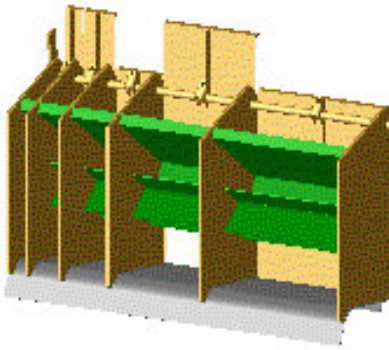


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BAFFLE DISTRIBUTORS®

**Constant flow intake
equipment for free
surface discharge**

The Baffle Distributors® are free surface intake equipment designed to supply controllable constant flow.



The flow is set to any required value by fully opening or closing the small gates with different spans. Once the distributor is locked at a given number of gates opened, the flow remains constant even though upstream and downstream water levels may vary to some extent.

Operating principle

The maintenance of a practically constant flow is achieved without any moving parts; the combination of a specially-shaped sill with a fixed baffle plate above it minimizes any effect that the upstream level may have upon the flow between the sill and the baffle. If the level is low, the discharge is performed under free surface flow conditions, (figure 1 A).

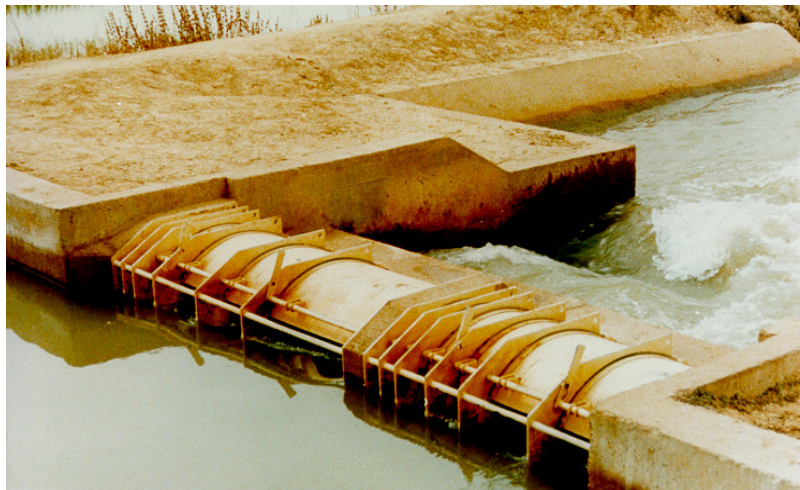
As the level rises, it reaches the baffle plate and the discharge is achieved under load with reduced discharge coefficient, and the water jet

outlet shows a contraction (figure 1 B).

As the load increases, the jet contraction tends to become more pronounced thus reducing the corresponding flow variation accordingly (Figure 1 C).

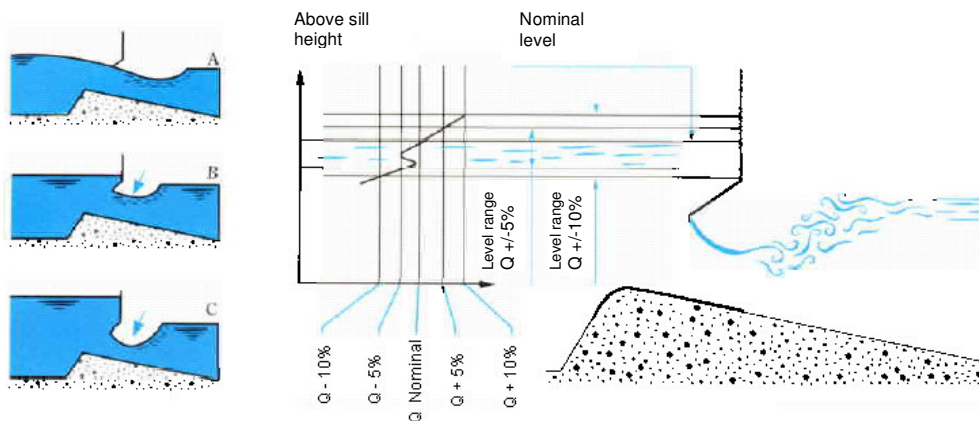
As figure 1 shows, it is possible to maintain a constant flow over a wide range of upstream level variation.

