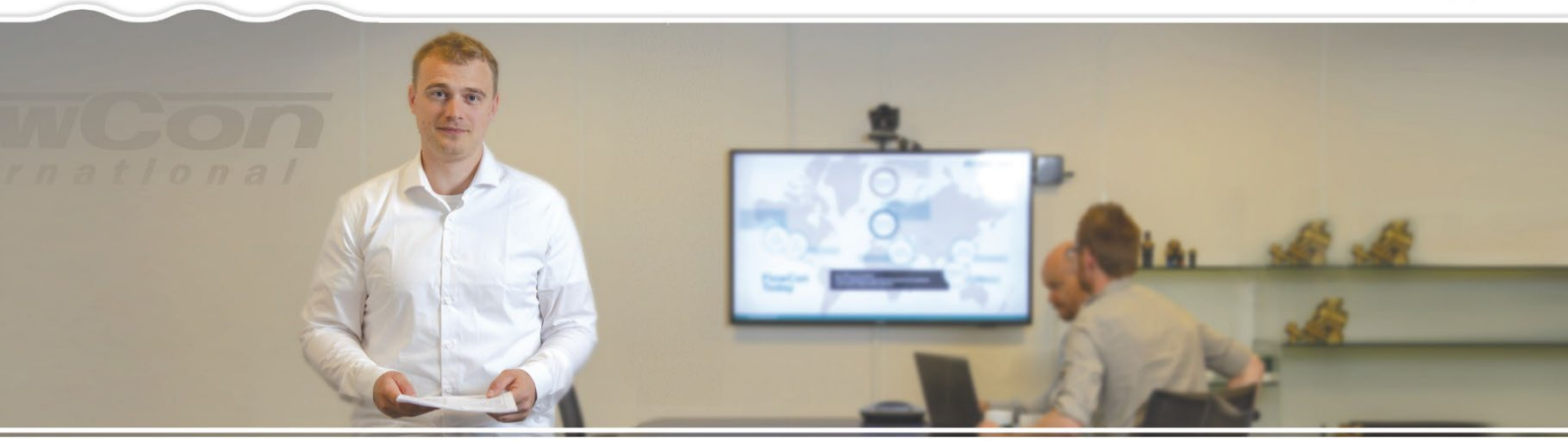

03.2021

FlowCon Topic Letter

FlowCon Valves - IEC60534-4 Leakage Classification

FlowCon International complies with the International Standard IEC60534-4 regarding leakage specification. The data used is taken from the International standard IEC60534-4. Sections of the standard are high-lighted in this document. making it possible to calculate the maximum leakage according to the standard.

General
Specified leakage test is carried out 100% on each insert/valve.

Test Medium
Test medium shall be liquid and at a temperature of 20°C.

Water
Test medium shall be clean water and with maximum 50% glycol.

Air Pockets
Care shall be taken to eliminate air pockets inside the valve housing and piping.

Test Pressure
Hydrostatic shell test pressure shall be according to the design code or standard for the valve housing or. alternatively. it shall be no less than 1.2 x the 20°C rated pressure. whichever is appropriate.

Test Actuator
The actuator shall be adjusted to meet the operating conditions according to FlowCon's specifications. The required closing thrust or torque, as a spring or other means. shall then be applied. No allowance or adjustment shall be made to compensate for any difference in seat load obtained when the test differential is less than the maximum valve operating differential pressure.

The test medium shall be applied to the valve housing inlet. The valve housing outlet may be open to the atmosphere or connected to a low head-loss flow measuring device with its outlet open to the atmosphere.

The valve shall be opened, and the valve housing assembly filled completely, including the outlet portion and any downstream connected piping. The valve shall then be closed. When the leakage flow rate has been stabilized, the rate of flow should be observed over a sufficient period to obtain the accuracy specified class IV and V.

The maximum allowable seat leakage as specified for each class shall not exceed the values resulting from the test method as defined.

Pressure
The test pressure must be minimum 50% of the maximum operating differential pressure across the valve.

Leakage Class
The leakage rate thus obtained can then be compared to the calculated values for classes II. III. IV and V. Classes IV and V are relevant for the included FlowCon valves.

Leakage Classification. IEC60534-4
Below table shows maximum allowable seat leakage for each leakage class.
FlowCon defines the rated valve capacity as: $\mathrm{Kv} * \sqrt{\max P}$, where $\mathrm{Kv} = \frac{Q_{max}}{\sqrt{\Delta Pmin}}$

Leakage Class	Test Medium	Test Procedure	Maximum Seat Leakage
IV	Liquid	1 or 2	10^{-4} * valve capacity[1]
V	Liquid	2	$1.8 * 10^{-5} * \Delta P * D$

Note 1: Rated valve capacity is the flow rate of test fluid that would pass through the valve at rated travel under stated test conditions.

