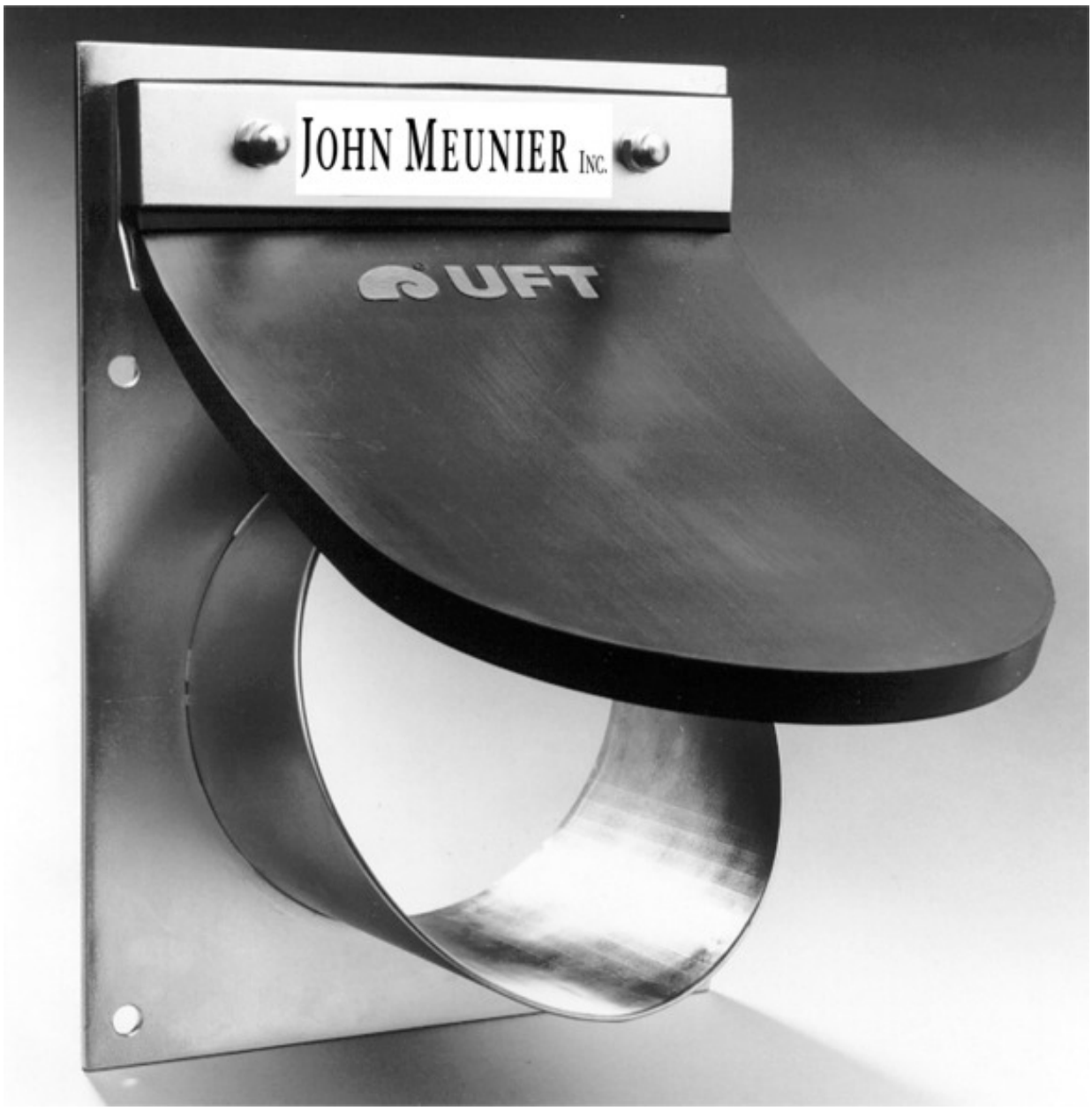
CSO/STORMWATER MANAGEMENT

HYDROVEX®
CCV Check Valve



JOHN MEUNIER

APPLICATION

The **HYDROVEX® CCV** Check Valve is designed for use in water and sewage. It has no reinforcement and is especially applicable in open channel flows, when a small pressure drop is desired and the back pressure is moderate, e.g. in sewers, all types of stormwater and overflow tanks, stormwater overflow and in sewage treatment plants.

ADVANTAGES

- Requires no reinforcement
- Corrosion resistant construction
- Easy to open
- Completely watertight in backflow conditions
- Easy to install

OPERATION

In its resting position, the soft rubber flap lies along the sloped section of the pipe seat. The flap opens easily with light upstream pressure; larger upstream pressures completely push the flap away from the flow stream. The flap has an extraordinary small flow resistance in the direction of flow.

