

CONVAL[®]

by F.I.R.S.T.

Preview of the upcoming „Actuated Valve Assembly“ module in CONVAL[®]

In June 2019, the recommended practice S2812-X-19 was published by WIB at Valve World Americas Conference. The RP (Recommended Practice) is called „Actuated Valve Assembly -A Recommended Practice for Part turn Automated On-Off valves“ and addresses the issue of the framework, including definitions, of the sizing and selection and mechanical integrity of the industry’s most common automated valve assemblies.

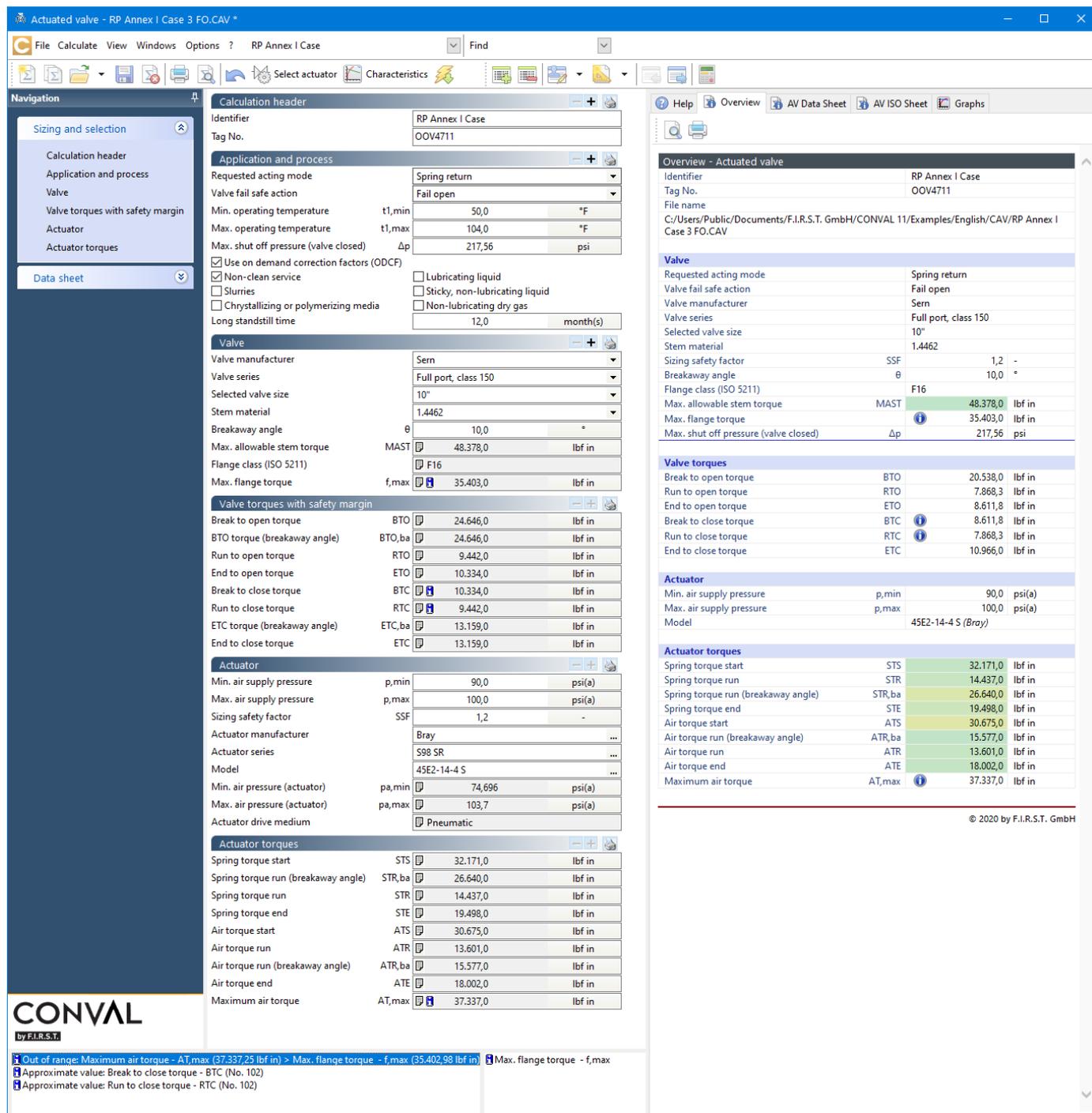
Since F.I.R.S.T. extensively supported the development of the RP both procedurally and with demonstrable prototypes, it is naturally obvious that a module in CONVAL[®] will soon be available that comprehensively maps the RP. This is procedurally further supported by the International Standards Organization (ISO) to accept the proposal and publish an ISO standard based on the RP.

