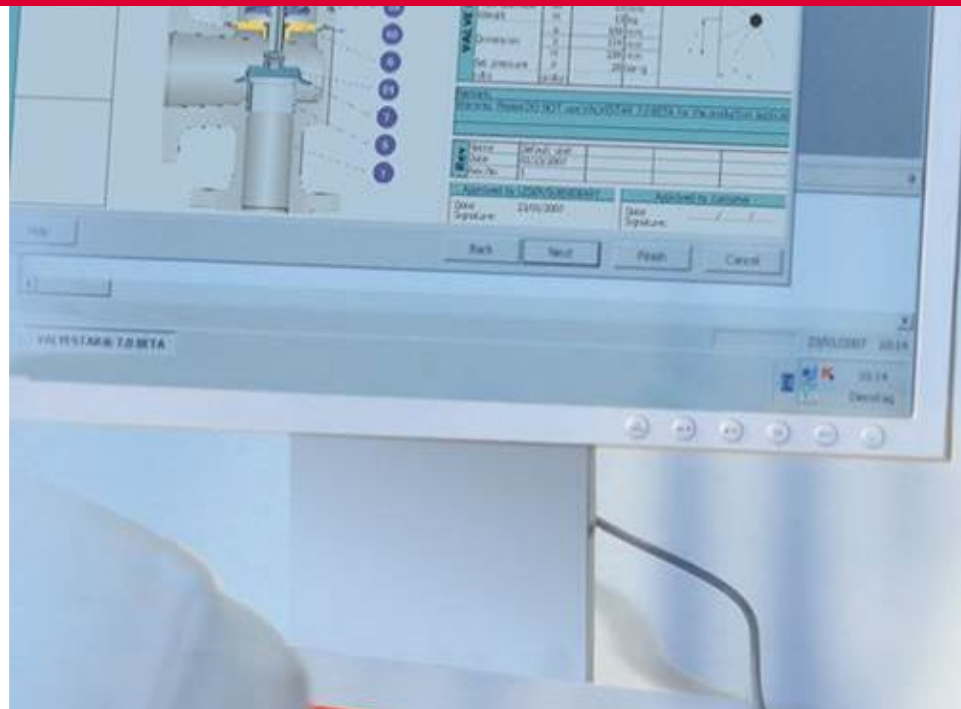


VALVESTAR® 7

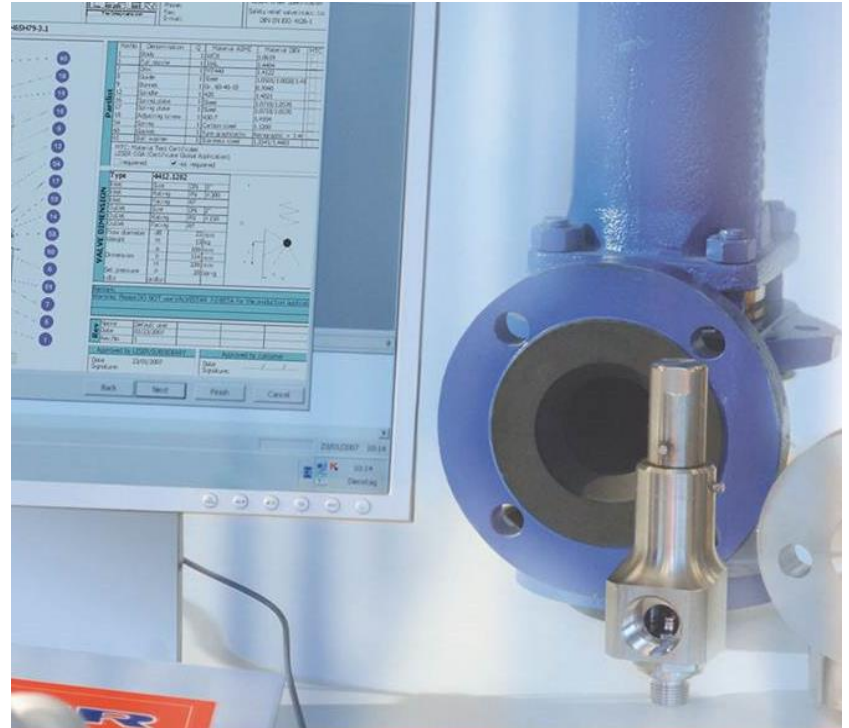
Training-Lectures



Objectives of this Presentation. Knowledge to learn.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

The aim of the presentation is to inform about training lectures of VALVESTAR® 7.