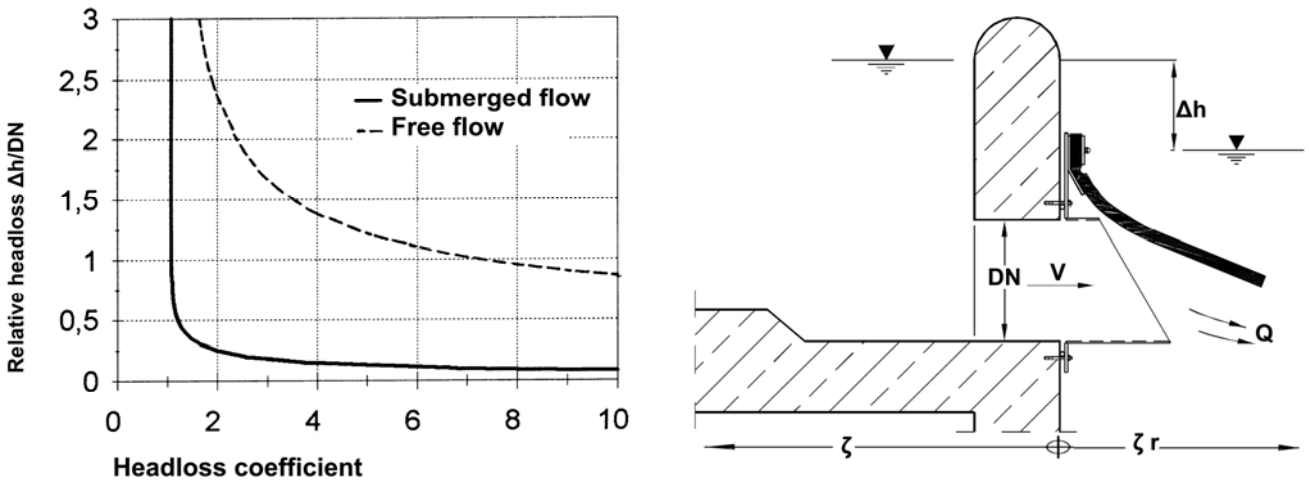


Figure 1: Diagram of HYDROVEX® CCV Check Valve and plot of relationship between resistance coefficient ζ and water level difference Δh.

Under backflow conditions, the flap is pressed tightly and evenly against the polished rim of the pipe seat. Larger pressures cause the flap to bulge into the pipe section, but the overlap prevents it from being drawn into the pipe. Because of the high pressure and even load distribution on the seat, the flap is reliable and drip free for both water and sewage. Any trapped solid would either be crushed or cut against the rim of the pipe socket.

Figure 2: The soft rubber flap is easy to lift from the seat and reliably sealed by back pressure

HYDRAULIC BEHAVIOR

The **HYDROVEX® CCV** Check Valve was fully tested and optimized with lab tests. Consequently, we can offer complete and tested data on the hydraulic behavior of each unit.

In calculating sewer pipes, the coefficient ζ is often used to calculate the headloss at the outflow from a channel or a pipe, while Δh is the applied head differential. ζ_r is the headloss coefficient of the CCV, calculated at the invert flange entry of the unit, along the wall. ζ_e is the sum of headloss coefficients for the upstream side of the installation. ζ_e must also be taken into account for every calculation.

$$Q = A_0 v = \frac{\pi D N^2}{4} \sqrt{2g \frac{\Delta h}{(\zeta_e + \zeta_r)}}$$

For the **HYDROVEX® CCV,** we use a flexible rubber lid as a check valve. We then have to evaluate two different flow conditions: submerged flow and free flow. The headloss coefficient ζ_r decreases when Δh becomes larger and leans toward the maximum 1 (see **Figure 1**). A value $\zeta_r = 1$ means that the valve does not create any headloss in the system. This condition is based on the flexible and smooth bending of the lid under the pressure of the water. The lid then acts like a perfect flow diffuser, thus helping to increase the flow capacity if compared to a rigid lid check valve. The headloss coefficient for a submerged valve is even more favorable than the one in free-flow condition. The submerged valve passes more water than a free flowing valve for the same head differential. This behavior comes from the effect of the submerged flexible lid under the effect of a vertical thrust from the water. This thrust creates a perfect diffuser shape in the lid, thus granting a very good hydraulic coefficient to the unit.

The flow calculation for the unit is slightly difficult, as the headloss coefficient of the unit changes with the head differential pressure. For this reason, we have supplied selection tables for the four most frequent cases; wall installations at pipe end or in tank configuration, both submerged and free flowing. The curves are shown in **Diagrams 1 to 4**. The flow curves also show the headloss values for head differential of 1 and 2 times the unit nominal diameter (DN). For flow values larger than those shown in **Diagrams 1 to 4**, we suggest the use of the **HYDROVEX® LCV** Check Valve.

INSTALLATION CONDITIONS

The **HYDROVEX® CCV** Check Valves are typically installed so they are not permanently submerged. Only in free flow conditions can the unit be self-cleaning. In a bad set up, sediments could settle either upstream or downstream from the valve and prevent its proper operation. The invert of the valve should be higher than the downstream water level in dry time conditions. Dimension F, describing the minimal requirement is given in **Table 3.**

The rubber lid rests at an angle on the pipe section. The **HYDROVEX® CCV** Check Valve presents a minimum headloss against the flow. Only a small water pressure is required to open the lid. The headloss is even lower in submerged conditions, based on the vertical thrust of the water. Minimum head to open the valve are shown below:

Minimum opening head (for all diameters)	
Free Flow	**0.20 DN**
Submerged Flow	**0.00 DN**

The **HYDROVEX® CCV** Check Valve invert must be aligned with the incoming pipe invert. The lid must move freely without interference. The concrete shape must assure a proper flow downstream from the unit. It should not be made with small areas close to the lid where debris could be blocked, thus preventing the lid from resting on the pipe seat. Please consider that the average flow velocity of the water passing by the closed **HYDROVEX® CCV** Check Valve in the downstream main channel should not exceed 1.8 feet/s. Higher velocity could affect the valve closure.

MAXIMUM ALLOWABLE BACKFLOW PRESSURE

As the unit relies on a flexible lid to operate, the backflow pressure must be limited to prevent the lid from being sucked inside the unit pipe. The maximum allowable backflow pressures are listed in the attached table. The reinforced **HYDROVEX® CCV** lid uses a less flexible and thicker rubber. For extreme pressure conditions, a double-hinged version of the unit can be supplied (consult us).

