Steam Trap Sizing and Selection

Key Steam Trap Functions

1. Remove Air and Non-condensable Gases

2. Remove Condensate

3. Respond to Changes in Condensate Load

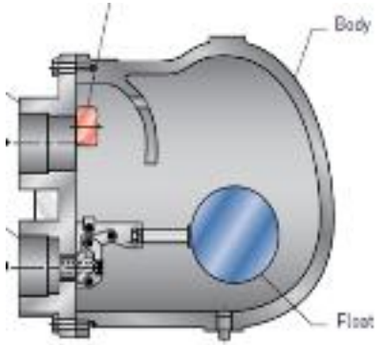
4. Keep Steam in the System

Steam Trap Technologies

Mechanical

Steam trapping principle utilizes the **difference in density between steam and water**

Most common types of steam traps out in the field

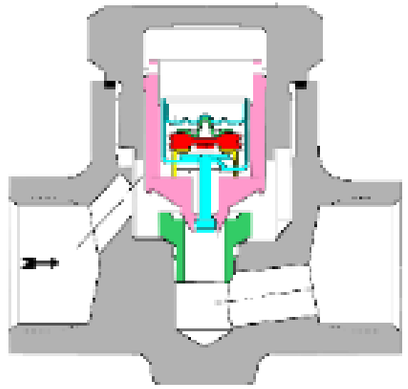


"Float"

"Bucket"

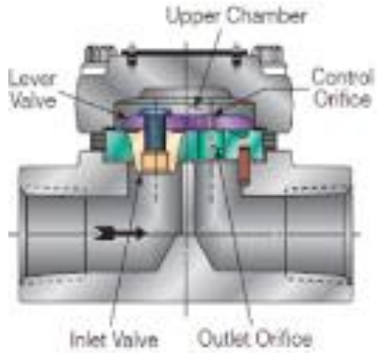
Thermostatic

Operation is based on the **temperature difference between steam & condensate.** Types include bellows, balanced pressure and **bimetallic**



Thermodynamic

Utilize **heat energy in hot condensate and kinetic energy in steam** to open and close the trap. Types include disc, piston and lever



Select Technology Based On Application

Overview of Steam Trap Applications

- **Drip** - removal of condensate generated as steam flows through the main steam line
- **Tracing** - using steam to keep a valve or pipe at constant temperature to prevent freezing
  - Typically used with small condensate loads
- **Process** – Steam heats a fluid indirectly through a metal wall (e.g. heat exchanger)
  - Typically used with medium / large condensate loads (fluctuating)
  - Excellent air handling capability required

Steam Pressure	Condensate Load (lb/hr)			
	Small		Medium / Large	
	Applications	Key Steam Trap Technologies	Applications	Key Steam Trap Technologies
Low <= 15psi	**Drip & Tracing**	**Disc, FTE and Bimetallic**	**Process**	**Float and Inverted Bucket**
Medium > 15psi and <= 600psi	**Drip & Tracing**	**Disc, FTE and Bimetallic**	**Process**	**Lever, Float & Inverted Bucket**
High (Utility Plant) > 600psi	**Drip & Tracing**	**Disc and Bimetallic**	**Process**	**Piston, Float & Inverted Bucket**

EMERSON

Challenges in Steam Systems With Improper Traps

Safety:

- Water Hammer – Can cause larger reliability issues, introducing safety risk
- Minimize Time in Plant – Eliminate routes to unsafe areas
- Slips and Falls – Condensate released into atmosphere can increase risk of slick floor

Energy Loss:

- Live steam being blown into the environment can have a major impact on steam generation costs, emissions, and operating budgets.

Steam Quality:

- Critical for certain industries like tire manufacturing, life sciences and food & beverage
- Cold traps can affect the steam consistency through the entire steam system

Reliability:

- Water hammer, impingement, corrosion or freezing can be caused by failed steam traps, resulting in major reliability issues.

Time / Focus:

- Steam traps are usually tested once or twice per year. If a steam trap does not work properly, it will likely not be noticed for 6+ months.