If one were to summarize the objective of the RP in a few sentences, it would be as follows:

- If you automate "part turn on-off valves", you have to find the right actuator for the required torque, which is derived from data of the valve and the application.
- On one hand, this actuator should have a reasonable safety margin in order to operate the valve safely under all expected conditions.
- On the other hand, it should not be over-sized, if only for reasons of cost. Or even be so forceful that it damages the valve or stem.

With the implementation of the RP in the CONVAL[®] AV module, you can accomplish that task very easy. And finally, automatically generate the required documentation in a standardized way.

For readers familiar with the typical CONVAL® user interface, the screenshot of the β version of the AV module will certainly look familiar.



The screenshot displays the CONVAL software interface for an actuated valve calculation. The main window is titled "Actuated valve - RP Annex I Case 3 FO.CAV". The interface is divided into several sections:

- Navigation:** Includes "Sizing and selection", "Calculation header", "Application and process", "Valve", "Valve torques with safety margin", "Actuator", and "Actuator torques".
- Calculation header:** Shows the identifier "RP Annex I Case" and tag number "OOV4711".
- Application and process:** Includes parameters like "Requested acting mode" (Spring return), "Valve fail safe action" (Fail open), and "Max. shut off pressure (valve closed)" (217,56 psi).
- Valve:** Lists parameters such as "Valve manufacturer" (Sern), "Valve series" (Full port, class 150), "Selected valve size" (10"), and "Stem material" (1.4462).
- Valve torques with safety margin:** Provides a table of torque values for various conditions like "Break to open torque" (BTO) and "Run to open torque" (RTO).
- Actuator:** Shows "Min. air supply pressure" (90,0 psi(a)) and "Max. air supply pressure" (100,0 psi(a)).
- Actuator torques:** Lists torque values for different actuator types, such as "Spring torque start" (STS) and "Air torque end" (ATE).

At the bottom of the interface, a status bar indicates: "Out of range: Maximum air torque - AT,max (37.337,25 lbf in) > Max. flange torque - f,max (35.402,98 lbf in)".

But let's have a step by step look at how to come to the result you see here.

First of all, we need to provide information on the application and process, such as you want to use a spring return or double acting actuator, the fail-safe action (Fail open/fail close), max. shut off pressure, etc.

Furthermore, tell CONVAL® if you are aware of any corrections on the torque requirements that need to be made for special application considerations like „long standstill times“ or „slurries“. CONVAL® will then automatically account for these considerations.

Application and process			
Requested acting mode		Spring return	
Valve fail safe action		Fail open	
Min. operating temperature	t1,min	50,0	°F
Max. operating temperature	t1,max	104,0	°F
Max. shut off pressure (valve closed)	Δp	220,0	psi
<input checked="" type="checkbox"/> Use on demand correction factors (ODCF)			
<input checked="" type="checkbox"/> Non-clean service		<input type="checkbox"/> Lubricating liquid	
<input type="checkbox"/> Slurries		<input type="checkbox"/> Sticky, non-lubricating liquid	
<input type="checkbox"/> Chrystallizing or polymerizing media		<input type="checkbox"/> Non-lubricating dry gas	
Long standstill time		12,0	month(s)

As you should know the valve you want to automate, just select the appropriate type from the database. In case it is not yet available there, providing the base torque data manually is possible.

Valve			
Valve manufacturer		Sern	
Valve series		Full port, class 150	
Selected valve size		10"	
Stem material		1.4462	
Breakaway angle	θ	10,0	°
Max. allowable stem torque	MAST	48.378,0	lbf in
Flange class (ISO 5211)		F16	
Max. flange torque	f,max	35.403,0	lbf in

But in our case, we selected the valve from the vendor database (which is constantly growing) and automatically get all we need. Based on that information, the torque requirements are calculated.