Maximum backflow head h_s in meters (ft.)			
DN mm (in.)	Standard Version m (ft.)	Reinforced Version m (ft.)	Double Hinged Version
100 (4")	5 (16.4)	9 (29.5)	Upon Request
150 (6")	4.5 (14.8)	7 (23.0)	
200 (8")	4 (13.1)	6.5 (21.3)	
250 (10")	4 (13.1)	6 (19.7)	
300 (12")	4 (13.1)	6 (19.7)	
350 (14")	4 (13.1)	6 (19.7)	
400 (16")	3.2 (10.5)	5.5 (18.0)	
500 (20")	1.5 (4.9)	4 (13.1)	
600 (24")	0.6 (2.0)	2 (6.6)	

TIGHTNESS

The **HYDROVEX® CCV** Check Valves have been tested in Europe for tightness classification. The standard used is DIN 19 569 /2/. This standard defines five tightness classes for valves of all types. For check valves, the applicable classes are classes 3 and 4. Laboratory evaluations with the clear water have shown that the **HYDROVEX® CCV** Check Valve meets class 4 characteristics. Class 4 is defined as superior tightness in normal application. Experience has shown that the same level of tightness is applicable for sewer application.

INSTALLATION

The **HYDROVEX® CCV** Check Valves are delivered ready for installation.

Type RW:

The wall flange is set in position on the wall with pipe outlet. The unit invert is aligned to the pipe invert to prevent any gap in the flow pattern. Anchor holes are pierced through the flange to prevent misalignment. The anchors (supplied with the unit) must be tightened moderately to prevent crushing the seal between the unit and the wall.

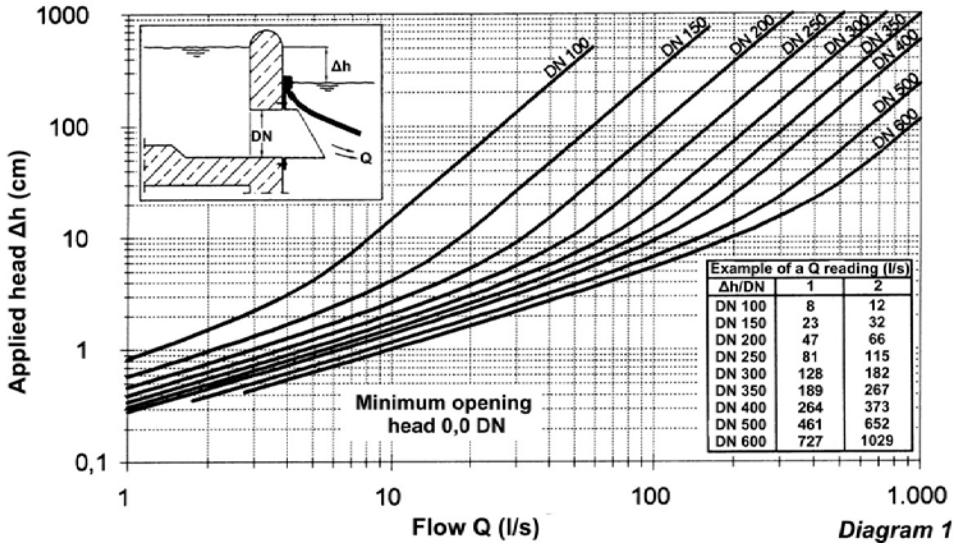
Type RM:

The unit is made with a wall flange made of steel or rubber disks mounted on the pipe. The disks must be centered in the wall thickness to assure a maximum strength. If the **HYDROVEX® CCV** is to be installed after the rest of the concrete work, a reservation, as per **Figure 5,** must be made.

Type RL:

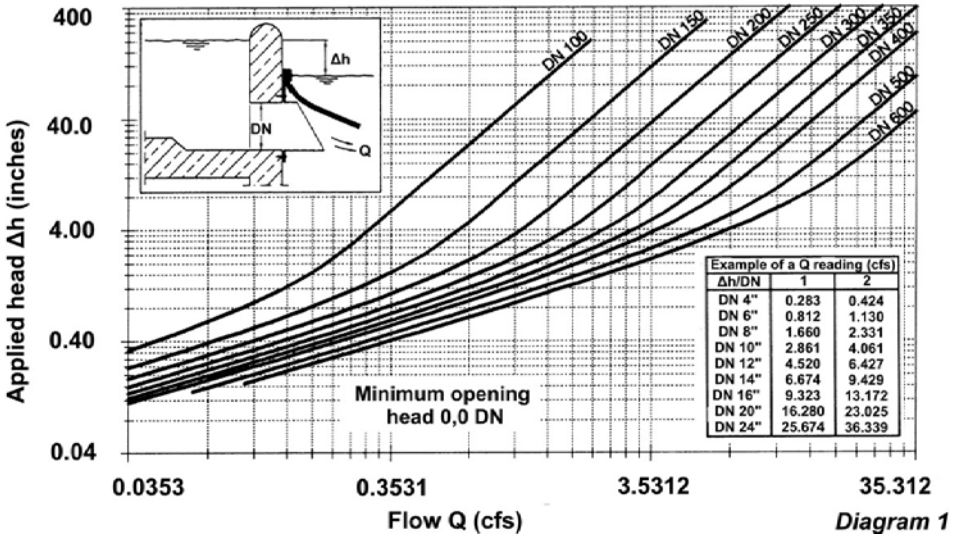
The valve is flanged to a standard pipe. The check valve parts must be vertical to guaranty a normal action of the unit. For unit diameters of 8" and more, not all the holding bolts are required; only 1 out of 2 or 3 holes can be used for the bolting.

