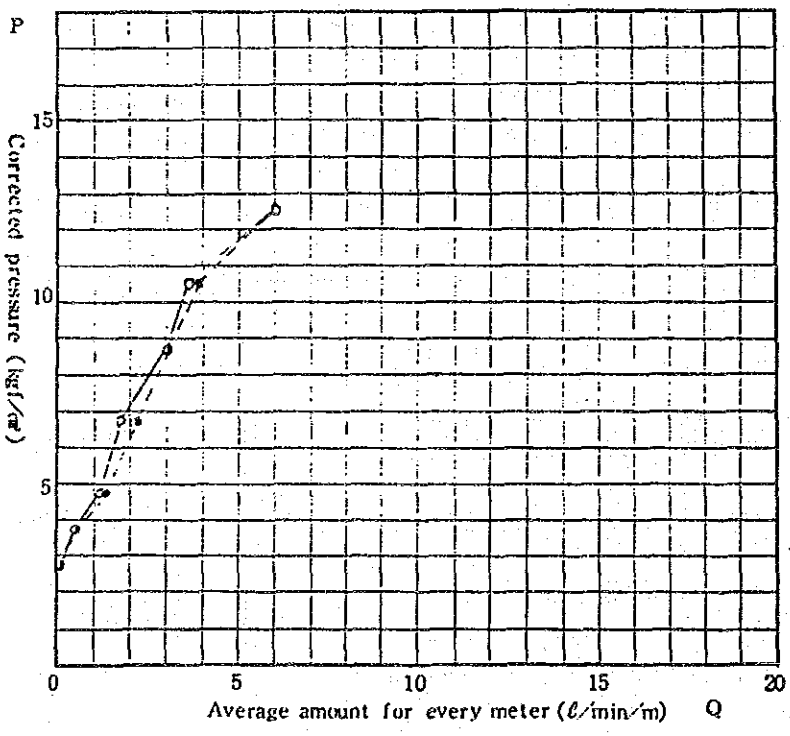


Lugeon Test Data Sheet

Stage No. 8

Location	Main Dam	Name of hole	D - 3	Depth (m)	45.0~50.0	Length of test section (m)	5.0
Water Level (m)	28.0	Hight of gauge (m)	0.5	Length of rod (m)	45.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	10/10

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Qo (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.8	1	0	1	1	0	0.5	0.1
			0	1	0	1	0		
1.0	0.1	3.8	2	2	3	2	2	2.4	0.5
			3	3	2	2	3		
2.0	0.1	4.8	5	6	6	6	5	5.6	1.1
			6	5	5	6	6		
4.0	0.3	6.8	9	8	9	10	8	8.9	1.8
			9	9	8	10	9		
6.0	0.7	8.8	13	14	14	15	14	14.9	3.0
			16	15	14	16	18		
8.0	1.0	10.7	18	18	19	18	17	18.0	3.6
			19	18	18	17	18		
10.0	2.9	12.6	29	30	29	31	30	29.9	6.0
			30	29	30	30	31		
8.0	1.2	10.7	19	19	20	19	20	19.4	3.9
			20	19	18	20	20		
6.0	0.7	8.8	16	15	15	15	16	15.0	3.0
			14	15	15	14	15		
4.0	0.4	6.8	11	11	12	11	10	10.9	2.2
			10	11	12	10	11		
2.0	0.1	4.8	6	7	7	6	6	6.0	1.2
			5	6	7	5	5		
1.0	0.0	3.8	4	3	3	2	4	2.6	0.5
			3	2	2	1	2		
0.0	0.0	2.8	0	1	0	0	0	0.3	0.1
			1	0	1	0	0		



Lugeon value (Lu)	3.4
Calculated Lugeon Value (Lu')	–
Maximum pressure (kgf/cm²)	12.6
Critical pressure (kgf/cm²)	–

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

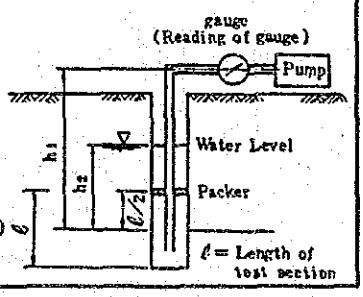
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

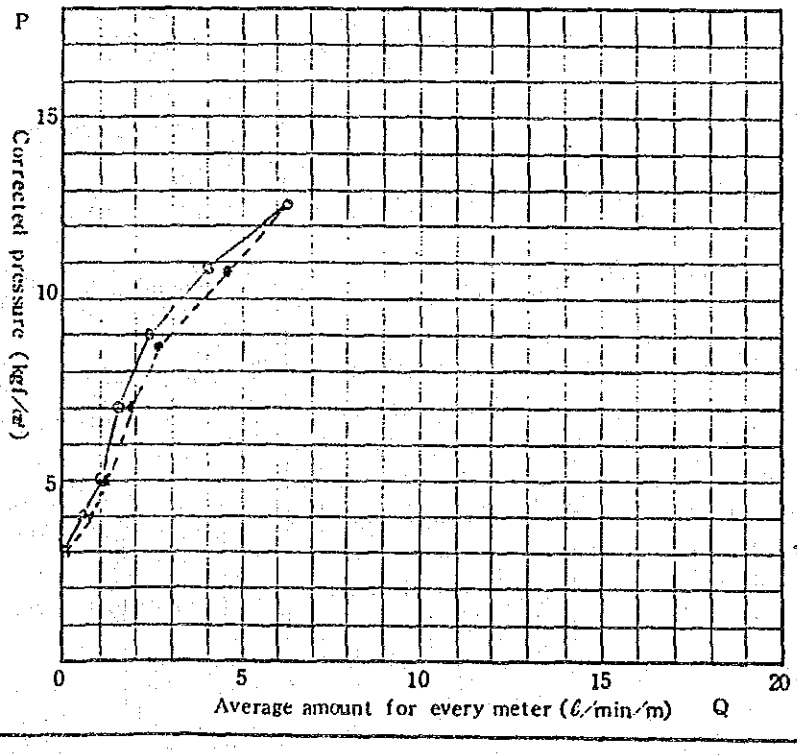


Lugeon Test Data Sheet

Stage No. 9

Location	Main Dam	Name of hole	D - 3	Depth (m)	50.0~55.0	Length of test section (m)	5.0
Water Level (m)	28.5	Hight of gauge (m)	1.5	Length of rod (m)	51.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	11/10

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	3.0	1	1	0	1	0	0.4	0.1
			0	0	1	0	0		
1.0	0.0	4.0	2	3	3	2	3	2.4	0.5
			2	3	2	2	2		
2.0	0.1	5.0	5	5	4	5	5	4.9	1.0
			4	6	5	5	5		
4.0	0.2	7.0	8	7	7	8	7	7.7	1.5
			9	8	8	7	8		
6.0	0.5	9.0	11	12	11	12	12	11.7	2.3
			12	11	13	11	12		
8.0	1.5	10.9	19	20	20	21	21	20.2	4.0
			20	19	21	21	20		
10.0	3.5	12.7	32	31	31	32	31	31.0	6.2
			30	32	31	30	30		
8.0	1.9	10.8	24	23	23	24	23	23.2	4.6
			24	24	23	22	22		
6.0	0.7	8.9	14	14	13	13	15	13.5	2.7
			13	13	14	13	13		
4.0	0.3	7.0	10	10	10	9	10	9.4	1.9
			9	9	10	8	9		
2.0	0.1	5.0	6	6	5	6	6	5.5	1.1
			5	5	6	5	5		
1.0	0.0	4.0	4	4	3	4	3	3.4	0.7
			3	4	3	3	3		
0.0	0.0	3.0	1	0	0	1	0	0.3	0.1
			0	0	0	1	0		



Lugeon value (Lu)	3.2
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	12.7
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

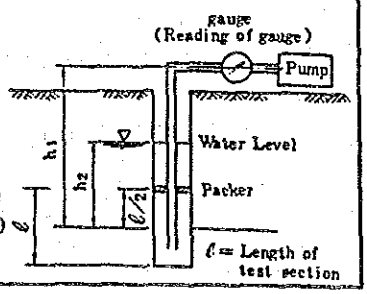
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

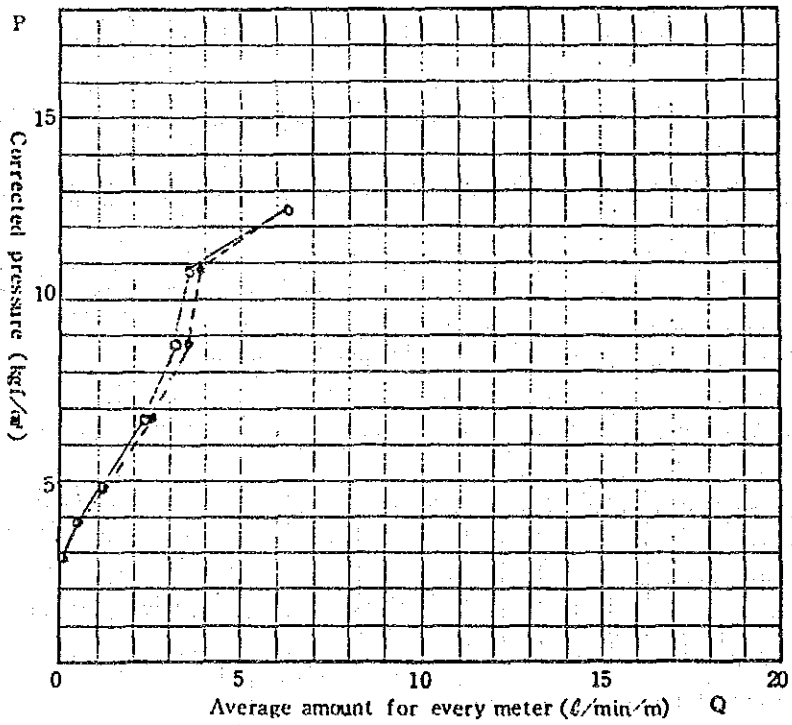


Lugeon Test Data Sheet

Stage No. 10

Location	Main Dam	Name of hole	D - 3	Depth (m)	55.0~60.0	Length of test section (m)	5.0
Water Level (m)	28.5	Hight of gauge (m)	0.5	Length of rod (m)	55.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	12/10

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.9	1	0	0	0	1	0.3	0.1
			0	0	0	1	0		
1.0	0.0	3.9	2	2	3	2	3	2.4	0.5
			2	2	3	3	2		
2.0	0.1	4.9	5	5	6	5	6	5.3	1.1
			5	5	6	5	5		
4.0	0.5	6.8	10	11	10	12	10	11.0	2.2
			10	11	12	12	12		
6.0	1.0	8.8	16	15	15	16	15	15.7	3.1
			16	16	17	15	16		
8.0	1.2	10.8	19	18	18	17	19	17.6	3.5
			18	17	19	19	12		
10.0	3.8	12.5	33	31	32	32	31	31.2	6.2
			30	33	30	30	30		
8.0	1.5	10.9	20	20	19	20	20	19.5	3.9
			19	19	20	19	19		
6.0	1.1	8.8	17	17	16	17	17	16.9	3.4
			18	17	17	16	17		
4.0	0.5	6.8	12	12	11	12	11	11.4	2.3
			11	12	11	11	11		
2.0	0.1	4.9	6	6	5	6	6	5.7	1.1
			5	6	6	5	6		
1.0	0.0	3.9	3	3	2	2	3	2.4	0.5
			2	2	3	2	2		
0.0	0.0	2.9	0	0	1	0	0	0.3	0.1
			1	0	0	0	1		



Lugeon value (Lu)	3.3
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	12.5
Critical pressure (kgf/cm²)	10.8

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

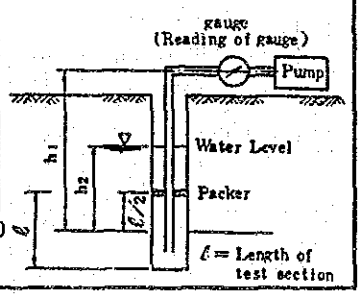
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

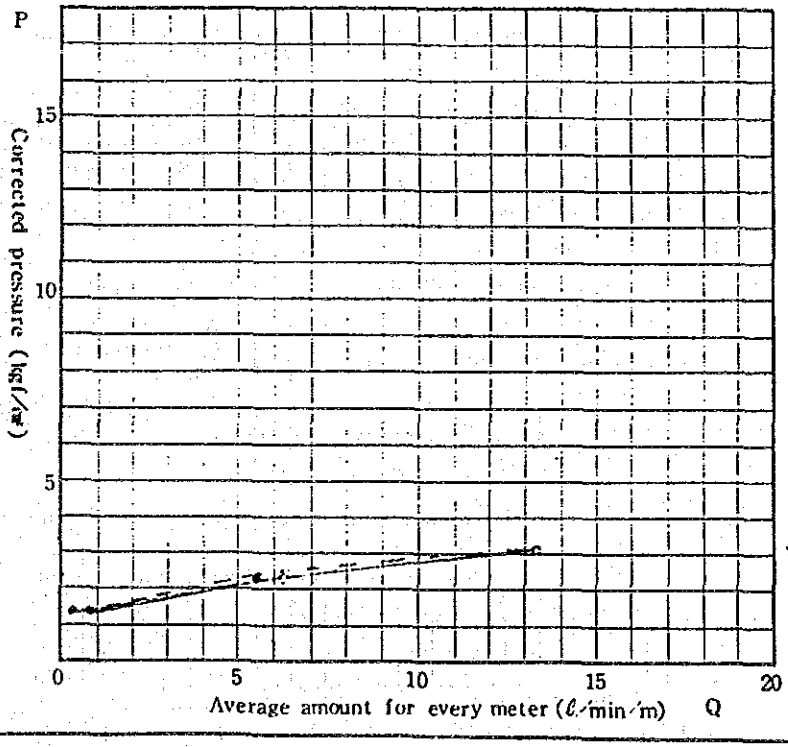


Lugeon Test Data Sheet

Stage No. 1

Location	Saddle Dam I	Name of hole	S - 1	Depth (m)	10.0~ 15.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	10.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	15/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.4	4 5	5 4	4 4	4 5	6 5	4.6	0.9
1.0	0.7	2.3	32 31	31 30	30 31	33 32	33 32	31.5	6.3
2.0	3.1	3.1	70 67	71 65	69 65	68 64	67 64	67.0	13.4
1.0	0.5	2.3	31 26	29 26	28 27	28 28	27 27	27.7	5.5
0.0	0.0	1.4	2 2	1 1	2 2	3 2	2 3	2.0	0.4



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	52.5
Maximum pressure (kgf/cm²)	3.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

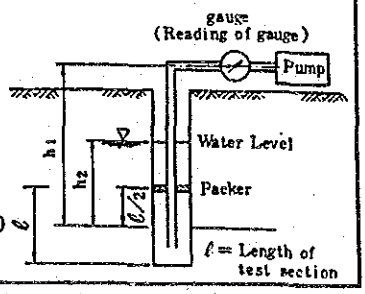
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

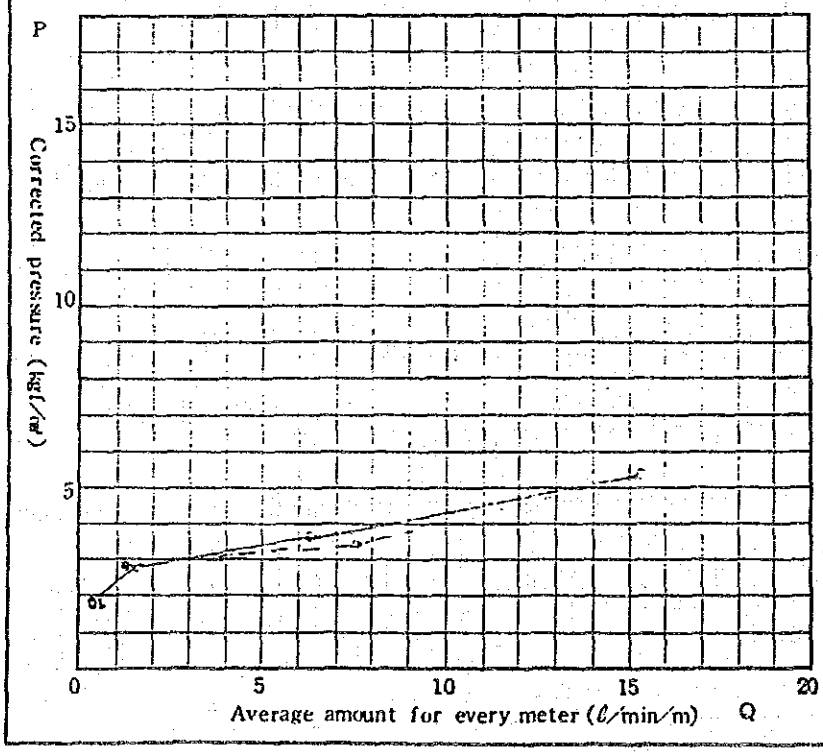


Lugeon Test Data Sheet

Stage No.2

Location	Saddle Dam I	Name of hole	S - 1	Depth (m)	15.0~20.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	15.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	21/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Qo (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.9	3	2	2	3	2	2.2	0.4
			2	2	3	1	2		
1.0	0.1	2.9	7	8	8	7	9	8.7	1.7
			8	8	7	16	9		
2.0	1.0	3.8	32	31	33	32	32	31.6	6.3
			33	33	30	29	31		
4.0	6.1	5.3	71	69	50	105	79	76.5	15.3
			78	79	79	76	79		
2.0	1.5	3.7	40	39	40	40	39	38.4	7.7
			38	37	37	36	38		
1.0	0.1	2.9	7	8	8	9	7	7.0	1.4
			7	8	6	5	5		
0.0	0.0	1.9	5	4	5	5	4	3.6	0.7
			1	3	4	3	2		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	21.4
Maximum pressure (kgf/cm²)	5.3
Critical pressure (kgf/cm²)	2.9

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

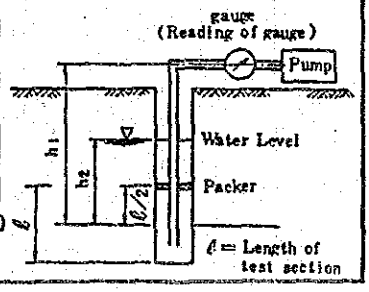
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

