Pressure Relief Valve Sizing Software

Emerson PRV²SIZE

Pressure relief valve sizing software

EMERSON

Pressure Relief Valve and Vent Sizing Software

PRV²SIZE
PRESSURE RELIEF VALVE AND VENT SIZING SOFTWARE

PRV²SIZE is a comprehensive and easy-to-use program that offers a thorough and integrated approach for sizing all types of pressure relief devices, including low-pressure tank protection and recirculation control valve products in a single sizing, selection and configuration platform.

Sizing Methodologies:

- **ASME Section VIII:** API 520, Part I, 9th edition gas, liquid and steam phases
- **ASME Section I:** Steam phase
- **ISO 4126-7:** Gas, liquid and steam phases
- **API 521:** Fire sizing tank flow rate calculation method for gas and liquid filled vessels
- **Two-Phase:** API 520, Part I, 9th ed., 7th ed., and 6th ed. and ASME Appendix 11
- **ARC Sizing:** Yarway™ Automatic recirculation control (ARC) valve sizing
- **API 2000/ISO 28300:** Tank vent and flame arrester sizing

Reports:

- **Format:** Reports can be generated in excel or PDF format
- **Datasheet Report:** Includes configuration, calculation and selection summary with tag notes
- **Calculation Report:** Variables, symbols, data input values, units, equations and results summary
- **Drawing Sheet:** Displays outline drawings with dimensions and weight
- **Configuration Report:** Includes ERP code for each selected option in valve configuration
- **Flow Curves:** Pressure and vacuum relief valve flow curves for Varec models
- **Tank Calculations:** Fire sizing capacity calculations for gas and liquid filled vessels

Reference Library:

- **Catalogs:** Emerson Anderson Greenwood™, Crosby™, Yarway and Varec™ product catalogs
- **PRV²SIZE Quick Start Guide:** Features and functionality guide
- **Material Compatibility:** Metals, soft goods, NACE and chemical compatibility reference
- **Emerson PRV Engineering Handbook:** Technical information resource
- **Two-phase Data Form:** Application data form for 9th and 7th editions
- **Valve Features:** Product model features
- **PRV Overview:** Emerson models overview

Software Utilities:

- **Backup Tag Data:** Tags database back up for replacing on new computer
- **View Error List:** Displays warnings and errors for sizing and invalid models for selection
- **Show Program Data Folders:** Provides quick access to program data folders
- **Omega 9 Calculator:** Liquid and gas density calculation using two phase mixture density

Sizing and Valve Selection:

- **Sizing:** Enter data in USC or SI units and values are converted when units are modified
- **Valve Filtering:** Limit selection based on product category and dataset (API or ASME)
- **Generic Sizing:** Generate drawing and calculation for special coefficients, dimensions or weight
- **Multiple Valves:** Select and stagger multiple valve set pressures for high flowrate applications
- **Selection:** Sort valves based on brand, model, type, size, required area and rated flow

Project Management:

- **Tag Management:** Update tag properties, copy, delete and move single or multiple tags
- **Project Management:** Set preferences for units and fluid, flowrate, valve or vessel properties
- **Project/Tag Summary Report:** Includes summary of sizing, selection and configuration data
- **Export/Import Feature:** Allows exporting and importing single or multiple project tags
- **Fluid Property Database:** Add new fluids or modify default gas, liquid or two-phase properties

Valve Configuration:

- **Standard Configuration:** Valid options identified in dropdowns with errors list
- **Custom Configuration:** Update material and dimensions for custom configuration
- **Accessory:** Valve accessories selection option
- **Special Requirements:** Project quality and documentation options
- **Notes:** Enter detailed custom configuration or project tag notes to be displayed on reports
- **Calculations:** Review or modify reaction force, noise and restricted lift calculations
- **Valve Dimensions:** Dimensions and weight display for standard or customized configuration
- **Valve Features:** Summary feature list and image of selected valve

