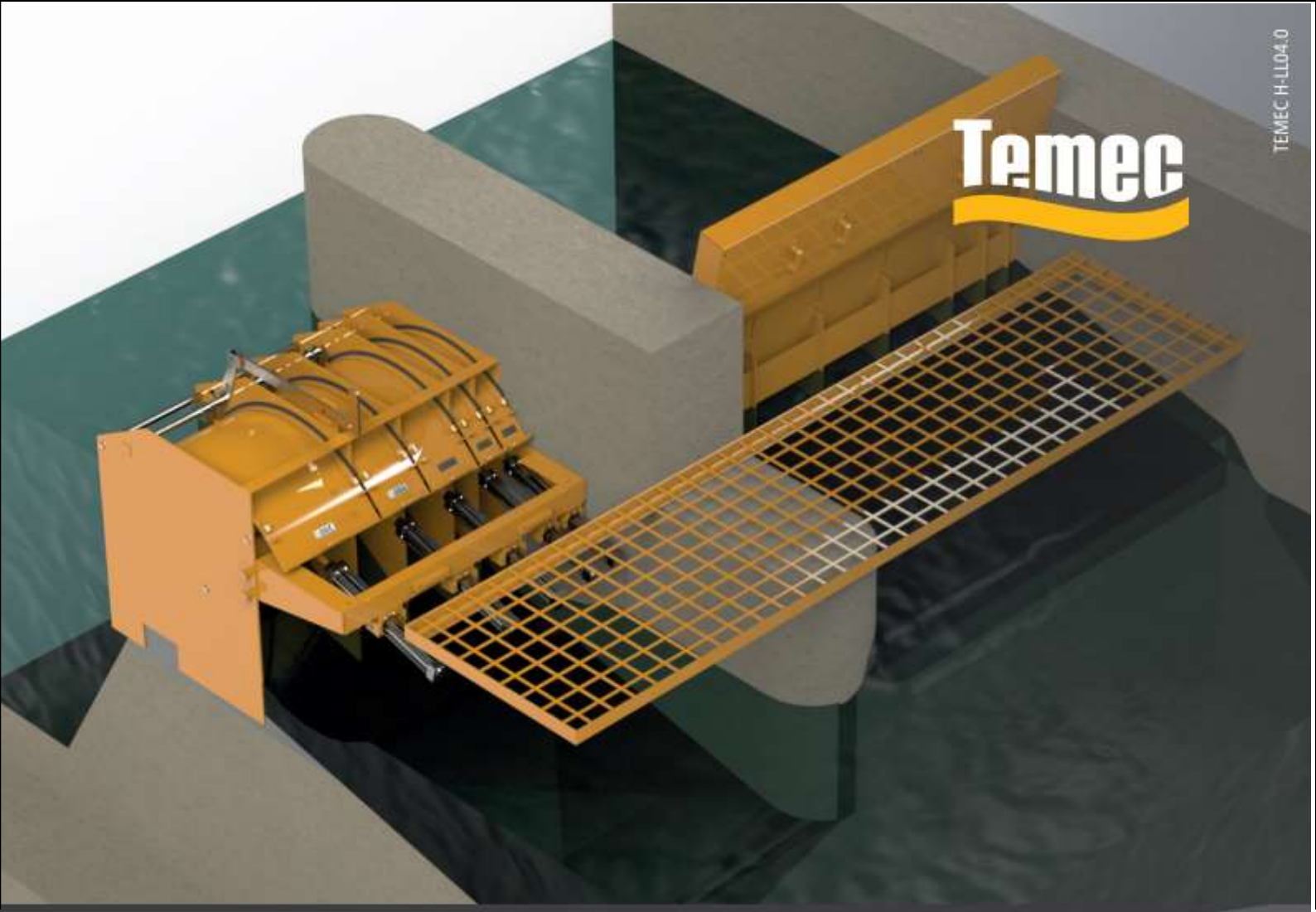


ORIFICE MODULES

Constant discharge distributors for open channel flows

- Robust
- Reliable
- Precise
- Without electricity
- Stationary
- Easy to operate

FUNCTION

Installed in channels, irrigation systems or at the outlet of reservoirs, they provide a practically constant flow rate, regardless of upstream level fluctuations (within certain limits indicated in the corresponding charts).