The figure 1 indicates the admissible range of the level variations relative to its nominal value for $\pm 5\%$ and $\pm 10\%$ flow variation.



Baffle Distributors® are a trademark

Figure 1 - Diagrammatic principle layout and operating curve for a Single Baffle Distributor.



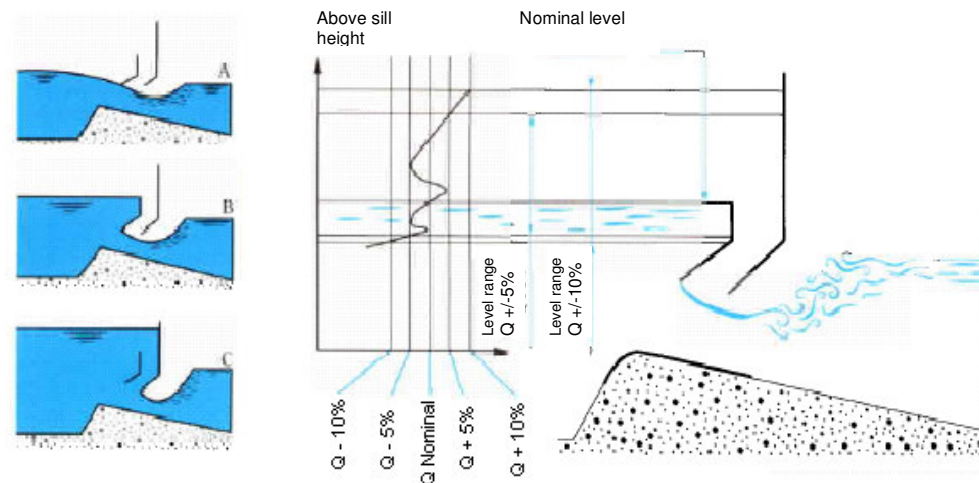
A second baffle mounted downstream of the first one, (figure 2) allows an appreciable increase in the upstream level variation range (about 150 to 190% greater than with the single baffle distributors). By contracting the jet discharging from the first baffle, the second baffle can be fitted nearer the sill so as to form a smaller orifice (figure 2 B). As the upstream

level exceeds a certain value, the first baffle is submerged, the second baffle then comes into action, and the flow's tendency to increase is retained still further (figure 2 C).

The shapes and the relative constructive element arrangement are designed to assure an optimized flow correction.

The equipment flow is not affected by downstream level variations: the sill downstream slope is so designed as to produce supercritical flow conditions, which establish a hydraulic discontinuity. The formation of a jump, however, enables one to recover the potential energy of the water flow. Thus the head loss caused by the equipment has a low value.

Figure 2 - Diagrammatic principle layout and operating curve for a Double Baffle Distributor.



Practical realization

The distributors are metallic monoblock assemblies fitted on the proper span dimension of the civil work defined in terms of the upstream water

level and the amplitude of its level variation.

The Baffle Distributors are standardized in four types of dimensions with different civil engineering structures

characterized by the nominal flow that may be discharged per width unit:

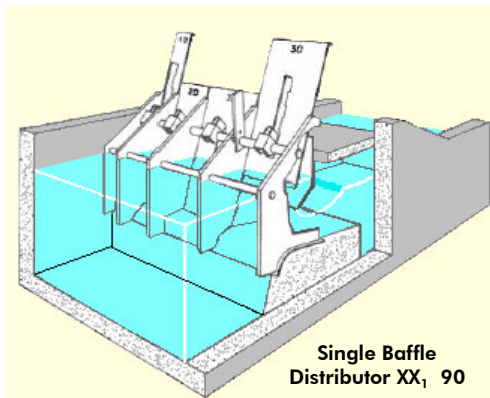
- Series X : 10 l/s / dm
- Series XX : 20 l/s / dm
- Series L : 50 l/s / dm
- Series C : 100 l/s / dm

The index 1 or 2, after the series letter X, XX, L or C denotes the type of the distributor (single or double baffle distributors).