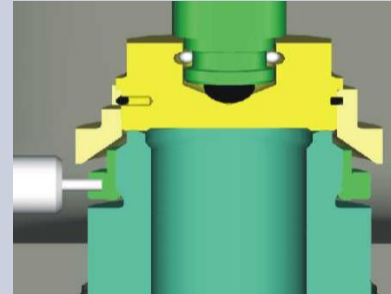
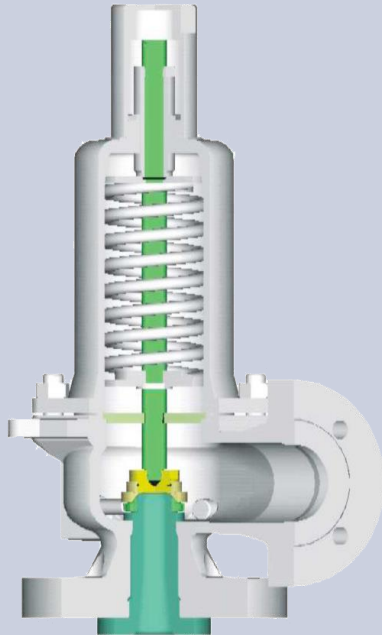
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Training basics.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

Conventional design – Example Type 526



German Notation	American Notation
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α_w	Certified coefficient of discharge	K
------------	------------------------------------	-----

A_o	Actual orifice diameter	A
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$$A_o = d_o^2 \times \frac{\pi}{4}$$

Training Example 1. Input data – Conventional.

1. Objectives | 2. Training basics | 3. **Training Example 1** | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

▪ Medium	Air
▪ Set pressure	10 barg
▪ Overpressure	10%
▪ Temperature	20 °C
▪ Required mass flow	11.500 kg/h
▪ Body material	1.0619/WCB
▪ Lifting device	Cap H2
▪ Sizing standard	DIN EN ISO 4126-7
▪ LESER Type	High Performance

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Training Example 1. Result – Conventional design Type 441.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

▪ Medium	Air
▪ Set pressure	10 barg
▪ Overpressure	10%
▪ Temperature	20 °C
▪ Required massflow	11.500 kg/h
▪ Body material	1.0619/WCB
▪ Lifting device	Cap H2
▪ Sizing standard	DIN EN ISO 4126-7
▪ LESER Type	High Performance
▪ Art.-No.	4412.4542
▪ Certified massflow	11.882,712 kg/h
▪ Capacity exceed	3,33%

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Training Example 1. Result – Conventional design Type 526.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

▪ Medium	Air
▪ Set pressure	10 barg
▪ Overpressure	10%
▪ Temperature	20 °C
▪ Required massflow	11.500 kg/h
▪ Body material	1.0619/WCB
▪ Lifting device	Cap H2
▪ Sizing standard	DIN EN ISO 4126-7
▪ LESER Type	API Series
▪ Art.-No.	5262.2022
▪ Certified massflow	11.866,667 kg/h
▪ Capacity exceed	3,19%

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Training Example 2. Additional inlet piping / pressure drop.

1. [Objectives](#) | 2. [Training basics](#) | 3. [Training Example 1](#) | 4. **Training Example 2** | 5. [Training Example 3](#) | 6. [Training Example 4](#) | 7. [Fire Case Sizing – vapor evaporation](#)

▪ Piping according to	ISO / CD 4126-9
▪ Inlet length	0,5 m
▪ Inlet diameter	DN 50 / 54,5 mm

Training Example 2. Result with inlet piping / pressure drop, Type 441.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. **Training Example 2** | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

▪ Piping according to	ISO / CD 4126-9
▪ Inlet length	0,5 m
▪ Inlet diameter	DN 50 / 54,5 mm
▪ Certified massflow	11.714,451 kg/h
▪ Capacity exceed	1,86%
▪ Pressure drop	1,70%

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Training Example 3. Additional outlet piping / back pressure.