Valve torques with safety margin			
Break to open torque	BTO	24.646,0	lbf in
BTO torque (breakaway angle)	BTO,ba	24.646,0	lbf in
Run to open torque	RTO	9.442,0	lbf in
End to open torque	ETO	10.334,0	lbf in
Break to close torque	BTC	10.334,0	lbf in
Run to close torque	RTC	9.442,0	lbf in
ETC torque (breakaway angle)	ETC,ba	13.159,0	lbf in
End to close torque	ETC	13.159,0	lbf in

Before we now can have a look for a suitable actuator, the air pressure range for the actuator (for a pneumatic one) and a general sizing safety factor (for my safety margin) needs to be defined.

Actuator			
Min. air supply pressure	p,min	90,0	psi(a)
Max. air supply pressure	p,max	100,0	psi(a)
Sizing safety factor	SSF	1,2	-

Then, simply press the  **Select actuator** button to get to the selection dialog.

If you have a preferred vendor/series in mind, navigate directly to it and select the matching device.

Grouped by manufacturer Combined view

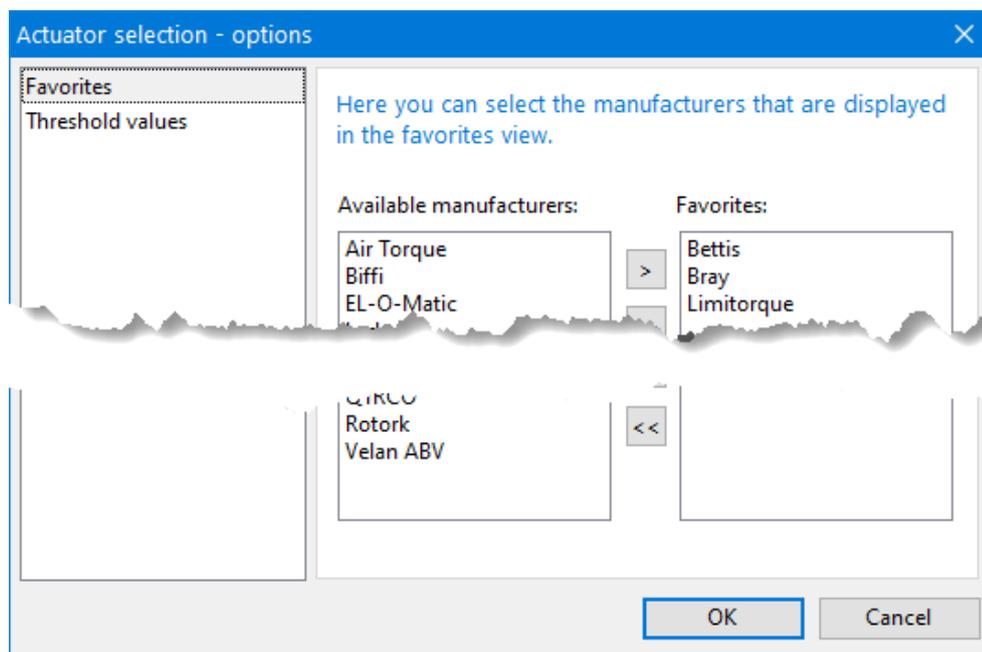
Manufacturer	Series	Model	SI	Wei...	Vol.	p,min	p,max	Type
Air Torque	S93	45E2-14-4 S	0,22	439,0	102...	74,7	104,0	SY Symm.
Bettis	S98 SR	73E2-14-3 S	0,26	569,0	123...	74,7	126,0	SY Symm.
Biffi		73E2-14-4 S	0,41	624,0	123...	84,7	132,0	SY Symm.
Bray		14E3-14-2 S	1,52	820,0	146...	74,7	165,0	SY Symm.
EL-O-Matic		73E2-14-2 S	1,55	547,0	123...	64,7	120,0	SY Symm.
Ledeen								
Limitorque								
Max-Air								
Pfeiffer								
QTRCO								
Rotork								

Or use a combined view showing you the suitable devices from your preferred vendor list, ordered by the Suitability Index (SI) - a key performance indicator (KPI) quantifying how closely assembly meets application requirements).