The flow is staggered as follows:

- In steps of 5 l/s for the series X that is formed with 5, 10, 15 and 30 l/s shutters,
- In steps of 10 l/s for the series XX that is formed with 10, 20, 30, 60 and 90 l/s shutters,
- In steps of 50 l/s for the series L that is formed with 50, 100, 200 and 400 l/s shutters,
- In steps of 100 l/s for the series C that is formed with 100, 200, 400, 600 and 1000 l/s shutters.

Distributors with different staggering can be supplied on special request.



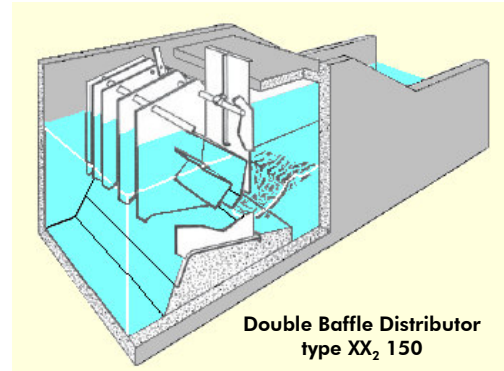
Single Baffle Distributor XX₁ 90

For standardization purposes, the smaller shutters have been always placed on the left bank side. The main dimensions of

all distributor types are showed on the next page. The Standard Staggering Tables list the nominal flows of each series and the corresponding widths.

The gates arranged side-by-side may operate either fully open or fully closed and the user may lock it into position, thus preventing in a simple way that others change the controlled values.

For large capacity facilities, the Series C distributors may be operated with large widths, and then making the implementation difficult. This difficulty can be overcome by building up composite series CC distributors (200 l/s/dm), consisting of metal baffles fixed above a concrete sill of special profile. The closing of the spans, which are separated by concrete piers, is assured by individual sliding gates. The flow is adjusted in steps of 1 m³/s (baffles with flow of 1, 2, 4 e 5 m³/s).



Double Baffle Distributor type XX₂ 150

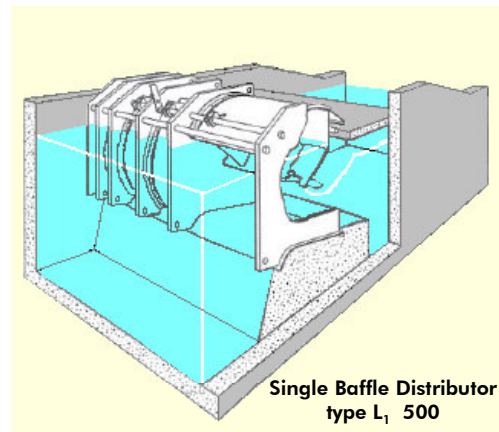
The characteristics of this fifth series of distributors are also shown in the correspondent table for information only.

Construction

The Baffle Distributors® are welded assemblies of steel plate, and rolled shapes of carbon steel. They require precision sheet-metal work with tight tolerance margins.

Series X and XX distributors are flat and slide in grooves milled in the partition plates.

In order to reduce the operating forces, the series L and C distributors are designed as sector-type and operated by rotation.