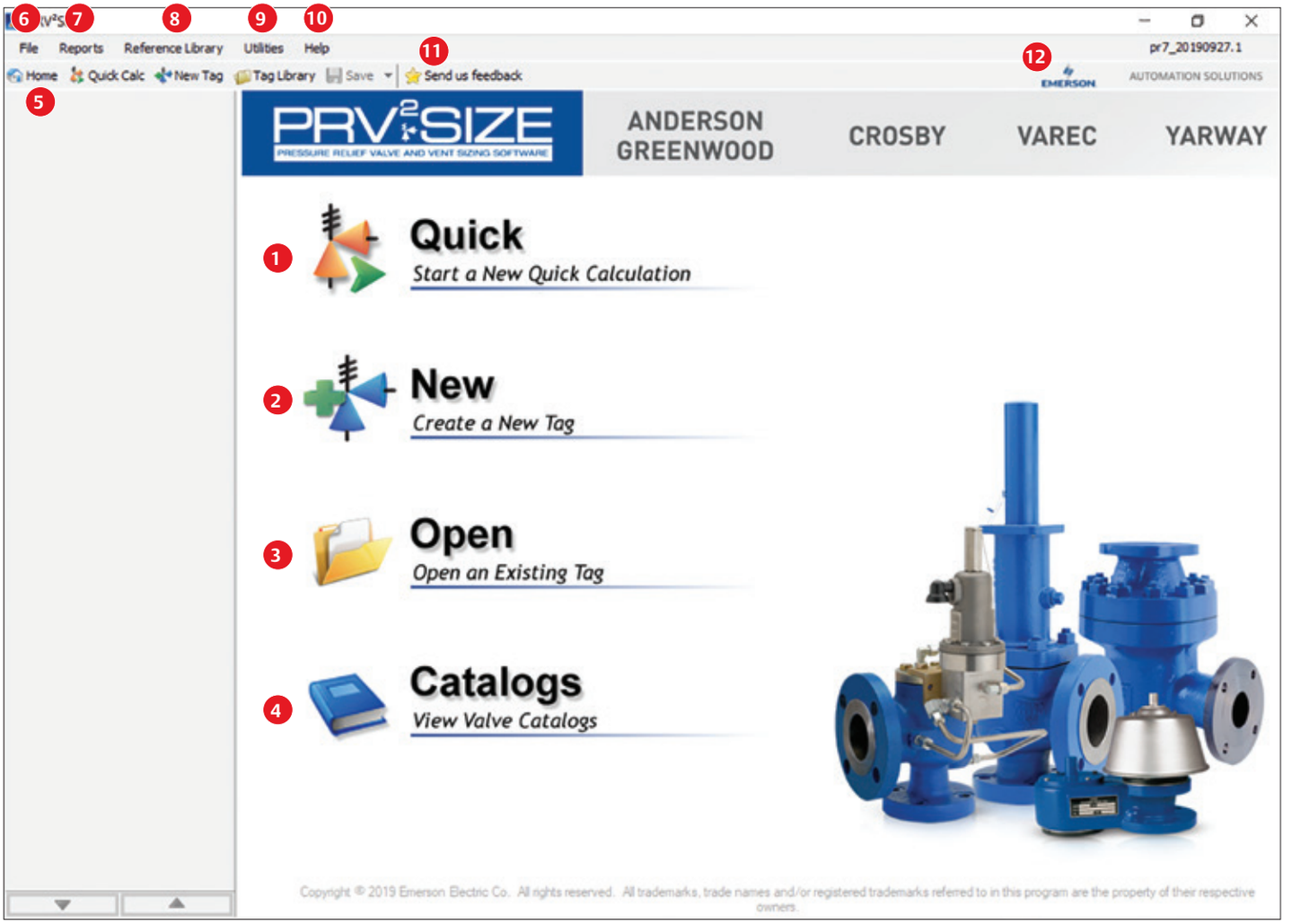
Emerson PRV²SIZE Website

https://valvesizing.emerson.com

Screenshots

Home Screen

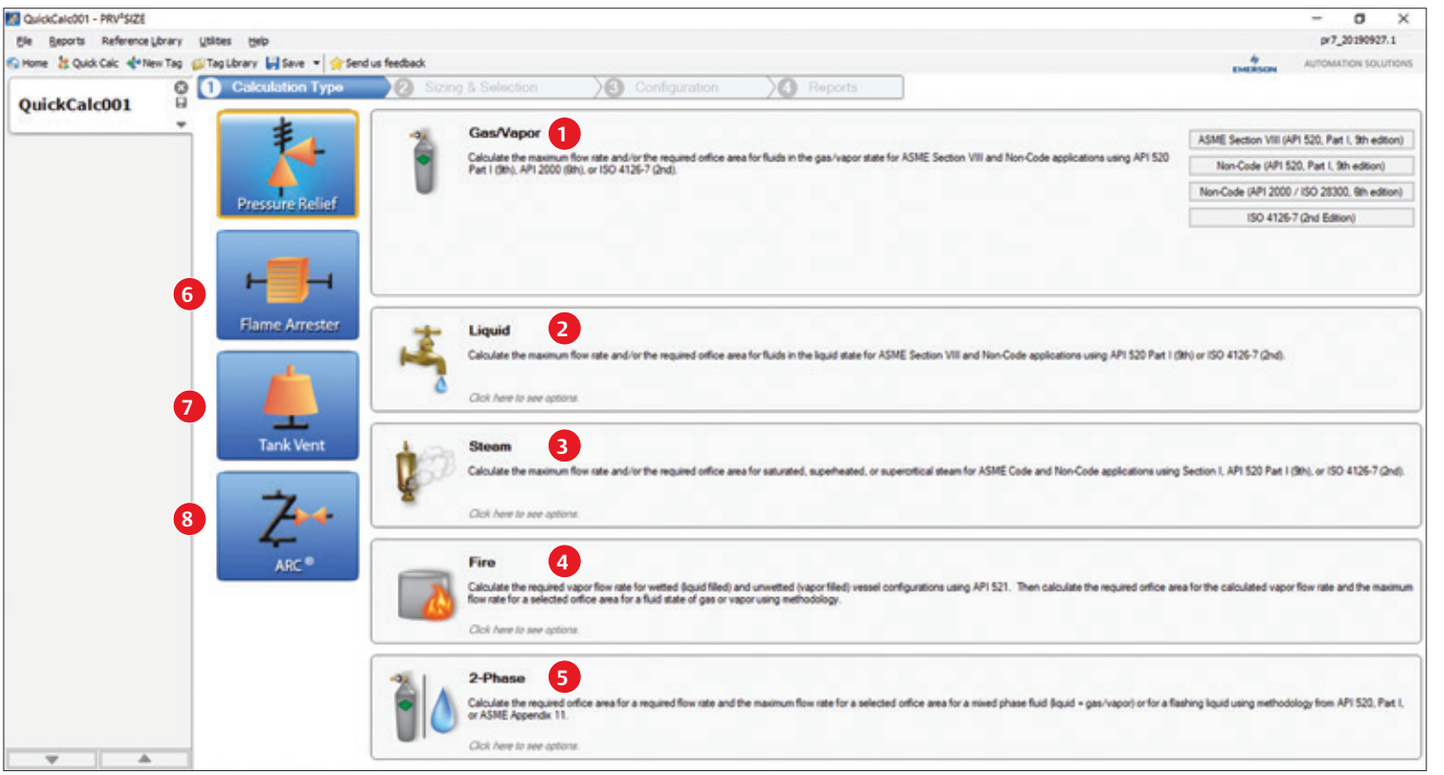
1. **Quick Calculation:** Size a tag without saving
2. **New Tag:** Create and save new company, project and tag
3. **Open Tag:** Open tags in tag library
4. **Catalogs:** View, save or print most catalogs
5. **Home:** Access home screen
6. **File Menu:**
   - Export and import multiple project tags
   - Preferences allow default units set up, fluid properties database update and two phase 7th or 6th edition method activation
7. **Reports Menu:** Generate datasheet, calculation, drawing, configuration, tank calculation, flow curve and tag summary reports
8. **Reference Library:** Access software quick start guide, product catalogs, PRV engineering handbook, metals and soft goods compatibility and two-phase application data form
9. **Utilities:**
   - *Back up tag data to location:* Tags database back up for replacing on new computer
   - View Errors List displays warnings and errors for open tag
   - *Show Program Data Folders:* Provides quick access to program data folders
   - *Omega 9 Calculator:* Liquid and gas density calculation using two phase mixture density
10. **Help:** Check for program updates, request special features and identify program version
11. **Send Feedback:** Report problem, send suggestion or feedback to software team
12. **Sizing Website:** Click Emerson logo to be redirected to https://valvesizing.emerson.com



Screenshots (continued)

Sizing Method Selection

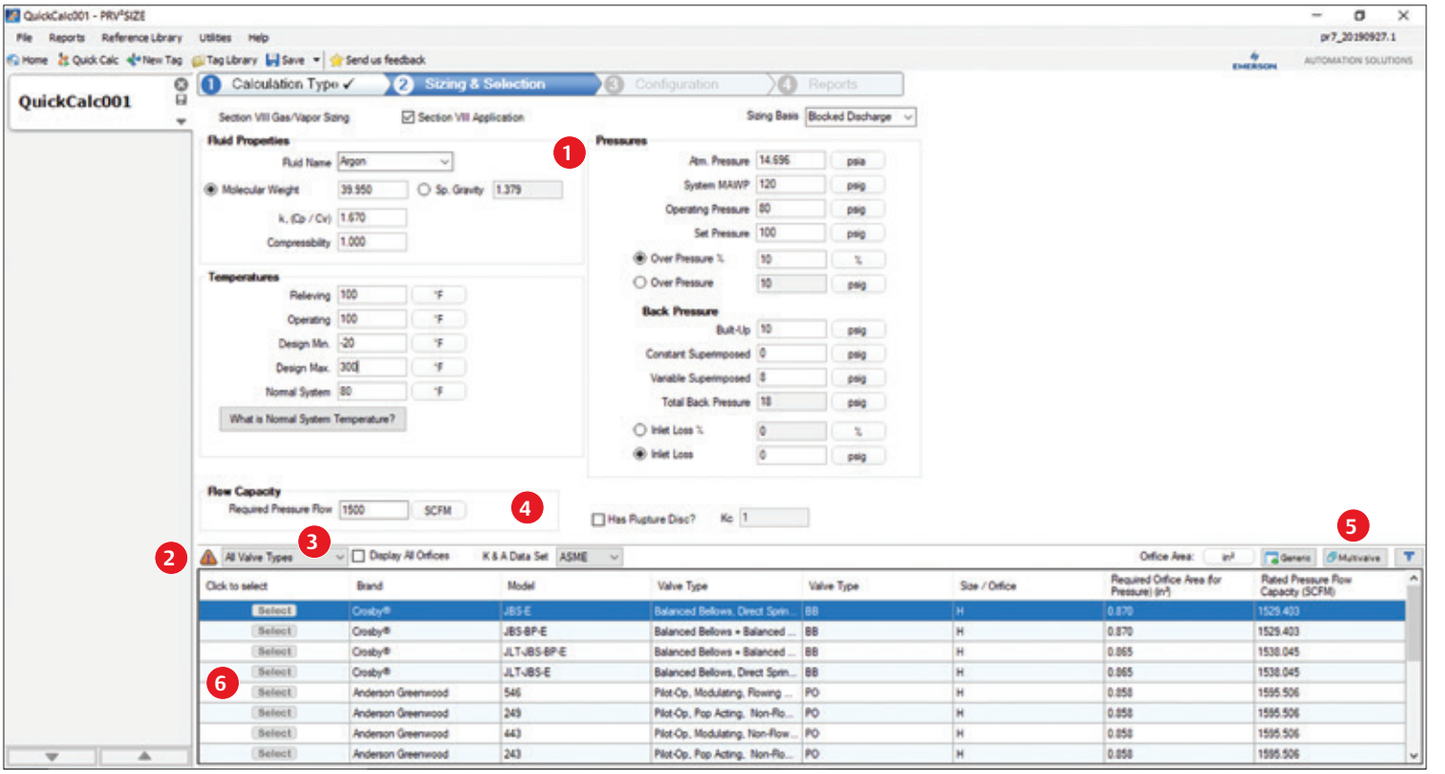
1. **Gas/Vapor:** ASME Section VIII code API 520 part I, 9th edition, non-code API 520 part I, non-code API 2000 and ISO4126-7, 2nd edition sizing methods
2. **Liquid:** ASME Section VIII code API 520 part I, 9th edition, non-code API 520 Part I and ISO4126-7, 2nd edition methods
3. **Steam:** ASME Section VIII code API 520 part I, 9th edition, non-code API 520 Part I, ASME section I and ISO4126-7, 2nd edition sizing methods
4. **Fire:** Calculate required vapor flow rate for liquid filled (wetted) or gas filled (unwetted) vessels using API 521
5. **Two-Phase:** API 520, part I, 9th edition, annex C mass flux direct integration (C.2.1), omega (C.2.2 and C.2.3), 7th edition (D.2.1, D.2.2 and D.2.3), separated flow method (6th edition) and ASME appendix 11 sizing methods
6. **Flame Arrester:** Flame arrester sizing for tank vents
7. **Tank Vent:** API 2000/ISO 28300, 6th edition pressure relief valve and free vent sizing
8. **ARC:** Yarway™ Automatic recirculation control (ARC) valve sizing