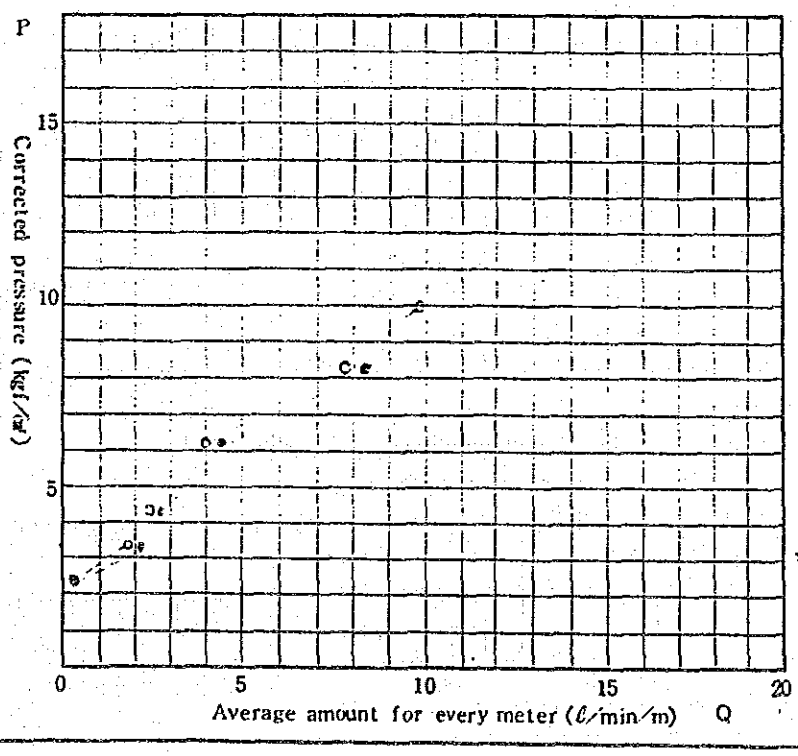


Lugeon Test Data Sheet

Stage No.3

Location	Saddle Dam I	Name of hole	S - 1	Depth (m)	20.0 ~ 25.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.34	Length of rod (m)	19.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	26/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.3	2	1	2	2	1	1.6	0.3
			2	2	1	1	2		
1.0	0.1	3.3	1	11	10	11	10	9.6	1.9
			10	11	10	11	11		
2.0	0.2	4.3	13	11	13	11	11	11.5	2.3
			11	11	12	11	11		
4.0	0.5	6.2	21	20	20	21	20	20.0	4.0
			20	19	19	20	20		
6.0	2.0	8.1	40	41	40	39	40	39.2	7.8
			39	38	38	39	38		
8.0	3.3	10.0	49	48	48	49	50	49.5	9.9
			49	50	50	51	51		
6.0	2.3	8.1	42	41	41	40	41	41.3	8.3
			42	41	42	42	41		
4.0	0.7	6.2	23	22	23	23	22	22.4	4.5
			21	22	23	23	22		
2.0	0.3	4.3	14	14	13	14	15	14.1	2.8
			16	15	14	13	13		
1.0	0.2	3.3	12	11	11	10	11	11.2	2.2
			12	11	12	11	11		
0.0	0.0	2.3	1	2	1	1	2	1.4	0.3
			2	1	2	1	1		



Lugeon value (Lu)	9.9
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.0
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

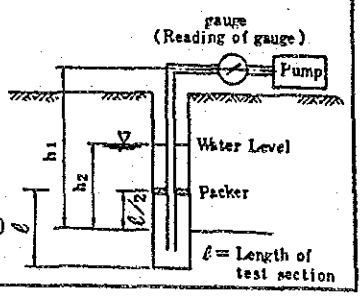
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

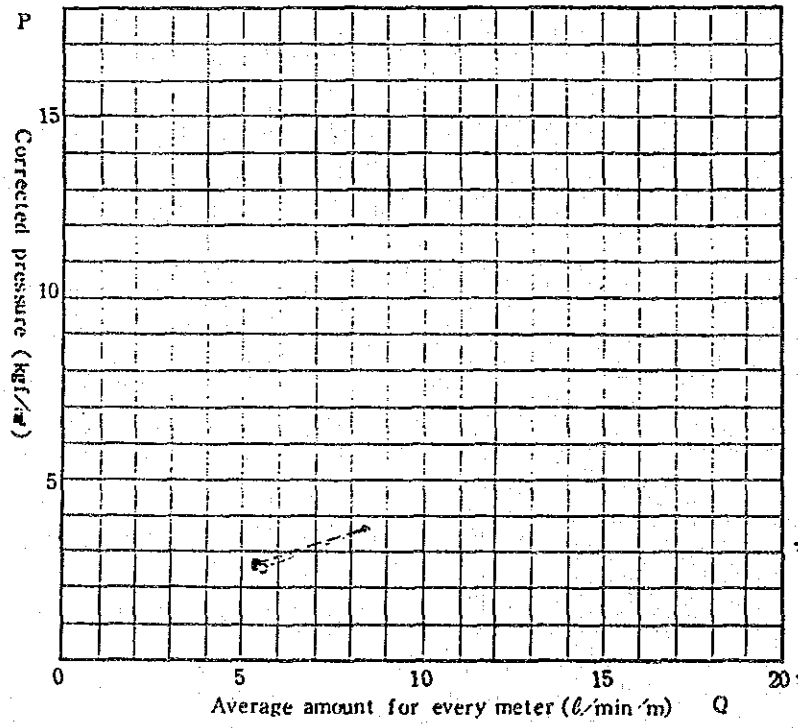


Lugeon Test Data Sheet

Stage No. 4

Location	Saddle Dam I	Name of hole	S - 1	Depth (m)	25.0 ~ 30.0	Length of test section (m)	5.0
Water Level (m)	No Hihg	Hight of gauge (m)	1.34	Length of rod (m)	25.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	28/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	1.4	2.7	29	29	28	28	29	28.2	5.6
			28	28	27	28	28		
1.0	3.1	3.6	37	41	41	42	42	41.9	8.4
			42	44	42	44	44		
0.0	1.3	2.8	27	28	27	27	28	27.5	5.5
			27	27	28	28	28		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	28.3
Maximum pressure (kgf/cm²)	3.6
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

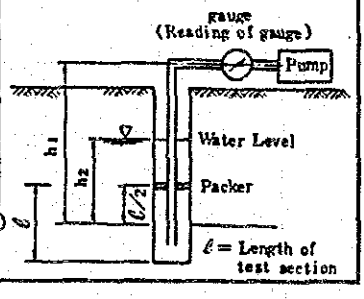
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

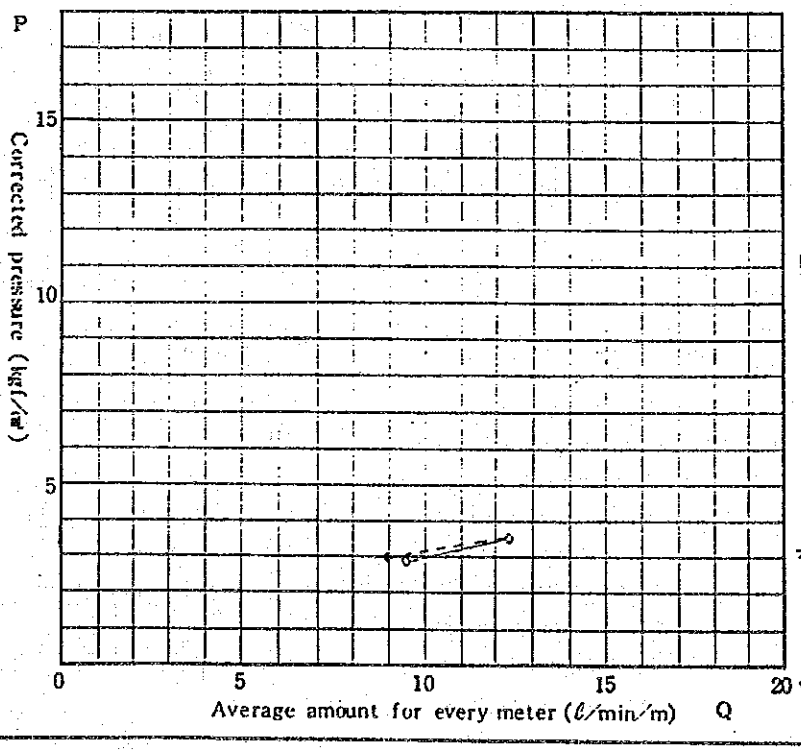


Lugeon Test Data Sheet

Stage No. 5

Location	Saddle Dam I	Name of hole	S - 1	Depth (m)	30.0 ~ 35.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	30.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	29/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	4.7	2.9	48	48	47	55	46	47.4	9.5
			55	44	42	45	44		
1.0	8.0	3.6	61	63	61	61	62	61.7	12.3
			61	61	63	62	62		
0.0	4.3	3.0	45	46	45	44	45	45.0	9.0
			45	46	44	45	45		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	38.0
Maximum pressure (kgf/cm²)	3.6
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

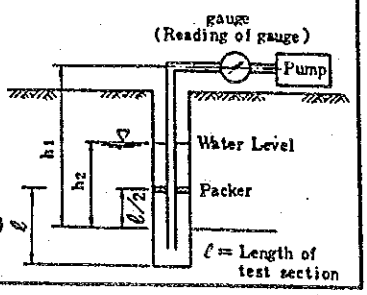
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

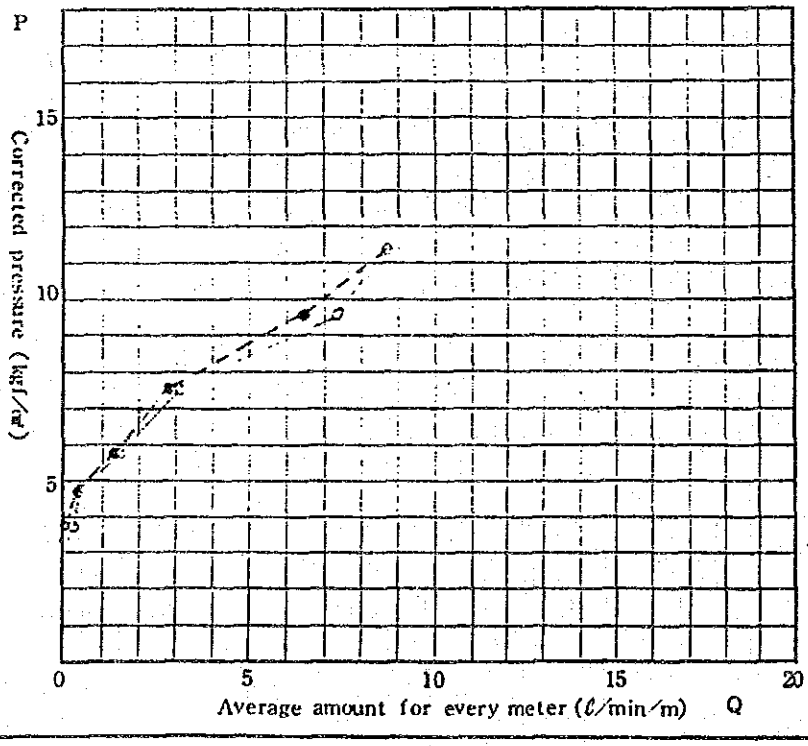


Lugeon Test Data Sheet

Stage No. 6

Location	Saddle Dam I	Name of hole	S - 1	Depth (m)	35.0 ~ 40.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.34	Length of rod (m)	34.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	30/7

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	3.8	1	1	1	0	1	0.9	0.2
			1	1	0	1	2		
1.0	0.0	4.8	2	2	3	2	2	2.2	0.4
			1	3	2	2	3		
2.0	0.1	5.8	6	7	7	8	7	7.4	1.5
			8	8	7	8	8		
4.0	0.6	7.7	16	15	15	14	15	15.4	3.1
			16	16	15	15	17		
6.0	3.2	9.5	31	64	32	31	33	36.5	7.3
			34	33	35	36	36		
8.0	4.6	11.3	42	43	44	44	43	44.0	8.8
			45	44	44	45	46		
6.0	2.6	9.5	33	34	33	33	34	33.0	6.6
			32	33	33	32	33		
4.0	0.5	7.7	15	14	14	15	16	14.6	2.9
			15	14	14	15	14		
2.0	0.1	5.8	8	8	7	8	6	7.2	1.4
			7	8	6	7	7		
1.0	0.0	4.8	2	2	2	1	2	2.0	0.4
			3	2	2	2	2		
0.0	0.0	3.8	1	0	1	1	0	0.7	0.1
			1	1	1	0	1		



Lugeon value (Lu)	7.7
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	11.3
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

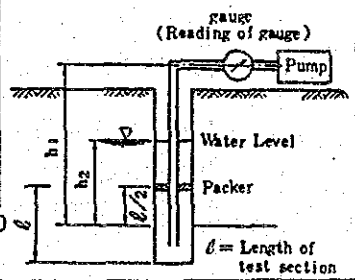
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

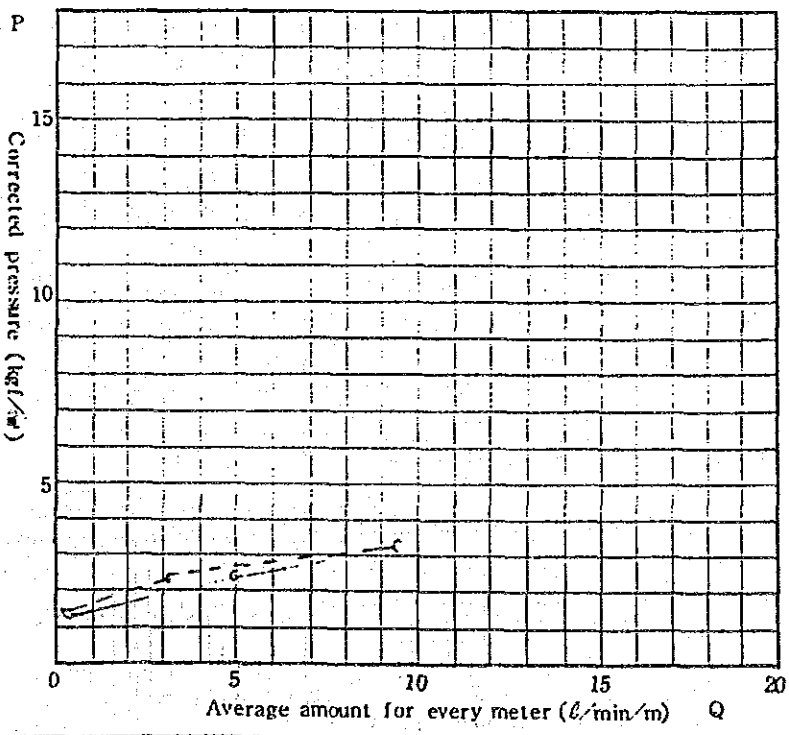


Lugeon Test Data Sheet

Stage No. 1

Location	Saddle Dam I	Name of hole	S - 2	Depth (m)	10.0~15.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.84	Length of rod (m)	10.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	15/7

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.4	4	1	1	1	1	1.3	0.3
			1	1	1	2	0		
1.0	0.5	2.4	18	20	21	23	25	25.2	5.0
			26	28	30	30	31		
2.0	1.6	3.3	45	43	45	47	47	47.2	9.4
			45	48	49	50	53		
1.0	0.2	2.4	20	20	19	17	17	16.2	3.2
			15	14	13	11			
0.0	0.0	1.4	3	1	0	0	1	0.8	0.2
			1	0	0	1	1		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	41.5
Maximum pressure (kgf/cm²)	3.3
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

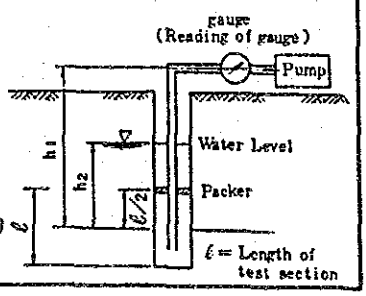
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

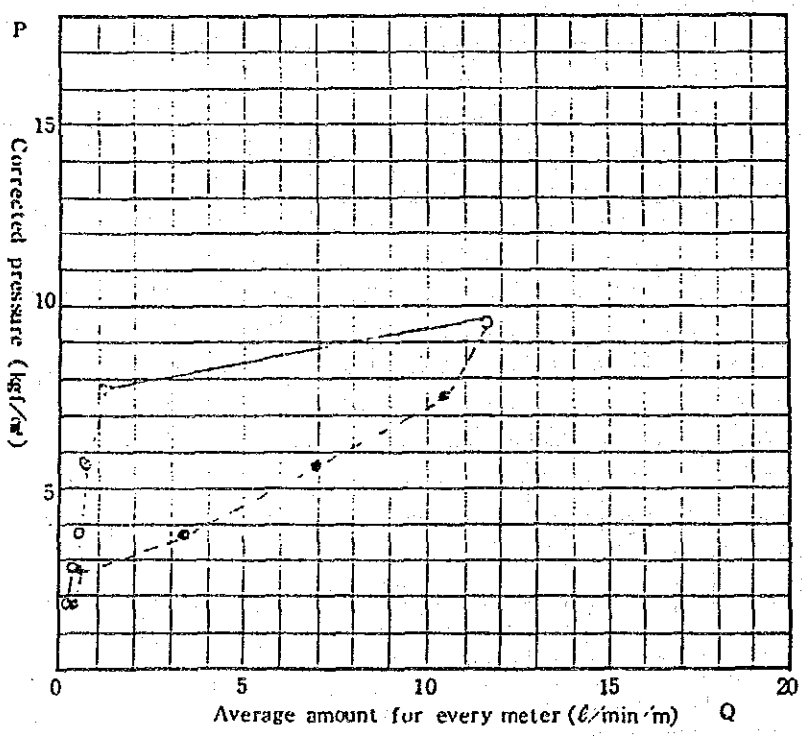


Lugeon Test Data Sheet

Stage No. 2

Location	Saddle Dam I	Name of hole	S - 2	Depth (m)	15.0~20.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	15.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	19/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.9	1	1	1	0	1	0.5	0.1
			0	1	0	0	0		
1.0	0.0	2.9	1	2	1	1	1	1.2	0.2
			2	1	1	1	1		
2.0	0.0	3.9	2	2	2	1	2	1.6	0.3
			2	1	1	2	1		
4.0	0.0	5.9	3	3	3	3	3	2.8	0.6
			3	3	3	2	2		
6.0	0.0	7.9	6	5	6	6	5	5.6	1.1
			6	6	5	6	5		
8.0	3.6	9.5	63	60	60	57	64	58.3	11.7
			55	55	57	56	56		
6.0	2.8	7.6	49	57	43	68	37	51.4	10.3
			43	58	54	53	52		
4.0	1.3	5.8	81	28	41	19	33	35.1	7.0
			27	36	24	34	28		
2.0	0.3	3.9	17	16	11	15	24	16.6	3.3
			20	17	17	14	15		
1.0	0.0	2.9	2	2	3	1	1	1.3	0.3
			1	0	1	1	1		
0.0	0.0	1.9	1	0	1	1	1	0.8	0.2
			1	1	1	0	1		