Single Baffle Distributor type L₁ 500

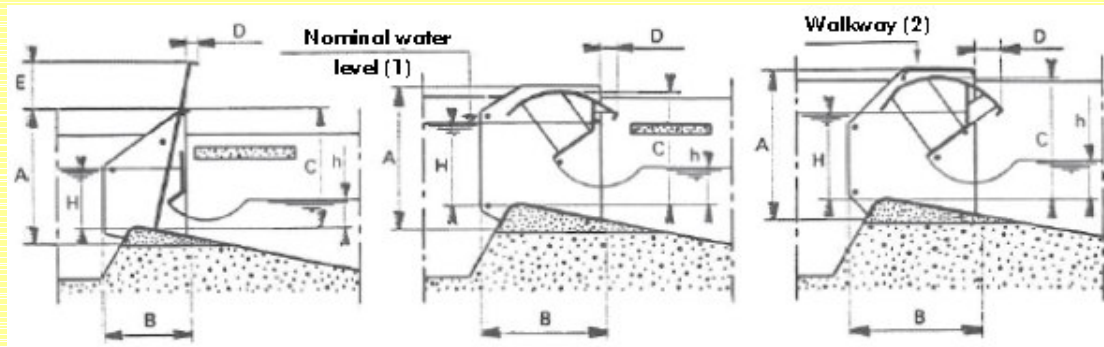
Baffle Distributor® – Dimensions

Single baffle distributor

Type X₁ and XX₁

Type L₁

Type C₁

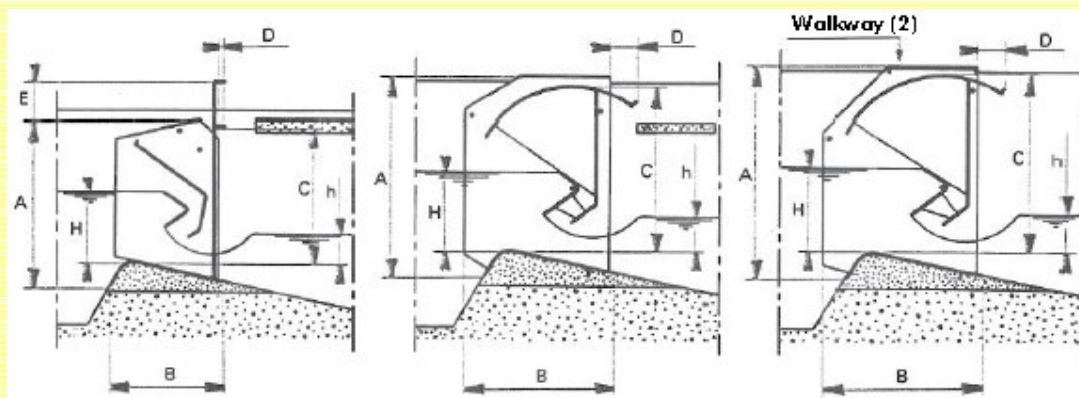


Double baffle distributor

Type X₂ and XX₂

Type L₂

Type C₂



Dimensions in cm

Type	A	B	C	D	E	Width for 100 l/s	Nominal Height	h (3)	Maximum retention height (closed gate)
X ₁	40	26	35	2	14	100	17	8 (10,5)	32
XX ₁	65	387	58	4	22	50	27	12 (16,5)	51
L ₁	88	77	72	16	-	20	50	22 (31)	68
C ₁	144	122	116	25	-	10	79	35 (49)	109
X ₂	47	27	36	2	8	100	17,5	8 (11)	35
XX ₂	66	43	54	2	15	50	28	12 (17)	51
L ₂	133	97	110	20	-	20	51	22 (31)	95
C ₂	205	152	180	28	-	10	81	35 (50)	147

(1) - See note (1) Civil Engineering Structure Table

(2) - See note (1) Civil Engineering Structure Table

(3) -The numbers in () may be used if the upstream level is never below the nominal level.

Standard sizes

A distributor is identified by one or two letters indicating its type and followed by a number corresponding to the nominal flow in l/s.

Example : X₁ 90

The standardized staggering for all types of Baffle Distributors® is showed in the tables below.