CCV TYPE RW AND RM FLOW CURVE
Wall installation, free upstream pressure head, submerged downstream flow condition



Example of a Q reading (l/s)		
Δh/DN	1	2
DN 100	8	12
DN 150	23	32
DN 200	47	66
DN 250	81	115
DN 300	128	182
DN 350	189	267
DN 400	264	373
DN 500	461	652
DN 600	727	1029

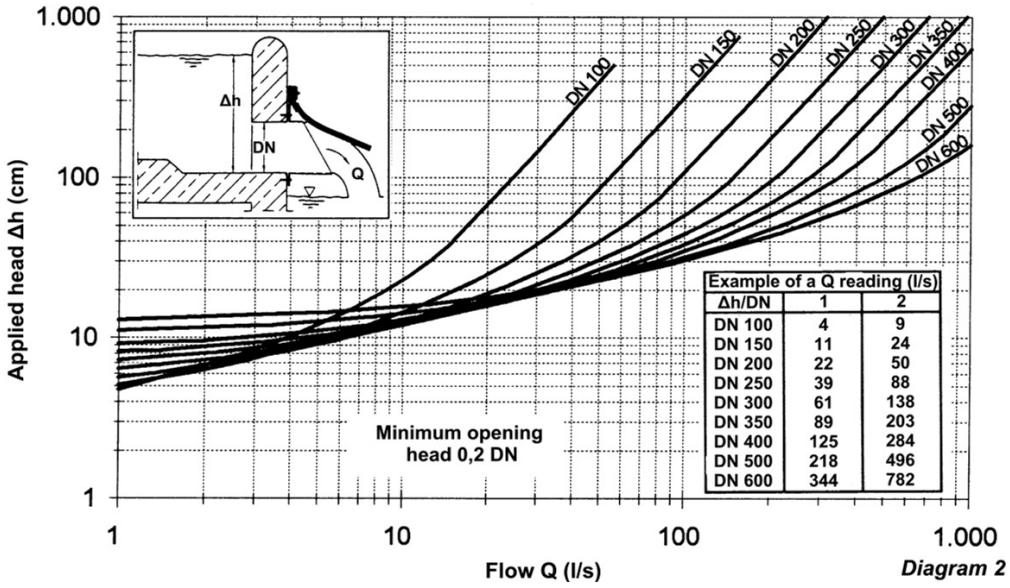
Diagram 1



Example of a Q reading (cfs)		
Δh/DN	1	2
DN 4"	0.283	0.424
DN 6"	0.812	1.130
DN 8"	1.660	2.331
DN 10"	2.861	4.061
DN 12"	4.520	6.427
DN 14"	6.674	9.429
DN 16"	9.323	13.172
DN 20"	16.280	23.025
DN 24"	25.674	36.339

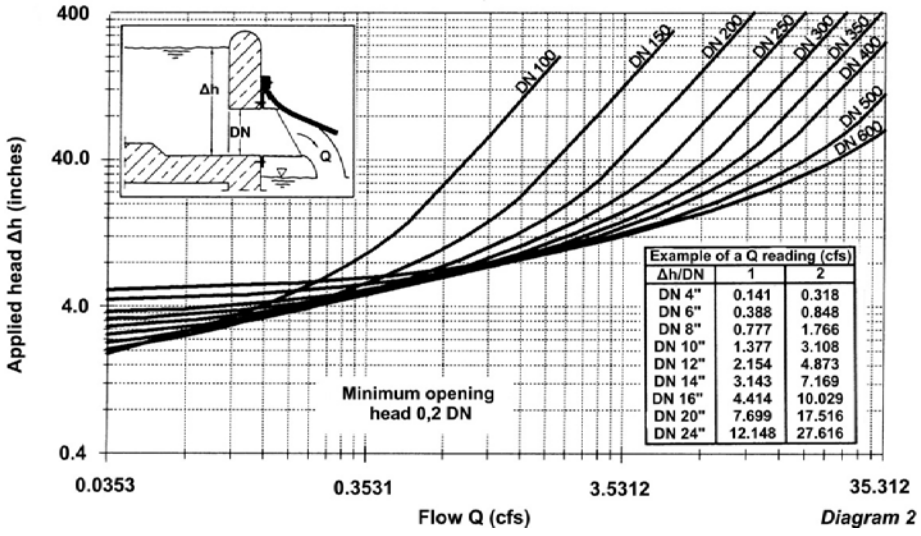
Diagram 1

CCV TYPE RW AND RM FLOW CURVE
Wall installation, free upstream pressure head, free downstream flow condition



Example of a Q reading (l/s)		
Δh/DN	1	2
DN 100	4	9
DN 150	11	24
DN 200	22	50
DN 250	39	88
DN 300	61	138
DN 350	89	203
DN 400	125	284
DN 500	218	496
DN 600	344	782

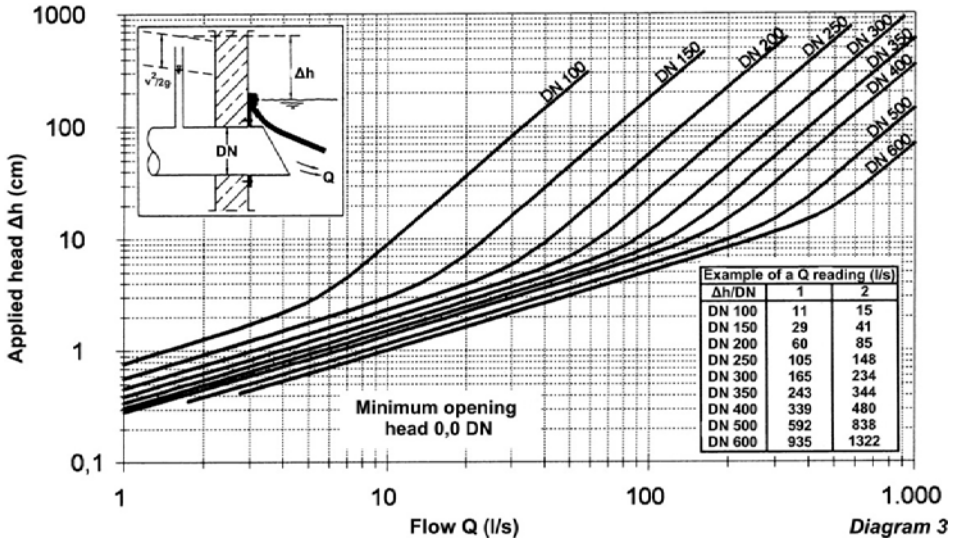
Diagram 2



Example of a Q reading (cfs)		
Δh/DN	1	2
DN 4"	0.141	0.318
DN 6"	0.388	0.848
DN 8"	0.777	1.766
DN 10"	1.377	3.108
DN 12"	2.154	4.873
DN 14"	3.143	7.169
DN 16"	4.414	10.029
DN 20"	7.699	17.516
DN 24"	12.148	27.616