Lugeon value (Lu)	–
Calculated Lugeon Value (Lu')	1.5
Maximum pressure (kgf/cm²)	9.5
Critical pressure (kgf/cm²)	7.9

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

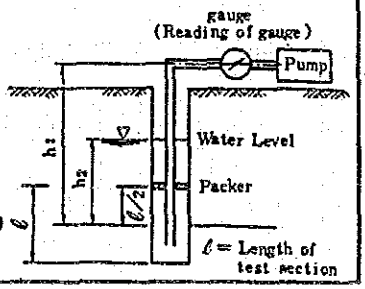
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

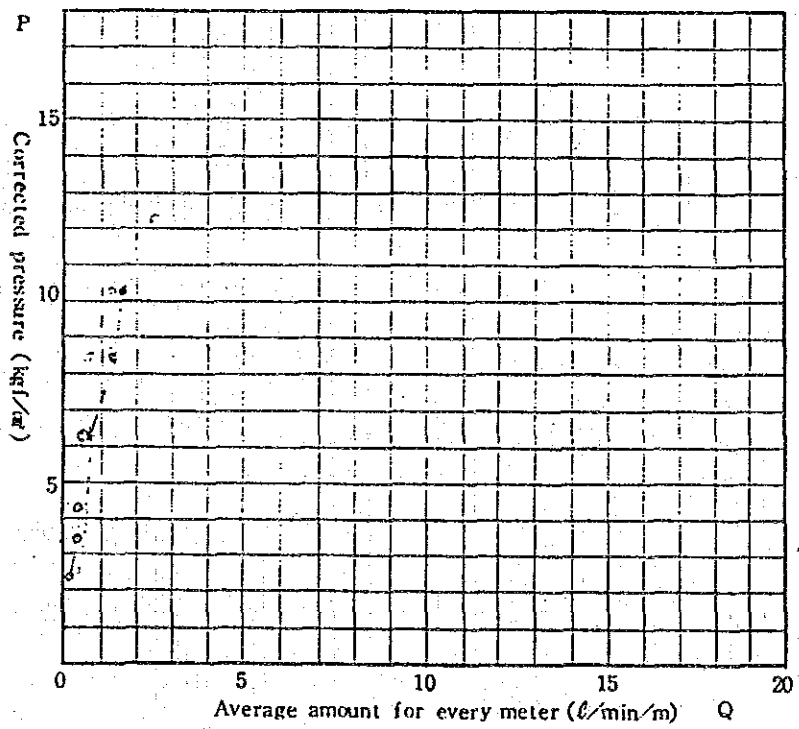


Lugeon Test Data Sheet

Stage No.3

Location	Saddle Dam I	Name of hole	S - 2	Depth (m)	20.0 ~ 25.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.84	Length of rod (m)	19.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	25/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Qo (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.3	2	0	1	1	0	0.6	0.1
			0	1	0	1	0		
1.0	0.0	3.3	2	1	2	1	1	1.3	0.3
			1	1	1	1	2		
2.0	0.0	4.3	3	2	1	2	2	1.7	0.3
			1	2	2	1	1		
4.0	0.0	6.3	4	4	4	4	4	2.7	0.5
			5	4	5	3	4		
6.0	0.0	8.3	3	3	3	3	3	4.1	0.8
			2	2	3	3	2		
8.0	0.0	10.3	2	6	6	7	6	6.0	1.2
			6	6	7	7	7		
10.0	0.2	12.3	13	14	13	13	14	13.2	2.6
			13	13	13	13	13		
8.0	0.1	10.3	8	9	8	8	9	8.1	1.6
			9	8	7	8	7		
6.0	0.1	8.3	7	6	7	7	8	6.9	1.4
			6	6	7	8	7		
4.0	0.0	6.3	4	3	4	4	4	3.3	0.7
			3	3	3	2	3		
2.0	0.0	4.3	4	3	3	2	2	2.7	0.5
			2	3	2	3	3		
1.0	0.0	3.3	2	2	3	2	2	2.0	0.4
			3	2	1	1	2		
0.0	0.0	2.3	2	1	1	1	1	0.8	0.2
			1	0	0	0	1		



Lugeon value (Lu)	1.1
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	12.3
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

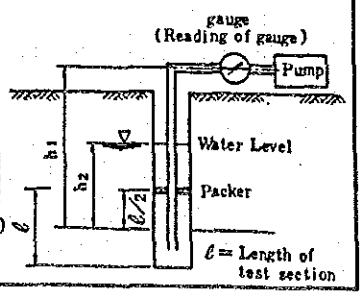
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

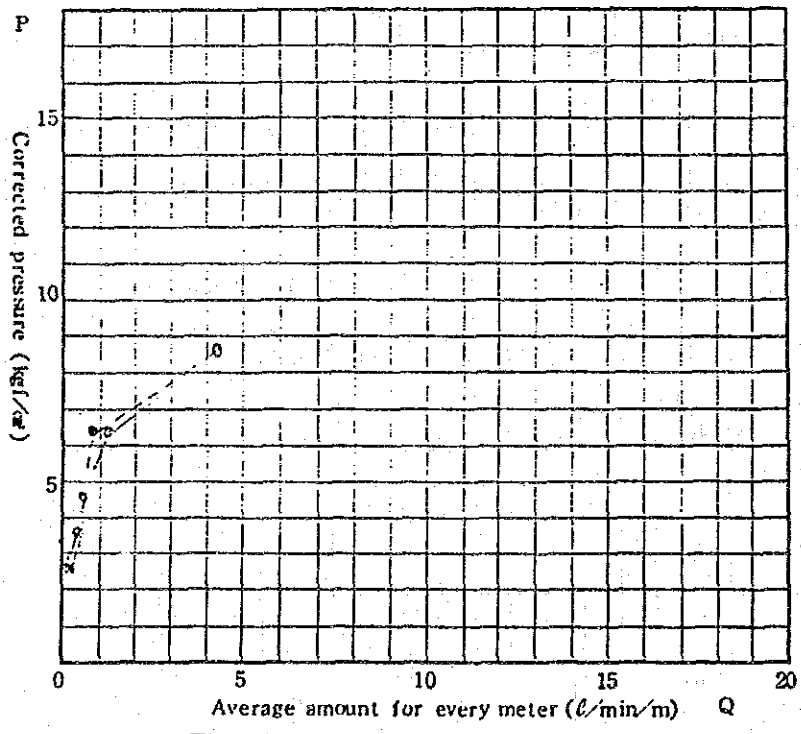


Lugeon Test Data Sheet

Stage No. 4

Location	Saddle Dam I	Name of hole	S - 2	Depth (m)	~ 25.0 30.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.84	Length of rod (m)	24.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	27/7

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.8	2	0	1	0	1	0.7	0.1
			1	0	1	0	1		
1.0	0.0	3.8	3	1	1	2	1	1.5	0.3
			2	1	1	1	2		
2.0	0.0	4.8	6	2	2	1	2	2.6	0.5
			3	2	2	3	3		
4.0	0.1	6.8	6	5	5	4	5	5.9	1.2
			4	6	7	7	10		
6.0	0.8	8.8	25	23	4	24	23	21.5	4.3
			4	24	26	30	32		
4.0	0.0	6.8	6	4	5	4	4	4.6	0.9
			4	5	5	5	4		
2.0	0.0	4.8	4	3	3	3	3	2.7	0.5
			2	2	2	3	2		
1.0	0.0	3.8	3	2	2	2	1	1.8	0.4
			2	2	1	2	1		
0.0	0.0	2.8	1	1	1	1	1	1.1	0.2
			2	1	1	1	1		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	2.1
Maximum pressure (kgf/cm²)	8.8
Critical pressure (kgf/cm²)	6.8

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

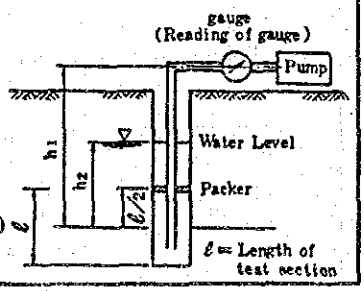
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

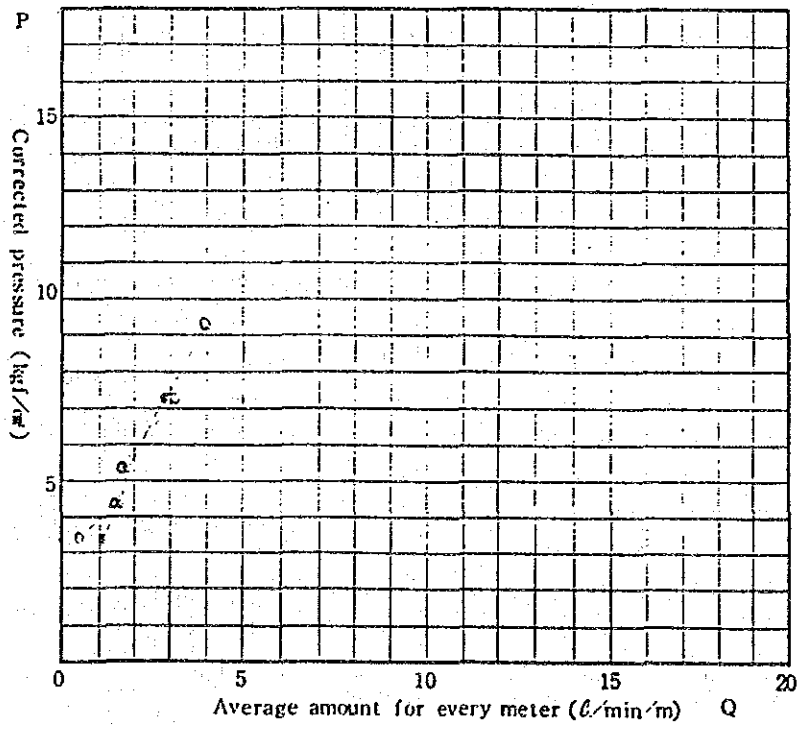


Lugeon Test Data Sheet

Stage No. 5

Location	Saddle Dam I	Name of hole	S - 2	Depth (m)	30.0 ~ 35.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	30.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	28/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1 / 6	2 / 7	3 / 8	4 / 9	5 / 10	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
0.0	0.0	3.4	7 / 3	2 / 2	3 / 2	3 / 3	2 / 2	2.9	0.6
1.0	0.1	4.4	6 / 6	7 / 7	5 / 6	7 / 7	7 / 7	6.5	1.3
2.0	0.2	5.4	8 / 9	9 / 8	9 / 9	9 / 8	9 / 9	8.7	1.7
4.0	0.5	7.3	15 / 15	20 / 15	15 / 15	15 / 15	15 / 15	15.5	3.1
6.0	0.9	9.3	20 / 17	22 / 22	23 / 24	18 / 6	20 / 30	20.2	4.0
4.0	0.4	7.3	16 / 14	14 / 13	15 / 6	14 / 22	15 / 14	14.3	2.9
2.0	0.2	5.4	5 / 10	9 / 10	7 / 9	11 / 10	8 / 9	8.8	1.8
1.0	0.1	4.4	8 / 7	7 / 7	7 / 4	7 / 10	7 / 6	7.0	1.4
0.0	0.1	3.4	5 / 5	5 / 5	6 / 5	5 / 6	6 / 5	5.3	1.1



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	4.4
Maximum pressure (kgf/cm²)	9.3
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

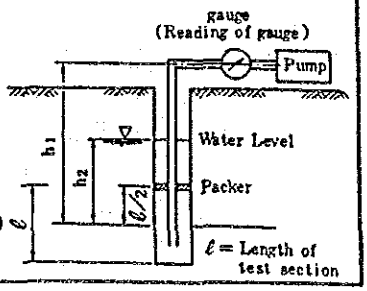
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

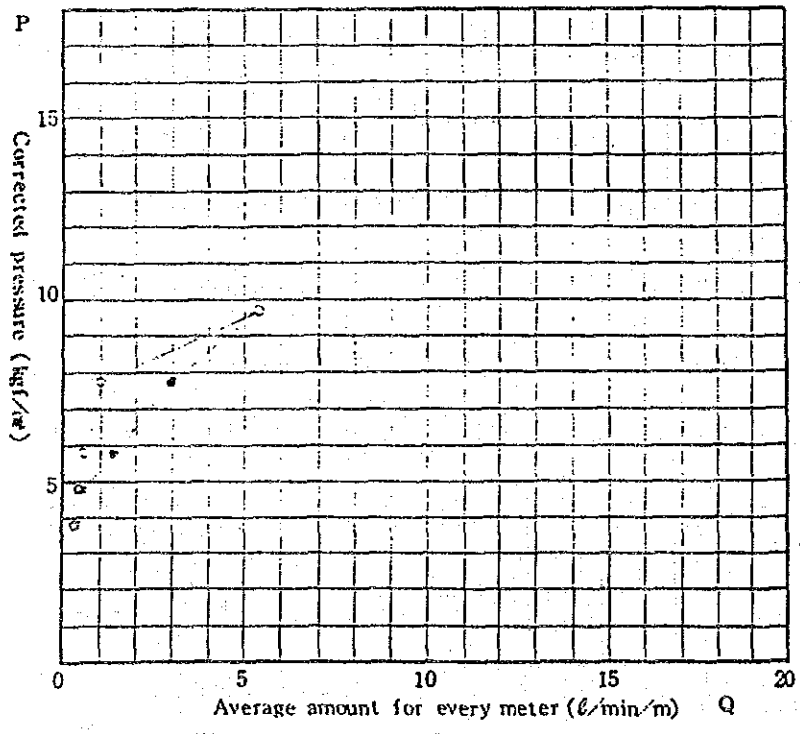


Lugeon Test Data Sheet

Stage No. 6

Location	Saddle Dam I	Name of hole	S - 2	Depth (m)	35.0 ~ 40.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.84	Length of rod (m)	34.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	29/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	3.8	2	1	1	1	1	1.1	0.2
			0	1	2	0	2		
1.0	0.0	4.8	3	2	2	2	1	1.9	0.4
			2	2	2	1	2		
2.0	0.0	5.8	3	4	3	3	2	3.2	0.6
			3	3	3	4	4		
4.0	0.1	7.8	6	5	5	5	5	5.2	1.0
			6	5	5	5	5		
6.0	1.8	9.7	24	22	24	26	26	27.1	5.4
			27	28	29	31	34		
4.0	0.6	7.8	20	20	21	20	9	15.1	3.0
			9	8	9	18	17		
2.0	0.1	5.8	6	7	8	6	6	6.8	1.4
			7	7	6	8	7		
1.0	0.0	4.8	4	3	3	2	3	2.6	0.5
			3	2	2	2	2		
0.0	0.0	3.8	2	3	2	2	1	1.6	0.3
			1	2	1	1	1		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	1.4
Maximum pressure (kgf/cm²)	9.7
Critical pressure (kgf/cm²)	7.8

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

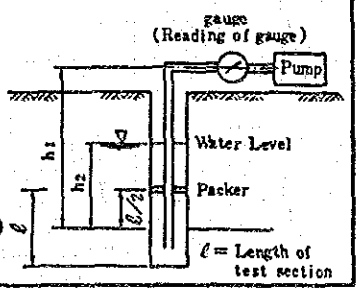
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

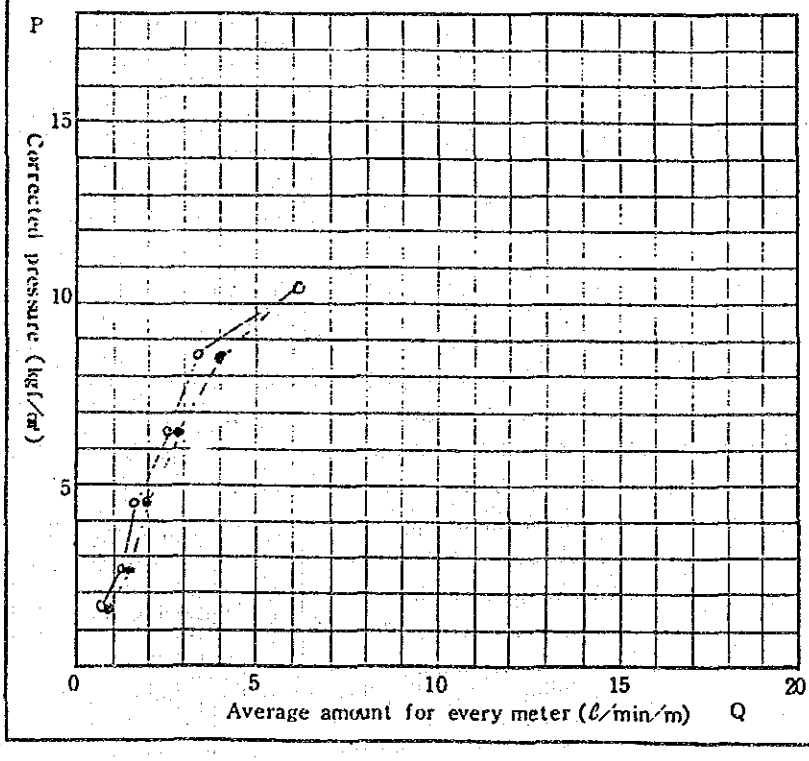


Lugeon Test Data Sheet

Stage No. 3

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	20.0 ~ 25.0	Length of test section (m)	5.0
Water Level (m)	4.5	Hight of gauge (m)	2.34	Length of rod (m)	21.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	12/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
1.0	0.01	1.7	3	4	3	3	4	3.4	0.7
2.0	0.05	2.7	6	6	6	7	6	6.2	1.2
4.0	0.09	4.7	8	9	8	8	7	8.0	1.6
6.0	0.22	6.7	13	12	13	12	12	12.4	2.5
8.0	0.42	8.6	17	18	17	17	16	17.0	3.4
10.0	1.35	10.5	30	31	32	30	29	30.4	6.1
8.0	0.58	8.6	20	21	20	19	20	20.0	4.0
6.0	0.31	6.7	14	14	15	15	15	14.6	2.9
4.0	0.15	4.7	10	11	11	10	9	10.2	2.0
2.0	0.06	2.7	6	7	7	8	6	6.8	1.4
1.0	0.03	1.7	4	5	5	4	5	4.6	0.9



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	3.9
Maximum pressure (kgf/cm²)	10.5
Critical pressure (kgf/cm²)	8.6

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

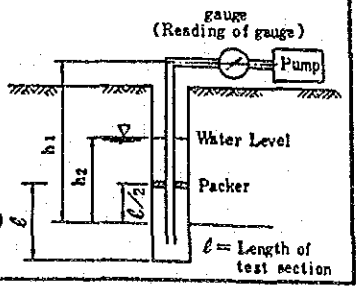
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

