ÄKTA Systems Column protection

Instructions

Introduction

This instruction describes protection for the columns in ÄKTA™ systems.

Background

Columns have three important specifications for column protection. These specifications are described in the table below.

1. Max flow rate
2. Max pressure drop over the packed bed
3. Column hardware pressure limit

The third is important for safety, especially with glass columns, as excessive pressure can damage the column hardware. The other two are important for protecting the packed bed from collapsing.

Specification	Description
Max flow rate	Protects the packed bed from collapsing.
Max pressure drop over the packed bed	
Column hardware pressure limit	Provides safety protection by preventing damage to the column hardware.

Flow rate

The specified maximum flow rate for a column shall not be exceeded. If a method flow rate exceeds this value for the column selected, the system issues a warning during method creation.

Note: *Flow rate needs to be lowered when running in low temperature or with high viscosity solutions (such as 20% ethanol or buffers containing glycerol).*

During a run, there is no built-in warning mechanism regarding the flow rate. To protect a column from a high flow rate during a run, due to for instance manually changing the flow rate, a watch instruction can be inserted in the method.

Pressure measurement in ÄKTA Systems

Different pressure signals are used in the systems:

- The System pressure is measured at the system pump outlet and is always the highest pressure in a system. It is available in all ÄKTA Systems.

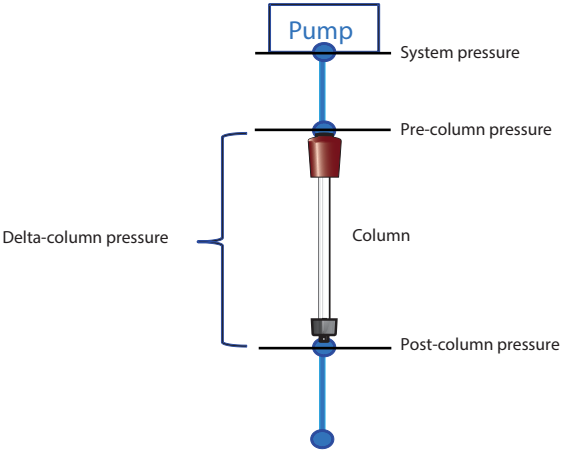
  Note: *System pressure is called Pressure in some systems.*

- The Sample pressure is measured at the sample pump outlet. It is available in systems with a dedicated sample pump such as ÄKTA avant or ÄKTA pure with sample pump.
- The Pre-column pressure is measured just before the column in the flow path. It is available in all ÄKTA avant and ÄKTA pure systems, and in ÄKTA go systems if Column Valve **V9-C** is installed.

  Note: *In ÄKTA pure without the Column Valve* **V9-C** *or Column Valve* **V9H-C** *(five columns) the pressure signal is calculated based on system pressure, flow rate, temperature and tubing dimensions.*

- The Post-column pressure is measured after the column. It is available in ÄKTA avant and ÄKTA pure if Column Valve **V9-C** or Column Valve **V9H-C** are installed, and in ÄKTA go if Column Valve **V9-C** is installed.
- The Delta-column pressure is calculated as the difference between pre-column and post-column pressure. It is available in ÄKTA avant and ÄKTA pure if Column Valve **V9-C** or Column Valve **V9H-C** are installed, and in ÄKTA go if Column Valve **V9-C** is installed.

  Note: *The* ***Delta-column pressure*** *includes the pressure generated by the tubing between the valve and the column.*



Pressure details of the ÄKTA Systems are listed in the table below:

System	Configuration	Available pressure signals
ÄKTA go	No column valve or Column Valve **V9-Cm**	• System pressure
ÄKTA go	Column Valve **V9-C**	• System pressure • Pre-column pressure • Delta-column pressure • Post-column pressure
ÄKTA avant	All configurations	• System pressure • Sample pressure • Pre-column pressure • Delta-column pressure • Post-column pressure

System	Configuration	Available pressure signals
ÄKTA pure	No column valve	• System pressure • Sample pressure (if Sample Pump **S9**/**S9H** is installed) • Pre-column pressure
ÄKTA pure	Column Valve **V9-Cs** or Column Valve **V9H-Cs** (one column)	• System pressure • Sample pressure (if Sample Pump **S9**/**S9H** is installed) • Pre-column pressure
ÄKTA pure	Column Valve **V9-C** or Column Valve **V9H-C** (five columns)	• System pressure • Sample pressure (if Sample Pump **S9**/**S9H** is installed) • Pre-column pressure • Delta-column pressure • Post-column pressure
ÄKTA start	N/A	• System pressure
ÄKTAxpress	N/A	• System pressure
ÄKTAprime plus	N/A	• System pressure
ÄKTAmicro	N/A	• System pressure
ÄKTAFPLC	N/A	• System pressure
ÄKTApurifier	N/A	• System pressure • Sample pressure (if Sample Pump **P-950**/**P-960** is installed)
ÄKTAexplorer	N/A	• System pressure • Sample pressure (if Sample Pump **P-950**/**P-960** is installed)

Setting pressure limits

For all pressure signals in a system there are corresponding pressure limits (alarms in UNICORN™) that can be set, both manually and in methods. When selecting a column, data from the column list will define the pressure limits.