Screenshots (continued)

Sizing and Selection

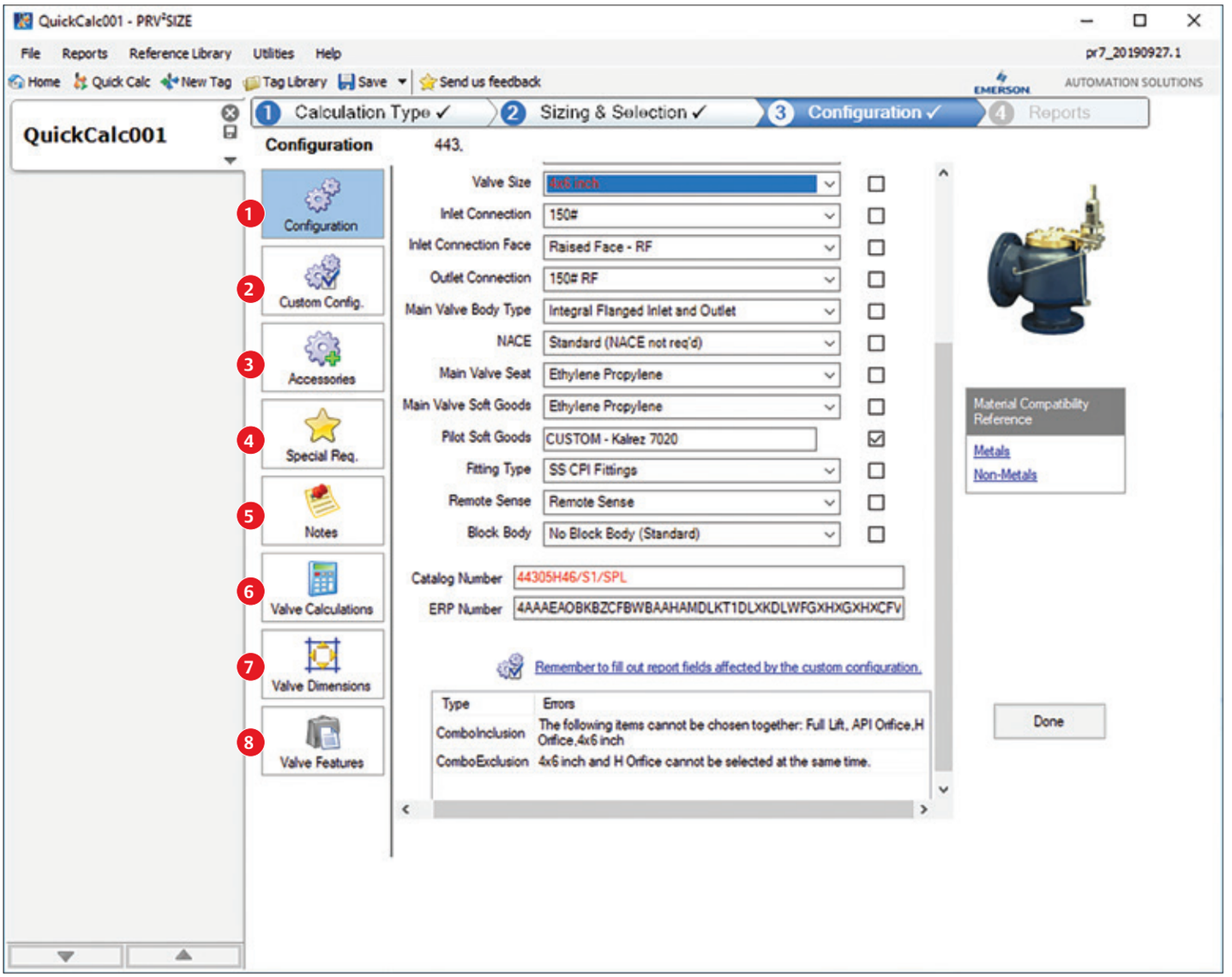
1. **Data Entry:** Enter process data in USC or SI units and values are converted when units are modified
2. **Error Triangle:** Filter bar triangle lists errors for invalid model and sizing process data warnings
3. **Valve Type:** Filter valves based on valve type
4. **Dataset:** Select API or ASME dataset for K and A values
5. **Multivalve:** Select multivalve option and stagger set pressures for high flowrate applications
6. **Valve Selection:** Sort valves based on model, valve type, size/orifice, calculated area and rated flow rate



Screenshots (continued)

Configuration

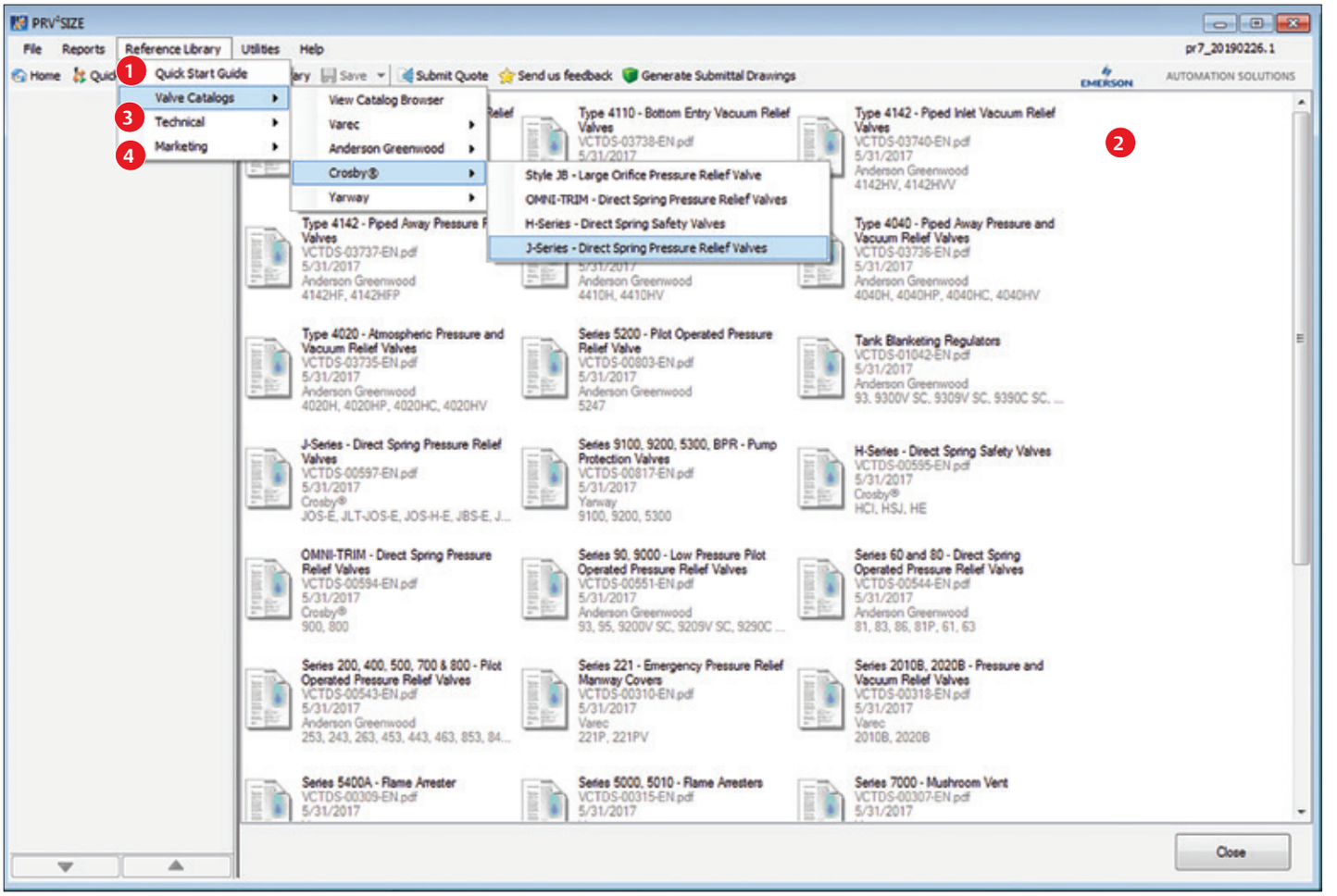
1. **Configuration:** Model and ERP number is updated based on selected valid options in configuration drop down and errors are displayed for invalid configuration
2. **Customize Configuration:** Customize material, soft goods, connections or other configuration options approved for special configuration
3. **Accessories:** Model and ERP number is updated for selected accessories
4. **Special Requirements:** Project quality and special requirements selection option
5. **Notes:** Enter detailed custom configuration or project tag notes to be displayed on reports
6. **Calculations:** Review or modify reaction force, noise and restricted lift calculations
7. **Valve Dimensions:** Dimensions and weight display for standard or customized configuration
8. **Valve Features:** Summary feature list and image of selected valve