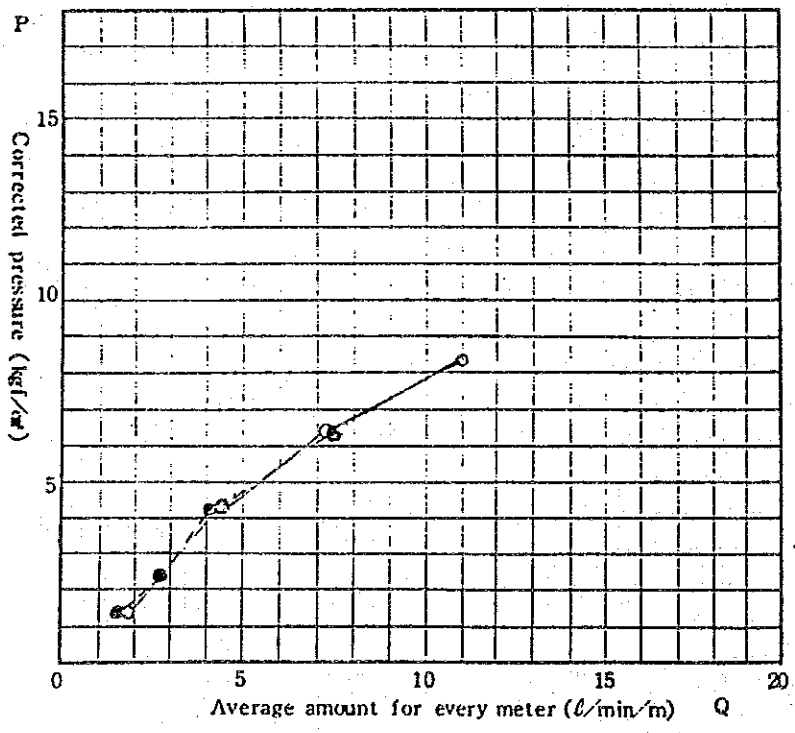


Lugeon Test Data Sheet

Stage No. 1

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	10.0 ~ 15.0	Length of test section (m)	5.0
Water Level (m)	3.2	Hight of gauge (m)	1.6	Length of rod (m)	10.9	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	9/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Qo (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
1.0	0.1	1.5	11	9	8	10	9	9.4	1.9
2.0	0.1	2.5	13	14	15	14	10	13.2	2.6
4.0	0.4	4.4	20	20	24	24	21	21.8	4.4
6.0	1.0	6.4	34	33	39	37	36	35.8	7.2
8.0	2.3	8.2	54	55	56	56	55	55.2	11.0
6.0	1.0	6.4	38	36	37	35	36	36.4	7.3
4.0	0.3	4.4	23	22	21	19	18	20.6	4.1
2.0	0.1	2.5	13	12	14	14	13	13.2	2.6
1.0	0.1	1.5	9	10	8	7	7	8.2	1.6



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	9.2
Maximum pressure (kgf/cm²)	8.2
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

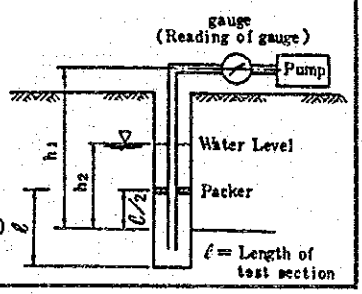
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

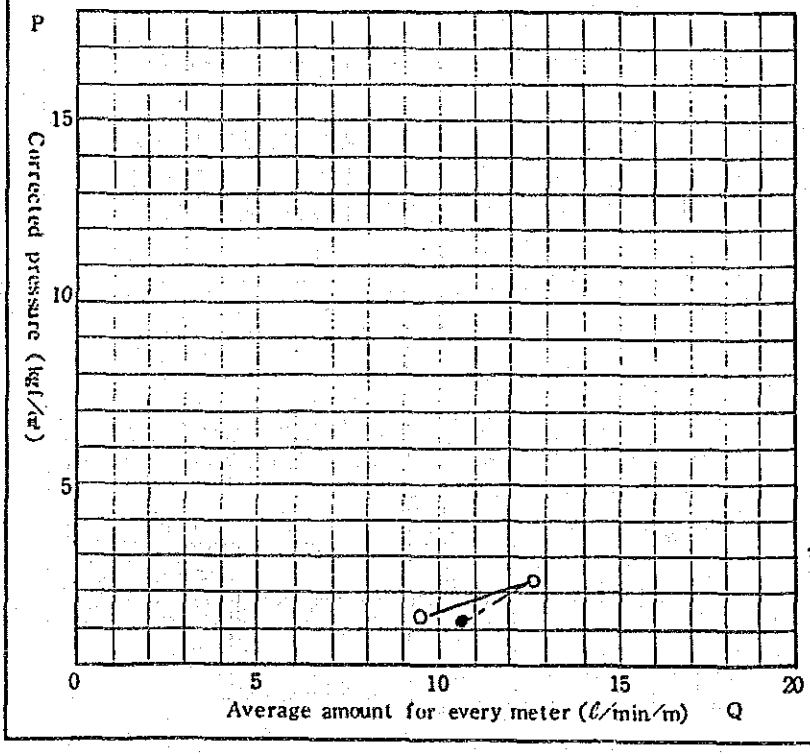


Lugeon Test Data Sheet

Stage No. 2

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	15.0 ~ 20.0	Length of test section (m)	5.0
Water Level (m)	4.5	Hight of gauge (m)	1.3	Length of rod (m)	15.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	11/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
1.0	2.4	1.3	54	50	46	43	45	47.6	9.5
2.0	4.3	2.2	64	61	60	67	67	63.8	12.8
1.0	2.9	1.3	52	51	50	52	59	52.8	10.6



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	41.4
Maximum pressure (kgf/cm²)	2.2
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

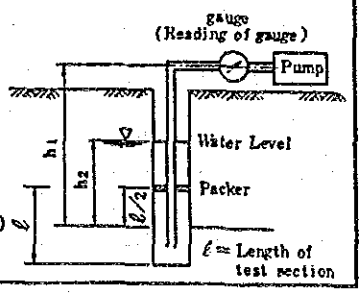
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

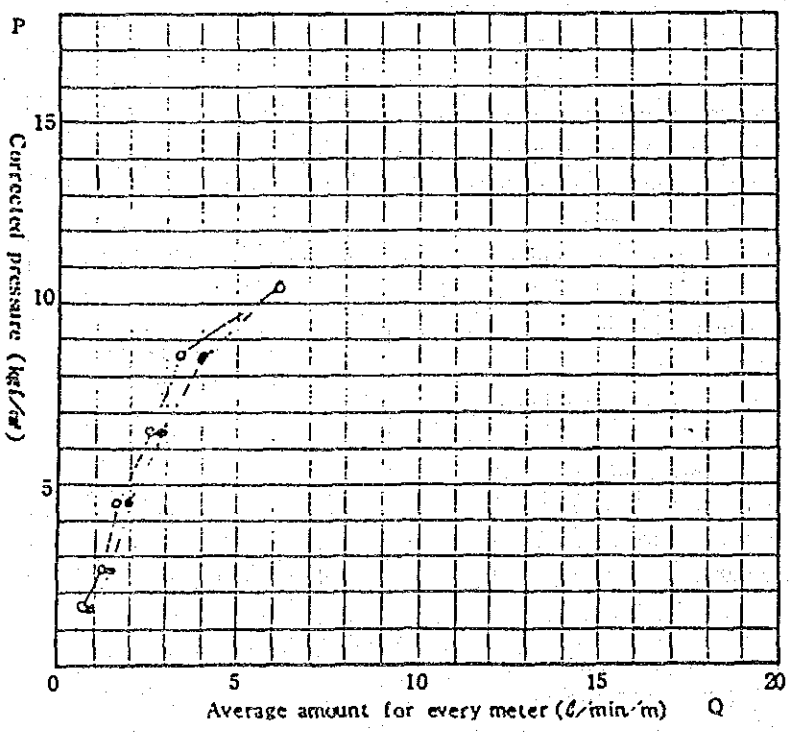


Lugeon Test Data Sheet

Stage No. 3

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	20.0 ~ 25.0	Length of test section (m)	5.0
Water Level (m)	4.5	Hight of gauge (m)	2.34	Length of rod (m)	21.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	12/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
1.0	0.01	1.7	3	4	3	3	4	3.4	0.7
2.0	0.05	2.7	6	6	6	7	6	6.2	1.2
4.0	0.09	4.7	8	9	8	8	7	8.0	1.6
6.0	0.22	6.7	13	12	13	12	12	12.4	2.5
8.0	0.42	8.6	17	18	17	17	16	17.0	3.4
10.0	1.35	10.5	30	31	32	30	29	30.4	6.1
8.0	0.58	8.6	20	21	20	19	20	20.0	4.0
6.0	0.31	6.7	14	14	15	15	15	14.6	2.9
4.0	0.15	4.7	10	11	11	10	9	10.2	2.0
2.0	0.06	2.7	6	7	7	8	6	6.8	1.4
1.0	0.03	1.7	4	5	5	4	5	4.6	0.9



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	3.9
Maximum pressure (kgf/cm²)	10.5
Critical pressure (kgf/cm²)	8.6

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

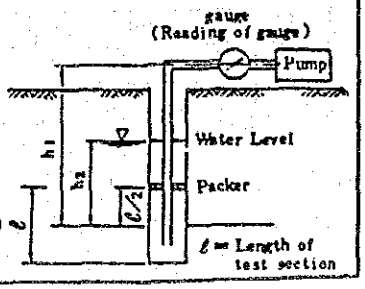
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

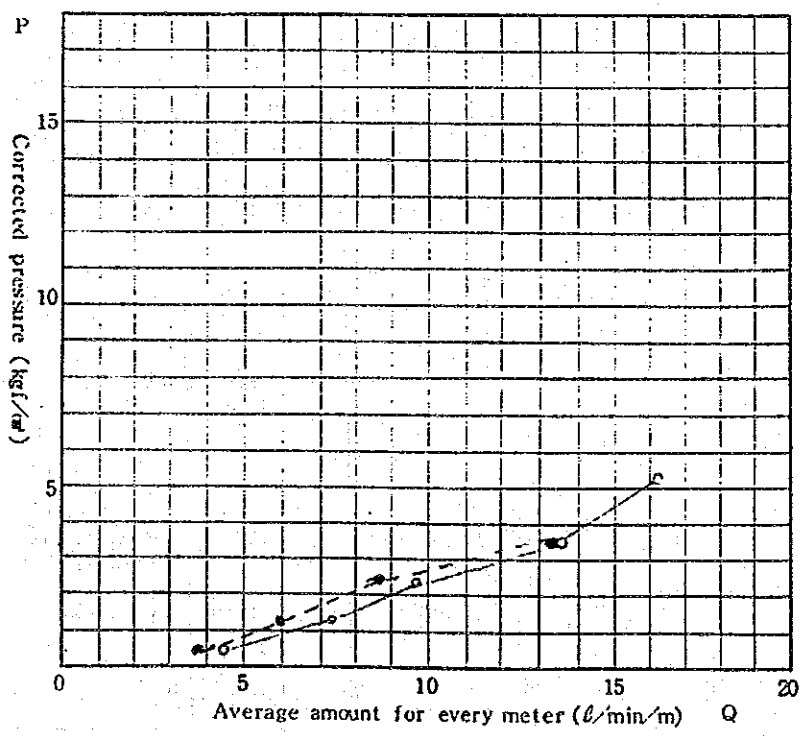


Lugeon Test Data Sheet

Stage No.4

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	25.0 ~ 30.23	Length of test section (m)	5.23
Water Level (m)	3.9	Hight of gauge (m)	1.3	Length of rod (m)	24.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Expansion			Date	14/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.8	0.4	23	22	22	22	20	22.2	4.2
			25	22	22	22	22		
1.0	2.7	1.2	38	40	42	40	41	40.4	7.7
			41	39	40	40	43		
2.0	4.2	2.1	48	49	54	51	51	50.2	9.6
			51	51	51	50	46		
4.0	8.6	3.7	71	72	72	71	73	71.6	13.7
			70	72	71	72			
6.0	11.9	5.3	85	86	85	84	86	84.2	16.1
			86	85	84	81	80		
4.0	8.5	3.7	72	70	71	69	70	71.0	13.6
			70	70	69	78			
2.0	3.5	2.2	48	47	45	46	47	45.8	8.8
			47	45	44	46	43		
1.0	2.3	1.3	38	38	38	36	35	36.6	7.0
			36	37	36	37	35		
0.0	0.7	0.4	21	21	21	20	22	20.8	4.0
			20	21	20	21	21		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	31.8
Maximum pressure (kgf/cm²)	5.3
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

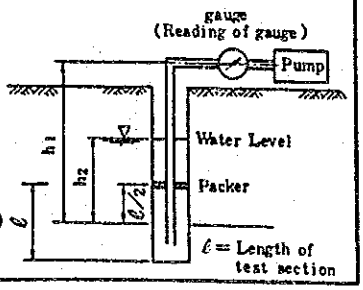
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

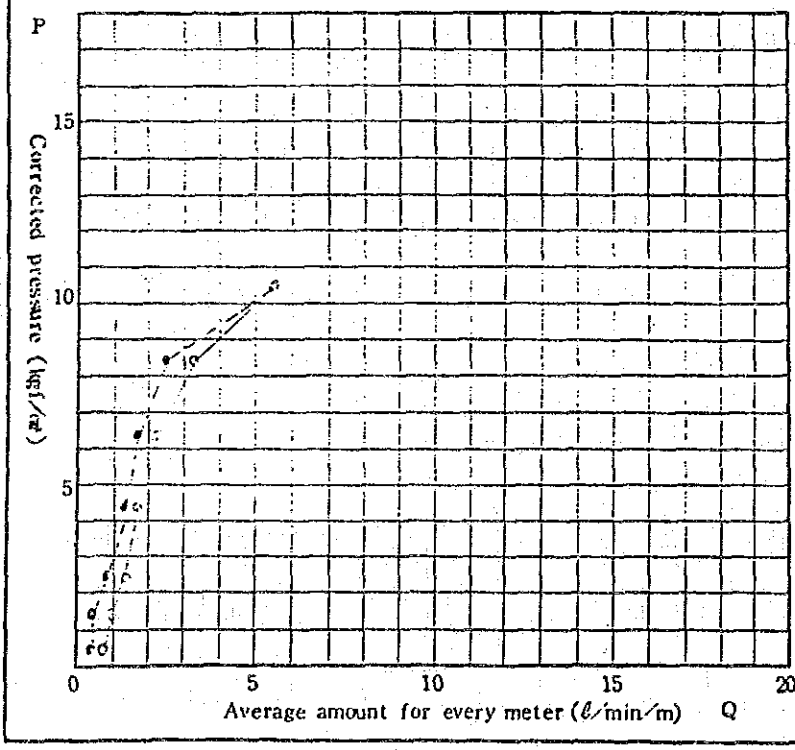


Lugeon Test Data Sheet

Stage No. 5

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	30.23~35.0	Length of test section (m)	4.77
Water Level (m)	4.5	Hight of gauge (m)	1.34	Length of rod (m)	30.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	16/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.6	4	4	4	3	4	3.8	0.8
			4	4	4	4	3		
1.0	0.1	1.6	3	5	5	5	5	5.0	1.0
			6	5	5	6	5		
2.0	0.1	2.6	7	7	6	6	6	6.2	1.3
			6	6	5	6	7		
4.0	0.1	4.6	9	8	9	8	9	8.3	1.7
			8	8	7	8	9		
6.0	0.2	6.6	11	11	10	10	11	10.4	2.2
			10	10	10	11	10		
8.0	0.5	8.5	12	14	14	15	16	15.4	3.2
			16	17	17	16	17		
10.0	1.4	10.4	49	61	17	14	15	26.0	5.5
			31	14	15	30	14		
8.0	0.3	8.6	11	11	22	11	11	11.8	2.5
			10	10	10	11	11		
6.0	0.2	6.6	10	10	10	8	9	8.7	1.8
			8	7	9	8	8		
4.0	0.1	4.6	7	7	7	5	6	6.5	1.4
			6	7	6	7	7		
2.0	0.0	2.6	4	5	4	5	4	4.4	0.9
			4	4	4	4	6		
1.0	0.0	1.6	2	1	3	2	3	2.6	0.5
			3	3	3	3	3		
0.0	0.0	0.6	2	1	5	1	3	2.5	0.5
			2	3	3	2	3		



Lugeon value (Lu)	5.0
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	10.4
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

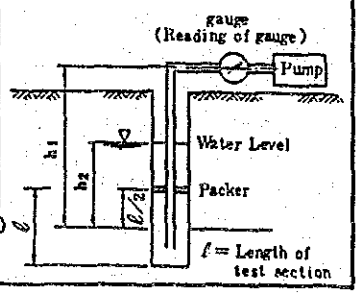
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

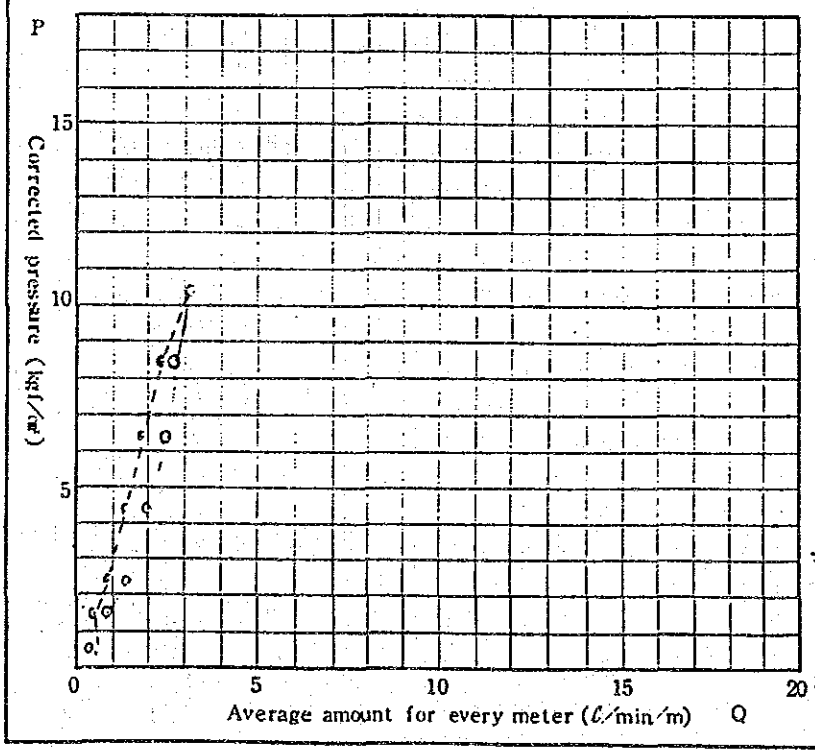


Lugeon Test Data Sheet

Stage No. 6

Location	Saddle Dam I	Name of hole	S - 3	Depth (m)	35.0~40.0	Length of test section (m)	5.0
Water Level (m)	4.5	Hight of gauge (m)	0.84	Length of rod (m)	34.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	19/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Qo (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	0.5	2	2	1	2	2	1.7	0.3
			2	1	2	1	2		
1.0	0.0	1.5	4	5	4	5	4	4.3	0.9
			5	5	3	4	4		
2.0	0.1	2.5	6	7	7	6	7	6.7	1.3
			8	2	12	6	6		
4.0	0.2	4.5	12	9	10	8	11	9.8	2.0
			10	10	9	10	9		
6.0	0.4	6.5	12	12	12	13	12	12.3	2.5
			13	12	12	12	13		
8.0	0.5	8.5	16	13	10	20	12	14.1	2.8
			13	15	14	13	15		
10.0	0.6	10.5	19	14	16	15	15	15.5	3.1
			17	19	14	11	15		
8.0	0.4	8.5	12	13	14	11	12	12.3	2.5
			12	12	12	13	12		
6.0	0.2	6.5	10	10	11	10	8	9.3	1.9
			9	9	8	9	9		
4.0	0.1	4.5	9	5	7	7	6	6.5	1.3
			7	7	7	5	5		
2.0	0.0	2.5	3	5	4	4	4	4.5	0.9
			5	5	5	5	5		
1.0	0.0	1.5	4	3	3	3	3	3.2	0.6
			4	3	4	2	3		
0.0	0.0	0.5	4	3	3	3	4	3.2	0.6
			3	3	3	3	3		