FlowCon Green.0 / FlowCon FIT-G.0 - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{0.575 m^3/h}{\sqrt{0.16 bar}} = 1.4375$$
$$Maximum\ seat\ leakage = \mathrm{Kv} * \sqrt{\max P} * 10^{-4} = 1.4375 * \sqrt{8 bar} * 10^{-4} = 0.000406586 m^3/h$$
$$Maximum\ seat\ leakage = 0.000406586 * 1000 = 0.407 l/h$$

FlowCon Green.1 / FlowCon FIT-G.1 - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{1.11 m^3/h}{\sqrt{0.30 bar}} = 2.0266$$
$$Maximum\ seat\ leakage = \mathrm{Kv} * \sqrt{\max P} * 10^{-4} = 2.0266 * \sqrt{8 bar} * 10^{-4} = 0.000573209 m^3/h$$
$$Maximum\ seat\ leakage = 0.000573209 * 1000 = 0.573 l/h$$

FlowCon Green.1HF - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{2.65 m^3/h}{\sqrt{0.35 bar}} = 4.4797$$
$$Maximum\ seat\ leakage = \mathrm{Kv} * \sqrt{\max P} * 10^{-4} = 4.4797 * \sqrt{8 bar} * 10^{-4} = 0.00126677 m^3/h$$
$$Maximum\ seat\ leakage = 0.00126677 * 1000 = 1.27 l/h$$

FlowCon Green.2 / FlowCon FIT-G.2 - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{4.630 m^3/h}{\sqrt{0.16 bar}} = 11.575$$
$$Maximum\ seat\ leakage = \mathrm{Kv} * \sqrt{\max P} * 10^{-4} = 11.575 * \sqrt{8 bar} * 10^{-4} = 0.003273904 m^3/h$$
$$Maximum\ seat\ leakage = 0.003273904 * 1000 = 3.27 l/h$$

FlowCon Green.3 / FlowCon FIT-G.3 - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{13.647 m^3/h}{\sqrt{0.16 bar}} = 34.12$$
$$Maximum\ seat\ leakage = \mathrm{Kvs} * \sqrt{\max P} * 10^{-4} = 34.12 * \sqrt{8 bar} * 10^{-4} = 0.00965 m^3/h$$
$$Maximum\ seat\ leakage = 0.00965 * 1000 = 9.65 l/h$$

FlowCon GreEQ.0 - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{0.454 m^3/h}{\sqrt{0.16 bar}} = 1.135$$
$$Maximum\ seat\ leakage = \mathrm{Kvs} * \sqrt{\max P} * 10^{-4} = 1.135 * \sqrt{6 bar} * 10^{-4} = 0.000278 m^3/h$$
$$Maximum\ seat\ leakage = 0.000278 * 1000 = 0.278 l/h$$

FlowCon GreEQ.1 - Leakage Class IV

$$\mathrm{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{0.805 m^3/h}{\sqrt{0.30 bar}} = 1.4697$$
$$Maximum\ seat\ leakage = \mathrm{Kvs} * \sqrt{\max P} * 10^{-4} = 1.4697 * \sqrt{8 bar} * 10^{-4} = 0.000416 m^3/h$$
$$Maximum\ seat\ leakage = 0.000416 * 1000 = 0.416 l/h$$

FlowCon GreEQ.2 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{2.160 m^3/h}{\sqrt{0.16 bar}} = 5.4$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 5.4 * \sqrt{8 bar} * 10^{-4} = 0.001527 m^3/h$$

$$Maximum\ seat\ leakage = 0.001527 * 1000 = 1.527 l/h$$

FlowCon SM.1.1 / FlowCon FIT.1.1 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{2.47 m^3/h}{\sqrt{0.32 bar}} = 4.37$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 4.37 * \sqrt{6 bar} * 10^{-4} = 0.001070427 m^3/h$$

$$Maximum\ seat\ leakage = 0.001070427 * 1000 = 1.07 l/h$$

FlowCon SM.2.1 / FlowCon FIT.2.1 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{8.42 m^3/h}{\sqrt{0.40 bar}} = 13.31$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 13.31 * \sqrt{6 bar} * 10^{-4} = 0.003261052 m^3/h$$

$$Maximum\ seat\ leakage = 0.003261052 * 1000 = 3.26 l/h$$

FlowCon SM.3.0 / FlowCon FIT.3.0 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{15 m^3/h}{\sqrt{0.30 bar}} = 27.39$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 27.39 * \sqrt{8 bar} * 10^{-4} = 0.007747062 m^3/h$$

$$Maximum\ seat\ leakage = 0.007747062 * 1000 = 7.74 l/h$$

FlowCon SM.3.1 / FlowCon FIT.3.1 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{25.7 m^3/h}{\sqrt{0.30 bar}} = 46.92$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 46.92 * \sqrt{8 bar} * 10^{-4} = 0.01327098 m^3/h$$