1. [Objectives](#) | 2. [Training basics](#) | 3. [Training Example 1](#) | 4. [Training Example 2](#) | 5. **Training Example 3** | 6. [Training Example 4](#) | 7. [Fire Case Sizing – vapor evaporation](#)

▪ Piping according to	ISO / CD 4126-9
▪ Outlet length	0,5 m
▪ Outlet diameter	DN 80 / 82.5 mm
▪ Silencer	p = 0,5 bar

Training Example 3. Result with outlet piping / back pressure, Type 441.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. **Training Example 3** | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

▪ Piping according to	ISO / CD 4126-9
▪ Outlet length	0,5 m
▪ Outlet diameter	DN 80 / 82.5 mm
▪ Silencer	$p = 0,5$ bar
▪ Certified massflow	11.714,451 kg/h
▪ Capacity exceed	1,86%
▪ Back pressure ratio	10,90%

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Training Example 4. Common specification sheet format.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

 C-2. DATA SHEET of PRESSURE SAFETY & RELIEF VALVE		Doc. No.:	Sheet :
0 CLIENT : Suez		DS-10-018	2 of 12
1 PROJECT : Marafiq RWPP			
2 PROJECT NO. : B0701			
3 SERVICE : Safety and Relief Valve		0	
		REV. DATE	J.S.Jung Y.M.Hwang H.H.Lyu
		Prepared	Checked Approval
GENERAL	4 Tag No.	100-PSV-05408	100-PSV-05408
	5 Quantity	1 Set	1 Set
	6 P&ID No.	FG-S-20-004-005	FG-S-20-004-005
	7 Line No.	100-FG-038-CA2-12"H	100-FG-038-CA2-12"H
	8 Manufacturer	By Supplier	By Supplier
	9 Model No.	By Supplier	By Supplier
	10 Safety valve location	Pressure Reducing Station	Pressure Reducing Station
	11 Protected equipment	Pressure Reducing Station	Pressure Reducing Station
	12 Discharge to	Cold Vent Stack	Cold Vent Stack
	13 Design code	ASME SEC VII	ASME SEC VII
BASIS OF SELECTION	14 Design hypothesis		
	15 Code stamp	UV	UV
	16 Accumulation in % of design pressure		
PROCESS CONDITIONS	17 Fluid	Fuel Gas	Fuel Gas
	18 Phase	Gas	Gas
	19 Required capacity (kg/h) /set	12200	12200
	20 MW	18.10	18.10
	21 Density at relief (kg/m ³)	28.76	28.76
	22 Viscosity at relief (cP)	0.01363	0.01363
	23 Operating Pressure (barg)	36	36
	24 Operating Temperature (deg. C)	65	65
	25 Set Pressure (barg)	41	41
	26 Relieving temp (deg. C)	65	65
	27 Back pressure (barg, Constant/Variable)	10	10
	28 Over pressure in % of set pressure		
	29 Cp/Cv	1.3739	1.3739
	30 Compressibility Factor	0.9405	0.9405
	31 Blowdown in % of set pressure	5	5
	32 Calculated Orifice Area (cm ²)	By Supplier	By Supplier
	33 Selected Orifice Area (cm ²)	By Supplier	By Supplier
34 Capacity of Selected Valve (kg/h)	By Supplier	By Supplier	
VALVE	35 Valve design pressure (barg)	74	74
	36 Valve design temperature (deg. C)	60	60
	37 Orifice designation	API 526	API 526
	38 Valve type (Piston / Spring Loaded)	Spring Loaded	Spring Loaded
	39 Valve type (Pilot / Conventional / Balanced)	Conventional	Conventional
	40 Nozzle type	Full	Full
	41 Bonnet type (Open/Closed)	Closed	Closed
	42 Seat Tightness	API 527	API 527
	43 Size (Inlet/Outlet)	By Supplier	By Supplier
	44 Connection Rating (Inlet/Outlet)	ASME 600#/ASME 150#	ASME 600#/ASME 150#
MATERIAL	45 Flange Facing Type (Inlet/Outlet)	WNRF/ANRF (Nose 1)	WNRF/ANRF (Nose 1)
	46 Body	SA216 WCB or Equivalent	SA216 WCB or Equivalent
	47 Bonnet	SA216 WCB or Equivalent	SA216 WCB or Equivalent
	48 Seat/Nozzle	316SS or Equivalent	316SS or Equivalent
	49 Disc	316SS or Equivalent	316SS or Equivalent
	50 Guide	316SS or Equivalent	316SS or Equivalent
	51 Spring	By Supplier	By Supplier
	52 Cap (Screwed/Boiled)	Boiled	Boiled
ACCESSORIES	53 Lifting lever	No	No
	54 Test gag	Yes	Yes
	55 Others (Recommended by Supplier)	Yes	Yes
NOTES	56 1. WNRF type shall be applied for flange size 1/2"-2", and WNRF type shall be applied for flange size 2 1/2" and over.		
	57		
	58		
	59		
	60		