Lugeon value (Lu)	3.0
Calculated Lugeon Value (Lu')	—
Maximum pressure (kgf/cm²)	10.5
Critical pressure (kgf/cm²)	—

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

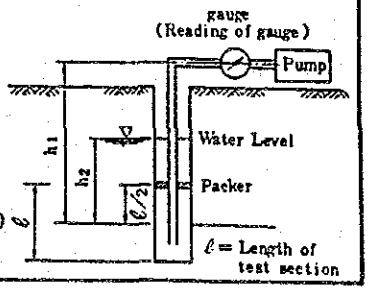
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

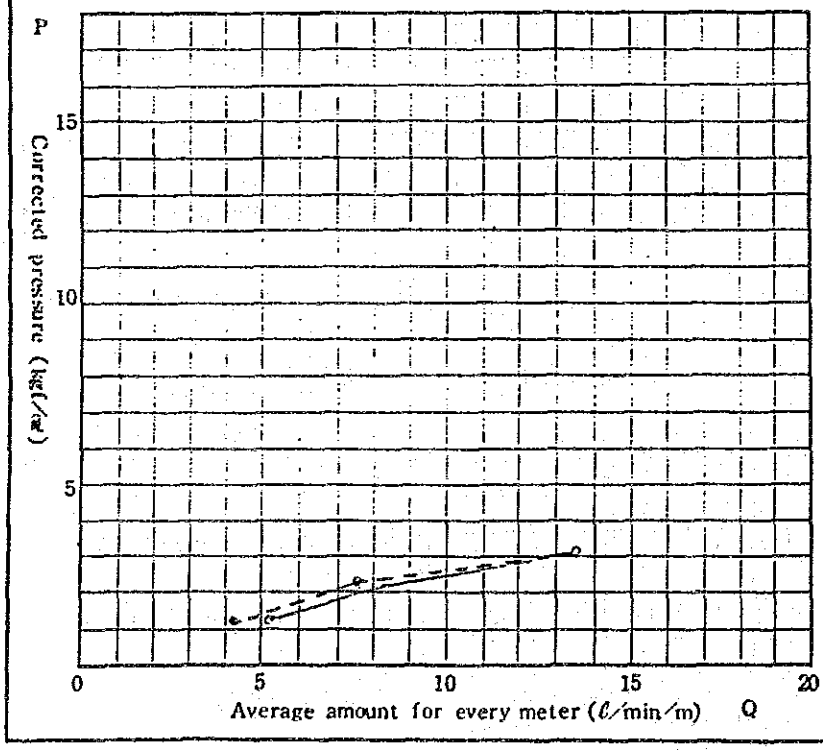


Lugeon Test Data Sheet

Stage No. 1

Location	Saddle Dam I	Name of hole	S - 4	Depth (m)	10.0~ 15.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.3	Length of rod (m)	10.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	17/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.5	1.3	27	28	26	26	26	25.9	5.2
			26	25	24	25			
1.0	1.2	2.3	43	43	44	42	40	41.1	8.2
			40	39	39	40			
2.0	3.2	3.1	67	69	69	67	70	67.7	13.5
			68	67	67	65			
1.0	1.0	2.3	38	37	37	38	39	37.9	7.6
			40	41	39	32			
0.0	0.3	1.3	27	26	24	24	23	21.1	4.2
			18	21	9	18			



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	31.3
Maximum pressure (kgf/cm²)	3.1
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

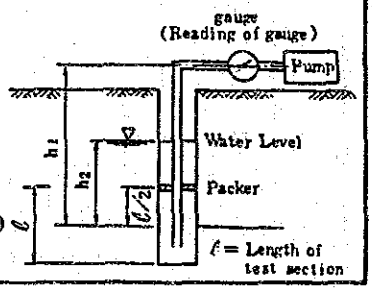
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

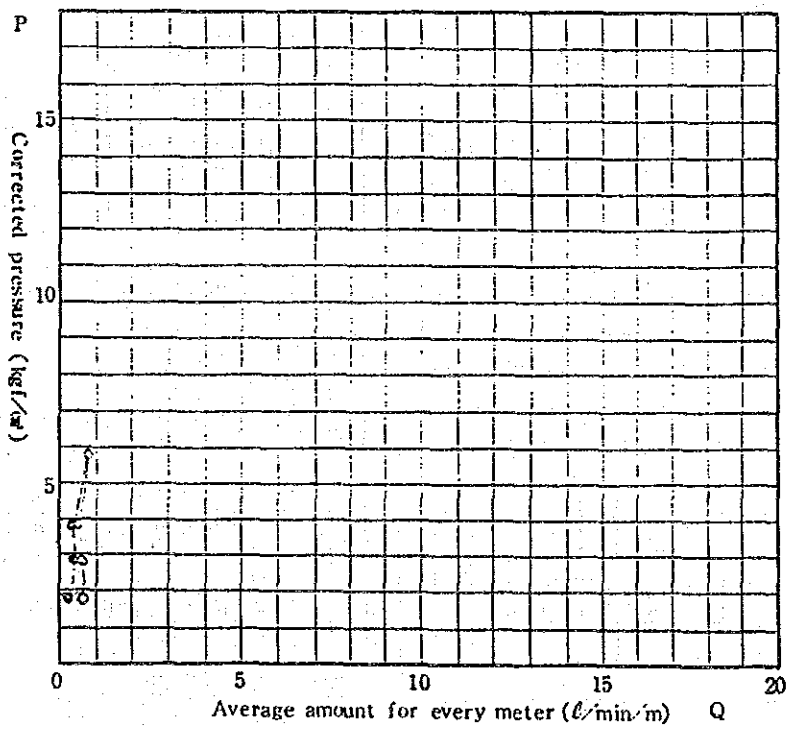


Lugeon Test Data Sheet

Stage No. 2

Location	Saddle Dam I	Name of hole	S - 4	Depth (m)	15.0 ~ 20.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	15.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	27/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.9	3	4	4	4	3	3.6	0.7
			4	3	3	6	2		
1.0	0.0	2.9	3	3	3	2	4	2.8	0.6
			3	2	3	3	2		
2.0	0.0	3.9	1	3	4	3	3	3.0	0.6
			3	3	3	4	3		
4.0	0.0	5.9	4	6	6	5	5	4.5	0.9
			4	5	4	4	2		
2.0	0.0	3.9	3	3	2	3	2	2.7	0.5
			3	3	3	3	2		
1.0	0.0	2.9	3	2	2	0	5	2.3	0.5
			3	1	3	2	2		
0.0	0.0	1.9	2	3	2	3	2	2.2	0.4
			2	2	2	2	2		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	1.5
Maximum pressure (kgf/cm²)	5.9
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

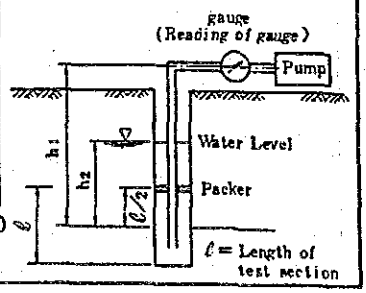
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

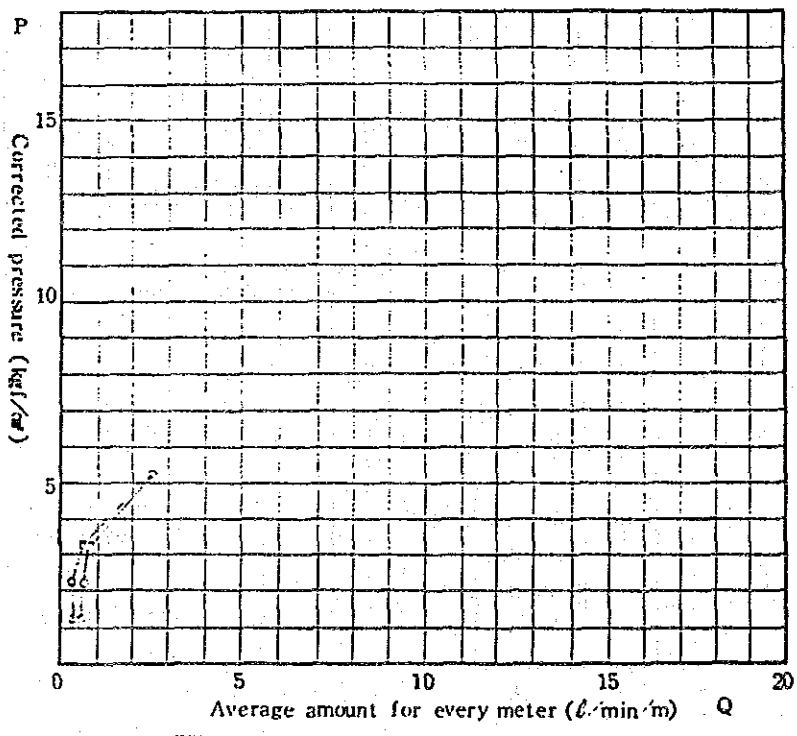


Lugeon Test Data Sheet

Stage No. 3

Location	Saddle Dam I	Name of hole	S - 4	Depth (m)	20.0 ~ 25.0	Length of test section (m)	5.0
Water Level (m)	12.0	Hight of gauge (m)	0.84	Length of rod (m)	19.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	28/7

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	1.3	5	3	2	2	3	3.0	0.6
			3	3	3	3	3		
1.0	0.0	2.3	4	3	5	3	2	3.4	0.7
			4	4	2	4	3		
2.0	0.0	3.3	4	5	5	3	4	4.0	0.8
			4	4	3	3	5		
4.0	0.2	5.3	8	12	12	11	23	12.9	2.6
			5	12	18	13	15		
2.0	0.0	3.3	10	2	3	3	2	3.5	0.7
			3	3	3	2	4		
1.0	0.0	2.3	2	3	2	2	2	2.0	0.4
			2	2	2	2	1		
0.0	0.0	1.3	2	3	1	2	3	2.2	0.4
			2	2	2	2	3		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	1.5
Maximum pressure (kgf/cm²)	5.3
Critical pressure (kgf/cm²)	3.3

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

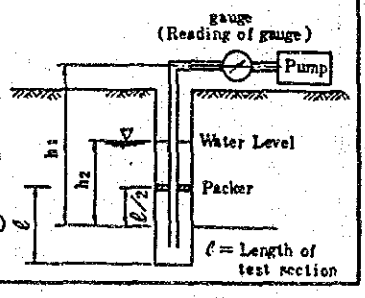
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

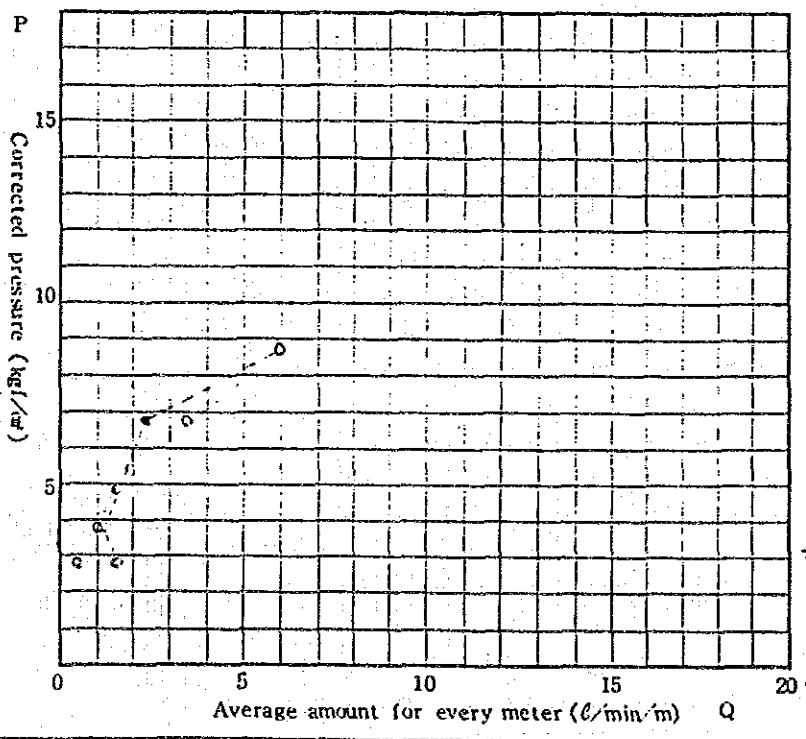


Lugeon Test Data Sheet

Stage No. 4

Location	Saddle Dam I	Name of hole	S - 4	Depth (m)	25.0 ~30.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	25.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	29/7

Reading of gauge P_0 (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	2.9	4	3	2	3	3	2.7	0.5
			2	3	4	2	1		
1.0	0.0	3.9	4	2	4	5	4	4.9	1.0
			5	5	6	7	7		
2.0	0.1	4.9	6	9	8	6	6	7.6	1.5
			7	5	9	9	11		
4.0	0.5	6.8	7	13	13	12	14	17.4	3.5
			15	18	26	27	29		
6.0	1.6	8.7	27	24	22	26	28	29.9	6.0
			28	31	24	10	79		
4.0	0.2	6.9	13	12	14	12	13	11.6	2.3
			9	11	8	13	11		
2.0	0.1	4.9	11	10	9	8	8	7.6	1.5
			6	6	6	6	6		
1.0	0.1	3.9	6	7	5	4	5	5.5	1.1
			6	5	6	6	5		
0.0	0.0	2.9	8	9	9	8	8	7.7	1.5
			8	5	7	7	8		



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	4.1
Maximum pressure (kgf/cm²)	8.7
Critical pressure (kgf/cm²)	4.9

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

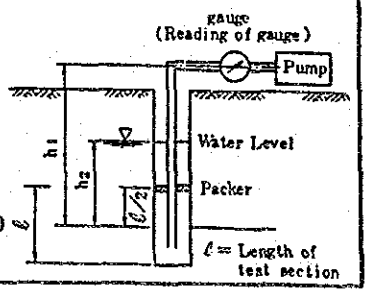
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

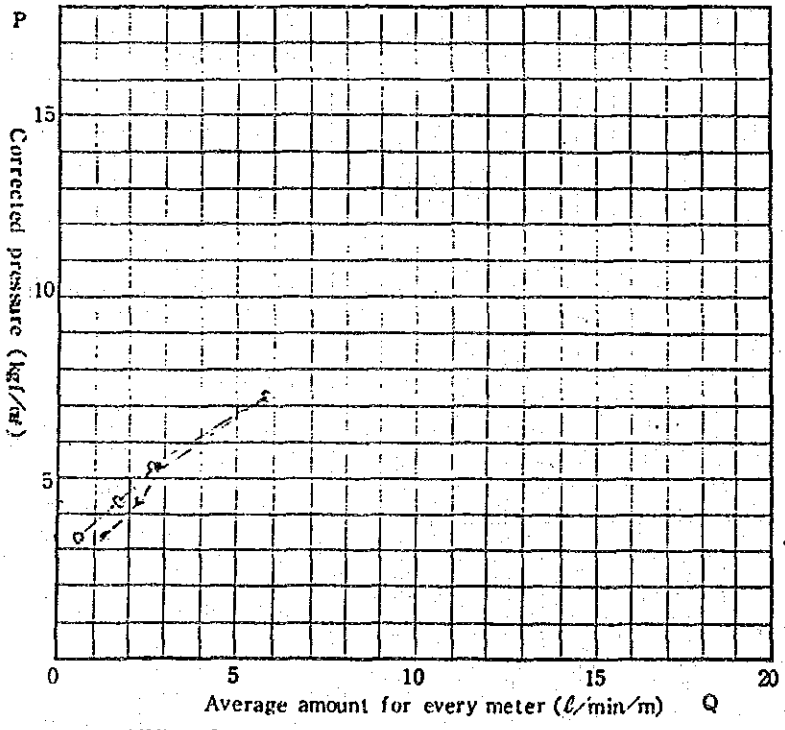


Lugeon Test Data Sheet

Stage No. 5

Location	Saddle Dam I	Name of hole	S - 4	Depth (m)	30.0 ~ 35.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	1.34	Length of rod (m)	30.0	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	30/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	3.4	4 / 5	3 / 4	3 / 4	5 / 4	4 / 5	4.1	0.8
1.0	0.2	4.4	6 / 5	7 / 11	9 / 13	9 / 11	7 / 12	9.0	1.8
2.0	0.4	5.3	12 / 14	12 / 13	14 / 15	14 / 16	14 / 16	14.0	2.8
4.0	1.8	7.2	22 / 32	24 / 32	28 / 34	29 / 35	25 / 35	29.6	5.9
2.0	0.4	5.3	17 / 10	15 / 13	15 / 15	13 / 15	14 / 16	14.3	2.9
1.0	0.3	4.4	11 / 13	12 / 11	9 / 11	12 / 12	12 / 12	11.5	2.3
0.0	0.1	3.4	6 / 6	7 / 6	5 / 7	7 / 7	6 / 6	6.3	1.3



Lugeon value (Lu)	-
Calculated Lugeon Value (Lu')	7.7
Maximum pressure (kgf/cm²)	7.2
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

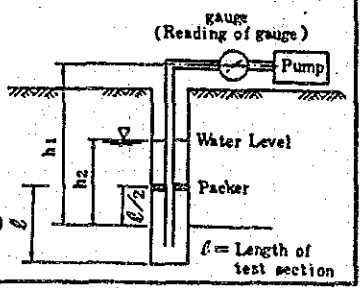
γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