Screenshots (continued)

Reference Library

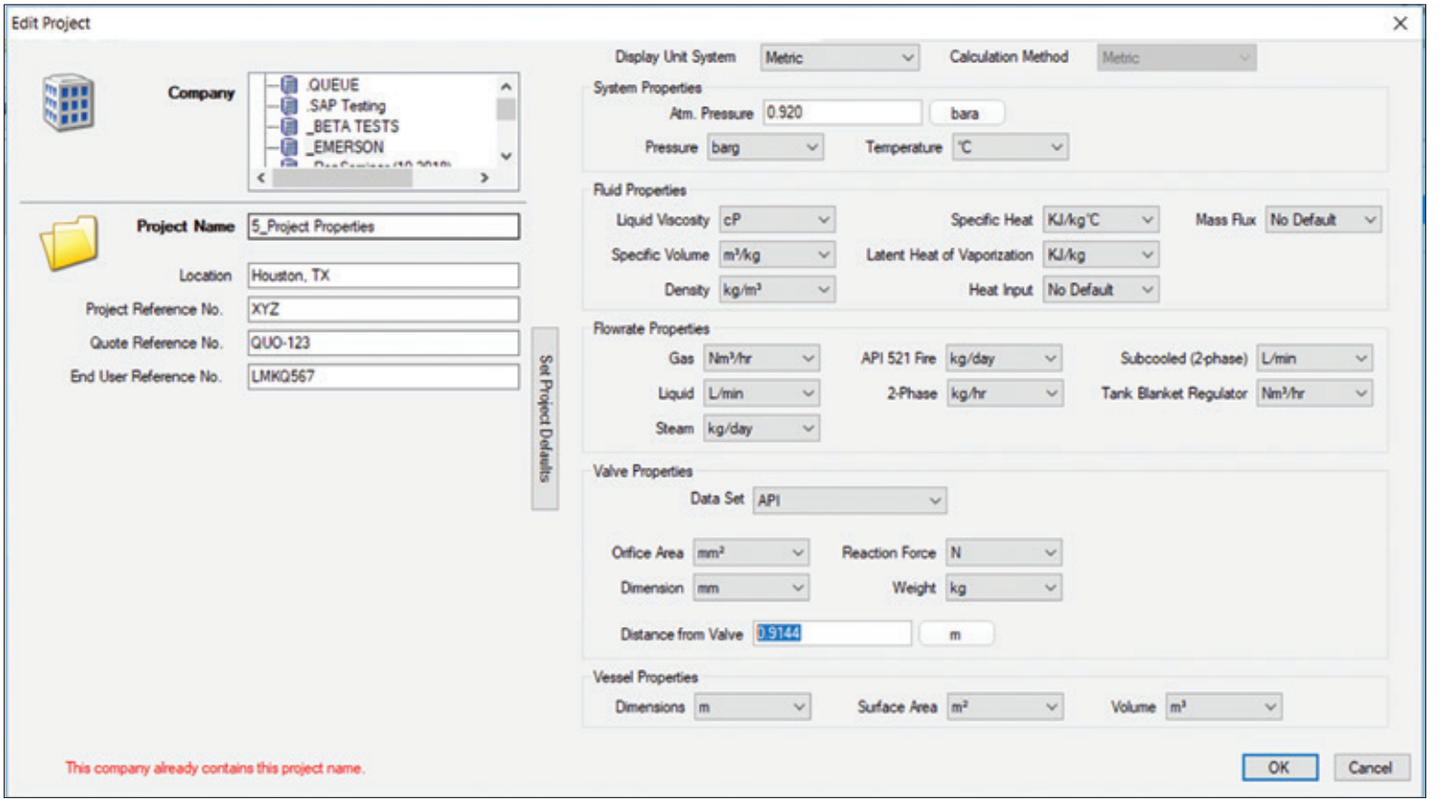
1. **PRV²SIZE Quick Start Guide:** Software utilities, features and functionality guide
2. **Catalogs:** Emerson Anderson Greenwood™, Crosby™, Yarway™ and Varec™ product catalogs
3. **Technical Reference:** Includes Emerson PRV engineering handbook, two-phase application data form, material compatibility for metals, soft goods, NACE and chemical compatibility reference
4. **Marketing:** Includes valve features drop down for product model features and PRV overview for all product models



Screenshots (continued)

Project Management

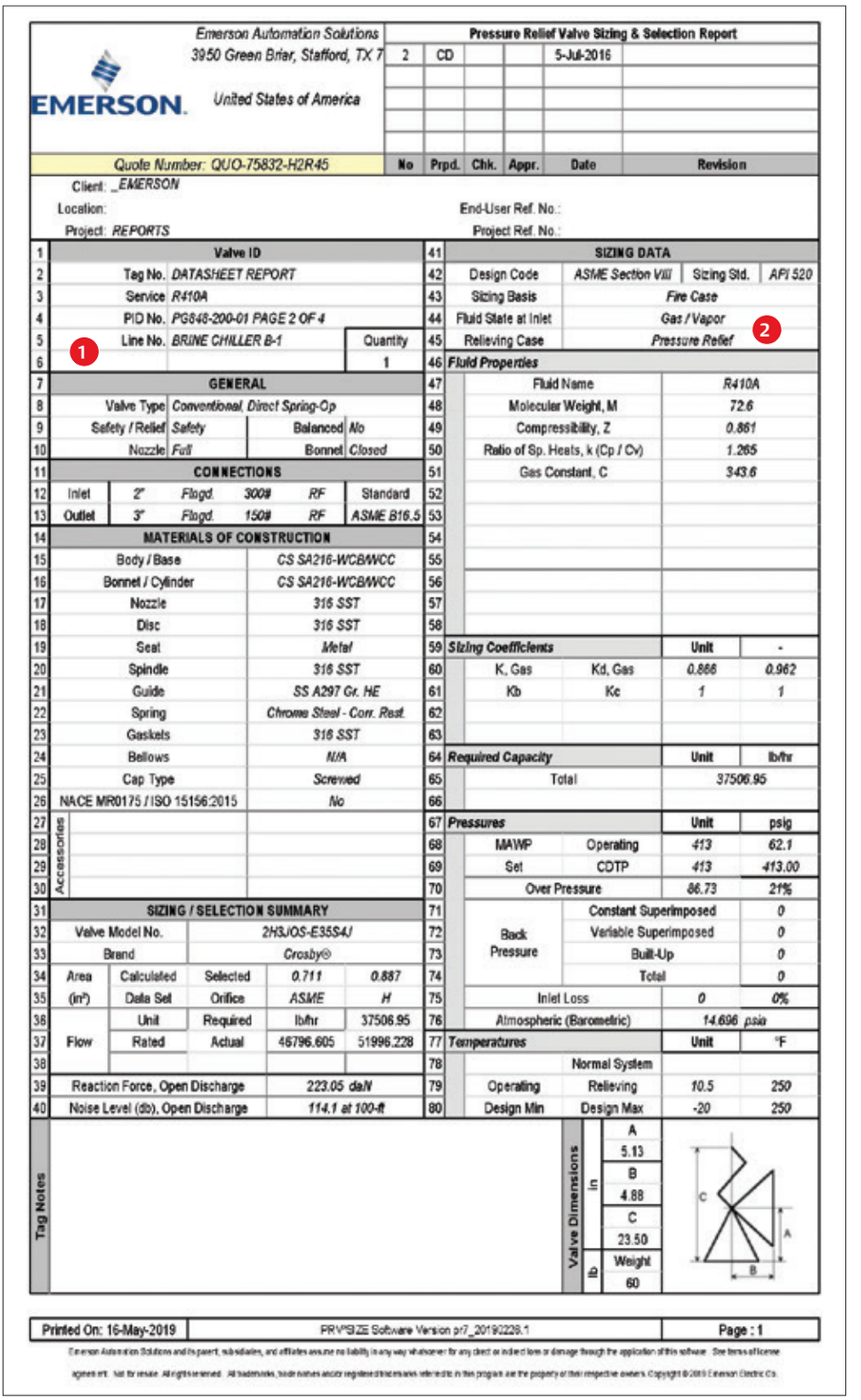
1. **Tag Management:** Update tag properties, copy, delete and move single or multiple tags
2. **Project Management:** Set preferences for units and fluid, flowrate, valve or vessel properties
3. **Project/Tag Summary Report:** Includes summary of sizing, valve selection and configuration data
4. **Export/Import Feature:** Allows exporting and importing single or multiple project tags
5. **Fluid Property Database:** Add new fluids or modify default gas, liquid or two-phase properties