Improper steam traps can to many issues in steam system

Trap Sizing and Selection

Trap Sizing

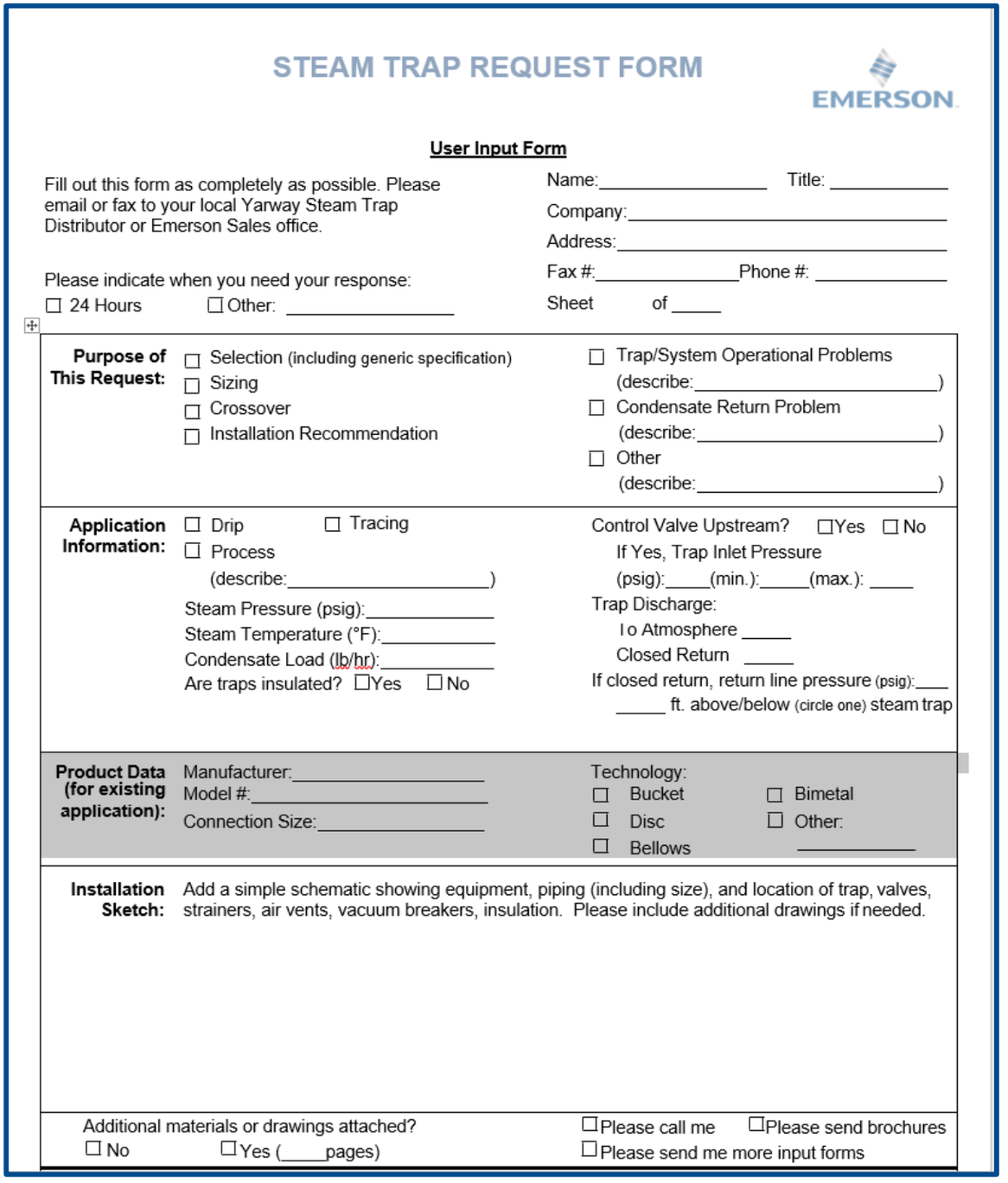
~~pipe size~~

condensate load

Key Factors for Steam Trap Selection

Primary Factors	Secondary Factors	Other Factors
Pressure Ratings	Material	Integrated Strainer
Temperature Ratings	Predominant Failure Mode	Spare Parts
Minimum Pressure	Size	Preferred Technology
Differential Pressure	Type of Connection	Installation Positions
Condensate Load	Air Handling	Painting
	App. Specific Requirements	Documents
		Special Requirements

Steam Trap Request Form



STEAM TRAP REQUEST FORM

EMERSON

User Input Form

Fill out this form as completely as possible. Please email or fax to your local Yarway Steam Trap Distributor or Emerson Sales office.