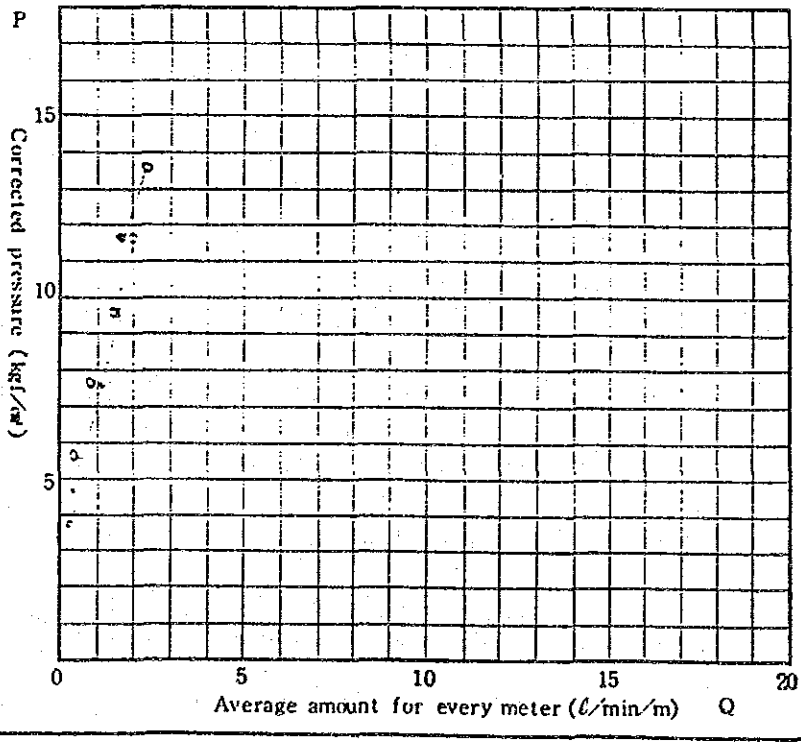


Lugeon Test Data Sheet

Stage No. 6

Location	Saddle Dam T	Name of hole	S - 4	Depth (m)	35.0 ~40.0	Length of test section (m)	5.0
Water Level (m)	Nothing	Hight of gauge (m)	0.84	Length of rod (m)	34.5	Direction, Dip	Vertical
Diamiter of pipe (mm)	35	Type of packer	Air			Date	31/7

Reading of gauge Po (kgf/cm²)	Head loss h_3 (m)	Corrected pressure P (kgf/cm²)	Amount of injection per minutes (ℓ) 1	2	3	4	5	Average amount Q_0 (ℓ/min)	Average amount for every meter Q (ℓ/min/m)
			6	7	8	9	10		
0.0	0.0	3.8	2	1	1	1	1	1.1	0.2
			1	1	1	1	1		
1.0	0.0	4.8	1	2	1	2	1	1.6	0.3
			1	2	2	2	2		
2.0	0.0	5.8	1	2	2	2	1	1.7	0.3
			1	2	2	2	2		
4.0	0.1	7.8	3	5	5	5	4	4.7	0.9
			6	4	6	4	5		
6.0	0.1	9.8	6	8	7	6	8	6.9	1.4
			7	6	7	6	8		
8.0	0.2	11.8	9	9	10	11	11	10.0	2.0
			9	11	9	12	9		
10.0	0.3	13.8	13	12	12	12	9	10.8	2.2
			11	9	10	11	9		
8.0	0.2	11.8	9	9	9	9	9	8.9	1.8
			9	9	9	9	8		
6.0	0.1	9.8	6	8	8	8	8	7.7	1.5
			8	8	8	7	8		
4.0	0.1	7.8	4	6	5	5	5	5.3	1.1
			5	6	6	6	5		
2.0	0.0	5.8	3	4	3	3	3	2.5	0.5
			2	1	2	2	2		
1.0	0.0	4.8	2	2	1	1	2	1.6	0.3
			1	2	2	1	2		
0.0	0.0	3.8	1	1	1	1	1	1.0	0.2
			1	1	1	1	1		



Lugeon value (Lu)	1.5
Calculated Lugeon Value (Lu')	-
Maximum pressure (kgf/cm²)	13.8
Critical pressure (kgf/cm²)	-

$P = P_0 + \gamma_w (h_1 - h_2 - h_3)$ (kgf/cm²)

P : Corrected pressure (kgf/cm²)

P_0 : Reading of gauge (kgf/cm²)

γ_w : Unitweight of water

$h_3 = \alpha Q_0^2 L$

Q_0 : Average amount (ℓ/min)

L : Length of Rod (m)

α : A coefficient (7×10^{-5} min²/ℓ²)

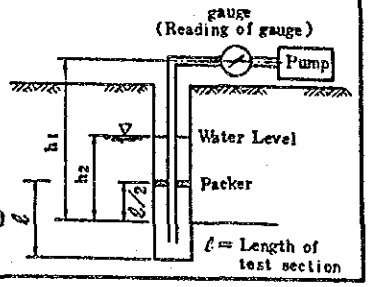


Fig.4-20 PHOTOS OF BORING CORE (D-1 and Q-1)

Main Damsite	
Drilling Number	D－4
Location	Power House
Length	20 m
Level	EL. 42.113m
Direction	Vertical

Quarry	
Drilling Number	Q－1
Location	North-East Ridge
Length	40 m
Level	EL.204.201m
Direction	Vertical

Fig. 5-1 RELATIONSHIP BETWEEN TUALANG AND GUILLEMARD OF MONTHLY DISCHARGE (JAN～MAR)

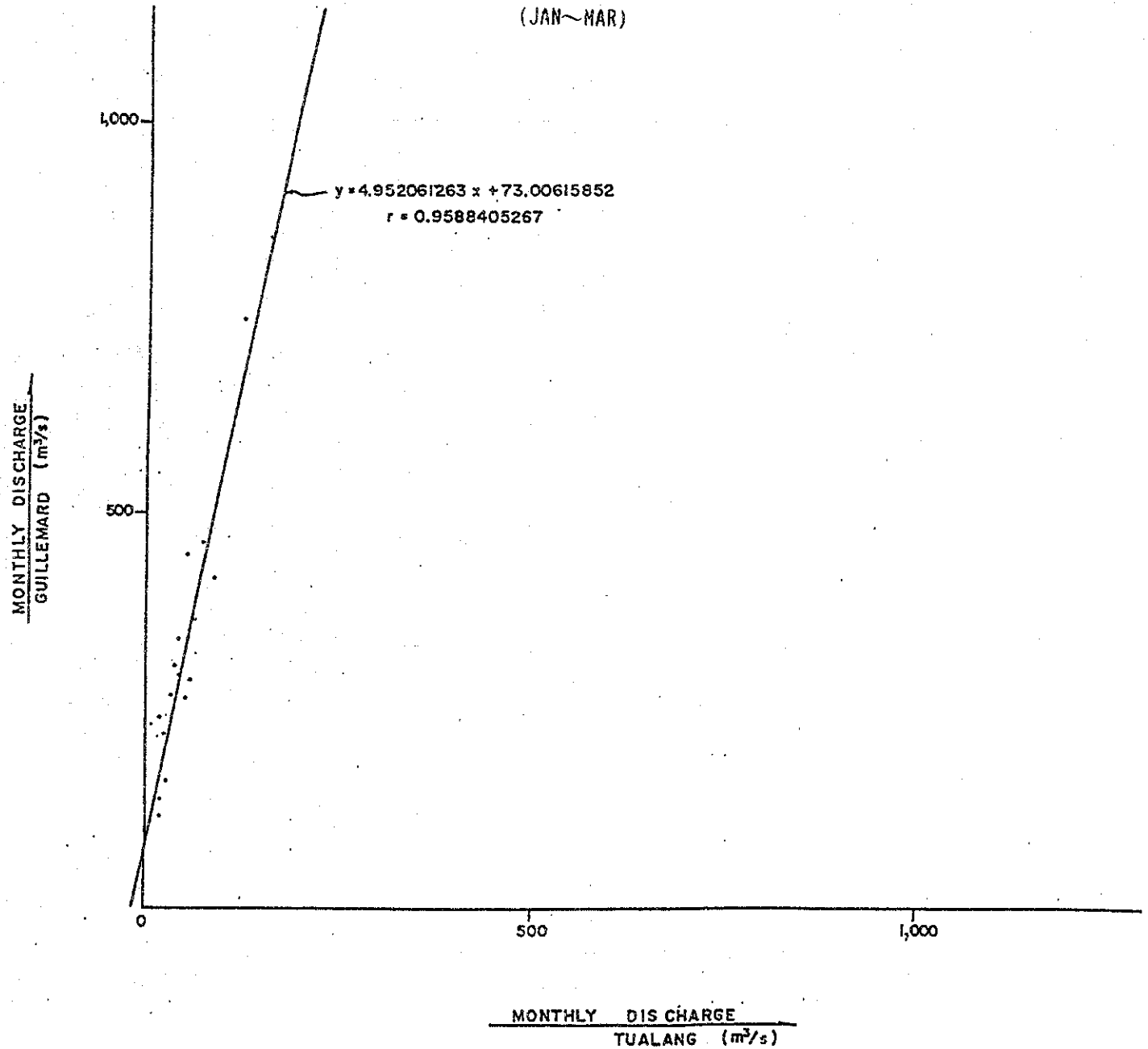


Fig. 5-2 RELATIONSHIP BETWEEN TUALANG AND GUILLEMARD OF MONTHLY DISCHARGE (APR~SEP)

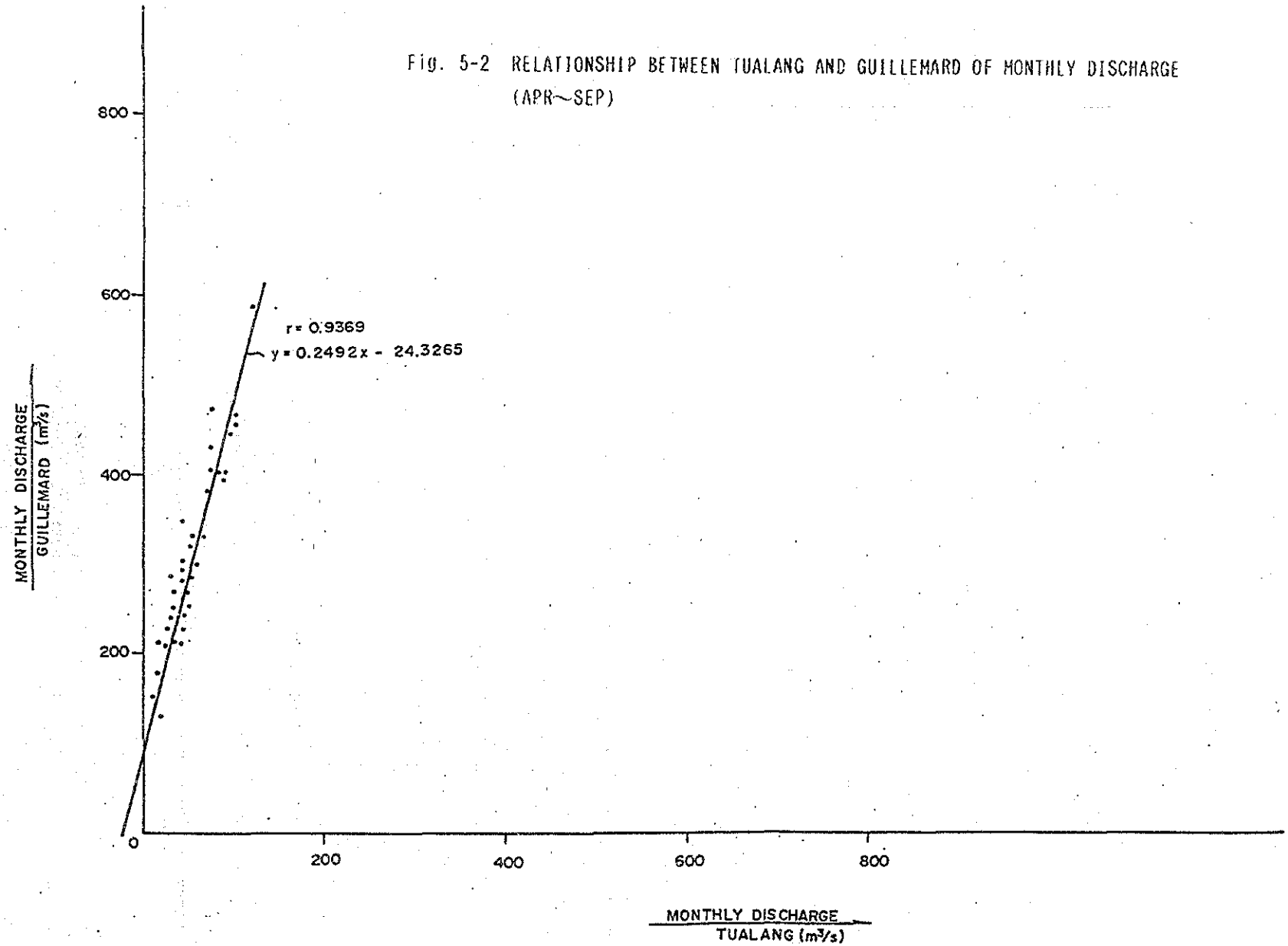


Fig. 5-3 RELATIONSHIP BETWEEN TUALANG AND GUILLEMARD OF MONTHLY DISCHARGE (OCT~DEC)

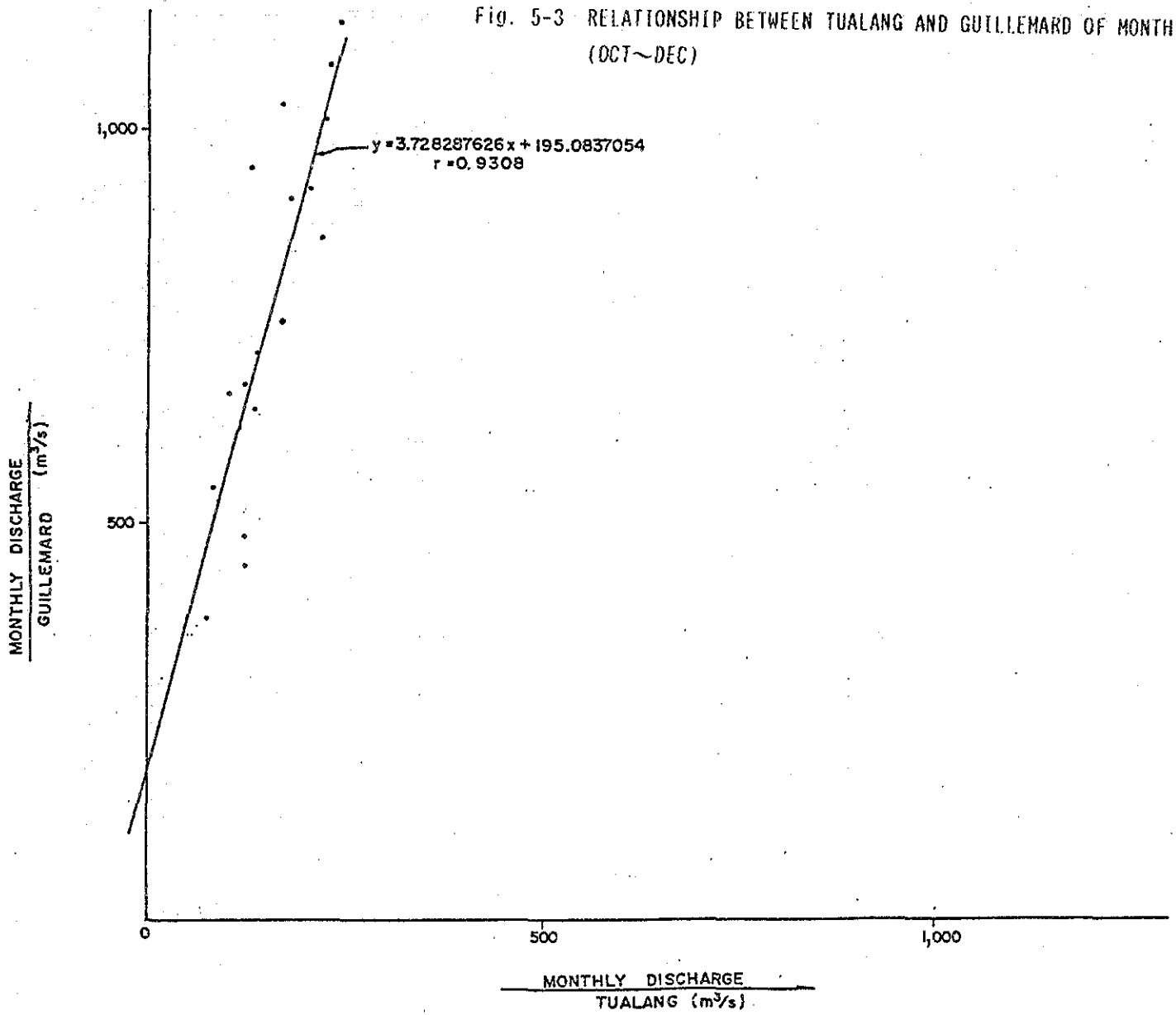


Fig. 5-4 WATER DISCHARGE (1965)