Distributors X₁ and X₂

Nominal Q l/s	Number of Shutters				l cm
	5 l/s	10 l/s	15 l/s	20 l/s	
30	1	1	1	-	32
60	1	1	1	1	63
90	1	1	1	2	94
120	1	1	1	3	125
150	1	1	1	4	156

Distributors XX₁ and XX₂

Nominal Q l/s	Number of Shutters					l cm
	10 l/s	20 l/s	30 l/s	60 l/s	90 l/s	
30	1	1	-	-	-	16
60	1	1	1	-	-	2
90	1	1	2	-	-	48
120	1	1	1	1	-	3
150	1	1	2	1	-	79
180	1	1	1	2	-	4
210	1	1	1	1	1	109
240	1	1	1	3	-	25
300	1	1	1	1	2	155
360	1	1	1	2	2	86
420	1	1	1	3	2	217
480	1	1	1	1	4	47

Distributors C₁ and C₂

Nominal Q l/s	Number of Shutters					l cm
	100 l/s	200 l/s	400 l/s	600 l/s	1000 l/s	
1000	2	1	1	-	-	105
1100	1	1	2	-	-	114
1200	2	1	2	-	-	125
1300	1	1	1	1	-	134
1400	2	1	1	1	-	145
1500	1	2	1	1	-	155
1600	2	2	1	1	-	166
1700	1	1	2	1	-	175
1800	2	1	2	1	-	186
1900	1	1	1	2	-	195
2000	2	1	1	2	-	206
2100	1	2	-	1	1	215
2200	2	1	2	-	1	226
2300	1	1	1	1	1	235
2400	2	1	1	1	1	246
2500	1	2	1	1	1	256
2600	2	2	1	1	1	268
2700	1	1	2	1	1	276
2800	2	1	2	1	1	288
2900	1	1	1	2	1	296
3000	2	1	1	2	1	308

The monoblock elements are less than 3100mm. The maximum discharge of a monoblock element is 3000l/s. A concrete pier with a minimum thickness of 300mm is required between two elements.

For capacities above 3000 l/s, a distributor from the table above shall be installed combined with one or more additional distributors selected in the table given below:

Nominal Q l/s	Number of Shutters of 1000 l/s	l cm
1000	1	100
2000	2	202
3000	3	303

Distributors L₁ and L₂

The monoblock elements width are less than 3100mm. The maximum discharge of a monoblock element is 1500 l/s. A concrete pier with a minimum thickness of 200mm is required between two elements.

Nominal Q l/s	Number of Shutters				l cm
	50 l/s	100 l/s	200 l/s	400 l/s	
500	2	2	1	-	104
550	1	1	2	-	113
600	2	1	2	-	124
650	1	2	2	-	134
700	2	2	2	-	145
750	1	1	1	1	153
800	2	1	1	1	164
850	1	2	1	1	174
900	2	2	1	1	185
950	1	1	2	1	194
1000	2	1	2	1	205
1050	1	2	2	1	215
1100	2	2	2	1	226
1150	1	1	1	2	234
1200	2	1	1	2	245
1250	1	2	1	2	255
1300	2	2	1	2	266
1350	1	1	2	2	275
1400	2	1	2	2	286
1450	1	2	2	2	296
1500	2	2	2	2	307

For capacities above 1500 l/s, a distributor from the table above shall be installed combined with one or more additional distributors selected in the table given below.

Nominal Q l/s	Number of Shutters of 400 l/s	l cm
400	1	80
800	2	161
1200	3	242

Selecting the equipment

The equipment is chosen in function of its flow capacity and the type of longitudinal section (X, XX, L ou C) that determines the width, the staggering value, the permissible head loss, and the permissible upstream level variation amplitude relative to the number of baffles in the

distributors (single or double baffle equipment).

The tables on previous page indicate that:

- The Distributors X are for flows between 30 and 150l/s, controlled by steps of 5l/s.
- The Distributors XX are for flows between 30 and

480l/s, controlled by steps of 10l/s.

- The Distributors L and C are for flows between 500 and 1500, with staggering of 50l/s and between 1000 and 3000 l/s, with staggering of 100l/s, respectively. The additional distributors allow the flow increasing up to the desired values.