The flow is regulated by the complete opening or closing of gates of different spans.

APLICATIONS

- In channel derivation, for equitable distribution of discharge.
- At the outlet of reservoirs or in places with little variation in order not to take excessive flows.

OPERATING PRINCIPLE

With a low upstream level, the water flows freely over a sill (phase A). As the water level rises, it reaches the mask or baffle (phase B) so the discharge becomes under-load with a drastically reduced flow coefficient (inflection point of the flow curve) and an increasing contraction of the nappe. As the load increases, the contraction is more pronounced maintaining the flow with small variations (+/- 5% or +/-10%).

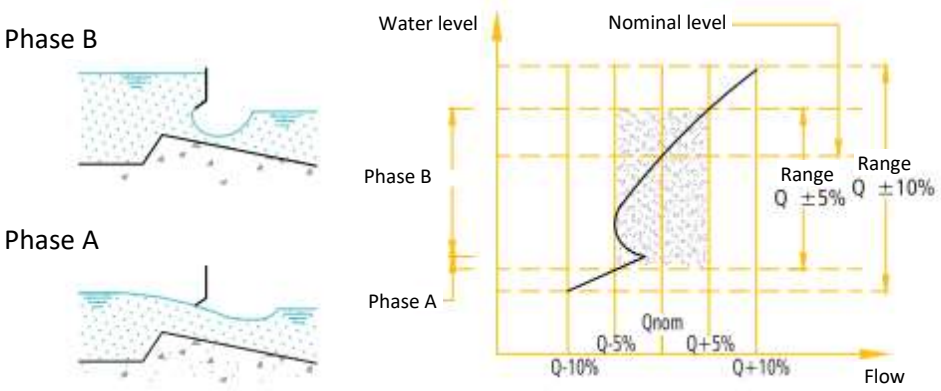


Figure N° 1

In the event of a major variation in the level of the main channel, higher than the one that can be admitted by the equipment presented above, an additional mask is placed that redirects the flow (Phase C) causing a strongly reduced flow coefficient again, so that the discharge does not increase.

The flow supplied does not depend on the downstream level either: in fact, the downstream slope of the sill is designed to cause a torrential flow with the corresponding "hydraulic isolation". For this reason, it is necessary to verify that the downstream conditions are compatible with the unit to be installed (submergence < 60%).

