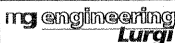


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VALVE CALCULATION SHEETS

V12/sro	2005-07-01	V12/lf	V12/di	2005-07-05	FINAL	FINAL ISSUE			
V12/sro	2005-06-20	V12/lf	V12/di	2005-06-27		SECOND ISSUE			
V12/sro	2005-01-10	V12/lf	V12/di	2005-01-20		FIRST ISSUE			
Name	Date	Name	Name	Date	Status				
Prepared, revised		Checked	Approved			Remark, kind of revision			
Contractor:  PETROCHEMICAL INDUSTRIES DESIGN & ENGINEERING CO. شرکت طراحی و مهندسی صنایع پتروشیمی						Owner Project No:	Contractor Order No:	Q.L.	DCC
						232000	1182-POR-IN-644	-	-
							Vendor Order Ref.		
						616 100			
		Project Name			Lurgi Doc. No.		Vendor Doc. No.	Sheet / of	Revision
2nd ZAGROS METHANOL PLANT							SAM-100	1 / 161	02

Valve Calculation Sheets - Table of Contents

Tag No.	Date	Page
FV-100326	2005-06-01	005
FV-100406	2005-06-01	006
FV-100416	2003-06-21	007-014
FV-100428	2003-06-20	015-018
FV-100429	2005-06-01	019
FV-100512	2005-06-01	020
FV-100704	2005-06-01	021
FV-100805	2003-06-20	022-026
FV-100807	2003-06-20	027-031
FV-100825	2005-06-01	032
FV-100831	2005-06-01	033
FV-101019	2005-07-05	034
FV-101021	2005-06-01	035
FV-101039	2005-06-01	036
FV-101041	2005-06-01	037
FV-101122	2005-06-01	038
FV-101125	2005-06-01	039
FV-101229A	2005-06-01	040
FV-101229B	2005-06-01	041-042
FV-101432	2004-09-07	043
FV-101433	2004-09-07	044
FV-101435	2004-09-07	045
FV-101439	2005-06-01	046
FV-101441	2005-06-01	047
FV-150411	2005-06-01	048
FV-150610	2004-09-07	049
FV-150630	2004-09-07	050
FV-150636	2004-09-07	051
FV-150725	2004-09-07	052
FV-250102	2005-06-01	053
FV-250105	2005-07-05	054
FV-300101	2005-06-07	055
FV-300203	2005-06-01	056
FV-300305	2005-06-01	057
FV-300306	2005-06-01	058
FV-300408	2005-06-01	059
FV-300510A	2005-06-01	060
FV-300510B	2005-06-01	061
FV-300611	2005-06-01	062
FV-300920	2005-06-01	063
HV-200204	2003-06-21	064-067
HV-200214	2002-06-21	068-075
HV-200503	2003-06-21	076-079

Valve Calculation Sheets - Table of Contents

Tag No.	Date	Page
LV-100411	2005-06-01	080
LV-100416	2005-06-01	081
LV-101308	2005-06-01	082
LV-101309	2005-06-01	083
LV-101512A	2005-06-01	084
LV-101512B	2005-06-01	085
LV-101602	2005-06-01	086
LV-150101A	2005-06-01	087
LV-150406	2005-06-01	088
LV-150505	2005-06-01	089
LV-200301	2005-06-01	090
LV-200403	2005-06-01	091
LV-300101A	2005-06-01	092
LV-300101B	2005-06-07	093
LV-300202	2005-06-07	094
LV-300203	2005-06-01	095
LV-300305	2005-06-07	096
LV-300406	2005-06-01	097
LV-300407	2005-07-05	098
LV-300508	2005-06-01	099
LV-300609	2005-06-01	100
LV-300910	2005-06-01	101
LV-600301	2005-06-01	102
PCV-100181	(not available)	-
PCV-100182	(not available)	-
PV-100201	2005-06-01	103
PV-100513	2005-06-01	104
PV-100529A/B	2005-06-01	105
PV-100801	2003-06-21	106-109
PV-101502A	2005-06-01	110
PV-101502B	2005-06-01	111
PV-150101	2005-06-01	112
PV-150601A	2005-06-01	113
PV-150601B	2005-06-01	114
PV-150607	2005-06-01	115
PV-150611	2005-06-01	116
PV-150612	2005-06-01	117
PV-150635A/B	2005-06-01	118
PV-150707	2005-06-01	119
PV-200307A	2005-06-01	120
PV-200307B	2005-07-05	159-160
PV-200409	2002-06-20	122-125

Valve Calculation Sheets - Table of Contents

Tag No.	Date	Page
PV-250102A	2005-06-01	126
PV-250102B	2005-06-01	127
PV-250103	2005-07-05	128
PV-300101	2005-06-01	129
PV-300303A	2005-06-01	130
PV-300303B	2005-06-01	131
PV-300808	2005-06-01	132
PV-300909A	2005-06-01	133
PV-300909B	2005-06-01	134
TV-100904A	2003-06-20	135-138
TV-100904B	2003-06-20	139-142
TV-101204A	2002-06-20	143-146
TV-101204B	2002-06-20	147-150
TV-200521A	2002-06-20	151-154
TV-200521B	2002-06-20	155-158

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV100326	Tag no.	FV100326
Process medium	Purge Gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	9200	8157	2800
Inlet pressure	p1	[bar(a)]	67,9	67,9	60
Outlet pressure	p2	[bar(a)]	50	48,5	45,5
Inlet temperature	t1	[°C]	40	40	40
Molar mass	M	[g/mol]	11,509	11,509	11,509
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		1,0087	1,0087	1,0087
Viscosity	eta	[mPas]	0,014	0,014	0,014

Results and factors

Valve coeff. calculated	Cv		8,54	7,35	3,03
Min. req. size	Req. DN [mm]		21,2	20,2	12,2
Outlet velocity	w	[Mach]	0,0560	0,0512	0,0187
SPL VDMA 24422 mod.	LA	[dB(A)]	77	77	68
relative travel	T	[%]	82,4	78,6	55,9
Different. pressure ratio	x		0,26	0,29	0,24
FL value	FL		0,95	0,96	0,97
xT value	xT		0,77	0,77	0,80
Valve style factor	Fd		0,43	0,42	0,38
Level exponent	G1		-4,66	-4,68	-4,81
Slope exponent	G2		0,75	0,75	0,75

Valve data

Body type		Globe valve		Series	globe valve
Valve coefficient	Cv	17		Type	3251
Nominal size	DN	["]	2"	Body material	A216 WCB
Pressure ratings	CLASS	600		Noise reduction	Flow Div.I
Travel	S	[mm]	15	Charact.	Equal perc.
Seat bore	SB	[mm]	31	Flow direction	FTO
Stem diameter	Sd	[mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)			Leakage rate	VI
Sealing	lapped-in (10)			Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	3"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	82	s [mm]	7,62

Actuator data

Type		3277		Fail-safe act.	extends		
Diaphr. area	A	[cm²]	700	Bench range	ps0	[bar]	1,6 ... 2,4
(Defaults:	p1max [bar(a)]	89	p2min [bar(a)]	1,01	t1max [°C]	100)	Supply
							psu
							[bar]
							2,60

Actuator results

req. act. force	Fo req.	[kN]	7,78	req. diff. psu-ps100	d ps	[bar]	0,03
max. act. force	Fmax	[kN]	57,41	Actuator force	Fa	[kN]	11,20
max. dp on plug	d. pmax	[bar]	133,07	Close safety factor	Fa/Fo (SF)		1,44
req. start bench range	ps0req.	[bar]	1,22	Open safety factor	Ff/Fw		-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV100406 Tag no. FV100406
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	5000	1000
Inlet pressure	p1	[bar(a)]	44	44,9	46
Outlet pressure	p2	[bar(a)]	3	3	3
Inlet temperature	t1	[°C]	50	50	50
Density	rho1	[kg/m³]	989,91	989,95	990
Vapor pressure	pv	[bar(a)]	0,12351	0,12351	0,12351
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,5476	0,54762	0,54764

Results and factors

Valve coeff. calculated	Cv		2,38	1,18	0,234
Min. req. size	Req. DN [mm]		26,7	18,9	8,45
Outlet velocity	w	[m/s]	1,43	0,715	0,143
SPL VDMA 24422 mod.	LA	[dB(A)]	81	79	73
Flow condition			Critical cavitation	Critical cavitation	Critical cavitation
relative travel	T	[%]	82,8	64,9	23,5
Different. pressure ratio	xF		0,93	0,94	0,94
FL value	FL		0,74	0,74	0,74
Kc value	Kc		0,55	0,55	0,55
Valve style factor	Fd		0,55	0,35	0,13
z value at capacity	xFz		0,55	0,55	0,55
Level exponent	F1		-7,39	-7,67	-8,18
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf	[dB]	4,89	7,53	4,56

Valve data

Body type		Globe valve		Series	angle valve
Valve coefficient	Cv	5		Type	3256
Nominal size	DN	["]	2"	Body material	A351 CF8C
Pressure ratings	PN	600		Noise reduction	without
Travel	S	[mm]	15	Charact.	Equal perc.
Seat bore	SB	[mm]	24	Flow direction	FTC
Stem diameter	Sd	[mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)			Leakage rate	IV
Sealing	metal (2,0)			Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	3"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	79	s [mm]	5,49

Actuator data

Type		3277		Fail-safe act.	extends		
Diaphr. area	A	[cm²]	700	Bench range	ps0	[bar]	1,2 ... 2
(Defaults:	p1max [bar(a)]	55	p2min [bar(a)]	1,01	t1max [°C]	100)	Supply
							psu
							[bar]
							2,24

Actuator results

req. act. force	Fo req.	[kN]	0,31	req. diff. psu-ps100	d ps	[bar]	0,24
max. act. force	Fmax	[kN]	57,41	Actuator force	Fa	[kN]	8,40
max. dp on plug	d. pmax	[bar]	32,00	Close safety factor	Fa/Fo (SF)		26,91
req. start bench range	ps0req.	[bar]	0,05	Open safety factor	Ff/Fw		-

Calculation header

Identifier		2004-63047 Methanol ZAGROS	
Author		uwinkel	20.06.2005 13:09:47
Editor		uwinkel	21.06.2005 09:52:27
Tag No.		FV-100416	

Medium selection and state

Medium		Natural Gas (Aga8)	
Gas composition		Standard	
Operating temperature	t1	290,0	°C
State		Gaseous	

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	46,0	bar(a)
Absolute pressure downstream of valve	p2	32,6	bar(a)
Flow coefficient	Cv	455,96	GPM(US)
● Mass flow rate	qm	150.000,0	kg/h
○ Volume flow rate (standard conditio...	qn	200.090,0	m³/h
Critical flow-related pressure difference	Δpc	23,605	bar(a)
Critical real pressure difference	ΔpXc	21,338	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	p1	16,422	kg/m³
Operating density (t2, p2)	p2	11,66	kg/m³
● Dynamic viscosity (t1,p1)	η1	0,020264	mPa s
Isentropic exponent (t1, p1)	κ	1,2174	-

Valve selection

Valve manufacturer		LEUSCH	
Series		LDE Class 600	
Valve selection		Cv: 3321, 12", Measured values (lin)	
☒ Valve from database	☒	Valve data can be modified	

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	455,96	GPM(US)
Selected flow coefficient	Cv100	3.321,0	GPM(US)
Selected valve size	DN	12"	
Flow velocity	u1	34,774	m/s
Flow velocity	u2	48,976	m/s
Valve modifier (Cv/Cv100 = 0.75)	FL²	0,42	-
Valve modifier (Cv/Cv100 = 0.75)	xT	0,343	-
Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-
☐ Function for FL²			
☐ Function for xT			

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	25,931	%
Valve load	Cv/Cv1...	13,729	%
Valve modifier (operating conditions)	FL ²	0,638	-
Valve modifier (operating conditions)	xT	0,59	-
Valve style modifier (operating conditions)	Fd	0,411	-

Pipe upstream of valve

Flow velocity in the pipe	u1R	38,733	m/s
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Pipe downstream of valve

Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 80	
Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,68898	in
Pipe inside diameter downstream of...	Di2	11,37	in
Flow velocity in the pipe	u2R	54,553	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	IEC 60534-8-3:2000
------------------------------	--------------------

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma	0,682	dB
Transmission loss	Rr	-54,8	dB
Sound power level	Lwi	144,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	119,0	dB(A)
Sound pressure level of valve (A-weight...	LpAa	110,0	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,083945	-
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Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	290,0	400,0		°C
t2	290,0	400,0		°C
p1	46,0	46,0		bar(a)
p2	32,6	32,6		bar(a)
Cv	455,96	330,96		GPM(US)
qm	150.000,0	100.000,0		kg/h
qn	200.090,0	133.390,0		m ³ /h
Δpc	23,605	24,3		bar(a)
cf1	583,97	632,71		m/s
η1	0,020264	0,023377		mPa s
κ	1,2174	1,1896		-
ρ1	16,422	13,67		kg/m ³
ρ2	11,66	9,7185		kg/m ³
LpAa	110,0	107,0		dB(A)

Control valve: 2004-63047 Methanol ZAGROS**LEUSCH GMBH**

21.06.2005 10:13:14

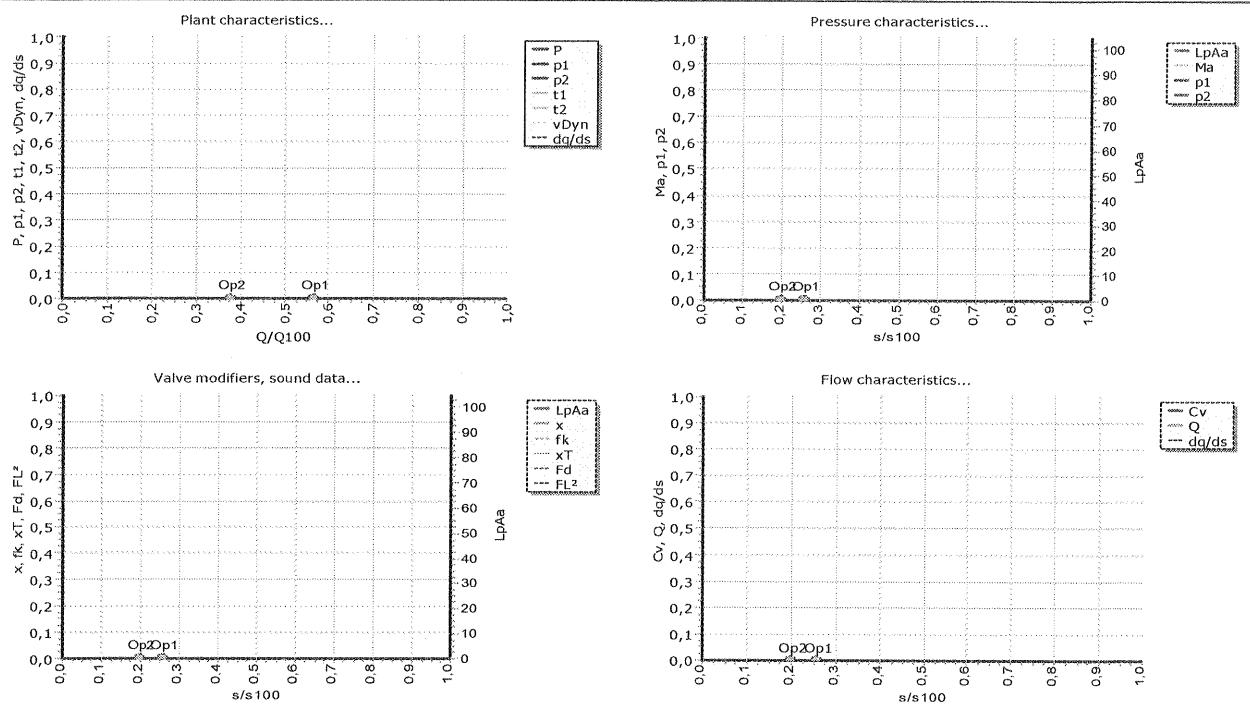
u1	34,774	27,85	m/s
u2	48,976	39,172	m/s
P	4.018,8	3.218,7	kW
MaDN	0,083945	0,062011	-
s/s100	25,931	19,946	%
Cv/Cv1...	13,729	9,9657	%
Fd	0,411	0,377	-
FL ²	0,638	0,666	-
xT	0,59	0,622	-
	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	
h1'	676,5	1.041,3	kJ/kg

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)	vDyn	1,0	-
Calculated short-circuit performance	ax	1,9607	-

Characteristics values table

Caption	Unit	5 [%]	24 [%]	50 [%]	75 [%]	100 [%]
s/s100	%					
t1	°C		-130,3			
p1	bar(a)		46,0			
p2	bar(a)		32,6			
Cv	GPM(US)					
qm	kg/h		265.100,0			
qn	m ³ /h		353.600,0			
Type of flow	-					
vDyn	-		1,0			
ρ_1	kg/m ³					
κ	-					
LpAa	dB(A)					
MaDN	-					
u2	m/s					
cf	m/s					



Hint:

- ① Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- Lookup value
- Hint

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 21.06.2005 10:00:16
Tag No.		FV-100416

Medium selection and state

Medium		Natural Gas (Aga8)
Gas composition		Standard
Operating temperature	t1	290,0 °C
State		Gaseous

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	33,4	bar(a)
Absolute pressure downstream of valve	p2	28,6	bar(a)
Flow coefficient	Cv	806,42	GPM(US)
☒ Mass flow rate	qm	150.000,0	kg/h
☐ Volume flow rate (standard conditio...	qn	199.570,0	m³/h
Critical flow-related pressure difference	Δpc	15,699	bar(a)
Critical real pressure difference	ΔpXc	14,525	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ1	11,945	kg/m³
Operating density (t2, p2)	ρ2	10,234	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,020181	mPa s
Isentropic exponent (t1, p1)	κ	1,2097	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	ρn	0,75163	kg/m³
☐ Specific gas constant	R	494,81	J/(kg K)
☒ Molecular weight	M	16,803	kg/kmol

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 3321, 12", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	806,42	GPM(US)
Selected flow coefficient	Cv100	3.321,0	GPM(US)
Selected valve size	DN	12"	
Flow velocity	u1	47,807	m/s
Flow velocity	u2	55,797	m/s
Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-
☒ Function for FI²			
☒ Function for xT			

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	41,12	%
Valve load	Cv/Cv1...	24,282	%
Valve modifier (operating conditions)	FL²	0,572	-
Valve modifier (operating conditions)	xT	0,544	-
Valve style modifier (operating conditio...	Fd	0,495	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	12"	
Pressure class upstream of valve	PN1	Schedule 80	
☐ Pipe outside diameter upstream of ...	Da1	12,748	in
Pipe wall thickness upstream of val...	s1	0,68898	in
☐ Pipe inside diameter upstream of v...	Di1	11,37	in
Flow velocity in the pipe	u1R	53,251	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,68898	in
☐ Pipe inside diameter downstream o...	Di2	11,37	in
Flow velocity in the pipe	u2R	62,151	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	IEC 60534-8-3:2000
------------------------------	--------------------

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	$\Delta L, Ma$	0,786	dB
Transmission loss	Rr	-57,4	dB
Sound power level	Lwi	134,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	106,0	dB(A)
Sound pressure level of valve (A-weight...	LpAa	97,4	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,095968	-
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Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	290,0	290,0		°C
t2	290,0	290,0		°C
p1	33,4	20,4		bar(a)
p2	28,6	15,6		bar(a)
Cv	806,42	740,38		GPM(US)
qm	150.000,0	100.000,0		kg/h
qn	199.570,0	133.040,0		m³/h
Δpc	15,699	9,6253		bar(a)
η_1	0,020181	0,02011		mPa s
κ	1,2097	1,2022		-
ρ_1	11,945	7,307		kg/m³

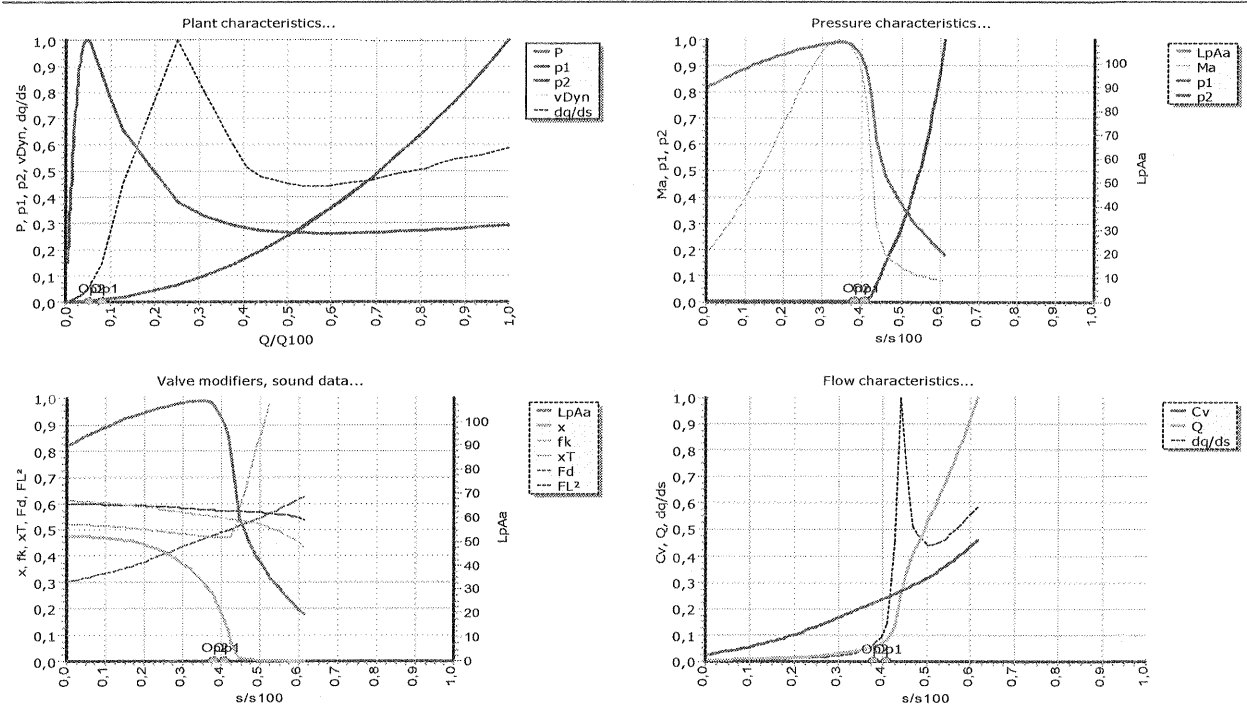
ρ_2	10,234	5,5905	kg/m ³
LpAa	97,4	106,0	dB(A)
u1	47,807	52,1	m/s
u2	55,797	68,097	m/s
P	1.807,6	2.080,5	kW
MaDN	0,095968	0,11757	-
s/s100	41,12	38,3	%
Cv/Cv1...	24,282	22,294	%
Fd	0,495	0,48	-
FL ²	0,572	0,574	-
xT	0,544	0,549	-
	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	
h1'	679,58	682,86	kJ/kg

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)	vDyn	0,995	-
Calculated short-circuit performance	ax	163,3	-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	61 [%]	100 [%]
s/s100	%	5,002	25,0	49,99	61,0	
t1	°C	290,0	290,0	290,0	290,0	
p1	bar(a)	10,11	11,51	924,3	3.219,0	
p2	bar(a)	5,306	6,706	919,5	3.215,0	
Cv	GPM(US)	127,7	435,3	1.047,0	1.505,0	
qm	kg/h	10.120,0	38.050,0	937.300,0	1,756 E6	
qn	m ³ /h	13.460,0	50.620,0	1,247 E6	2,336 E6	
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	
vDyn	-	1,0	1,0	0,9985	0,9949	
pv1	bar(a)					
ρ_1	kg/m ³	3,624	4,125	224,2	381,3	
κ	-	1,197	1,198	2,301	3,779	
LpAa	dB(A)	94,02	106,2	41,46	20,22	
MaDN	-	0,03504	0,1042	0,01641	9,825 E-3	
u2	m/s	20,24	60,22	15,96	17,54	
cf	m/s					



Hint:

- ④ Approximate value: Density of pipeline - ρ_P

Legend

- Calculated value
- Lookup value
- ④ Hint

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 16:50:25
Tag No.		FV-100428

Medium selection and state

Medium		Water	
Operating temperature	t1	133,0	°C
State		Liquid	
☒ Automatic phase detection			

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	49,0	bar(a)
Absolute pressure downstream of valve	p2	48,4	bar(a)
Flow coefficient	Cv	958,39	GPM(US)
☒ Mass flow rate	qm	585.000,0	kg/h
☐ Volume flow rate	qv	629,71	m³/h
Critical flow-related pressure difference	Δpc	21,171	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	p1	929,0	kg/m³
Operating density (t2, p2)	p2	929,0	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,21	cP
Boiling pressure (t1)	pv1	2,9541	bar(a)
Boiling temperature (p1)	tv1	262,68	°C

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 1437, 8", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	958,39	GPM(US)
Selected flow coefficient	Cv100	1.437,0	GPM(US)
Selected valve size	DN	8"	
Flow velocity	u1	5,3939	m/s
Flow velocity	u2	5,3939	m/s
Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-
☒ Function for FI²			
☒ Function for xFz			

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	73,579	%
Valve load	Cv/Cv1...	66,694	%
Valve modifier (operating conditions)	FL²	0,456	-
Cavitation modifier (operating conditions)	xFz	0,23	-

Valve style modifier (operating conditio...	Fd	0,71	-
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Pipe upstream of valve

☒ Size class upstream of valve	DN1	12"	
Pressure class upstream of valve	PN1	Schedule 30	
☐ Pipe outside diameter upstream of ...	Da1	12,748	in
Pipe wall thickness upstream of val...	s1	0,33071	in
☐ Pipe inside diameter upstream of v...	Di1	12,087	in
Flow velocity in the pipe	u1R	2,363	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 30	
☐ Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,33071	in
☐ Pipe inside diameter downstream o...	Di2	12,087	in
Flow velocity in the pipe	u2R	2,363	m/s
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-4:1994

Calculated values

Low-noise design		n.a.	
Sound velocity	cf1	1.510,9	m/s
Level exponent	F1	-7,0	-
Inclination exponent	F2	0,0	-

	500-1000 Hz	1000-2000 Hz	2000-4000 Hz	4000-8000 Hz	
ΔL	-3,0	-3,0	-3,0	-3,0	dB

Pressure level	LA1	90,2	dB
Sound power level	Lwi	90,2	dB
Sound power level (A-weighted)	LwAa	83,0	dB(A)
Sound pressure level of valve (A-weight...	LpAa	69,7	dB(A)

Minor noise prediction data

Pressure ratio	xF	0,013	-
Acoustical efficiency factor	η	100,0	E -9
Ring frequency	fr	5.370,8	Hz
Speed of sound (fluid)	cf	1.510,9	m/s
Power loss	P	10,495	kW
Stream power	Wm	23,012	kW

Spectrum

	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Lwi	87,3	84,3	81,3	78,3	75,3	dB
Rr	29,6	23,7	18,3	14,9	16,9	dB
LwAa	70,3	76,2	78,9	77,6	71,5	dB(A)
LpAa	56,9	62,8	65,5	64,2	58,1	dB(A)

Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,21	cP
---------------------------	----	------	----

Influence of fittings

Piping geometry factor

FP 

0,945

Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	133,0	133,0	133,0	°C
t2	133,0	133,0	133,0	°C
p1	49,0	50,0	50,5	bar(a)
p2	48,4	48,2	46,0	bar(a)
Cv	958,39	440,46	82,59	GPM(US)
qm	585.000,0	486.580,0	146.000,0	kg/h
qv	629,71	523,76	157,16	m³/h
Δpc	21,171	26,779	28,529	bar(a)
cf1	1.510,9	1.511,2	1.511,3	m/s
η1	0,21	0,21	0,21	cP
pv1	2,9541	2,9541	2,9541	bar(a)
ρ1	929,0	929,0	929,0	kg/m³
ρ2	929,0	929,0	929,0	kg/m³
LpAa	69,7	73,6	72,4	dB(A)
u1	5,3939	4,4864	1,3462	m/s
u2	5,3939	4,4864	1,3462	m/s
P	10,495	26,188	19,645	kW
s/s100	73,579	49,055	10,751	%
Cv/Cv1...	66,694	30,651	5,7474	%
Fd	0,71	0,539	0,337	-
FL²	0,456	0,565	0,596	-
xFz	0,23	0,309	0,341	-
FP	0,945	0,988	1,0	-
	Turbulent flow	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	Non-critical	
h1'	562,29	562,36	562,39	kJ/kg

Control optimization

Valve authority (Δp100/Δp0)

vDyn 

0,072

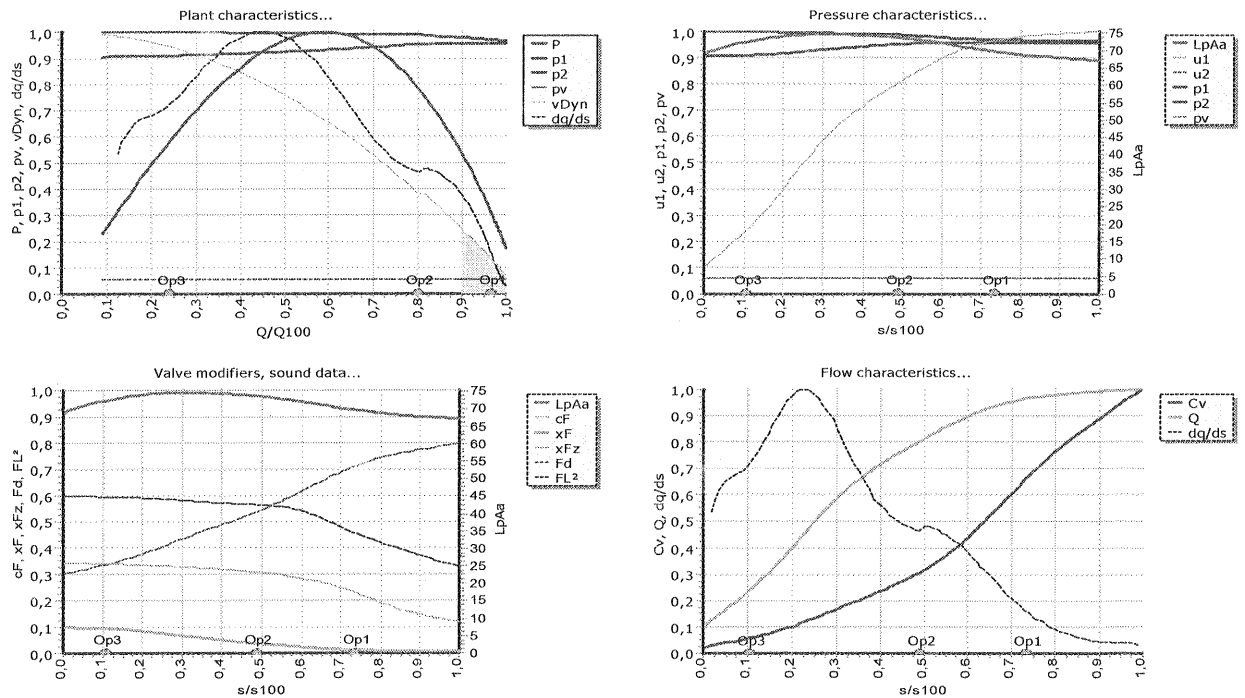
Calculated short-circuit performance

ax

1,0743

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,002	25,0	50,0	75,0	99,93
t1	°C	133,0	133,0	133,0	133,0	133,0
p1	bar(a)	50,53	50,34	49,95	48,97	48,77
p2	bar(a)	45,88	46,7	48,21	48,41	48,45
Cv	GPM(US)	55,23	188,3	453,3	992,5	1.436,0
qv	m³/h	106,8	321,9	529,6	632,3	651,6
qm	kg/h	99.210,0	299.100,0	492.000,0	587.400,0	605.400,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9741	0,7647	0,3831	0,1265	0,07214
pv1	bar(a)	2,954	2,954	2,954	2,954	2,954
ρ1	kg/m³	929,0	929,0	929,0	929,0	929,0
ρ2	kg/m³	929,0	929,0	929,0	929,0	929,0
LpAa	dB(A)	70,85	74,59	73,54	69,45	67,14
u1	m/s	0,9147	2,758	4,536	5,416	5,582
FP	-	0,9998	0,9977	0,9869	0,9416	0,8881

**Warning:**

⚠ The flow reserve to control $Q_{\max}$ is too low. Therefore the control quality is limited.

Hint:

💡 Influence of fittings

Legend

- Calculated value
- ✕ Modified calculated value
- ◻ Lookup value
- ⚠ Warning
- 💡 Hint

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV100429 Tag no. FV100429
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	29000	26316	5000
Inlet pressure	p1	[bar(a)]	50	51	51,5
Outlet pressure	p2	[bar(a)]	48,2	48	47,5
Inlet temperature	t1	[°C]	151	151	151
Density	rho1	[kg/m³]	918,62	918,68	918,71
Vapor pressure	pv	[bar(a)]	4,89	4,89	4,89
Critical pressure	pc	[bar(a)]	221,2	221,2	221,2
Viscosity	eta	[mPas]	0,1823	0,18232	0,18234

Results and factors

Valve coeff. calculated	Cv		26,8	18,7	3,05
Min. req. size	Req. DN [mm]		47,3	45,0	19,6
Outlet velocity	w	[m/s]	4,47	4,05	0,770
SPL VDMA 24422 mod.	LA	[dB(A)]	51	54	43
relative travel	T	[%]	85,6	76,4	30,1
Different. pressure ratio	xF		0,04	0,07	0,09
FL value	FL		0,91	0,93	0,97
Kc value	Kc		0,76	0,80	0,91
Valve style factor	Fd		0,43	0,42	0,21
z value at capacity	xFz		0,27	0,30	0,52
Level exponent	F1		-6,83	-6,87	-7,21
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0	0	0

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	47	Type	3251
Nominal size	DN ["]	2"	Body material	A351 CF8C
Pressure ratings	CLASS	900	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	50	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	3"	D2 ["]	3"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	81	s [mm]	5,49

Actuator data

Type			3277	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	700	Bench range	ps0 [bar]	2,4 ... 3,6	
(Defaults:	p1max [bar(a)]	70	p2min [bar(a)]	1,01	Supply	psu [bar]	3,80
			t1max [°C]	270)			

Actuator results

req. act. force	Fo req. [kN]	14,37	req. diff. psu-ps100	d ps [bar]	0,08
max. act. force	Fmax [kN]	50,06	Actuator force	Fa [kN]	16,80
max. dp on plug	d. pmax [bar]	81,28	Close safety factor	Fa/Fo (SF)	1,17
req. start bench range	ps0req. [bar]	2,26	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV100512 Tag no. FV100512
Process medium Natural Gas Fuel State of medium at inlet: gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	14500	2729	1500
Inlet pressure	p1	[bar(a)]	5,8	5,8	5,8
Outlet pressure	p2	[bar(a)]	2	3,5	1,2
Inlet temperature	t1	[°C]	20	20	20
Molar mass	M	[g/mol]	16,827	16,827	16,827
Isentropic exponent	gamma		1,3	1,3	1,3
Real gas factor	Z		0,995	0,995	0,995
Viscosity	eta	[mPas]	0,011037	0,011037	0,011037

Results and factors

Valve coeff. calculated	Cv		153	30,4	14,5
Min. req. size	Req. DN [mm]		146	48,0	60,8
Outlet velocity	w	[Mach]	0,311	0,0327	0,0523
SPL VDMA 24422 mod.	LA	[dB(A)]	81	68	68
relative travel	T	[%]	83,4	42,1	23,1
Different. pressure ratio	x		0,66	0,40	0,79
FL value	FL		0,93	0,97	0,97
xT value	xT		0,73	0,79	0,80
Valve style factor	Fd		0,43	0,30	0,18
Level exponent	G1		-4,58	-4,65	-4,75
Slope exponent	G2		1,02	0,75	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	290	Type	3241
Nominal size	DN	[""]	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	Flow div. I
Travel	S	[mm]	Charact.	Equal perc.
Seat bore	SB	[mm]	Flow direction	FTO
Stem diameter	Sd	[mm]	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	V
Sealing	lapped-in (10)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 [""]	12"	D2 [""]	12"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	308	s [mm]	9,53

Actuator data

Type					3277	Fail-safe act.	extends	
Diaphr. area	A		[cm²]	700		Bench range	ps0 [bar]	2,35 ... 3,8
						Supply	psu [bar]	4,00
(Defaults:	p1max [bar(a)]	9	p2min [bar(a)]	1,01	t1max [°C]	20)		

Actuator results

req. act. force	Fo req.	[kN]	14,80	req. diff. psu-ps100	d ps	[bar]	0,02
max. act. force	Fmax	[kN]	66,29	Actuator force	Fa	[kN]	16,45
max. dp on plug	d. pmax	[bar]	9,22	Close safety factor	Fa/Fo (SF)		1,11
req. start bench range	ps0req.	[bar]	2,33	Open safety factor	Ff/Fw		-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV100704 Tag no. FV100704
Process medium Water/Steam State of medium at inlet: vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	60000	52326	10000
Inlet pressure	p1	[bar(a)]	44	44	44
Outlet pressure	p2	[bar(a)]	43	42,3	33
Inlet temperature	t1	[°C]	490	490	490
Density	rho1	[kg/m³]	12,96	12,96	12,96
Isentropic exponent	gamma		1,278	1,278	1,278
Viscosity	eta	[mPas]	0,028241	0,028241	0,028241

Results and factors

Valve coeff. calculated	Cv		631	423	35,0
Min. req. size	Req. DN [mm]		92,1	86,7	42,9
Outlet velocity	w	[Mach]	0,0626	0,0564	0,0138
SPL VDMA 24422 mod.	LA	[dB(A)]	62	67	84
relative travel	T	[%]	96,0	85,8	22,1
Different. pressure ratio	x		0,02	0,04	0,25
FL value	FL		0,90	0,91	0,97
xT value	xT		0,69	0,71	0,80
Valve style factor	Fd		0,46	0,43	0,16
Level exponent	G1		-3,40	-3,55	-4,25
Slope exponent	G2		2,48	2,49	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	735	Type	3254
Nominal size	DN ["]	8"	Body material	A217 WC6
Pressure ratings	CLASS	900	Noise reduction	without
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	200	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	Graphite (10)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	248	s [mm]	15,09

Actuator data

Type		3271	Fail-safe act.	extends	
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]	1,4 ... 2,7
			Supply	psu [bar]	3,30
(Defaults:	p1max [bar(a)] 55	p2min [bar(a)] 1,01	t1max [°C] 500)		

Actuator results

req. act. force	Fm req. [kN]	15,72	req. diff. psu-ps100	d ps [bar]	0,60
max. act. force	Fmax [kN]	112,43	Actuator force	Fa [kN]	19,60
max. dp on plug	d. pmax [bar]	82,80	Close safety factor	Fa/Fo (SF)	1,25
req. start bench range	ps0req. [bar]	1,24	Open safety factor	Ff/Fw	-

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 18:11:49
Tag No.		FV-100805

Medium selection and state

Medium		Feed Gas
Operating temperature	t1	400,0 °C
State		Gaseous (Standard conditions)
Gas		Gas, dry

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	46,5	bar(a)
Absolute pressure downstream of valve	p2	46,0	bar(a)
Absolute pressure downstream of resist...	p2,end	45,1	bar(a)
Flow coefficient	Cv	1.635,3	GPM(US)
☐ Mass flow rate	qm	115.290,0	kg/h
☒ Volume flow rate (standard conditio...	qn	150.000,0	m³/h
Critical flow-related pressure difference	Δpc	11,752	bar(a)
Critical real pressure difference	ΔpXc	12,286	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ1	14,312	kg/m³
Operating density (t2, p2)	ρ2	14,159	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,023	mPa s
Isentropic exponent (t1, p1)	κ	1,208	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	ρn	0,76858	kg/m³
☐ Specific gas constant	R	482,64	J/(kg K)
☒ Molecular weight	M	17,227	kg/kmol
Real gas factor (standard conditions)	Zn	1,0	-

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 2281, 10", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	1.635,3	GPM(US)
Selected flow coefficient	Cv100	1.705,0	GPM(US)
Selected valve size	DN	10"	
Flow velocity	u1	44,158	m/s
Flow velocity	u2	44,638	m/s
Valve modifier (Cv/Cv100 = 0.75)	FL ²	0.42	-

Valve modifier (Cv/Cv100 = 0.75)	xT	0,343	-
Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-
☐ Function for FL ²			
☐ Function for xT			

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	96,225	%
Valve load	Cv/Cv1...	95,911	%
Valve modifier (operating conditions)	FL ²	0,367	-
Valve modifier (operating conditions)	xT	0,293	-
Valve style modifier (operating conditio...	Fd	0,789	-

Pipe downstream of valve

● Size class downstream of valve	DN2	16"	
Pressure class downstream of valve	PN2	Schedule 80	
○ Pipe outside diameter downstream ...	Da2	16,0	in
Pipe wall thickness downstream of ...	s2	0,84252	in
○ Pipe inside diameter downstream o...	Di2	14,315	in
Flow velocity in the pipe	u2R	21,783	m/s
Material group		Steel I	
Density of pipeline	ρP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)

VDMA 24422-05.89

Calculated values

Low-noise design		n.a.				
Level exponent	G1	-3,0				
Inclination exponent	G2	1,0				
	500-1000 Hz	1000-2000 Hz	2000-4000 Hz	4000-8000 Hz		
ΔL	3,0	3,0	3,0	3,0		dB
Pressure level (correction)		ΔL,Co	-10,0			dB
☐ Pressure level (mach no.)		ΔL,Ma				dB
Pressure level (resistances)		ΔL,Res	-5,0			dB
Sound power level		Lwi	113,0			dB
Sound power level (A-weighted)		LwAa	86,2			dB(A)
Sound pressure level of valve (A-weight...		LpAa	74,5			dB(A)
Sound pressure level of resistance struc...		La,res	86,7			dB(A)
Total sound level (valve and resistances)		La,tot	87,0			dB(A)

Minor noise prediction data

Pressure ratio	x	0,011	-
Acoustical efficiency factor	η	35,235	E -6
Ring frequency	fr	4.534,8	Hz
Speed of sound (p2)	cf2	626,47	m/s
Mach number (valve outlet)	MaDN	0,071252	-
Mach number (vena contracta)	MaVC	0,18771	-
Recommended nominal diameter (100...	DN	8,0	in
Power loss	P	112,48	kW
Stream power	Wm	200,56	kW

Spectrum

	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Lwi	98,6	102,0	105,0	108,0	111,0	dB
Rr	42,5	37,0	37,9	40,8	43,8	dB

LwAa	66,3	78,0	81,3	81,2	79,1	dB(A)
LpAa	54,6	66,3	69,5	69,5	67,4	dB(A)

Viscosity and laminar flow

Dynamic viscosity (t1,p1) η_1 0,023 mPa s

Influence of fittings

Piping geometry factor FP 0,977 -

Influence of resistance structures

Absolute pressure downstream of valve	p2	46,0	bar(a)
Absolute pressure downstream of resist...	p2,end	45,1	bar(a)
Type of resistance structure		Silencer (direct)	
Diameter of bores	d	5,0	mm
No. of resistances	n	1	-
Mach number per resistance (selected)	Ma	0,3	-
Type of flow		Non-critical	
Sound pressure level of resistance struc...	La,res	86,7	dB(A)
Sound pressure level of valve (A-weight...	LpAa	74,5	dB(A)
Total sound level (valve and resistances)	La,tot	87,0	dB(A)
DN of last perforated plate	DN	12,0	in
Bore spacing	a	8,0	mm
Number of bores in last plate	nΦ	1.178	-

Resistance structure in detail

No.	t1	p1	p2	Cv	rho1	rho2	La [dB]	Ma	DN Mx	DN M0,3	DN M0,7	DN M1,0
1	400,0	46,0	45,1	1.193,0	14,16	13,88	86,73	0,2907	5,0	5,0	4,0	2,7

Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	400,0	400,0	400,0	°C
t2	400,0	400,0	400,0	°C
p1	46,5	45,4	45,4	bar(a)
p2	46,0	44,702	34,125	bar(a)
p2,end	45,1	43,9	34,0	bar(a)
Cv	1.635,3	1.316,5	147,75	GPM(US)
qm	115.290,0	108.830,0	43.040,0	kg/h
qn	150.000,0	141.600,0	56.000,0	m³/h
Δpc	11,752	13,12	24,83	bar(a)
η_1	0,023	0,023	0,023	mPa s
κ	1,208	1,208	1,208	-
ρ1	14,312	13,974	13,974	kg/m³
ρ2	14,159	13,759	10,504	kg/m³
LpAa	74,5	76,1	90,6	dB(A)
La,res	86,7	85,8	70,5	dB(A)
La,tot	87,0	86,2	90,7	dB(A)
u1	44,158	42,694	16,885	m/s
u2	44,638	43,361	22,463	m/s
P	112,48	152,17	1.108,8	kW
MaDN	0,071252	0,069215	0,035857	-
s/s100	96,225	80,31	17,544	%
Cv/Cv1...	95,911	77,217	8,6655	%
Fd	0,789	0,743	0,365	-
FL²	0,367	0,406	0,676	-
xT	0,293	0,335	0,634	-
FP	0,977	0,985	1,0	-

**Turbulent flow
Non-critical**

**Turbulent flow
Non-critical**

**Turbulent flow
Non-critical**

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)

vDyn
ax

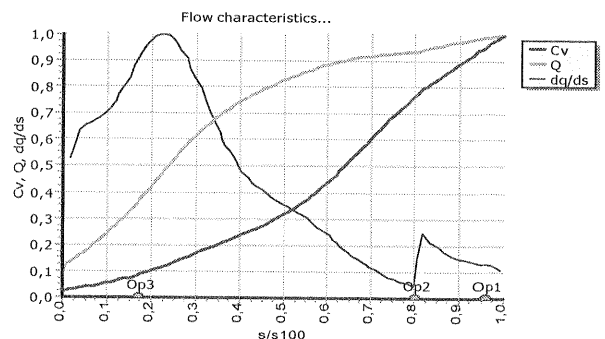
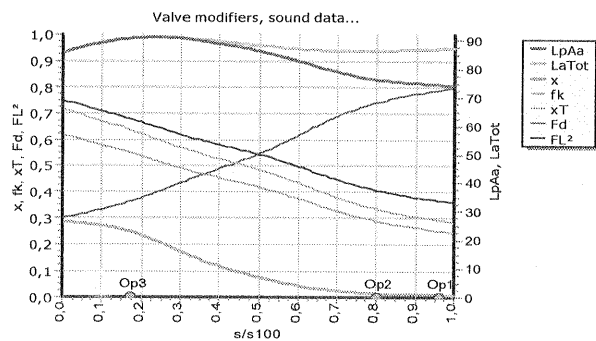
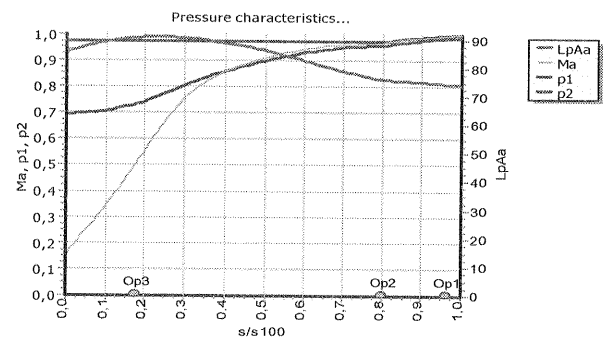
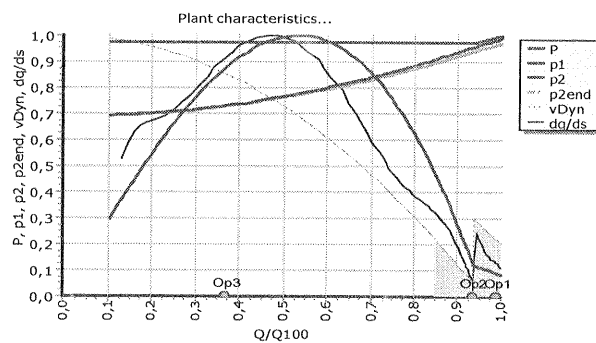
0,201
1,1291

-
-

Calculated short-circuit performance

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,0	25,0	50,0	74,99	100,0
t1	°C	400,0	400,0	400,0	400,0	400,0
p1	bar(a)	45,4	45,4	45,4	45,4	46,68
p2	bar(a)	32,6	36,04	41,93	44,54	46,21
p2,end	bar(a)	32,57	35,79	41,3	43,75	45,3
Cv	GPM(US)	65,53	223,5	537,9	1.177,0	1.705,0
qm	kg/h	20.200,0	60.510,0	96.030,0	108.100,0	116.300,0
qn	m³/h	26.280,0	78.730,0	124.900,0	140.700,0	151.300,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9674	0,7071	0,2625	0,06509	0,2014
pv1	bar(a)					
κ	-	1,208	1,208	1,208	1,208	1,208
LpAa	dB(A)	87,67	91,06	86,24	77,33	74,16
La,res	dB(A)	57,68	76,39	83,88	85,73	86,87
La,tot	dB(A)	87,67	91,2	88,23	86,31	87,09
MaDN	-	0,01762	0,04773	0,06512	0,06901	0,07155
u2	m/s	11,04	29,9	40,79	43,24	44,83
FP	-	0,9999	0,9994	0,9972	0,9878	0,9752



Warning:

The flow reserve to control Q_{max} is too low. Therefore the control quality is limited.