Sample Reports

Datasheet Report

1. **Selection and Configuration Summary:** Displays project/tag ID, type, material of construction, connections, valve calculations, selection summary with tag notes and dimensions
2. **Process Data:** Includes fluid properties, sizing coefficients, required capacity, pressure and temperature values



Emerson Automation Solutions
3950 Green Briar, Stafford, TX 7
United States of America

Pressure Relief Valve Sizing & Selection Report

No	Prpd.	Chk.	Appr.	Date	Revision
2	CD			5-Jul-2016	

Quote Number: QUO-75832-H2R45

Client: _EMERSON
Location:
Project: REPORTS
End-User Ref. No.:
Project Ref. No.:

1	**Valve ID**					41	**SIZING DATA**		
2	Tag No.	DATASHEET REPORT				42	Design Code	ASME Section VIII	Sizing Std. API 520
3	Service	R410A				43	Sizing Basis	Fire Case	
4	PID No.	PG646-200-01 PAGE 2 OF 4				44	Fluid State at Inlet	Gas / Vapor	
5	Line No.	BRINE CHILLER B-1		Quantity		45	Relieving Case	Pressure Relief	2
6	1			1		46	**Fluid Properties**		
7	**GENERAL**					47	Fluid Name	R410A	
8	Valve Type	Conventional, Direct Spring-Op				48	Molecular Weight, M	72.6	
9	Safety / Relief	Safety	Balanced	No		49	Compressibility, Z	0.861	
10	Nozzle	Full	Bonnet	Closed		50	Ratio of Sp. Heats, k (Cp / Cv)	1.265	
11	**CONNECTIONS**					51	Gas Constant, C	343.6	
12	Inlet	2"	Flngd.	300#	RF	Standard	52		
13	Outlet	3"	Flngd.	150#	RF	ASME B16.5	53		
14	**MATERIALS OF CONSTRUCTION**					54			
15	Body / Base	CS SA216-WCB/WCC				55			
16	Bonnet / Cylinder	CS SA216-WCB/WCC				56			
17	Nozzle	316 SST				57			
18	Disc	316 SST				58			
19	Seat	Metal				59	**Sizing Coefficients**	Unit	-
20	Spindle	316 SST				60	K, Gas	Kd, Gas	0.866 0.962
21	Guide	SS A297 Gr. HE				61	Kb	Kc	1 1
22	Spring	Chrome Steel - Corr. Resi.				62			
23	Gaskets	316 SST				63			
24	Bellows	N/A				64	**Required Capacity**	Unit	lb/hr
25	Cap Type	Screwed				65	Total	37506.95	
26	NACE MR0175 / ISO 15156:2015	No				66			
27	Accessories					67	**Pressures**	Unit	psig
28						68	MAWP	Operating	413 62.1
29						69	Set	CDTP	413 413.00
30						70	Over Pressure		86.73 21%
31	**SIZING / SELECTION SUMMARY**					71	Back Pressure	Constant Superimposed	0
32	Valve Model No.	2HSJOS-E35S4J				72		Variable Superimposed	0
33	Brand	Crosby®				73		Built-Up	0
34	Area (in²)	Calculated	Selected	0.711	0.887	74		Total	0
35		Data Set	Orifice	ASME	H	75	Inlet Loss		0 0%
36	Flow	Unit	Required	lb/hr	37506.95	76	Atmospheric (Barometric)		14.696 psia
37		Rated	Actual	46796.605	51996.228	77	**Temperatures**	Unit	°F
38						78		Normal System	
39	Reaction Force, Open Discharge			223.05 daN		79	Operating	Relieving	10.5 250
40	Noise Level (db), Open Discharge			114.1 at 100-ft		80	Design Min	Design Max	-20 250

Tag Notes

Valve Dimensions

in	A
	5.13
	B
	4.88
	C
	23.50
lb	Weight
	60

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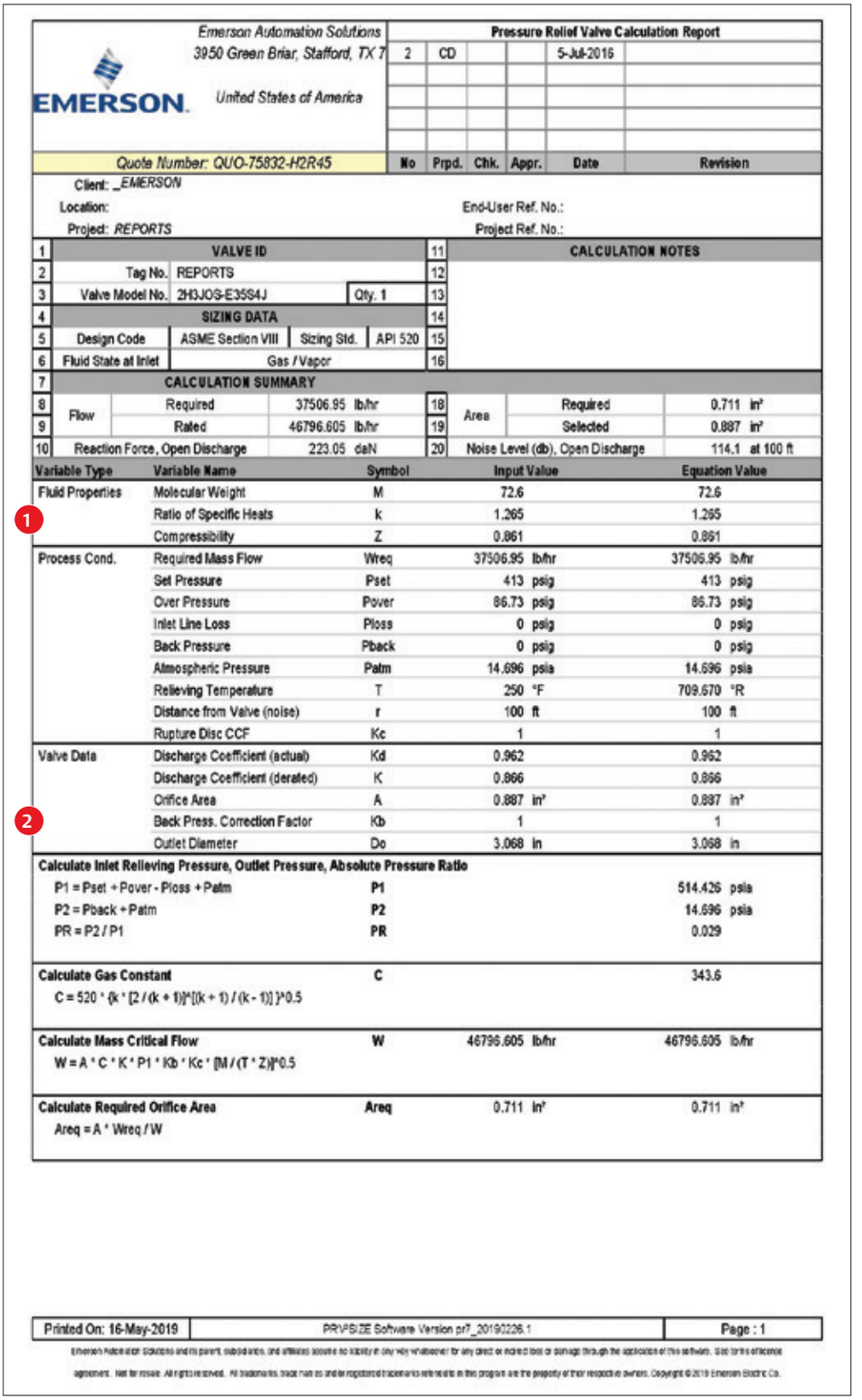
Sample Reports (continued)

Calculation Report

1. **Calculation Summary:** Includes variable type, name, symbols, input values, units and summary of calculated and selected orifice area for required flow rate
2. **Equations:** Equations and formulas with calculated results are displayed as per the sequence followed by API or ISO standard for sizing calculations



Emerson Automation Solutions
3950 Green Briar, Stafford, TX 7
United States of America

Pressure Relief Valve Calculation Report

No	Prpd.	Chk.	Appr.	Date	Revision
2	CD			5-Jul-2016	

Quote Number: QUO-75832-H2R45

Client: _EMERSON
Location:
Project: REPORTS
End-User Ref. No.:
Project Ref. No.:

1	VALVE ID				11	CALCULATION NOTES	
2	Tag No.	REPORTS			12		
3	Valve Model No.	2H3JOS-E35S4J	Qty. 1		13		
4	SIZING DATA				14		
5	Design Code	ASME Section VIII	Sizing Std.	API 520	15		
6	Fluid State at Inlet	Gas / Vapor			16		
7	CALCULATION SUMMARY						
8	Flow	Required	37506.95 lb/hr		18	Area	Required 0.711 in²
9		Rated	46796.605 lb/hr		19		Selected 0.887 in²
10	Reaction Force, Open Discharge		223.05 daN		20	Noise Level (db), Open Discharge	114.1 at 100 ft