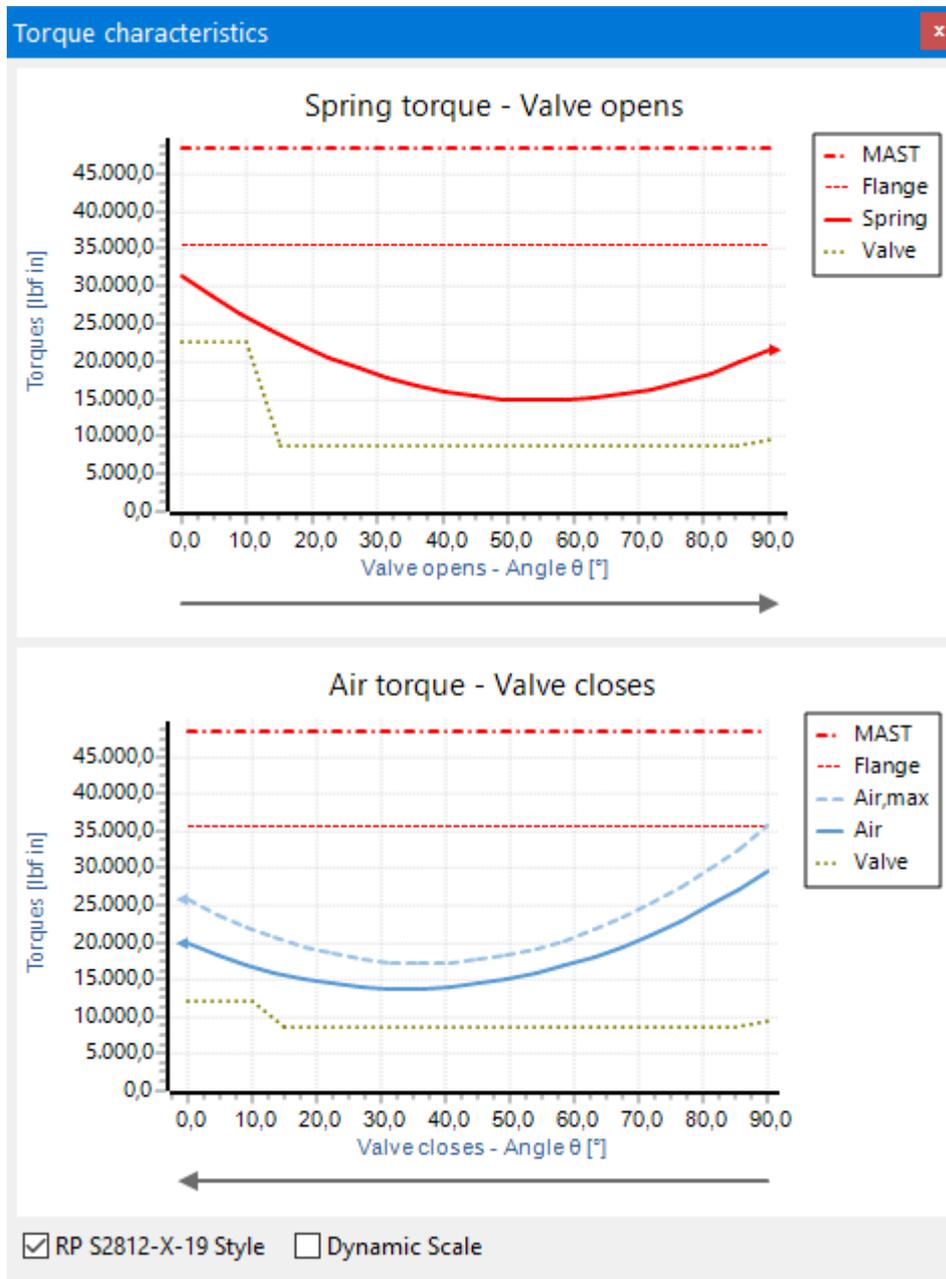
Grouped by manufacturer Combined view

Manufacturer	Series	Model	SI	Weight	Vol.	p,min	p,max	Type
Biffi	SR	S:s009-0335-0700	0,20			80,0	189,0	SY Symm.
Bray	S98 SR	73E2-12-2 S	0,22	496,0	902,0	74,7	159,0	SY Symm.
Velan ABV	PS	PS2/S-A/130/X5	0,24			87,2	160,0	SY Symm.
Pfeiffer	BR 31a - SRP	05000:6-6	0,27	450,0	1530,0	94,5	131,0	R&P
Air Torque	PT	PT800 S 12	0,27	450,0	1530,0	94,5	131,0	R&P
Limitorque	LPS SR	25A-285X-FX1-2	0,30	814,0	1090,0	94,5	189,0	SY Symm.
Rotork	GP SR	GP-085C-280A/O2	0,33			87,2	189,0	SY Canted
Limitorque	LPS SR	20A-300X-FX2-2	1,38	662,0	976,0	87,2	189,0	SY Symm.
Limitorque	LPS SR	25A-285X-FX3-1	1,39	924,0	1090,0	94,5	189,0	SY Symm.
Pfeiffer	BR 31a - SRP	05000:5-6	1,49	437,0	1530,0	87,2	131,0	R&P
Air Torque	PT	PT800 S 11	1,49	437,0	1530,0	87,2	131,0	R&P