Hint:

- ① Influence of fittings
- ② Approximate value: Density of pipeline - ρ_P

Legend

-  Calculated value
-  Modified calculated value
-  Lookup value
-  Modified database value
-  Warning
-  Hint

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 18:16:18
Tag No.		FV-100807

Medium selection and state

Medium		Feed Gas
Operating temperature	t1	400,0 °C
State		Gaseous (Standard conditions)
Gas		Gas, dry

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	45,4	bar(a)
Absolute pressure downstream of valve	p2	44,0	bar(a)
Absolute pressure downstream of resist...	p2,end	43,0	bar(a)
Flow coefficient	Cv 	1.409,8	GPM(US)
☐ Mass flow rate	qm 	161.400,0	kg/h
☒ Volume flow rate (standard conditio...	qn	210.000,0	m³/h
Critical flow-related pressure difference	Δpc 	12,487	bar(a)
Critical real pressure difference	ΔpXc 	12,889	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ1 	13,974	kg/m³
Operating density (t2, p2)	ρ2 	13,543	kg/m³
☒ Dynamic viscosity (t1,p1)	η1 	0,023	mPa s
Isentropic exponent (t1, p1)	κ 	1,208	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	ρn 	0,76858	kg/m³
☐ Specific gas constant	R 	482,64	J/(kg K)
☒ Molecular weight	M	17,227	kg/kmol
Real gas factor (standard conditions)	Zn	1,0	-

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 2281, 10", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv 	1.409,8	GPM(US)
Selected flow coefficient	Cv100 	1.705,0	GPM(US)
Selected valve size	DN 	10"	
Flow velocity	u1 	63,319	m/s
Flow velocity	u2 	65,333	m/s
Valve style modifier (Cv/Cv100 = 1)	Fd 	0,8	-

☒ Function for FL^2 ☒ Function for xT**Load-dependent auxiliary values**

Stroke/angle-of-rotation ratio	s/s100	84,497	%
Valve load	Cv/Cv1...	82,688	%
Valve modifier (operating conditions)	FL^2	0,377	-
Valve modifier (operating conditions)	xT	0,319	-
Valve style modifier (operating conditio...	Fd	0,757	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	14"	
Pressure class upstream of valve	PN1	Schedule 80	
☐ Pipe outside diameter upstream of ...	Da1	14,0	in
Pipe wall thickness upstream of val...	s1	0,74803	in
☐ Pipe inside diameter upstream of v...	Di1	12,504	in
Flow velocity in the pipe	u1R	40,498	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	16"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	16,0	in
Pipe wall thickness downstream of ...	s2	0,84252	in
☐ Pipe inside diameter downstream o...	Di2	14,315	in
Flow velocity in the pipe	u2R	31,883	m/s
Material group		Steel I	
Density of pipeline	ρ_P	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)

VDMA 24422-05.89

Calculated values

Low-noise design			n.a.		
Level exponent		G1		-3,0	-
Inclination exponent		G2		1,0	-
	500-1000 Hz	1000-2000 Hz	2000-4000 Hz	4000-8000 Hz	
ΔL	3,0	3,0	3,0	3,0	dB
Pressure level (correction)		ΔL_{Co}		-10,0	dB
☐ Pressure level (mach no.)		ΔL_{Ma}			dB
Pressure level (resistances)		ΔL_{Res}		-5,0	dB
Sound power level		L_{wi}		123,0	dB
Sound power level (A-weighted)		L_{wAa}		96,0	dB(A)
Sound pressure level of valve (A-weight...		L_{pAa}		84,2	dB(A)
Sound pressure level of resistance struc...		$L_{a,res}$		80,0	dB(A)
Total sound level (valve and resistances)		$L_{a,tot}$		85,6	dB(A)

Minor noise prediction data

Pressure ratio	x	0,031	-
Acoustical efficiency factor	η	93,801	E -6
Ring frequency	fr	4.534,8	Hz
Speed of sound (p2)	cf2	626,47	m/s
Mach number (valve outlet)	MaDN	0,10429	-
Mach number (vena contracta)	MaVC	0,30627	-
Recommended nominal diameter (100...	DN	10,0	in
Power loss	P	456,25	kW
Stream power	Wm	747,51	kW

Spectrum

	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Lwi	109,0	112,0	115,0	118,0	121,0	dB
Rr	42,6	37,2	38,1	41,0	44,0	dB
LwAa	76,1	87,8	91,0	91,0	88,9	dB(A)
LpAa	64,4	76,1	79,3	79,3	77,2	dB(A)

Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η_1 	0,023	mPa s
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Influence of fittings

Piping geometry factor	FP  	0,982	-
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Influence of resistance structures

Absolute pressure downstream of valve	p2	44,0	bar(a)
Absolute pressure downstream of resist...	p2,end	43,0	bar(a)
Type of resistance structure		Silencer (direct)	
Diameter of bores	d	5,0	mm
No. of resistances	n	2	-
Mach number per resistance (selected)	Ma	0,3	-
Type of flow		Non-critical	
Sound pressure level of resistance struc...	La,res 	80,0	dB(A)
Sound pressure level of valve (A-weight...	LpAa 	84,2	dB(A)
Total sound level (valve and resistances)	La,tot 	85,6	dB(A)
DN of last perforated plate	DN 	16,0	in
Bore spacing	a 	8,0	mm
Number of bores in last plate	nΦ 	2.272	-

Resistance structure in detail

No.	t1	p1	p2	Cv	rho1	rho2	La [dB]	Ma	DN Mx	DN M0,3	DN M0,7	DN M1,0
1	400,0	44,0	43,5	2.275,0	13,54	13,39	77,01	0,293	6,0	6,0	4,0	4,0
2	400,0	43,5	43,0	2.301,0	13,39	13,24	76,97	0,2964	6,0	6,0	4,0	4,0

Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	400,0	400,0	400,0	°C
t2	400,0	400,0	400,0	°C
p1	45,4	45,4	45,4	bar(a)
p2	44,0	42,869	33,609	bar(a)
p2,end	43,0	42,0	33,6	bar(a)
Cv	1.409,8	990,92	52,414	GPM(US)
qm	161.400,0	150.420,0	15.372,0	kg/h
qn	210.000,0	195.710,0	20.000,0	m³/h
Δpc	12,487	14,323	23,864	bar(a)
η_1	0,023	0,023	0,023	mPa s
κ	1,208	1,208	1,208	-
ρ1	13,974	13,974	13,974	kg/m³
ρ2	13,543	13,195	10,345	kg/m³
LpAa	84,2	87,9	86,9	dB(A)
La,res	80,0	78,8	39,8	dB(A)
La,tot	85,6	88,4	86,9	dB(A)
u1	63,319	59,01	6,0303	m/s
u2	65,333	62,495	8,1459	m/s
P	456,25	778,85	417,17	kW

MaDN	0,10429	0,099757	0,013003	-
s/s100	84,497	68,644	2,3978	%
Cv/Cv1...	82,688	58,118	3,0741	%
Fd	0,757	0,679	0,309	-
FL ²	0,377	0,48	0,597	-
xT	0,319	0,366	0,609	-
FP	0,982	0,991	1,0	-
	Turbulent flow	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)

vDyn

0,101

-

Calculated short-circuit performance

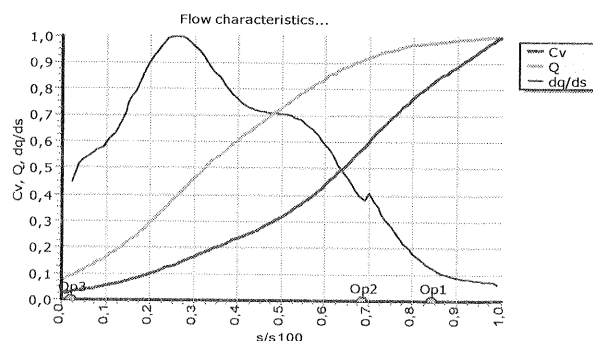
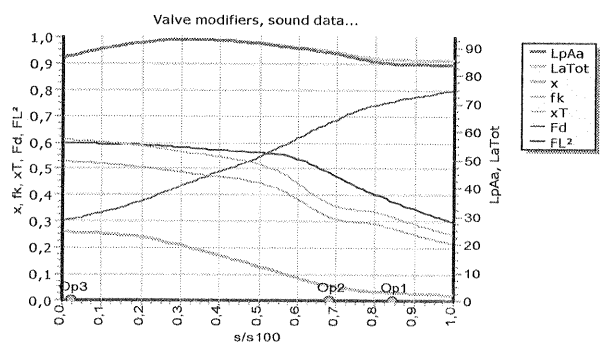
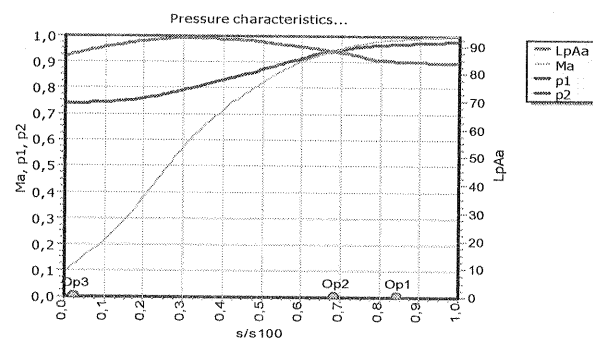
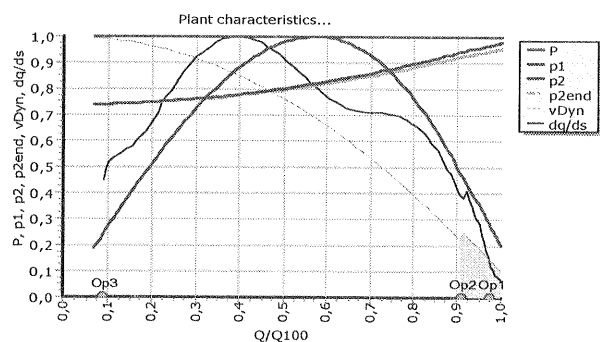
ax

1,0783

-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,004	25,0	50,0	75,0	99,56
t1	°C	400,0	400,0	400,0	400,0	400,0
p1	bar(a)	45,4	45,4	45,4	45,4	45,4
p2	bar(a)	33,66	35,11	39,5	43,49	44,38
p2,end	bar(a)	33,65	34,96	38,94	42,55	43,34
Cv	GPM(US)	65,54	223,5	537,9	1.178,0	1.698,0
qm	kg/h	19.180,0	62.130,0	120.300,0	156.600,0	164.900,0
qn	m³/h	24.960,0	80.840,0	156.600,0	203.700,0	214.600,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9872	0,8657	0,4963	0,1905	0,1008
pv1	bar(a)					
κ	-	1,208	1,208	1,208	1,208	1,208
LpAa	dB(A)	87,84	92,27	91,25	86,07	83,71
La,res	dB(A)	43,95	64,21	75,28	79,51	80,35
La,tot	dB(A)	87,84	92,27	91,36	86,94	85,35
MaDN	-	0,0162	0,05031	0,08661	0,1024	0,1057
u2	m/s	10,15	31,52	54,26	64,12	66,19
FP	-	0,9999	0,9994	0,9969	0,9876	0,9742



Warning:

 The flow reserve to control Q,max is too low. Therefore the control quality is limited.

Hint:

-  Influence of fittings
-  Approximate value: Density of pipeline - ρ_P

Legend

-  Calculated value
-  Modified calculated value
-  Lookup value
-  Modified database value
-  Warning
-  Hint

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV100825 Tag no. FV100825
Process medium Water/Steam State of medium at inlet: vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	40000	30000	8000
Inlet pressure	p1	[bar(a)]	41	41	41
Outlet pressure	p2	[bar(a)]	36	35	11
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	14,111	14,111	14,111
Isentropic exponent	gamma		1,2858	1,2858	1,2858
Viscosity	eta	[mPas]	0,024152	0,024152	0,024152

Results and factors

Valve coeff. calculated	Cv		188	130	21,5
Min. req. size	Req. DN [mm]		78,9	69,3	63,8
Outlet velocity	w	[Mach]	0,0830	0,0640	0,0543
SPL VDMA 24422 mod.	LA	[dB(A)]	81	79	78
relative travel	T	[%]	96,0	86,5	40,6
Different. pressure ratio	x		0,12	0,15	0,73
FL value	FL		0,92	0,93	0,97
xT value	xT		0,71	0,74	0,80
Valve style factor	Fd		0,46	0,43	0,28
Level exponent	G1		-5,45	-5,55	-5,68
Slope exponent	G2		0,25	0,25	0,25

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	220	Type	3251
Nominal size	DN ["]	6"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.III
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	125	Flow direction	FTO
Stem diameter	Sd [mm]	25	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	157	s [mm]	10,97

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	2800	Bench range	ps0 [bar]	2,8 ... 3,8	
			Supply	psu [bar]	4,00	
(Defaults:	p1max [bar(a)] 55	p2min [bar(a)] 1,01	t1max [°C] 420)			

Actuator results

req. act. force	Fo req. [kN]	67,88	req. diff. psu-ps100	d ps [bar]	0,03
max. act. force	Fmax [kN]	60,27	Actuator force	Fa [kN]	78,40
max. dp on plug	d. pmax [bar]	47,75	Close safety factor	Fa/Fo (SF)	1,15
req. start bench range	ps0req. [bar]	2,67	Open safety factor	Ff/Fw	-

Propl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV100831 Tag no. FV100831
Process medium Water/Steam State of medium at inlet: vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	20000	8000	2000
Inlet pressure	p1	[bar(a)]	41	41	41
Outlet pressure	p2	[bar(a)]	11	11	6
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	14,111	14,111	14,111
Isentropic exponent	gamma		1,2858	1,2858	1,2858
Viscosity	eta	[mPas]	0,024152	0,024152	0,024152

Results and factors

Valve coeff. calculated	Cv		52,3	21,5	5,13
Min. req. size	Req. DN [mm]		101	63,8	43,2
Outlet velocity	w	[Mach]	0,136	0,0543	0,0249
SPL VDMA 24422 mod.	LA	[dB(A)]	82	77	69
Flow condition					Choked flow
relative travel	T	[%]	86,1	63,5	26,8
Different. pressure ratio	x		0,73	0,73	0,85
FL value	FL		0,96	0,97	0,98
xT value	xT		0,78	0,80	0,81
Valve style factor	Fd		0,43	0,40	0,20
Level exponent	G1		-5,75	-5,78	-5,85
Slope exponent	G2		0,25	0,25	0,25

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	90	Type	3251
Nominal size	DN	6"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.III
Travel	S	30	Charact.	Equal perc.
Seat bore	SB	80	Flow direction	FTO
Stem diameter	Sd	25	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	157	s [mm]	10,97

Actuator data

Type			3271	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	1400	Bench range	ps0	[bar]	2,45 ... 3,2
(Defaults:	p1max	[bar(a)]	55	Supply	psu	[bar]	3,40
	p2min	[bar(a)]	1,01	t1max	[°C]		420)

Actuator results

req. act. force	Fo req.	[kN]	28,44	req. diff. psu-ps100	d ps	[bar]	0,06
max. act. force	Fmax	[kN]	60,27	Actuator force	Fa	[kN]	34,30
max. dp on plug	d. pmax	[bar]	65,55	Close safety factor	Fa/Fo (SF)		1,21
req. start bench range	ps0req.	[bar]	2,23	Open safety factor	Ff/Fw		-

Propsl./order no.: 525 000
Project: 4th Methanol Plant

Customer LURGI - PIDEK
Date: 05.07.2005 Data entered by: V12/Di



Valve Sizing Version 4.05B

Item no.	FV101019	Tag no.	FV101019
Process medium	Oxigene	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	45000	29500	10000
Inlet pressure	p1	[bar(a)]	39,6	39,8	39,9
Outlet pressure	p2	[bar(a)]	37,2	34	33
Inlet temperature	t1	[°C]	20	20	20
Molar mass	M	[g/mol]	31,999	31,999	31,999
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		0,95868	0,95848	0,95838
Viscosity	eta	[mPas]	0,010282	0,010292	0,010297

Results and factors

Valve coeff. calculated	Cv		214	93,5	29,3
Min. req. size	Req. DN [mm]		68,9	58,4	34,5
Outlet velocity	w	[Mach]	0,0378	0,0264	0,00931
SPL VDMA 24422 mod.	LA	[dB(A)]	70	84	81
relative travel	T	[%]	82,7	61,5	31,9
Different. pressure ratio	x		0,06	0,15	0,17
FL value	FL		0,94	0,96	0,97
xT value	xT		0,75	0,78	0,80
Valve style factor	Fd		0,43	0,40	0,22
Level exponent	G1		-3,95	-4,20	-4,30
Slope exponent	G2		2,50	1,77	1,62

Valve data

Body type		Globe valve		Series		Globe valve
Valve coefficient	Cv	420		Type		3251
Nominal size	DN ["]	8"		Body material		A351 CF8C
Pressure ratings	CLASS	600		Noise reduction		without
Travel	S [mm]	60		Charact.		Equal perc.
Seat bore	SB [mm]	150		Flow direction		FTO
Stem diameter	Sd [mm]	40		Balanced		without (0,0)
Packing	Graphit (20)			Leakage rate		V
Sealing	lapped-in (10)			Bonnet		standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	255	s [mm]	6,35

Actuator data

Type			3271Tandem	Fail-safe act.		extends	
Diaphr. area	A	[cm²]	5600	Bench range		ps0	[bar]
				Supply		psu	[bar]
(Defaults:	p1max [bar(a)]	42	p2min [bar(a)]	1,01	t1max [°C]	100)	
							2 ... 2,6
							3,93

Actuator results

req. act. force	Fo req.	[kN]	79,74	req. diff. psu-ps100	d ps	[bar]	0,05
max. act. force	Fmax	[kN]	162,52	Actuator force	Fa	[kN]	112,00
max. dp on plug	d. pmax	[bar]	59,17	Close safety factor	Fa/Fo (SF)		1,40
req. start bench range	ps0req.	[bar]	1,57				

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV101021 Tag no. FV101021
Process medium Water/Steam State of medium at inlet: vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	7000	4500	2000
Inlet pressure	p1	[bar(a)]	44	44	44
Outlet pressure	p2	[bar(a)]	37	36,1	33
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	15,216	15,216	15,216
Isentropic exponent	gamma		1,2855	1,2855	1,2855
Viscosity	eta	[mPas]	0,02415	0,02415	0,02415

Results and factors

Valve coeff. calculated	Cv		28,0	16,8	6,48
Min. req. size	Req. DN [mm]		32,5	26,4	18,4
Outlet velocity	w	[Mach]	0,147	0,0959	0,0452
SPL VDMA 24422 mod.	LA	[dB(A)]	80	77	76
relative travel	T	[%]	86,8	73,7	49,4
Different. pressure ratio	x		0,16	0,18	0,25
FL value	FL		0,91	0,93	0,96
xT value	xT		0,70	0,74	0,78
Valve style factor	Fd		0,43	0,42	0,33
Level exponent	G1		-3,49	-3,66	-3,81
Slope exponent	G2		1,68	1,59	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	47	Type	3251
Nominal size	DN ["]	2"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	50	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	106	s [mm]	8,56

Actuator data

Type		3277	Fail-safe act.	extends
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]
			Supply	psu [bar]
(Defaults: p1max [bar(a)] 55	p2min [bar(a)] 1,01	t1max [°C] 420)		2,1 ... 3,3
				3,50

Actuator results

req. act. force	Fo req. [kN]	11,42	req. diff. psu-ps100	d ps [bar]	0,08
max. act. force	Fmax [kN]	44,94	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	70,58	Close safety factor	Fa/Fo (SF)	1,29
req. start bench range	ps0req. [bar]	1,79	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV101039	Tag no.	FV101039
Process medium	Oxygen	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	59000	54800	15000
Inlet pressure	p1	[bar(a)]	39,6	39,6	39,9
Outlet pressure	p2	[bar(a)]	38,5	38,4	34
Inlet temperature	t1	[°C]	20	20	20
Molar mass	M	[g/mol]	31,999	31,999	31,999
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		0,95868	0,95868	0,95838
Viscosity	eta	[mPas]	0,020823	0,020823	0,020831

Results and factors

Valve coeff. calculated	Cv		411	365	47,0
Min. req. size	Req. DN [mm]		77,6	74,9	41,6
Outlet velocity	w	[Mach]	0,0471	0,0439	0,0133
SPL VDMA 24422 mod.	LA	[dB(A)]	70	70	84
relative travel	T	[%]	99,4	96,4	44,0
Different. pressure ratio	x		0,03	0,03	0,15
FL value	FL		0,91	0,92	0,97
xT value	xT		0,71	0,72	0,80
Valve style factor	Fd		0,47	0,45	0,29
Level exponent	G1		-3,00	-3,06	-3,95
Slope exponent	G2		2,50	2,50	1,76

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	420	Type	3251
Nominal size	DN ["]	8"	Body material	A351 CF8C
Pressure ratings	CLASS	600	Noise reduction	without
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	150	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	V
Sealing	lapped-in (10)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	255	s [mm]	6,35

Actuator data

Type		3271Tandem	Fail-safe act.	extends
Diaphr. area	A [cm²]	5600	Bench range	ps0 [bar] 2 ... 2,6
(Defaults: p1max [bar(a)] 55	p2min [bar(a)] 1,01	t1max [°C] 100)	Supply	psu [bar] 2,80

Actuator results

req. act. force	Fo req. [kN]	101,46	req. diff. psu-ps100	d ps [bar]	0,03
max. act. force	Fmax [kN]	162,52	Actuator force	Fa [kN]	112,00
max. dp on plug	d. pmax [bar]	59,88	Close safety factor	Fa/Fo (SF)	1,10
req. start bench range	ps0req. [bar]	1,99	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV101041 Tag no. FV101041
Process medium Water/Steam State of medium at inlet: vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	8400	4000
Inlet pressure	p1	[bar(a)]	44	44	44
Outlet pressure	p2	[bar(a)]	37	36,1	33
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	15,216	15,216	15,216
Isentropic exponent	gamma		1,2855	1,2855	1,2855
Viscosity	eta	[mPas]	0,02415	0,02415	0,02415

Results and factors

Valve coeff. calculated	Cv		38,9	31,1	12,9
Min. req. size	Req. DN [mm]		38,9	36,1	26,0
Outlet velocity	w	[Mach]	0,0803	0,0690	0,0353
SPL VDMA 24422 mod.	LA	[dB(A)]	80	79	76
relative travel	T	[%]	86,1	80,4	58,0
Different. pressure ratio	x		0,16	0,18	0,25
FL value	FL		0,93	0,94	0,96
xT value	xT		0,74	0,75	0,78
Valve style factor	Fd		0,43	0,42	0,39
Level exponent	G1		-4,72	-4,86	-4,98
Slope exponent	G2		0,75	0,75	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	67	Type	3251
Nominal size	DN ["]	3"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.I
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	106	s [mm]	8,56

Actuator data

Type		3271	Fail-safe act.	extends
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]
			Supply	psu [bar]
(Defaults:	p1max [bar(a)] 55	p2min [bar(a)] 1,01	t1max [°C] 420)	1,6 ... 2,4
				2,60

Actuator results

req. act. force	Fo req. [kN]	17,74	req. diff. psu-ps100	d ps [bar]	0,04
max. act. force	Fmax [kN]	44,94	Actuator force	Fa [kN]	22,40
max. dp on plug	d. pmax [bar]	68,89	Close safety factor	Fa/Fo (SF)	1,26
req. start bench range	ps0req. [bar]	1,39	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV101122	Tag no.	FV101122
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	4000	3700	3000
Inlet pressure	p1	[bar(a)]	44	44	44
Outlet pressure	p2	[bar(a)]	36,5	36,5	10
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	15,216	15,216	15,216
Isentropic exponent	gamma		1,2855	1,2855	1,2855
Viscosity	eta	[mPas]	0,02415	0,02415	0,02415

Results and factors

Valve coeff. calculated	Cv		15,2	14,0	7,25
Min. req. size	Req. DN [mm]		24,8	23,8	41,0
Outlet velocity	w	[Mach]	0,0767	0,0716	0,214
SPL VDMA 24422 mod.	LA	[dB(A)]	74	74	81
relative travel	T	[%]	86,3	84,2	67,4
Different. pressure ratio	x		0,17	0,17	0,77
FL value	FL		0,93	0,94	0,97
xT value	xT		0,74	0,74	0,79
Valve style factor	Fd		0,43	0,43	0,32
Level exponent	G1		-4,44	-4,45	-4,66
Slope exponent	G2		0,75	0,75	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	26	Type	3251
Nominal size	DN ["]	2"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.I
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	38	Flow direction	FTO
Stem diameter	Sd [mm]	12	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	3"	D2 ["]	3"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	82	s [mm]	7,62

Actuator data

Type		3277	Fail-safe act.	retracts		
Diaphr. area	A [cm²]	350	Bench range	ps0 [bar]	0,2 ... 1	
(Defaults:	p1max [bar(a)] 55	p2min [bar(a)] 1,01	t1max [°C] 420)	Supply	psu [bar]	3,12

Actuator results

req. act. force	Fo req. [kN]	6,74	req. diff. psu-ps100	d ps [bar]	2,12
max. act. force	Fmax [kN]	23,14	Actuator force	Fa [kN]	7,42
max. dp on plug	d. pmax [bar]	59,88	Close safety factor	Fa/Fo (SF)	1,10
req. start bench range	ps0req. [bar]	0,12	Open safety factor	Ff/Fw	1,85



Valve Sizing Version 4.04

Item no.	FV101125	Tag no.	FV101125
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

Process and medium data			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	9800	3000
Inlet pressure	p1	[bar(a)]	44	44	44
Outlet pressure	p2	[bar(a)]	36,5	36,5	34
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	15,216	15,216	15,216
Isentropic exponent	gamma		1,2855	1,2855	1,2855
Viscosity	eta	[mPas]	0,02415	0,02415	0,02415

Results and factors

Valve coeff. calculated	Cv	37,9	37,1	10,0
Min. req. size	Req. DN [mm]	39,1	38,7	22,2
Outlet velocity	w [Mach]	0,0810	0,0800	0,0261
SPL VDMA 24422 mod.	LA [dB(A)]	76	76	72
relative travel	T [%]	85,4	84,9	51,5
Different. pressure ratio	x	0,17	0,17	0,23
FL value	FL	0,94	0,94	0,97
xT value	xT	0,74	0,74	0,79
Valve style factor	Fd	0,43	0,43	0,34
Level exponent	G1	-4,58	-4,58	-4,77
Slope exponent	G2	1,64	1,64	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	67	Type	3251
Nominal size	DN [""]	3"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.I
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	106	s [mm]	8.56

Actuator data

Type					3277		Fail-safe act.		retracts			
Diaphr. area	A		[cm²]		700		Bench range		ps0		[bar] 0,2 ... 1	
							Supply		psu		[bar] 3,79	
(Defaults:	p1max	[bar(a)]	55	p2min	[bar(a)]	1,01	t1max	[°C]	420)			

Actuator results

req. act. force	Fo req. [kN]	17,74	req. diff. psu-ps100	d ps [bar]	2,79
max. act. force	Fmax [kN]	44,94	Actuator force	Fa [kN]	19,53
max. dp on plug	d. pmax [bar]	59,68	Close safety factor	Fa/Fo (SF)	1,10
req. start bench range	ps0req. [bar]	0,08	Open safety factor	Ff/Fw	2,75

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV101229A Tag no. FV101229A
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	60000	
Inlet pressure	p1	[bar(a)]	155	152	
Outlet pressure	p2	[bar(a)]	21	125	
Inlet temperature	t1	[°C]	111	111	
Density	rho1	[kg/m³]	957,32	957,46	
Vapor pressure	pv	[bar(a)]	1,4826	1,4826	
Critical pressure	pc	[bar(a)]	221,2	221,2	
Viscosity	eta	[mPas]	0,25624	0,25631	

Results and factors

Valve coeff. calculated	Cv		1,03	13,8
Min. req. size	Req. DN [mm]		27,2	66,6
Outlet velocity	w	[m/s]	0,369	2,22
SPL VDMA 24422 mod.	LA	[dB(A)]	72	61
Flow condition			Critical cavitation	
relative travel	T	[%]	33,4	99,6
Different. pressure ratio	xF		0,87	0,18
FL value	FL		0,97	0,98
Kc value	Kc		0,92	0,94
Valve style factor	Fd		0,42	0,18
z value at capacity	xFz		0,80	0,80
Level exponent	F1		-6,94	-7,97
Slope exponent	F2		0,30	0,30
Correct. term	delta Lf	[dB]	-7,54	-6,68

Valve data

Body type		Globe valve	Series	multistage valve
Valve coefficient	Cv	14	Type	3251M
Nominal size	DN	[""]	Body material	A216 WCB
Pressure ratings	CLASS	1500	Noise reduction	without
Travel	S	[mm]	Charact.	Equal perc.
Seat bore	SB	[mm]	Flow direction	FTO
Stem diameter	Sd	[mm]	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	233	s [mm]	31,75

Actuator data

Type					3271	Fail-safe act.	extends		
Diaphr. area	A		[cm²]		1400	Bench range	ps0	[bar] 2 ... 2,4	
							Supply	psu	[bar] 2,60
(Defaults:	p1max	[bar(a)]	181	p2min	[bar(a)]	1,01	t1max	[°C]	160)

Actuator results

req. act. force	Fo req.	[kN]	20,81	req. diff. psu-ps100	d ps	[bar]	0,01
max. act. force	Fmax	[kN]	53,82	Actuator force	Fa	[kN]	28,00
max. dp on plug	d. pmax	[bar]	243,17	Close safety factor	Fa/Fo (SF)		1,35
req. start bench range	ps0req.	[bar]	1,64	Open safety factor	Ff/Fw		-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV101229B-1 Tag no. FV101229B
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	270000	270000	350000
Inlet pressure	p1	[bar(a)]	152	152	140
Outlet pressure	p2	[bar(a)]	125	148,5	136
Inlet temperature	t1	[°C]	111	111	111
Density	rho1	[kg/m³]	956,76	957,32	957,46
Vapor pressure	pv	[bar(a)]	1,4826	1,4826	1,4826
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,25592	0,25624	0,25631

Results and factors

Valve coeff. calculated	Cv	62,2	173	210
Min. req. size	Req. DN [mm]	141	141	161
Outlet velocity	w [m/s]	2,50	2,49	3,23
SPL VDMA 24422 mod.	LA [dB(A)]	81	62	54
relative travel	T [%]	60,4	86,5	91,5
Different. pressure ratio	xF	0,18	0,02	0,03
FL value	FL	0,94	0,95	0,98
Kc value	Kc	0,83	0,85	0,93
Valve style factor	Fd	0,44	0,43	0,14
z value at capacity	xFz	0,20	0,21	0,48
Level exponent	F1	-7,23	-7,25	-7,54
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0	0

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3254
Nominal size	DN ["]	Body material	A216 WCB
Pressure ratings	PN	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	PTFE (1,6)
Packing	PTFE (1,6)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	250	s [mm]	31,75

Actuator data

Type	3271	Fail-safe act.	extends
Diaphr. area	A [cm²]	Bench range	ps0 [bar]
	2800	Supply	1,6 ... 2,4
(Defaults: p1max [bar(a)] 181 p2min [bar(a)] 1,01 t1max [°C] 160)			psu [bar]
			2,60

Actuator results

req. act. force	Fm req. [kN]	24,29	req. diff. psu-ps100	d ps [bar]	0,03
max. act. force	Fmax [kN]	150,99	Actuator force	Fa [kN]	44,80
max. dp on plug	d. pmax [bar]	341,19	Close safety factor	Fa/Fo (SF)	1,84
req. start bench range	ps0req. [bar]	0,95	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV101229B-2 Tag no. FV101229B
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	60000	70000	50000
Inlet pressure	p1	[bar(a)]	152	140	155
Outlet pressure	p2	[bar(a)]	148,5	136	125
Inlet temperature	t1	[°C]	111	111	111
Density	rho1	[kg/m³]	956,76	957,32	957,46
Vapor pressure	pv	[bar(a)]	1,4826	1,4826	1,4826
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,25592	0,25624	0,25631

Results and factors

Valve coeff. calculated	Cv		38,4	41,9	10,9
Min. req. size	Req. DN [mm]		66,6	71,9	60,8
Outlet velocity	w	[m/s]	0,554	0,647	0,462
SPL VDMA 24422 mod.	LA	[dB(A)]	56	57	64
relative travel	T	[%]	48,1	50,3	15,9
Different. pressure ratio	xF		0,02	0,03	0,20
FL value	FL		0,94	0,95	0,98
Kc value	Kc		0,83	0,85	0,93
Valve style factor	Fd		0,44	0,43	0,14
z value at capacity	xFz		0,20	0,21	0,48
Level exponent	F1		-7,23	-7,25	-7,54
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0	0	0

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	290	Type	3254
Nominal size	DN ["]	8"	Body material	A216 WCB
Pressure ratings	PN	1500	Noise reduction	without
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	125	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	PTFE (1,6)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	250	s [mm]	31,75

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	2800	Bench range	ps0 [bar]	1,6 ... 2,4	
(Defaults: p1max [bar(a)] 181 p2min [bar(a)] 1,01 t1max [°C] 160)			Supply	psu [bar]	2,60	

Actuator results

req. act. force	Fm req. [kN]	24,29	req. diff. psu-ps100	d ps [bar]	0,03
max. act. force	Fmax [kN]	150,99	Actuator force	Fa [kN]	44,80
max. dp on plug	d. pmax [bar]	341,19	Close safety factor	Fa/Fo (SF)	1,84
req. start bench range	ps0req. [bar]	0,95	Open safety factor	Ff/Fw	-



Dampfkühler-Datenblatt SA.RV.000769

DESUPERHEATER-DATA SHEET

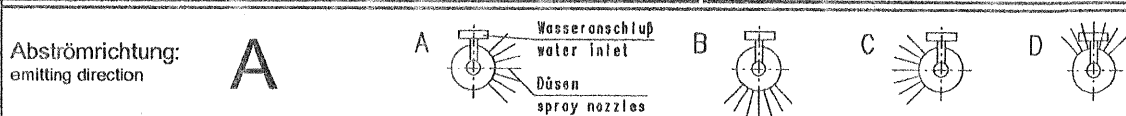
Verteiler
Ordner
Auftrag

Anlage: project	2 nd Methanol	Kom.-Nr./Ang.-Nr.: work-no./quotation-no.	K04-0618.1
Kunde: customer	SAMSOMATIC GmbH	Ventiltyp: type	DKVP 088/116U-PH1
Anlagenkennz./Pos.: item-no	No.: FV-101432 / 100-22	Stückzahl: quantity	1.00
Auftrags-Nr.: order-no.	976524/4060/742	Liefertermin: delivery	08.11.2004
Spezifikation/Abnahme: specification	EN 10 204 - 3.1 B	Auslegungsdaten: design data	54,00/ 98bar 420/ 140°C

Betriebsdaten operating data	Medium: Dampf medium					Kühlwasser coolwater					
	vor Einspritzung before injection	Menge: flow rate	kg/s	2.78	13.89	15.83	Menge flow rate	kg/s	0.04	1	1.03
		Druck: pressure	bar abs	45.5	45.5	45.5	Druck pressure	bar abs	64	64	64
		Temperatur: temperature	°C	395	395	395	Temperatur temperature	°C	111	111	111
		Enthalpie: enthalpie	kJ/kg				Enthalpie enthalpie	kJ/kg			
	nach Einspritzung after injection	Druck: pressure	bar abs	45.5	45.5	45.5	Kv errechnet Kv	m³/h	0.03	0.86	0.88
		Temperatur: temperature	°C	381	323.6	329.7					
		Enthalpie: enthalpie	kJ/kg								
		Menge: flow rate	kg/s	2.82	14.89	16.86					

Kühlerausführung
desuperheater design

K _{vs} [m³/h]: K _{vs}	1	Kennlinie: characteristic	gl%	Hub [mm]: stroke	32	Stellzeit normal/schnell [sek]: stroke time	/
		DN	PN	Flansch-Norm type of flange		Gehäuse-Material: body-material	1.5415
Eintritt-Kühlwasser: inlet coolwater	2"	1500# RF	ASMS B 16.5			Dampfleitung steam pipe	ãØ 184,40 x 12,70 Wd
Montageflansch: mounting flange	4"	600# RF	ASME B 16.5			Einbaulage installation	Horizontal horizontal
							Vertikal vertical



Anstrich : SA Standard
painting

Antrieb actuator	Ap-Antrieb: öffnen/schließen ap-actuator. open/ close		98	elektr. Drehantr. electric actuator	pneum. Schubantr.: pneumatic actuator	Sonstiges: Pneumatik antrieb special	
	Hersteller: SAMSON manufacturer			Typ: 3277 (700 cm2, 2,1 - 3,3) type			
	Drehm.: Nm torque	U/Hub: revolution/stroke	U/min: revolution/minute	Feder öffnet spring open	schließt ☒ closed	doppeltwirkend double-action	
	U/f: V/Hz voltage	DE: Stck torque switches	WE: Stck limit switches	Eingangssignal pneum. elektr. ☒ input signal pneum. electr.		Eingangssignal: 4-20 mA input signal	
	ESR: Stck mA electronic positioner		Stecker Klemmen plug terminals	Stellungsregler ☒ positioner	Verstärker ☒ booster	Verblockung interblock relais	Handrad handwheel
	Goldkontakte gold contacts			Magnetventil solenoid valve	Zuluftdruck : 10,00bar air supply	Druckminderer ☒ pressure reducing	

Bemerkungen:
remarks

Zuluftdruck 4 - 9 bar ü

Antriebsstange einfahrend schließt Kühler

Ausführung wie unter K03-0227.1 geliefert

Typenschild kompl. in engl. Sprache, mit Angabe cvs = 1,16

Revision	Datum	Änderungen	Name	Unterschrift
1	07.09.2004	Hinweis Typenschild	SKEPLER	
0	29.07.2004	Erstellung	KEPLER	

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Dampfkühler-Datenblatt SA.RV.000770

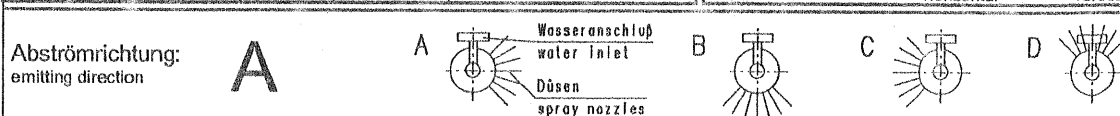
DESUPERHEATER-DATA SHEET

Verteiler
Ordner
Auftrag

Anlage: project	2 nd Methanol	Kom.-Nr./Ang.-Nr.: work-no./quotation-no.	K04-0618.2
Kunde: customer	SAMSOMATIC GmbH	Ventiltyp: type	DKVP 088/117U-LH1
Anlagenkennz./Pos.: item-no	No.: FV-101433 / 100-23	Stückzahl: quantity	1.00
Auftrags-Nr.: order-no.	976524/4060/742	Liefertermin: delivery	08.11.2004
Spezifikation/Abnahme: specification	EN 10 204 - 3.1 B	Auslegungsdaten: design data	54,00/ 98bar 470/ 140°C

Betriebsdaten operating data		Medium: Dampf medium					Kühlwasser coolwater									
		vor Einspritzung before injection					Menge flow rate	kg/s	17.5	43.89	50.56	Menge flow rate	kg/s	0.83	3.81	4.39
							Druck: pressure	bar abs	45.5	45.5	45.5	Druck pressure	bar abs	64	64	64
							Temperatur: temperature	°C	336	414	460	Temperatur temperature	°C	111	111	111
							Enthalpie: enthalpie	kJ/kg				Enthalpie enthalpie	kJ/kg			
		nach Einspritzung after injection					Druck: pressure	bar abs	45.5	45.5	45.5	Kv errechnet Kv	m³/h	0.71	3.26	3.77
							Temperatur: temperature	°C	295.5	326.3	351.2					
							Enthalpie: enthalpie	kJ/kg								
							Menge: flow rate	kg/s	18.33	47.7	54.95					

Kühlerausführung desuperheater design	K _{vs} [m³/h]: 4.2	Kennlinie: characteristic	linear	Hub [mm]: 32	Stellzeit normal/schnell [sek]: /
		DN	PN	Flansch-Norm type of flange	Gehäuse-Material: 1.5415
	Eintritt-Kühlwasser: inlet coolwater	2"	1500# RF	ASME B 16.5	Dampfleitung steam pipe
	Montageflansch: mounting flange	4"	900# RF	ASME B 16.5	Einbaulage installation



Anstrich :
painting

SA Standard

Antrieb actuator	ap-Antrieb: öffnen/schließen ap-actuator: open/close	98	elektr. Drehantr. electric actuator	pneum. Schubantr.: pneumatic actuator	Sonstiges: Pneumatik Antrieb special
	Hersteller: manufacturer	SAMSON	Typ: type	3277 (700 cm², 2,1 - 3,3)	
	Drehm.: Nm torque	U/Hub: revolution/stroke	U/min: revolution/minute	Feder öffnet spring open	schließt ☒ closed
	U/f: V/Hz voltage	DE: Stck torque switches	WE: Stck limit switches	Eingangssignal input signal	pneum. ☒ electr. ☒
	ESR: Stck mA electronic positioner	Stecker plug	Klemmen terminals	Stellungsregler ☒ positioner	Verstärker ☒ booster
	Goldkontakte gold contacts			Magnetventil solenoid valve	Zuluftdruck : 10,00bar air supply

Bemerkungen:
remarks

Zuluftdruck 4 - 9 bar ü

Antriebsstange einfahrend schließt Kühler

Ausführung wie unter K03-0227.2 geliefert

Typenschild kompl. in engl. Sprache, mit Angabe cvs = 4,86

Revision	Datum	Änderungen	Name	Unterschrift
1	07.09.2004	Hinweis Typenschild	SKEPPLER	
0	29.07.2004	Erstellung	KEPPLER	