Variable Type	Variable Name	Symbol	Input Value	Equation Value
Fluid Properties	Molecular Weight	M	72.6	72.6
	Ratio of Specific Heats	k	1.265	1.265
	Compressibility	Z	0.861	0.861
Process Cond.	Required Mass Flow	Wreq	37506.95 lb/hr	37506.95 lb/hr
	Set Pressure	Pset	413 psig	413 psig
	Over Pressure	Pover	86.73 psig	86.73 psig
	Inlet Line Loss	Ploss	0 psig	0 psig
	Back Pressure	Pback	0 psig	0 psig
	Atmospheric Pressure	Patm	14.696 psia	14.696 psia
	Relieving Temperature	T	250 °F	709.670 °R
	Distance from Valve (noise)	r	100 ft	100 ft
	Rupture Disc CCF	Kc	1	1
Valve Data	Discharge Coefficient (actual)	Kd	0.962	0.962
	Discharge Coefficient (derated)	K	0.866	0.866
	Orifice Area	A	0.887 in²	0.887 in²
	Back Press. Correction Factor	Kb	1	1
	Outlet Diameter	Do	3.068 in	3.068 in
Calculate Inlet Relieving Pressure, Outlet Pressure, Absolute Pressure Ratio				
P1 = Pset + Pover - Ploss + Patm		P1		514.426 psia
P2 = Pback + Patm		P2		14.696 psia
PR = P2 / P1		PR		0.029
Calculate Gas Constant		C		343.6
C = 520 * {k * [2 / (k + 1)]^[(k + 1) / (k - 1)] }^0.5				
Calculate Mass Critical Flow		W	46796.605 lb/hr	46796.605 lb/hr
W = A * C * K * P1 * Kb * Kc * [M / (T * Z)]^0.5				
Calculate Required Orifice Area		Areq	0.711 in²	0.711 in²
Areq = A * Wreq / W				

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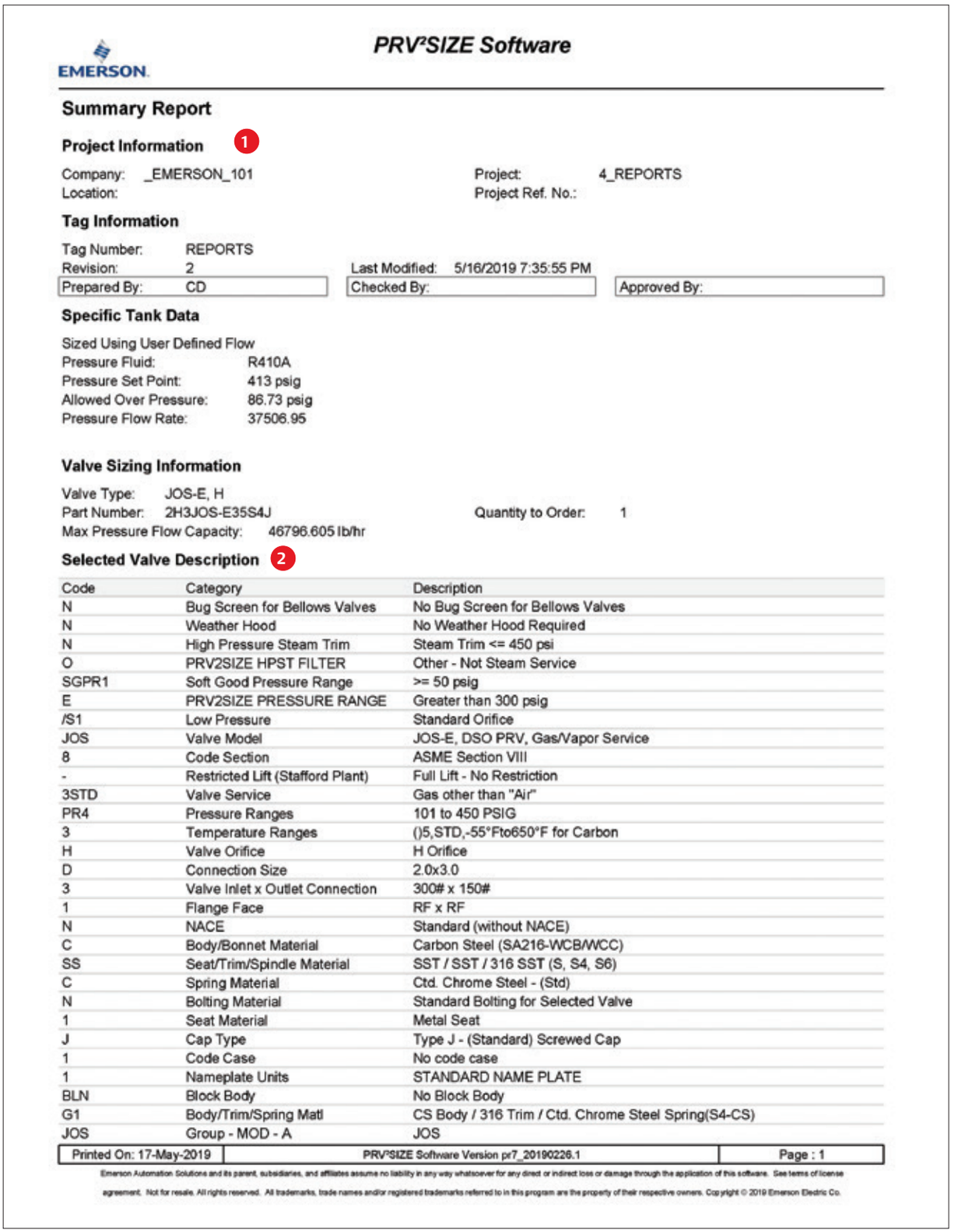
Sample Reports (continued)

Configuration Report

1. **Header:** Includes project and tag information with process data and valve sizing information
2. **Configuration Summary:** Displays selected valve configuration options description with ERP and model number code for all configuration features, accessories and special requirement options



EMERSON

PRV²SIZE Software

Summary Report

Project Information 1

Company: _EMERSON_101
Location:
Project: 4_REPORTS
Project Ref. No.:

Tag Information

Tag Number: REPORTS
Revision: 2
Last Modified: 5/16/2019 7:35:55 PM
Prepared By: CD
Checked By:
Approved By:

Specific Tank Data

Sized Using User Defined Flow
Pressure Fluid: R410A
Pressure Set Point: 413 psig
Allowed Over Pressure: 86.73 psig
Pressure Flow Rate: 37506.95

Valve Sizing Information

Valve Type: JOS-E, H
Part Number: 2H3JOS-E35S4J
Quantity to Order: 1
Max Pressure Flow Capacity: 46796.605 lb/hr

Selected Valve Description 2

Code	Category	Description
N	Bug Screen for Bellows Valves	No Bug Screen for Bellows Valves
N	Weather Hood	No Weather Hood Required
N	High Pressure Steam Trim	Steam Trim <= 450 psi
O	PRV2SIZE HPST FILTER	Other - Not Steam Service
SGPR1	Soft Good Pressure Range	>= 50 psig
E	PRV2SIZE PRESSURE RANGE	Greater than 300 psig
/S1	Low Pressure	Standard Orifice
JOS	Valve Model	JOS-E, DSO PRV, Gas/Vapor Service
8	Code Section	ASME Section VIII
-	Restricted Lift (Stafford Plant)	Full Lift - No Restriction
3STD	Valve Service	Gas other than "Air"
PR4	Pressure Ranges	101 to 450 PSIG
3	Temperature Ranges	()5,STD,-55°Fto650°F for Carbon
H	Valve Orifice	H Orifice
D	Connection Size	2.0x3.0
3	Valve Inlet x Outlet Connection	300# x 150#
1	Flange Face	RF x RF
N	NACE	Standard (without NACE)
C	Body/Bonnet Material	Carbon Steel (SA216-WCB/WCC)
SS	Seat/Trim/Spindle Material	SST / SST / 316 SST (S, S4, S6)
C	Spring Material	Ctd. Chrome Steel - (Std)
N	Bolting Material	Standard Bolting for Selected Valve
1	Seat Material	Metal Seat
J	Cap Type	Type J - (Standard) Screwed Cap
1	Code Case	No code case
1	Nameplate Units	STANDARD NAME PLATE
BLN	Block Body	No Block Body
G1	Body/Trim/Spring Matl	CS Body / 316 Trim / Ctd. Chrome Steel Spring(S4-CS)
JOS	Group - MOD - A	JOS