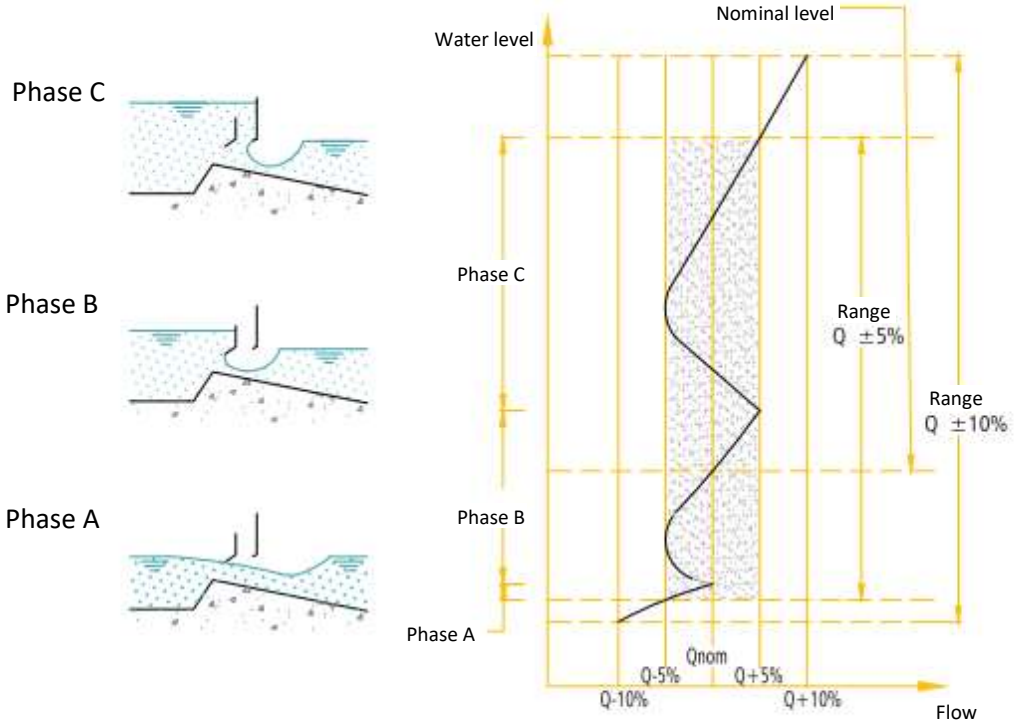


Figure N° 2

DESCRIPTION

Each element consists of fixed screens ("masks" or “baffles”) placed on top of a curved sill, both fitted to vertical side plates. In addition, a small gate, flat or sector, depending on the size, allows to open or close the module (ON/OFF operation).

As the flow rate supplied is proportional to the width of a unit, several units are arranged together in parallel, allowing the flow rate to be selected by opening or closing the corresponding gates. By adding a second fixed mask, greater upstream level variations can be supported.

CONSTRUCTION

The module, a set of several elements, is presented in monobloc form to be embedded in the split site.

They are made of carbon steel plate and carefully protected against corrosion by coating with a zinc-rich primer, finished with two coats of two-component epoxy paint.

The gates of modules V and X are flat and slide in slots milled on the dividing plates.

A locking system prevents any unauthorized modification of the flow rate.

To reduce maneuvering efforts, series L and C use sector gates and are operated by rotation.

The M series resembles a flat gate.

CHARACTERISTICS

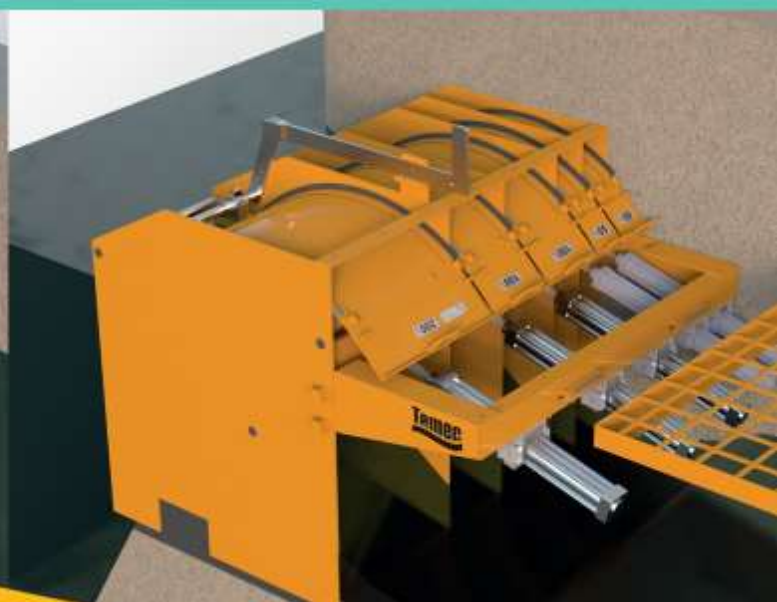
The delivered flow rate is less susceptible to variations than a loaded orifice and or a free flow diversion.
Robust, accurate and reliable equipment.
Transparency in service provision as it is ON/OFF with no intermediate positions.
Simple and fast manual operation
Possibility of monitoring instantaneous flow rates and accumulated volumes: by installing end switches on the gates that make up the equipment, it is possible to record whether they are open or closed and at what time the maneuvers are made. This recording can be done locally with a data-logger or sent remotely with an RTU. As they are low power consumption devices, they can be powered by an internal battery.
It is possible to remote control the maneuvers by installing 12 VDC outdoor electric actuators, with integrated limit switches and torque limiters.

PLACEMENT CONDITIONS

The upstream level variation must be compatible with the variation admissible by the equipment selected.
The downstream level must be compatible with the maximum submergence of the equipment.
The upstream velocity must be uniform over the width of the equipment.
The installation of upstream grids is recommended for the retention of flotant and debris.
Although they have a locking system to prevent any undue modification of the flow rate, the installation of an anti-vandalism perimeter fence is recommended, especially if the monitoring and motorization option is chosen.