By the way, the list of preferred suppliers can of course be defined by the user.



As pictures tell you more than 1000 numbers 😊, CONVAL® supports the selection by showing you all the torques in a dynamic diagram allowing you to visually assess the margins and limits while walking through the list of possible actuator choices.



Both, the selection dialog itself...

Actuator selection
✕

★ Favorites
🔍 Suggestion
🔍 Current actuator
No filter
📈 Characteristics
⚙️ ODCF settings...
⚙️

The selection is filtered on suitable actuators (143)

Grouped by manufacturer
Combined view

Manufacturer	Series	Model	SI Δ	Weight	Vol.	p,min	p,max	Type
Rotork	GP SR	GP-085C-280A/O4	0,10			87,2	189,0	SY Canted
Biffi	SR	S:s009-0335-0700	0,20			80,0	189,0	SY Symm.
Bray	S98 SR	73E2-12-2 S	0,22	496,0	902,0	74,7	159,0	SY Symm.
Rotork	GP SR	GP-085S-335A/C3	0,23			87,2	189,0	SY Symm.
Velan ABV	PS	PS2/S-A/130/X5	0,24			87,2	160,0	SY Symm.
Velan ABV	PS	PS2/S-A/130/X3	0,25			87,2	152,0	SY Symm.
Limitorque	LPS SR	25A-300X-FX3-1	0,26	952,0	1210,0	87,2	189,0	SY Symm.
Limitorque	LPS SR	20A-335X-FX2-3	0,26	741,0	1220,0	87,2	186,0	SY Symm.
Pfeiffer	BR 31a - SRP	05000:6-6	0,27	450,0	1530,0	94,5	131,0	R&P
Air Torque	PT	PT800 S 12	0,27	450,0	1530,0	94,5	131,0	R&P
Limitorque	LPS SR	25A-300X-FX1-2	0,27	844,0	1210,0	87,2	189,0	SY Symm.
Bray	S98 SR	14E3-12-1 S	0,29	747,0	1070,0	94,7	165,0	SY Symm.

Actuator

Sizing safety factor Supply air pressure

SSF p,min p,max psi(a)

Safety margins Torques [lbf in]

	Valve closed	Running	Valve open	Breakaway angle
Spring torques	38 %	70 %	126 %	14 %
Air torques	63 %	59 %	212 %	39 %
Max. torques	26 %		-1 %	

Filter

Requested acting mode

Filter air torques

Consider flange torque

Help
Ok
Cancel
Apply

...as well as the dynamic info view are indicating suitability by a traffic light color-coding system.

Help | Overview | AV Data Sheet | AV ISO Sheet | Graphs

Overview - Actuated valve

Identifier	RP Annex I Case		
Tag No.	OOV4711		
File name	C:/Users/Public/Documents/F.I.R.S.T. GmbH/CONVAL 11/Examples/English/CAV/RP Annex I Case 3 FO.CAV		

Valve

Requested acting mode	Spring return		
Valve fail safe action	Fail open		
Valve manufacturer	Sern		
Valve series	Full port, class 150		
Selected valve size	10"		
Stem material	1.4462		
Sizing safety factor	SSF	1,1	-
Breakaway angle	θ	10,0	°
Flange class (ISO 5211)	F16		
Max. allowable stem torque	MAST	48.378,0	lbf in
Max. flange torque		35.403,0	lbf in
Max. shut off pressure (valve closed)	Δp	220,0	psi

Valve torques

Break to open torque	BTO	20.538,0	lbf in
Run to open torque	RTO	7.868,3	lbf in
End to open torque	ETO	8.611,8	lbf in
Break to close torque	BTC	8.611,8	lbf in
Run to close torque	RTC	7.868,3	lbf in
End to close torque	ETC	10.966,0	lbf in