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Training Example 4. Data from specification sheet.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. **Training Example 4** | 7. Fire Case Sizing – vapor evaporation

▪ Medium	Fuel Gas: MW = 18,1; Cp/Cv = 1,3739; compressibility factor Z = 0,9405
▪ Set pressure	41 barg
▪ Overpressure	10%
▪ Relieving Temperature	65 °C
▪ Required massflow	12200 kg/h
▪ Body material	1.0619/WCB
▪ Lifting device	Bolted Cap
▪ Sizing standard	ASME VIII
▪ LESER Type	API Series/Conventional

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Training Example 4. Result – conventional design, Type 526.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. **Training Example 4** | 7. Fire Case Sizing – vapor evaporation

▪ Medium	Fuel Gas: MW = 18,1; Cp/Cv = 1,3739; compressibility factor Z = 0,9405
▪ Set pressure	41 barg
▪ Overpressure	10%
▪ Relieving Temperature	65 °C
▪ Required massflow	12200 kg/h
▪ Body material	1.0619/WCB
▪ Lifting device	Bolted Cap
▪ Sizing standard	ASME VIII
▪ LESER Type	API Series/Conventional

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Training Example 4. Result – conventional design, Type 526.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. **Training Example 4** | 7. Fire Case Sizing – vapor evaporation

▪ Art.-No.	5262.1452, 2H3,
▪ Certified massflow	14.902,653 kg/h
▪ Capacity exceed	22,15%

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Fire Case Sizing – vapor evaporation.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation



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Fire Case Sizing – vapor evaporation.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

- VALVESTAR® makes Fire Case sizing according to API RP 521 foolproof.
- In the ASME Boiler & Pressure Vessel Code, Selection VII Div. 1, the protection of pressure vessel in external fire applications is defined. A maximum accumulation of 21% is allowed.
- The sizing equations for external fire applications are specified in API RP 521. The standard differentiates between sizing for the unwetted surface area for gases and wetted surface area for liquids.
- How do you size and select the correct safety valve to protect a pressure vessel filled up with liquid propane with VALVESTAR®? The WIZARD will guide you in 6 steps through this sizing for Fire Vapor generation.

Fire Case Sizing – vapor evaporation.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

Create new sizing wizard - Sizing Type and Medium Selection

Sizing Type and Medium Selection

At this step you need to select a type of sizing and a medium. Please specify sizing or calculation for a valve. Then specify a medium and

Tag No.	
Medium	Gas
Sizing standard	ASME VIII
Selected units	ASME VIII
CDTP Calculation	<input checked="" type="checkbox"/>

Additional calculations

	AD2000-A2	API 520	ISO / CD 4126-9
Reaction force	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Case	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pressure drop inlet line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bulk up back pressure outlet pipe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Step 1: The sizing standard selection

Please select the sizing standard ASME VIII and the extended calculation "Fire Case".

Create new sizing wizard - Medium selection

Medium selection

Use this page to select a medium.

Az (-) 0 % Select New

Name	Formula	Molar mass	k	%
Propane	C3H8	44.1 kg/kmol	1.13	100.00

Total percentage 100.00%

Remove

Designation	Propane	Molar mass	M	44.1	kg/kmol
Type of mix.	Volume	Ratio of specific heats	k	1.130	
		Compressibility factor	Z	1.000	

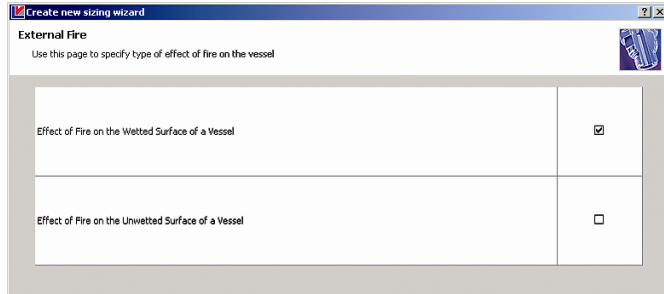
Help Back Next Finish Cancel

Step 2: The medium selection

Please select Propane in the medium database.

Fire Case Sizing – vapor evaporation.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation



Step 3: The “Wetted Surface Area” sizing

Select the case for FIRE VAPOR GENERATION. This will calculate the amount of vapour generated from the liquid in the protected vessel.