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Dampfkühler-Datenblatt SA.RV.000771

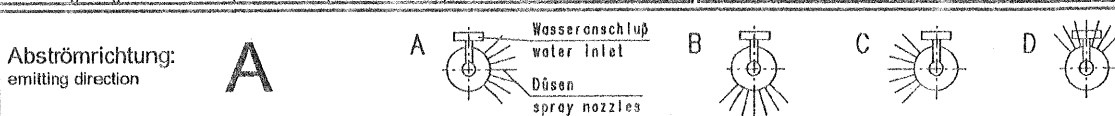
DESUPERHEATER-DATA SHEET

Verteiler
Ordner
Auftrag

Anlage: project	2 nd Methanol	Kom.-Nr./Ang.-Nr.: work-no./quotation-no.	K04-0618.3
Kunde: customer	SAMSOMATIC GmbH	Ventiltyp: type	DKP 080/110U-PLS
Anlagenkennz./Pos.: item-no	No.: FV-101435 / 100-24	Stückzahl: quantity	1.00
Auftrags-Nr.: order-no.	976524/4060/742	Liefertermin: delivery	08.11.2004
Spezifikation/Abnahme: specification	EN 10 204 - 3.1 B	Auslegungsdaten: design data	128,00/ 200bar 565/ 140°C

Betriebsdaten operating data	vor Einspritzung before injection	Medium: Dampf medium					Kühlwasser coolwater				
		Menge: flow rate	kg/s	16.94	87.22	50.83	Menge: flow rate	kg/s	0.92	1.25	2.08
		Druck: pressure	bar abs	114	114	114	Druck: pressure	bar abs	153	153	153
		Temperatur: temperature	°C	551	472	524	Temperatur: temperature	°C	111	111	111
	nach Einspritzung after injection	Enthalpie: enthalpie	kJ/kg				Enthalpie: enthalpie	kJ/kg			
		Druck: pressure	bar abs	114	114	114	Kv errechnet Kv	m³/h	0.54	0.74	1.23
		Temperatur: temperature	°C	491	457.6	479.9					
		Enthalpie: enthalpie	kJ/kg								
		Menge: flow rate	kg/s	17.86	88.47	52.91					

Ausführung desuperheater design	K _{vs} [m³/h]: 2.7 K _{vg}	Kennlinie: characteristic		gl%	Hub [mm]: 32 stroke	Stellzeit normal/schnell [sek]: / stroke time		
		DN	PN	Flansch-Norm type of flange		Gehäuse-Material: 1.4903 body-material		
	Eintritt-Kühlwasser: inlet coolwater	2"	2500# RF	ASME B 16.5		Dampfleitung steam pipe ∅ 322,50 x 31,75 Wd		
	Montageflansch: mounting flange	4"	2500# RF	ASME B 16.5		Einbaulage Installation	Horizontal horizontal	Vertikal ☒ vertical



Anstrich : SA Standard
painting

Antrieb actuator	ap-Antrieb: öffnen/schließen ap-actuator. open/ close		200	elektr. Drehantr. electric actuator	pneum. Schubantr.: pneumatic actuator	Sonstiges: Pneumatik Antrieb special	
	Hersteller: manufactor			Typ: type			
	SAMSON			3271 (1400 cm2, 1,1 - 2,4)			
	Drehm.: Nm torque	U/Hub: revolution/stroke	U/min: revolution/minute	Feder öffnet spring open	schließt ☒ closed	doppeltwirkend double-action	
	U/f: V/Hz voltage	DE: Stck torque switches	WE: Stck limit switches	Eingangssignal pneum. elektr. ☒ input signal pneum. electr.		Eingangssignal: 4-20 mA input signal	
	ESR: Stck mA electronic positioner		Stecker Klemmen plug terminals	Stellungsregler ☒ positioner	Verstärker ☒ booster	Verblockung interblock relais	Handrad handwheel
Goldkontakte gold contacts				Magnetventil solenoid valve	Zuluftdruck : 10,00bar air supply		Druckminderer ☒ pressure reducing

Bemerkungen:
remarks

Zuluftdruck 4 - 9 bar ü

Antriebsstange einfahrend schließt Kühler

Zusätzlicher Lastfall: Einspritzwasser 4,17 kg/s, 153 bar, 111 °C, kv = 2,46

Ausführung wie unter K03-0227.3 geliefert

Typenschild kompl. in engl. Sprache, mit Angabe cvs = 3,12

Revision	Datum	Änderungen	Name	Unterschrift
1	07.09.2004	Hinweis Typenschild	SKEPLER	
0	29.07.2004	Erstellung	KEPLER	

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Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV101439	Tag no.	FV-101439
Process medium	Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	115000	50000	30000
Inlet pressure	p1	[bar(a)]	101	101	35
Outlet pressure	p2	[bar(a)]	47	47	32
Inlet temperature	t1	[°C]	505	505	450
Density	rho1	[kg/m³]	30,6	30,6	10,9
Isentropic exponent	gamma		1,31	1,31	1,31
Viscosity	eta	[mPas]	0,0296	0,0296	0,0269

Results and factors

Valve coeff. calculated	Cv		141	60,3	204
Min. req. size	Req. DN [mm]		122	80,2	74,0
Outlet velocity	w	[Mach]	0,197	0,0750	0,0639
SPL VDMA 24422 mod.	LA	[dB(A)]	85	82	60
relative travel	T	[%]	52,4	21,2	76,5
Different. pressure ratio	x		0,53	0,53	0,09
FL value	FL		0,93	0,96	0,92
xT value	xT		0,74	0,78	0,71
Valve style factor	Fd		0,43	0,40	0,45
Level exponent	G1		-6,06	-5,99	-5,80
Slope exponent	G2		0,60	0,75	1,17

Valve data

Body type		Globe valve		Series		globe valve
Valve coefficient	Cv	265		Type		3251
Nominal size	DN	6"		Body material		A217 WC9
Pressure ratings	CLASS	1500		Noise reduction		Flow Div.I
Travel	S	60		Charact.		Linear
Seat bore	SB	125		Flow direction		FTO
Stem diameter	Sd	25		Balanced		Graphite (10)
Packing	Graphite (10)			Leakage rate		IV
Sealing	metal (2,0)			Bonnet		insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	8"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	187	s [mm]	26

Actuator data

Type				3271		Fail-safe act.		extends	
Diaphr. area		A		[cm²]		1400		Bench range	
								ps0 [bar]	
								1 ... 3	
								Supply	
(Defaults:		p1max [bar(a)]		70		p2min [bar(a)]		1,01	
								t1max [°C]	
								515)	
								psu [bar]	
								3,37	

Actuator results

req. act. force	Fm req. [kN]	8,94	req. diff. psu-ps100	d ps [bar]	0,37
max. act. force	Fmax [kN]	55,77	Actuator force	Fa [kN]	14,00
max. dp on plug	d. pmax [bar]	170,03	Close safety factor	Fa/Fo (SF)	1,57
req. start bench range	ps0req. [bar]	0,70	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV101441Rev3 Tag no. FV101441
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	70000	50000	20000
Inlet pressure	p1	[bar(a)]	55	56	56
Outlet pressure	p2	[bar(a)]	3	3	3
Inlet temperature	t1	[°C]	240	240	240
Density	rho1	[kg/m³]	814,79	814,86	815,1
Vapor pressure	pv	[bar(a)]	33,467	33,467	33,467
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,11122	0,11124	0,1113
Flashing portion	xd2	[%]	21,7	21,7	21,7
spec. Volume	v2	[m³/kg]	0,695	0,695	0,695

Results and factors

Valve coeff. calculated	Cv		18,0	12,6	5,04
Min. req. size	Req. DN [mm]		250	212	134
Outlet velocity	w	[m/s]	60,1	42,9	17,2
SPL VDMA 24422 mod.	LA	[dB(A)]	84	82	75
Flow condition			Flashing	Flashing	Flashing
relative travel	T	[%]	64,0	54,9	31,5
Different. pressure ratio	xF		2,41	2,35	2,35
FL value	FL		0,98	0,98	0,98
Kc value	Kc		0,93	0,93	0,94
Valve style factor	Fd		0,35	0,30	0,15
z value at capacity	xFz		0,32	0,35	0,47
Level exponent	F1		-7,45	-7,49	-7,79
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf	[dB]	10,04	9,90	9,89

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	75	Type	3254
Nominal size	DN	["]	Body material	A351 CF8C
Pressure ratings	CLASS	900	Noise reduction	without
Travel	S	[mm]	Charact.	Equal perc.
Seat bore	SB	[mm]	Flow direction	FTO
Stem diameter	Sd	[mm]	Balanced	without (0,0)
Packing	Graphite (10)		Leakage rate	V
Sealing	lapped-in (10)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	248	s [mm]	12,7

Actuator data

Type				3271		Fail-safe act.		extends	
Diaphr. area		A		[cm²]		1400		Bench range	
						Supply		ps0 [bar] 2,4 ... 3,2	
(Defaults:	p1max [bar(a)]	70	p2min [bar(a)]	1,01	t1max [°C]	270)	psu [bar] 3,40		

Actuator results

req. act. force	Fo req.	[kN]	24,75	req. diff. psu-ps100	d ps [bar]	0,10
max. act. force	Fmax	[kN]	132,33	Actuator force	Fa [kN]	33,60
max. dp on plug	d. pmax	[bar]	96,98	Close safety factor	Fa/Fo (SF)	1,36
req. start bench range	ps0req.	[bar]	1,94	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV150411 Tag no. FV150411
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	18000	14000	5000
Inlet pressure	p1	[bar(a)]	5,4	5,4	6
Outlet pressure	p2	[bar(a)]	1,6	1,6	1,6
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	992,42	992,42	992,44
Vapor pressure	pv	[bar(a)]	0,073844	0,073844	0,073844
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,65301	0,65301	0,65302

Results and factors

Valve coeff. calculated	Cv	10,8	8,43	2,80
Min. req. size	Req. DN [mm]	35,8	31,6	18,9
Outlet velocity	w [m/s]	2,57	2,00	0,713
SPL VDMA 24422 mod.	LA [dB(A)]	73	71	62
relative travel	T [%]	86,0	79,6	51,4
Different. pressure ratio	xF	0,71	0,71	0,74
FL value	FL	0,95	0,95	0,97
Kc value	Kc	0,85	0,86	0,91
Valve style factor	Fd	0,30	0,27	0,12
z value at capacity	xFz	0,40	0,44	0,59
Level exponent	F1	-7,04	-7,10	-7,38
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	-2,66	-1,62	0,41

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3241
Nominal size	DN ["]	Body material	A351 CF8C
Pressure ratings	CLASS	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	without (0,0)
Packing	PTFE (1,6)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	55	s [mm]	5,54

Actuator data

Type					3277	Fail-safe act.		retracts				
Diaphr. area	A				[cm²]	350	Bench range		ps0	[bar]	0,2 ... 1	
(Defaults:	p1max	[bar(a)]	13	p2min	[bar(a)]	1,01	t1max	[°C]	40)	psu	[bar]	1,36

Actuator results

req. act. force	Fo req. [kN]	1,15	req. diff. psu-ps100	d ps [bar]	0,36
max. act. force	Fmax [kN]	27,34	Actuator force	Fa [kN]	1,26
max. dp on plug	d. pmax [bar]	13,33	Close safety factor	Fa/Fo (SF)	1,09
req. start bench range	ps0req. [bar]	0,02	Open safety factor	Ff/Fw	13,69

		Dampfkühler-Datenblatt SA.RV.000772 DESUPERHEATER-DATA SHEET				Verteiler Ordner Auftrag					
Anlage: project			2 nd Methanol			Kom-Nr./Ang.-Nr.: work-no./quotation-no.			K04-0618.4		
Kunde: customer			SAMSOMATIC GmbH			Ventiltyp: type			DKVP 088/117U-LH1		
Anlagenkennz./Pos.: item-no			No.: FV-150610 / 150-02			Stückzahl: quantity			1.00		
Auftrags-Nr.: order-no.			976524/4060/742			Liefertermin: delivery			08.11.2004		
Spezifikation/Abnahme: specification			EN 10 204 - 3.1 B			Auslegungsdaten: design data			54,00/ 98bar 500/ 160°C		

Betriebsdaten operating data	vor Einspritzung before injection	Medium: Dampf medium					Kühlwasser coolwater				
		Menge: flow rate	kg/s	3.59	8.72	35.89	Menge flow rate	kg/s	0.83	2.03	8.33
		Druck: pressure	bar abs	47	47	47	Druck pressure	bar abs	60	60	60
		Temperatur: temperature	°C	475	475	475	Temperatur temperature	°C	111	111	111
	nach Einspritzung after injection	Enthalpie: enthalpie	kJ/kg				Enthalpie enthalpie	kJ/kg			
		Druck: pressure	bar abs	47	47	47	Kv errechnet Kv	m³/h	0.85	2.07	8.53
		Temperatur: temperature	°C	269	269	269					
		Enthalpie: enthalpie	kJ/kg								
			Menge: flow rate	kg/s	4.42	10.75	44.22				

Kühlerausführung desuperheater design	K _{vs} [m³/h]:	9.5	Kennlinie: characteristic	linear	Hub [mm]: stroke	80	Stellzeit normal/schnell [sek]: stroke time	/
		DN	PN	Flansch-Norm type of flange		Gehäuse-Material: body-material		
	Eintritt-Kühlwasser: inlet coolwater	2"	1500# RF	ASME B 16.5		Dampfleitung steam pipe		
	Montageflansch: mounting flange	4"	900# RF	ASME B 16.5		Einbaulage Installation		
							Horizontal Vertikal ☒ horizontal vertical	

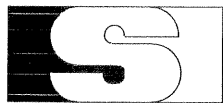
Abströmrichtung: emitting direction		A		B	C	D
			Wassereinlass water inlet Düsen spray nozzles			

Antrieb actuator	Δp-Antrieb: öffnen/schließen Δp-actuator. open/ close		98		elektr. Drehantr. electric actuator	pneum. Schubantr.: pneumatic actuator	Sonstiges: Pneumatik Antrieb special	
	Hersteller: manufacturer			Typ: type				
	Drehm.: Nm torque		U/Hub: revolution/stroke	U/min: revolution/minute	Feder öffnet spring open	schließt ☒ closed		doppeltwirkend double-action
	U/f: V/Hz voltage	DE: Stck torque switches	WE: Stck limit switches	Eingangssignal pneum. input signal	elektr. ☒ electr.	Eingangssignal: F.F.B. input signal SIGNAL		
	ESR: Stck mA electronic positioner		Stecker plug	Klemmen terminals	Stellungsregler ☒ positioner	Verstärker ☒ booster	Verblockung interblock relais	Handrad handwheel
	Goldkontakte gold contacts				Magnetventil solenoid valve	Zuluftdruck : 10,00bar air supply	Druckminderer ☒ pressure reducing	

Bemerkungen: remarks		Zuluftdruck 4 - 9 bar ü Antriebsstange einfahrend schließt Kühler Zusätzlicher Lastfall: 11,97 kg/s Dampf, 47 bar / 475 °C auf 269 °C, Kühlw. 2,78 kg/s, 60 bar / 111 °C, kv = 2,84 Ausführung wie unter K03-0227.4 geliefert Typenschild kompl. in engl. Sprache, mit Angabe cvs = 10,98	
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Revision	Datum	Änderungen	Name	Unterschrift
1	07.09.2004	Hinweis Typenschild	SKEPLER	
0	29.07.2004	Erstellung	KEPPLER	

Schroedahl-Arapp Spezial-Armaturen GmbH & Co KG Schönenbacher Str.4 - 51580 Reichshof - Mittelaggar Telefon (02265) 99 27 -0 - Telefax (02265) 99 27 27 © SCHROEDAHL ARAPP Spezialarmaturen GmbH & Co. KG, D-51580 Reichshof-Mittelaggar email: info@schroedahl.com Internet: http://www.schroedahl.de	SCHROEDAHL Spezial-Armaturen
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Dampfkühler-Datenblatt SA.RV.000773

DESUPERHEATER-DATA SHEET

Verteiler
Ordner
Auftrag

Anlage: project	2 nd Methanol	Kom-Nr./Ang.-Nr.: work-no./quotation-no.	K04-0618.5
Kunde: customer	SAMSOMATIC GmbH	Ventiltyp: type	DKVP 088/117U-PH1
Anlagenkennz./Pos.: item-no	No.: FV-150630 / 150-03	Stückzahl: quantity	1.00
Auftrags-Nr.: order-no.	976524/4060/742	Liefertermin: delivery	08.11.2004
Spezifikation/Abnahme: specification	EN 10 204 - 3.1 B	Auslegungsdaten: design data	54,00/ 98bar 500/ 160°C

Betriebsdaten operating data		Design data					Design data				
		Medium: Dampf medium					Kühlwasser coolwater				
	vor Einspritzung before injection	Menge: flow rate	kg/s	1.08	6.83	28.06	Menge flow rate	kg/s	0.08	0.53	2.17
		Druck: pressure	bar _{abs}	5.7	5.7	5.7	Druck pressure	bar _{abs}	60	60	60
		Temperatur: temperature	°C	364	364	364	Temperatur temperature	°C	111	111	111
		Enthalpie: enthalpie	kJ/kg				Enthalpie enthalpie	kJ/kg			
	nach Einspritzung after injection	Druck: pressure	bar _{abs}	5.7	5.7	5.7	Kv errechnet Kv	m³/h	0.04	0.26	1.09
		Temperatur: temperature	°C	270	270	270					
Enthalpie: enthalpie		kJ/kg									
Menge: flow rate		kg/s	1.16	7.36	30.23						

Kühlerausführung desuperheater design	K _{vs} [m³/h]: 1.2 K _{ys}	Kennlinie: characteristic gl%		Hub [mm]: 32 stroke	Stellzeit normal/schnell [sek]: / stroke time	
		DN	PN	Flansch-Norm type of flange	Gehäuse-Material: 1.5415 body-material	
	Eintritt-Kühlwasser: inlet coolwater	2"	1500# RF	ASME B 16.5	Dampfleitung steam pipe ∅ 508,00 x Wd	
	Montageflansch: mounting flange	4"	900# RF	ASME B 16.5	Einbaulage Installation	Horizontal horizontal Vertikal vertical ☒
	Abströmrichtung: emitting direction					A  Wasseranschluss water inlet Düsen spray nozzles
Anstrich : painting					SA Standard	

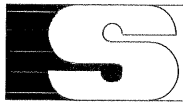
Antrieb actuator	Δp-Antrieb: öffnen/schließen 98 Δp-actuator. open/ close		elektr. Drehantr. electric actuator	pneum. Schubantr.: pneumatic actuator	Sonstiges: Pneumatikantrieb special	
	Hersteller: SAMSON manufacturer		Typ: 3277 (700 cm2, 2,1 - 3,3) type			
	Drehm.: Nm torque	U/Hub: revolution/stroke	U/min: revolution/minute	Feder öffnet spring open	schließt ☒ closed	doppeltwirkend double-action
	U/f: V/Hz voltage	DE: Stck torque switches	WE: Stck limit switches	Eingangssignal pneum. elektr. ☒ input signal pneum. electr.	Eingangssignal: F.F.B input signal SIGNAL	
	ESR: Stck mA electronic positioner		Stecker Klemmen plug terminals	Stellungsregler ☒ positioner	Verstärker ☒ booster	Verblockung interblock relays
	Goldkontakte gold contacts			Magnetventil solenoid valve	Zuluftdruck : 10,00bar air supply	Druckminderer ☒ pressure reducing

Bemerkungen:
remarks

Zuluftdruck 4 - 9 bar ü
Antriebsstange einfahrend schließt Kühler
Ausführung wie unter K03-0227.5 geliefert
Typenschild kompl. in engl. Sprache, mit Angabe cvs = 1,39

Revision	Datum	Änderungen	Name	Unterschrift
1	07.09.2004	Hinweis Typenschild	SKEPLER	
0	29.07.2004	Erstellung	KEPPLER	

		Dampfkühler-Datenblatt SA.RV.000774 DESUPERHEATER-DATA SHEET				Verteiler Ordner Auftrag						
Anlage: project		2 nd Methanol		Kom-Nr./Ang.-Nr.: work-no./quotation-no.		K04-0618.6						
Kunde: customer		SAMSOMATIC GmbH		Ventiltyp: type		DKVP 088/117U-PH1						
Anlagenkennz./Pos.: item-no		No.: FV-150636 / 150-04		Stückzahl: quantity		1.00						
Auftrags-Nr.: order-no.		976524/4060/742		Liefertermin: delivery		08.11.2004						
Spezifikation/Abnahme: specification		EN 10 204 - 3.1 B		Auslegungsdaten: design data		54,00/ 98bar 500/ 160°C						
Betriebsdaten operating data		Medium: Dampf medium			Kühlwasser coolwater							
		vor Einspritzung before injection	Menge: flow rate	kg/s	71.16	47.44	2.37	Menge: flow rate	kg/s	5	3.33	0.17
			Druck: pressure	bar abs	47	47	47	Druck: pressure	bar abs	60	60	60
			Temperatur: temperature	°C	482	482	482	Temperatur: temperature	°C	111	111	111
			Enthalpie: enthalpie	kJ/kg				Enthalpie: enthalpie	kJ/kg			
		nach Einspritzung after injection	Druck: pressure	bar abs	47	47	47	Kv errechnet Kv	m³/h	5.12	3.41	0.17
			Temperatur: temperature	°C	400	400	400					
			Enthalpie: enthalpie	kJ/kg								
			Menge: flow rate	kg/s	76.16	50.77	2.54					
		Kühlerausführung desuperheater design		K _{vs} [m³/h]:	5.7	Kennlinie: characteristic	gl%	Hub [mm]: stroke	80	Stellzeit normal/schnell [sek]: /		
	DN			PN	Flansch-Norm type of flange		Gehäuse-Material: 1.5415 body-material					
Eintritt-Kühlwasser: inlet coolwater	2"			1500# RF	ASME B 16.5		Dampfleitung steam pipe ø 406,40 x Wd					
Montageflansch: mounting flange	4"			900# RF	ASME B 16.5		Einbaulage installation Horizontal Vertikal ☒					
Abströmrichtung: emitting direction A B C D 												
Antrieb actuator		Δp-Antrieb: öffnen/schließen Δp-actuator. open/ close		98	elektr. Drehantr. electric actuator	pneum. Schubantr.: pneumatic actuator	Sonstiges: Pneumatik Antrieb special					
		Hersteller: manufacturer		SAMSON		Typ: type		3271 (1400 cm², 1,1 - 2,4)				
		Drehm.: Nm torque	U/Hub: revolution/stroke	U/min: revolution/minute	Feder öffnet spring open	schließt ☒ closed		doppeltwirkend double-action				
		U/f: V/Hz voltage	DE: Stck torque switches	WE: Stck limit switches	Eingangssignal pneum. input signal	elektr. ☒ electr.		Eingangssignal: F.F.B input signal SIGNAL				
		ESR: Stck mA electronic positioner		Stecker plug	Klemmen terminals	Stellungsregler ☒ positioner		Verstärker ☒ booster		Verblockung interblock relais		Handrad handwheel
		Goldkontakte gold contacts				Magnetventil solenoid valve		Zuluftdruck : 10,00bar air supply		Druckminderer ☒ pressure reducing		
		Bemerkungen: Zuluftdruck 4 - 9 bar ü Antriebsstange einfahrend schließt Kühler Zusätzlicher Lastfall: 19,77 kg/s Dampf, 47 bar / 482 °C auf 400 °C, Kühlw. 1,39 kg/s, 60 bar / 111 °C, kv = 1,42 Ausführung wie unter K03-0227.6 geliefert Typenschild kompl. in engl. Sprache, mit Angabe cvs = 6,59										
Revision	Datum	Änderungen		Name		Unterschrift						
1	07.09.2004	Hinweis Typenschild		SKEPLER								
0	29.07.2004	Erstellung		KEPPLER								
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Dampfkühler-Datenblatt SA.RV.000775

DESUPERHEATER-DATA SHEET

Verteiler
Ordner
Auftrag

Anlage: project	2 nd Methanol	Kom-Nr./Ang.-Nr.: work-no./quotation-no.	K04-0618.7
Kunde: customer	SAMSOMATIC GmbH	Ventiltyp: type	DKVP 088/116U-PL1
Anlagenkennz./Pos.: item-no	No.: FV-150725 / 150-05	Stückzahl: quantity	1.00
Auftrags-Nr.: order-no.	976524/4060/742	Liefertermin: delivery	08.11.2004
Spezifikation/Abnahme: specification	EN 10 204 - 3.1 B	Auslegungsdaten: design data	7,00/ 98bar 380/ 160°C

Betriebsdaten operating data	Medium: Dampf medium					Kühlwasser coolwater					
	vor Einspritzung before injection	Menge: flow rate	kg/s	5.31	26.53	39.81	Menge flow rate	kg/s	0.56	2.78	4.17
		Druck: pressure	bar _{abs}	5.7	5.7	5.7	Druck pressure	bar _{abs}	60	60	60
		Temperatur: temperature	°C	270	270	270	Temperatur temperature	°C	111	111	111
		Enthalpie: enthalpie	kJ/kg				Enthalpie enthalpie	kJ/kg			
	nach Einspritzung after injection	Druck: pressure	bar _{abs}	5.7	5.7	5.7	Kv errechnet Kv	m³/h	0.28	1.39	2.09
		Temperatur: temperature	°C	160	160	160					
		Enthalpie: enthalpie	kJ/kg								
		Menge: flow rate	kg/s	5.87	29.31	43.98					

Kühlerausführung desuperheater design	K _{vs} [m ³ /h]: 2.3 K _{vs}	Kennlinie: characteristic g1%		Hub [mm]: 32 stroke	Stellzeit normal/schnell [sek]: / stroke time	
		DN	PN	Flansch-Norm type of flange	Gehäuse-Material: 1.5415 body-material	
	Eintritt-Kühlwasser: inlet coolwater	2"	1500# RF	ASME B 16.5	Dampfleitung steam pipe äØ 508,00 x Wd	
	Montageflansch: mounting flange	4"	600# RF	ASME B 16.5	Einbaulage Installation Horizontal Vertikal ☒ horizontal vertical	
	Abströmrichtung: emitting direction	A  B  C  D  Wasseranschluß water inlet Düsen spray nozzles				
Anstrich : painting	SA Standard					

Antrieb
actuator

Δp-Antrieb: öffnen/schließen Δp-actuator. open/ close		98	elektr. Drehantr. electric actuator		pneum. Schubantr.: pneumatic actuator		Sonstiges: Pneumatik antrieb special										
Hersteller: manufacturer			SAMSON					Typ: type		3277 (700 cm2, 2,1 - 3,3)							
Drehm.: Nm torque		U/Hub: revolution/stroke		U/min: revolution/minute		Feder öffnet spring open		schließt ☒ closed		doppeltwirkend double-action							
U/f: V/Hz voltage		DE: Stck torque switches		WE: Stck limit switches		Eingangssignal input signal		pneum. ☒ pneum.		elektr. ☒ electr.		Eingangssignal: F.F.B input signal: SIGNAL					
ESR: Stck mA electronic positioner			Stecker plug			Klemmen terminals			Stellungsregler ☒ positioner		Verstärker ☒ booster		Verblockung interblock relays		Handrad handwheel		
Goldkontakte gold contacts						Magnetventil solenoid valve				Zuluftdruck : 10,00bar air supply				Druckminderer ☒ pressure reducing			

Bemerkungen: Zuluftdruck 4 - 9 bar ü
Antriebsstange einfahrend schließt Kühler
Ausführung wie unter K03-0227.7 geliefert
Typenschild kompl. in engl. Sprache, mit Angabe cvs = 2,66

Revision	Datum	Änderungen	Name	Unterschrift
1	07.09.2004	Hinweis Typenschild	SKEPLER	
0	29.07.2004	Erstellung	KEPLER	

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Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV250102	Tag no.	FV250102
Process medium	Hydrogen	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	23000	19254	5800
Inlet pressure	p1	[bar(a)]	35	35	35
Differential pressure	dp	[bar]	2,8	2,9	3
Inlet temperature	t1	[°C]	50	50	50
Molar mass	M	[g/mol]	2,02	2,02	2,02
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		1	1	1
Viscosity	eta	[mPas]	0,00880	0,00880	0,00880

Results and factors

Valve coeff. calculated	Kv	26,3	21,5	6,28
Min. req. size	Req. DN [mm]	27,2	24,9	13,7
Outlet velocity	w [Mach]	0,0922	0,0761	0,0230
SPL VDMA 24422 mod.	LA [dB(A)]	65	63	57
relative travel	T [%]	85,1	80,0	48,5
Different. pressure ratio	x	0,08	0,08	0,09
FL value	FL	0,76	0,75	0,74
xT value	xT	0,49	0,48	0,47
Valve style factor	Fd	0,42	0,35	0,22
Level exponent	G1	-3,52	-3,75	-3,87
Slope exponent	G2	2,50	2,50	2,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Kvs	47	Type	3241
Nominal size	DN ["]	2"	Body material	A105
Pressure ratings	PN	300	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	48	Flow direction	FTO
Stem diameter	Sd [mm]	10	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	bellows

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	101	s [mm]	6,02

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	1,6 ... 2,4	
(Defaults:	p1max [bar(a)] 40	p2min [bar(a)] 1,01	Supply	psu [bar]	2,60	
		t1max [°C]	80)			

Actuator results

req. act. force	Fo req. [kN]	8,04	req. diff. psu-ps100	d ps [bar]	0,11
max. act. force	Fmax [kN]	25,45	Actuator force	Fa [kN]	11,20
max. dp on plug	d. pmax [bar]	56,42	Close safety factor	Fa/Fo (SF)	1,39
req. start bench range	ps0req. [bar]	1,26	Open safety factor	Ff/Fw	-

Propsl./order no.: 525 000
Project: 4th Methanol Plant

Customer LURGI - PIDEK
Date: 05.07.2005 Data entered by: V12/Di



Valve Sizing Version 4.05B

Item no.	FV250105	Tag no.	FV250105
Process medium	Hydrogen	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	3700	2700	1600
Inlet pressure	p1	[bar(a)]	31,2	31,2	31,2
Differential pressure	dp	[bar]	0,4	1,2	2,2
Inlet temperature	t1	[°C]	40	40	40
Molar mass	M	[g/mol]	2,02	2,02	2,02
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		1	1	1
Viscosity	eta	[mPas]	0,00880	0,00880	0,00880

Results and factors

Valve coeff. calculated	Kv		10,8	4,64	2,08
Min. req. size	Req. DN [mm]		11,1	9,58	7,50
Outlet velocity	w	[Mach]	0,0147	0,0110	0,00675
SPL VDMA 24422 mod.	LA	[dB(A)]	<30	33	35
relative travel	T	[%]	73,8	52,3	31,8
Different. pressure ratio	x		0,01	0,04	0,07
FL value	FL		0,76	0,75	0,74
xT value	xT		0,49	0,48	0,47
Valve style factor	Fd		0,42	0,35	0,22
Level exponent	G1		-3,82	-4,35	-4,97
Slope exponent	G2		2,50	2,50	2,50

Valve data

Body type		Globe valve	Series	Globe valve
Valve coefficient	Kvs	30	Type	3251
Nominal size	DN ["]	2"	Body material	A216 WCC
Pressure ratings	PN	600	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	38	Flow direction	FTO
Stem diameter	Sd [mm]	12	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	bellows

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	51	s [mm]	5,54

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	1,2 ... 2	
(Defaults:	p1max [bar(a)] 75	p2min [bar(a)] 1,01	Supply	psu [bar]	2,20	
		t1max [°C] 40)				

Actuator results

req. act. force	Fo req. [kN]	9,23	req. diff. psu-ps100	d ps [bar]	0,09
max. act. force	Fmax [kN]	32,99	Actuator force	Fa [kN]	8,40
max. dp on plug	d. pmax [bar]	66,60	Close safety factor	Fa/Fo (SF)	0,91
req. start bench range	ps0req. [bar]	1,45	Open safety factor	Ff/Fw	-

01 Order-No. : 1064 24081 Customer : Samson Frankfurt
 02 Name : Marc Bastius Project : P 1725



VETEC
 Valve Sizing V2000

03 Pos.-No. : 1 Rev. 3 Process Fluid : raw methanol 07.06.2005
 04 TAG - No. : FV-300101 Upstream Conditions : Liquid

Process and Medium Data			m i n	n o r m	m a x
06 Flow Rate	[kg/h]	W	70.000	239.406	275.000
07 Inlet Pressure	[bara]	p1	5,60	5,40	5,30
08 Outlet Pressure	[bara]	p2	4,60	5,00	5,10
09 Inlet Temperature	[°C]	t1	38,00	38,00	38,00
10 Density	[kg/m³]	rho	788,000	788,000	788,000
11 Vapor Pressure	[bara]	pv	5,480	5,399	5,299
12 Critical Pressure	[bara]	pc	106,8	106,8	106,8
13 Viscosity	[mPas]	eta	0,49	0,49	0,49
14 Ratio. Spc. Heat	[cp/cv]				
15 Compressibility Factor					
16 Flashing	[%]				

Pipeline		
18 Line size	[mm]	Da * s / PN (In) 323,9 x 9,53 / std Da * s / PN (Out) 323,9 x 9,53 / std

Results		
20 Calculated Valve Coeff.	[Kv]	187,43 728,83 855,30
21 Valve Opening in %		34 82 92
22 Outlet Velocity	[m/s]	
23 Max. admitted Velocity	[m/s]	
24 Mach		
25 Acoustic Cap. Lev. LwA,a	[dB(A)]	72 73 71
26 Sound Pres. Lev. LpA,a	[dB(A)]	58 59 57
27 Flow Remark		Flashing Flashing Flashing

Valve Data		
29 Valve Style		Rotary Plug Valve Valve Type 72.3 R
30 Body Size	[inch]	DN 8" Body Material A216 WCC
31 Press. Rating	[lbs]	PN 150 Plug Material 1.4581 / Stellite 6
32 End Connections		RF Seat Ring Material 1.4571 / Stellite 6
33 Face to Face	[mm]	543 Guide Material 1.4571
34 Selected Valve Coeff.		Kvs 950 Cvs 1098 Plug/Seat Facing Metallic
35 Seat Diameter	[mm]	135,0 Sitzfaktor 1 Gaskets S.S. / Graphite
36 Leakage Class		DIN IEC 534 T4, KL IV L1 Packing PTFE / Graphite
37 Characteristic		Equal % Bonnet Standard
38 Noise Reduction		Flow Direction Flow to Open

Actuator Data		
40 Actuator Style		Pneumatic Fail Position Spring to Close
41 Actuator Type		R 250v Handwheel Without
42 Spring Range	[bar]	1,3 - 2,4 Stroke Time o/c [s] t < 20 / < 20
43 Air Supply	[bar]	3,0 - 6,0 Req. Torque [Nm] 300
44 Max. Shut Off	[bar]	dp 7,5 Max. Torque [Nm] 1280
		Mounting A

Accessories		
46 Positioner	Type	FF_3787-100, 4-20 mA, IP 65, gaug Air Set Type Norgren B74G-4AK-AP3
47 Limit Switches	Type	Piping 1/2" s.s. / Swagelok
48 Solenoid Valve	Type	Others Booster, EIL 100 F03

Certification/Requirements		Remarks
50 Material	EN 10204 / 3.1B	55 Zubehör und Rohr 1/2" s.s. wird von Samson beigestellt,
51 Inspection	EN 10204 / 3.1B	56 Verschraubung von VETEC
52 Others		57
53 Cust. Std.		58
54 Weight	260 kg	59

Propl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV300203 Tag no. FV300203
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	33000	25215	8000
Inlet pressure	p1	[bar(a)]	4,6	4,8	5
Outlet pressure	p2	[bar(a)]	3,6	3,5	3,5
Inlet temperature	t1	[°C]	148	150	151
Density	rho1	[kg/m³]	918,87	917,01	916,08
Vapor pressure	pV	[bar(a)]	4,5112	4,761	4,89
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,18512	0,18246	0,18116
Flashing portion	xd2	[%]	1,63	2,22	2,42
spec. Volume	v2	[m³/kg]	0,589	0,605	0,605

Results and factors

Valve coeff. calculated	Cv		69,2	53,3	14,8
Min. req. size	Req. DN [mm]		50,4	46,4	27,2
Outlet velocity	w	[m/s]	19,5	20,2	6,94
SPL VDMA 24422 mod.	LA	[dB(A)]	64	66	57
Flow condition			Flashing	Flashing	Flashing
relative travel	T	[%]	92,3	85,6	52,8
Different. pressure ratio	xF		11,26	33,33	13,64
FL value	FL		0,89	0,90	0,93
Kc value	Kc		0,69	0,72	0,81
Valve style factor	Fd		0,46	0,46	0,46
z value at capacity	xFz		0,36	0,40	0,58
Level exponent	F1		-7,00	-7,00	-7,00
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf	[dB]	14,55	18,18	15,71

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	95	Type	3241
Nominal size	DN	["]	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S	[mm]	Charact.	Equal perc.
Seat bore	SB	[mm]	Flow direction	FTO
Stem diameter	Sd	[mm]	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	159,3	s [mm]	7,11

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	350	Bench range	ps0	[bar]
				Supply	psu	[bar]
(Defaults:	p1max [bar(a)]	8	p2min [bar(a)]	1,01	t1max [°C]	200)
						1,4 ... 2,3
						2,50

Actuator results

req. act. force	Fo req.	[kN]	4,07	req. diff. psu-ps100	d ps	[bar]	0,02
max. act. force	Fmax	[kN]	22,39	Actuator force	Fa	[kN]	4,90
max. dp on plug	d. pmax	[bar]	8,62	Close safety factor	Fa/Fo (SF)		1,20
req. start bench range	ps0req.	[bar]	1,28				

Propl./order no.: 616 100
Project: 42th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV300305	Tag no.	FV300305
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	71000		
Inlet pressure	p1	[bar(a)]	11,7		
Outlet pressure	p2	[bar(a)]	3		
Inlet temperature	t1	[°C]	92		
Density	rho1	[kg/m³]	731,21		
Vapor pressure	pv	[bar(a)]	2,7845		
Critical pressure	pc	[bar(a)]	81		
Viscosity	eta	[mPas]	0,396		

Results and factors

Valve coeff. calculated	Cv	33,8
Min. req. size	Req. DN [mm]	129
Outlet velocity	w [m/s]	3,43
SPL VDMA 24422 mod.	LA [dB(A)]	71
relative travel	T [%]	80,0
Different. pressure ratio	xF	0,98
FL value	FL	0,95
Kc value	Kc	0,86
Valve style factor	Fd	0,42
z value at capacity	xFz	0,29
Level exponent	F1	-6,98
Slope exponent	F2	0,30
Correct. term	delta Lf [dB]	-9,40

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	75	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107,1	s [mm]	6,02

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	0,8 ... 2,4	
			Supply	psu [bar]	2,60	
(Defaults:	p1max [bar(a)] 13,5	p2min [bar(a)] 1,01	t1max [°C] 150)			

Actuator results

req. act. force	Fo req. [kN]	4,38	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	5,60
max. dp on plug	d. pmax [bar]	16,35	Close safety factor	Fa/Fo (SF)	1,28
req. start bench range	ps0req. [bar]	0,69	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV300306	Tag no.	FV300306
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	33000		
Inlet pressure	p1	[bar(a)]	6,4		
Outlet pressure	p2	[bar(a)]	3,1		
Inlet temperature	t1	[°C]	64		
Density	rho1	[kg/m³]	749	749	749
Vapor pressure	pv	[bar(a)]	2	2	2
Critical pressure	pc	[bar(a)]	80,8	80,8	80,8
Viscosity	eta	[mPas]	0,396	0,396	0,396

Results and factors

Valve coeff. calculated	Cv	24,6
Min. req. size	Req. DN [mm]	57,6
Outlet velocity	w [m/s]	2,43
SPL VDMA 24422 mod.	LA [dB(A)]	75
relative travel	T [%]	83,4
Different. pressure ratio	xF	0,75
FL value	FL	0,95
Kc value	Kc	0,86
Valve style factor	Fd	0,43
z value at capacity	xFz	0,28
Level exponent	F1	-6,86
Slope exponent	F2	0,30
Correct. term	delta Lf [dB]	-12,59

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	47	Type	3241
Nominal size	DN ["]	3"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	10	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	3"	D2 ["]	3"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	82,5	s [mm]	5,49

Actuator data

Type		3277	Fail-safe act.	extends	
Diaphr. area	A [cm²]	350	Bench range	ps0 [bar]	1,4 ... 2,3
			Supply	psu [bar]	2,50
(Defaults:	p1max [bar(a)] 8,4	p2min [bar(a)] 1,01	t1max [°C] 150)		

Actuator results

req. act. force	Fo req. [kN]	2,75	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	23,11	Actuator force	Fa [kN]	4,90
max. dp on plug	d. pmax [bar]	14,25	Close safety factor	Fa/Fo (SF)	1,78
req. start bench range	ps0req. [bar]	0,87	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. FV300408 Tag no. FV300408
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	160000	125238	37000
Inlet pressure	p1	[bar(a)]	3,6	4,8	6
Outlet pressure	p2	[bar(a)]	3	3	3
Inlet temperature	t1	[°C]	128,7	152	151,8
Density	rho1	[kg/m³]	936,58	925,3	927,16
Vapor pressure	p _v	[bar(a)]	2,5448	3,7185	3,5139
Critical pressure	p _c	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,21651	0,19507	0,19813
Flashing portion	xd2	[%]		1,48	1,08
spec. Volume	v2	[m³/kg]		0,695	0,695

Results and factors

Valve coeff. calculated	Cv	256	142	28,5
Min. req. size	Req. DN [mm]	142	97,8	53,1
Outlet velocity	w [m/s]	2,69	22,3	4,99
SPL VDMA 24422 mod.	LA [dB(A)]	76	71	68
Flow condition			Flashing	Flashing
relative travel	T [%]	87,3	72,0	31,2
Different. pressure ratio	x _F	0,57	1,66	1,21
FL value	FL	0,91	0,93	0,95
Kc value	Kc	0,76	0,82	0,87
Valve style factor	F _d	0,43	0,41	0,36
z value at capacity	x _{Fz}	0,21	0,25	0,31
Level exponent	F1	-7,20	-7,27	-7,34
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	-10,33	7,91	6,19

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3251
Nominal size	DN ["]	Body material	A216 WCB
Pressure ratings	CLASS	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	without (0,0)
Packing	PTFE (1,6)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	12"	D2 ["]	12"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	307,9	s [mm]	9,53

Actuator data

Type	A	3271	Fail-safe act.	extends
Diaphr. area	[cm²]	1400	Bench range	ps0 [bar]
			Supply	psu [bar]
(Defaults:	p1max [bar(a)] 8	p2min [bar(a)] 1,01	t1max [°C] 200)	1,4 ... 2,7
				2,90

Actuator results

req. act. force	Fo req. [kN]	13,46	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	52,46	Actuator force	Fa [kN]	19,60
max. dp on plug	d. pmax [bar]	10,46	Close safety factor	Fa/Fo (SF)	1,46
req. start bench range	ps0req. [bar]	1,06	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV300510A	Tag no.	FV300510A
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	90000	305420	420000
Inlet pressure	p1	[bar(a)]	14,9	14,2	13,6
Outlet pressure	p2	[bar(a)]	12,3	12,7	13
Inlet temperature	t1	[°C]	128	128	128
Density	rho1	[kg/m³]	679,04	679,04	679,04
Vapor pressure	pv	[bar(a)]	8,2359	8,2359	8,2359
Critical pressure	pc	[bar(a)]	81	81	81
Viscosity	eta	[mPas]	0,396	0,396	0,396

Results and factors

Valve coeff. calculated	Cv		79,3	357	802
Min. req. size	Req. DN [mm]		96,8	178	209
Outlet velocity	w	[m/s]	1,17	3,98	5,47
SPL VDMA 24422 mod.	LA	[dB(A)]	57	63	60
relative travel	T	[%]	25,8	64,2	84,9
Different. pressure ratio	xF		0,39	0,25	0,11
FL value	FL		0,96	0,92	0,90
Kc value	Kc		0,89	0,78	0,73
Valve style factor	Fd		0,18	0,40	0,43
z value at capacity	xFz		0,43	0,28	0,22
Level exponent	F1		-7,81	-7,65	-7,57
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0,28	0	0

Valve data

Body type		Globe valve		Series		Butterfly valve
Valve coefficient	Cv	1447		Type		14c
Nominal size	DN ["]	8"		Body material		A516 Gr.70
Pressure ratings	CLASS	300		Noise reduction		without
Travel	S [mm]	60		Charact.		Equal perc.
Seat bore	SB [mm]	200		Flow direction		FTO
Stem diameter	Sd [mm]	16		Balanced		without (0,0)
Packing	PTFE (1,6)			Leakage rate		IV
Sealing	metal (2,0)			Bonnet		standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	12"	D2 ["]	12"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	307,9	s [mm]	9,53

Actuator data

Type			SRP2000	Fail-safe act.	extends		
Diaphr. area	A	[cm²]		Bench range	ps0 [bar]	...	
				Supply	psu [bar]		4
(Defaults:	p1max [bar(a)]	16	p2min [bar(a)]	1,01	t1max [°C]	200)	

Actuator results

req. act. force	Fo req. [kN]	48,57	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	52,46	Actuator force	Fa [kN]	9,80
max. dp on plug	d. pmax [bar]	18,27	Close safety factor	Fa/Fo (SF)	1,21
req. start bench range	ps0req. [bar]	1,28			

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV300510B	Tag no.	FV300510B
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	90000		
Inlet pressure	p1	[bar(a)]	15		
Outlet pressure	p2	[bar(a)]	9		
Inlet temperature	t1	[°C]	128		
Density	rho1	[kg/m³]	679,04		
Vapor pressure	pv	[bar(a)]	8,2359		
Critical pressure	pc	[bar(a)]	81		
Viscosity	eta	[mPas]	0,396		

Results and factors

Valve coeff. calculated	Cv	52,2
Min. req. size	Req. DN [mm]	110
Outlet velocity	w [m/s]	4,69
SPL VDMA 24422 mod.	LA [dB(A)]	78
relative travel	T [%]	79,4
Different. pressure ratio	xF	0,89
FL value	FL	0,94
Kc value	Kc	0,83
Valve style factor	Fd	0,42
z value at capacity	xFz	0,23
Level exponent	F1	-6,85
Slope exponent	F2	0,30
Correct. term	delta Lf [dB]	-15,34

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	120	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	80	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107,1	s [mm]	6,02

Actuator data

Type		3277	Fail-safe act.	extends	
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	1,4 ... 2,3
			Supply	psu [bar]	2,50
(Defaults:	p1max [bar(a)] 16	p2min [bar(a)] 1,01	t1max [°C] 200)		

Actuator results

req. act. force	Fo req. [kN]	8,13	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	52,46	Actuator force	Fa [kN]	9,80
max. dp on plug	d. pmax [bar]	18,27	Close safety factor	Fa/Fo (SF)	1,21
req. start bench range	ps0req. [bar]	1,28	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV300611	Tag no.	FV300611
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	75000	251518	350000
Inlet pressure	p1	[bar(a)]	8,5	8	7,5
Outlet pressure	p2	[bar(a)]	6,3	6,6	7
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	773	773	773
Vapor pressure	pv	[bar(a)]	0,35	0,35	0,35
Critical pressure	pc	[bar(a)]	81	81	81
Viscosity	eta	[mPas]	0,449	0,449	0,449

Results and factors

Valve coeff. calculated	Cv		67,3	284	678
Min. req. size	Req. DN [mm]		82,8	152	179
Outlet velocity	w	[m/s]	0,858	2,88	4,00
SPL VDMA 24422 mod.	LA	[dB(A)]	54	61	56
relative travel	T	[%]	21,6	58,4	80,6
Different. pressure ratio	xF		0,27	0,18	0,07
FL value	FL		0,96	0,92	0,90
Kc value	Kc		0,89	0,78	0,73
Valve style factor	Fd		0,18	0,40	0,43
z value at capacity	xFz		0,43	0,28	0,22
Level exponent	F1		-7,81	-7,65	-7,57
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0	0	0

Valve data

Body type		Globe valve		Series	butterfly valve
Valve coefficient	Cv	1447		Type	14c
Nominal size	DN ["]	8"		Body material	A516 Gr.70
Pressure ratings	CLASS	150		Noise reduction	without
Travel	S [mm]	60		Charact.	Equal perc.
Seat bore	SB [mm]	200		Flow direction	FTO
Stem diameter	Sd [mm]	16		Balanced	without (0,0)
Packing	PTFE (1,6)			Leakage rate	IV
Sealing	metal (2,0)			Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	12"	D2 ["]	12"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	307,9	s [mm]	9,53

Actuator data

Type			SRP2000	Fail-safe act.	extends		
Diaphr. area	A	[cm²]		Bench range	ps0	[bar]	...
(Defaults:	p1max [bar(a)]	16	p2min [bar(a)]	1,01	t1max [°C]	200)	4

Actuator results

req. act. force	Fo req. [kN]	48,57	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	52,46	Actuator force	Fa [kN]	9,80
max. dp on plug	d. pmax [bar]	18,27	Close safety factor	Fa/Fo (SF)	1,21
req. start bench range	ps0req. [bar]	1,28	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	FV300920	Tag no.	FV300920
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	109000		
Inlet pressure	p1	[bar(a)]	8,5		
Outlet pressure	p2	[bar(a)]	5		
Inlet temperature	t1	[°C]	40		
Density	rho1	[kg/m³]	773		
Vapor pressure	pv	[bar(a)]	0,32665		
Critical pressure	pc	[bar(a)]	81		
Viscosity	eta	[mPas]	0,41087		

Results and factors

Valve coeff. calculated	Cv	77,5
Min. req. size	Req. DN [mm]	99,9
Outlet velocity	w [m/s]	4,99
SPL VDMA 24422 mod.	LA [dB(A)]	81
relative travel	T [%]	89,5
Different. pressure ratio	xF	0,43
FL value	FL	0,93
Kc value	Kc	0,79
Valve style factor	Fd	0,44
z value at capacity	xFz	0,30
Level exponent	F1	-6,81
Slope exponent	F2	0,30
Correct. term	delta Lf [dB]	-5,05

Valve data

Body type		Globe valve	Series	Globe valve
Valve coefficient	Cv	120	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCC
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	80	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107,1	s [mm]	6,02

Actuator data

Type					3277	Fail-safe act.	extends	
Diaphr. area	A	[cm²]	700			Bench range	ps0 [bar]	1,4 ... 2,3
						Supply	psu [bar]	2,50
(Defaults:	p1max [bar(a)] 13	p2min [bar(a)] 1,01	t1max [°C] 150)					

Actuator results

req. act. force	Fo req. [kN]	6,62	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	9,80
max. dp on plug	d. pmax [bar]	18,27	Close safety factor	Fa/Fo (SF)	1,48
req. start bench range	ps0req. [bar]	1,04	Open safety factor	Ff/Fw	-

Calculation header

Identifier
Author
Editor
Tag No.

