Technical Brief

NovAseptic® Valves, Flow Rate Capabilities of Process and Tank Outlet Valves: K_v & C_v

OVERVIEW

Millipore offers a wide range of NovAseptic valves for use within Bio-Process applications. These valves are engineered for optimal process performance, reliability and ease of cleanability. NovAseptic valves comply with cGMP Design Qualification criteria for aseptic processes. This is the reason why these valves are labeled "Aseptic by Design".

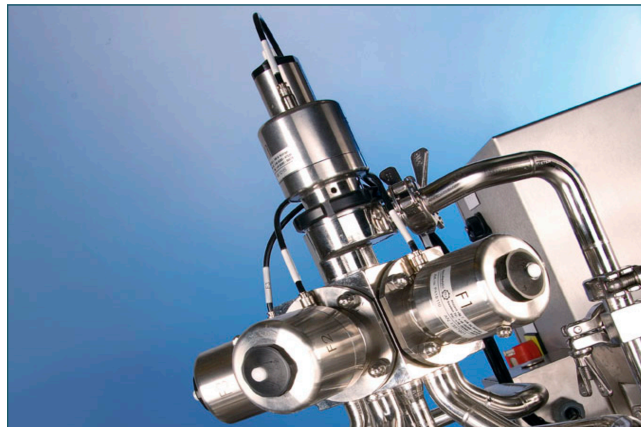
NovAseptic valves are used within a range of biopharm unit operations and applications. These include valves for tank outlets, directional process flow control, divert valves for filter housings as well as valve assemblies for high value unit operations such as membrane and chromatography processes. With our experience in aseptic processing we help you choose the best aseptic valve for your application. The aseptic design of the NovAseptic valve makes the process easier to validate, with diaphragm materials such as, EPDM, Silicone and PTFE available. These materials fulfill FDA criteria and are USP Class VI tested. NovAseptic Valves are specifically designed to comply with the most stringent cleanability and sterility requirements.

To select the proper valve for your application the valve's flow capacity or coefficient must be known to ensure over pressurization does not occur during normal operation. Several methods are used to determine flow coefficients.

The most common methods are:

- Empirically – flow capacity is determined by testing. This is the most accurate method of measuring valve's performance.
- Theoretically – flow capability is estimated using Bernoulli's equation to predict the capacity based on the valve's internal diameter and geometry.

Picture 1. Tank Top with NovAseptic Valve connected with NovAseptic Connector



Picture 2. Custom Made Block Valve for Chromatography System

DETERMINATION OF VALVE FLOW CAPACITY

The flow capacity of NovAseptic valves has been determined empirically in this test. A test station is used to challenge the valve. Water is delivered to the valve using a positive displacement pump, with the pressure and flow rates monitored using precisely calibrated measurement instrumentation*. The pressure drop of the valve is measured at steady state flow through the body. Flow through the valve body is measured using a magnetic flow meter. Two pressure sensors are used to measure the differential pressure across the body. These sensors are positioned immediately upstream and downstream of the valve body to minimize the effect of the pressure drop due to the surrounding pipework. All instrumentation data is collected via a high speed data acquisition system to eliminate the chance of error. After the flow within the test station has reached steady state condition the pressure drop across the valve body is measured at five different flow rates. Each valve body is tested with different types of diaphragm materials to determine the effect this may have on the performance of the valve. Using standardized test conditions the specific gravity for water is assumed to be 1.

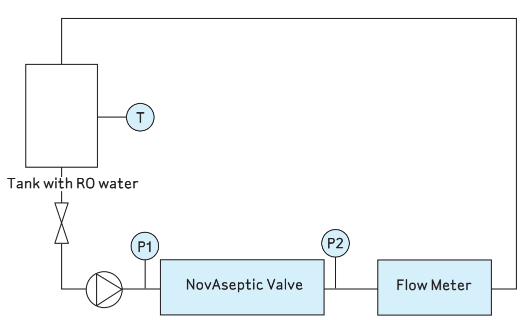


Figure 1. Test Schematic

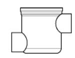
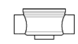
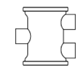
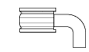
Picture 3. Test Station

Table 1. The K_v and C_v values were computed as follows

Flow Factor	$K_v = \frac{Q}{\sqrt{\Delta P}}$	Q = Flow Rate (m^3/h)	ΔP = Pressure drop across valve (bar)
Flow Coefficient	$C_v = \frac{Q}{\sqrt{\Delta P}}$	Q = Flow Rate (GPM)	ΔP = Pressure drop across valve (psi)

*Note: Prior to use, all instruments are calibrated to NIST standards.

Table 2. **Measured Flow Coefficients & Flow Factors**

Catalogue Number		NU#/31-211		NU#/311-211		NU#/32-211		NU#/39-211		NU#/441-311	
Picture											
Description		Shut off 90°		Shut off 180°		Flow through 180°		Divert Valve (Measured - Common to side port)		Tank Outlet Valve 90°	
Body Size	Diaphragm Material	PTFE	EPDM	PTFE	EPDM	PTFE	EPDM	PTFE	EPDM	PTFE	EPDM
NU050	K_v***	1.9	1.9	1.8	1.8	1.8	1.8	1.6	1.5	1.7	1.7
	C_v**	2.2	2.2	2.1	2.1	2.1	2.0	1.8	1.7	2.0	2.0
NU075	K_v*	3.9	4.2	3.6	4.0	4.1	4.5	3.54	3.9	3.6	4.3
	C_v**	4.5	4.9	4.2	4.6	4.8	5.2	4.1	4.5	4.2	4.9
NU100	K_v***	10	8.6	9.1	8.0	10	8.4	7.7	6.9	7.9	6.6
	C_v**	12	10	11	9.3	12	10	9.0	8.0	9.2	7.7
NU150	K_v***	20	20	18	18	20	20	15	15	16	16
	C_v**	23	23	21	21	23	23	17	18	19	19
NU200	K_v***	33	36	34	36	38	43	34	36	26	27
	C_v**	38	42	39	42	44	50	39	41	30	31
NU300	K_v***	104	-	-	-	108	-	-	-	107	-
	C_v**	120	-	-	-	125	-	-	-	124	-

**Note: C_v (GMP) @ D 1 psig, $C_v = 1.16\ K_v$

***Note: K_v (m^3/h) @ D 1 bar

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Lit. No. TB1016EN00 Rev.- 01/08 08-TEK