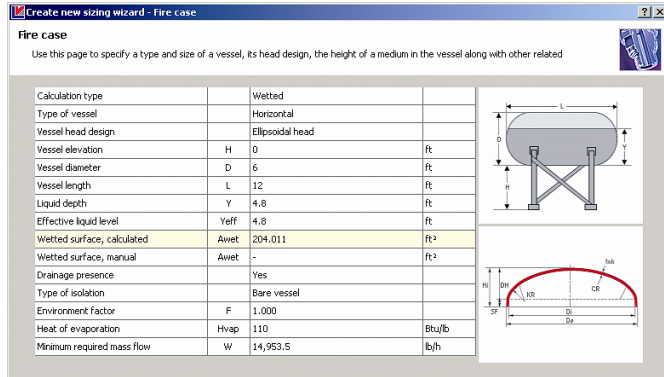
Step 4: The calculation of required mass flow

Where adequate draining and firefighting equipment exist, the following equation has to be used.

$$Q = 21,00FA^{0,82}$$

(API RP 521 Chapter 3.15.2, Equation 3)

Several pieces are necessary to be able to size the required massflow.



Normal liquid level: 80% filled, result: Y = 4,8 ft

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Fire Case Sizing – vapor evaporation.

1. Objectives | 2. Training basics | 3. Training Example 1 | 4. Training Example 2 | 5. Training Example 3 | 6. Training Example 4 | 7. Fire Case Sizing – vapor evaporation

Create new sizing wizard - Service condition

Service Condition

At this step you need to set values for Input Pressure, Temperature, Massflow or Volumeflow.

Maximum allowable working pressure	-	psig
Set pressure	p1	250 psig
Supervised back pressure	psbf	0 psig
Built up back pressure	psbe	0 psig
Overpressure	dp	21.00 %
Temperature	T	142 °F
Required massflow	qm_ab	14,983.501 lb/h
Volume flow to be discharged (working condition)	qv_ab	6,902.24 ft³/h
Volume flow to be discharged (std condition) [T=60 °F P=14.7 psi]	qm_ab	2,143.685 SCFM

Options

Volume flow standard	ASME
Case for blow off	Firecase

Installations

Rupture disc correction factor	<input type="checkbox"/>	1.000
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Create new sizing wizard - Valve selection

Valve Selection

First, choose a valve group and then any one valve from that group.

Type	Diameter range	Body material
485	d0 13 - 25mm	1.0619 / SA 216 WCB
488	d0 23 - 52mm	Lifting device
532	IPS 1" - 4" / Office 0-1	Cap HC

Capacity exceeded [%]	Certified massflow [Bb/h]	Article No.	DN inlet x DN outlet	d0	Description
-6.45	13,988.599	S262.0462	1 1/2D3	22.5	Type S262 Office G #150
-6.45	13,988.599	S262.0462	1 1/2D3	22.5	Type S262 Office G #300 L
-6.45	13,988.599	S262.0472	1 1/2D3	22.5	Type S262 Office G #300
-6.45	13,988.599	S262.0482	1 1/2D3	22.5	Type S262 Office G #600
-6.45	13,988.599	S262.0492	1 1/2D3	22.5	Type S262 Office G #900
-6.45	13,988.599	S262.0502	2D3	22.5	Type S262 Office G #1500
-6.45	13,988.599	S262.0512	2D3	22.5	Type S262 Office G #2500
47.99	22,130.017	S262.1422	1 1/2D3	28.3	Type S262 Office H #150
47.99	22,130.017	S262.1432	1 1/2D3	28.3	Type S262 Office H #300 L

Selection criteria:

Capacity exceeded [%]	Certified massflow [Bb/h]	Article No.	DN inlet x DN outlet	d0	Description
47.99	22,130.017	S262.1422	1 1/2D3	28.3	Type S262 Office H #150

Total: capacity exceeded 47.99 [%], certified massflow 22,130.017 [Bb/h]

Buttons: Back, Next, Finish, Cancel

Step 5: The main sizing"

The data for service conditions has to be added to the main calculation according to ASME VIII.

The required mass flow has been determined by step 4 with the fire case calculation and has been imported into the main calculation.

Set pressure: 250 psig

Saturation temperature: 142 °F

Step 6: The selection of safety valve

The WIZARD will then help you in the next steps to select the correct safety valve.

The sizing is finished and can be printed or filed.

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Thank you for your attention.