Head losses and level tolerances

Type	Flow per unit width	H _{min}	H _{min}	H _{nom}	H _{max}	H _{max}	dH	dH	J _{min} para H _{nom}	J _{min} para H _{min}	P _{min}	
		Q -10%	Q - 5%	Q	Q + 5%	Q + 10%	Q ± 10%	Q ± 5%				
1 baffle	X ₁	10 l/s/dm	13	13,5	17	18,5	20	7	5	6,5	5	16
	XX ₁	20 "	20	21,5	27	29,5	31	11	8	10,5	8	25
	L ₁	50 "	37	39,5	50	54,5	58	21	15	19	15	47
	C ₁	00 "	59	62,5	79	86	92	33	23,5	30	24	75
	(CC ₁)	200 "	94	100	126	137	146	52	37	48	38	118
	Q ₁ l/s/dm	Q	2,75*	2,91*	3,68*	4,00*	4,27*	1,52*	1,09	1,41*	1,10*	3,45*
2 baffles	X ₂	10 l/s/dm	13	13,5	17,5	18,5	20	18	14,5	6,5	5	17
	XX ₂	20 "	20	21	28	44	48	28	23	11	8	26
	L ₂	50 "	37	39	51	82	89	52	43	20	15	49
	C ₂	00 "	59	62	81	130	142	83	68	31	24	77
	(CC ₂)	200 "	94	99	129	206	225	131	107	50	38	122
	Q ₂ l/s/dm	Q	2,75*	2,88*	3,77*	6,02*	6,58*	3,83*	3,14*	1,45*	1,10*	3,57*

(*) To be multiplied by Q^{2/3} to obtain the corresponding dimensions of an homothetic (similar) baffle distributor discharging per width unit Q l/s/dm.

(**) P is the depth, below the sill, of the upstream channel bottom (P = a - H_{nom,r} in accordance to the Civil Engineering Structure table in the next page).

Important note :

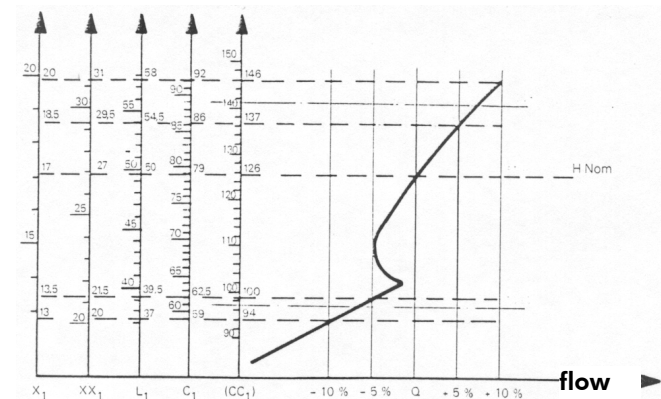
The ratio $\frac{\text{Permissible range}}{\text{Head loss}}$ wich is respectively :

- 0,99 for single baffle distributors at Q ± 5%
- 1,38 for single baffle distributors at Q ± 10%
- 2,85 for double baffle distributors at Q ± 5%
- 3,48 for double baffle distributors at Q ± 10%

show the advantage of this equipment over the intakes fitted with submerged gates operating with ratios of 0,22 and 0,49 or weir gates operating with ratios of 0,17 and 0,35.

Single baffle distributors operating curve

Above sill height in cm



Defining the installation level

The operating curves represent the flow variations in function of the upstream water level for