2004-63047 Methanol ZAGROS
uwinkel 20.06.2005 13:09:47
uwinkel 21.06.2005 08:58:08
HV-200204

Medium selection and state

Medium
Operating temperature
State
Gas

t1

MAKE UP GAS
170,0 °C
Gaseous (Standard conditions)
Gas, dry

First operating point (max. flow)

Calculation
Absolute pressure upstream of valve
Absolute pressure downstream of valve
Flow coefficient
☐ Mass flow rate
☒ Volume flow rate (standard conditio...
Critical flow-related pressure difference
Critical real pressure difference
Type of flow
State of flow

Kv/Cv
p1 82,8 bar(a)
p2 82,65 bar(a)
Cv 5.629,1 GPM(US)
qm 301.180,0 kg/h
qn 604.000,0 m³/h
Δpc 23,097 bar(a)
ΔpXc 23,888 bar(a)
Non-critical
Turbulent flow

Properties at first operating point

Operating density (t1, p1)
Operating density (t2, p2)
☒ Dynamic viscosity (t1, p1)
Isentropic exponent (t1, p1)

ρ1 25,618 kg/m³
ρ2 25,572 kg/m³
η1 0,018 mPa s
κ 1,39 -

Physical constants

Standard conditions
☐ Density (standard conditions, dry g...
☐ Specific gas constant
☒ Molecular weight
Real gas factor (standard conditions)

0°C, 1013 mbar
pn 0,49864 kg/m³
R 729,34 J/(kg K)
M 11,4 kg/kmol
Zn 1,02 -

Valve selection

Valve manufacturer
Series
Valve selection
☒ Valve from database

LEUSCH
LDE Class 900
Cv: 6158, 18", Measured values (lin)
☒ Valve data can be modified

Valve data

Size and pressure class according to
Valve type
Basic characteristic (IEC 60534-2-4)
Flow direction
Flow coefficient
Selected flow coefficient
Selected valve size
Flow velocity
Flow velocity
Valve style modifier (Cv/Cv100 = 1)
☒ Function for FI²

ANSI
Butterfly valve
Measured values (lin)
FTO
Cv 5.629,1 GPM(US)
Cv100 6.158,0 GPM(US)
DN 18"
u1 19,892 m/s
u2 19,928 m/s
Fd 0,8 -

☒ Function for xT**Load-dependent auxiliary values**

Stroke/angle-of-rotation ratio	s/s100	92,238	%
Valve load	Cv/Cv1...	91,411	%
Valve modifier (operating conditions)	FL ²	0,342	-
Valve modifier (operating conditions)	xT	0,281	-
Valve style modifier (operating conditio...	Fd	0,779	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	18"	
Pressure class upstream of valve	PN1	Schedule 60	
☐ Pipe outside diameter upstream of ...	Da1	18,0	in
Pipe wall thickness upstream of val...	s1	0,74803	in
☐ Pipe inside diameter upstream of v...	Di1	16,504	in
Flow velocity in the pipe	u1R	23,661	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	18"	
Pressure class downstream of valve	PN2	Schedule 60	
☐ Pipe outside diameter downstream ...	Da2	18,0	in
Pipe wall thickness downstream of ...	s2	0,74803	in
☐ Pipe inside diameter downstream o...	Di2	16,504	in
Flow velocity in the pipe	u2R	23,704	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	$\Delta L, Ma$	0,25	dB
Transmission loss	Rr	-84,7	dB
Sound pressure level	Lpi	111,0	dB
Sound power level	Lwi	85,8	dB
Sound pressure (0 m distance, A-weight...	LpAa	31,3	dB(A)
Sound pressure level of valve (A-weight...	LpAa	23,8	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,029731	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η_1	0,018	mPa s
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Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	170,0	147,0		°C
t2	170,0	147,0		°C
p1	82,8	76,6		bar(a)
p2	82,65	76,45		bar(a)
Cv	5.629,1	5.426,7		GPM(US)
qm	301.180,0	286.790,0		kg/h

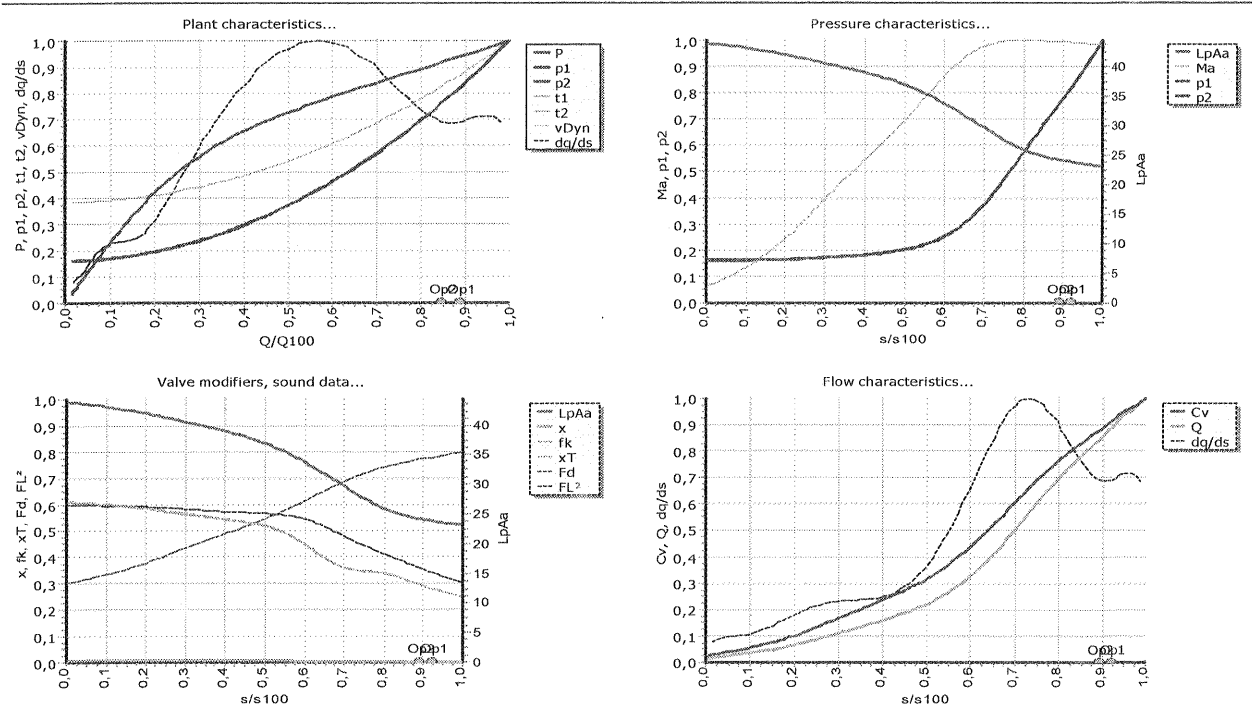
qn	604.000,0	575.150,0	m³/h
Δpc	23,097	22,5	bar(a)
cf1	670,27	652,64	m/s
η1	0,018	0,018	mPa s
κ	1,39	1,39	-
ρ1	25,618	24,997	kg/m³
ρ2	25,572	24,948	kg/m³
LpAa	23,8	24,2	dB(A)
u1	19,892	19,412	m/s
u2	19,928	19,45	m/s
P	49,029	47,851	kW
MaDN	0,029731	0,029802	-
s/s100	92,238	89,248	%
Cv/Cv1...	91,411	88,125	%
Fd	0,779	0,771	-
FL²	0,342	0,358	-
xT	0,281	0,296	-
	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$) vDyn 1,0 -

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,002	25,01	50,01	75,0	99,93
t1	°C	-76,49	-74,39	-61,62	37,32	234,9
p1	bar(a)	16,35	16,92	20,36	47,03	100,3
p2	bar(a)	16,2	16,77	20,21	46,88	100,1
Cv	GPM(US)	236,7	807,3	1.943,0	4.253,0	6.154,0
qm	kg/h	8.424,0	29.070,0	74.430,0	204.700,0	338.500,0
qn	m³/h	16.890,0	58.300,0	149.300,0	410.500,0	678.800,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	1,0	1,0
pv1	bar(a)					
κ	-	1,39	1,39	1,39	1,39	1,39
LpAa	dB(A)	43,54	41,25	36,9	27,59	23,12
MaDN	-	2,825 E-3	9,471 E-3	0,02076	0,02982	0,02953
u2	m/s	1,262	4,251	9,611	16,73	21,19
cf	m/s					



Hint:

- ④ Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- ✕ Modified calculated value
- Lookup value
- ④ Hint

Calculation header

Identifier
Author
Editor
Tag No.

2004-63047 Methanol ZAGROS

uwinkel 20.06.2005 13:09:47

uwinkel 21.06.2005 09:36:28

HV-200214

Medium selection and state

Medium
Operating temperature
State
Gas

t1

RECYCLE GAS

40,0

°C

Gaseous (Standard conditions)**Gas, dry****First operating point (max. flow)**

Calculation

Absolute pressure upstream of valve
Absolute pressure downstream of valve
Absolute pressure downstream of resist...
Flow coefficient
☐ Mass flow rate
☒ Volume flow rate (standard conditio...
Critical flow-related pressure difference
Critical real pressure difference
Type of flow
State of flow

p1

p2

p2,end

Cv

qm

qn

 Δp_c Δp_{Xc} **Kv/Cv**

4,9

3,2

2,5

1.036,8

58.852,0

45.000,0

1,7223

1,7089

bar(a)

bar(a)

bar(a)

GPM(US)

kg/h

m³/h

bar(a)

bar(a)

Non-critical**Turbulent flow****Properties at first operating point**

Operating density (t1, p1)
Operating density (t2, p2)
☒ Dynamic viscosity (t1, p1)
Isentropic exponent (t1, p1)

 ρ_1 ρ_2 η_1 κ

5,627

3,6748

0,014

1,39

kg/m³

kg/m³

mPa s

-

Physical constants

Standard conditions
☐ Density (standard conditions, dry g...
☐ Specific gas constant
☒ Molecular weight
Real gas factor (standard conditions)

 ρ_n

R

M

Zn

0°C, 1013 mbar

1,3078

278,08

29,9

1,02

kg/m³

J/(kg K)

kg/kmol

-

Valve selection

Valve manufacturer
Series
Valve selection
☒ Valve from database

LEUSCH**LDE Class 900****Cv: 2624, 12", Measured values (lin)**☒ Valve data can be modified**Valve data**

Size and pressure class according to
Valve type
Basic characteristic (IEC 60534-2-4)
Flow direction
Flow coefficient
Selected flow coefficient
Selected valve size
Flow velocity
Flow velocity
Valve style modifier (Cv/Cv100 = 1)

Cv

Cv100

DN

u1

u2

Fd

ANSI**Butterfly valve****Measured values (lin)****FTO**

1.036,8

1.620,0

12"

39,816

60,969

0,8

GPM(US)

GPM(US)

m/s

m/s

-

- ☒ Function for FL²
☒ Function for xT

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	72,006	%
Valve load	Cv/Cv1...	63,999	%
Valve modifier (operating conditions)	FL ²	0,463	-
Valve modifier (operating conditions)	xT	0,354	-
Valve style modifier (operating conditio...	Fd	0,701	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	12"	
Pressure class upstream of valve	PN1	Schedule 60	
☐ Pipe outside diameter upstream of ...	Da1	12,748	in
Pipe wall thickness upstream of val...	s1	0,56299	in
☐ Pipe inside diameter upstream of v...	Di1	11,622	in
Flow velocity in the pipe	u1R	42,448	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,68898	in
☐ Pipe inside diameter downstream o...	Di2	11,37	in
Flow velocity in the pipe	u2R	67,912	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	IEC 60534-8-3:2000
------------------------------	--------------------

Calculated values

Low-noise design		n.a.	
Pressure level (correction)	ΔL,Co	-10,0	dB
Pressure level (mach no.)	ΔL,Ma	1,51	dB
Pressure level (resistances)	ΔL,Res	-5,0	dB
Transmission loss	Rr	-53,0	dB
Sound pressure level	Lpi	154,0	dB
Sound power level	Lwi	137,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	92,1	dB(A)
Sound pressure level of valve (A-weight...	LpAa	83,3	dB(A)
Sound pressure level of resistance struc...	La,res	76,4	dB(A)
Total sound level (valve and resistances)	La,tot	84,1	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,17524	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,014	mPa s
---------------------------	----	-------	-------

Influence of resistance structures

Absolute pressure downstream of valve	p2	3,2	bar(a)
Absolute pressure downstream of resist...	p2,end	2,5	bar(a)
Type of resistance structure		Silencer (direct)	

Diameter of bores	d	5,0	mm
No. of resistances	n	2	-
Mach number per resistance (selected)	Ma	0,3	-
Type of flow		Non-critical	
Sound pressure level of resistance struc...	La,res 	76,4	dB(A)
Sound pressure level of valve (A-weight...	LpAa 	83,3	dB(A)
Total sound level (valve and resistances)	La,tot 	84,1	dB(A)
DN of last perforated plate	DN 	16,0	in
Bore spacing	a 	8,0	mm
Number of bores in last plate	nΦ 	2.174	-

Resistance structure in detail

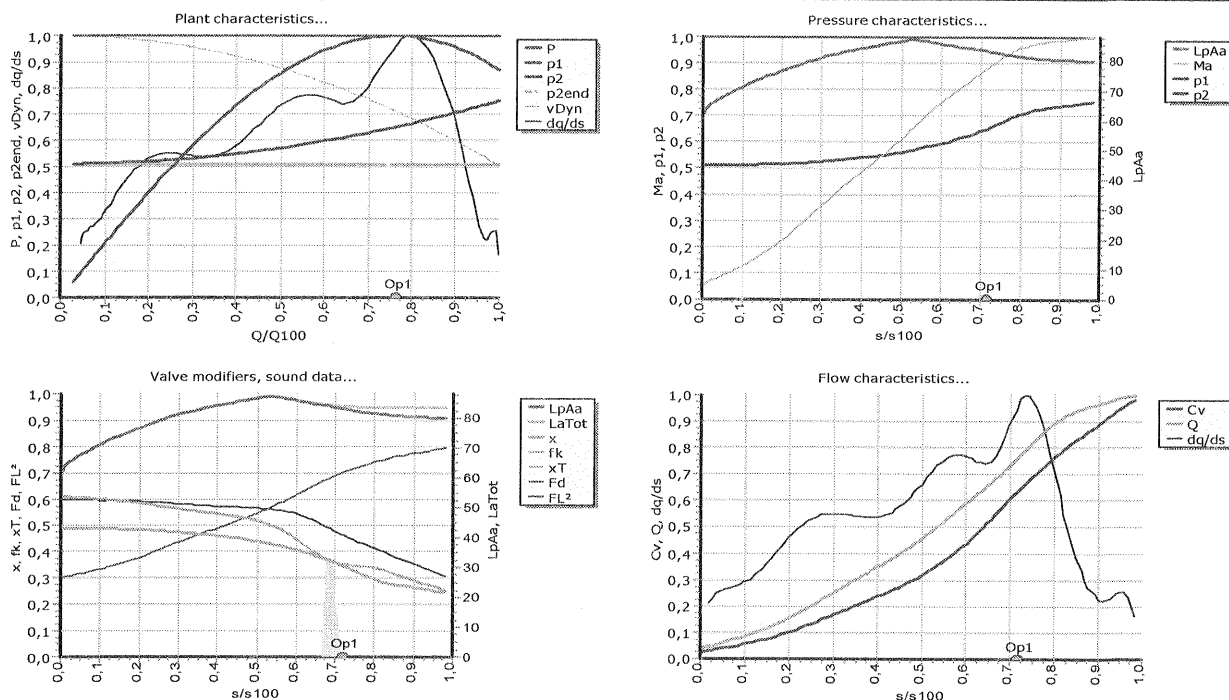
No.	t1	p1	p2	Cv	rho1	rho2	La [dB]	Ma	DN Mx	DN M0,3	DN M0,7	DN M1,0
1	40,0	3,2	2,828	1.947,0	3,675	3,248	73,67	0,2855	10,0	10,0	8,0	6,0
2	40,0	2,828	2,5	2.202,0	3,248	2,871	73,19	0,2243	12,0	12,0	8,0	6,0

Further operating points**Control optimization**

Valve authority ($\Delta p_{100}/\Delta p_0$)	vDyn	0,505	-
Calculated short-circuit performance	ax	1,8516	-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	98 [%]
s/s100	%	5,005	25,0	50,0	75,0	97,9
t1	°C	40,0	40,0	40,0	40,0	40,0
p1	bar(a)	4,9	4,9	4,9	4,9	4,9
p2	bar(a)	2,504	2,547	2,745	3,302	3,687
p2,end	bar(a)	2,5	2,5	2,5	2,5	2,5
Cv	GPM(US)	62,28	212,3	511,1	1.119,0	1.584,0
qm	kg/h	4.564,0	15.230,0	34.850,0	62.990,0	76.620,0
qn	m³/h	3.489,0	11.640,0	26.650,0	48.170,0	58.590,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9982	0,9805	0,8977	0,6658	0,5055
pv1	bar(a)	-	-	-	-	-
κ	-	1,39	1,39	1,39	1,39	1,39
LpAa	dB(A)	67,7	79,08	86,7	82,62	80,01
La,res	dB(A)	31,77	52,7	67,13	77,51	80,95
La,tot	dB(A)	67,7	79,09	86,75	83,78	83,51
MaDN	-	0,01736	0,05696	0,121	0,1818	0,198
u2	m/s	6,041	19,82	42,08	63,24	68,9
cf	m/s	-	-	-	-	-



Hint:

- ① Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- ⊗ Modified calculated value
- Lookup value
- ⊗ Modified database value
- ① Hint

Calculation header

Identifier
Author
Editor
Tag No.

**2004-63047 Methanol ZAGROS**

uwinkel 20.06.2005 13:09:47

uwinkel 21.06.2005 09:39:59

HV-200214**Medium selection and state**

Medium
Operating temperature
State
Gas

t1

RECYCLE GAS**40,0**

°C

Gaseous (Standard conditions)**Gas, dry****First operating point (max. flow)**

Calculation

Absolute pressure upstream of valve
Absolute pressure downstream of valve
Absolute pressure downstream of resist...

p2,end

Flow coefficient

Cv

☐ Mass flow rate

qm

☒ Volume flow rate (standard conditio...

qn

Critical flow-related pressure difference

Δpc

Critical real pressure difference

ΔpXc

Type of flow

State of flow

Kv/Cv**11,5**

bar(a)

7,9

bar(a)

5,0

bar(a)

813,33

GPM(US)

113.780,0

kg/h

87.000,0

m³/h

4,6467

bar(a)

4,4761

bar(a)

Non-critical**Turbulent flow****Properties at first operating point**

Operating density (t1, p1)

ρ1

13,206

kg/m³

Operating density (t2, p2)

ρ2

9,0721

kg/m³

☒ Dynamic viscosity (t1,p1)

η1

0,014

mPa s

Isentropic exponent (t1, p1)

κ

1,39

-

Physical constants

Standard conditions

☐ Density (standard conditions, dry g...

pn

0°C, 1013 mbar**1,3078**

kg/m³

☐ Specific gas constant

R

278,08

J/(kg K)

☒ Molecular weight

M

29,9

kg/kmol

Real gas factor (standard conditions)

Zn

1,02

-

Valve selection

Valve manufacturer

Series

Valve selection

☒ Valve from database**LEUSCH****LDE Class 900****Cv: 2624, 12", Measured values (lin)**☒ Valve data can be modified**Valve data**

Size and pressure class according to

Valve type

Basic characteristic (IEC 60534-2-4)

Flow direction

Flow coefficient

Selected flow coefficient

Selected valve size

Flow velocity

Flow velocity

Valve style modifier (Cv/Cv100 = 1)

☒ Function for FI²**ANSI****Butterfly valve****Measured values (lin)****FTO**

Cv

813,33

GPM(US)

Cv100

1.620,0

GPM(US)

DN

12"

u1

32,799

m/s

u2

47,746

m/s

Fd

0,8

-

☒ Function for xT

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	64,044	%
Valve load	Cv/Cv1...	50,205	%
Valve modifier (operating conditions)	FL ²	0,522	-
Valve modifier (operating conditions)	xT	0,407	-
Valve style modifier (operating conditio...	Fd	0,646	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	12"	
Pressure class upstream of valve	PN1	Schedule 60	
☐ Pipe outside diameter upstream of ...	Da1	12,748	in
Pipe wall thickness upstream of val...	s1	0,56299	in
☐ Pipe inside diameter upstream of v...	Di1	11,622	in
Flow velocity in the pipe	u1R	34,967	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,68898	in
☐ Pipe inside diameter downstream o...	Di2	11,37	in
Flow velocity in the pipe	u2R	53,183	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (correction)	$\Delta L, Co$	-10,0	dB
Pressure level (mach no.)	$\Delta L, Ma$	1,15	dB
Pressure level (resistances)	$\Delta L, Res$	-5,0	dB
Transmission loss	Rr	-55,3	dB
Sound pressure level	Lpi	159,0	dB
Sound power level	Lwi	138,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	95,1	dB(A)
Sound pressure level of valve (A-weight...	LpAa	86,3	dB(A)
Sound pressure level of resistance struc...	La,res	86,8	dB(A)
Total sound level (valve and resistances)	La,tot	89,6	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,13724	-
----------------------------	------	---------	---

Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η_1	0,014	mPa s
---------------------------	----------	-------	-------

Influence of resistance structures

Absolute pressure downstream of valve	p2	7,9	bar(a)
Absolute pressure downstream of resist...	p2,end	5,0	bar(a)
Type of resistance structure		Silencer (direct)	
Diameter of bores	d	5,0	mm

No. of resistances	n	2	-
Mach number per resistance (selected)	Ma	0,3	-
Type of flow		Non-critical	
Sound pressure level of resistance struc...	La,res	86,8	dB(A)
Sound pressure level of valve (A-weight...	LpAa	86,3	dB(A)
Total sound level (valve and resistances)	La,tot	89,6	dB(A)
DN of last perforated plate	DN	14,0	in
Bore spacing	a	8,0	mm
Number of bores in last plate	nΦ	1.490	-

Resistance structure in detail

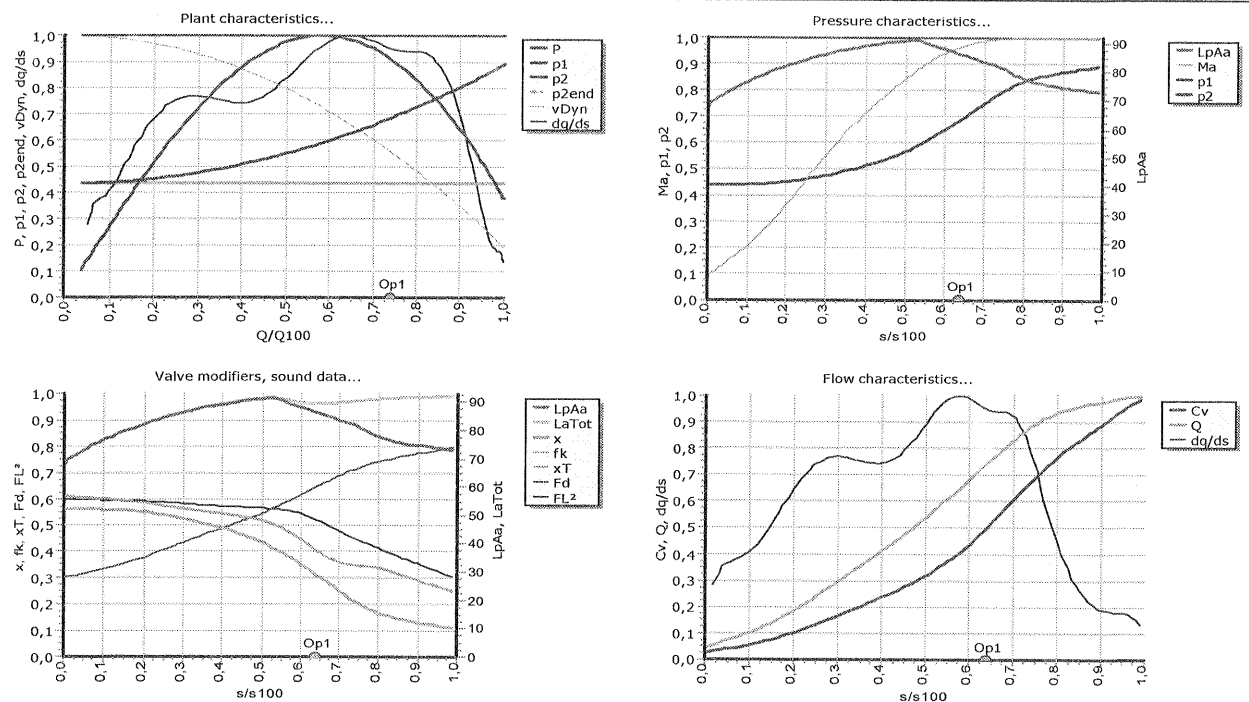
No.	t1	p1	p2	Cv	rho1	rho2	La [dB]	Ma	DN Mx	DN M0,3	DN M0,7	DN M1,0
1	40,0	7,9	6,285	1.201,0	9,072	7,217	84,21	0,2484	10,0	10,0	6,0	5,0
2	40,0	6,285	5,0	1.510,0	7,217	5,742	83,31	0,2168	12,0	12,0	8,0	6,0

Further operating points**Control optimization**

Valve authority ($\Delta p_{100}/\Delta p_0$)	vDyn	0,191	-
Calculated short-circuit performance	ax	1,4971	-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	99 [%]
s/s100	%	5,004	25,0	50,0	74,99	98,91
t1	°C	40,0	40,0	40,0	40,0	40,0
p1	bar(a)	11,5	11,5	11,5	11,5	11,5
p2	bar(a)	5,026	5,291	6,495	9,177	10,24
p2,end	bar(a)	5,0	5,0	5,0	5,0	5,0
Cv	GPM(US)	62,28	212,3	511,1	1.119,0	1.602,0
qm	kg/h	10.850,0	36.060,0	81.700,0	136.600,0	152.900,0
qn	m³/h	8.294,0	27.570,0	62.470,0	104.400,0	116.900,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9959	0,9552	0,7699	0,3573	0,1945
pv1	bar(a)					
κ	-	1,39	1,39	1,39	1,39	1,39
LpAa	dB(A)	72,9	84,36	91,05	81,0	73,07
La,res	dB(A)	45,51	66,39	80,71	89,73	91,7
La,tot	dB(A)	72,91	84,43	91,43	90,27	91,76
MaDN	-	0,02056	0,06494	0,1199	0,1418	0,1423
u2	m/s	7,154	22,59	41,7	49,33	49,51
cf	m/s					



Hint:

- Approximate value: Density of pipeline - ρ_P

Notes:

Selected flow coefficient - Cv_{100}

Cv 100 for Butterfly Valve 12 inch Class 900 with LN-Trim

Legend

- Calculated value
- Modified calculated value
- Lookup value
- Modified database value
- Hint

Calculation header

Identifier
Author
Editor
Tag No.

**2004-63047 Methanol ZAGROS**

uwinkel 20.06.2005 13:09:47

uwinkel 21.06.2005 09:01:18

HV-200503**Medium selection and state**

Medium
Operating temperature
State
Gas

t1

RECYCLE GAS**55,0**

°C

Gaseous (Standard conditions)**Gas, dry****First operating point (max. flow)**

Calculation

Absolute pressure upstream of valve

Absolute pressure downstream of valve

Flow coefficient

☐ Mass flow rate☒ Volume flow rate (standard conditio...

Critical flow-related pressure difference

Critical real pressure difference

Type of flow

State of flow

p1

p2

Cv

qm

qn

 Δp_c Δp_{Xc} **Kv/Cv****76,7**

bar(a)

72,0

bar(a)

244,78

GPM(US)

79.318,0

kg/h

155.000,0

m³/h

42,805

bar(a)

37,873

bar(a)

Non-critical**Turbulent flow****Properties at first operating point**

Operating density (t1, p1)

Operating density (t2, p2)

☒ Dynamic viscosity (t1,p1)

Isentropic exponent (t1, p1)

 ρ_1 ρ_2 η_1 κ **32,244**

kg/m³

30,268

kg/m³

0,014

mPa s

1,42

-

Physical constants

Standard conditions

☐ Density (standard conditions, dry g...☐ Specific gas constant☒ Molecular weight

Real gas factor (standard conditions)

 ρ_n

R

M

Zn

0°C, 1013 mbar**0,51173**

kg/m³

724,89

J/(kg K)

11,47

kg/kmol

1,0

-

Valve selection

Valve manufacturer

Series

Valve selection

☒ Valve from database**LEUSCH****LDE Class 900****Cv: 1136, 8", Measured values (lin)**☒ Valve data can be modified**Valve data**

Size and pressure class according to

Valve type

Basic characteristic (IEC 60534-2-4)

Flow direction

Flow coefficient

Selected flow coefficient

Selected valve size

Flow velocity

Flow velocity

Valve style modifier (Cv/Cv100 = 1)

☒ Function for Fl^2 

Cv

Cv100

DN

u1

u2

Fd

ANSI**Butterfly valve****Measured values (lin)****FTO****244,78**

GPM(US)

1.136,0

GPM(US)

8"**21,071**

m/s

22,446

m/s

0,8

-

☒ Function for xT
Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	37,225	%
Valve load	Cv/Cv1...	21,547	%
Valve modifier (operating conditions)	FL ²	0,573	-
Valve modifier (operating conditions)	xT	0,55	-
Valve style modifier (operating conditio...	Fd	0,475	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	10"	
Pressure class upstream of valve	PN1	Schedule 80	
☐ Pipe outside diameter upstream of ...	Da1	10,748	in
Pipe wall thickness upstream of val...	s1	0,59449	in
☐ Pipe inside diameter upstream of v...	Di1	9,5591	in
Flow velocity in the pipe	u1R	14,758	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	10"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	10,748	in
Pipe wall thickness downstream of ...	s2	0,59449	in
☐ Pipe inside diameter downstream o...	Di2	9,5591	in
Flow velocity in the pipe	u2R	15,722	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	$\Delta L, Ma$	0,191	dB
Transmission loss	Rr	-62,8	dB
Sound pressure level	Lpi	148,0	dB
Sound power level	Lwi	118,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	90,2	dB(A)
Sound pressure level of valve (A-weight...	LpAa	80,7	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,038622	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η_1	0,014	mPa s
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Further operating points

	Maximum flow	Mean flow	Minimum flow
t1	55,0	55,0	°C
t2	55,0	55,0	°C
p1	76,7	76,7	bar(a)
p2	72,0	72,0	bar(a)
Cv	244,78	199,54	GPM(US)
qm	79.318,0	64.734,0	kg/h

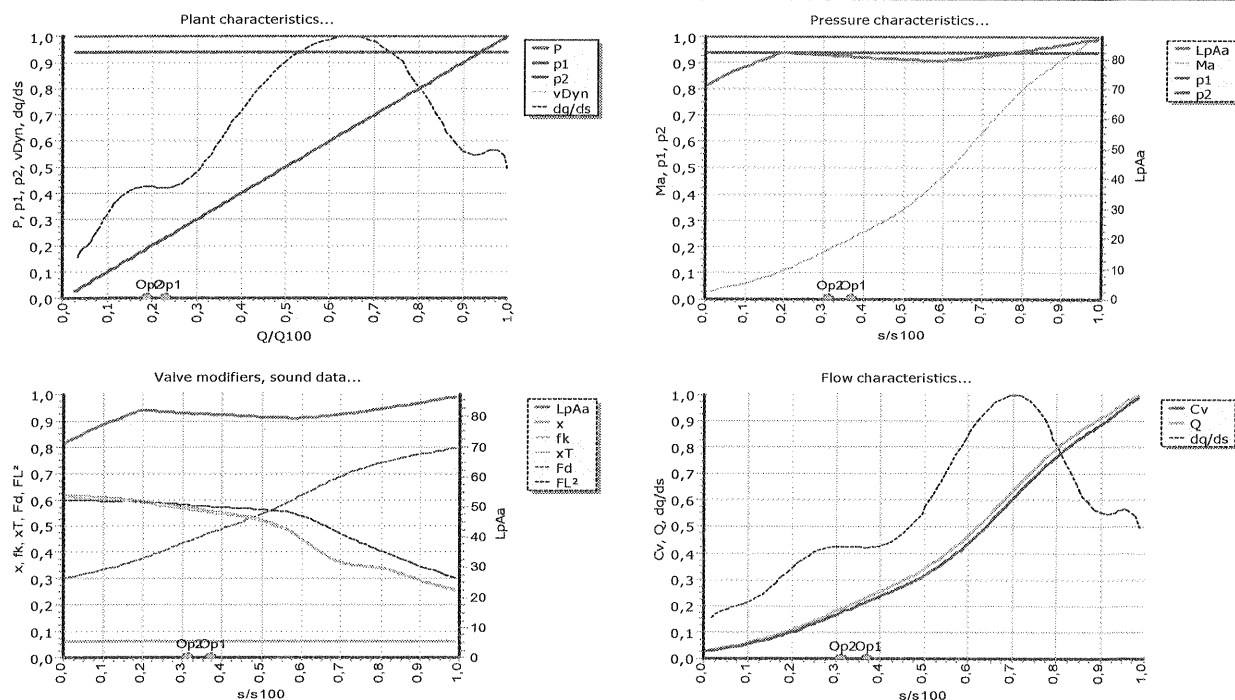
qn	155.000,0	126.500,0	m³/h
Δpc	42,805	43,697	bar(a)
cf1	581,19	581,19	m/s
η1	0,014	0,014	mPa s
κ	1,42	1,42	-
p1	32,244	32,244	kg/m³
p2	30,268	30,268	kg/m³
LpAa	80,7	81,1	dB(A)
u1	21,071	17,197	m/s
u2	22,446	18,319	m/s
P	331,42	270,48	kW
MaDN	0,038622	0,03152	-
s/s100	37,225	31,488	%
Cv/Cv1...	21,547	17,565	%
Fd	0,475	0,443	-
FL²	0,573	0,579	-
xT	0,55	0,562	-
FP	0,999	0,999	-
	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$) vDyn 1,0 -

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	99 [%]
s/s100	%	5,001	25,0	50,0	75,0	99,0
t1	°C	55,0	55,0	55,0	55,0	55,0
p1	bar(a)	76,7	76,7	76,7	76,7	76,7
p2	bar(a)	72,0	72,0	72,0	72,0	72,0
Cv	GPM(US)	43,66	148,9	358,4	784,6	1.125,0
qm	kg/h	14.210,0	48.360,0	115.700,0	246.100,0	340.600,0
qn	m³/h	27.780,0	94.510,0	226.100,0	480.900,0	665.600,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	1,0	1,0
pv1	bar(a)					
κ	-	1,42	1,42	1,42	1,42	1,42
LpAa	dB(A)	74,46	81,69	79,89	81,67	86,63
MaDN	-	6,921 E-3	0,02355	0,05634	0,1198	0,1659
u2	m/s	4,022	13,69	32,75	69,64	96,39
cf	m/s					



Hint:

- ① Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- ✕ Modified calculated value
- Lookup value
- ① Hint

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. LV100411 Tag no. LV100411
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	35000	27958	5000
Inlet pressure	p1	[bar(a)]	32,5	33,7	23
Outlet pressure	p2	[bar(a)]	30,5	30,5	20
Inlet temperature	t1	[°C]	180	167	140
Density	rho1	[kg/m³]	888,5	902,13	927
Vapor pressure	pv	[bar(a)]	10,026	7,3625	5,4535
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,1507	0,16327	0,1457

Results and factors

Valve coeff. calculated	Cv	30,8	19,3	3,51
Min. req. size	Req. DN [mm]	52,8	46,8	19,5
Outlet velocity	w [m/s]	2,18	1,71	0,298
SPL VDMA 24422 mod.	LA [dB(A)]	51	52	38
relative travel	T [%]	77,7	65,7	22,2
Different. pressure ratio	xF	0,09	0,12	0,17
FL value	FL	0,94	0,96	0,97
Kc value	Kc	0,84	0,87	0,93
Valve style factor	Fd	0,42	0,41	0,16
z value at capacity	xFz	0,30	0,34	0,57
Level exponent	F1	-6,98	-7,02	-7,59
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0	0

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3251
Nominal size	DN ["]	Body material	A351 CF8M
Pressure ratings	CLASS	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	without (0,0)
Packing	PTFE (1,6)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	106,3	s [mm]	6,02

Actuator data

Type	3277	Fail-safe act.	extends
Diaphr. area	A [cm²]	Bench range	ps0 [bar]
	700	Supply	psu [bar]
(Defaults: p1max [bar(a)] 40 p2min [bar(a)] 1,01 t1max [°C] 200)			2,1 ... 3,3
			3,50

Actuator results

req. act. force	Fo req. [kN]	12,64	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	52,46	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	45,54	Close safety factor	Fa/Fo (SF)	1,16
req. start bench range	ps0req. [bar]	1,99	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. LV100416Rev.2 Tag no. LV100416
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	112000	92612	40000
Inlet pressure	p1	[bar(a)]	55	56	60
Outlet pressure	p2	[bar(a)]	50	49	48,5
Inlet temperature	t1	[°C]	240	240	240
Density	rho1	[kg/m³]	814,84	814,86	814,89
Vapor pressure	pv	[bar(a)]	33,467	33,467	33,467
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,11123	0,11124	0,11124

Results and factors

Valve coeff. calculated	Cv	64,9	45,4	15,3
Min. req. size	Req. DN [mm]	98,6	89,7	58,9
Outlet velocity	w [m/s]	2,16	1,79	0,772
SPL VDMA 24422 mod.	LA [dB(A)]	72	80	78
relative travel	T [%]	84,9	75,8	48,0
Different. pressure ratio	xF	0,23	0,31	0,43
FL value	FL	0,96	0,96	0,97
Kc value	Kc	0,87	0,89	0,92
Valve style factor	Fd	0,43	0,42	0,32
z value at capacity	xFz	0,22	0,24	0,34
Level exponent	F1	-6,95	-6,98	-7,09
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	-0,48	-2,84	-4,89

Valve data

Body type	Globe valve	Series	250
Valve coefficient	Cv	Type	3251
Nominal size	DN ["]	Body material	A351 CF8C
Pressure ratings	PN	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	Graphite (10)
Packing	Graphit (20)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	149	s [mm]	7,11

Actuator data

Type					3271	Fail-safe act.		extends	
Diaphr. area	A		[cm²]	1400		Bench range		ps0	[bar] 1,2 ... 2
(Defaults:	p1max	[bar(a)] 85	p2min	[bar(a)] 1,01	t1max	[°C] 270)	Supply	psu	[bar] 2,32

Actuator results

req. act. force	Fm req. [kN]	8,72	req. diff. psu-ps100	d ps [bar]	0,32
max. act. force	Fmax [kN]	67,38	Actuator force	Fa [kN]	16,80
max. dp on plug	d. pmax [bar]	246,55	Close safety factor	Fa/Fo (SF)	1,93
req. start bench range	ps0req. [bar]	0,69	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV101308	Tag no.	LV101308
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	12000	3390	1500
Inlet pressure	p1	[bar(a)]	32	32	21
Outlet pressure	p2	[bar(a)]	3	3	2
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	993,58	993,58	993,58
Vapor pressure	pv	[bar(a)]	0,073844	0,073844	0,073844
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,65323	0,65323	0,65323

Results and factors

Valve coeff. calculated	Cv	2,62	0,739	0,404
Min. req. size	Req. DN [mm]	29,2	15,5	10,3
Outlet velocity	w [m/s]	1,71	0,483	0,214
SPL VDMA 24422 mod.	LA [dB(A)]	78	73	65
Flow condition		Critical cavitation	Critical cavitation	
relative travel	T [%]	85,1	52,8	37,4
Different. pressure ratio	xF	0,91	0,91	0,91
FL value	FL	0,97	0,98	0,98
Kc value	Kc	0,91	0,93	0,93
Valve style factor	Fd	0,30	0,13	0,09
z value at capacity	xFz	0,54	0,68	0,72
Level exponent	F1	-7,32	-8,04	-8,30
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	2,59	7,58	6,67

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	5	Type	3241
Nominal size	DN ["]	2"	Body material	A351 CF8C
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	12	Flow direction	FTO
Stem diameter	Sd [mm]	10	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	55	s [mm]	5,54

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	350	Bench range	ps0 [bar]	0,2 ... 1	
(Defaults:	p1max [bar(a)] 40	p2min [bar(a)] 1,01	t1max [°C] 100)	psu [bar]	1,20	

Actuator results

req. act. force	Fo req. [kN]	0,57	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	24,50	Actuator force	Fa [kN]	0,70
max. dp on plug	d. pmax [bar]	50,07	Close safety factor	Fa/Fo (SF)	1,24
req. start bench range	ps0req. [bar]	0,18	Open safety factor	Ff/Fw	-

Quote/order no.: follow Customer: 2nd Zagros Mrtanol Plant
 Project: Zagros II Mega Meth... Date: 20.10.2010 Data entered by: Our/V50(



Valve Sizing Specialist Version 1.21

Item no.: 01 Tag no.: LV101309
 Process medium: Water State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	69000	5000	52000
Inlet pressure	p1	[bar(a)]	22	32.8	32.8
Differential pressure	dp	[bar]	20	29.8	29.8
Inlet temperature	T1	[°C]	70	70	70
Inlet density	rho1	[kg/m³]	974.95	974.95	974.95
Vapor pressure	pv	[bar(a)]	0.31	0.31	0.31
Critical pressure	pc	[bar(a)]	221.2	221.2	221.2
Inlet viscosity	ny1	[mm²/s]	0.41	0.41	0.41

Results and factors

Flow coeff. calculated	Cv	[gpm]	18.1	1.1	11.2
Min req. size	Req. DN	[mm]	70.8	19	61.4
Outlet velocity	w	[m/s]	2.5	0.18	1.89
SPL (VDMA 24422 mod.)	LA	[dB(A)]	83.9	63.9	82.6
relative travel	T	[%]	83.32	18.18	71.08
Different. pressure ratio	xF	[-]	0.92	0.92	0.92

Valve data

Body type	Globe Valve		Series	3250
Valve coefficient	Cv	30	Type	3251
Nominal size		[inch]	Body material	A351 CF8
Pressure ratings	Class	600	Trim material	4112 / S44003
Travel	S	[mm]	Noise reduction	AC3-Trim
Seat bore	SB	[mm]	Characteristic	Equal percent. 50:1
Stem diameter	Sd	[mm]	Flow direction	FTO
Packing	PTFE (3,2)		Balanced	Without (0)
Sealing	Metal (2)		Leakage rate	IV
Bonnet	Standard			

Pipe data

Type of pipe	Steel	Pipe insulation	none	D1 [inch]	6	D2 [inch]	6
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	146.3	s [mm]	11

Actuator data

Type			3277	Fail safe act.		stem extends	
Diaphr. area	A	[cm²]	700	Bench range		psO	[bar]
				Supply		psu	[bar]
(Defaults:	p1max [bar(a)]	40	p2min [bar(a)]	1.01	t1max [°C]	150	

Actuator results

req. act. force	Fa req.	[kN]	12.71	req. diff. psu-ps100	d ps	[bar]	0.026
max. act. force	Fmax.	[kN]	54.17	Actuator force	Fa	[kN]	18.9
max. dp on plug	d pmax	[bar]	58.83	Close safety factor	Fa/Fa req. (SF)		1.49
req. start bench range	ps0req.	[bar]	2				

Note: Optimazation of the Tag acc. to new process data (e-mail from Mr Kamali 19.10.10)

Quote/order no.: follow Customer: Zagros Pc
 Project: Zagros II Mega Meth... Date: 20.10.2010 Data entered by: Our/V50(



Valve Sizing Specialist Version 1.21

Item no.: 01 Tag no.: LV101309
 Process medium: Water State of medium at inlet: liquid

SAMSON - More calculation data

Flow rate			Case 1	Case 2	Case 3
Piping geometry factor	FP	[-]	1	1	1
Reynolds num. factor	FR	[-]	1	1	1
Valve Reynolds num.	ReV	[-]	998628	63124	724773

SPL calculation acc. VDMA 24422 (1989) / SAMSON-Standard

Different. pressure ratio	x	[-]	0.92	0.92	0.92
In. sound power level	Lwi	[dB]	109.1	81.1	108.4
Ext. sound power level	LWAa	[dB(A)]	96.9	76.9	95.7
Sound pressure level 1m distance pAe		[dB(A)]	83.9	63.9	82.6
Acoustical efficiency factor	etaF	[dB]	-25.7	-34.8	-26.5

Frequency distribution

Internal sound power level LWi (octave bands)

31.5 Hz	[dB]	100.4	51.8	91.6
63 Hz	[dB]	104.8	54.9	96.1
125 Hz	[dB]	108.6	57.8	100.5
250 Hz	[dB]	109.8	60.8	104.3
500 Hz	[dB]	107.2	63.8	105.7
1000 Hz	[dB]	102.9	67.8	103
2000 Hz	[dB]	98.5	72.2	98.8
4000 Hz	[dB]	94	76.2	94.4
8000 Hz	[dB]	89.4	78	89.9
16000 Hz	[dB]	84.9	85.3	75.7

External sound power level LWA (octave bands)

31.5 Hz	[dB]	15.2	-14.6	6.5
63 Hz	[dB]	37.6	-4.1	29
125 Hz	[dB]	57.4	8.6	49.3
250 Hz	[dB]	76.1	29.2	70.7
500 Hz	[dB]	82.8	41.5	81.3
1000 Hz	[dB]	87.9	54.3	87.9
2000 Hz	[dB]	91	64.7	90.6
4000 Hz	[dB]	93.4	72.6	91
8000 Hz	[dB]	91.2	74.5	87.2
16000 Hz	[dB]	82.9	78.1	67.4

A-weight. (octave bands correction tern)

f [Hz]:	31.5	63	125	250	500	1000	2000	4000	8000	16000
A-weight.:	-41.0	-26.2	-16.1	-8.6	-3.2	0.0	+1.2	+1.0	-1.2	-6.5

Quote/order no.: follow

Customer: Zagros Pc

Project: Zagros II Mega Meth...