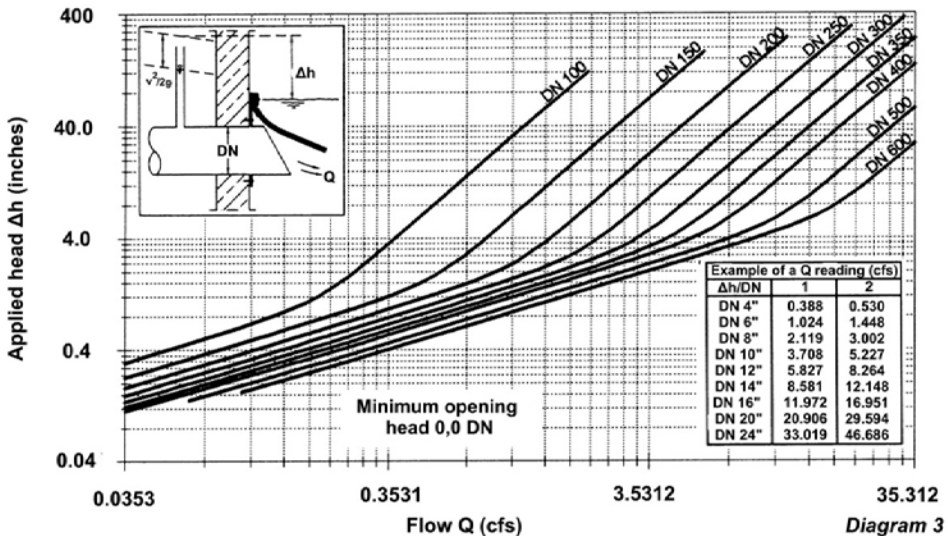
Diagram 2

CCV TYPE RL FLOW CURVE
Pipe installation with submerged downstream flow condition



Example of a Q reading (l/s)		
Δh/DN	1	2
DN 100	11	15
DN 150	29	41
DN 200	60	85
DN 250	105	148
DN 300	165	234
DN 350	243	344
DN 400	339	480
DN 500	592	838
DN 600	935	1322

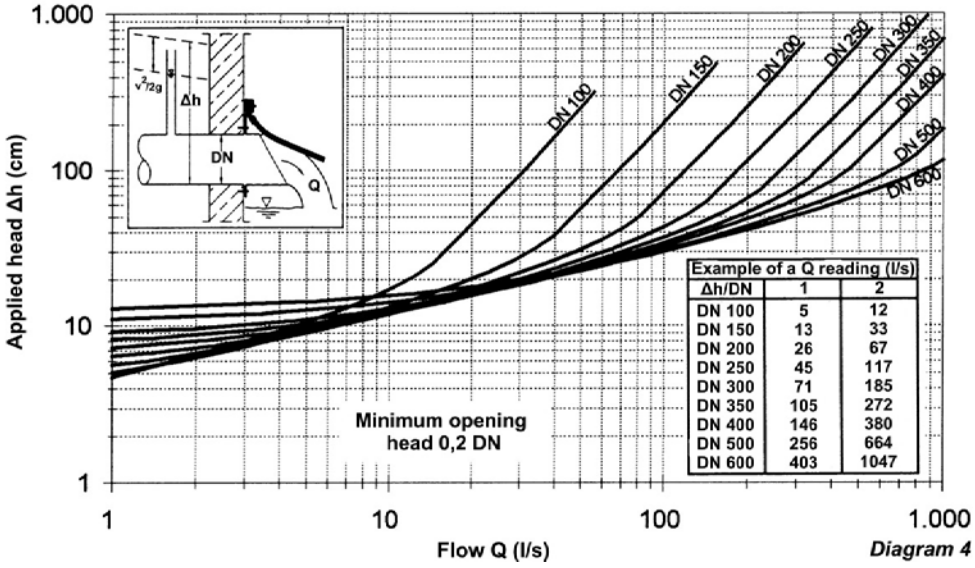
Diagram 3



Example of a Q reading (cfs)		
Δh/DN	1	2
DN 4"	0.388	0.530
DN 6"	1.024	1.448
DN 8"	2.119	3.002
DN 10"	3.708	5.227
DN 12"	5.827	8.264
DN 14"	8.581	12.148
DN 16"	11.972	16.951
DN 20"	20.906	29.594
DN 24"	33.019	46.686