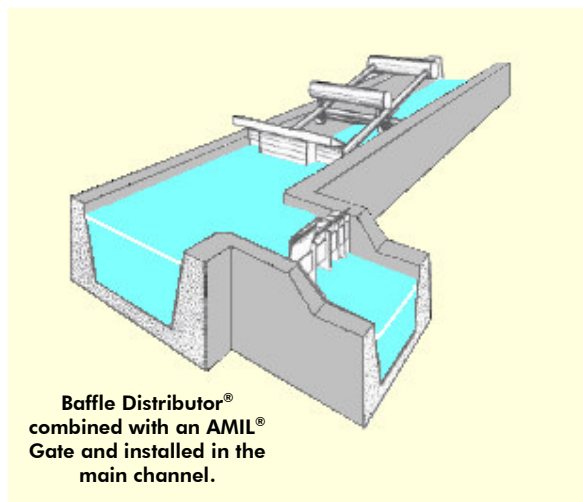
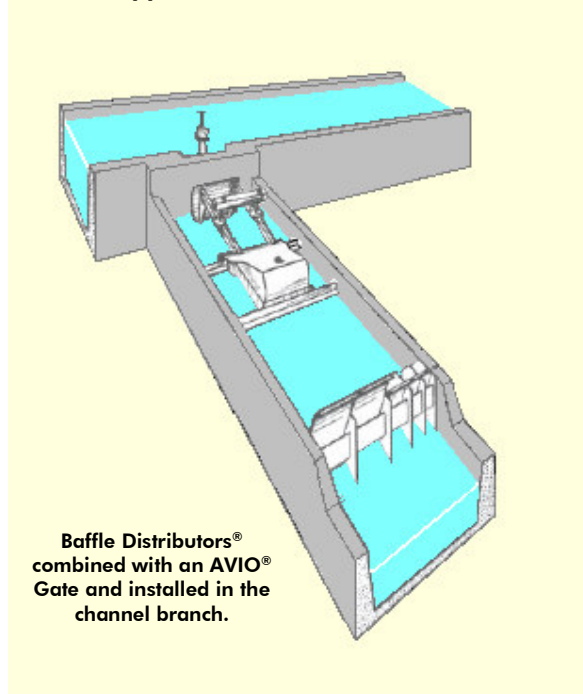
single and double distributors.

They allow the proper distributor installation level definition, i.e. establishing the absolute dimension for

nominal level in function of the upstream water levels for the distributor.

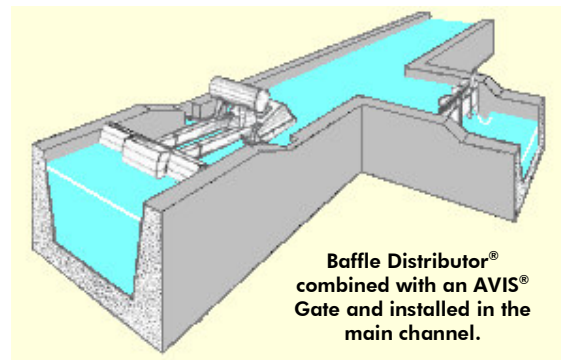
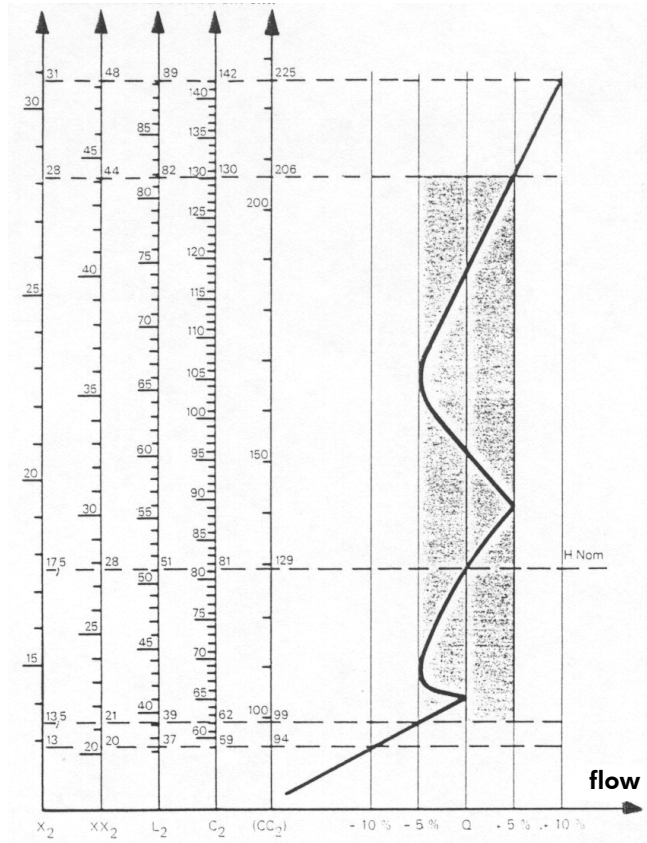
The civil engineering structure is showed in the table on the next page.