Please indicate when you need your response:
☐ 24 Hours ☐ Other: _____

Name:_____ Title: _____
Company:_____
Address:_____
Fax #:_____Phone #: _____
Sheet of _____

Purpose of This Request:
☐ Selection (including generic specification)
☐ Sizing
☐ Crossover
☐ Installation Recommendation
☐ Trap/System Operational Problems (describe:_____)
☐ Condensate Return Problem (describe:_____)
☐ Other (describe:_____)

Application Information:
☐ Drip ☐ Tracing
☐ Process (describe:_____)
Steam Pressure (psig):_____
Steam Temperature (°F):_____
Condensate Load (lb/hr):_____
Are traps insulated? ☐Yes ☐ No
Control Valve Upstream? ☐Yes ☐ No
If Yes, Trap Inlet Pressure (psig):____(min.):_____(max.): ____
Trap Discharge:
To Atmosphere _____
Closed Return _____
If closed return, return line pressure (psig):____
_____ ft. above/below (circle one) steam trap

Product Data (for existing application):
Manufacturer:_____
Model #:_____
Connection Size:_____
Technology:
☐ Bucket ☐ Bimetal
☐ Disc ☐ Other: _____
☐ Bellows

Installation Sketch: Add a simple schematic showing equipment, piping (including size), and location of trap, valves, strainers, air vents, vacuum breakers, insulation. Please include additional drawings if needed.

Additional materials or drawings attached?
☐ No ☐Yes (_____pages)
☐Please call me ☐Please send brochures
☐Please send me more input forms

Example of Sizing – Drip Application

Design Temperature: **232C (450F)**	Design Pressure: **17bar (246psi)**
Operating Inlet Pressure: **6.9bar (100psi)**	Operating Outlet Pressure: **0bar**
Operating Temperature: **171C (340F)**	Operating Condensate Load: **100kg/h (220lb/h)**

Ratings

Design: 600 psig, 750°F
Operating: 4 to 450 psig/750°F
(0.3 to 31 bar/400°C)