Date: 20.10.2010

Data entered by: Our/V50(



Valve Sizing Specialist Version 1.21

Item no.: 01

Tag no.:

LV101309

Process medium: Water

State of medium at inlet:

liquid

Time calculation data

Accessories data

Accessory

Positioner 3730

Flow coefficient (Filling)

Cv

[gpm]

0.1

Flow coefficient (Venting)

Cv

[gpm]

0.17

Closing and opening times

Opening times

dp = 0 bar

dpmax = 39 bar

Filling delay time at 0 %

t1

[s]

6.1

2

Filling time

t2

[s]

7.2

2.8

Total time (t1 + t2)

t

[s]

13.2

4.8

Closing time

Venting time

t2

[s]

2.4

3.3

Venting delay time at 0 %

t1

[s]

9.3

5.8

Total time (t1 + t2)

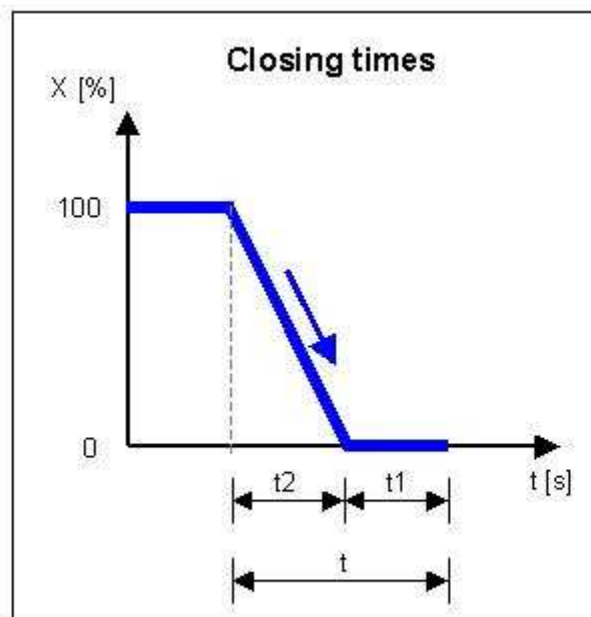
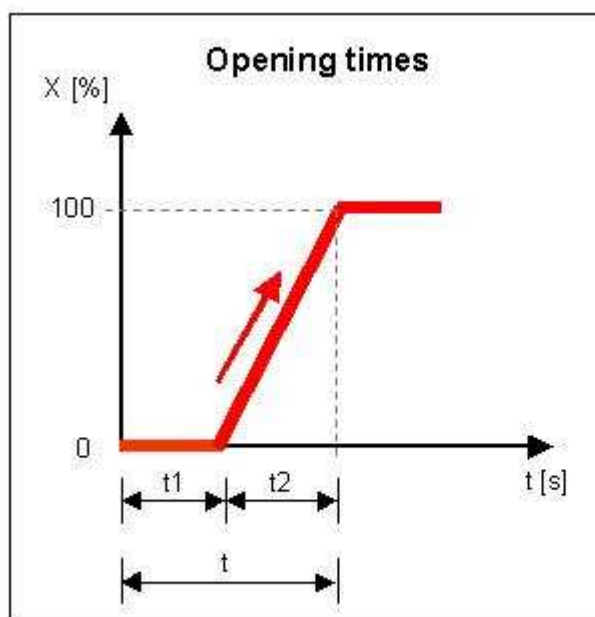
t

[s]

11.8

9.1

Legend



Notes

The transit time t_2 is based on the nominal range.

Quote/order no.: follow Customer: Zagros Pc
 Project: Zagros II Mega Meth... Date: 20.10.2010 Data entered by: Our/V50(



Valve Sizing Specialist Version 1.21

Item no.: 01 Tag no.: LV101309
 Process medium: Water State of medium at inlet: liquid

Expert

Category	Noise
Evaluation	o.k.
Recommendation	-
Category	Cavitation
Evaluation	none, o.k.
Recommendation	-
Category	Flashing
Evaluation	none, o.k.
Recommendation	-
Category	Wet steam at vena contracta
Evaluation	-
Recommendation	-
Category	Gas icing at vena contracta
Evaluation	-
Recommendation	-
Category	Outlet velocity
Evaluation	o.k.
Recommendation	-
Category	Ratio of seat diameter / valve size
Evaluation	o.k.
Recommendation	-
Category	Rangeability
Evaluation	o.k.
Recommendation	-
Category	Control loop behavior
Evaluation	o.k.
Recommendation	-
Category	Actuator: safety factor (Fa/Fa req.)
Evaluation	o.k.
Recommendation	-
Category	Actuator: safety factor (Ff/Fw)
Evaluation	-
Recommendation	-
Category	Actuator: closing force
Evaluation	o.k.
Recommendation	-
Category	Dynamic performance of complete control valve
Evaluation	Run time o.k.
Recommendation	-
Category	Attenuation plate: strength when valve is fully opened
Evaluation	-
Recommendation	-
Category	Attenuation plate: choked flow
Evaluation	none, o.k.
Recommendation	-

Quote/order no.: follow

Customer: Zagros Pc

Project: Zagros II Mega Meth...

Date: 20.10.2010

Data entered by: Our/V50(



Valve Sizing Specialist Version 1.21

Item no.: 01

Tag no.:

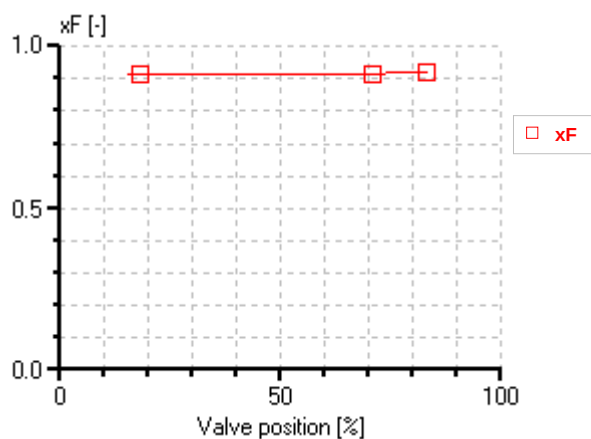
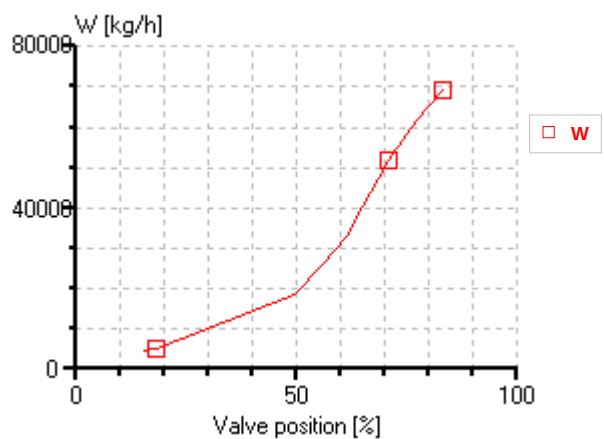
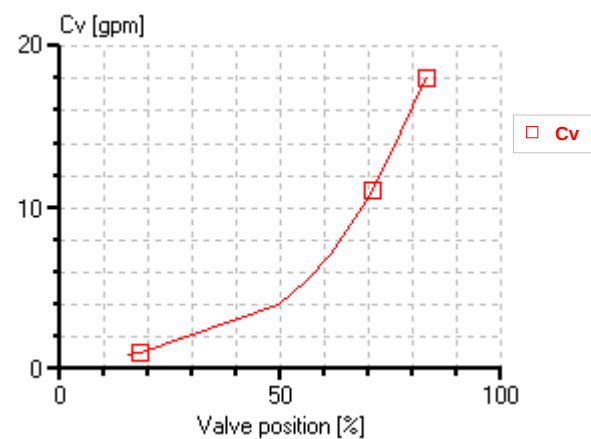
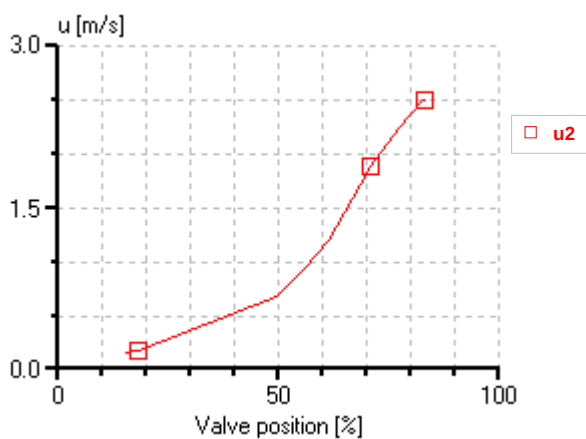
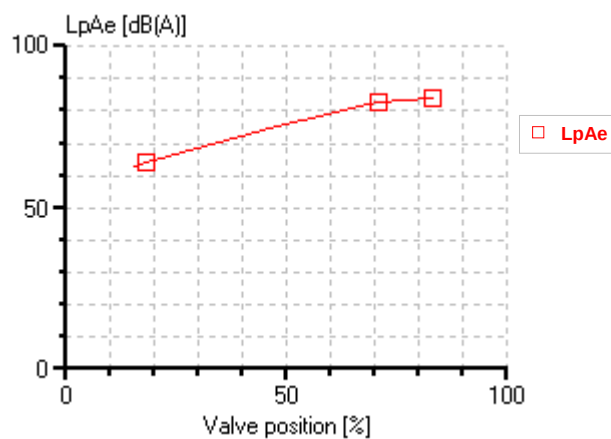
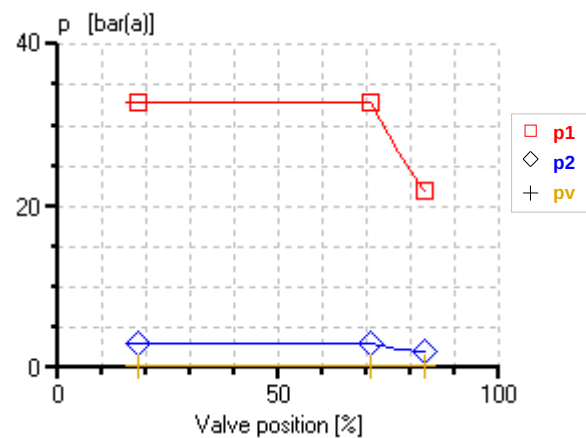
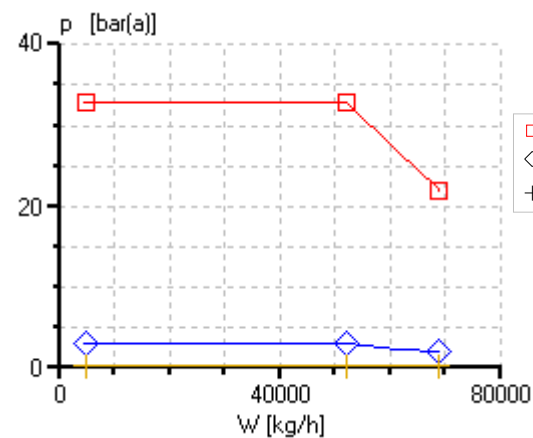
LV101309

Process medium: Water

State of medium at inlet:

liquid

Diagram overview



Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. LV101512A Tag no. LV101512A
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	5000	2000
Inlet pressure	p1	[bar(a)]	60	60	60
Outlet pressure	p2	[bar(a)]	30	30	5
Inlet temperature	t1	[°C]	111	111	111
Density	rho1	[kg/m³]	953	953	953
Vapor pressure	pv	[bar(a)]	1,4826	1,4826	1,4826
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,2538	0,2538	0,2538

Results and factors

Valve coeff. calculated	Cv		2,19	1,09	0,323
Min. req. size	Req. DN [mm]		27,2	19,3	12,2
Outlet velocity	w	[m/s]	1,48	0,742	0,297
SPL VDMA 24422 mod.	LA	[dB(A)]	58	54	75
Flow condition					Critical cavitation
relative travel	T	[%]	78,6	60,9	29,7
Different. pressure ratio	xF		0,51	0,51	0,94
FL value	FL		0,97	0,98	0,98
Kc value	Kc		0,92	0,93	0,94
Valve style factor	Fd		0,42	0,40	0,20
z value at capacity	xFz		0,65	0,65	0,65
Level exponent	F1		-7,26	-7,62	-8,15
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		-2,15	0,12	7,15

Valve data

Body type		Globe valve	Series	multistage valve
Valve coefficient	Cv	5	Type	3251M
Nominal size	DN ["]	2"	Body material	A216 WCB
Pressure ratings	CLASS	900	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	31	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	54	s [mm]	5,54

Actuator data

Type		3277	Fail-safe act.	extends	
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	1,6 ... 2,4
(Defaults: p1max [bar(a)] 81	p2min [bar(a)] 1,01	t1max [°C] 140)	Supply	psu [bar]	2,60

Actuator results

req. act. force	Fo req. [kN]	6,39	req. diff. psu-ps100	d ps [bar]	0,03
max. act. force	Fmax [kN]	54,51	Actuator force	Fa [kN]	11,20
max. dp on plug	d. pmax [bar]	143,40	Close safety factor	Fa/Fo (SF)	1,75
req. start bench range	ps0req. [bar]	1,00	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV101512B	Tag no.	LV101512B
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	60000	43404	12000
Inlet pressure	p1	[bar(a)]	30	30	20
Outlet pressure	p2	[bar(a)]	3	3	3
Inlet temperature	t1	[°C]	151	151	151
Density	rho1	[kg/m³]	917,5	917,5	917,5
Vapor pressure	pv	[bar(a)]	4,89	4,89	4,89
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,18179	0,18179	0,18179
Flashing portion	xd2	[%]	3,46	3,46	3,46
spec. Volume	v2	[m³/kg]	0,695	0,695	0,695

Results and factors

Valve coeff. calculated	Cv		15,0	10,8	3,80
Min. req. size	Req. DN [mm]		94,2	80,1	42,1
Outlet velocity	w	[m/s]	53,3	38,5	10,7
SPL VDMA 24422 mod.	LA	[dB(A)]	81	79	68
Flow condition			Flashing	Flashing	Flashing
relative travel	T	[%]	82,9	74,6	47,9
Different. pressure ratio	xF		1,08	1,08	1,13
FL value	FL		0,97	0,97	0,98
Kc value	Kc		0,90	0,91	0,93
Valve style factor	Fd		0,43	0,42	0,32
z value at capacity	xFz		0,31	0,32	0,36
Level exponent	F1		-6,88	-6,84	-7,21
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf	[dB]	5,70	5,67	5,87

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	30	Type	3251
Nominal size	DN	["]	Body material	A351 CF8M
Pressure ratings	CLASS	600	Noise reduction	without
Travel	S	[mm]	Charact.	Equal perc.
Seat bore	SB	[mm]	Flow direction	FTO
Stem diameter	Sd	[mm]	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	106	s [mm]	6,02

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	700	Bench range	ps0	[bar]
				Supply	psu	[bar]
(Defaults:	p1max [bar(a)]	40	p2min [bar(a)]	1,01	t1max [°C]	200)
						1,6 ... 2,4
						2,60

Actuator results

req. act. force	Fo req.	[kN]	4,82	req. diff. psu-ps100	d ps	[bar]	0,03
max. act. force	Fmax	[kN]	52,46	Actuator force	Fa	[kN]	11,20
max. dp on plug	d. pmax	[bar]	95,04	Close safety factor	Fa/Fo (SF)		2,32
req. start bench range	ps0req.	[bar]	0,76	Open safety factor	Ff/Fw		-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. LV101602 Tag no. LV101602
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	5000	1000
Inlet pressure	p1	[bar(a)]	4	4	4
Outlet pressure	p2	[bar(a)]	3	3	3
Inlet temperature	t1	[°C]	35	35	35
Density	rho1	[kg/m³]	994,17	994,17	994,17
Vapor pressure	pv	[bar(a)]	0,056286	0,056286	0,056286
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,71932	0,71932	0,71932

Results and factors

Valve coeff. calculated	Cv	11,7	5,87	1,21
Min. req. size	Req. DN [mm]	26,7	18,9	8,44
Outlet velocity	w [m/s]	1,42	0,712	0,142
SPL VDMA 24422 mod.	LA [dB(A)]	<30	<30	<30
relative travel	T [%]	88,1	70,3	29,9
Different. pressure ratio	xF	0,25	0,25	0,25
FL value	FL	0,94	0,96	0,98
Kc value	Kc	0,84	0,89	0,93
Valve style factor	Fd	0,32	0,21	0,08
z value at capacity	xFz	0,38	0,49	0,66
Level exponent	F1	-7,02	-7,15	-7,84
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0	0

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	20	Type	3241
Nominal size	DN ["]	2"	Body material	A351 CF8C
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	31	Flow direction	FTO
Stem diameter	Sd [mm]	10	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [inch]	2,1	s [inch]	5,54

Actuator data

Type		3277	Fail-safe act.	retracts		
Diaphr. area	A [cm²]	350	Bench range	ps0 [bar]	0,2 ... 1	
(Defaults:	p1max [bar(a)] 9	p2min [bar(a)] 1,01	t1max [°C] 35)	Supply	psu [bar]	1,27

Actuator results

req. act. force	Fo req. [kN]	0,85	req. diff. psu-ps100	d ps [bar]	0,27
max. act. force	Fmax [kN]	27,58	Actuator force	Fa [kN]	0,94
max. dp on plug	d. pmax [bar]	9,16	Close safety factor	Fa/Fo (SF)	1,11
req. start bench range	ps0req. [bar]	0,02	Open safety factor	Ff/Fw	13,69

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. LV-150101A Tag no. LV150101A
Process medium Water/Steam State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	390000	347840	30000
Inlet pressure	p1	[bar(a)]	7	7,2	7,4
Outlet pressure	p2	[bar(a)]	3,3	3,2	3
Inlet temperature	t1	[°C]	35	35	35
Density	rho1	[kg/m³]	994,3	994,31	994,32
Vapor pressure	pv	[bar(a)]	0,056286	0,056286	0,056286
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,71932	0,71932	0,71932

Results and factors

Valve coeff. calculated	Cv	238	204	16,8
Min. req. size	Req. DN [mm]	167	157	46,2
Outlet velocity	w [m/s]	3,47	3,09	0,267
SPL VDMA 24422 mod.	LA [dB(A)]	76	80	71
relative travel	T [%]	85,4	81,5	17,6
Different. pressure ratio	xF	0,53	0,56	0,60
FL value	FL	0,94	0,94	0,98
Kc value	Kc	0,82	0,83	0,93
Valve style factor	Fd	0,43	0,42	0,15
z value at capacity	xFz	0,50	0,50	0,50
Level exponent	F1	-7,32	-7,34	-7,62
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	-5,95	-6,68	-3,83

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	420	Type	3241
Nominal size	DN ["]	8"	Body material	A351 CF8C
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	200	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	259	s [mm]	4,19

Actuator data

Type							3271	Fail-safe act.	extends		
Diaphr. area	A						2800	Bench range	ps0	[bar]	2 ... 2,6
								Supply	psu	[bar]	2,80
(Defaults:	p1max	[bar(a)]	11	p2min	[bar(a)]	1,01	t1max	[°C]	100)		

Actuator results

req. act. force	Fo req. [kN]	32,99	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	162,52	Actuator force	Fa [kN]	56,00
max. dp on plug	d. pmax [bar]	17,27	Close safety factor	Fa/Fo (SF)	1,70
req. start bench range	ps0req. [bar]	1,30	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV150406	Tag no.	LV150406
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	78000	63317	10000
Inlet pressure	p1	[bar(a)]	5,4	5,4	6
Outlet pressure	p2	[bar(a)]	4,6	4,5	4,8
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	992,42	992,42	992,44
Vapor pressure	pv	[bar(a)]	0,073844	0,073844	0,073844
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,65301	0,65301	0,65302

Results and factors

Valve coeff. calculated	Cv		102	78,4	10,7
Min. req. size	Req. DN [mm]		74,6	67,2	26,7
Outlet velocity	w	[m/s]	2,78	2,26	0,356
SPL VDMA 24422 mod.	LA	[dB(A)]	53	52	41
relative travel	T	[%]	84,6	77,7	26,9
Different. pressure ratio	xF		0,15	0,17	0,20
FL value	FL		0,92	0,93	0,97
Kc value	Kc		0,77	0,79	0,91
Valve style factor	Fd		0,43	0,42	0,19
z value at capacity	xFz		0,22	0,24	0,43
Level exponent	F1		-6,92	-6,95	-7,15
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0	0	0

Valve data

Body type		Globe valve		Series		globe valve
Valve coefficient	Cv		190	Type		3241
Nominal size	DN	["]	4"	Body material		A351 CF8C
Pressure ratings	CLASS		300	Noise reduction		without
Travel	S	[mm]	30	Charact.		Equal perc.
Seat bore	SB	[mm]	100	Flow direction		FTO
Stem diameter	Sd	[mm]	16	Balanced		without (0,0)
Packing	PTFE (1,6)			Leakage rate		IV
Sealing	metal (2,0)			Bonnet		standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107	s [mm]	3,05

Actuator data

Type			3277	Fail-safe act.		extends	
Diaphr. area	A	[cm²]	700	Bench range		ps0 [bar]	1,4 ... 2,3
				Supply		psu [bar]	2,50
(Defaults:	p1max [bar(a)]	10	p2min [bar(a)]	1,01	t1max [°C]	40)	

Actuator results

req. act. force	Fo req. [kN]	7,79	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	64,07	Actuator force	Fa [kN]	9,80
max. dp on plug	d. pmax [bar]	11,53	Close safety factor	Fa/Fo (SF)	1,26
req. start bench range	ps0req. [bar]	1,22	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV150505	Tag no.	LV150505
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	11000	6197	1000
Inlet pressure	p1	[bar(a)]	5,5	5,5	5,5
Outlet pressure	p2	[bar(a)]	3,5	3,5	3,5
Inlet temperature	t1	[°C]	50	50	50
Density	rho1	[kg/m³]	988,24	988,24	988,24
Vapor pressure	pv	[bar(a)]	0,12351	0,12351	0,12351
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,54693	0,54693	0,54693

Results and factors

Valve coeff. calculated	Cv	9,14	5,16	0,832
Min. req. size	Req. DN [mm]	28,1	21,1	8,46
Outlet velocity	w [m/s]	1,57	0,887	0,143
SPL VDMA 24422 mod.	LA [dB(A)]	46	42	<30
relative travel	T [%]	81,7	67,0	20,4
Different. pressure ratio	xF	0,37	0,37	0,37
FL value	FL	0,95	0,96	0,98
Kc value	Kc	0,86	0,89	0,93
Valve style factor	Fd	0,28	0,19	0,07
z value at capacity	xFz	0,43	0,51	0,69
Level exponent	F1	-7,08	-7,16	-8,01
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0	0

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3241
Nominal size	DN ["]	Body material	A105
Pressure ratings	CLASS	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	without (0,0)
Packing	PTFE (1,6)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107	s [mm]	6,02

Actuator data

Type	3277	Fail-safe act.	extends
Diaphr. area	A [cm²]	Bench range	ps0 [bar]
		Supply	psu [bar]
(Defaults: p1max [bar(a)] 5,5 p2min [bar(a)] 1,01 t1max [°C] 200)			0,8 ... 2,4 2,60

Actuator results

req. act. force	Fo req. [kN]	0,58	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	22,39	Actuator force	Fa [kN]	2,80
max. dp on plug	d. pmax [bar]	33,73	Close safety factor	Fa/Fo (SF)	4,79
req. start bench range	ps0req. [bar]	0,18	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV200301	Tag no.	LV200301
Process medium	Raw methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	270000	244013	80000
Inlet pressure	p1	[bar(a)]	68	68	51
Outlet pressure	p2	[bar(a)]	5,5	5,5	5,5
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	782	782	782
Vapor pressure	pv	[bar(a)]	0,35	0,35	0,35
Critical pressure	pc	[bar(a)]	81,3	81,3	81,3
Viscosity	eta	[mPas]	0,437	0,437	0,437

Results and factors

Valve coeff. calculated	Cv	57,9	52,3	20,1
Min. req. size	Req. DN [mm]	156	149	85,1
Outlet velocity	w [m/s]	3,05	2,76	0,905
SPL VDMA 24422 mod.	LA [dB(A)]	98	97	94
Flow condition		Critical cavitation	Critical cavitation	Critical cavitation
relative travel	T [%]	82,1	79,6	54,9
Different. pressure ratio	xF	0,92	0,92	0,90
FL value	FL	0,75	0,75	0,74
Kc value	Kc	0,42	0,42	0,41
Valve style factor	Fd	0,42	0,42	0,37
z value at capacity	xFz	0,33	0,33	0,41
Level exponent	F1	-7,09	-7,10	-7,19
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	-8,91	-8,76	-8,93

Valve data

Body type		Globe valve	Series	angle valve
Valve coefficient	Cv	120	Type	3256
Nominal size	DN ["]	8"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	80	Flow direction	FTC
Stem diameter	Sd [mm]	40	Balanced	PTFE (1,6)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	12"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	302	s [mm]	9,53

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]	0,8 ... 1,2	
(Defaults:	p1max [bar(a)]	89	p2min [bar(a)]	1,01	t1max [°C]	100)
				Supply	psu [bar]	1,40

Actuator results

req. act. force	Fm req. [kN]	1,32	req. diff. psu-ps100	d ps [bar]	0,06
max. act. force	Fmax [kN]	162,52	Actuator force	Fa [kN]	11,20
max. dp on plug	d. pmax [bar]	9,77	Close safety factor	Fa/Fo (SF)	8,49
req. start bench range	ps0req. [bar]	0,10	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV200403	Tag no.	LV200403
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	195000	154530	30000
Inlet pressure	p1	[bar(a)]	61	67	73
Outlet pressure	p2	[bar(a)]	51	51	51
Inlet temperature	t1	[°C]	112	112	112
Density	rho1	[kg/m³]	952,28	952,57	952,86
Vapor pressure	pv	[bar(a)]	1,5328	1,5328	1,5328
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,25143	0,25158	0,25174

Results and factors

Valve coeff. calculated	Cv	74,4	46,4	7,67
Min. req. size	Req. DN [mm]	120	107	47,2
Outlet velocity	w [m/s]	7,24	5,74	1,11
SPL VDMA 24422 mod.	LA [dB(A)]	76	78	66
relative travel	T [%]	88,4	76,4	30,3
Different. pressure ratio	xF	0,17	0,24	0,31
FL value	FL	0,93	0,94	0,97
Kc value	Kc	0,80	0,84	0,92
Valve style factor	Fd	0,43	0,42	0,21
z value at capacity	xFz	0,21	0,24	0,41
Level exponent	F1	-6,81	-6,86	-7,07
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0,02	0

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	120	Type	3251
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	900	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	80	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	154	s [mm]	10,97

Actuator data

Type		3271	Fail-safe act.	extends
Diaphr. area	A [cm²]	2800	Bench range	ps0 [bar]
			Supply	psu [bar]
(Defaults:	p1max [bar(a)] 73	p2min [bar(a)] 1,01	t1max [°C] 160)	2 ... 2,4
				3,43

Actuator results

req. act. force	Fo req. [kN]	36,86	req. diff. psu-ps100	d ps [bar]	0,00677
max. act. force	Fmax [kN]	53,82	Actuator force	Fa [kN]	56,00
max. dp on plug	d. pmax [bar]	105,70	Close safety factor	Fa/Fo (SF)	1,52
req. start bench range	ps0req. [bar]	1,45	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV300101A	Tag no.	LV300101A
Process medium	Raw Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	147000	24000	12000
Inlet pressure	p1	[bar(a)]	7,6	7,9	9
Outlet pressure	p2	[bar(a)]	5,9	5,7	5,7
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	788	788	788
Vapor pressure	pv	[bar(a)]	0,3	0,3	0,3
Critical pressure	pc	[bar(a)]	106,8	106,8	106,8
Viscosity	eta	[mPas]	0,49	0,49	0,49

Results and factors

Valve coeff. calculated	Cv		149	21,3	8,71
Min. req. size	Req. DN [mm]		115	46,4	32,8
Outlet velocity	w	[m/s]	2,93	0,479	0,239
SPL VDMA 24422 mod.	LA	[dB(A)]	73	50	47
relative travel	T	[%]	81,8	32,1	9,16
Different. pressure ratio	xF		0,23	0,29	0,38
FL value	FL		0,91	0,97	0,98
Kc value	Kc		0,75	0,91	0,93
Valve style factor	Fd		0,47	0,29	0,14
z value at capacity	xFz		0,20	0,36	0,49
Level exponent	F1		-7,15	-7,32	-7,43
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0,14	0	-0,13

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	300	Type	3241
Nominal size	DN ["]	6"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	130	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	8"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	207	s [mm]	8,18

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	2,1 ... 3,3	
			Supply	psu [bar]	3,50	
(Defaults:	p1max [bar(a)] 9	p2min [bar(a)] 1,01	t1max [°C] 90)			

Actuator results

req. act. force	Fo req. [kN]	11,53	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	58,52	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	10,36	Close safety factor	Fa/Fo (SF)	1,27
req. start bench range	ps0req. [bar]	1,81	Open safety factor	Ff/Fw	-

01 Order-No. : 1064 24081 Customer : Samson Frankfurt
 02 Name : Marc Bastius Project : P 1725



VETEC
 Valve Sizing V2000

03 Pos.-No. : 2 Rev. 3 Process Fluid : raw methanol 07.06.2005
 04 TAG - No. : LV-300101B Upstream Conditions : Liquid

Process and Medium Data			m i n	n o r m	m a x
06 Flow Rate	[kg/h]	W	30.000	60.000	280.000
07 Inlet Pressure	[bara]	p1	5,50	5,50	5,00
08 Outlet Pressure	[bara]	p2	2,40	2,40	3,80
09 Inlet Temperature	[°C]	t1	38,00	38,00	38,00
10 Density	[kg/m³]	rho	788,000	788,000	788,000
11 Vapor Pressure	[bara]	p _v	5,480	5,480	5,480
12 Critical Pressure	[bara]	p _c	106,8	106,8	106,8
13 Viscosity	[mPas]	eta	0,49	0,49	0,49
14 Ratio. Spc. Heat	[cp/cv]				
15 Compressibility Factor					
16 Flashing	[%]				

17 Pipeline

18 Line size [mm] Da * s / PN (In) 219,1 x 8,18 / std Da * s / PN (Out) 219,1 x 8,18 / std

19 Results

20 Calculated Valve Coeff.	[Kv]	80,26	174,17	623,88
21 Valve Opening in %		28	70	82
22 Outlet Velocity	[m/s]			
23 Max. admitted Velocity	[m/s]			
24 Mach				
25 Acoustic Cap. Lev. LwA,a	[dB(A)]	72	75	78
26 Sound Pres. Lev. LpA,a	[dB(A)]	58	61	64
27 Flow Remark		Flashing	Flashing	Flashing

28 Valve Data

29 Valve Style		Rotary Plug Valve	Valve Type	72.3 R
30 Body Size	[inch]	DN 6"	Body Material	A216 WCC
31 Press. Rating	[lbs]	PN 300	Plug Material	1.4581 / Stellite 6
32 End Connections		RF	Seat Ring Material	1.4571 / Stellite 6
33 Face to Face	[mm]	473,2	Guide Material	1.4571
34 Selected Valve Coeff.		Kvs 685 Cvs 792	Plug/Seat Facing	Metallic
35 Seat Diameter	[mm]	105,0 Sitzfaktor 1	Gaskets	S.S. / Graphite
36 Leakage Class		DIN IEC 534 T4, KL IV L1	Packing	PTFE / Graphite
37 Characteristic		Equal %	Bonnet	TA-Luft / Viton
38 Noise Reduction			Flow Direction	Flow to Open

39 Actuator Data

40 Actuator Style		Pneumatic	Fail Position	Spring to Close
41 Actuator Type		R 200	Handwheel	Without
42 Spring Range	[bar]	0,4 - 1,2	Stroke Time o/c [s] t	< 20 / < 20
43 Air Supply	[bar]	4,0 - 6,0	Req. Torque [Nm]	150
44 Max. Shut Off	[bar]	dp 6	Max. Torque [Nm]	1280
			Mounting	A

45 Accessories

46 Positioner	Type	FF_3787-100, 4-20 mA, IP 65, gaug	Air Set Type	Norgren B74G-4AK-AP3
47 Limit Switches	Type		Piping	1/2" s.s. / Swagelok
48 Solenoid Valve	Type		Others	

49 Certification/Requirements

50 Material	EN 10204 / 3.1B	55	Zubehör und Rohr 1/2" s.s. wird von Samson beigestellt,
51 Inspection	EN 10204 / 3.1B	56	Verschraubung von VETEC
52 Others		57	
53 Cust. Std.		58	
54 Weight	150 kg	59	

01 Order-No. : 1064 24081 Customer : Samson Frankfurt
 02 Name : Marc Bastius Project : P 1725



VETEC
 Valve Sizing V2000

03 Pos.-No. : 3 Rev. 3 Process Fluid : stabilized methanol 07.06.2005
 04 TAG - No. : LV-300202 Upstream Conditions : Liquid

Process and Medium Data			m i n	n o r m	m a x
06 Flow Rate	[kg/h]	W	71.000	236.025	313.500
07 Inlet Pressure	[bara]	p1	11,70	11,20	10,80
08 Outlet Pressure	[bara]	p2	9,80	10,00	10,30
09 Inlet Temperature	[°C]	t1	92,00	92,00	92,00
10 Density	[kg/m³]	rho	742,000	742,000	742,000
11 Vapor Pressure	[bara]	p _v	2,400	2,400	2,400
12 Critical Pressure	[bara]	p _c	107,1	107,1	107,1
13 Viscosity	[mPas]	eta	0,25	0,25	0,25
14 Ratio. Spc. Heat	[cp/cv]				
15 Compressibility Factor					
16 Flashing	[%]				

17 Pipeline

18 Line size [mm] Da * s / PN (In) 323,9 x 9,53 / std Da * s / PN (Out) 323,9 x 9,53 / std

19 Results

20 Calculated Valve Coeff.	[Kv]	59,82	251,62	528,03
21 Valve Opening in %		15	41	65
22 Outlet Velocity	[m/s]	0,85	2,81	3,74
23 Max. admitted Velocity	[m/s]	27,81	28,19	28,74
24 Mach				
25 Acoustic Cap. Lev. LwA,a	[dB(A)]	75	78	75
26 Sound Pres. Lev. LpA,a	[dB(A)]	61	64	61
27 Flow Remark				

28 Valve Data

29 Valve Style		Rotary Plug Valve	Valve Type	72.3 R
30 Body Size	[inch]	DN 8"	Body Material	A216 WCC
31 Press. Rating	[lbs]	PN 300	Plug Material	1.4581
32 End Connections		RF	Seat Ring Material	1.4571
33 Face to Face	[mm]	568,4	Guide Material	1.4571
34 Selected Valve Coeff.		Kvs 950 Cvs 1098	Plug/Seat Facing	Metallic
35 Seat Diameter	[mm]	135,0 Sitzfaktor 1	Gaskets	S.S. / Graphite
36 Leakage Class		DIN IEC 534 T4, KL IV L1	Packing	PTFE / Graphite
37 Characteristic		Equal %	Bonnet	TA-Luft / Viton
38 Noise Reduction			Flow Direction	Flow to Open

39 Actuator Data

40 Actuator Style		Pneumatic	Fail Position	Spring to Close
41 Actuator Type		R 250v	Handwheel	Without
42 Spring Range	[bar]	1,3 - 2,4	Stroke Time o/c [s] t	< 20 / < 20
43 Air Supply	[bar]	4,0 - 6,0	Req. Torque [Nm]	500
44 Max. Shut Off	[bar]	dp 15	Max. Torque [Nm]	1280
			Mounting	A

45 Accessories

46 Positioner	Type	FF_3787-100, 4-20 mA, IP 65, gaug	Air Set Type	Norgren B74G-4AK-AP3
47 Limit Switches	Type		Piping	1/2" s.s. / Swagelok
48 Solenoid Valve	Type		Others	Booster, EIL 100 F03

49 Certification/Requirements

50 Material	EN 10204 / 3.1B	55 Zubehör und Rohr 1/2" s.s. wird von Samson beigestellt,
51 Inspection	EN 10204 / 3.1B	56 Verschraubung von VETEC
52 Others		57
53 Cust. Std.		58
54 Weight	260 kg	59

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV300203	Tag no.	LV300203
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	47500	37975	11400
Inlet pressure	p1	[bar(a)]	32,5	32,6	33
Outlet pressure	p2	[bar(a)]	30,8	30,6	30,3
Inlet temperature	t1	[°C]	115	115	115
Density	rho1	[kg/m³]	948,59	948,59	948,61
Vapor pressure	pv	[bar(a)]	1,6918	1,6918	1,6918
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,2437	0,2437	0,24372

Results and factors

Valve coeff. calculated	Cv		43,9	32,3	8,33
Min. req. size	Req. DN [mm]		59,5	53,2	29,2
Outlet velocity	w	[m/s]	2,77	2,21	0,664
SPL VDMA 24422 mod.	LA	[dB(A)]	53	52	44
relative travel	T	[%]	88,0	80,2	45,5
Different. pressure ratio	xF		0,06	0,06	0,09
FL value	FL		0,93	0,94	0,97
Kc value	Kc		0,81	0,83	0,91
Valve style factor	Fd		0,43	0,42	0,31
z value at capacity	xFz		0,26	0,29	0,43
Level exponent	F1		-6,92	-6,95	-7,09
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		0	0	0

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	70	Type	3241
Nominal size	DN ["]	3"	Body material	A351 CF8C
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	10	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107	s [mm]	4,78

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	2,4 ... 3,6	
			Supply	psu [bar]	3,80	
(Defaults:	p1max [bar(a)] 40	p2min [bar(a)] 1,01	t1max [°C] 180)			

Actuator results

req. act. force	Fo req. [kN]	12,60	req. diff. psu-ps100	d ps [bar]	0,00846
max. act. force	Fmax [kN]	22,68	Actuator force	Fa [kN]	16,80
max. dp on plug	d. pmax [bar]	52,43	Close safety factor	Fa/Fo (SF)	1,33
req. start bench range	ps0req. [bar]	1,98	Open safety factor	Ff/Fw	-

01 Order-No. : 1064 24081 Customer : Samson Frankfurt
 02 Name : Marc Bastius Project : P 1725



VETEC
 Valve Sizing V2000

03 Pos.-No. : 4 Rev. 3 Process Fluid : methanol 07.06.2005
 04 TAG - No. : LV-300305 Upstream Conditions : Liquid

Process and Medium Data			m i n	n o r m	m a x
06 Flow Rate	[kg/h]	W	24.000	80.197	132.800
07 Inlet Pressure	[bara]	p1	6,60	6,40	6,00
08 Outlet Pressure	[bara]	p2	4,80	5,00	5,50
09 Inlet Temperature	[°C]	t1	64,00	64,00	64,00
10 Density	[kg/m³]	rho	749,000	749,000	749,000
11 Vapor Pressure	[bara]	p _v	2,000	2,000	2,000
12 Critical Pressure	[bara]	p _c	80,3	80,3	80,3
13 Viscosity	[mPas]	eta	0,33	0,33	0,33
14 Ratio. Spc. Heat	[cp/cv]				
15 Compressibility Factor					
16 Flashing	[%]				

17 Pipeline

18 Line size [mm] Da * s / PN (In) 219,1 x 8,18 / std Da * s / PN (Out) 219,1 x 8,18 / std

19 Results

20 Calculated Valve Coeff.	[Kv]	20,67	78,41	218,95
21 Valve Opening in %		17	44	84
22 Outlet Velocity	[m/s]	0,50	1,68	2,79
23 Max. admitted Velocity	[m/s]	17,12	17,72	19,14
24 Mach				
25 Acoustic Cap. Lev. L _{WA} ,a	[dB(A)]	66	70	68
26 Sound Pres. Lev. L _{pA} ,a	[dB(A)]	53	57	55
27 Flow Remark				