Actuator

Min. air supply pressure	p,min	100,0	psi(a)
Max. air supply pressure	p,max	110,0	psi(a)
Model	73E2-12-2 S (Bray)		

Actuator torques

Spring torque start	STS	31.339,0	lbf in
Spring torque run	STR	14.754,0	lbf in
Spring torque run (breakaway angle)	STR,ba	25.857,0	lbf in
Spring torque end	STE	21.466,0	lbf in
Air torque start	ATS	29.631,0	lbf in
Air torque run (breakaway angle)	ATR,ba	16.784,0	lbf in
Air torque run	ATR	13.800,0	lbf in
Air torque end	ATE	19.757,0	lbf in
Maximum air torque	AT,max	35.621,0	lbf in

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As soon you are satisfied with your selection, complement the sizing with additional data for documentation purposes on the datasheet page in the calculation, to finally generate the documents necessary.

AV Assembly Sizing Data Sheet

Identification									
1	Tag No.			OOV4711			End user		
2	Running			Feed to boiler 1			End user		
3	P&ID			PID 456			End user		
4	Line number			Line-100-ABV			End user		
5	Purchase order			PO 789			End user		
6	Remarks			none			End user		
Ambient conditions									
7	Ambient temperature	min/max		14,0	122,0	*F	End user		
8	Environmental conditions			outdoor			End user		
9	Environmental conditions			corrosive			End user		
Application									
	Requested acting mode			Spring return			End user		
10	Valve fail safe action			Fail open			End user		
11	Travel time	open/close		10,0	5,0	s	End user		
12	Response time	open/close		20,0	8,0	s	End user		
13	Air supply pressure	min/max		72,711	159,73	psi(a)	End user		
Process									
14	Medium			hydrocarbon + tar			End user		
15	State / phase			liquid			End user		
16	Mass flow rate			220,460,0	lb/h		End user		
17	Volume flow rate			550,36	GPM(US)		End user		
18	Density			56,185	lb/ft ³		End user		
19	1,5	Long standstill time		12,0	month(s)		End user (1)		
20	1,4	Non-clean service		Yes			End user (1)		
		Slurries		No			End user (1)		
		Chrystallizing or polymerizing media		No			End user (1)		
		Lubricating liquid		No			End user (1)		
		Sticky, non-lubricating liquid		No			End user (1)		
		Non-lubricating dry gas		No			End user (1)		
23	Fluid operation temp.	min/max	t1,min	50,0	104,0	*F	End user (1)		
24	Max. shut off pressure (valve closed)		Δp		220,0	psi	End user		
25	Design pressure				435,11	psi(a)	End user		
Valve									
27	Valve manufacturer			Sern			End user		
28	Valve series			Full port, class 150			End user		
29	Valve type			Ball valve			End user		
30	Valve design			Trunnion mounted			End user		
31	Port type			Full port			End user		
32	Flow direction						End user		
33	Seat sealing type			Soft seated			End user		
34	Seat material						End user		
35	Seating method			Position seated			End user		
36	Pressure rating			Class 150			End user		
37	Tightness rate/class						End user		
38	Selected valve size			10"			End user		
40	2,1	Break to open torque	net/ODCF corr.	BTO	9.780,1	20.538,0	lbf in	Valve mfr	
41		Breakaway angle		θ		10,0	°	Valve mfr	
42	1,4	Run to open torque	net/ODCF corr.	RTO	5.620,2	7.868,3	lbf in	Valve mfr	
43	1,4	End to open torque	net/ODCF corr.	ETO	6.151,3	8.611,8	lbf in	Valve mfr	
44	1,4	Break to close torque	net/ODCF corr.	BTC	6.151,3	8.611,8	lbf in	Valve mfr	
45	1,4	Run to close torque	net/ODCF corr.	RTC	5.620,2	7.868,3	lbf in	Valve mfr	
47	1,4	End to close torque	net/ODCF corr.	ETC	7.832,9	10.966,0	lbf in	Valve mfr	
48		Max. allowable stem torque		MAST		48.378,0	lbf in	Valve mfr	
49		Max. flange torque	f,max			35.403,0	lbf in	Valve mfr	
50		Stem / top works dimensions provided		No			Valve mfr		
Mounting kit									
51	Material						Mounting Kit mfr		
53	Max. allowable coupling torque		MAST,c			lbf in	Mounting Kit mfr		
54	MK mechanical integrity checked and documented			No			Mounting Kit mfr		
55	Stem orientation						Mounting Kit mfr		
Actuator									
57	Supply pressure	min/max	p,min	100,0	110,0	psi(a)	End user		
58	Air volume	open/close		902,0	902,0	in ³	End user		
59	Sizing safety factor		SSF		1,1	-	End user		
60	Actuator drive medium			Pneumatic			End user		
61	Actuator drive medium quality						End user		
	Acting mode			Spring return			AV Assembly Contr		
62	Actuator style			Scotch Yoke (Symmetrical)			AV Assembly Contr		
63	Actuator manufacturer			Bray			AV Assembly Contr		
	Actuator series			S98 SR			AV Assembly Contr		
	Model			73E2-12-2 S			AV Assembly Contr		
64	Size					in ²	AV Assembly Contr		
65	Spring set			2			AV Assembly Contr		
66	Spring torque start		STS		31.339,0	lbf in	Actuator mfr		
67	Spring torque run		STR		14.754,0	lbf in	Actuator mfr		
68	Spring torque end		STE		21.466,0	lbf in	Actuator mfr		
69	Air torque start		ATS		29.631,0	lbf in	Actuator mfr		
70	Air torque run		ATR		13.800,0	lbf in	Actuator mfr		
71	Air torque end		ATE		19.757,0	lbf in	Actuator mfr		
72	Maximum air torque		AT,max		35.621,0	lbf in	Actuator mfr		
73	Max. air pressure (actuator)		pa,max		158,7	psi(a)	Actuator mfr		