$$Maximum\ seat\ leakage = 0.01327098 * 1000 = 13.3 l/h$$

FlowCon SM.3.2 / FlowCon FIT.3.2 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{35.6 m^3/h}{\sqrt{0.35 bar}} = 60.17$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 60.17 * \sqrt{8 bar} * 10^{-4} = 0.017018646 m^3/h$$

$$Maximum\ seat\ leakage = 0.017018646 * 1000 = 17.0 l/h$$

FlowCon SM.4.1 / FlowCon FIT.4.1 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta pmin}} = \frac{33.8 m^3/h}{\sqrt{0.30 bar}} = 61.71$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 61.71 * \sqrt{8 bar} * 10^{-4} = 0.017454224 m^3/h$$

$$Maximum\ seat\ leakage = 0.017454224 * 1000 = 17.5 l/h$$

FlowCon SM.4.2 / FlowCon FIT.4.2 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{51 m^3/h}{\sqrt{0.35 bar}} = 86.20$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 86.20 * \sqrt{8 bar} * 10^{-4} = 0.024381042 m^3/h$$

$$Maximum\ seat\ leakage = 0.024381042 * 1000 = 24.4 l/h$$

FlowCon SM.4.3 / FlowCon FIT.4.3 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{72.7 m^3/h}{\sqrt{0.50 bar}} = 102.81$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 102.81 * \sqrt{8 bar} * 10^{-4} = 0.029079059 m^3/h$$

$$Maximum\ seat\ leakage = 0.029079059 * 1000 = 29.1 l/h$$

FlowCon SM.5.1 / FlowCon FIT.5.1 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{83.8m^3/h}{\sqrt{0.30bar}} = 152.99$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 152.99 * \sqrt{8bar} * 10^{-4} = 0.043272107m^3/h$$

$$Maximum\ seat\ leakage = 0.043272107 * 1000 = 43.37l/h$$

FlowCon SM.5.2 / FlowCon FIT.5.2 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{106m^3/h}{\sqrt{0.35bar}} = 179.2$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 179.2 * \sqrt{8bar} * 10^{-4} = 0.05065713m^3/h$$

$$Maximum\ seat\ leakage = 0.05065713 * 1000 = 50.6l/h$$

FlowCon SM.6.2 / FlowCon FIT.6.2 - Leakage Class IV

$$\text{Kvs} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{277m^3/h}{\sqrt{0.35bar}} = 468.22$$

$$Maximum\ seat\ leakage = \text{Kvs} * \sqrt{\max P} * 10^{-4} = 468.22 * \sqrt{8bar} * 10^{-4} = 0.132432615m^3/h$$

$$Maximum\ seat\ leakage = 0.132432615 * 1000 = 132l/h$$

FlowCon UniQ® - Leakage Class IV

$$\text{Kv} = \frac{Q_{max}}{\sqrt{\Delta Pmin}} = \frac{0.751m^3/h}{\sqrt{0.10bar}} = 2.4$$

$$Maximum\ seat\ leakage = \text{Kv} * \sqrt{\max P} * 10^{-4} = 2.4 * \sqrt{2bar} * 10^{-4} = 0.000339411m^3/h$$

$$Maximum\ seat\ leakage = 0.000339411 * 1000 = 0.339l/h$$

FlowCon EVS - Leakage Class V

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * maxP * D$$

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * 4bar * 13.72mm$$

$$Maximum\ seat\ leakage = 0.000988l/h \sim 0l/h$$

FlowCon EVC - Leakage Class V

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * maxP * D$$

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * 4bar * 14.5mm$$

$$Maximum\ seat\ leakage = 0.001044l/h \sim 0l/h$$

FlowCon ABM.1 - Leakage Class V

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * maxP * \text{"}D\text{"}$$

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * 7bar * 16.5mm$$

$$Maximum\ seat\ leakage = 0.002079l/h \sim 0l/h$$

FlowCon ABM.2 - Leakage Class V

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * maxP * \text{"}D\text{"}$$

$$Maximum\ seat\ leakage = 1.8 * 10^{-5} * 7bar * 26.6mm$$

$$Maximum\ seat\ leakage = 0.00335l/h \sim 0l/h$$

ABM.1 and ABM.2 have integrated a ball valve; the IEC standard specifies leakages only for seat valves. However, FlowCon ABM.1 and AMB.2 are still able to comply with the low leakage specifications.

Kv (Kvs)	= $\frac{\text{Qmax}}{\sqrt{\Delta\text{Pmin}}}$ [m³/h at 1 bar]
Qmax	= Maximum flow rate [m³/h]
ΔPmin	= Minimum operational pressure [bar]
maxP	= Maximum close off pressure [bar]
D	= Diameter [mm]
“D”	= Estimated value [mm]