ORIFICE MODULES

Constant discharge distributors for open channel flows

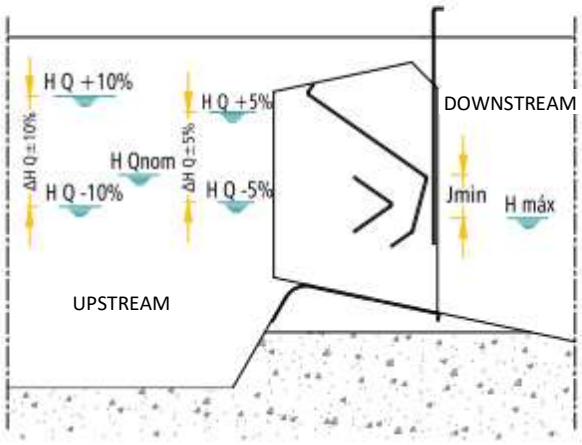


DEVICE SELECTION

The choice of the type of device depends on the flow rate to be supplied and the type (V, X, L, C or M) which determines the dimensions (width), the flow rate range, the minimum head loss and the admissible fluctuations of the upstream level depending on whether 1 or 2 masks are involved (subindex 1 or 2).

Five types of Orifice Modules are manufactured, characterized by the nominal flow rate through the unit width.

Modules of different types (e.g. M and C) can be combined to optimize the equipment, but considering the admissible upstream variation and the head loss in both equipments.



	Type	Q by length (10 cm)	H_{min} Q-10%	H_{min} Q-5%	H_{nom} Q	H_{max} Q+5%	H_{max} Q+10%	ΔH Q ±5%	ΔH Q ±10%	J_{min} H_{nom}	J_{min} H_{min}
Single mask/baffle	V 1	10 (l/s)	13	13,5	17	18,5	20	5	7	6,5	5
	X 1	20 (l/s)	20	21,5	27	29,5	31	8	11	10,5	8
	L 1	50 (l/s)	37	39,5	50	54,5	58	15	21	19	15
	C 1	100 (l/s)	59	62,5	79	86	92	23,5	33	30	24
	M1	200 (l/s)	94	100	126	137	146	37	52	48	38
Doble mask/baffle	V 2	10 (l/s)	13	13,5	17,5	28	31	14,5	18	6,5	5
	X 2	20 (l/s)	20	21	28	44	48	23	28	11	8
	L 2	50 (l/s)	37	39	51	82	89	43	52	20	15
	C 2	100 (l/s)	59	62	81	130	142	68	83	31	24
	M2	200 (l/s)	94	99	129	206	225	107	131	50	38

Dimensions in cm. Reference level located at the device sill

STANDARD FRACTIONATION (*)

A module is characterized by a letter identifying the type, a number indicating whether it is a 1 or 2 mask module followed by the flow rate in liters per second.
Example: L2-500
The following tables show the standard fractionations of all types of orifice modules.

Modules V1 and V2

Q nominal	ancho nominal	Número de compuertas de			
l/s	cm	5 l/s	10 l/s	15 l/s	30 l/s
30	32	1	1	1	-
60	63	1	1	1	1
90	94	1	1	1	2
120	125	1	1	1	3
150	156	1	1	1	4

Modules X1 and X2

Q nominal	ancho nominal	Número de compuertas de				
l/s	cm	10l/s	20 l/s	30 l/s	60 l/s	90l/s
30	16	1	1	-	-	-
60	32	1	1	1	-	-
90	48	1	1	2	-	-
120	63	1	1	1	1	-
150	79	1	1	2	1	-
180	94	1	1	1	2	-
210	109	1	1	1	1	1
240	125	1	1	1	3	-
300	155	1	1	1	1	2
360	186	1	1	1	2	2
420	217	1	1	1	3	2
480	247	1	1	1	1	4

Modules M1 and M2

For this type of equipment, please ask our technical team.

Modules L1 y L2

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

For flows above 1500 l/s, a module from the table above must be installed in conjunction with one or more complementary modules defined in the table below.