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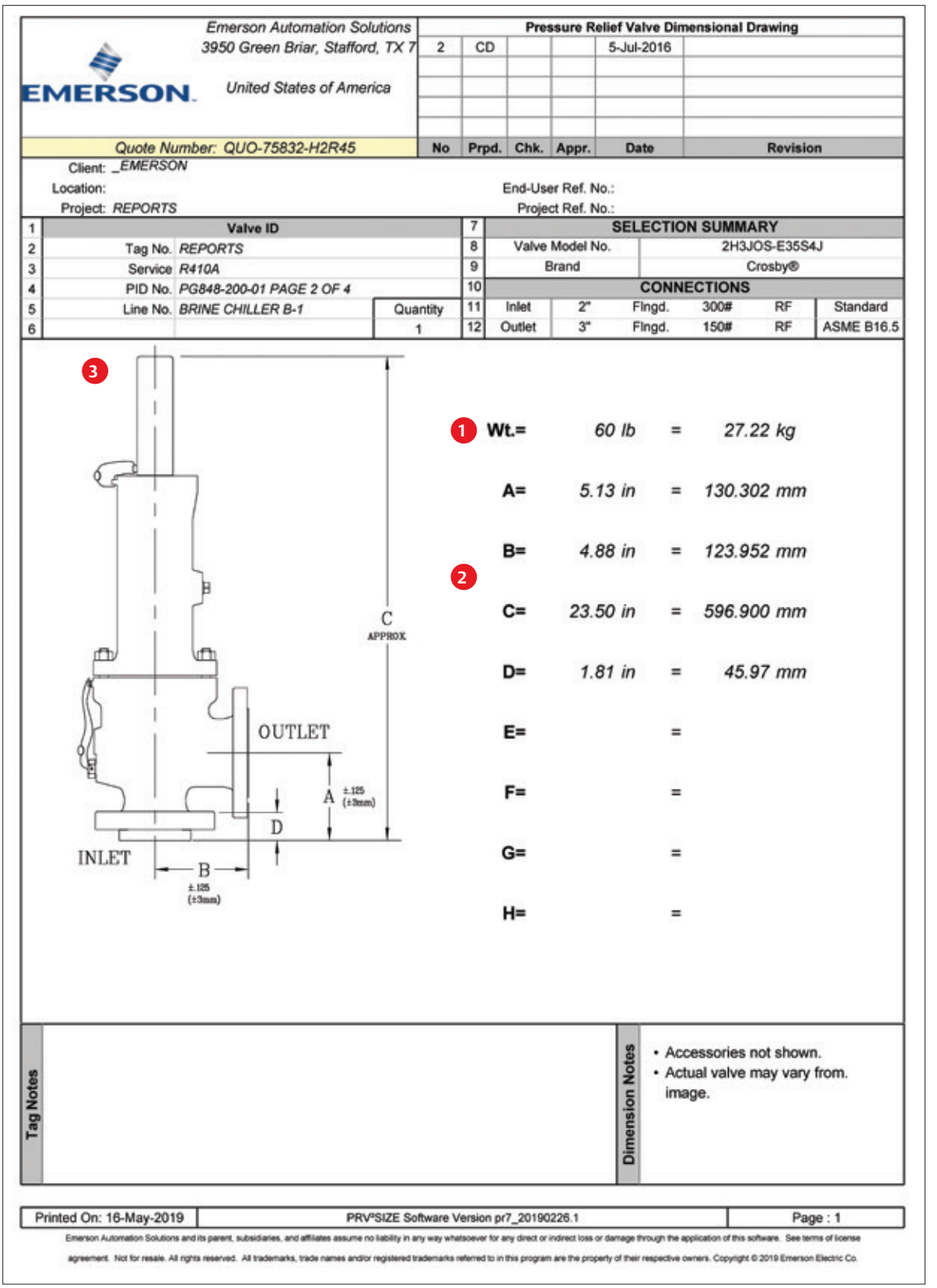
Sample Reports (continued)

Drawing Report

1. Weights: Weights displayed for standard configuration and can be updated for special configuration
2. Dimensions: Dimensions displayed for standard configuration and can be updated for special configuration
3. Outline Drawing: Displays selected valve's outline drawing with applicable dimensions



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3950 Green Briar, Stafford, TX 7
United States of America

Pressure Relief Valve Dimensional Drawing

No	Prpd.	Chk.	Appr.	Date	Revision
2	CD			5-Jul-2016	

Quote Number: QUO-75832-H2R45

Client: _EMERSON
Location:
Project: REPORTS
End-User Ref. No.:
Project Ref. No.:

	Valve ID			SELECTION SUMMARY					
1			7						
2	Tag No. REPORTS		8	Valve Model No.	2H3JOS-E35S4J				
3	Service R410A		9	Brand	Crosby®				
4	PID No. PG848-200-01 PAGE 2 OF 4		10	CONNECTIONS					
5	Line No. BRINE CHILLER B-1	Quantity	11	Inlet	2"	Flngd.	300#	RF	Standard
6		1	12	Outlet	3"	Flngd.	150#	RF	ASME B16.5

1 Wt.= 60 lb = 27.22 kg

A= 5.13 in = 130.302 mm

B= 4.88 in = 123.952 mm

2

C= 23.50 in = 596.900 mm

D= 1.81 in = 45.97 mm

E= =

F= =

G= =

H= =

Tag Notes

Dimension Notes

- Accessories not shown.
- Actual valve may vary from image.

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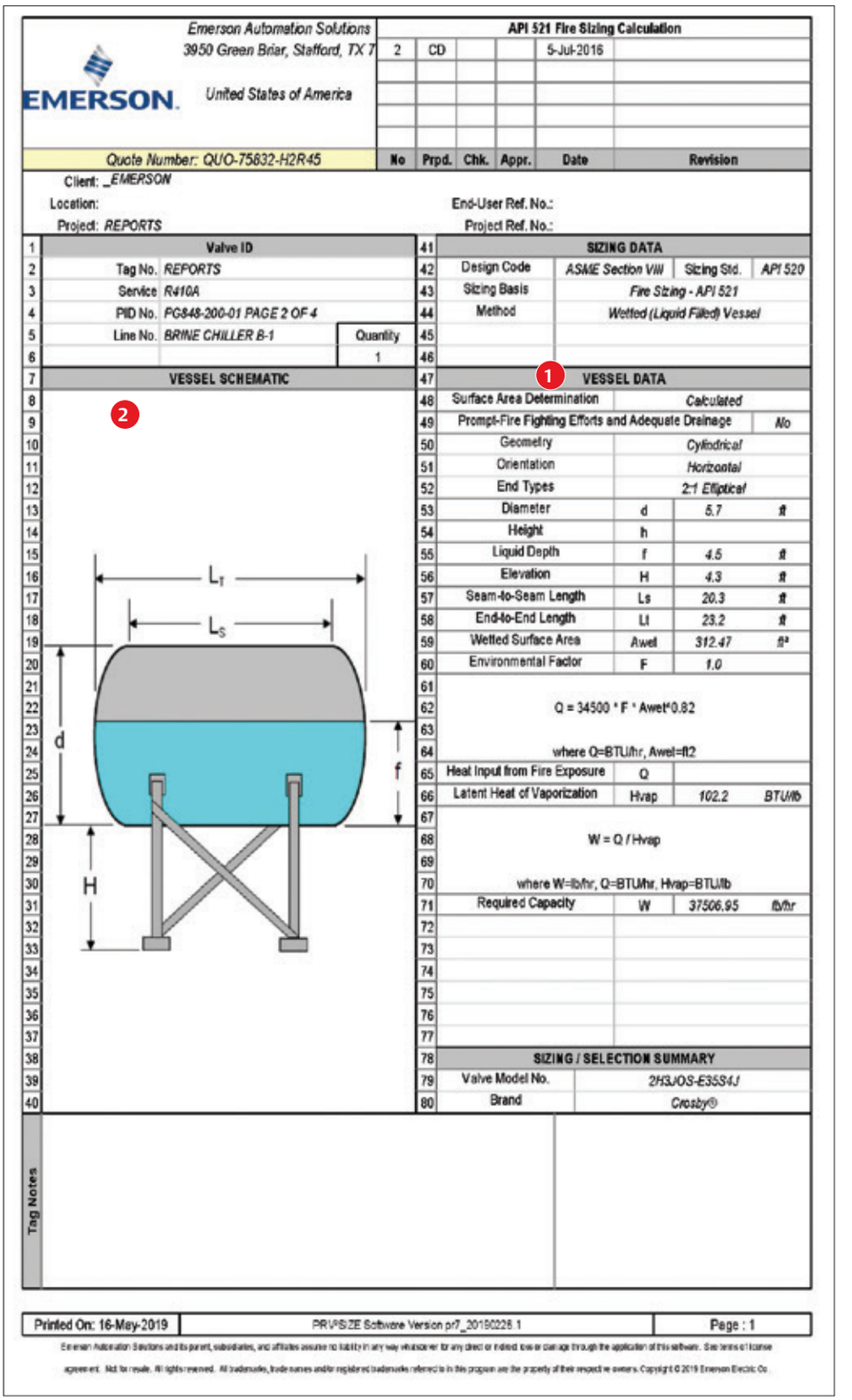
Sample Reports (continued)