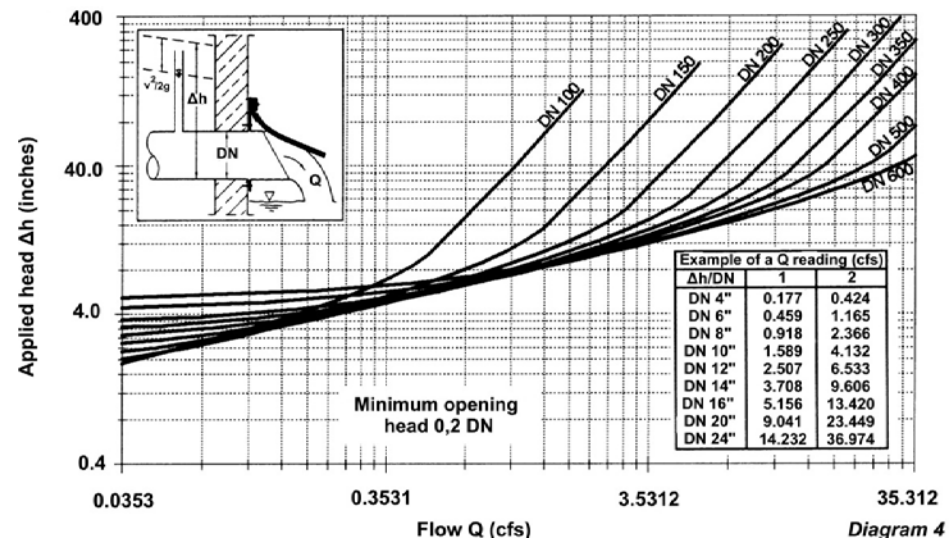
Diagram 3

CCV TYPE RL FLOW CURVE
Pipe installation with free downstream flow condition



Example of a Q reading (l/s)		
Δh/DN	1	2
DN 100	5	12
DN 150	13	33
DN 200	26	67
DN 250	45	117
DN 300	71	185
DN 350	105	272
DN 400	146	380
DN 500	256	664
DN 600	403	1047

Diagram 4

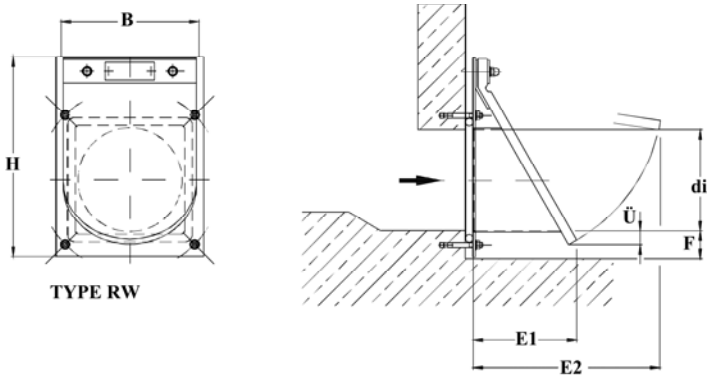


Example of a Q reading (cfs)		
Δh/DN	1	2
DN 4"	0.177	0.424
DN 6"	0.459	1.165
DN 8"	0.918	2.366
DN 10"	1.589	4.132
DN 12"	2.507	6.533
DN 14"	3.708	9.606
DN 16"	5.156	13.420
DN 20"	9.041	23.449
DN 24"	14.232	36.974

Diagram 4

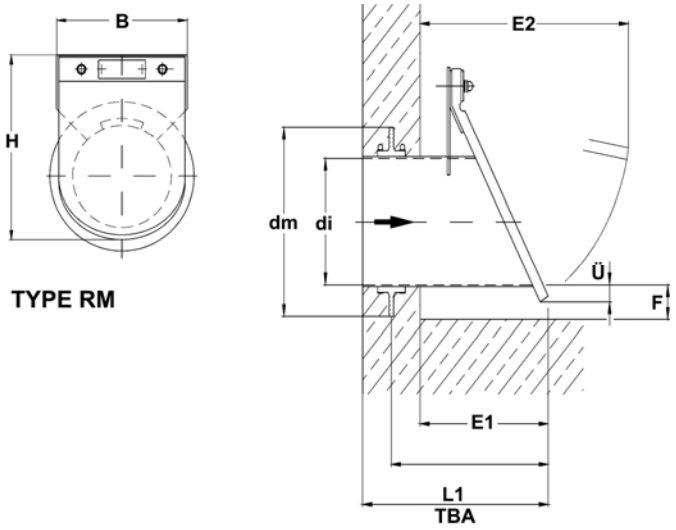
Wall type check valve Type RW
To be anchored on a flat vertical wall

DN		E1		E2		B		H		Weight	
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	kg	lb.
100	4	140	5.5	240	9.4	220	8.7	300	12.0	4	8.8
150	6	180	7.1	310	12.2	250	10.0	360	14.2	7	15.4
200	8	220	8.7	390	15.4	310	12.2	420	16.5	11	24.3
250	10	265	10.4	470	18.5	390	15.4	490	19.3	15	33.1
300	12	300	12.0	540	21.3	430	17.0	550	21.7	21	46.3
350	14	330	13.0	610	24.0	500	20.0	610	24.0	29	63.9
400	16	370	14.6	680	26.8	590	23.2	700	27.6	37	81.6
500	20	450	18.0	830	32.7	700	27.6	820	32.3	49	108.0
600	24	530	21.0	980	38.6	800	31.5	950	37.4	66	145.5



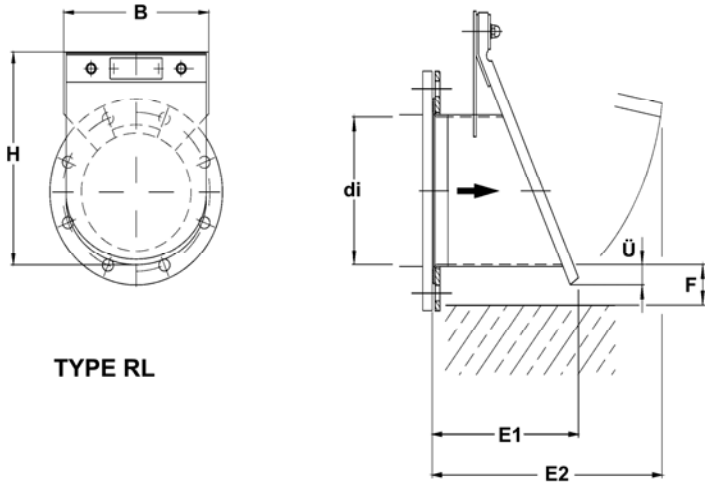
Wall type check valve Type RM
To be cast in a concrete wall