Q nominal	ancho nominal	Número de compuertas de			
l/s	cm	500 l/s	100 l/s	200 l/s	400 l/s
400	80	-	-	-	1
800	161	-	-	-	2
1200	242	-	-	-	3

Between two monoblock elements, concrete pillars with a thickness of not less than 20 cm must be used

Modules C1 and C2

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

For flows above 3000 l/s, a module from the table above must be installed in conjunction with one or more complementary modules defined in the table below.

Q nominal	ancho nominal	Número de compuertas de				
l/s	cm	1000 l/s	200 l/s	400 l/s	600 l/s	1000 l/s
1000	100	-	-	-	-	1
2000	202	-	-	-	-	2
3000	303	-	-	-	-	3

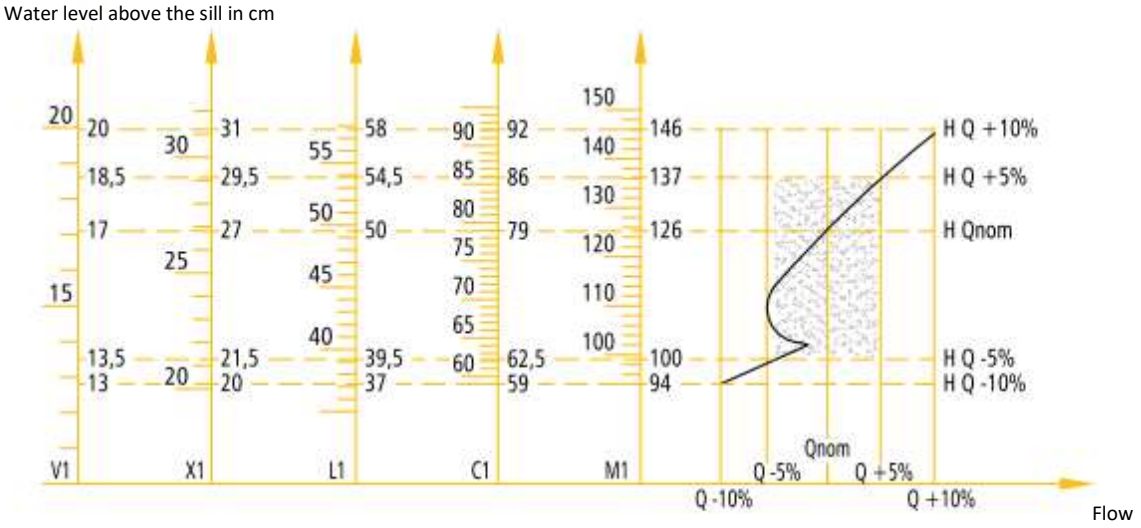
Between two monoblock elements, concrete pillars with a thickness of not less than 30 cm must be used

(*) On request, different fractionation modules can be supplied, including single gate modules for delivery of a fixed flow rate.