Practical applications

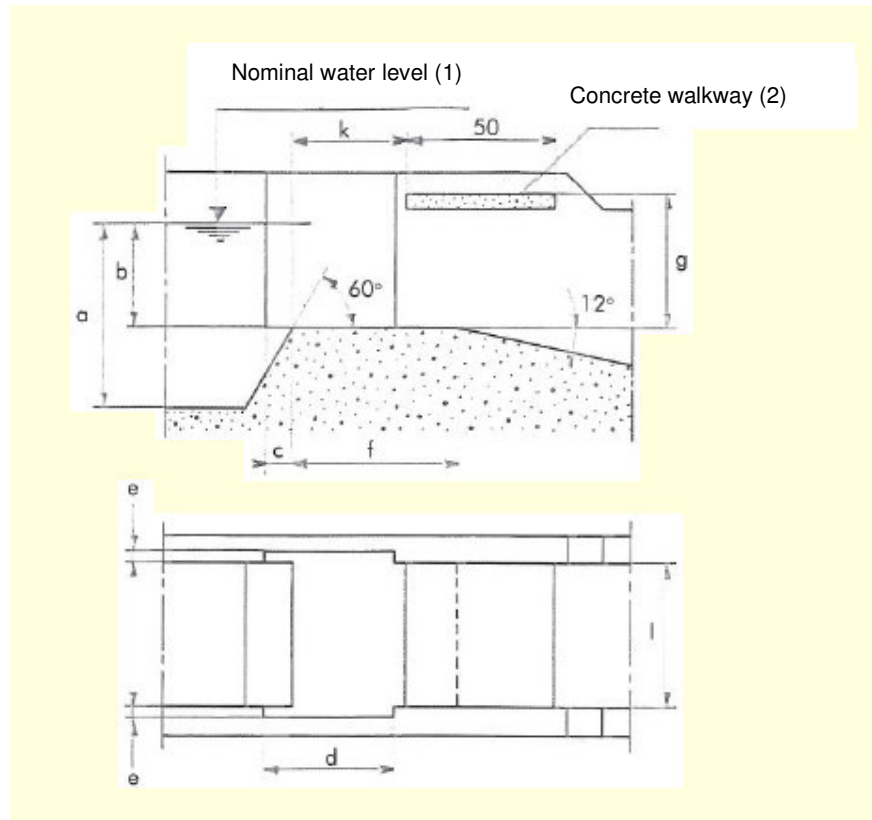


Double baffle distributors operating curve

Above sill height in cm



Baffle Distributors® – civil engineering structure



Distributor type	a min.	b	c	d	e	f	g	k	l
X ₁	33	25	9	34	5	45	35	25	See the Standardized Staggering tables
XX ₁	52	37	10	46	5	57	47	36	
L ₁	97	68	16	94	10	103	68	85	
C ₁	154	105	25	140	15	146	-	-	
X ₂	35	26	3	36	5	48	49	40	
XX ₂	54	40	4	54	5	68	70	60	
L ₂	100	75	20	115	10	135	105	100	
C ₂	158	120	25	170	15	210	-	-	

- (1) The nominal water level is established in terms of the actual water level in the channel, as close as possible to the average level of the upstream level variation interval, according to the indications shown on "Head losses and level tolerances table".
- (2) For spans with widths more than 1 m, a concrete walkway shall be designed. The distributors of type C are supplied with a metallic walkway fitted above the distributor.