DN		Dm		E1		E2		B		H		Weight	
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	kg	lb.
100	4	220	8.7	225	8.9	325	12.8	210	8.3	260	10.2	7	15.4
150	6	270	10.6	265	10.4	395	15.6	220	8.7	330	13.0	11	24.3
200	8	320	12.6	300	12.0	470	18.5	290	11.4	400	16.0	14	30.9
250	10	375	14.8	345	13.6	550	21.7	360	14.2	470	18.5	22	48.5
300	12	425	16.7	380	15.0	640	25.2	430	17.0	535	21.1	32	70.6
350	14	480	18.9	410	16.1	690	27.2	480	18.9	580	22.8	40	88.2
400	16	530	21.0	455	17.9	765	30.1	540	21.3	650	25.6	48	105.8
500	20	630	24.8	530	21.0	910	35.8	670	26.4	785	30.9	63	138.9
600	24	730	28.7	610	24.0	1060	41.7	800	31.5	915	36.0	82	180.8



Pipe type check valve Type RL
To be flanged to a pipe section

DN		E1		E2		B		H		Weight	
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	kg	lb.
100	4	225	8.9	325	12.8	210	8.3	260	10.2	5	11.0
150	6	265	10.4	395	15.6	220	8.7	330	13.0	8	17.6
200	8	300	12.0	470	18.5	290	11.4	400	15.8	11	24.3
250	10	345	13.6	550	21.7	360	14.2	470	18.5	16	35.3
300	12	380	15.0	640	25.2	430	16.9	535	21.1	23	50.7
350	14	410	16.1	690	27.2	480	18.9	580	22.8	31	68.3
400	16	455	17.9	765	30.1	540	21.3	650	25.6	38	83.8
500	20	530	21.0	910	35.8	670	26.4	785	31.0	50	110.2
600	24	610	24.0	1060	41.7	800	31.5	915	36.0	67	147.7



Overall dimensions for all types

DN		di		da		Ü		F	
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
100	4	110.3	4.3	114.3	4.5	15.0	0.6	60	2.4
150	6	163.3	6.4	168.3	6.6	22.5	0.9	60	2.4
200	8	213.1	8.4	219.1	8.6	29.0	1.1	60	2.4
250	10	267.0	10.5	273.0	10.8	36.5	1.4	65	2.6
300	12	315.9	12.4	323.9	12.8	43.0	1.7	65	2.6
350	14	347.6	13.7	355.6	14.0	45.5	1.8	80	3.1
400	16	398.4	15.7	406.4	16.0	52.0	2.0	110	4.3
500	20	500.0	19.7	508.0	20.0	69.0	2.7	110	4.3
600	24	602.0	23.7	610.0	24.0	78.0	3.1	120	4.7