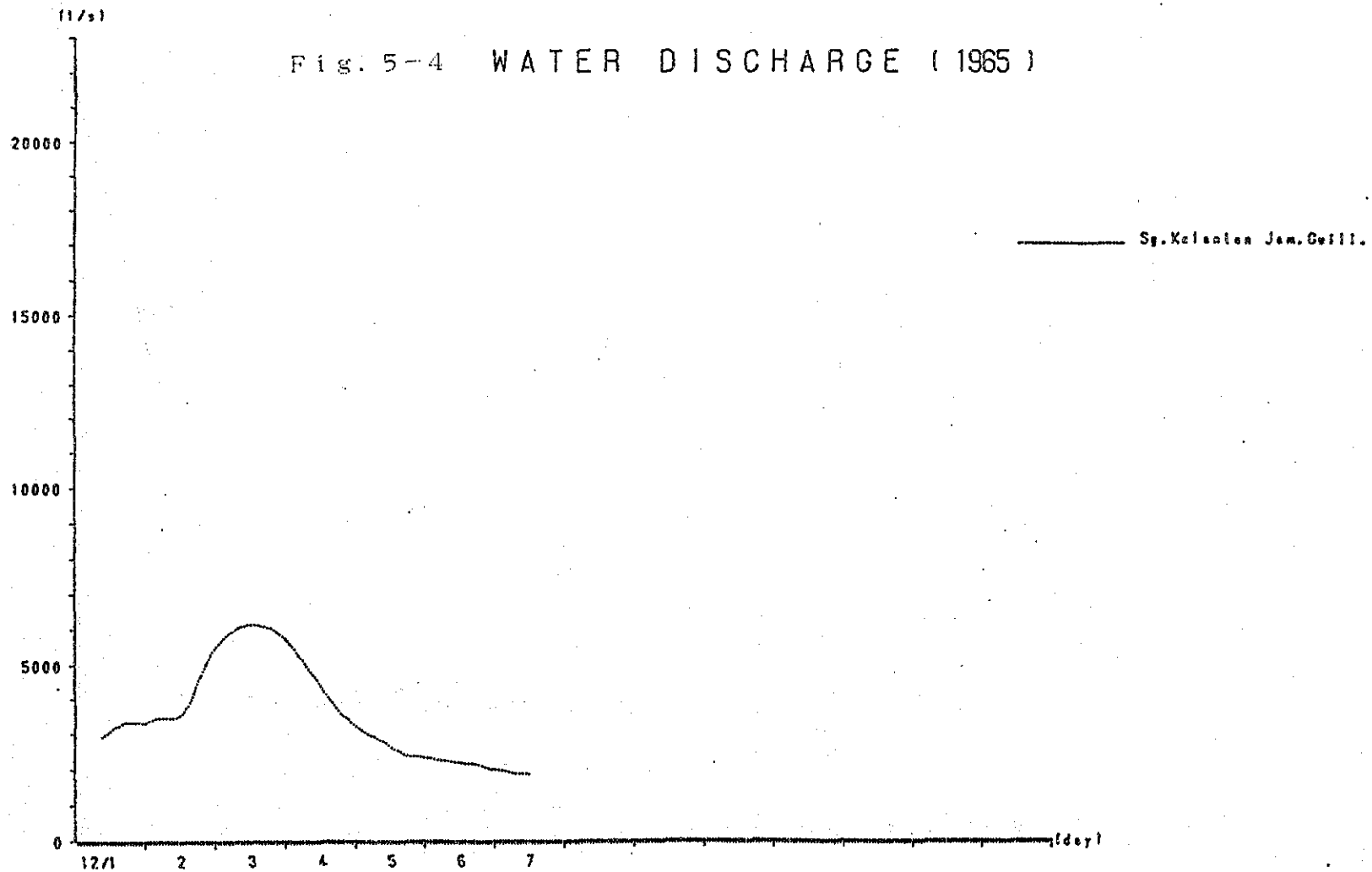


Fig. 5-5 WATER DISCHARGE (1967)

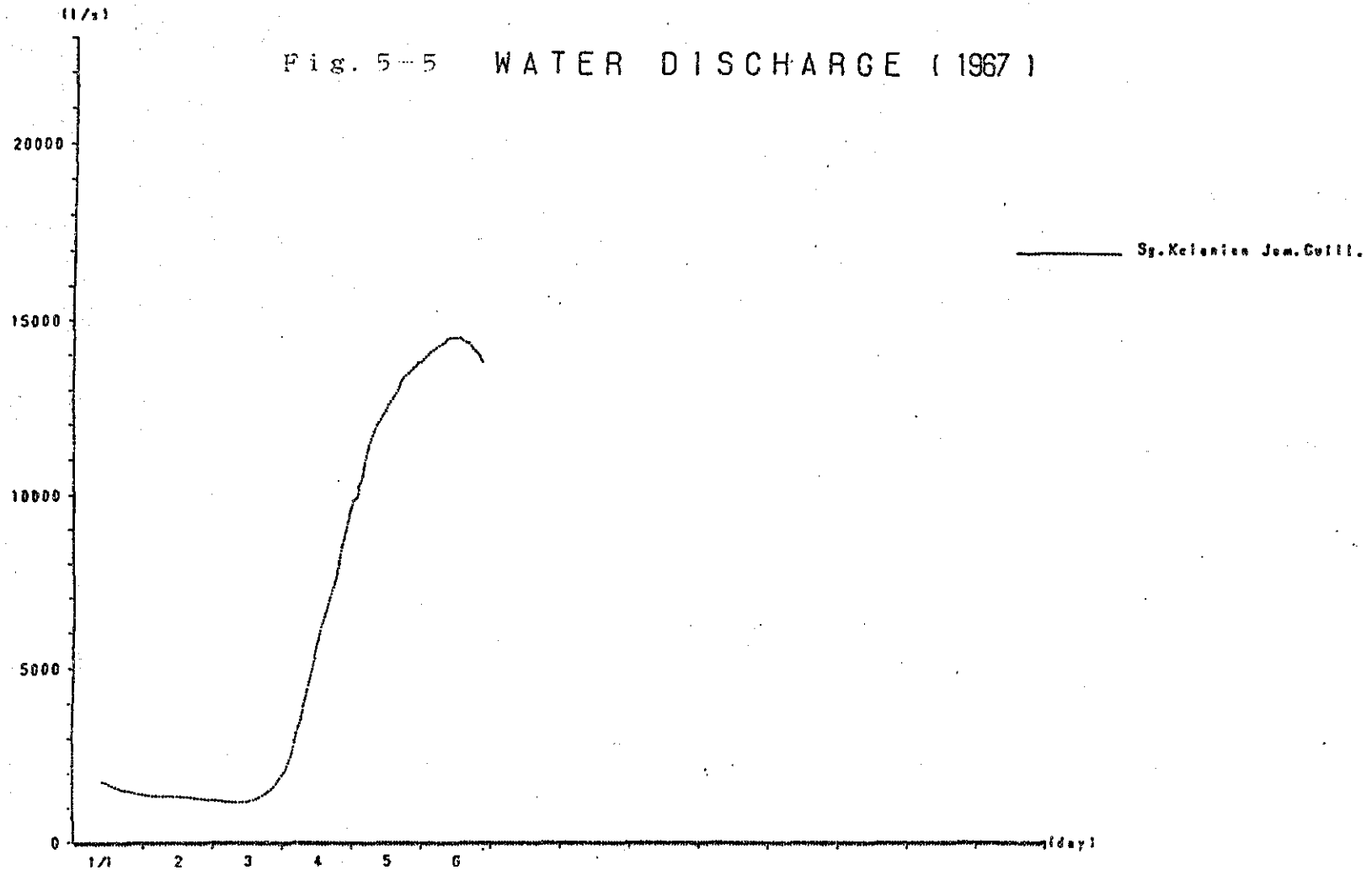


Fig. 5-6 WATER DISCHARGE (1969)

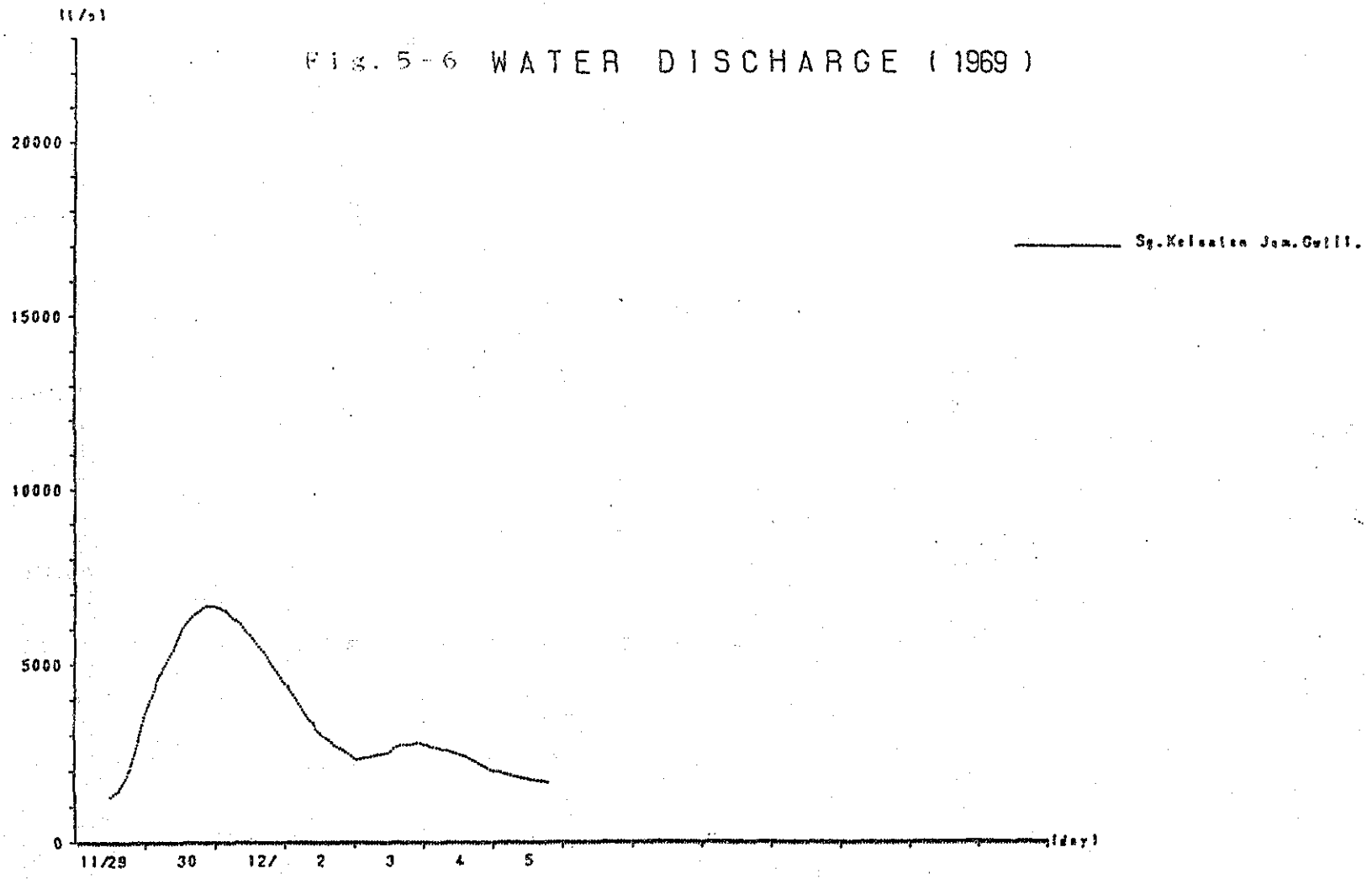


Fig. 5-7 WATER DISCHARGE (1973)

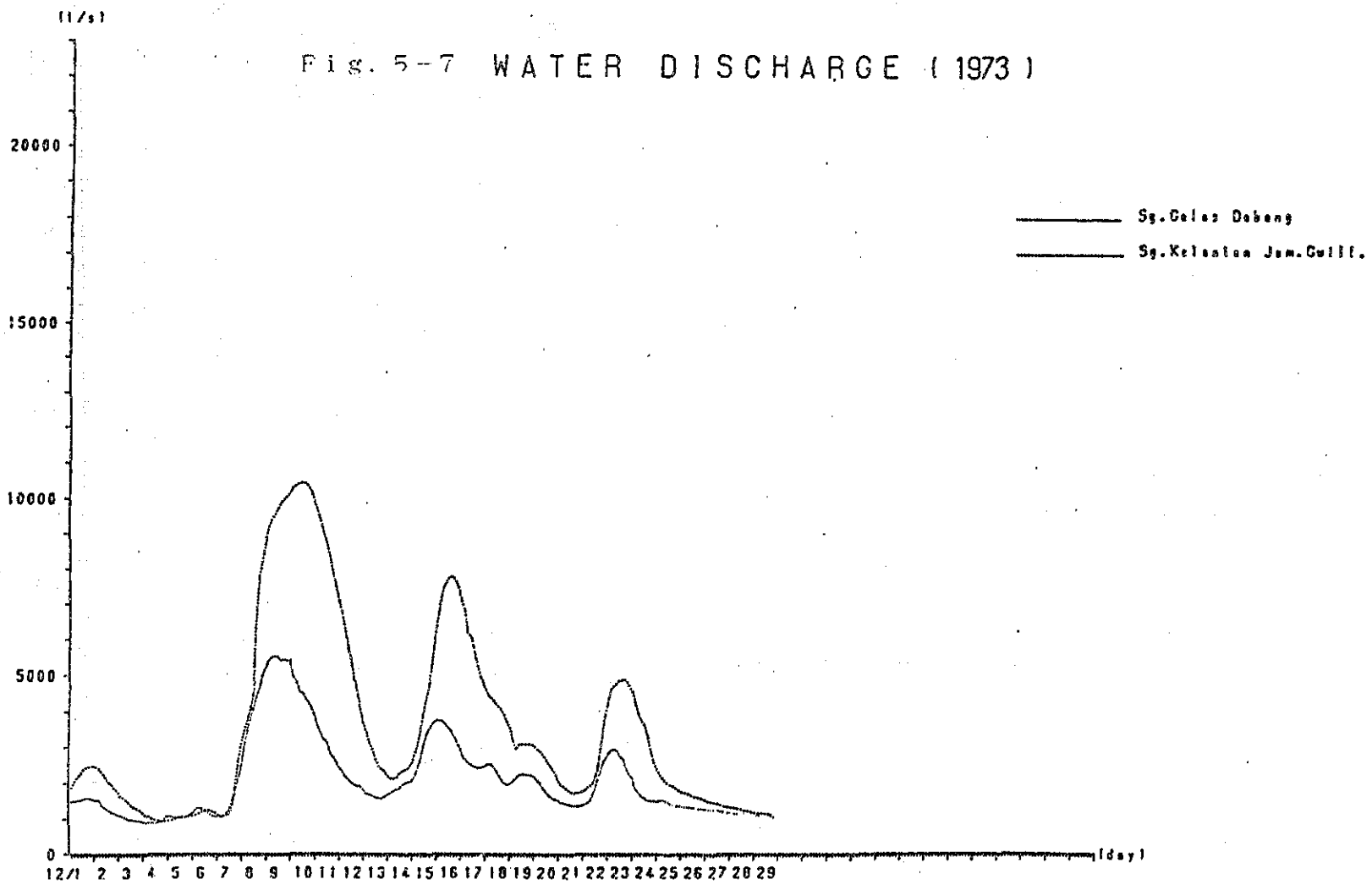


Fig. 5-8 WATER DISCHARGE (1974,75)

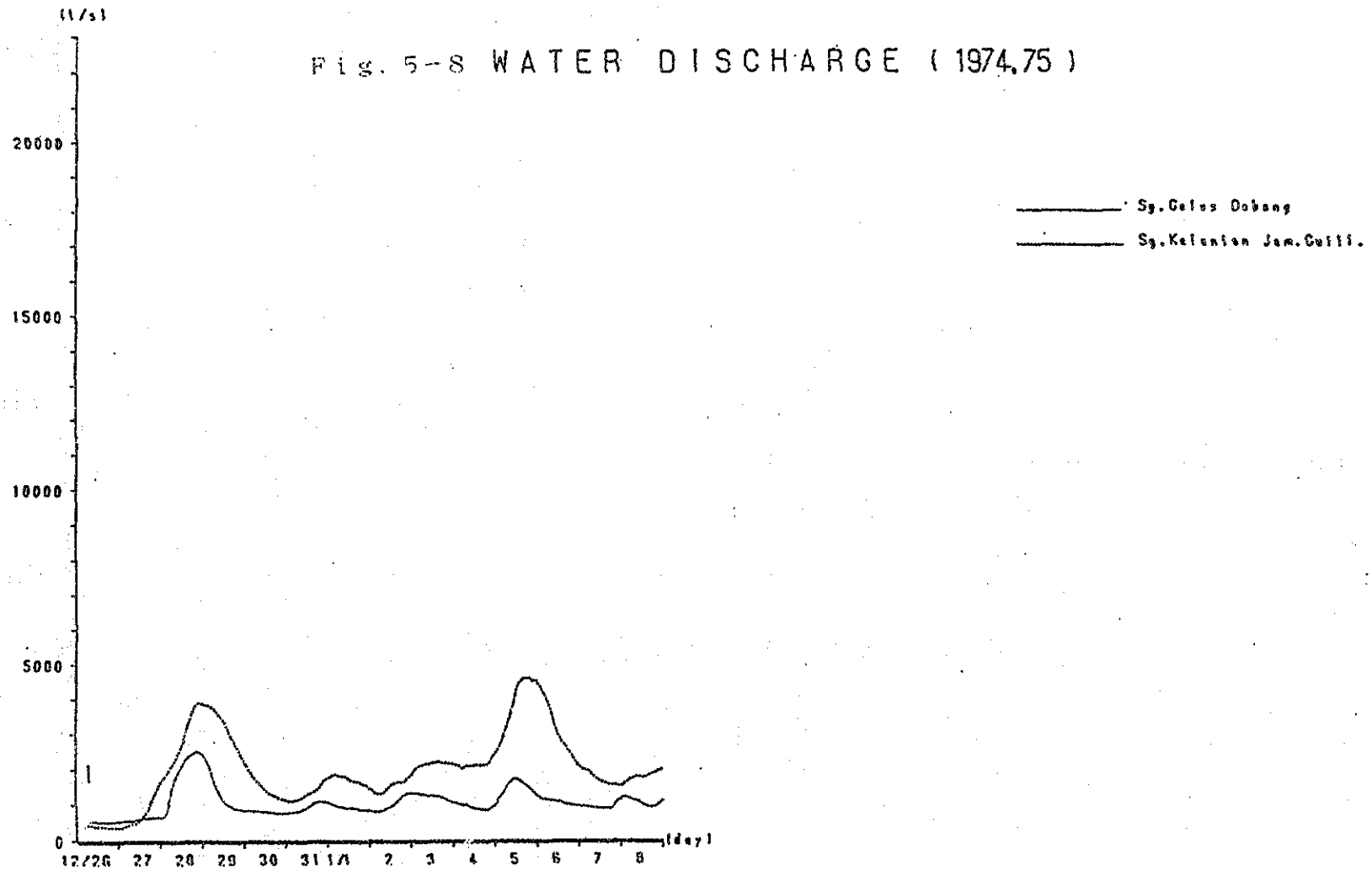


Fig. 5-9 WATER DISCHRAGE (1981)