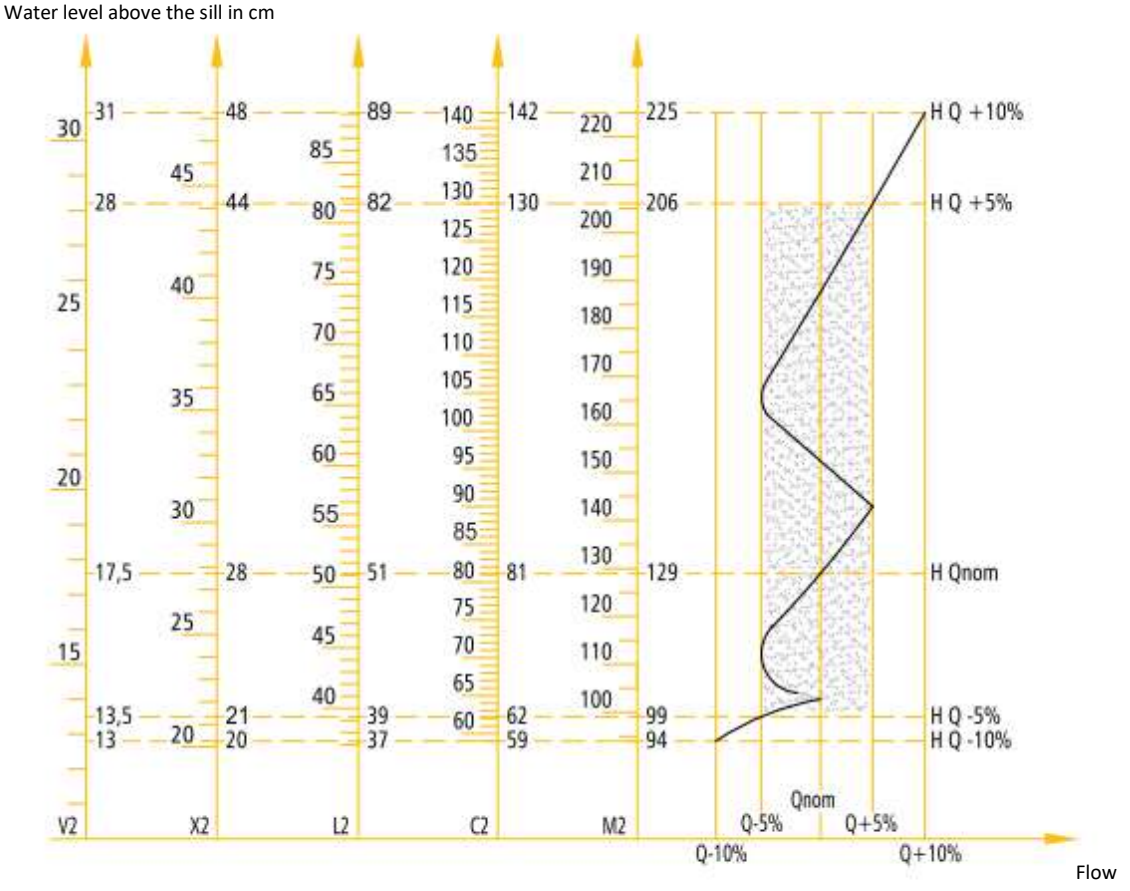
INSTALLATION LEVEL DEFINITION

The operating curves allow the optimum determination of the nominal level as a function of the level fluctuations in the corresponding derivation.