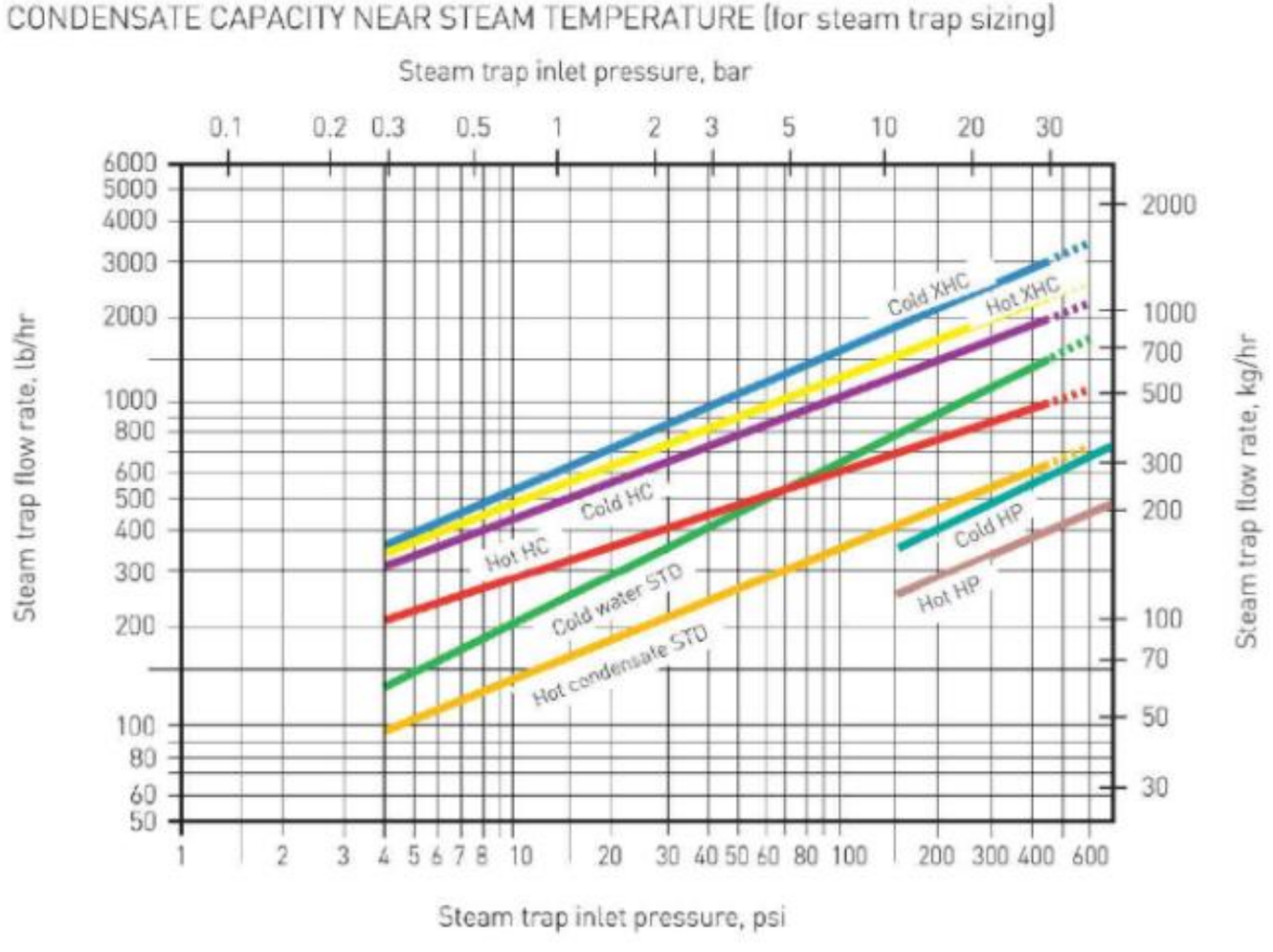
711HP/721HP only

Design: 650 psig, 750°F
Operating: 150 to 650 psig/750°F
(10.3 to 45 Bar/400°C)

Back pressure to 80% of inlet, psia

Applicable codes and standards

Pressure rating per ANSI/FCI-69-1.
Performance testing per ANSI/ASME PTC-39.1.
End connections per ANSI B1.20.1 for threaded ends, per ANSI B16.11 for socket-welding ends.



Steam Trap Technology Comparison Summary

Criteria	Mechanical		Thermostatic		Thermodynamic			
	IB	F&T	Bimetallic	Bellows	Disc	V. Orifice	Lever	Orifice
Ease of checking								
Ease of Maintenance								
Sensitivity to back pressure								
Resistance to freeze damage								
Dirt sensitivity								
Orientation Limits								
Air venting								
Responsiveness to changing loads								
Resistance to vibration and water hammer								
Steam Trap discharge follows saturation curve								
Condensate Discharge	Intermittent	Continuous	Intermittent	Intermittent	Intermittent	Continuous	Continuous	Continuous
Capacity	Varies	Varies	Low	Varies	Low	Moderate	High	Low
Predominant failure mode	Open	Closed	Open	Depends	Open	Open	Open	Closed

Example of Sizing – Process Application

Outdoor Heat Exchanger with Control Valve for temperature control (customer prefers F&T)