The column list in UNICORN 5 only contains one pressure limit. Generally this value is the pre-column pressure limit. For some columns, it is the delta-column pressure limit. The value from the column list is used to set the pressure alarm for the only pressure signal available (system pressure).

In UNICORN 6 and 7 the column list includes two pressure limit values for all columns, pre-column and delta-column pressure limits. These two values are used to set the values for the corresponding pressure alarms. Since system configuration differs and not all systems have all pressure signals special considerations apply, see the table in the *Special considerations* section below.

Special considerations

Depending on the column type and the system used, special actions might be needed to protect the packed bed from high pressure, see the table below.

Note: *Column pressure alarm values are only populated automatically if a column from the column list is set in the method. See table below for guidelines. If no column is set or when running manually, the pressure alarms must be configured manually.*

Column type	Most important pressure limit	System	Configuration	Action when creating methods
HiScreen™ HiTrap™ RESOURCE™	Pre-column pressure	All	N/A	None - default values are OK.
HiLoad™ HiPrep™	Both pre-column and delta-column pressure	ÄKTA go	No column valve or Column Valve **V9-Cm**	None [1]

Column type	Most important pressure limit	System	Configuration	Action when creating methods
			Column Valve **V9-C**	None. Both pre-column pressure and delta-column pressure alarms are set with correct values from the column list.
		ÄKTA avant	N/A	None. Both pre-column pressure and delta-column pressure alarms are set with correct values from the column list.
		ÄKTA pure	No column valve, Column Valve **V9-Cs** or Column Valve **V9H-Cs** (1 column)	None[1]
			Column Valve **V9-C** or Column Valve **V9H-C** (5 columns)	Activate the delta-column pressure alarm with the value for delta-column pressure limit from the column list.
		All otherÄKTA	N/A	None - default values are OK.
Superdex™ Superdex Increase [2] Superose™ Superose Increase [2]	Delta-column pressure	ÄKTA go	No column valve or Column Valve **V9-Cm**	Use the value for delta-column pressure limit and set this as the pre-column pressure alarm.[3]

Column type	Most important pressure limit	System	Configuration	Action when creating methods
			Column Valve **V9-C**	None. Both pre-column pressure and delta-column pressure alarms are set with correct values from the column list.
		ÄKTA avant	N/A	None. Both pre-column pressure and delta-column pressure alarms are set with correct values from the column list.
		ÄKTA pure	No column valve or Column Valve **V9-Cs** or Column Valve **V9H-Cs** (1 column)	Use the value for delta-column pressure limit and set this as the pre-column pressure alarm.[4]
			Column Valve **V9-C** or Column Valve **V9H-C** (5 columns)	Activate the delta-column pressure alarm with the value for delta-column pressure limit from the column list.
		All otherÄKTA	N/A	None - default values are OK.

[1] No delta-column pressure monitoring available. Measure the pre-column pressure without a column, "P0", under running conditions. During the method run monitor the pre-column pressure, "P". If P-P0 reaches the delta-column pressure limit for the column then there is a risk for the packed bed.

[2] To fully utilize the potential of Superdex Increase and Superose Increase columns the individual column pressure limit needs to be determined. A detailed description on the procedure is available in the *Instruction for use* included in the column delivery.

[3] This is done automatically for ÄKTA go.

[4] This is done automatically with Instrument configuration version 1.5 or later for ÄKTA pure 25 and Instrument configuration version 1.3 or later for ÄKTA pure 150. Instrument configurations can be downloaded from *cytiva.com*.

Troubleshooting

Problem	System	Possible cause	Action[1]
High pressure alarms	System with only system pressure measurement	Relatively high system contribution to monitored pressure	First make sure there is no clogged on-line filter or nicked tubing generating the high pressure. Then measure the system contribution to the pressure (before the column) and add this to the value for the pressure alarm. Alternatively, shorten the tubing and/or use larger tubing i.d.
High delta-column pressure alarm	System with delta-column pressure measurement	High pressure contribution from tubing used to connect the column to the column valve	Measure the tubing contribution to the pressure and add this to the value for the delta pressure alarm. Alternatively, shorten the tubing and/or use larger tubing i.d.

[1] Note that the obtained values are only valid when using the same buffer composition, at the same temperature and with the same flow rate.

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