Performance curve of single mask module

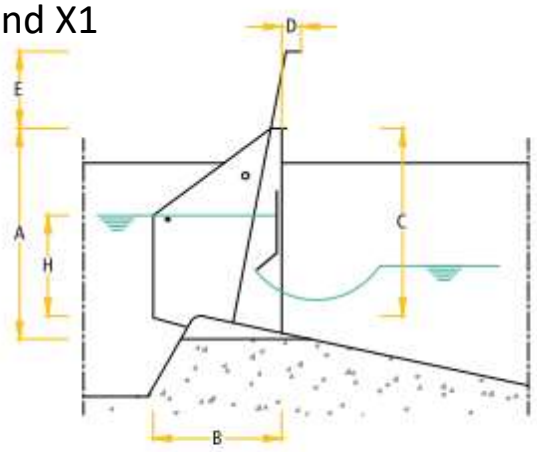


Performance curve of doble mask module

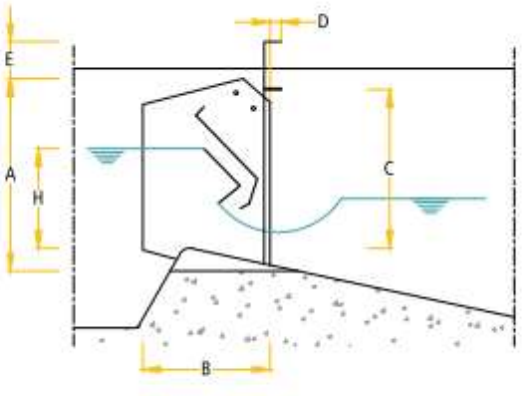


EQUIPMENT SIZES

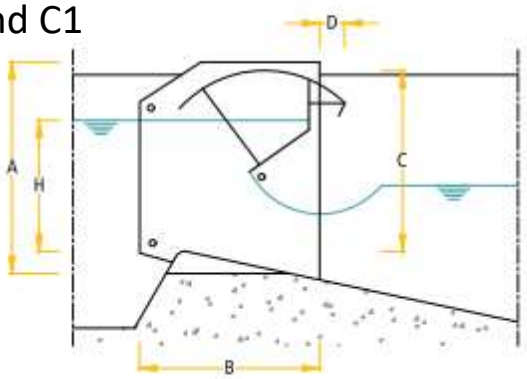
V1 and X1



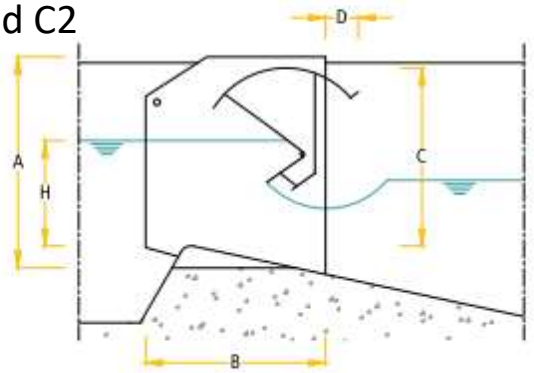
V2 and X2



L1 and C1

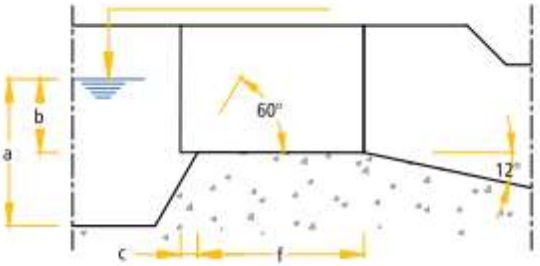


L2 and C2

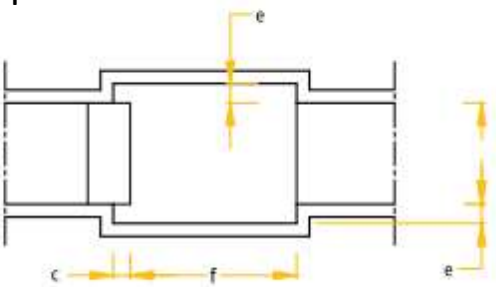


ASSOCIATED CIVIL WORKS

Longitudinal section



Floor plan



	Type	Equipment					Civil works				
		A	B	C	D	E	a_{min}	b	c	e	f
Single mask/baffle	V1	40	26	35	2	14	33	25	9	12	45
	X1	65	38	58	4	22	52	37	10	12	57
	L1	88	77	72	16	-	97	68	16	15	103
	C1	144	122	116	25	-	154	105	25	20	146
Doble mask/baffle	V2	47	27	36	2	8	35	26	3	12	48
	X2	66	43	54	2	15	54	40	4	12	68
	L2	133	97	110	20	-	100	75	20	15	135
	C2	205	152	180	28	-	158	120	25	20	210

SOLUTIONS FOR LEVEL FLUCTUATIONS HIGHER THAN THE ALLOWED BY THE EQUIPMENT

The type of module selected must be compatible with the level fluctuations of the water source. If they are small, a series of modules will be enough, but if they are large, it will be necessary to incorporate a level regulation system such as the ones presented below.

Derivation from channel or reservoir

Where there is a derivation whose level is below the minimum level of its source and the variation with the maximum level is not admitted by the orifice module, it is recommended to place a TEMEC AB1 support. See catalog H-LL02 and Figure 3.

Figure N° 3

Channels with energy problems

In the case of diversions with dominance problems, AR1 type gates are used to raise the level at its maximum and drain the exceedances. See catalog H-LL03 and Figure 4.

Figure N° 4

Channels with downstream demand

The use of a TEMEC AB2 gate is recommended for an on-demand distribution system where - excess flows are not desired. See catalog H-LL02 and Figure 5.

Figure N° 5

Other level control structures

Sharp-crested weir

Indicated for channels where the flow rates are small. The length of the civil work will depend on the passing flow and the range accepted by the orifice module to be installed.

Broad-crested weir - Long-throated flume

Indicated for Channels where through flow rates are large. The width of the civil work will depend on the through flow and the range accepted by the module to be installed.

CONCLUSION

These equipments have many advantages in terms of flow control. Totally simple and exceptionally robust, they are perfectly adapted to severe working conditions.

TEMEC orifice modules make an effective contribution to the rationality of available water use and to the cost-effective operation of Channel networks.

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