28 Valve Data

29 Valve Style		Rotary Plug Valve	Valve Type	72.3 R
30 Body Size	[inch]	DN 6"	Body Material	A216 WCC
31 Press. Rating	[lbs]	PN 300	Plug Material	1.4581
32 End Connections		RF	Seat Ring Material	1.4571
33 Face to Face	[mm]	473,2	Guide Material	1.4571
34 Selected Valve Coeff.		K _{vs} 275 C _{vs} 318	Plug/Seat Facing	Metallic
35 Seat Diameter	[mm]	73,0 Sitzfaktor 0,4	Gaskets	S.S. / Graphite
36 Leakage Class		DIN IEC 534 T4, KL IV L1	Packing	PTFE / Graphite
37 Characteristic		Equal %	Bonnet	TA-Luft / Viton
38 Noise Reduction			Flow Direction	Flow to Open

39 Actuator Data

40 Actuator Style		Pneumatic	Fail Position	Spring to Open / Locked
41 Actuator Type		R 200	Handwheel	Without
42 Spring Range	[bar]	0,4 - 1,2	Stroke Time o/c [s] t	< 20 / < 20
43 Air Supply	[bar]	4,0 - 6,0	Req. Torque [Nm]	200
44 Max. Shut Off	[bar]	dp 9	Max. Torque [Nm]	1280
			Mounting	A

45 Accessories

46 Positioner	Type	FF_3787-100, 4-20 mA, IP 65, gaug.	Air Set Type	Norgren B74G-4AK-AP3
47 Limit Switches	Type		Piping	1/2" s.s. / Swagelok
48 Solenoid Valve	Type		Others	Lock Up Relay, 3 bar

49 Certification/Requirements

50 Material	EN 10204 / 3.1B	55	Zubehör und Rohr 1/2" s.s. wird von Samson beigestellt,
51 Inspection	EN 10204 / 3.1B	56	Verschraubung von VETEC
52 Others		57	
53 Cust. Std.		58	
54 Weight	150 kg	59	

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV300406	Tag no.	LV300406
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	84000	70090	21000
Inlet pressure	p1	[bar(a)]	32,7	32,9	33,2
Outlet pressure	p2	[bar(a)]	30,4	30,4	30,3
Inlet temperature	t1	[°C]	144	144	144
Density	rho1	[kg/m³]	924,11	924,12	924,14
Vapor pressure	pv	[bar(a)]	4,0432	4,0432	4,0432
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,19139	0,1914	0,1914

Results and factors

Valve coeff. calculated	Cv	67,7	54,1	15,0
Min. req. size	Req. DN [mm]	80,2	73,2	40,1
Outlet velocity	w [m/s]	3,21	2,68	0,804
SPL VDMA 24422 mod.	LA [dB(A)]	61	60	51
relative travel	T [%]	86,0	80,3	47,5
Different. pressure ratio	xF	0,08	0,09	0,10
FL value	FL	0,93	0,94	0,97
Kc value	Kc	0,81	0,83	0,90
Valve style factor	Fd	0,43	0,42	0,32
z value at capacity	xFz	0,22	0,23	0,34
Level exponent	F1	-6,82	-6,84	-6,97
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0	0

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3251
Nominal size	DN ["]	Body material	A351 CF8C
Pressure ratings	CLASS	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	without (0,0)
Packing	PTFE (3,2)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	157	s [mm]	7,11

Actuator data

Type	3271	Fail-safe act.	extends
Diaphr. area	A [cm²]	Bench range	ps0 [bar]
	1400	Supply	1,6 ... 2,4
(Defaults: p1max [bar(a)] 40	p2min [bar(a)] 1,01	t1max [°C] 144)	psu [bar]
			2,60

Actuator results

req. act. force	Fo req. [kN]	20,27	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	54,37	Actuator force	Fa [kN]	22,40
max. dp on plug	d. pmax [bar]	43,18	Close safety factor	Fa/Fo (SF)	1,10
req. start bench range	ps0req. [bar]	1,59	Open safety factor	Ff/Fw	-

Propsl./order no.: 525 000
Project: 4th Methanol Plant

Customer LURGI - PIDEK
Date: 05.07.2005 Data entered by: V12/Di



Valve Sizing Version 4.05B

Item no. LV300407 Tag no. LV300407
Process medium stabilized Methanol State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	166000	138280	41500
Inlet pressure	p1	[bar(a)]	8,9	8,9	8,9
Outlet pressure	p2	[bar(a)]	4,5	4,3	4
Inlet temperature	t1	[°C]	137	137	137
Density	rho1	[kg/m³]	704	704	704
Vapor pressure	pv	[bar(a)]	8,6	8,6	8,6
Critical pressure	pc	[bar(a)]	123,2	123,2	123,2
Viscosity	eta	[mPas]	0,16	0,16	0,16
Flashing portion	xd2	[%]	5,17	5,49	6
spec. Volume	v2	[m³/kg]	0,479	0,5	0,535

Results and factors

Valve coeff. calculated	Cv		219	182	52,7
Min. req. size	Req. DN [mm]		160	153	90,4
Outlet velocity	w	[m/s]	38,3	35,2	12,3
SPL VDMA 24422 mod.	LA	[dB(A)]	76	76	71
Flow condition			Flashing	Flashing	Flashing
relative travel	T	[%]	92,6	87,7	56,3
Different. pressure ratio	xF		14,67	15,33	16,33
FL value	FL		0,94	0,94	0,97
Kc value	Kc		0,83	0,84	0,91
Valve style factor	Fd		0,44	0,43	0,38
z value at capacity	xFz		0,52	0,46	0,49
Level exponent	F1		-7,23	-7,25	-7,38
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		16,76	16,99	17,18

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	290	Type	3241
Nominal size	DN ["]	8"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	125	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	10"	D2 ["]	16"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	384	s [mm]	9,53

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]	1,7 ... 3,2	
(Defaults:	p1max [bar(a)] 12	p2min [bar(a)] 1,01	t1max [°C] 200)	psu [bar]	3,40	

Actuator results

req. act. force	Fo req. [kN]	14,53	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	143,52	Actuator force	Fa [kN]	23,80
max. dp on plug	d. pmax [bar]	18,44	Close safety factor	Fa/Fo (SF)	1,64
req. start bench range	ps0req. [bar]	1,14			

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV300508	Tag no.	LV300508
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	118000	97742	29000
Inlet pressure	p1	[bar(a)]	6,6	7	7,9
Outlet pressure	p2	[bar(a)]	5,1	4,4	2,5
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	798,46	798,47	798,51
Vapor pressure	pv	[bar(a)]	0,32665	0,32665	0,32665
Critical pressure	pc	[bar(a)]	81	81	81
Viscosity	eta	[mPas]	0,41087	0,41087	0,41087

Results and factors

Valve coeff. calculated	Cv		130	80,2	16,3
Min. req. size	Req. DN [mm]		102	93,1	50,7
Outlet velocity	w	[m/s]	5,23	4,33	1,28
SPL VDMA 24422 mod.	LA	[dB(A)]	71	82	80
relative travel	T	[%]	90,6	78,3	37,7
Different. pressure ratio	xF		0,24	0,39	0,71
FL value	FL		0,91	0,93	0,97
Kc value	Kc		0,75	0,79	0,90
Valve style factor	Fd		0,44	0,42	0,26
z value at capacity	xFz		0,21	0,24	0,38
Level exponent	F1		-6,90	-6,95	-7,11
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		-0,89	-2,64	-8,14

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	190	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	100	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	159	s [mm]	7,11

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	2,1 ... 3,3	
(Defaults:	p1max [bar(a)]	15	Supply	psu [bar]	3,50	
	p2min [bar(a)]	1,01	t1max [°C]			
			150)			

Actuator results

req. act. force	Fo req. [kN]	11,71	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	17,77	Close safety factor	Fa/Fo (SF)	1,25
req. start bench range	ps0req. [bar]	1,84	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV300609	Tag no.	LV300609
Process medium	Water/Steam	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	46000	26317	7900
Inlet pressure	p1	[bar(a)]	59,2	67,4	69,1
Outlet pressure	p2	[bar(a)]	58,2	56,8	56,1
Inlet temperature	t1	[°C]	117	117	117
Density	rho1	[kg/m³]	948,32	951,05	951,13
Vapor pressure	pv	[bar(a)]	1,8051	1,6373	1,6373
Critical pressure	pc	[bar(a)]	220,64	220,64	220,64
Viscosity	eta	[mPas]	0,23995	0,24691	0,24695

Results and factors

Valve coeff. calculated	Cv	55,5	9,70	2,63
Min. req. size	Req. DN [mm]	58,6	44,2	24,2
Outlet velocity	w [m/s]	2,68	1,53	0,459
SPL VDMA 24422 mod.	LA [dB(A)]	44	58	50
relative travel	T [%]	92,7	48,2	14,8
Different. pressure ratio	xF	0,02	0,16	0,19
FL value	FL	0,94	0,97	0,98
Kc value	Kc	0,83	0,92	0,93
Valve style factor	Fd	0,44	0,32	0,14
z value at capacity	xFz	0,25	0,42	0,62
Level exponent	F1	-6,93	-7,10	-7,93
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	0	0	0

Valve data

Body type		Globe valve	Series	Globe valve
Valve coefficient	Cv	75	Type	3251
Nominal size	DN ["]	3"	Body material	A216 WCC
Pressure ratings	CLASS	600	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	106	s [mm]	8,56

Actuator data

Type					3271	Fail-safe act.	extends		
Diaphr. area	A		[cm²]		1400	Bench range	ps0	[bar]	2 ... 3
						Supply	psu	[bar]	3,20
(Defaults:	p1max	[bar(a)]	71	p2min	[bar(a)]	1.01	t1max	[°C]	160)

Actuator results

req. act. force	Fo req. [kN]	22,38	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	53,82	Actuator force	Fa [kN]	28,00
max. dp on plug	d. pmax [bar]	87,95	Close safety factor	Fa/Fo (SF)	1,25
req. start bench range	ps0req. [bar]	1,76	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	LV300910	Tag no.	LV300910
Process medium	Methanol	State of medium at inlet:	liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	130000	110600	33000
Inlet pressure	p1	[bar(a)]	8,3	8,5	8,6
Outlet pressure	p2	[bar(a)]	5,5	5	3
Inlet temperature	t1	[°C]	40	40	40
Density	rho1	[kg/m³]	798,52	798,53	798,53
Vapor pressure	pv	[bar(a)]	0,32665	0,32665	0,32665
Critical pressure	pc	[bar(a)]	81	81	81
Viscosity	eta	[mPas]	0,41087	0,41087	0,41087

Results and factors

Valve coeff. calculated	Cv		102	77,4	18,3
Min. req. size	Req. DN [mm]		107	99,0	54,1
Outlet velocity	w	[m/s]	2,56	2,18	0,650
SPL VDMA 24422 mod.	LA	[dB(A)]	74	79	80
relative travel	T	[%]	84,4	77,4	40,5
Different. pressure ratio	xF		0,35	0,43	0,68
FL value	FL		0,94	0,95	0,97
Kc value	Kc		0,84	0,86	0,92
Valve style factor	Fd		0,43	0,42	0,28
z value at capacity	xFz		0,30	0,32	0,37
Level exponent	F1		-7,05	-7,08	-7,22
Slope exponent	F2		0,30	0,30	0,30
Correct. term	delta Lf [dB]		-3,50	-5,62	-11,10

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	190	Type	3241
Nominal size	DN ["]	6"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	100	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	159	s [mm]	7,11

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	2,1 ... 3,3	
			Supply	psu [bar]	3,50	
(Defaults:	p1max [bar(a)] 13	p2min [bar(a)] 1,01	t1max [°C] 150)			

Actuator results

req. act. force	Fo req. [kN]	10,14	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	17,77	Close safety factor	Fa/Fo (SF)	1,45
req. start bench range	ps0req. [bar]	1,59	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. LV600301 Tag no. LV600301
Process medium Water State of medium at inlet: liquid

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	35000	25000	3000
Inlet pressure	p1	[bar(a)]	4,5	5	5,5
Outlet pressure	p2	[bar(a)]	2,5	2,4	2,2
Inlet temperature	t1	[°C]	38	38	38
Density	rho1	[kg/m³]	991	991	991
Vapor pressure	pv	[bar(a)]	0,0666	0,0666	0,0666
Critical pressure	pc	[bar(a)]	221	221	221
Viscosity	eta	[mPas]	0,679	0,679	0,679

Results and factors

Valve coeff. calculated	Cv	29,9	18,4	1,94
Min. req. size	Req. DN [mm]	50,0	42,2	14,6
Outlet velocity	w [m/s]	5,00	3,57	0,428
SPL VDMA 24422 mod.	LA [dB(A)]	76	75	50
relative travel	T [%]	88,4	76,0	18,5
Different. pressure ratio	xF	0,45	0,53	0,61
FL value	FL	0,91	0,93	0,97
Kc value	Kc	0,75	0,80	0,92
Valve style factor	Fd	0,43	0,42	0,15
z value at capacity	xFz	0,30	0,36	0,59
Level exponent	F1	-6,82	-6,87	-7,55
Slope exponent	F2	0,30	0,30	0,30
Correct. term	delta Lf [dB]	-0,37	-2,13	-0,25

Valve data

Body type	Globe valve	Series	globe valve
Valve coefficient	Cv	Type	3241
Nominal size	DN ["]	Body material	A105
Pressure ratings	CLASS	Noise reduction	without
Travel	S [mm]	Charact.	Equal perc.
Seat bore	SB [mm]	Flow direction	FTO
Stem diameter	Sd [mm]	Balanced	without (0,0)
Packing	PTFE (3,2)	Leakage rate	IV
Sealing	metal (2,0)	Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107	s [mm]	6,02

Actuator data

Type	3277	Fail-safe act.	extends
Diaphr. area	A [cm²]	Bench range	ps0 [bar]
	350	Supply	psu [bar]
(Defaults: p1max [bar(a)] 8,5 p2min [bar(a)] 1,01 t1max [°C] 100)			0,8 ... 2,4
			2,60

Actuator results

req. act. force	Fo req. [kN]	1,76	req. diff. psu-ps100	d ps [bar]	0,03
max. act. force	Fmax [kN]	24,50	Actuator force	Fa [kN]	2,80
max. dp on plug	d. pmax [bar]	13,20	Close safety factor	Fa/Fo (SF)	1,59
req. start bench range	ps0req. [bar]	0,55	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV100201	Tag no.	PV100201
Process medium	H2 (Start Up)	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	6000	5275	2000
Inlet pressure	p1	[bar(a)]	5,8	5,8	5,8
Outlet pressure	p2	[bar(a)]	2	3,5	1,2
Inlet temperature	t1	[°C]	92	92	50
Molar mass	M	[g/mol]	2,01	2,01	2,01
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		1,003	1,003	1,003
Viscosity	eta	[mPas]	0,017291	0,017291	0,015709

Results and factors

Valve coeff. calculated	Cv		23,2	22,6	7,03
Min. req. size	Req. DN [mm]		57,4	40,7	41,5
Outlet velocity	w	[Mach]	0,169	0,0847	0,0867
SPL VDMA 24422 mod.	LA	[dB(A)]	72	68	65
relative travel	T	[%]	84,7	84,1	54,3
Different. pressure ratio	x		0,66	0,40	0,79
FL value	FL		0,95	0,95	0,97
xT value	xT		0,76	0,76	0,80
Valve style factor	Fd		0,43	0,43	0,37
Level exponent	G1		-4,62	-4,64	-4,82
Slope exponent	G2		0,74	0,74	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	42	Type	3251
Nominal size	DN	3"	Body material	A217 WC6
Pressure ratings	CLASS	900	Noise reduction	Flow Div.I
Travel	S	30	Charact.	Equal perc.
Seat bore	SB	50	Flow direction	FTO
Stem diameter	Sd	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	V
Sealing	lapped-in (10)		Bonnet	bellows

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	104	s [mm]	8,56

Actuator data

Type				3277		Fail-safe act.		extends	
Diaphr. area		A		[cm²]		700		Bench range	
								ps0 [bar] 2,1 ... 3,3	
								Supply	
(Defaults:		p1max [bar(a)] 55		p2min [bar(a)] 1,01		t1max [°C] 150)		psu [bar] 3,50	

Actuator results

req. act. force	Fo req. [kN]	12,51	req. diff. psu-ps100	d ps [bar]	0,05
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	65,02	Close safety factor	Fa/Fo (SF)	1,17
req. start bench range	ps0req. [bar]	1,97	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. PV100513 Tag no. PV100513
Process medium Natural gas Fuel State of medium at inlet: gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	3000	2000	1000
Inlet pressure	p1	[bar(a)]	1,2	1,2	1,1
Outlet pressure	p2	[bar(a)]	1	1	1
Inlet temperature	t1	[°C]	40	40	40
Molar mass	M	[g/mol]	16,827	16,827	16,827
Isentropic exponent	gamma		1,3	1,3	1,3
Real gas factor	Z		0,995	0,995	0,995
Viscosity	eta	[mPas]	0,011738	0,011738	0,011738

Results and factors

Valve coeff. calculated	Cv	264	162	112
Min. req. size	Req. DN [mm]	95,7	78,2	55,3
Outlet velocity	w [Mach]	0,275	0,183	0,0916
SPL VDMA 24422 mod.	LA [dB(A)]	68	66	55
relative travel	T [%]	109	96,4	86,9
Different. pressure ratio	x	0,17	0,17	0,09
FL value	FL	0,90	0,91	0,94
xT value	xT	0,69	0,71	0,75
Valve style factor	Fd	0,36	0,21	0,12
Level exponent	G1	-3,50	-3,50	-3,50
Slope exponent	G2	1,50	1,50	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	190	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	100	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	V
Sealing	lapped-in (20)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	4"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	107	s [mm]	6,02

Actuator data

Type		3277	Fail-safe act.	extends	
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	2,1 ... 3,3
			Supply	psu [bar]	3,50
(Defaults:	p1max [bar(a)] 9	p2min [bar(a)] 1,01	t1max [°C] 100)		

Actuator results

req. act. force	Fo req. [kN]	12,66	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	57,41	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	10,57	Close safety factor	Fa/Fo (SF)	1,16
req. start bench range	ps0req. [bar]	1,99	Open safety factor	Ff/Fw	-



Valve Sizing Version 4.04

Item no.	PV100529	Tag no.	PV100529
Process medium	Natural Gas Fuel	State of medium at inlet:	gas

Process and medium data

Process and medium data			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	26000	8636	500
Inlet pressure	p1	[bar(a)]	55	55	55
Outlet pressure	p2	[bar(a)]	6	6	6
Inlet temperature	t1	[°C]	40	40	40
Molar mass	M	[g/mol]	16,827	16,827	16,827
Isentropic exponent	gamma		1,248	1,248	1,248
Real gas factor	Z		0,9299	0,9299	0,9299
Viscosity	eta	[mPas]	0,012629	0,012629	0,012629

Results and factors

Valve coeff. calculated	Cv	27,3	8,81	0,505
Min. req. size	Req. DN [mm]	116	67,0	16,1
Outlet velocity	w [Mach]	1,62	0,235	0,0135
SPL VDMA 24422 mod.	LA [dB(A)]	127	78	60
Flow condition		Choked flow	Choked flow	Choked flow
relative travel	T [%]	93,6	64,8	->0
Different. pressure ratio	x	0,89	0,89	0,89
FL value	FL	0,94	0,97	0,98
xT value	xT	0,75	0,79	0,81
Valve style factor	Fd	0,45	0,41	0,08
Level exponent	G1	-5,25	-5,42	-5,84
Slope exponent	G2	6,43	0,38	0,25

Valve data

Body type		Globe valve	Series	250
Valve coefficient	Cv	35	Type	3251
Nominal size	DN ["]	3"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow div. III
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	50	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	V
Sealing	lapped-in (20)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	3"	D2 ["]	6"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	157	s [mm]	10.97

Actuator data

Type					3271	Fail-safe act.		extends	
Diaphr. area	A		[cm²]	1400	Bench range		ps0	[bar]	1,6 ... 2,4
							Supply	psu	[bar]
(Defaults:	p1max	[bar(a)]	75	p2min	[bar(a)]	1,01	t1max	[°C]	75)
									2,60

Actuator results

req. act. force	Fo req.	[kN]	17,83	req. diff. psu-ps100	d ps	[bar]	0,01
max. act. force	Fmax	[kN]	60,19	Actuator force	Fa	[kN]	22,40
max. dp on plug	d. pmax	[bar]	97,14	Close safety factor	Fa/Fo (SF)		1,26
req. start bench range	ps0req.	[bar]	1,40	Open safety factor	Ff/Fw		-

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 21.06.2005 10:07:08
Tag No.		PV-100801

Medium selection and state

Medium		Natural Gas (Aga8)
Gas composition		Standard
Operating temperature	t1	40,0 °C
State		Gaseous

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	54,5	bar(a)
Absolute pressure downstream of valve	p2	50,0	bar(a)
Flow coefficient	Cv	430,67	GPM(US)
☐ Mass flow rate	qm	142.810,0	kg/h
☒ Volume flow rate (standard conditio...	qn	190.000,0	m³/h
Critical flow-related pressure difference	Δpc	22,402	bar(a)
Critical real pressure difference	ΔpXc	21,449	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ1	38,244	kg/m³
Operating density (t2, p2)	ρ2	34,856	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,012634	mPa s
Isentropic exponent (t1, p1)	κ	1,248	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	ρn	0,75163	kg/m³
☐ Specific gas constant	R	494,81	J/(kg K)
☒ Molecular weight	M	16,803	kg/kmol

Valve selection

Valve manufacturer		LEUSCH
Series		Cage Ball low noise Class 600
Valve selection		Cv: 1021, 8", Measured values (eq)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI
Valve type		Ball valve
Basic characteristic (IEC 60534-2-4)		Measured values (eq)
Flow direction		FTO
Flow coefficient	Cv	430,67 GPM(US)
Selected flow coefficient	Cv100	1.021,0 GPM(US)
Selected valve size	DN	8"
Flow velocity	u1	31,985 m/s
Flow velocity	u2	35,095 m/s
Valve style modifier (Cv/Cv100 = 1)	Fd	0,6 -
☒ Function for FI²		
☒ Function for xT		

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	77,045	%
Valve load	Cv/Cv1...	42,182	%
Valve modifier (operating conditions)	FL ²	0,546	-
Valve modifier (operating conditions)	xT	0,461	-
Valve style modifier (operating conditio...	Fd	0,434	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	12"	
Pressure class upstream of valve	PN1	Schedule 80	
☐ Pipe outside diameter upstream of ...	Da1	12,748	in
Pipe wall thickness upstream of val...	s1	0,68898	in
☐ Pipe inside diameter upstream of v...	Di1	11,37	in
Flow velocity in the pipe	u1R	15,835	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,68898	in
☐ Pipe inside diameter downstream o...	Di2	11,37	in
Flow velocity in the pipe	u2R	17,374	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	✕	IEC 60534-8-3:2000
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Calculated values

Low-noise design		n.a.	
Pressure level (correction)	ΔL,Co	-5,0	dB
Pressure level (mach no.)	ΔL,Ma	0,291	dB
Transmission loss	Rr	-60,7	dB
Sound power level	Lwi	121,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	87,8	dB(A)
Sound pressure level of valve (A-weight...	LpAa	79,0	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,082944	-
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Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	40,0	40,0	40,0	°C
t2	40,0	40,0	40,0	°C
p1	54,5	54,5	55,0	bar(a)
p2	50,0	48,0	45,9	bar(a)
Cv	430,67	345,39	32,632	GPM(US)
qm	142.810,0	135.070,0	15.033,0	kg/h
qn	190.000,0	179.700,0	20.000,0	m ³ /h
Δpc	22,402	24,743	29,851	bar(a)
η1	0,012634	0,012634	0,012646	mPa s
κ	1,248	1,248	1,248	-

p1	38,244	38,244	38,623	kg/m³
p2	34,856	33,363	31,804	kg/m³
LpAa	79,0	86,2	71,7	dB(A)
u1	31,985	30,252	3,3339	m/s
u2	35,095	34,678	4,0487	m/s
P	487,17	679,03	107,55	kW
MaDN	0,082944	0,081838	9,5399	E -3 -
s/s100	77,045	72,797	11,321	%
Cv/Cv1...	42,182	33,829	3,1961	%
Fd	0,434	0,422	0,346	-
FL²	0,546	0,562	0,597	-
xT	0,461	0,509	0,609	-
FP	0,99	0,994	1,0	-
	Turbulent flow	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	Non-critical	
h1'	-18,274	-18,274	-18,75	kJ/kg

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)vDyn 

0,04

-

Calculated short-circuit performance

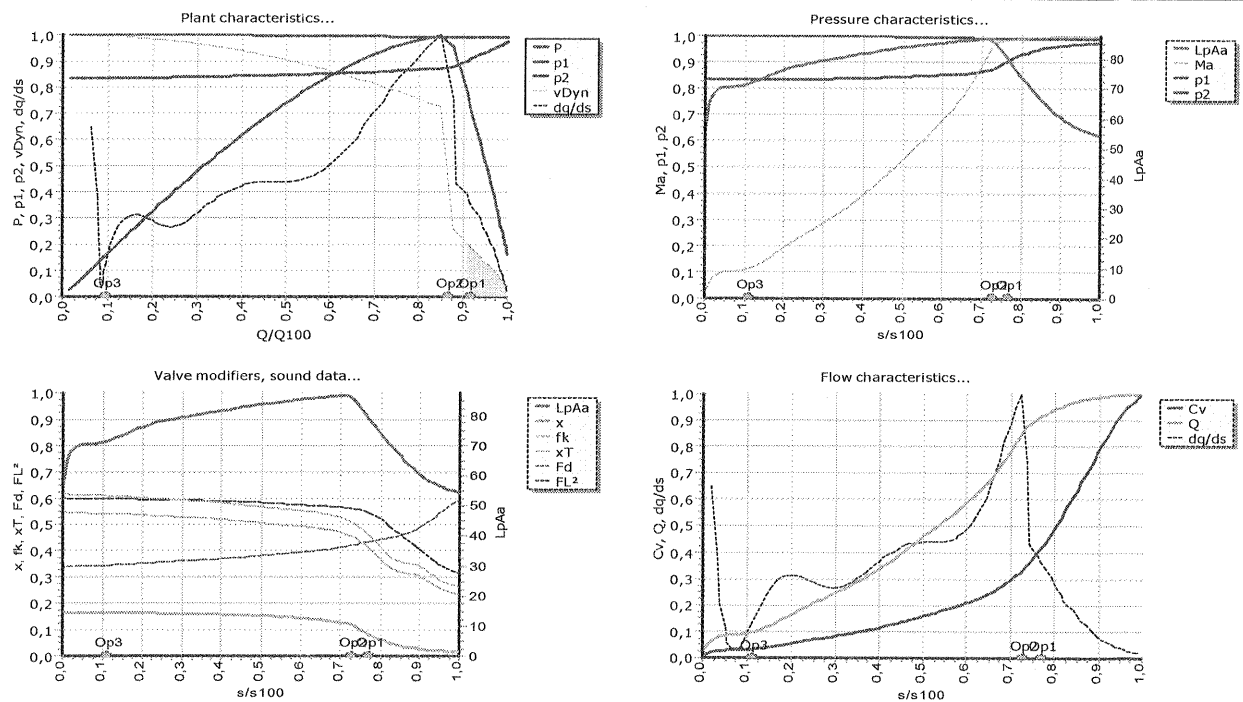
ax

1,1123

-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	4,963	25,0	50,0	74,99	99,57
t1	°C	40,0	40,0	40,0	40,0	40,0
p1	bar(a)	55,0	54,98	54,87	54,5	54,5
p2	bar(a)	45,89	45,99	46,46	49,09	53,54
Cv	GPM(US)	28,4	70,28	161,2	386,2	1.014,0
qm	kg/h	13.090,0	32.130,0	71.210,0	139.300,0	155.600,0
qn	m³/h	17.410,0	42.750,0	94.740,0	185.400,0	207.000,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9973	0,9837	0,9199	0,2307	0,04036
pv1	bar(a)					
ρ1	kg/m³	38,62	38,61	38,52	38,24	38,24
κ	-	1,248	1,248	1,248	1,248	1,248
LpAa	dB(A)	70,45	78,12	83,85	82,52	54,45
MaDN	-	8,308 E-3	0,02035	0,04462	0,08248	0,08416
u2	m/s	3,526	8,635	18,93	34,92	35,52
cf	m/s					
FP	-	1,0	0,9997	0,9986	0,992	0,9494



Warning:

⚠ The flow reserve to control Q_{max} is too low. Therefore the control quality is limited.

Hint:

💡 Approximate value: Density of pipeline - ρ_P

Legend

- Calculated value
- ✕ Modified calculated value
- Lookup value
- ✕ Modified database value
- ⚠ Warning
- 💡 Hint

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no. PV101502A Tag no. PV101502A
Process medium Reformed Gas State of medium at inlet: gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	500	300	50
Inlet pressure	p1	[bar(a)]	33,7	33,7	33,7
Outlet pressure	p2	[bar(a)]	30,7	30,7	30,7
Inlet temperature	t1	[°C]	167	167	50
Molar mass	M	[g/mol]	13,221	13,221	13,221
Isentropic exponent	gamma		1,34	1,34	1,34
Real gas factor	Z		0,984	0,984	0,984
Viscosity	eta	[mPas]	0,017082	0,017082	0,013094

Results and factors

Valve coeff. calculated	Cv		1,87	1,12	0,160
Min. req. size	Req. DN [mm]		7,18	5,56	2,10
Outlet velocity	w	[Mach]	0,0294	0,0176	0,00252
SPL VDMA 24422 mod.	LA	[dB(A)]	48	43	35
relative travel	T	[%]	88,6	75,5	25,7
Different. pressure ratio	x		0,09	0,09	0,09
FL value	FL		0,96	0,96	0,98
xT value	xT		0,77	0,79	0,81
Valve style factor	Fd		0,33	0,24	0,08
Level exponent	G1		-3,62	-3,87	-3,93
Slope exponent	G2		2,31	2,31	2,31

Valve data

Body type		Globe valve		Series		globe valve
Valve coefficient	Cv	3		Type		3251
Nominal size	DN	["]	1"	Body material		A351 CF8C
Pressure ratings	CLASS	600		Noise reduction		without
Travel	S	[mm]	15	Charact.		Equal perc.
Seat bore	SB	[mm]	12	Flow direction		FTO
Stem diameter	Sd	[mm]	12	Balanced		without (0,0)
Packing	PTFE (3,2)			Leakage rate		IV
Sealing	metal (2,0)			Bonnet		standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	55	s [mm]	5,54

Actuator data

Type				3277		Fail-safe act.		retracts	
Diaphr. area		A		[cm²]		350		Bench range	
						Supply		ps0 [bar] 0,2 ... 1	
(Defaults:	p1max [bar(a)]	40	p2min [bar(a)]	1,01	t1max [°C]	200)	psu [bar] 1,20		

Actuator results

req. act. force	Fo req. [kN]	0,64	req. diff. psu-ps100	d ps [bar]	0,20
max. act. force	Fmax [kN]	27,01	Actuator force	Fa [kN]	0,70
max. dp on plug	d. pmax [bar]	43,54	Close safety factor	Fa/Fo (SF)	1,10
req. start bench range	ps0req. [bar]	0,04	Open safety factor	Ff/Fw	5,80

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV101502B	Tag no.	PV101502B
Process medium	Reformed Gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	300	20	10
Inlet pressure	p1	[bar(a)]	30,7	30,7	30,7
Outlet pressure	p2	[bar(a)]	3	3	3
Inlet temperature	t1	[°C]	151	151	151
Molar mass	M	[g/mol]	13,221	13,221	13,221
Isentropic exponent	gamma		1,34	1,34	1,34
Real gas factor	Z		0,984	0,984	0,984
Viscosity	eta	[mPas]	0,016535	0,016535	0,016535

Results and factors

Valve coeff. calculated	Cv		0,580	0,0384	0,0192
Min. req. size	Req. DN [mm]		17,6	4,55	3,22
Outlet velocity	w	[Mach]	0,177	0,0118	0,00590
SPL VDMA 24422 mod.	LA	[dB(A)]	77	64	60
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	93,5	24,0	6,32
Different. pressure ratio	x		0,90	0,90	0,90
FL value	FL		0,97	0,98	0,98
xT value	xT		0,80	0,81	0,81
Valve style factor	Fd		0,38	0,08	0,06
Level exponent	G1		-3,91	-3,94	-4,04
Slope exponent	G2		1,50	1,50	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	0,75	Type	3251
Nominal size	DN ["]	1"	Body material	A351 CF8C
Pressure ratings	CLASS	600	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	6	Flow direction	FTO
Stem diameter	Sd [mm]	12	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	55	s [mm]	5,54

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	350	Bench range	ps0 [bar]	0,4 ... 2	
(Defaults:	p1max [bar(a)] 40	p2min [bar(a)] 1,01	t1max [°C] 200)	psu [bar]	2,20	

Actuator results

req. act. force	Fo req. [kN]	0,64	req. diff. psu-ps100	d ps [bar]	0,04
max. act. force	Fmax [kN]	27,01	Actuator force	Fa [kN]	1,40
max. dp on plug	d. pmax [bar]	107,66	Close safety factor	Fa/Fo (SF)	2,20
req. start bench range	ps0req. [bar]	0,20	Open safety factor	Ff/Fw	-



Valve Sizing Version 4.04

Item no.	PV150101	Tag no.	PV150101
Process medium	Steam	State of medium at inlet:	vapor

Process and medium data

Process and medium data			Case 1	Case 2	Case 3
Flow	W	[kg/h]	12000	7463	1000
Inlet pressure	p1	[bar(a)]	5,5	5,5	5,5
Outlet pressure	p2	[bar(a)]	2	2	2
Inlet temperature	t1	[°C]	160	160	160
Density	rho1	[kg/m³]	2,87	2,87	2,87
Isentropic exponent	gamma		1,31	1,31	1,31
Viscosity	eta	[mPas]	0,0145	0,0145	0,0145

Results and factors

Valve coeff. calculated	Cv	207	126	16,3
Min. req. size	Req. DN [mm]	165	130	47,8
Outlet velocity	w [Mach]	0,475	0,275	0,0354
SPL VDMA 24422 mod.	LA [dB(A)]	88	80	67
relative travel	T [%]	92,7	79,9	27,7
Different. pressure ratio	x	0,64	0,64	0,64
FL value	FL	0,92	0,94	0,97
xT value	xT	0,71	0,74	0,80
Valve style factor	Fd	0,44	0,42	0,18
Level exponent	G1	-4,30	-4,38	-4,68
Slope exponent	G2	3,72	1,03	0,75

Valve data

Body type		Globe valve	Series	240
Valve coefficient	Cv	275	Type	3241
Nominal size	DN [""]	6"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	Flow div. I
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	130	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	14"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	384	s [mm]	9,53

Actuator data

Type					3277		Fail-safe act.		extends			
Diaphr. area	A		[cm²]		700		Bench range		ps0		[bar] 2,1 ... 3,3	
							Supply		psu		[bar] 3,50	
(Defaults:	p1max	[bar(a)]	8	p2min	[bar(a)]	1,01	t1max	[°C]	300)			

Actuator results

req. act. force	Fo req. [kN]	10,21	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	49,04	Actuator force	Fa [kN]	14,70
max. dp on plug	d. pmax [bar]	10,36	Close safety factor	Fa/Fo (SF)	1,44
req. start bench range	ps0req. [bar]	1,60	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV-150601A	Tag no.	PV150601A
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	188000	140000	10000
Inlet pressure	p1	[bar(a)]	101	101	101
Outlet pressure	p2	[bar(a)]	47	47	47
Inlet temperature	t1	[°C]	505	505	505
Density	rho1	[kg/m³]	30,537	30,537	30,537
Isentropic exponent	gamma		1,279	1,279	1,279
Viscosity	eta	[mPas]	0,029131	0,029131	0,029131

Results and factors

Valve coeff. calculated	Cv		258	204	14,6
Min. req. size	Req. DN [mm]		155	134	35,7
Outlet velocity	w	[Mach]	0,180	0,134	0,00784
SPL VDMA 24422 mod.	LA	[dB(A)]	107	107	94
relative travel	T	[%]	38,5	30,0	0,247
Different. pressure ratio	x		0,53	0,53	0,53
FL value	FL		0,79	0,74	0,74
xT value	xT		0,53	0,47	0,47
Valve style factor	Fd		0,43	0,11	0,08
Level exponent	G1		-4,55	-4,59	-4,67
Slope exponent	G2		1,00	1,30	1,30

Valve data

Body type		Globe valve		Series	globe valve
Valve coefficient	Cv	650		Type	3254
Nominal size	DN ["]	8"		Body material	A217 WC9
Pressure ratings	CLASS	1500		Noise reduction	Flow Div.I
Travel	S [mm]	60		Charact.	Linear
Seat bore	SB [mm]	200		Flow direction	FTO
Stem diameter	Sd [mm]	40		Balanced	Graphite (10)
Packing	Graphite (10)			Leakage rate	IV
Sealing	metal (2,0)			Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	16"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	362	s [mm]	21,44

Actuator data

Type			3271	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	1400	Bench range	ps0	[bar]	1,7 ... 3,2
(Defaults:	p1max [bar(a)]	55	p2min [bar(a)]	1,01	t1max [°C]	515)	Supply
						psu	[bar]
							3,80

Actuator results

req. act. force	Fm req. [kN]	15,72	req. diff. psu-ps100	d ps [bar]	0,60
max. act. force	Fmax [kN]	112,03	Actuator force	Fa [kN]	23,80
max. dp on plug	d. pmax [bar]	116,22	Close safety factor	Fa/Fo (SF)	1,51
req. start bench range	ps0req. [bar]	1,24	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV-150601B	Tag no.	PV150601B
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	10000	4500	1500
Inlet pressure	p1	[bar(a)]	101	101	101
Outlet pressure	p2	[bar(a)]	47	47	47
Inlet temperature	t1	[°C]	505	505	505
Density	rho1	[kg/m³]	30,537	30,537	30,537
Isentropic exponent	gamma		1,279	1,279	1,279
Viscosity	eta	[mPas]	0,029131	0,029131	0,029131

Results and factors

Valve coeff. calculated	Cv		12,1	5,45	1,81
Min. req. size	Req. DN [mm]		35,7	24,0	13,8
Outlet velocity	w	[Mach]	0,0490	0,0220	0,00735
SPL VDMA 24422 mod.	LA	[dB(A)]	79	75	69
relative travel	T	[%]	83,7	63,1	34,9
Different. pressure ratio	x		0,53	0,53	0,53
FL value	FL		0,96	0,97	0,97
xT value	xT		0,79	0,79	0,80
Valve style factor	Fd		0,43	0,42	0,40
Level exponent	G1		-5,29	-5,33	-5,42
Slope exponent	G2		0,25	0,25	0,25

Valve data

Body type		Globe valve		Series	globe valve
Valve coefficient	Cv	23		Type	3151
Nominal size	DN ["]	3"		Body material	A217 WC9
Pressure ratings	CLASS	1500		Noise reduction	Flow div. III
Travel	S [mm]	15		Charact.	Equal perc.
Seat bore	SB [mm]	38		Flow direction	FTO
Stem diameter	Sd [mm]	16		Balanced	without (0,0)
Packing	Graphite (10)			Leakage rate	IV
Sealing	metal (2,0)			Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	16"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	362	s [mm]	21,44

Actuator data

Type			3271	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	1400	Bench range	ps0	[bar]	2 ... 2,4
(Defaults:	p1max [bar(a)]	116	p2min [bar(a)]	1,01	t1max [°C]	515)	Supply
						psu	[bar]
							2,84

Actuator results

req. act. force	Fo req.	[kN]	13,78	req. diff. psu-ps100	d ps	[bar]	0,04
max. act. force	Fmax	[kN]	41,69	Actuator force	Fa	[kN]	28,00
max. dp on plug	d. pmax	[bar]	240,16	Close safety factor	Fa/Fo (SF)		2,03
req. start bench range	ps0req.	[bar]	1,08	Open safety factor	Ff/Fw		-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV-150607	Tag no.	PV150607
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	80700	43609	10000
Inlet pressure	p1	[bar(a)]	41	41	41
Outlet pressure	p2	[bar(a)]	5,7	5,7	5,7
Inlet temperature	t1	[°C]	420	420	420
Density	rho1	[kg/m³]	13,486	13,486	13,486
Isentropic exponent	gamma		1,2841	1,2841	1,2841
Viscosity	eta	[mPas]	0,025242	0,025242	0,025242

Results and factors

Valve coeff. calculated	Cv		221	117	26,3
Min. req. size	Req. DN [mm]		285	209	100
Outlet velocity	w	[Mach]	0,657	0,329	0,0661
SPL VDMA 24422 mod.	LA	[dB(A)]	109	96	86
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	86,5	70,2	32,1
Different. pressure ratio	x		0,86	0,86	0,86
FL value	FL		0,94	0,96	0,97
xT value	xT		0,74	0,77	0,80
Valve style factor	Fd		0,43	0,41	0,22
Level exponent	G1		-4,46	-4,56	-4,78
Slope exponent	G2		2,15	0,82	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	375	Type	3254
Nominal size	DN ["]	8"	Body material	A217 WC6
Pressure ratings	CLASS	900	Noise reduction	Flow Div.I
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	150	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	Graphite (10)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	8"	D2 ["]	16"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	374	s [mm]	21,44

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]	1,4 ... 2,7	
			Supply	psu [bar]	3,18	
(Defaults:	p1max [bar(a)] 41	p2min [bar(a)] 1,01	t1max [°C] 470)			

Actuator results

req. act. force	Fm req. [kN]	12,02	req. diff. psu-ps100	d ps [bar]	0,48
max. act. force	Fmax [kN]	113,56	Actuator force	Fa [kN]	19,60
max. dp on plug	d. pmax [bar]	98,30	Close safety factor	Fa/Fo (SF)	1,63
req. start bench range	ps0req. [bar]	0,94			

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV-150611	Tag no.	PV150611
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	65000	35000	5000
Inlet pressure	p1	[bar(a)]	101	101	101
Outlet pressure	p2	[bar(a)]	20	15	10
Inlet temperature	t1	[°C]	505	505	505
Density	rho1	[kg/m³]	30,537	30,537	30,537
Isentropic exponent	gamma		1,279	1,279	1,279
Viscosity	eta	[mPas]	0,029131	0,029131	0,029131

Results and factors

Valve coeff. calculated	Cv		74,5	39,4	5,55
Min. req. size	Req. DN [mm]		140	118	54,8
Outlet velocity	w	[Mach]	0,260	0,187	0,0400
SPL VDMA 24422 mod.	LA	[dB(A)]	89	85	73
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	70,0	36,2	3,36
Different. pressure ratio	x		0,80	0,85	0,90
FL value	FL		0,94	0,96	0,98
xT value	xT		0,76	0,79	0,81
Valve style factor	Fd		0,44	0,41	0,15
Level exponent	G1		-5,37	-5,40	-5,70
Slope exponent	G2		0,25	0,25	0,25

Valve data

Body type		Globe valve		Series	globe valve
Valve coefficient	Cv	105		Type	3251
Nominal size	DN ["]	6"		Body material	A217 WC9
Pressure ratings	CLASS	1500		Noise reduction	Flow Div.I
Travel	S [mm]	30		Charact.	Linear
Seat bore	SB [mm]	80		Flow direction	FTO
Stem diameter	Sd [mm]	25		Balanced	without (0,0)
Packing	Graphite (10)			Leakage rate	IV
Sealing	metal (2,0)			Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	10"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	233	s [mm]	31,75

Actuator data

Type			3271	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	2800	Bench range	ps0	[bar]	3,3 ... 3,8
				Supply	psu	[bar]	4,00
(Defaults:	p1max [bar(a)]	116	p2min [bar(a)]	1,01	t1max [°C]	515)	

Actuator results

req. act. force	Fo req.	[kN]	59,10	req. diff. psu-ps100	d ps	[bar]	0,03
max. act. force	Fmax	[kN]	55,77	Actuator force	Fa	[kN]	92,40
max. dp on plug	d. pmax	[bar]	108,27	Close safety factor	Fa/Fo (SF)		1,56
req. start bench range	ps0req.	[bar]	2,32	Open safety factor	Ff/Fw		-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV-150612	Tag no.	PV150612
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	140000	21700	6000
Inlet pressure	p1	[bar(a)]	30	41	41
Outlet pressure	p2	[bar(a)]	6	4	3
Inlet temperature	t1	[°C]	350	420	420
Density	rho1	[kg/m³]	13,486	13,486	13,486
Isentropic exponent	gamma		1,2841	1,2841	1,2841
Viscosity	eta	[mPas]	0,025242	0,025242	0,025242

Results and factors

Valve coeff. calculated	Cv		541	74,7	20,7
Min. req. size	Req. DN [mm]		338	176	107
Outlet velocity	w	[Mach]	0,382	0,0940	0,0347
SPL VDMA 24422 mod.	LA	[dB(A)]	98	92	85
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	51,0	5,29	->0
Different. pressure ratio	x		0,80	0,90	0,93
FL value	FL		0,77	0,74	0,74
xT value	xT		0,51	0,47	0,47
Valve style factor	Fd		0,43	0,22	0,11
Level exponent	G1		-4,84	-4,66	-4,81
Slope exponent	G2		0,75	0,75	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	1040	Type	3254
Nominal size	DN ["]	12"	Body material	A217 WC6
Pressure ratings	CLASS	900	Noise reduction	Flow Div.I
Travel	S [mm]	120	Charact.	Linear
Seat bore	SB [mm]	250	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	Graphite (10)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	12"	D2 ["]	20"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	476	s [mm]	26,19

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	2800	Bench range	ps0 [bar]	0,8 ... 2,4	
(Defaults:	p1max [bar(a)] 8	p2min [bar(a)] 1,01	Supply	psu [bar]	2,78	
		t1max [°C]	470)			