Tank Calculation Report

1. **Vessel Data:** Includes tank dimensions, geometry, orientation, calculated heat input and required flow rate for wetted and unwetted vessels
2. **Tank Schematic:** Displays cut away image for selected tank geometry with dimensions utilized for wetted or unwetted area calculations



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3950 Green Briar, Stafford, TX 7
United States of America

API 521 Fire Sizing Calculation

No	Prpd.	Chk.	Appr.	Date	Revision
2	CD			5-Jul-2016	

Quote Number: QUO-75832-H2R45

Client: _EMERSON
Location:
Project: REPORTS
End-User Ref. No.:
Project Ref. No.:

Valve ID

Tag No.	REPORTS
Service	R410A
PID No.	PG848-200-01 PAGE 2 OF 4
Line No.	BRINE CHILLER B-1
Quantity	1

VESSEL SCHEMATIC

2

SIZING DATA

Design Code	ASME Section VIII	Sizing Std.	API 520
Sizing Basis	Fire Sizing - API 521		
Method	Wetted (Liquid Filled) Vessel		

1 **VESSEL DATA**

Surface Area Determination	Calculated		
Prompt-Fire Fighting Efforts and Adequate Drainage	No		
Geometry	Cylindrical		
Orientation	Horizontal		
End Types	2:1 Elliptical		
Diameter	d	5.7	ft
Height	h		
Liquid Depth	f	4.5	ft
Elevation	H	4.3	ft
Seam-to-Seam Length	Ls	20.3	ft
End-to-End Length	Lt	23.2	ft
Wetted Surface Area	Awet	312.47	ft²
Environmental Factor	F	1.0	

$Q = 34500 * F * Awet^{0.82}$

where Q=BTU/hr, Awet=ft2

Heat Input from Fire Exposure	Q		
Latent Heat of Vaporization	Hvap	102.2	BTU/lb

$W = Q / Hvap$

where W=lb/hr, Q=BTU/hr, Hvap=BTU/lb

Required Capacity	W	37506.95	lb/hr

SIZING / SELECTION SUMMARY

Valve Model No.	2H3J0S-E3SS4J
Brand	Crosby®

Tag Notes

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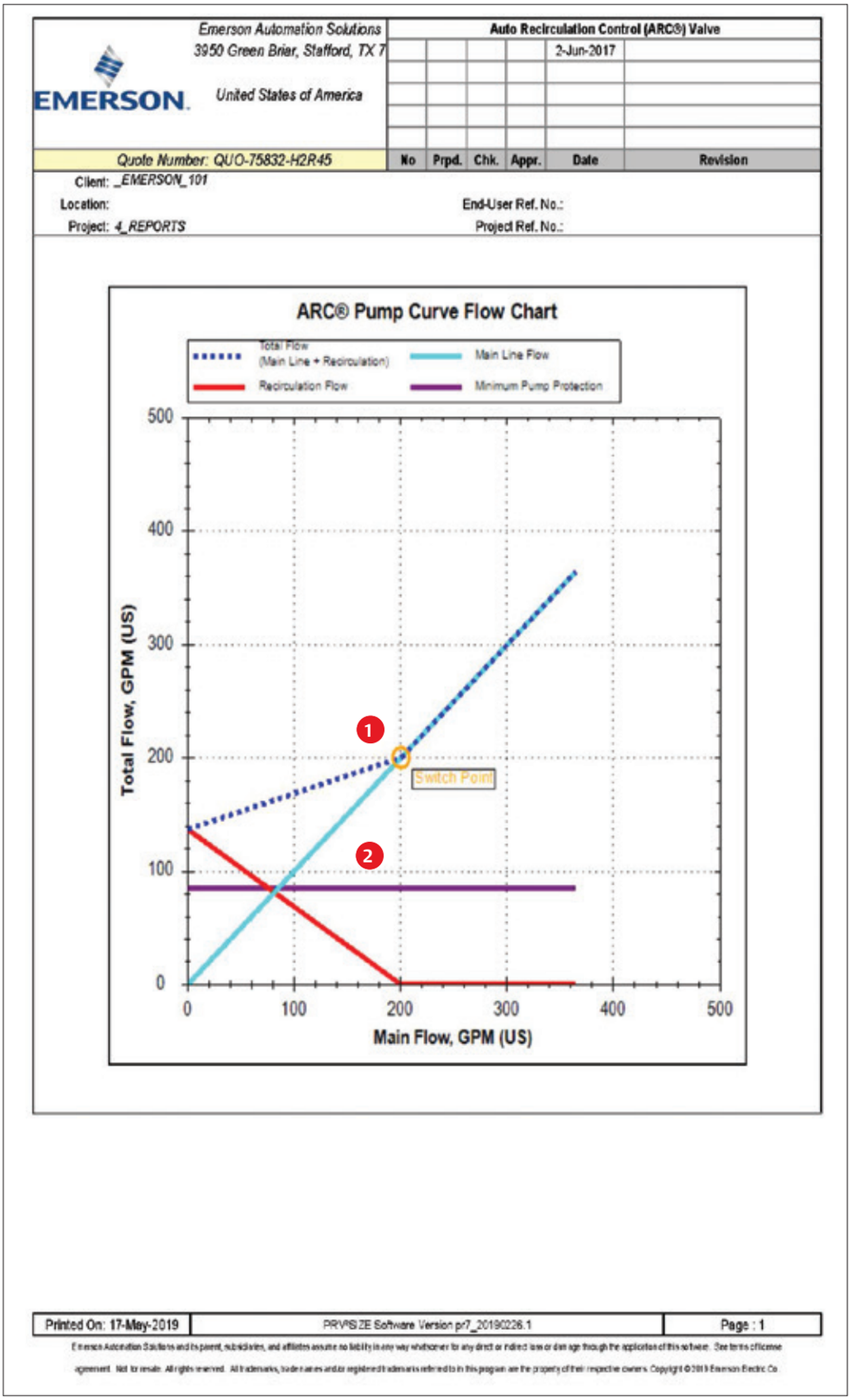
Sample Reports (continued)

ARC Pump Curve

1. Switch Point Flow: Identifies switch point flow when bypass begins to open
2. Pump Flow: Displays main line, recirculation and minimum pump protection flow



Emerson Automation Solutions
3950 Green Brier, Stafford, TX 7
United States of America

Auto Recirculation Control (ARC®) Valve

2-Jun-2017

Quote Number: QUO-75832-H2R45	No	Prpd.	Chk.	Appr.	Date	Revision

Client: _EMERSON_101
Location:
Project: 4_REPORTS
End-User Ref. No.:
Project Ref. No.:

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Notes

Pressure Relief Valve Sizing Software

Emerson Electric Co.
Global Headquarters
8000 West Florissant Avenue
St. Louis, Missouri, 63136
United States
T +1 314 679 8984
ContactUs@Emerson.com
Emerson.com/FinalControl

Final Control
North America

Marshalltown
301 South 1st Avenue
Marshalltown, Iowa, 50158
United States
T +1 641 754 3011

Black Mountain
953 Old US Hwy 70W
Black Mountain, NC 28711
United States
T +1 800 879 2042

McKinney
3200 Emerson Way
McKinney, Texas, 75070
United States
T +1 800 558 5853

Stafford
3950 Greenbriar Drive
Stafford, Texas, 77477
United States
T +1 281 274 4400

Emerson Automation Solutions
World Area Headquarters

Asia Pacific
1 Pandan Crescent
Singapore 128461
T +65 6777 8211

Europe
Avenue Pierre Brossolette BP 159,
59280 Armentières, France
T +33 (0)3 2010 5500

Latin America
1300 Concord Terrace Suite 400
Sunrise, Florida 33323,
United States
T +1 954 846 5030

Middle East & Africa
Emerson FZE P.O. Box 17033,
Jebel Ali Free Zone - South 2,
Dubai, United Arab Emirates
T +971 4 8118100

Emerson.com
Facebook.com/EmersonAutomationSolutions
LinkedIn.com/company/Emerson-Automation-Solutions
Twitter.com/EMR-Automation

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