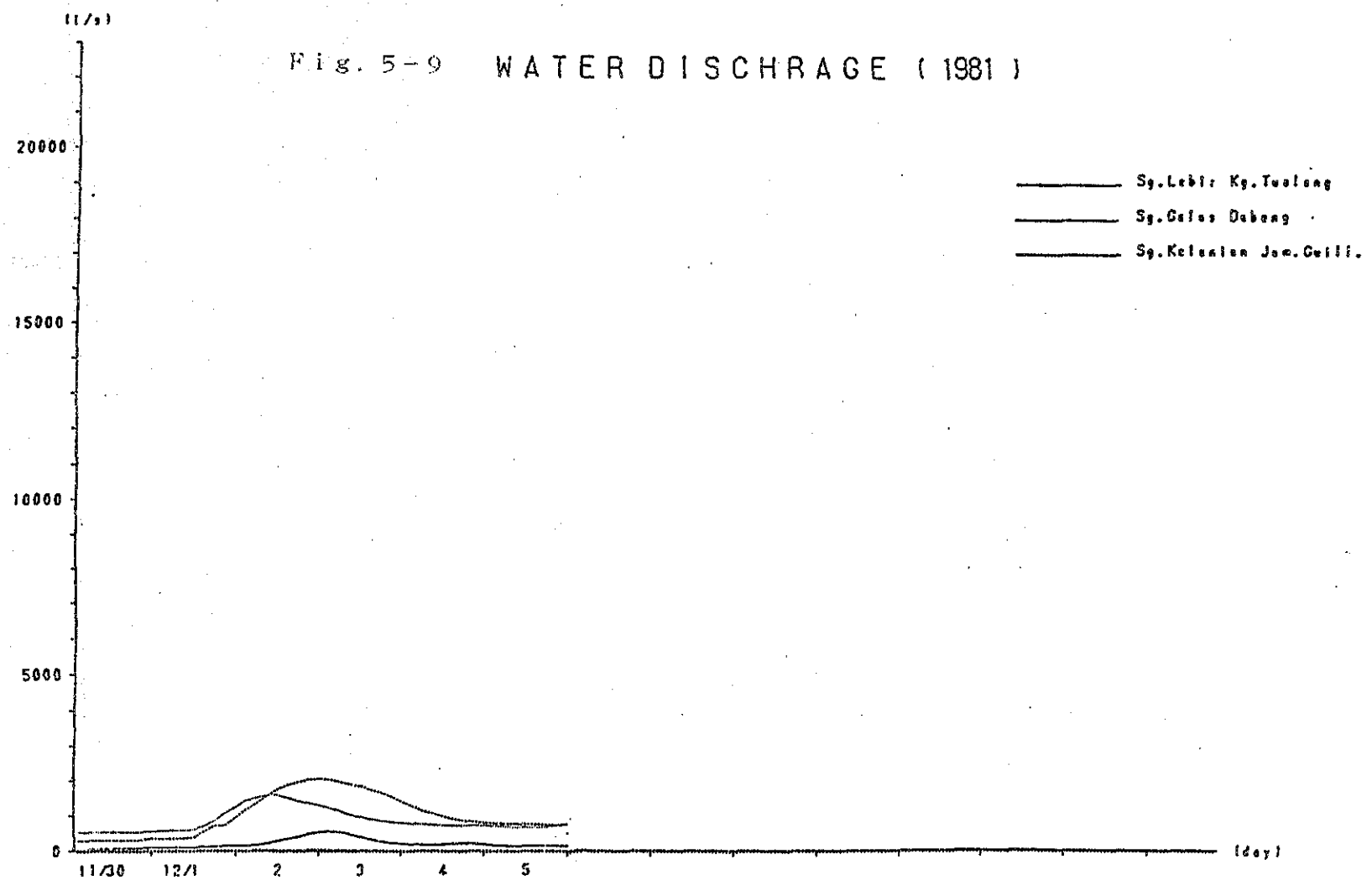


Fig. 5-10 WATER DISCHARGE (1982)

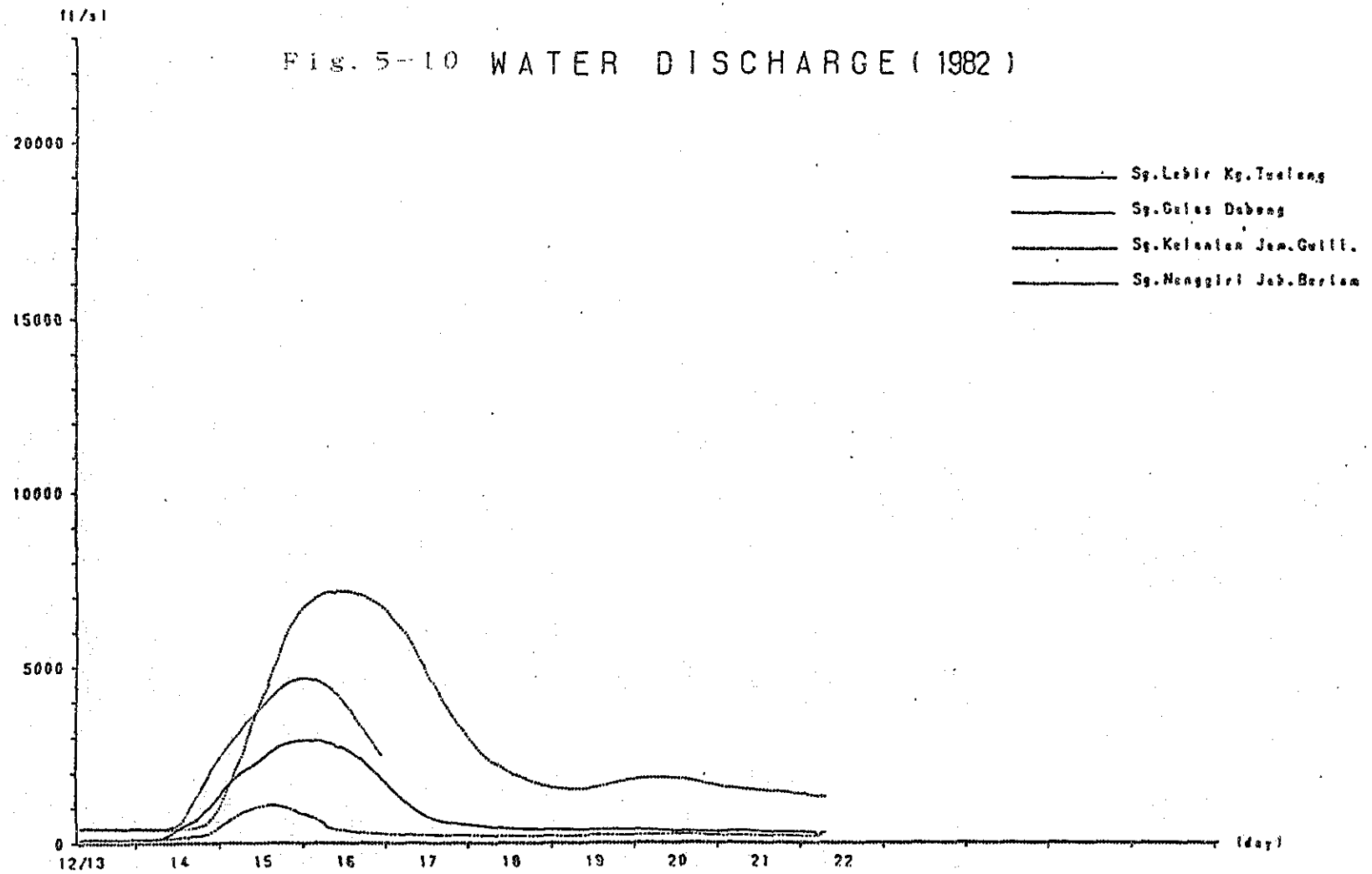


Fig. 5-11 WATER DISCHARGE (1983)

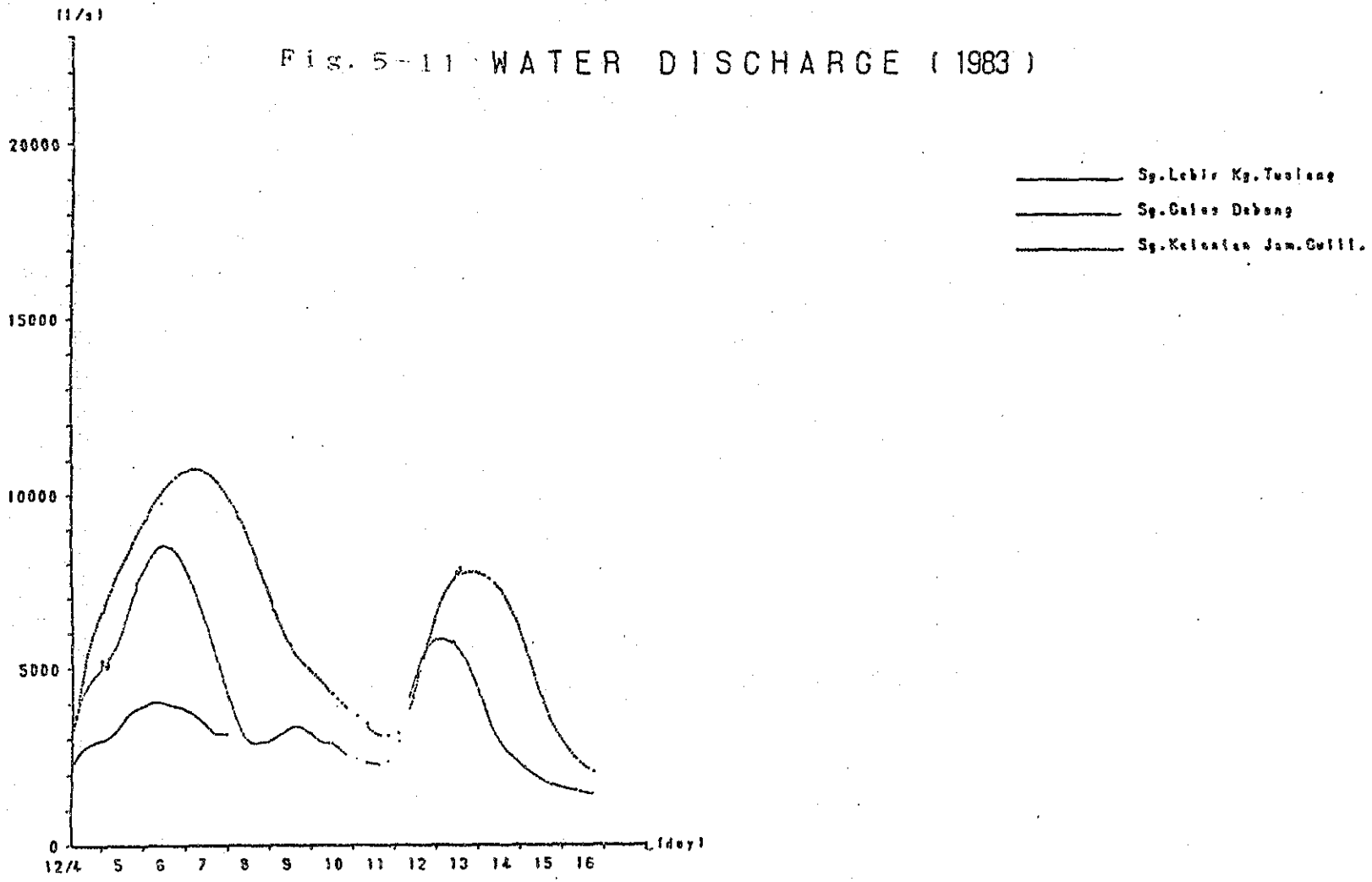


Fig. 5-12 WATER DISCHARGE (1984)

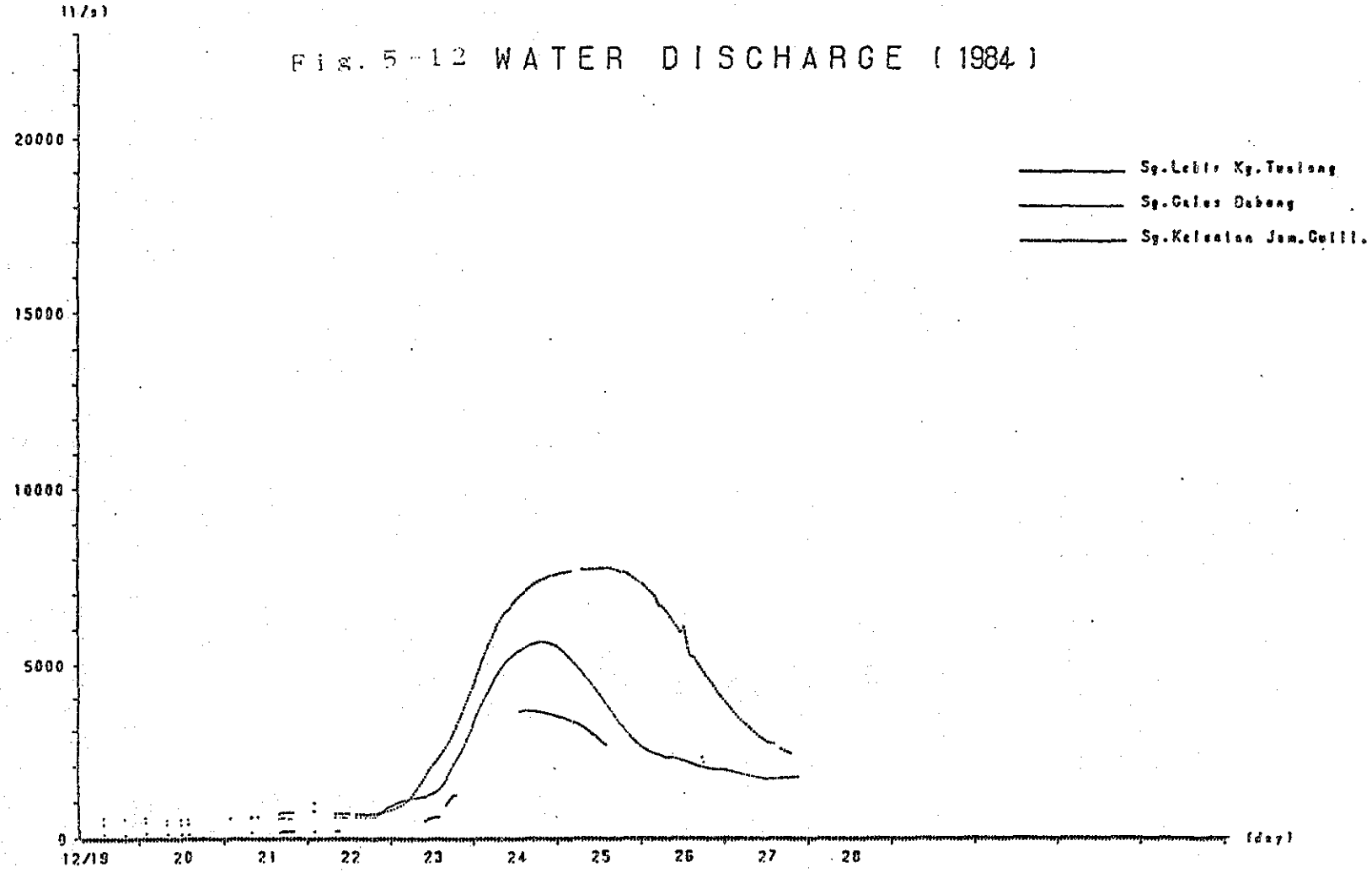
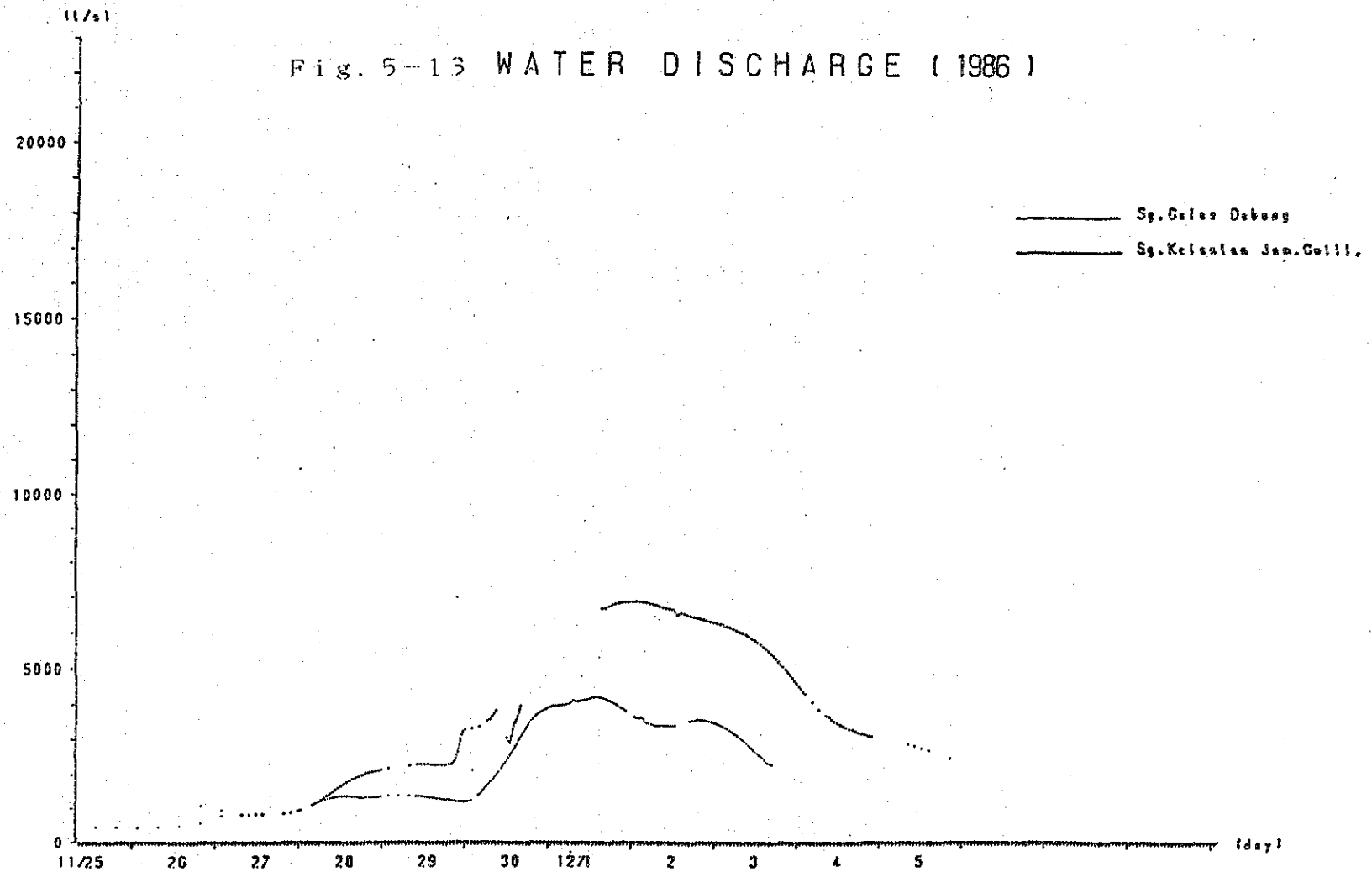



Fig. 5-13 WATER DISCHARGE (1986)