Figure 3 : Standard HYDROVEX® CCV Check Valve Types-Dimensions-Weight

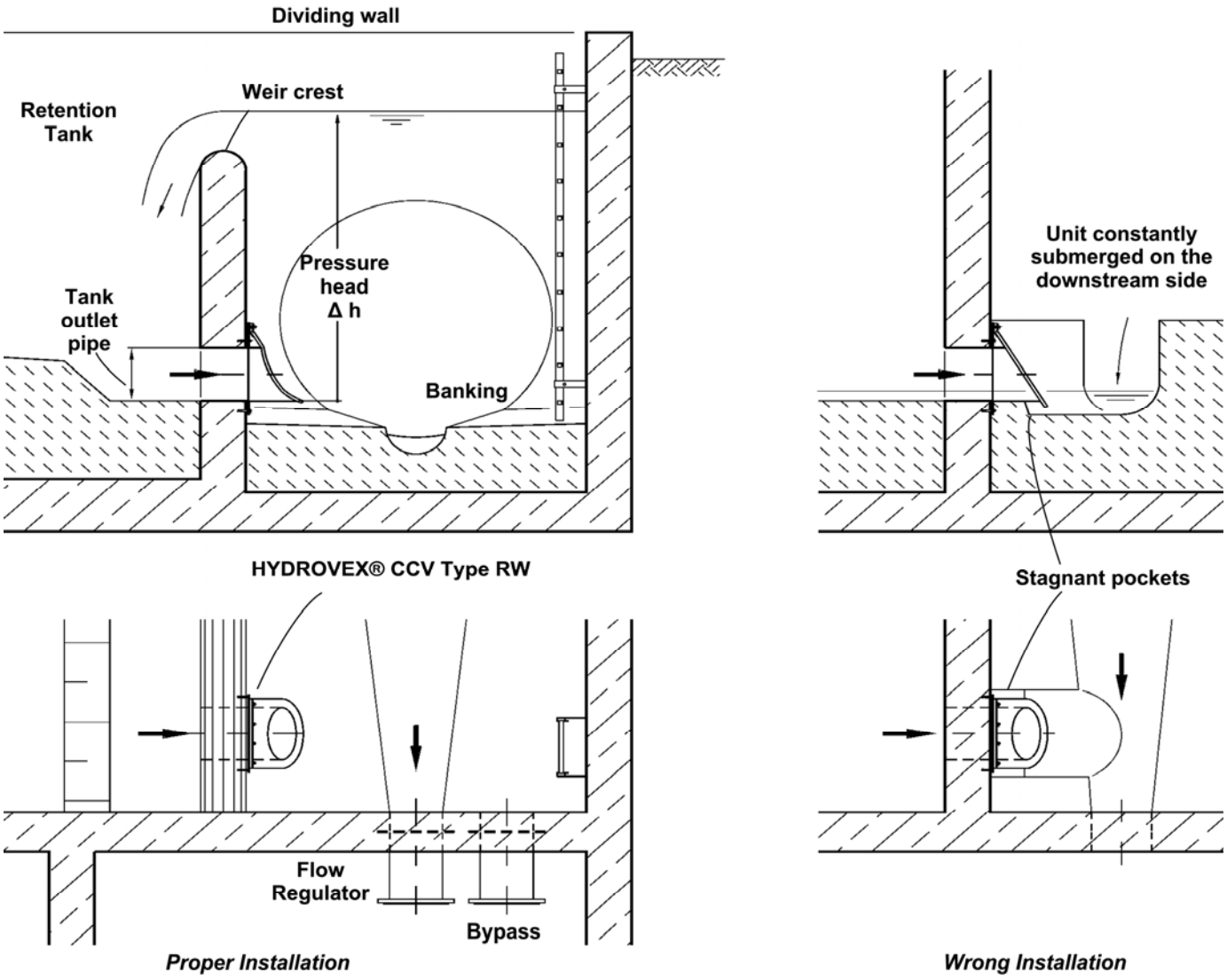


Figure 4: HYDROVEX® CCV Check Valve DN 200 (8"), Model RW in the wall of a combined sewer overflow tank

The throttling device limits the discharge until the water level reaches the upper edge of the overflow wall and water fills the overflow tank. After the rain has stopped, the tank automatically empties itself through the check valve.

Left: Correctly installed check valve, mounted so that it does not create stagnant pockets.

Right: Incorrectly installed check valve, mounted with little level difference between the bottom of the valve and the effluent channel, thus creating stagnant pockets in which dirt may collect.

APPLICATIONS

The **HYDROVEX® CCV** Check Valve does not include any bearing or rotating parts. It is maintenance free and constructed of corrosion resistant materials. Visual inspection of the unit is recommended every three months. Inspection includes lifting the lid to check for caught debris. The unit seat should be clean at all times. If sludge or sediments are present, simply wipe them off with a rag.

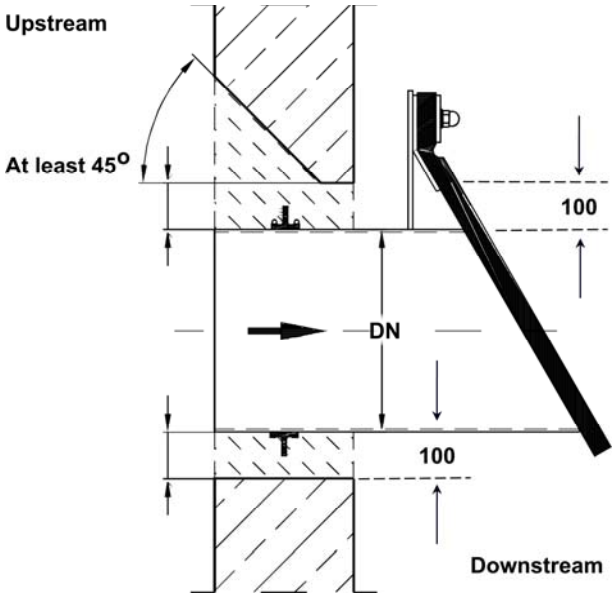


Figure 5: Concrete reservation for the installation of a HYDROVEX® CCV Check Valve, Type RM

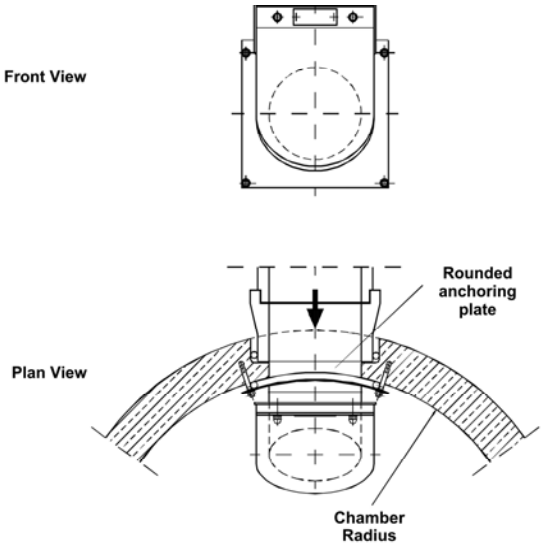


Figure 6 : Special order, HYDROVEX® CCV Check Valve, installation in a circular manhole or chamber

SPECIAL ORDERS

Projects may sometimes need special units, for example if the **HYDROVEX® CCV** is to be installed in a round prefabricated manhole (see **Figure 6**), or if the installation wall presents a special angle. These special units can be readily fabricated upon request.

If the unit is to be installed in a particularly corrosive environment, all 316 Stainless Steel construction can be supplied upon request.

TEXT FOR BID

Check valve CCV
Model RW to be wall mounted
Nominal diameter DN … mm
Manufactured in stainless steel with soft flap made of nitrite rubber, stainless steel masonry bolts and O-ring gasket

Check valve CCV
Model RF to be bolted onto existing pipe work
Nominal diameter DN … mm
Manufactured in stainless steel with fixed flange, soft flap made of nitrite rubber and O-ring gasket

Check valve CCV
Model RL to be bolted onto the flange of a valve or pipe
Nominal diameter DN … mm
Manufactured in stainless steel with soft flap made of nitrite rubber and loose flange made of glass-fiber reinforced polypropylene with steel inserts

Check valve CCV
Model RM to be cemented in
Nominal diameter DN … mm
Manufactured in stainless steel with soft flap made of nitrite rubber and wall collar made of stainless steel or nitrite rubber

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