Actuator results

req. act. force	Fm req. [kN]	12,01	req. diff. psu-ps100	d ps [bar]	0,38
max. act. force	Fmax [kN]	113,56	Actuator force	Fa [kN]	22,40
max. dp on plug	d. pmax [bar]	87,64	Close safety factor	Fa/Fo (SF)	1,87
req. start bench range	ps0req. [bar]	0,47	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV150635A	Tag no.	PV150635A
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	135000	80000	3750
Inlet pressure	p1	[bar(a)]	47	47	47
Outlet pressure	p2	[bar(a)]	42	42	42
Inlet temperature	t1	[°C]	395	395	395
Density	rho1	[kg/m³]	16,332	16,332	16,332
Isentropic exponent	gamma		1,2853	1,2853	1,2853
Viscosity	eta	[mPas]	0,024149	0,024149	0,024149

Results and factors

Valve coeff. calculated	Cv		601	348	16,2
Min. req. size	Req. DN [mm]		134	103	22,3
Outlet velocity	w	[Mach]	0,153	0,0902	0,00414
SPL VDMA 24422 mod.	LA	[dB(A)]	90	81	69
relative travel	T	[%]	98,0	84,1	5,51
Different. pressure ratio	x		0,11	0,11	0,11
FL value	FL		0,90	0,95	0,95
xT value	xT		0,69	0,76	0,77
Valve style factor	Fd		0,47	0,41	0,40
Level exponent	G1		-4,28	-4,30	-4,32
Slope exponent	G2		0,93	1,52	1,52

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	650	Type	3254
Nominal size	DN ["]	8"	Body material	A217 WC6
Pressure ratings	CLASS	900	Noise reduction	Flow Div.I
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	200	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	Graphite (10)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	12"	D2 ["]	14"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	374	s [mm]	19,05

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]	1,4 ... 2,7	
(Defaults:	p1max [bar(a)] 55	p2min [bar(a)] 1,01	Supply	psu [bar]	3,30	
		t1max [°C] 470)				

Actuator results

req. act. force	Fm req. [kN]	15,72	req. diff. psu-ps100	d ps [bar]	0,60
max. act. force	Fmax [kN]	113,56	Actuator force	Fa [kN]	19,60
max. dp on plug	d. pmax [bar]	82,80	Close safety factor	Fa/Fo (SF)	1,25
req. start bench range	ps0req. [bar]	1,24	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV150707	Tag no.	PV150707
Process medium	Water/Steam	State of medium at inlet:	vapor

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	93000	6500	3500
Inlet pressure	p1	[bar(a)]	5,7	5,7	5,7
Outlet pressure	p2	[bar(a)]	3	2	1,8
Inlet temperature	t1	[°C]	270	270	270
Density	rho1	[kg/m³]	2,3137	2,3137	2,3137
Isentropic exponent	gamma		1,3013	1,3013	1,3013
Viscosity	eta	[mPas]	0,01897	0,01897	0,01897

Results and factors

Valve coeff. calculated	Cv		1803	117	62,2
Min. req. size	Req. DN [mm]		399	129	99,9
Outlet velocity	w	[Mach]	0,389	0,0380	0,0228
SPL VDMA 24422 mod.	LA	[dB(A)]	92	76	74
relative travel	T	[%]	86,0	3,64	0,998
Different. pressure ratio	x		0,47	0,65	0,68
FL value	FL		0,90	0,97	0,98
xT value	xT		0,69	0,79	0,80
Valve style factor	Fd		0,40	0,03	0,01
Level exponent	G1		-4,50	-4,50	-4,50
Slope exponent	G2		0,75	0,75	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	2080	Type	3254
Nominal size	DN ["]	16"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	Flow Div.I
Travel	S [mm]	120	Charact.	Linear
Seat bore	SB [mm]	350	Flow direction	FTO
Stem diameter	Sd [mm]	40	Balanced	Graphite (10)
Packing	Graphite (10)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	insulating s

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	16"	D2 ["]	28"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	785	s [mm]	9,53

Actuator data

Type		3271	Fail-safe act.	extends		
Diaphr. area	A [cm²]	2800	Bench range	ps0 [bar]	1,1 ... 1,8	
(Defaults:	p1max [bar(a)] 8	p2min [bar(a)] 1,01	Supply	psu [bar]	2,32	
		t1max [°C]	380)			

Actuator results

req. act. force	Fm req. [kN]	16,21	req. diff. psu-ps100	d ps [bar]	0,52
max. act. force	Fmax [kN]	119,59	Actuator force	Fa [kN]	30,80
max. dp on plug	d. pmax [bar]	121,05	Close safety factor	Fa/Fo (SF)	1,90
req. start bench range	ps0req. [bar]	0,64	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV200307A	Tag no.	PV200307A
Process medium	Flare Gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	140000		
Inlet pressure	p1	[bar(a)]	67,9		
Outlet pressure	p2	[bar(a)]	3,5		
Inlet temperature	t1	[°C]	40		
Molar mass	M	[g/mol]	11,51		
Isentropic exponent	gamma		1,3		
Real gas factor	Z		1		
Viscosity	eta	[mPas]	0,014		

Results and factors

Valve coeff. calculated	Cv	102
Min. req. size	Req. DN [mm]	318
Outlet velocity	w [Mach]	2,40
SPL VDMA 24422 mod.	LA [dB(A)]	149
Flow condition		Choked flow
relative travel	T [%]	80,3
Different. pressure ratio	x	0,95
FL value	FL	0,94
xT value	xT	0,75
Valve style factor	Fd	0,42
Level exponent	G1	-5,32
Slope exponent	G2	5,61

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	220	Type	3251
Nominal size	DN ["]	6"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.III
Travel	S [mm]	60	Charact.	Equal perc.
Seat bore	SB [mm]	125	Flow direction	FTO
Stem diameter	Sd [mm]	25	Balanced	PTFE (1,6)
Packing	PTFE (3,2)		Leakage rate	V
Sealing	lapped-in (10)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	16"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	378	s [mm]	21,44

Actuator data

Type		3271	Fail-safe act.	extends	
Diaphr. area	A [cm²]	1400	Bench range	ps0 [bar]	0,8 ... 2,4
(Defaults:	p1max [bar(a)] 89	p2min [bar(a)] 1,01	Supply	psu [bar]	2,73
		t1max [°C]	100)		

Actuator results

req. act. force	Fm req. [kN]	9,18	req. diff. psu-ps100	d ps [bar]	0,07
max. act. force	Fmax [kN]	77,52	Actuator force	Fa [kN]	11,20
max. dp on plug	d. pmax [bar]	127,07	Close safety factor	Fa/Fo (SF)	1,22
req. start bench range	ps0req. [bar]	0,72	Open safety factor	Ff/Fw	-

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 18:30:47
Tag No.		PV-200409

Medium selection and state

Medium		Steam	
Operating temperature	t1	262,0	°C
State		Vapor	

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	48,0	bar(a)
Absolute pressure downstream of valve	p2	47,5	bar(a)
Flow coefficient	Cv	1.751,4	GPM(US)
☒ Mass flow rate	qm	165.000,0	kg/h
☐ Volume flow rate (standard conditio...	qn	205.270,0	m³/h
Critical flow-related pressure difference	Δpc	16,403	bar(a)
Critical real pressure difference	ΔpXc	16,309	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	p1	24,215	kg/m³
Operating density (t2, p2)	p2	23,96	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,019	mPa s
Boiling pressure (t1)	pv1	48,464	bar(a)
Boiling temperature (p1)	tv1	261,4	°C
Isentropic exponent (t1, p1)	κ	1,22	-

Physical constants

Formula		H2O	
Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	pn	0,8038	kg/m³
☐ Specific gas constant	R	461,53	J/(kg K)
☒ Molecular weight	M	18,015	kg/kmol
Critical temperature	tc	373,95	°C
Critical pressure	pc	220,64	bar(a)

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 3321, 12", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	1.751,4	GPM(US)
Selected flow coefficient	Cv100	3.321,0	GPM(US)
Selected valve size	DN	12"	
Flow velocity	u1	25,941	m/s

Flow velocity	u2	26,217	m/s
Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-
☒ Function for FL ²			
☒ Function for xT			

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	65,545	%
Valve load	Cv/Cv1...	52,738	%
Valve modifier (operating conditions)	FL ²	0,512	-
Valve modifier (operating conditions)	xT	0,392	-
Valve style modifier (operating conditio...	Fd	0,657	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	12"	
Pressure class upstream of valve	PN1	Schedule 80	
☐ Pipe outside diameter upstream of ...	Da1	12,748	in
Pipe wall thickness upstream of val...	s1	0,68898	in
☐ Pipe inside diameter upstream of v...	Di1	11,37	in
Flow velocity in the pipe	u1R	28,895	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	12"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	12,748	in
Pipe wall thickness downstream of ...	s2	0,68898	in
☐ Pipe inside diameter downstream o...	Di2	11,37	in
Flow velocity in the pipe	u2R	29,202	m/s
Material group		Steel I	
Density of pipeline	ρP ①	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	IEC 60534-8-3:2000
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Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma	0,425	dB
Transmission loss	Rr	-77,7	dB
Sound power level	Lwi	100,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	54,6	dB(A)
Sound pressure level of valve (A-weight...	LpAa	45,8	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,053308	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,019	mPa s
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Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	262,0	262,0	262,0	°C
t2	261,27	260,53	259,04	°C
p1	48,0	48,0	48,0	bar(a)
p2	47,5	47,0	46,0	bar(a)
Cv	1.751,4	1.143,1	107,89	GPM(US)

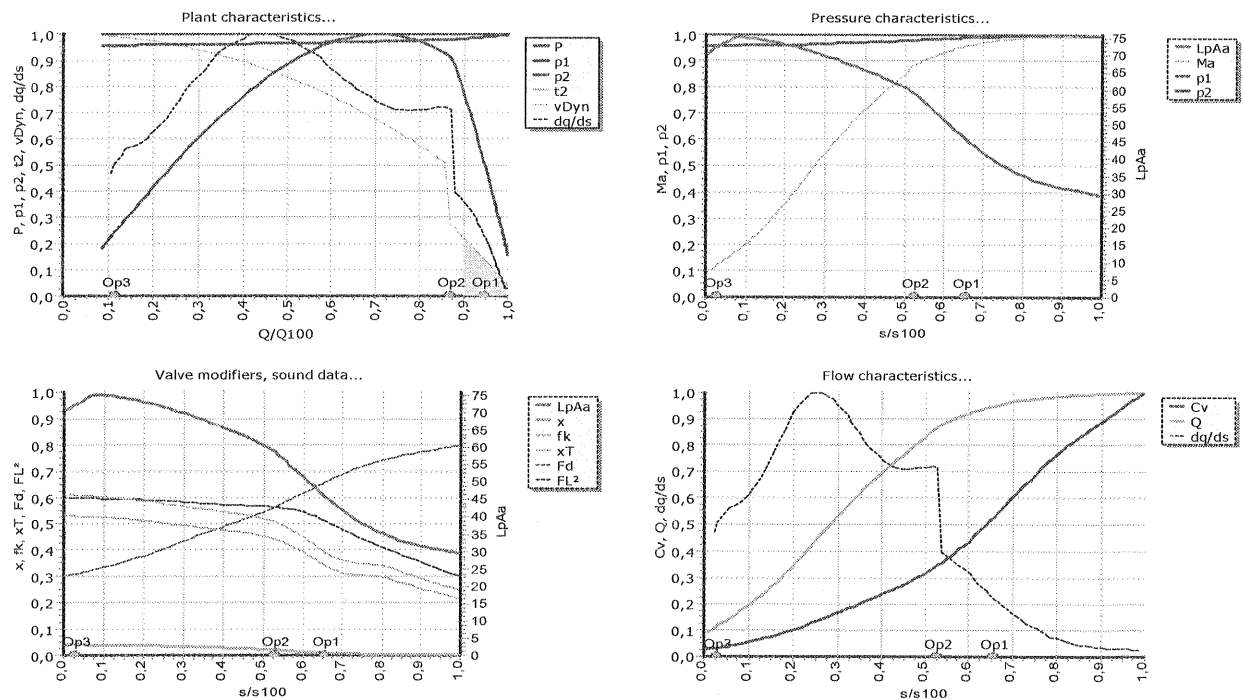
qm	165.000,0	151.440,0	20.000,0	kg/h
qn	205.270,0	188.400,0	24.882,0	m³/h
Δpc	16,403	21,195	25,462	bar(a)
η ₁	0,019	0,019	0,019	mPa s
κ	1,22	1,22	1,22	-
pv1	48,464	48,464	48,464	bar(a)
ρ ₁	24,215	24,215	24,215	kg/m³
ρ ₂	23,96	23,705	23,196	kg/m³
LpAa	45,8	58,8	72,5	dB(A)
u ₁	25,941	23,808	3,1443	m/s
u ₂	26,217	24,32	3,2825	m/s
P	95,136	175,56	46,869	kW
MaDN	0,053308	0,049449	6,6734	E -3 -
s/s100	65,545	52,777	3,0207	%
Cv/Cv1...	52,738	34,419	3,2488	%
Fd	0,657	0,563	0,311	-
FL ²	0,512	0,563	0,597	-
xT	0,392	0,507	0,609	-
	Turbulent flow	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	Non-critical	
h ₁ '	2.798,4	2.798,4	2.798,4	kJ/kg

Control optimization

Valve authority (Δp ₁₀₀ /Δp ₀)	vDyn	0,042	-
Calculated short-circuit performance	ax	1,0759	-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,0	25,0	50,0	74,98	100,0
t ₁	°C	262,0	262,0	262,0	262,0	262,0
p ₁	bar(a)	48,0	48,0	48,0	48,0	48,0
p ₂	bar(a)	46,01	46,24	46,91	47,69	47,85
Cv	GPM(US)	127,6	435,3	1.048,0	2.293,0	3.321,0
qm	kg/h	23.620,0	75.880,0	144.700,0	169.900,0	173.800,0
qn	m³/h	29.380,0	94.400,0	180.000,0	211.400,0	216.200,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	0,9877	0,8733	0,5395	0,08377	0,04155
ρ ₁	kg/m³	24,21	24,21	24,21	24,21	24,21
κ	-	1,22	1,22	1,22	1,22	1,22
LpAa	dB(A)	73,76	71,63	60,61	38,01	29,49
MaDN	-	7,879 E-3	0,02519	0,04733	0,05468	0,05574
u ₂	m/s	3,876	12,39	23,28	26,89	27,41
cf	m/s					



Warning:

The flow reserve to control Q_{max} is too low. Therefore the control quality is limited.

Hint:

Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- Modified calculated value
- Lookup value
- Warning
- Hint

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV250102A	Tag no.	PV250102A
Process medium	Purge Gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	45000	38100	10000
Inlet pressure	p1	[bar(a)]	67,9	67,9	67,9
Outlet pressure	p2	[bar(a)]	36	36	36
Inlet temperature	t1	[°C]	40	40	40
Molar mass	M	[g/mol]	11,51	11,51	11,51
Isentropic exponent	gamma		1,42	1,42	1,42
Real gas factor	Z		1,01	1,01	1,01
Viscosity	eta	[mPas]	0,013446	0,013446	0,013446

Results and factors

Valve coeff. calculated	Cv		34,8	29,4	7,65
Min. req. size	Req. DN [mm]		55,0	50,6	25,9
Outlet velocity	w	[Mach]	0,100	0,0841	0,0221
SPL VDMA 24422 mod.	LA	[dB(A)]	84	82	75
relative travel	T	[%]	88,3	84,0	49,6
Different. pressure ratio	x		0,47	0,47	0,47
FL value	FL		0,95	0,95	0,97
xT value	xT		0,76	0,77	0,80
Valve style factor	Fd		0,43	0,43	0,33
Level exponent	G1		-5,55	-5,67	-5,72
Slope exponent	G2		0,25	0,25	0,25

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	55	Type	3251
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	600	Noise reduction	Flow Div.III
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (3,2)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	bellows

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	157	s [mm]	10,97

Actuator data

Type		3271	Fail-safe act.	extends
Diaphr. area	A [cm²]	2800	Bench range	ps0 [bar] 2 ... 2,4
			Supply	psu [bar] 3,00
(Defaults:	p1max [bar(a)] 89	p2min [bar(a)] 1,01	t1max [°C] 100)	

Actuator results

req. act. force	Fo req. [kN]	28,29	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	57,41	Actuator force	Fa [kN]	56,00
max. dp on plug	d. pmax [bar]	176,81	Close safety factor	Fa/Fo (SF)	1,98
req. start bench range	ps0req. [bar]	1,11	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV250102B	Tag no.	PV250102B
Process medium	purge gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	3000	2500	500
Inlet pressure	p1	[bar(a)]	36	36	36
Outlet pressure	p2	[bar(a)]	2,5	2,5	2,5
Inlet temperature	t1	[°C]	40	40	40
Molar mass	M	[g/mol]	11,51	11,51	11,51
Isentropic exponent	gamma		1,42	1,42	1,42
Real gas factor	Z		1	1	1
Viscosity	eta	[mPas]	0,013069	0,013069	0,013069

Results and factors

Valve coeff. calculated	Cv		4,02	3,35	0,662
Min. req. size	Req. DN [mm]		53,9	49,2	22,0
Outlet velocity	w	[Mach]	0,348	0,290	0,0580
SPL VDMA 24422 mod.	LA	[dB(A)]	69	67	56
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	79,4	74,7	33,3
Different. pressure ratio	x		0,93	0,93	0,93
FL value	FL		0,96	0,97	0,98
xT value	xT		0,79	0,79	0,81
Valve style factor	Fd		0,42	0,42	0,23
Level exponent	G1		-5,31	-5,34	-5,58
Slope exponent	G2		0,25	0,25	0,25

Valve data

Body type		Globe valve		Series	globe valve
Valve coefficient	Cv	9		Type	3251
Nominal size	DN ["]	2"		Body material	A216 WCB
Pressure ratings	CLASS	600		Noise reduction	Flow Div.III
Travel	S [mm]	15		Charact.	Equal perc.
Seat bore	SB [mm]	24		Flow direction	FTO
Stem diameter	Sd [mm]	16		Balanced	without (0,0)
Packing	PTFE (3,2)			Leakage rate	IV
Sealing	metal (2,0)			Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	2"	D2 ["]	2"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	55	s [mm]	5,54

Actuator data

Type			3277	Fail-safe act.	extends		
Diaphr. area	A	[cm²]	350	Bench range	ps0	[bar]	1,4 ... 2,3
(Defaults:	p1max [bar(a)]	36	p2min [bar(a)]	1,01	t1max [°C]	100)	Supply
							psu [bar] 2,50

Actuator results

req. act. force	Fo req.	[kN]	1,90	req. diff. psu-ps100	d ps	[bar]	0,05
max. act. force	Fmax	[kN]	57,41	Actuator force	Fa	[kN]	4,90
max. dp on plug	d. pmax	[bar]	100,96	Close safety factor	Fa/Fo (SF)		2,59
req. start bench range	ps0req.	[bar]	0,60	Open safety factor	Ff/Fw		-

Propl./order no.: 525 000
Project: 4th Methanol Plant

Customer LURGI - PIDEK
Date: 05.07.2005 Data entered by: V12/Di



Valve Sizing Version 4.05B

Item no.	PV250103	Tag no.	PV250103
Process medium	Hydrogen	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	23000	19254	5800
Inlet pressure	p1	[bar(a)]	35	35	35
Outlet pressure	p2	[bar(a)]	2,3	2	1,5
Inlet temperature	t1	[°C]	50	50	50
Strd. density	rhon	[kg/m³(N)]	0,09	0,0900	0,0900
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		1	1	1
Viscosity	eta	[mPas]	0,009	0,009	0,009

Results and factors

Valve coeff. calculated	Cv		13,5	11,3	3,37
Min. req. size	Req. DN [mm]		102	99,8	63,3
Outlet velocity	w	[Mach]	0,643	0,600	0,205
SPL VDMA 24422 mod.	LA	[dB(A)]	94	91	67
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	86,5	81,8	50,9
Different. pressure ratio	x		0,93	0,94	0,96
FL value	FL		0,96	0,96	0,97
xT value	xT		0,78	0,79	0,80
Valve style factor	Fd		0,43	0,42	0,34
Level exponent	G1		-5,34	-5,37	-5,55
Slope exponent	G2		3,34	2,94	0,34

Valve data

Body type		Globe valve		Series		globe valve
Valve coefficient	Cv	23		Type		3241
Nominal size	DN ["]	3"		Body material		A216 WCB
Pressure ratings	CLASS	300		Noise reduction		Flow Div.III
Travel	S [mm]	15		Charact.		Equal perc.
Seat bore	SB [mm]	48		Flow direction		FTO
Stem diameter	Sd [mm]	10		Balanced		without (0,0)
Packing	PTFE (1,6)			Leakage rate		V
Sealing	lapped-in (10)			Bonnet		bellows

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	3"	D2 ["]	8"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	207	s [mm]	8,18

Actuator data

Type					3277	Fail-safe act.	extends	
Diaphr. area	A	[cm²]	700		Bench range	ps0	[bar]	1,6 ... 2,4
(Defaults:	p1max	[bar(a)]	35	p2min	[bar(a)]	1,01	t1max	[°C] 80)
						Supply	psu	[bar] 2,60

Actuator results

req. act. force	Fo req. [kN]	7,77	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	25,45	Actuator force	Fa [kN]	11,20
max. dp on plug	d. pmax [bar]	52,90	Close safety factor	Fa/Fo (SF)	1,44
req. start bench range	ps0req. [bar]	1,22			

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV300101	Tag no.	PV300101
Process medium	Expansion gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	5000	4182	1200
Inlet pressure	p1	[bar(a)]	5,4	5,4	5,5
Outlet pressure	p2	[bar(a)]	4,9	4,2	1,3
Inlet temperature	t1	[°C]	38	38	38
Molar mass	M	[g/mol]	26,05	26,05	26,05
Isentropic exponent	gamma		1,31	1,31	1,31
Real gas factor	Z		0,98	0,98	0,98
Viscosity	eta	[mPas]	0,014	0,014	0,014

Results and factors

Valve coeff. calculated	Cv		138	78,7	15,6
Min. req. size	Req. DN [mm]		62,0	61,3	59,0
Outlet velocity	w	[Mach]	0,131	0,130	0,116
SPL VDMA 24422 mod.	LA	[dB(A)]	67	77	81
relative travel	T	[%]	92,3	77,9	36,5
Different. pressure ratio	x		0,09	0,22	0,76
FL value	FL		0,90	0,93	0,97
xT value	xT		0,69	0,73	0,79
Valve style factor	Fd		0,44	0,42	0,25
Level exponent	G1		-3,12	-3,57	-3,95
Slope exponent	G2		2,24	1,50	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	190	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	100	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	159	s [mm]	7,11

Actuator data

Type		3277	Fail-safe act.	extends		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	1,4 ... 2,3	
(Defaults:	p1max [bar(a)] 9	p2min [bar(a)] 1,01	t1max [°C] 38)	Supply	psu [bar]	2,50

Actuator results

req. act. force	Fo req. [kN]	7,00	req. diff. psu-ps100	d ps [bar]	0,02
max. act. force	Fmax [kN]	64,29	Actuator force	Fa [kN]	9,80
max. dp on plug	d. pmax [bar]	11,53	Close safety factor	Fa/Fo (SF)	1,40
req. start bench range	ps0req. [bar]	1,10	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV300303A	Tag no.	PV300303A
Process medium	Off gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	600	1989	2400
Inlet pressure	p1	[bar(a)]	1,8	1,7	1,6
Outlet pressure	p2	[bar(a)]	1	1,1	1,1
Inlet temperature	t1	[°C]	120	120	120
Molar mass	M	[g/mol]	40,18	40,18	40,18
Isentropic exponent	gamma		1,25	1,25	1,25
Real gas factor	Z		1,002	1,002	1,002
Viscosity	eta	[mPas]	0,018	0,018	0,018

Results and factors

Valve coeff. calculated	Cv		38,5	145	197
Min. req. size	Req. DN [mm]		56,9	98,7	108
Outlet velocity	w	[Mach]	0,0656	0,201	0,240
SPL VDMA 24422 mod.	LA	[dB(A)]	80	82	83
relative travel	T	[%]	10,9	29,0	33,5
Different. pressure ratio	x		0,44	0,35	0,31
FL value	FL		0,94	0,91	0,87
xT value	xT		0,75	0,72	0,65
Valve style factor	Fd		0,23	0,34	0,37
Level exponent	G1		-3,04	-3,16	-3,22
Slope exponent	G2		1,50	1,39	1,18

Valve data

Body type		Butterfly valve	Series	14c
Nominal size	DN ["]	6	Type	14c
Pressure ratings	CLASS	300	Body material	A216 WCC
Valve coefficient	Cv	729	Disc	Swing through
Angle of rotation	[°]	70	Charact.	inherent
Seat bore	Sb [mm]	152,4	Flow direction	Standard
Seat	metal		Packing	PTFE
Leakage rate	VI		Flange actuator	
Bearing	Centric			

Pipe data

Type of pipe	Steel pipe	D1 ["]	8	cR [m/s]	5100	di [mm]	254,5
Pipe insulation	none	D2 ["]	8	rho [kg/m³]	7800	s [mm]	8,18

Actuator data

Type	SRP3000	Fail-safe action	close
Nominal size		Springs	
		Supply	psu [bar]
(Defaults: p1max [bar(a)] 4,5	p2min [bar(a)] 1,01	t1max [°C] 150)	4

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDECE
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV300303B	Tag no.	PV300303B
Process medium	Off gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	600	1989	2400
Inlet pressure	p1	[bar(a)]	2	1,8	1,7
Outlet pressure	p2	[bar(a)]	1,3	1,4	1,4
Inlet temperature	t1	[°C]	120	120	120
Molar mass	M	[g/mol]	40,18	40,18	40,18
Isentropic exponent	gamma		1,25	1,25	1,25
Real gas factor	Z		1,002	1,002	1,002
Viscosity	eta	[mPas]	0,018	0,018	0,018

Results and factors

Valve coeff. calculated	Cv		36,8	159	225
Min. req. size	Req. DN [mm]		49,9	87,5	96,1
Outlet velocity	w	[Mach]	0,0504	0,156	0,187
SPL VDMA 24422 mod.	LA	[dB(A)]	78	78	78
relative travel	T	[%]	10,2	30,3	36,1
Different. pressure ratio	x		0,35	0,22	0,18
FL value	FL		0,94	0,91	0,87
xT value	xT		0,75	0,72	0,65
Valve style factor	Fd		0,23	0,34	0,37
Level exponent	G1		-3,04	-3,16	-3,22
Slope exponent	G2		1,50	1,39	1,18

Valve data

Body type		Butterfly valve	Series	14c
Nominal size	DN ["]	6	Type	14c
Pressure ratings	CLASS	300	Body material	A216 WCC
Valve coefficient	Cv	729	Disc	Swing through
Angle of rotation	[°]	70	Charact.	inherent
Seat bore	Sb [mm]	152,4	Flow direction	Standard
Seat	metal		Packing	PTFE
Leakage rate	VI		Flange actuator	
Bearing	Centric			

Pipe data

Type of pipe	Steel pipe	D1 ["]	8	cR [m/s]	5100	di [mm]	254,5
Pipe insulation	none	D2 ["]	8	rho [kg/m³]	7800	s [mm]	8,18

Actuator data

Type	SRP3000	Fail-safe action	close
Nominal size		Springs	
		Supply	
(Defaults: p1max [bar(a)] 4,5	p2min [bar(a)] 1,01	t1max [°C] 150)	psu [bar] 4

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV300808	Tag no.	PV300808
Process medium	Nitrogen	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	4000	3600	360
Inlet pressure	p1	[bar(a)]	6,1	7,3	8
Outlet pressure	p2	[bar(a)]	1,4	1,4	1
Inlet temperature	t1	[°C]	30	30	30
Molar mass	M	[g/mol]	28,0	28,0	28,0
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		1	1	1
Viscosity	eta	[mPas]	0,0175	0,0175	0,0175

Results and factors

Valve coeff. calculated	Cv		49,9	37,1	3,29
Min. req. size	Req. DN [mm]		103	98,0	36,7
Outlet velocity	w	[Mach]	0,320	0,288	0,0403
SPL VDMA 24422 mod.	LA	[dB(A)]	82	82	66
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	92,4	84,9	23,0
Different. pressure ratio	x		0,77	0,81	0,88
FL value	FL		0,94	0,95	0,98
xT value	xT		0,75	0,76	0,81
Valve style factor	Fd		0,44	0,43	0,17
Level exponent	G1		-4,59	-4,64	-5,00
Slope exponent	G2		0,75	0,75	0,75

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	67	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	Flow Div.I
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	63	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	4"	D2 ["]	4"
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	107,1	s [mm]	6,02

Actuator data

Type		3277	Fail-safe act.	extends
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar] 0,8 ... 2,4
(Defaults: p1max [bar(a)] 11,5 p2min [bar(a)] 1,01 t1max [°C] 150)			Supply	psu [bar] 2,60

Actuator results

req. act. force	Fo req. [kN]	3,75	req. diff. psu-ps100	d ps [bar]	0,01
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	5,60
max. dp on plug	d. pmax [bar]	16,35	Close safety factor	Fa/Fo (SF)	1,49
req. start bench range	ps0req. [bar]	0,59	Open safety factor	Ff/Fw	-

Propsl./order no.: 616 100
Project: 1th Methanol Plant

Customer LURGI - PIDEDEC
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV300909A	Tag no.	PV300909A
Process medium	Methanol-Gas	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	700		
Inlet pressure	p1	[bar(a)]	1,1		
Outlet pressure	p2	[bar(a)]	1,05		
Inlet temperature	t1	[°C]	40		
Molar mass	M	[g/mol]	28,01		
Isentropic exponent	gamma		1,3		
Real gas factor	Z		1		
Viscosity	eta	[mPas]	0,01006		

Results and factors

Valve coeff. calculated	Cv	139
Min. req. size	Req. DN [mm]	51,3
Outlet velocity	w [Mach]	0,0900
SPL (DIN IEC 534 8-3)	LA [dB(A)]	45
relative travel	T [%]	92,4
Different. pressure ratio	x	0,05
FL value	FL	0,90
xT value	xT	0,69
Valve style factor	Fd	0,44

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	190	Type	3241
Nominal size	DN ["]	4"	Body material	A216 WCB
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	30	Charact.	Equal perc.
Seat bore	SB [mm]	100	Flow direction	FTO
Stem diameter	Sd [mm]	16	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	6"	D2 ["]	6"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	159	s [mm]	7,11

Actuator data

Type		3277	Fail-safe act.	retracts		
Diaphr. area	A [cm²]	700	Bench range	ps0 [bar]	0,2 ... 1	
(Defaults:	p1max [bar(a)] 4,5	p2min [bar(a)] 1,01	t1max [°C] 150)	Supply	psu [bar]	1,54

Actuator results

req. act. force	Fo req. [kN]	3,47	req. diff. psu-ps100	d ps [bar]	0,54
max. act. force	Fmax [kN]	54,17	Actuator force	Fa [kN]	3,78
max. dp on plug	d. pmax [bar]	3,86	Close safety factor	Fa/Fo (SF)	1,09
req. start bench range	ps0req. [bar]	0,02	Open safety factor	Ff/Fw	14,22

Propsl./order no.: 616 100
Project: 2th Methanol Plant

Customer LURGI - PIDEK
Date: 01.06.2005 Data entered by: V12/Di



Valve Sizing Version 4.04

Item no.	PV300909B	Tag no.	PV300909B
Process medium	Nitrogen	State of medium at inlet:	gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	Qn	[m³/h(N)]	706	600	180
Inlet pressure	p1	[bar(a)]	6,9	7,9	8
Outlet pressure	p2	[bar(a)]	1,02	1,01	1
Inlet temperature	t1	[°C]	30	30	30
Molar mass	M	[g/mol]	28,013	28,013	28,013
Isentropic exponent	gamma		1,4	1,4	1,4
Real gas factor	Z		0,99593	0,99535	0,9953
Viscosity	eta	[mPas]	0,018069	0,01808	0,018081

Results and factors

Valve coeff. calculated	Cv		7,67	5,65	1,65
Min. req. size	Req. DN [mm]		50,9	47,1	25,9
Outlet velocity	w	[Mach]	0,346	0,294	0,0865
SPL VDMA 24422 mod.	LA	[dB(A)]	80	79	72
Flow condition			Choked flow	Choked flow	Choked flow
relative travel	T	[%]	89,2	81,4	49,9
Different. pressure ratio	x		0,85	0,87	0,88
FL value	FL		0,95	0,96	0,97
xT value	xT		0,77	0,78	0,80
Valve style factor	Fd		0,33	0,27	0,12
Level exponent	G1		-3,72	-3,76	-3,79
Slope exponent	G2		1,52	1,51	1,50

Valve data

Body type		Globe valve	Series	globe valve
Valve coefficient	Cv	12	Type	3241
Nominal size	DN ["]	2"	Body material	A105
Pressure ratings	CLASS	300	Noise reduction	without
Travel	S [mm]	15	Charact.	Equal perc.
Seat bore	SB [mm]	24	Flow direction	FTO
Stem diameter	Sd [mm]	10	Balanced	without (0,0)
Packing	PTFE (1,6)		Leakage rate	IV
Sealing	metal (2,0)		Bonnet	standard

Pipe data

Type of pipe	Steel pipe	Pipe insulation	none	D1 ["]	3"	D2 ["]	3"
cR [m/s]	5180	rho [kg/m³]	7850	di [mm]	83	s [mm]	5,49

Actuator data

Type		3277	Fail-safe act.	extends	
Diaphr. area	A [cm²]	120	Bench range	ps0 [bar]	1,4 ... 2,3
(Defaults:	p1max [bar(a)] 11,5	p2min [bar(a)] 1,01	Supply	psu [bar]	2,50
		t1max [°C]	75)		

Actuator results

req. act. force	Fo req. [kN]	0,68	req. diff. psu-ps100	d ps [bar]	0,05
max. act. force	Fmax [kN]	25,68	Actuator force	Fa [kN]	1,68
max. dp on plug	d. pmax [bar]	32,50	Close safety factor	Fa/Fo (SF)	2,48
req. start bench range	ps0req. [bar]	0,62	Open safety factor	Ff/Fw	-

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 17:25:07
Tag No.		TV-100904A

Medium selection and state

Medium		Natural - Purge Gas	
Operating temperature	t1	330,0	°C
State		Gaseous (Standard conditions)	
Gas		Gas, dry	

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	48,0	bar(a)
Absolute pressure downstream of valve	p2	47,4	bar(a)
Flow coefficient	Cv	1.000,0	GPM(US)
☐ Mass flow rate	qm	83.673,0	kg/h
☒ Volume flow rate (standard conditions)	qn	113.000,0	m³/h
Critical flow-related pressure difference	Δpc	21,802	bar(a)
Critical real pressure difference	ΔpXc	20,329	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ1	15,886	kg/m³
Operating density (t2, p2)	ρ2	15,687	kg/m³
☒ Dynamic viscosity (t1, p1)	η1	0,02	mPa s
Isentropic exponent (t1, p1)	κ	1,191	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...)	ρn	0,74047	kg/m³
☐ Specific gas constant	R	500,96	J/(kg K)
☒ Molecular weight	M	16,597	kg/kmol
Real gas factor (standard conditions)	Zn	1,0	-

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 4482, 14", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	1.000,0	GPM(US)
Selected flow coefficient	Cv100	4.482,0	GPM(US)
Selected valve size	DN	14"	
Flow velocity	u1	14,732	m/s
Flow velocity	u2	14,918	m/s
Valve modifier (Cv/Cv100 = 0.75)	xT	0,343	-
Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-

- ☒ Function for FL²
☐ Function for xT

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	38,326	%
Valve load	Cv/Cv1...	22,312	%
Valve modifier (operating conditions)	FL ²	0,574	-
Valve modifier (operating conditions)	xT	0,534	-
Valve style modifier (operating conditio...	Fd	0,481	-

Pipe upstream of valve

● Size class upstream of valve	DN1	14"	
Pressure class upstream of valve	PN1	Schedule 80	
○ Pipe outside diameter upstream of ...	Da1	14,0	in
Pipe wall thickness upstream of val...	s1	0,74803	in
○ Pipe inside diameter upstream of v...	Di1	12,504	in
Flow velocity in the pipe	u1R	18,468	m/s

Pipe downstream of valve

● Size class downstream of valve	DN2	14"	
Pressure class downstream of valve	PN2	Schedule 80	
○ Pipe outside diameter downstream ...	Da2	14,0	in
Pipe wall thickness downstream of ...	s2	0,74803	in
○ Pipe inside diameter downstream o...	Di2	12,504	in
Flow velocity in the pipe	u2R	18,702	m/s
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma	0,22	dB
Transmission loss	Rr	-69,9	dB
Sound power level	Lwi	101,0	dB
Sound pressure (0 m distance, A-weight...)	LpAa	60,7	dB(A)
Sound pressure level of valve (A-weight...)	LpAa	52,3	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,024869	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,02	mPa s
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Further operating points

	Maximum flow	Mean flow	Minimum flow
t1	330,0	330,0	°C
t2	330,0	330,0	°C
p1	48,0	49,5	bar(a)
p2	47,4	48,9	bar(a)
Cv	1.000,0	541,03	GPM(US)
qm	83.673,0	46.031,0	kg/h
qn	113.000,0	62.165,0	m ³ /h

TV-100904A max start up.CCV

2(4)

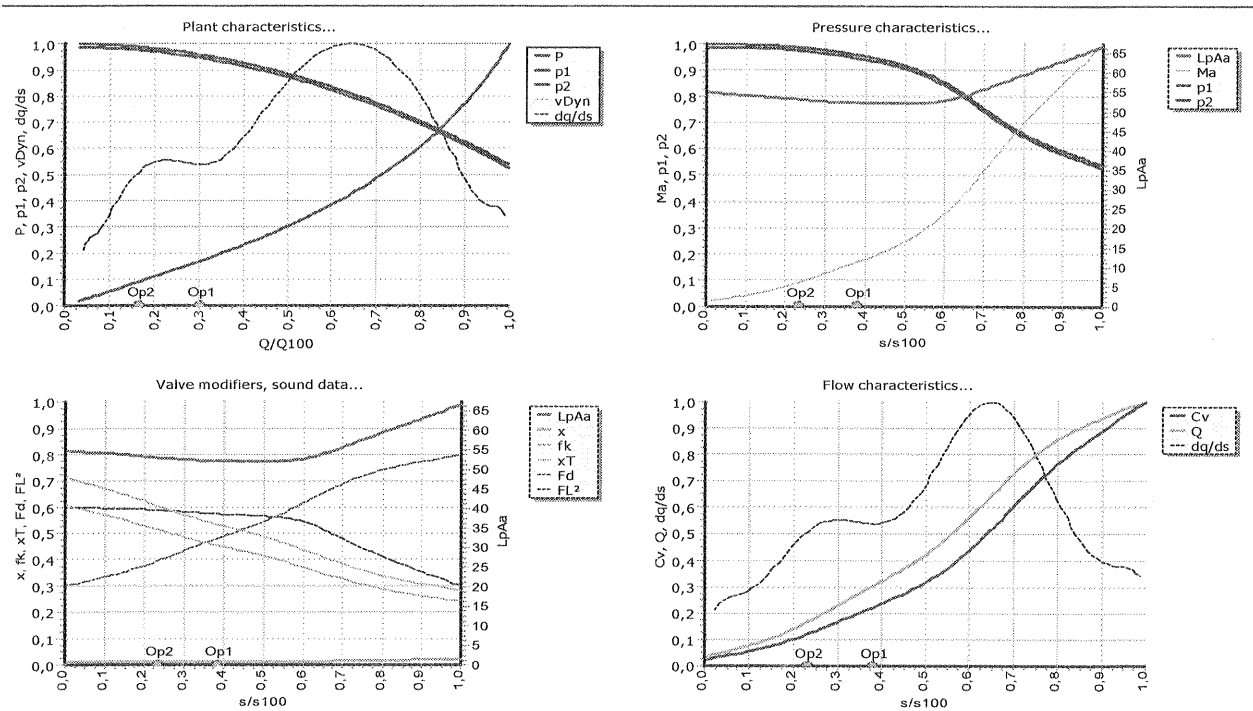
Δp_c	21,802	25,406	bar(a)
η_1	0,02	0,02	mPa s
κ	1,191	1,191	-
ρ_1	15,886	16,382	kg/m ³
ρ_2	15,687	16,184	kg/m ³
LpAa	52,3	53,1	dB(A)
u1	14,732	7,859	m/s
u2	14,918	7,9554	m/s
P	88,34	47,117	kW
MaDN	0,024869	0,013261	-
s/s100	38,326	23,412	%
Cv/Cv1...	22,312	12,071	%
Fd	0,481	0,396	-
FL ²	0,574	0,589	-
xT	0,534	0,603	-
	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)	vDyn	1,0	-
Calculated short-circuit performance	ax	4,8286	-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,001	25,0	50,01	75,0	99,99
t1	°C	330,0	330,0	330,0	330,0	330,0
p1	bar(a)	50,08	49,39	46,04	35,29	26,94
p2	bar(a)	49,48	48,79	45,44	34,69	26,34
Cv	GPM(US)	172,3	587,5	1.414,0	3.095,0	4.481,0
qm	kg/h	14.760,0	49.920,0	115.700,0	220.000,0	274.900,0
qn	m ³ /h	19.930,0	67.410,0	156.300,0	297.100,0	371.200,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	1,0	1,0
ρ_2	kg/m ³	16,38	16,15	15,04	11,48	8,718
κ	-	1,191	1,191	1,191	1,191	1,191
LpAa	dB(A)	54,58	52,97	52,12	57,59	66,78
MaDN	-	4,202 E-3	0,01442	0,03588	0,08934	0,147
u2	m/s	2,521	8,647	21,53	53,59	88,18
cf	m/s	1.470,0	1.470,0	1.470,0	1.470,0	1.470,0



Hint:

- Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- Modified calculated value
- Lookup value
- Hint

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 17:33:23
Tag No.		TV-100904B

Medium selection and state

Medium		Natural - Purge Gas	
Operating temperature	t1	330,0	°C
State		Gaseous (Standard conditions)	
Gas		Gas, dry	

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	49,0	bar(a)
Absolute pressure downstream of valve	p2	48,8	bar(a)
Flow coefficient	Cv	2.188,0	GPM(US)
☐ Mass flow rate	qm	107.370,0	kg/h
☒ Volume flow rate (standard conditio...	qn	145.000,0	m³/h
Critical flow-related pressure difference	Δp_c	17,332	bar(a)
Critical real pressure difference	Δp_{Xc}	17,091	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ_1	16,217	kg/m³
Operating density (t2, p2)	ρ_2	16,151	kg/m³
☒ Dynamic viscosity (t1,p1)	η_1	0,02	mPa s
Isentropic exponent (t1, p1)	κ	1,191	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	ρ_n	0,74047	kg/m³
☐ Specific gas constant	R	500,96	J/(kg K)
☒ Molecular weight	M	16,597	kg/kmol
Real gas factor (standard conditions)	Zn	1,0	-

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 600
Valve selection		Cv: 4482, 14", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv 	2.188,0	GPM(US)
Selected flow coefficient	Cv100 	4.482,0	GPM(US)
Selected valve size	DN 	14"	
Flow velocity	u1 	18,518	m/s
Flow velocity	u2 	18,594	m/s
Valve style modifier (Cv/Cv100 = 1)	Fd 	0,8	-
☒ Function for FI ²			

☒ Function for xT**Load-dependent auxiliary values**

Stroke/angle-of-rotation ratio	s/s100	63,203	%
Valve load	Cv/Cv1...	48,818	%
Valve modifier (operating conditions)	FL ²	0,527	-
Valve modifier (operating conditions)	xT	0,416	-
Valve style modifier (operating conditio...	Fd	0,64	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	14"	
Pressure class upstream of valve	PN1	Schedule 80	
☐ Pipe outside diameter upstream of ...	Da1	14,0	in
Pipe wall thickness upstream of val...	s1	0,74803	in
☐ Pipe inside diameter upstream of v...	Di1	12,504	in
Flow velocity in the pipe	u1R	23,214	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	14"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	14,0	in
Pipe wall thickness downstream of ...	s2	0,74803	in
☐ Pipe inside diameter downstream o...	Di2	12,504	in
Flow velocity in the pipe	u2R	23,31	m/s
Material group		Steel I	
Density of pipeline	ρP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma	0,275	dB
Transmission loss	Rr	-80,3	dB
Sound pressure level	Lpi	114,0	dB
Sound power level	Lwi	88,7	dB
Sound pressure (0 m distance, A-weight...	LpAa	38,6	dB(A)
Sound pressure level of valve (A-weight...	LpAa	30,2	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,030996	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,02	mPa s
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Further operating points

	Maximum flow	Mean flow	Minimum flow
t1	330,0	326,0	°C
t2	330,0	326,0	°C
p1	49,0	48,0	bar(a)
p2	48,8	47,8	bar(a)
Cv	2.188,0	1.144,0	GPM(US)
qm	107.370,0	55.795,0	kg/h
qn	145.000,0	75.350,0	m ³ /h