In addition to the documentation specified by the Recommended Practice or the forthcoming ISO standard, typical CONVAL® style calculation documentation for the AV module can, of course, always be provided in the form of a PDF containing all the information entered and calculated.

CONVAL® by F.I.R.S.T. Version 11.0 (Build 11.0.0)

Actuated valve: RP Annex I Case 3 FO

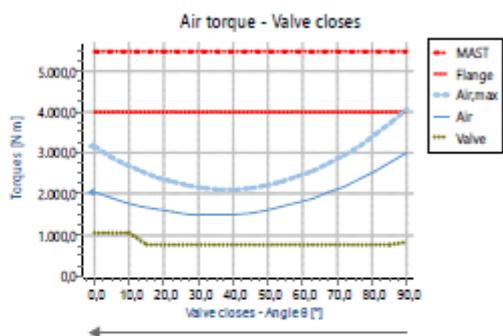
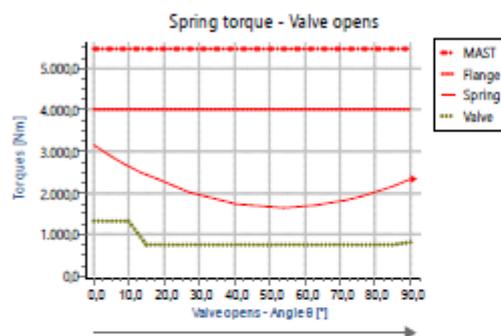
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Mounting kit

MK mechanical integrity checked and documented

Actuator

Actuator manufacturer		<i>Velan ABV</i>	
Actuator series		<i>PS</i>	
Model		<i>PS1/S-A/150/X3</i>	
Min. air supply pressure	p,min	5,0	bar(g)
Max. air supply pressure	p,max	6,0	bar(g)
Sizing safety factor	SSF	1,2	-
Actuator drive medium		<i>Pneumatic</i>	
Acting mode		<i>Spring return</i>	
Actuator style		<i>Scotch Yoke</i>	
Scotch yoke type		<i>Symmetrical</i>	
Spring torque start	STS	3.165,0	Nm
Spring torque run	STR	1.657,0	Nm
Spring torque end	STE	2.352,0	Nm
Air torque start	ATS	3.006,4	Nm
Air torque run	ATR	1.491,4	Nm
Air torque end	ATE	2.052,6	Nm
Maximum air torque	AT,max	4.047,3	Nm
Max. air pressure (actuator)	pa,max	6,0	bar(g)



There is certainly much more to say and show, but the purpose of this article is to highlight the general process handled in the "actuated valve assembly" module. And keep in mind that the illustrated features are still under development and might change any time.

Stay tuned, there is more detailed information to come shortly. It always helps to digest the RP we are relying on