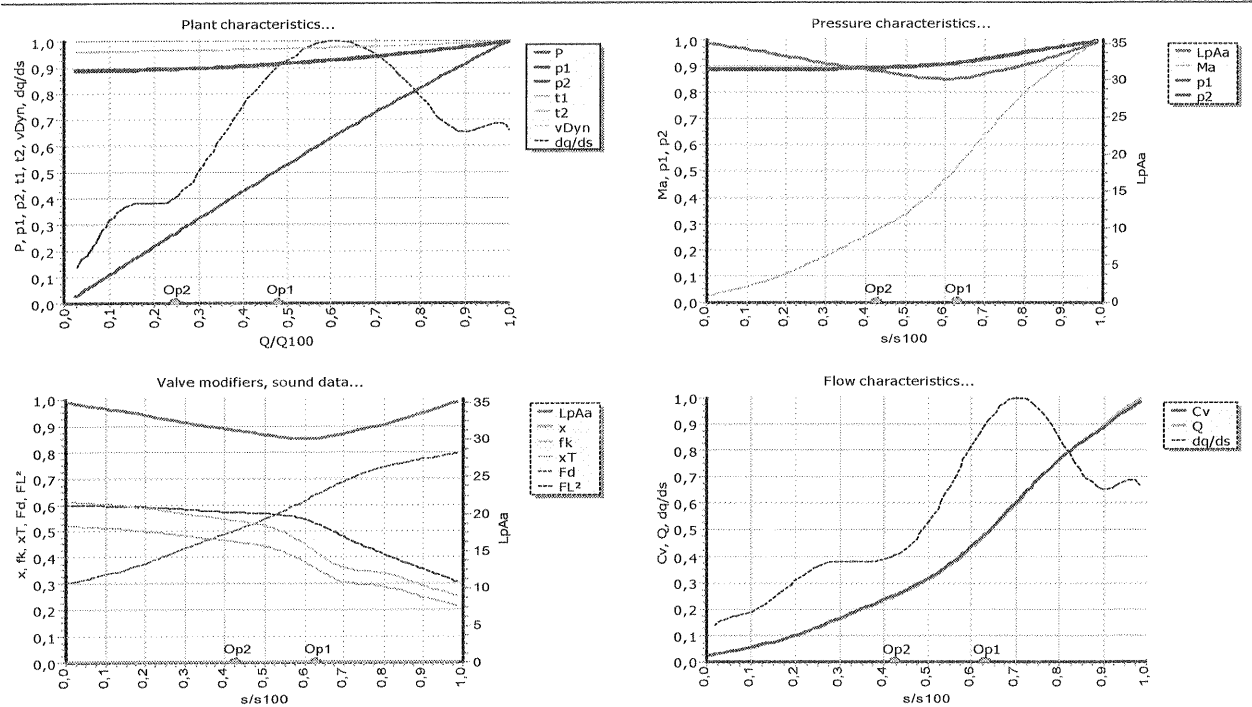
Δp_c	17,332	22,07	bar(a)
η_1	0,02	0,02	mPa s
κ	1,191	1,191	-
ρ_1	16,217	15,992	kg/m ³
ρ_2	16,151	15,925	kg/m ³
LpAa	30,2	31,3	dB(A)
u1	18,518	9,7584	m/s
u2	18,594	9,7992	m/s
P	36,858	19,423	kW
MaDN	0,030996	0,016389	-
s/s100	63,203	42,824	%
Cv/Cv1...	48,818	25,525	%
Fd	0,64	0,504	-
FL ²	0,527	0,571	-
xT	0,416	0,54	-
	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$) vDyn 1,0 -

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	99 [%]
s/s100	%	5,005	25,0	50,0	75,0	98,64
t1	°C	324,6	324,9	326,8	335,7	348,1
p1	bar(a)	47,64	47,73	48,2	50,42	53,54
p2	bar(a)	47,44	47,53	48,0	50,22	53,34
Cv	GPM(US)	172,3	587,5	1.414,0	3.096,0	4.420,0
qm	kg/h	8.385,0	28.600,0	69.050,0	153.300,0	222.900,0
qn	m ³ /h	11.320,0	38.620,0	93.250,0	207.000,0	301.100,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	1,0	1,0
pv1	bar(a)					
κ	-	1,191	1,191	1,191	1,191	1,191
LpAa	dB(A)	34,63	32,76	30,7	31,44	35,14
MaDN	-	2,479 E-3	8,442 E-3	0,02021	0,0432	0,05976
u2	m/s	1,48	5,043	12,09	26,04	36,39
cf	m/s	1.470,0	1.470,0	1.470,0	1.470,0	1.470,0



Hint:

- ④ Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- ✕ Modified calculated value
- Lookup value
- ④ Hint

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 20.06.2005 17:46:01
Tag No.		TV-101204A

Medium selection and state

Medium		Feed Gas
Operating temperature	t1	400,0 °C
State		Gaseous (Standard conditions)
Gas		Gas, dry

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	45,6	bar(a)
Absolute pressure downstream of valve	p2	45,5	bar(a)
Flow coefficient	Cv	8.086,5	GPM(US)
☐ Mass flow rate	qm	261.320,0	kg/h
☒ Volume flow rate (standard conditio...	qn	340.000,0	m³/h
Critical flow-related pressure difference	Δpc	11,974	bar(a)
Critical real pressure difference	ΔpXc	12,448	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	p1	14,035	kg/m³
Operating density (t2, p2)	p2	14,005	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,023	mPa s
Isentropic exponent (t1, p1)	κ	1,207	-

Physical constants

Formula		H2O	
Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...	ρn	0,76858	kg/m³
☐ Specific gas constant	R	482,64	J/(kg K)
☒ Molecular weight	M	17,227	kg/kmol
Real gas factor (standard conditions)	Zn	1,0	-

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 900
Valve selection		Cv: 7395, 20", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv	8.086,5	GPM(US)
Selected flow coefficient	Cv100	8.870,0	GPM(US)
Selected valve size	DN	20"	
Flow velocity	u1	25,517	m/s
Flow velocity	u2	25,573	m/s
Valve modifier (Cv/Cv100 = 0.75)	FL²	0,42	-
Valve modifier (Cv/Cv100 = 0.75)	xT	0,343	-

TV-101204A.CCV

1(4)

Valve style modifier (Cv/Cv100 = 1)	Fd	0,8	-
☐ Function for FL ²			
☐ Function for xT			

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	92,017	%
Valve load	Cv/Cv1...	91,167	%
Valve modifier (operating conditions)	FL ²	0,386	-
Valve modifier (operating conditions)	xT	0,305	-
Valve style modifier (operating conditio...	Fd	0,778	-

Pipe upstream of valve

Flow velocity in the pipe	u1R	31,724	m/s
---------------------------	-----	--------	-----

Pipe downstream of valve

☒ Size class downstream of valve	DN2	20"	
Pressure class downstream of valve	PN2	Schedule 80	
☐ Pipe outside diameter downstream ...	Da2	20,0	in
Pipe wall thickness downstream of ...	s2	1,0315	in
☐ Pipe inside diameter downstream o...	Di2	17,937	in
Flow velocity in the pipe	u2R	31,793	m/s
Material group		Steel I	
Density of pipeline	ρP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	IEC 60534-8-3:2000
------------------------------	--------------------

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma	0,362	dB
Transmission loss	Rr	-84,4	dB
Sound power level	Lwi	87,7	dB
Sound pressure (0 m distance, A-weight...	LpAa	30,0	dB(A)
Sound pressure level of valve (A-weight...	LpAa	22,9	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,040837	-
----------------------------	------	----------	---

Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,023	mPa s
---------------------------	----	-------	-------

Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	400,0	410,0	435,0	°C
t2	400,0	410,0	435,0	°C
p1	45,6	45,6	45,6	bar(a)
p2	45,5	45,3	45,3	bar(a)
Cv	8.086,5	2.356,8	1.410,7	GPM(US)
qm	261.320,0	130.660,0	76.858,0	kg/h
qn	340.000,0	170.000,0	100.000,0	m ³ /h
Δpc	11,974	20,092	22,574	bar(a)
cf1	626,21	630,85	642,29	m/s
η1	0,023	0,023	0,023	mPa s
κ	1,207	1,207	1,207	-

p1	14,035	13,83	13,342	kg/m³
p2	14,005	13,739	13,254	kg/m³
LpAa	22,9	41,4	41,6	dB(A)
u1	25,517	12,948	7,8951	m/s
u2	25,573	13,034	7,9474	m/s
P	51,774	78,989	48,165	kW
MaDN	0,040837	0,02066	0,012374	-
s/s100	92,017	44,207	29,102	%
Cv/Cv1...	91,167	26,571	15,905	%
Fd	0,778	0,511	0,429	-
FL²	0,386	0,568	0,624	-
xT	0,305	0,511	0,574	-
	Turbulent flow	Turbulent flow	Turbulent flow	
	Non-critical	Non-critical	Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)vDyn 

0,237

-

Calculated short-circuit performance

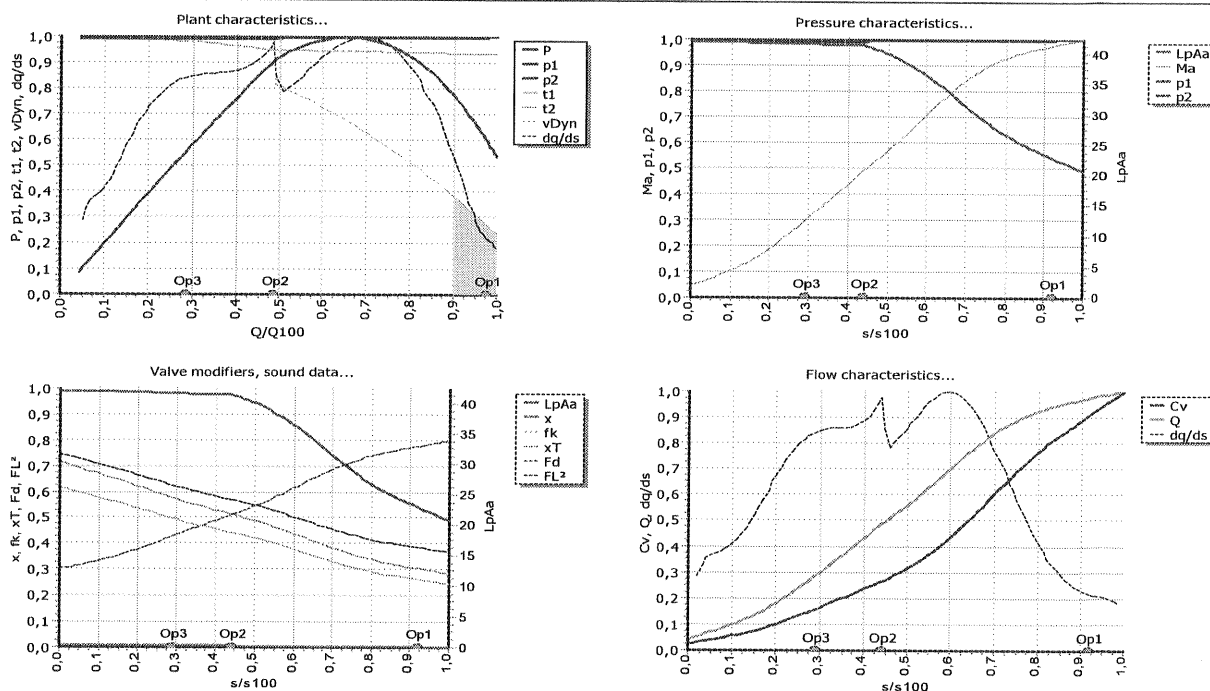
ax

1,1726

-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,003	25,0	50,0	75,0	100,0
t1	°C	447,5	439,3	409,0	402,3	399,4
p1	bar(a)	45,6	45,6	45,6	45,6	45,6
p2	bar(a)	45,3	45,3	45,32	45,45	45,51
Cv	GPM(US)	341,0	1.163,0	2.798,0	6.126,0	8.870,0
qm	kg/h	18.430,0	63.170,0	149.800,0	238.100,0	267.600,0
qn	m³/h	23.980,0	82.180,0	194.800,0	309.800,0	348.200,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	0,7611	0,3963	0,2373
κ	-	1,207	1,207	1,207	1,207	1,207
LpAa	dB(A)	42,01	41,72	40,07	28,89	20,72
MaDN	-	2,993 E-3	0,0102	0,02365	0,03731	0,04179
u2	m/s	1,939	6,571	14,91	23,4	26,15
cf	m/s	1.470,0	1.470,0	1.470,0	1.470,0	1.470,0



Warning:

⚠ The flow reserve to control Q_{max} is too low. Therefore the control quality is limited.

Hint:

💡 Approximate value: Density of pipeline - ρP

Notes:

Selected flow coefficient - Cv100

CV 100 for Butterfly Valve Type WVTB 20 inch Class 900

Legend

- Calculated value
- ⊠ Modified calculated value
- 📖 Lookup value
- ⊠ Modified database value
- ⚠ Warning
- 💡 Hint

Calculation header

Identifier
Author
Editor
Tag No.

2004-63047 Methanol ZAGROS

uwinkel 20.06.2005 13:09:47

uwinkel 20.06.2005 17:52:22

TV-101204B

Medium selection and state

Medium
Operating temperature
State
Gas

t1

Feed Gas

400,0

°C

Gaseous (Standard conditions)**Gas, dry****First operating point (max. flow)**

Calculation

Absolute pressure upstream of valve
Absolute pressure downstream of valve
Flow coefficient
☐ Mass flow rate
☒ Volume flow rate (standard conditio...
Critical flow-related pressure difference
Critical real pressure difference
Type of flow
State of flow

p1

p2

Cv

qm

qn

 Δp_c Δp_{xc} **Kv/Cv**

45,8

bar(a)

45,7

bar(a)

4.983,3

GPM(US)

161.400,0

kg/h

210.000,0

m³/h

12,291

bar(a)

12,735

bar(a)

Non-critical**Turbulent flow****Properties at first operating point**

Operating density (t1, p1)
Operating density (t2, p2)
☒ Dynamic viscosity (t1,p1)
Isentropic exponent (t1, p1)

p1

p2

 η_1 κ

14,097

kg/m³

14,066

kg/m³

0,023

mPa s

1,207

-

Physical constants

Standard conditions
☐ Density (standard conditions, dry g...
☐ Specific gas constant
☒ Molecular weight
Real gas factor (standard conditions)

pn

R

M

Zn

0°C, 1013 mbar

0,76858

kg/m³

482,64

J/(kg K)

17,227

kg/kmol

1,0

-

Valve selection

Valve manufacturer
Series
Valve selection
☒ Valve from database

LEUSCH**LDE Class 900****Cv: 4707, 16", Measured values (lin)**☒ Valve data can be modified**Valve data**

Size and pressure class according to
Valve type
Basic characteristic (IEC 60534-2-4)
Flow direction
Flow coefficient
Selected flow coefficient
Selected valve size
Flow velocity
Flow velocity
Valve modifier (Cv/Cv100 = 0.75)
Valve modifier (Cv/Cv100 = 0.75)
Valve style modifier (Cv/Cv100 = 1)

Cv

Cv100

DN

u1

u2

FL²

xT

Fd

ANSI**Butterfly valve****Measured values (lin)****FTO**

4.983,3

GPM(US)

5.650,0

GPM(US)

16"

24,518

m/s

24,571

m/s

0,42

-

0,343

-

0,8

-

TV-101204B.CCV

1(4)

- ☐ Function for FI²
☐ Function for xT

Load-dependent auxiliary values

Stroke/angle-of-rotation ratio	s/s100	89,317	%
Valve load	Cv/Cv1...	88,2	%
Valve modifier (operating conditions)	FL ²	0,391	-
Valve modifier (operating conditions)	xT	0,311	-
Valve style modifier (operating conditio...	Fd	0,771	-

Pipe downstream of valve

☉ Size class downstream of valve	DN2	16"	
Pressure class downstream of valve	PN2	Schedule 80	
○ Pipe outside diameter downstream ...	Da2	16,0	in
Pipe wall thickness downstream of ...	s2	0,84252	in
○ Pipe inside diameter downstream o...	Di2	14,315	in
Flow velocity in the pipe	u2R	30,697	m/s
Material group		Steel I	
Density of pipeline	ρP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise)	IEC 60534-8-3:2000
------------------------------	--------------------

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma	0,349	dB
Transmission loss	Rr	-84,5	dB
Sound power level	Lwi	85,4	dB
Sound pressure (0 m distance, A-weight...	LpAa	29,6	dB(A)
Sound pressure level of valve (A-weight...	LpAa	21,7	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,039238	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1	0,023	mPa s
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Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	400,0	370,0	380,0	°C
t2	400,0	370,0	380,0	°C
p1	45,8	45,8	45,8	bar(a)
p2	45,7	45,5	45,5	bar(a)
Cv	4.983,3	2.014,2	1.081,7	GPM(US)
qm	161.400,0	115.290,0	61.486,0	kg/h
qn	210.000,0	150.000,0	80.000,0	m ³ /h
Δpc	12,291	18,531	21,827	bar(a)
cf1	626,21	612,1	616,84	m/s
η1	0,023	0,023	0,023	mPa s
κ	1,207	1,207	1,207	-
ρ1	14,097	14,755	14,529	kg/m ³
ρ2	14,066	14,658	14,433	kg/m ³
LpAa	21,7	40,2	40,2	dB(A)
u1	24,518	16,732	9,0626	m/s

u2	24,571	16,843	9,1224	m/s
P	31,839	65,328	35,383	kW
MaDN	0,039238	0,027516	0,014789	-
s/s100	89,317	53,863	33,758	%
Cv/Cv1...	88,2	35,649	19,145	%
Fd	0,771	0,57	0,456	-
FL ²	0,391	0,531	0,605	-
xT	0,311	0,469	0,553	-
Turbulent flow Non-critical		Turbulent flow Non-critical	Turbulent flow Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)vDyn 

0,16

-

Calculated short-circuit performance

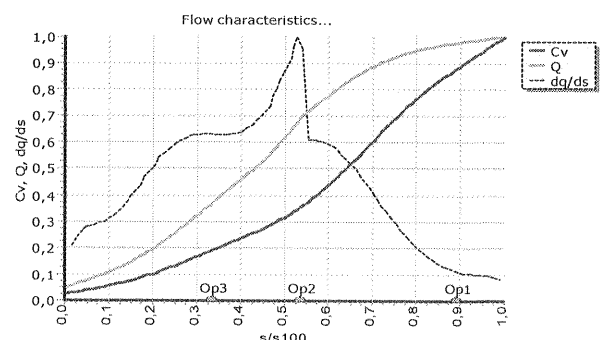
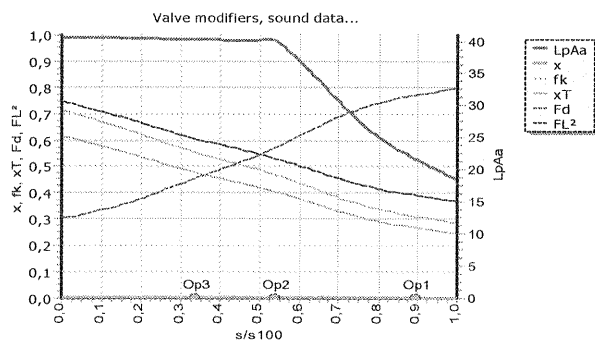
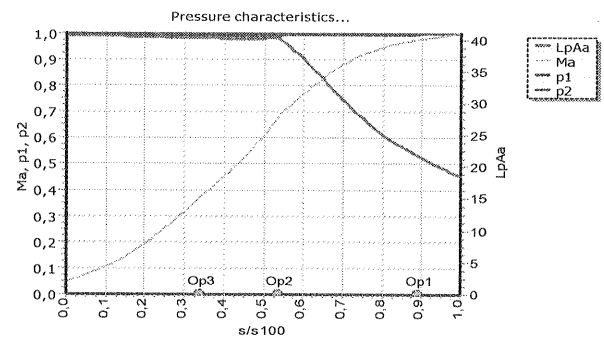
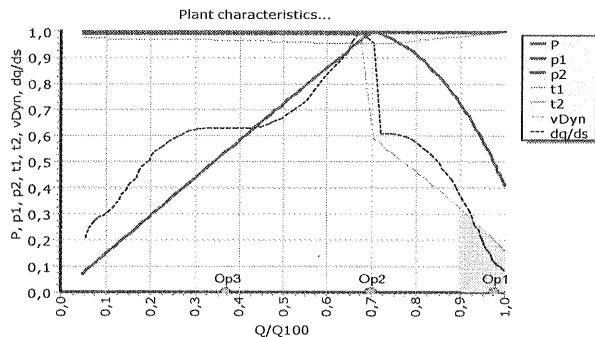
ax

1,1157

-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,001	25,0	50,01	74,99	100,0
t1	°C	383,8	382,1	373,1	393,4	402,8
p1	bar(a)	45,8	45,8	45,8	45,8	45,8
p2	bar(a)	45,5	45,5	45,5	45,66	45,72
Cv	GPM(US)	217,1	740,6	1.783,0	3.902,0	5.650,0
qm	kg/h	12.320,0	42.040,0	101.800,0	152.400,0	165.000,0
qn	m³/h	16.030,0	54.700,0	132.500,0	198.300,0	214.700,0
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	0,2837	0,1605
pv1	bar(a)					
κ	-	1,207	1,207	1,207	1,207	1,207
LpAa	dB(A)	40,62	40,36	40,18	27,63	18,45
MaDN	-	2,972 E-3	0,01013	0,02436	0,0369	0,04018
u2	m/s	1,838	6,258	14,95	23,0	25,21
cf	m/s	1.470,0	1.470,0	1.470,0	1.470,0	1.470,0



Warning:

 The flow reserve to control Q,max is too low. Therefore the control quality is limited.

Hint:

 Approximate value: Density of pipeline - ρ_P

Notes:

Selected flow coefficient - Cv100

CV 100 for Butterfly Valve Type WVTB 16 inch Class 900

Legend

-  Calculated value
-  Modified calculated value
-  Lookup value
-  Modified database value
-  Warning
-  Hint

Calculation header

Identifier
Author
Editor
Tag No.

**2004-63047 Methanol ZAGROS**

uwinkel 20.06.2005 13:09:47

uwinkel 21.06.2005 08:44:51

TV-200521A

Medium selection and state

Medium
Operating temperature
State
Gas

t1

Recycle Gas

120,0

°C

Gaseous (Standard conditions)**Gas, dry****First operating point (max. flow)**

Calculation

Absolute pressure upstream of valve

Absolute pressure downstream of valve

Flow coefficient

☐ Mass flow rate☒ Volume flow rate (standard conditio...

Critical flow-related pressure difference

Critical real pressure difference

Type of flow

State of flow

p1

p2

Cv

qm

qn

 Δp_c Δp_{xc} **Kv/Cv**

77,0

bar(a)

76,9

bar(a)

15.770,0

GPM(US)

708.900,0

kg/h

1,3955

E 6

m³/h

22,795

bar(a)

23,343

bar(a)

Non-critical**Turbulent flow****Properties at first operating point**

Operating density (t1, p1)

Operating density (t2, p2)

☒ Dynamic viscosity (t1,p1)

Isentropic exponent (t1, p1)

p1

p2

 η_1 κ

27,089

kg/m³

27,054

kg/m³

0,014

mPa s

1,35

-

Physical constants

Standard conditions

☐ Density (standard conditions, dry g...☐ Specific gas constant☒ Molecular weight

Real gas factor (standard conditions)

p0

R

M

Zn

0°C, 1013 mbar

0,50799

kg/m³

723,0

J/(kg K)

11,5

kg/kmol

1,01

-

Valve selection

Valve manufacturer

Series

Valve selection

☒ Valve from database**LEUSCH****LDE Class 900****Cv: 10809, 24", Measured values (lin)**☒ Valve data can be modified**Valve data**

Size and pressure class according to

Valve type

Basic characteristic (IEC 60534-2-4)

Flow direction

Flow coefficient

Selected flow coefficient

Selected valve size

Flow velocity

Flow velocity

Valve modifier (Cv/Cv100 = 0.75)

Valve modifier (Cv/Cv100 = 0.75)

**ANSI****Butterfly valve****Measured values (lin)****FTO**

15.770,0

GPM(US)

17.505,0

GPM(US)

24"

24,906

m/s

24,939

m/s

0,42

-

0,343

-

Valve style modifier (Cv/Cv100 = 1)

Fd 

0,8

-

☐ Function for FL²☐ Function for xT**Load-dependent auxiliary values**

Stroke/angle-of-rotation ratio	s/s100 	91,035	%
Valve load	Cv/Cv1... 	90,086	%
Valve modifier (operating conditions)	FL ² 	0,388	-
Valve modifier (operating conditions)	xT 	0,307	-
Valve style modifier (operating conditio...)	Fd 	0,776	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1 	24"	
Pressure class upstream of valve	PN1 	Schedule 60	
☐ Pipe outside diameter upstream of ...	Da1 	24,0	in
Pipe wall thickness upstream of val...	s1 	0,9685	in
☐ Pipe inside diameter upstream of v...	Di1 	22,063	in
Flow velocity in the pipe	u1R 	29,472	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2 	24"	
Pressure class downstream of valve	PN2 	Schedule 60	
☐ Pipe outside diameter downstream ...	Da2 	24,0	in
Pipe wall thickness downstream of ...	s2 	0,9685	in
☐ Pipe inside diameter downstream o...	Di2 	22,063	in
Flow velocity in the pipe	u2R 	29,51	m/s
Material group		Steel I	
Density of pipeline	pP 	7.850,0	kg/m ³
Sound velocity in pipe material	cP 	5.180,0	m/s

Noise calculation

Calculation standard (noise)

IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	ΔL, Ma 	0,339	dB
Transmission loss	Rr 	-88,6	dB
Sound pressure level	Lpi 	106,0	dB
Sound power level	Lwi 	84,1	dB
Sound pressure (0 m distance, A-weight...)	LpAa 	23,2	dB(A)
Sound pressure level of valve (A-weight...)	LpAa 	16,7	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN 	0,040259	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η1 	0,014	mPa s
---------------------------	--	-------	-------

Further operating points

	Maximum flow	Mean flow	Minimum flow	
t1	120,0	120,0	120,0	°C
t2	120,0	120,0	120,0	°C
p1	77,0	77,0	77,0	bar(a)
p2	76,9	76,9	76,9	bar(a)
Cv	15.770,0	14.297,0	677,46	GPM(US)

qm	708.900,0		642.780,0		30.479,0	kg/h
qn	1,3955	E 6	1,2653	E 6	60.000,0	m³/h
Δpc	22,795		24,247		51,382	bar(a)
cf1	619,46		619,46		619,46	m/s
η1	0,014		0,014		0,014	mPa s
κ	1,35		1,35		1,35	-
ρ1	27,089		27,089		27,089	kg/m³
ρ2	27,054		27,054		27,054	kg/m³
LpAa	16,7		16,3		15,1	dB(A)
u1	24,906		22,583		1,0709	m/s
u2	24,939		22,613		1,0722	m/s
P	72,74		65,955		3,1275	kW
MaDN	0,040259		0,036504		1,7309	E -3 -
s/s100	91,035		83,675		5,0872	%
Cv/Cv1...	90,086		81,676		3,8701	%
Fd	0,776		0,755		0,318	-
FL²	0,388		0,405		0,728	-
xT	0,307		0,327		0,692	-
	Turbulent flow		Turbulent flow		Turbulent flow	
	Non-critical		Non-critical		Non-critical	

Control optimization

Valve authority (Δp100/Δp0)

vDyn

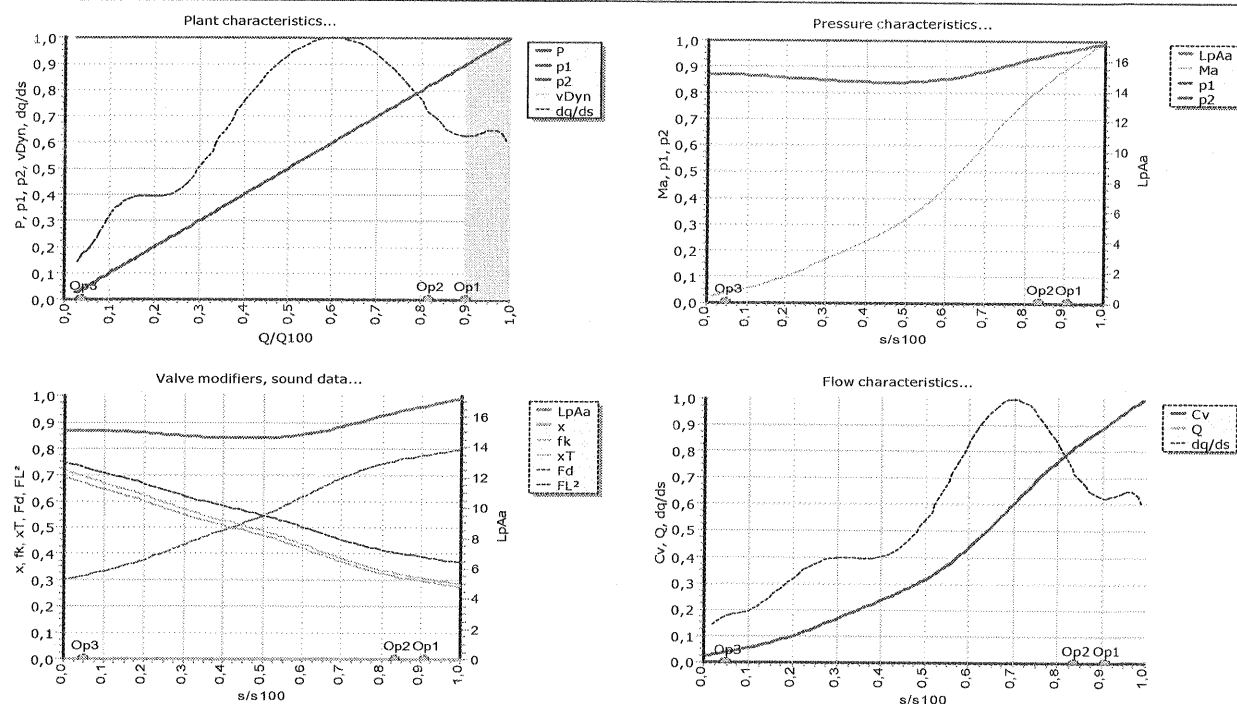


1,0

-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	100 [%]
s/s100	%	5,004	25,0	50,01	75,0	99,91
t1	°C	120,0	120,0	120,0	120,0	120,0
p1	bar(a)	77,0	77,0	77,0	77,0	77,0
p2	bar(a)	76,9	76,9	76,9	76,9	76,9
Cv	GPM(US)	672,9	2.294,0	5.523,0	12.090,0	17.490,0
qm	kg/h	30.280,0	103.200,0	248.400,0	543.600,0	786.100,0
qn	m³/h	59.600,0	203.200,0	489.100,0	1,07 E6	1,548 E6
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	1,0	1,0
κ	-	1,35	1,35	1,35	1,35	1,35
LpAa	dB(A)	15,11	14,83	14,63	15,71	17,22
MaDN	-	1,719 E-3	5,862 E-3	0,01411	0,03087	0,04465
u2	m/s	1,065	3,631	8,74	19,12	27,66
cf	m/s					



Warning:

⚠ The flow reserve to control Q_{max} is too low. Therefore the control quality is limited.

Hint:

💡 Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- ✕ Modified calculated value
- 📖 Lookup value
- ✕ Modified database value
- ⚠ Warning
- 💡 Hint

Calculation header

Identifier		2004-63047 Methanol ZAGROS
Author		uwinkel 20.06.2005 13:09:47
Editor		uwinkel 21.06.2005 08:43:12
Tag No.		TV-200521B

Medium selection and state

Medium		Recycle Gas	
Operating temperature	t1	56,0	°C
State		Gaseous (Standard conditions)	
Gas		Gas, dry	

First operating point (max. flow)

Calculation		Kv/Cv	
Absolute pressure upstream of valve	p1	77,5	bar(a)
Absolute pressure downstream of valve	p2	76,9	bar(a)
Flow coefficient	Cv	5.910,8	GPM(US)
☐ Mass flow rate	qm	708.900,0	kg/h
☒ Volume flow rate (standard conditions)	qn	1,3955	E 6 m³/h
Critical flow-related pressure difference	Δpc	24,748	bar(a)
Critical real pressure difference	ΔpXc	25,008	bar(a)
Type of flow		Non-critical	
State of flow		Turbulent flow	

Properties at first operating point

Operating density (t1, p1)	ρ1	32,566	kg/m³
Operating density (t2, p2)	ρ2	32,314	kg/m³
☒ Dynamic viscosity (t1,p1)	η1	0,016	mPa s
Isentropic exponent (t1, p1)	κ	1,35	-

Physical constants

Standard conditions		0°C, 1013 mbar	
☐ Density (standard conditions, dry g...)	pn	0,50799	kg/m³
☐ Specific gas constant	R	723,0	J/(kg K)
☒ Molecular weight	M	11,5	kg/kmol
Real gas factor (standard conditions)	Zn	1,01	-

Valve selection

Valve manufacturer		LEUSCH
Series		LDE Class 900
Valve selection		Cv: 7395, 20", Measured values (lin)
☒ Valve from database	☒	Valve data can be modified

Valve data

Size and pressure class according to		ANSI	
Valve type		Butterfly valve	
Basic characteristic (IEC 60534-2-4)		Measured values (lin)	
Flow direction		FTO	
Flow coefficient	Cv 	5.910,8	GPM(US)
Selected flow coefficient	Cv100 	7.395,0	GPM(US)
Selected valve size	DN 	20"	
Flow velocity	u1 	29,833	m/s
Flow velocity	u2 	30,066	m/s
Valve style modifier (Cv/Cv100 = 1)	Fd 	0,8	-
☒ Function for FIP			

☒ Function for xT**Load-dependent auxiliary values**

Stroke/angle-of-rotation ratio	s/s100	82,308	%
Valve load	Cv/Cv1...	79,929	%
Valve modifier (operating conditions)	FL ²	0,398	-
Valve modifier (operating conditions)	xT	0,331	-
Valve style modifier (operating conditio...	Fd	0,75	-

Pipe upstream of valve

☒ Size class upstream of valve	DN1	20"	
Pressure class upstream of valve	PN1	Schedule 60	
☐ Pipe outside diameter upstream of ...	Da1	20,0	in
Pipe wall thickness upstream of val...	s1	0,81102	in
☐ Pipe inside diameter upstream of v...	Di1	18,378	in
Flow velocity in the pipe	u1R	35,331	m/s

Pipe downstream of valve

☒ Size class downstream of valve	DN2	20"	
Pressure class downstream of valve	PN2	Schedule 60	
☐ Pipe outside diameter downstream ...	Da2	20,0	in
Pipe wall thickness downstream of ...	s2	0,81102	in
☐ Pipe inside diameter downstream o...	Di2	18,378	in
Flow velocity in the pipe	u2R	35,607	m/s
Material number		1.0038 R St 37-2	
Material group		Steel I	
Density of pipeline	pP	7.850,0	kg/m ³
Sound velocity in pipe material	cP	5.180,0	m/s

Noise calculation

Calculation standard (noise) IEC 60534-8-3:2000

Calculated values

Low-noise design		n.a.	
Pressure level (mach no.)	$\Delta L, Ma$	0,451	dB
Transmission loss	Rr	-78,7	dB
Sound power level	Lwi	105,0	dB
Sound pressure (0 m distance, A-weight...	LpAa	56,0	dB(A)
Sound pressure level of valve (A-weight...	LpAa	48,9	dB(A)

Minor noise prediction data

Mach number (valve outlet)	MaDN	0,053044	-
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Viscosity and laminar flow

Dynamic viscosity (t1,p1)	η_1	0,016	mPa s
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Further operating points

	Maximum flow		Mean flow		Minimum flow		
t1	56,0		56,0		56,0		°C
t2	56,0		56,0		56,0		°C
p1	77,5		77,5		77,5		bar(a)
p2	76,9		76,9		76,9		bar(a)
Cv	5.910,8		5.357,5		253,2		GPM(US)
qm	708.900,0		642.780,0		30.479,0		kg/h
qn	1,3955	E 6	1,2653	E 6	60.000,0		m ³ /h

Δp_c	24,748	25,886	45,453	bar(a)
cf1	566,8	566,8	566,8	m/s
η_1	0,016	0,016	0,016	mPa s
κ	1,35	1,35	1,35	-
ρ_1	32,566	32,566	32,566	kg/m ³
ρ_2	32,314	32,314	32,314	kg/m ³
LpAa	48,9	48,0	50,2	dB(A)
u1	29,833	27,05	1,2827	m/s
u2	30,066	27,261	1,2927	m/s
P	364,21	330,24	15,659	kW
MaDN	0,053044	0,048097	2,2807	E -3 -
s/s100	82,308	77,102	3,6208	%
Cv/Cv1...	79,929	72,448	3,4239	%
Fd	0,75	0,729	0,313	-
FL ²	0,398	0,43	0,597	-
xT	0,331	0,346	0,608	-
	Turbulent flow Non-critical	Turbulent flow Non-critical	Turbulent flow Non-critical	

Control optimization

Valve authority ($\Delta p_{100}/\Delta p_0$)

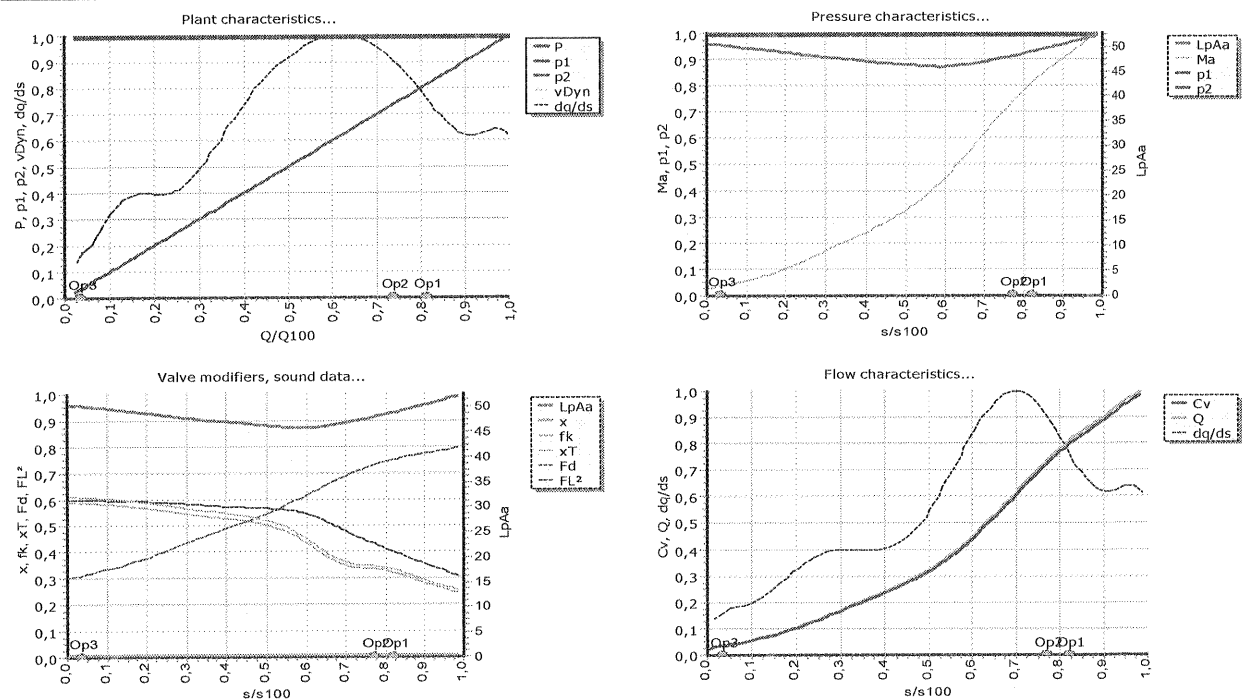
vDyn

1,0

-

Characteristics values table

Caption	Unit	5 [%]	25 [%]	50 [%]	75 [%]	99 [%]
s/s100	%	5,0	25,0	50,0	75,0	98,56
t1	°C	56,0	56,0	56,0	56,0	56,0
p1	bar(a)	77,5	77,5	77,5	77,5	77,5
p2	bar(a)	76,9	76,9	76,9	76,9	76,9
Cv	GPM(US)	284,2	969,4	2.333,0	5.108,0	7.286,0
qm	kg/h	34.210,0	116.700,0	280.700,0	612.800,0	871.600,0
qn	m ³ /h	67.350,0	229.700,0	552.500,0	1,206 E6	1,716 E6
Type of flow	-	Non-critical	Non-critical	Non-critical	Non-critical	Non-critical
vDyn	-	1,0	1,0	1,0	1,0	1,0
pv1	bar(a)					
κ	-	1,35	1,35	1,35	1,35	1,35
LpAa	dB(A)	50,11	48,26	46,32	47,67	52,18
MaDN	-	2,56 E-3	8,73 E-3	0,021	0,04586	0,06522
u2	m/s	1,451	4,948	11,9	25,99	36,97
cf	m/s					

**Hint:**

- ④ Approximate value: Density of pipeline - ρP

Legend

- Calculated value
- ✕ Modified calculated value
- Lookup value
- ④ Hint

Quote/order no.: 525 000

Customer: LURGI - PIDEDEC

Project: 4th Methanol Plant

Date: 05.07.2005



Valve Sizing Specialist Version 1.16

Item no.: PV200307B

Tag no.:

PV200307B

Process medium: Purge Gas

State of medium at inlet:

gas

Process and medium data

			Case 1	Case 2	Case 3
Flow	W	[kg/h]	17984.38	11648.74	
Inlet pressure	p1	[bar(a)]	67.9	67.9	
Outlet pressure	p2	[bar(a)]	3.5	3.5	
Inlet temperature	T1	[°C]	40	40	
Normal density	rhoN	[kg/m³]	0.51	0.51	
Real gas factor	Z	[-]	1	1	
Isentropic coefficient	gamma	[-]	1.4	1.4	
Inlet viscosity	ny1	[cSt]	0.47	0.47	

Total results

Flow coeff. calculated	Cv	[gpm]	24.5	15.9
Different. pressure ratio	x	[-]	0.95	0.95
Outlet velocity	w	[Ma]	0.18	0.12
SPL (VDMA 24422 mod.)	LA	[dB(A)]	86.9	80.9

Valve results

Flow coeff. calculated	Cv	[gpm]	25.1	16
Min req. size	Req. DN	[mm]	77.3	76.3
Outlet velocity	w	[Ma]	0.28	0.27
relative travel	T	[%]	91.86	80.4
Different. pressure ratio	x	[-]	0.79	0.86

Valve and attenuation plates data

Body type	Globe Valve	Series	3250
Flow coeff. with att. plates	Cv	Type	3251
Flow coeff. without att. plates	Cv	Body material	A216 WCB
Nominal size	[inch]	Trim material	4571 / 316Ti
Pressure ratings	Class	Noise reduction	Flow div. III with p2-att.
Travel	S	Number of att. plates	3
Seat bore	SB	Characteristic	Equal percent. 50:1
Stem diameter	Sd	Flow direction	FTO
Packing	PTFE (3,2)	Balanced	Without (0)
Sealing	Lapped-in (20)	Leakage rate	V
Bonnet	Standard		

Pipe data

Type of pipe	Steel	Pipe insulation	none	D1 [inch]	3	D2 [inch]	8
cR [m/s]	5100	rho [kg/m³]	7800	di [mm]	193.7	s [mm]	12.7

Actuator data

Type	3271	Fail safe act.	stem extends
Diaphr. area	A	Bench range	psO [bar]
	[cm²]	Supply	[bar]
(Defaults: p1max [bar(a)] 68	p2min [bar(a)] 1.01	t1max [°C] 100)	1.6 ... 2.4
			2.6

Actuator results

req. act. force	Fa req.	[kN]	16.46	req. diff. psu-ps100	d ps	[bar]	0.01
max. act. force	Fmax.	[kN]	57.41	Actuator force	Fa	[kN]	22.4
max. dp on plug	d pmax	[bar]	97.14	Close safety factor	Fa/Fa req. (SF)		1.36
req. start bench range	ps0req.	[bar]	1.29				

Quote/order no.: 525 000 Customer: LURGI - PIDEDEC
 Project: 4th Methanol Plant Date: 05.07.2005



Valve Sizing Specialist Version 1.16

Item no.: PV200307B Tag no.: PV200307B
 Process medium: Purge Gas State of medium at inlet: gas

More calculation data

More attenuation plates data

Type	3381-3			
Diameter of att. plates	D	[inch]	8	
Diameter of bores	d	[mm]	5	
			1. att. plate	2. att. plate
Code			DN200-016A	DN200-018A
Max. differential pressure	dp	[bar]	7	DN200-023A
Body	yes			

More valve results

			Case 1	Case 2
Flow	W	[kg/h]	17984.38	11648.74
Inlet pressure	p1	[bar(a)]	67.9	67.9
Outlet pressure	p2	[bar(a)]	14.25	9.48
SPL (VDMA 24422 1989)	LA	[dB(A)]	76.8	73.3
FL value	FL	[-]	0.94	0.96
xT value	xT	[-]	0.76	0.78
Valve style factor	Fd	[-]	0.44	0.42
Level exponent	G1	[-]	-5.26	-5.32
Slope exponent	G2	[-]	1.03	0.7

More actuator results

req. act. force	Fa req.	[kN]	16	16
Actuator force	Fa	[kN]	22.4	22.4
max. act. force	Fmax.	[kN]	64.07	64.07
req. diff. psu-ps100	d ps	[bar]	0.01	0.01
max. dp on plug	d pmax	[bar]	97.14	97.14
req. start bench range	ps0req.	[bar]	1.26	1.26
Close safety factor	Fa/Fa req. (SF)		1.4	1.4
Open safety factor	Ff/Fw		16.93	16.93

Index of Revisions

Rev.	Sheet	Prepared, revised		Checked	Approved			Remark, kind of revision
		Name	Date	Name	Name	Date	Status	
00	1 - 105	V12/sro	2005-01-10	V12/lf	V12/di	2005-01-20		FIRST ISSUE
01	159	V12/sro	2005-06-20	V12/lf	V12/di	2005-06-27		SECOND ISSUE
02	161	V12/sro	2005-07-01	V12/lf	V12/di	2005-07-05	FINAL	FINAL ISSUE