Design Temperature: **232C (450F)**

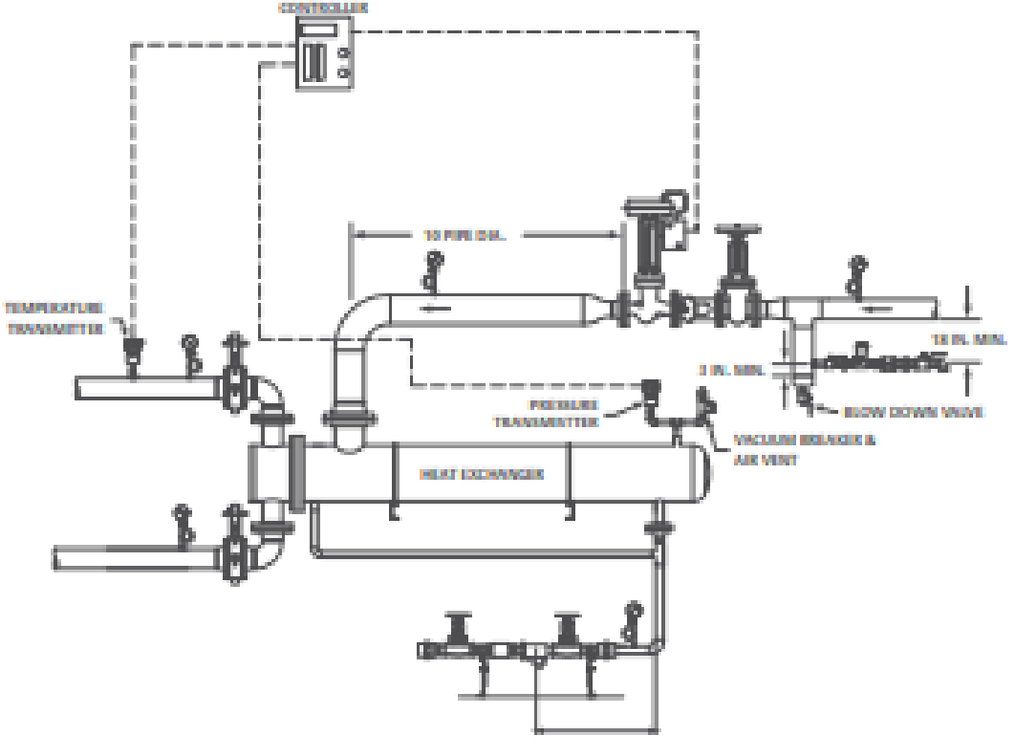
Design Pressure: **13.8bar (200psi)**

Operating Inlet Pressure: **6.9bar (100psi)**

Operating Outlet Pressure: **0bar**

Operating Temperature: **171C (340F)**

Operating Condensate Load: **1000kg/h (2204lb/h)** (at max operating inlet)



HEAT EXCHANGER DETAILS

Example of Sizing – Process Application

Outdoor Heat Exchanger with Control Valve for temperature control (customer prefers F&T)

Design Temperature: **232C (450F)**

Design Pressure: **13.8 bar (200psi)**

Operating Inlet Pressure: **6.9bar (100psi)**

Operating Outlet Pressure: **0 bar**

Operating Temperature: **171C (340F)**

Operating Condensate Load: **1000kg/h (2204lb/h)** (at max operating inlet)

FLOW RATE CAPACITY in kg/h

	Size	Differential Pressure (bar)														
Model	in (DN)	0.5	1	1.5	2	3	4.5	6	7	8	9	10	12	14	16	21
F883HC-65	1" (25)	900	1250	1450	1700	2010	2400									
F883HC-145	1" (25)	450	620	790	880	1100	1250	1500	1600	1700	1750	1800				
F883HC-203	1" (25)	340	435	530	600	610	850	990	1100	1190	1240	1300	1350	1380		
F883HC-305	1" (25)	230	330	400	440	535	630	720	800	840	900	920	1020	1120	1260	1270

Max. Differential Pressure

F883HC-65: 65 psi (4.5 bar)

F883HC-145: 145 psi (10 bar)

F883HC-203: 203 psi (14 bar)

F883HC-305: 305 psi (21 bar)

Technical Data

Options: SLR – steam lock release
Equalizing plug or vent connection
Internal strainer

Use: Saturated and superheated steam

Available Models: F883HC-65, 145, 203 and 305

Sizes: 1"; DN 25

Connections: Female screwed (BSP or NPT)
Flanged EN 1092-1 PN40 or ANSI

Material: Cast Steel

Installation: Standard horizontal installation – From left to right F883HC (L-R)

Upon Request:

- Horizontal installation with the flow from right to left (R-L)
- Vertical installation with the flow from top to bottom (V)

Example of Sizing – Process Application

Outdoor Heat Exchanger with Control Valve for temperature control

Design Temperature: **232C (450F)**

Design Pressure: **13.8 bar (200psi)**

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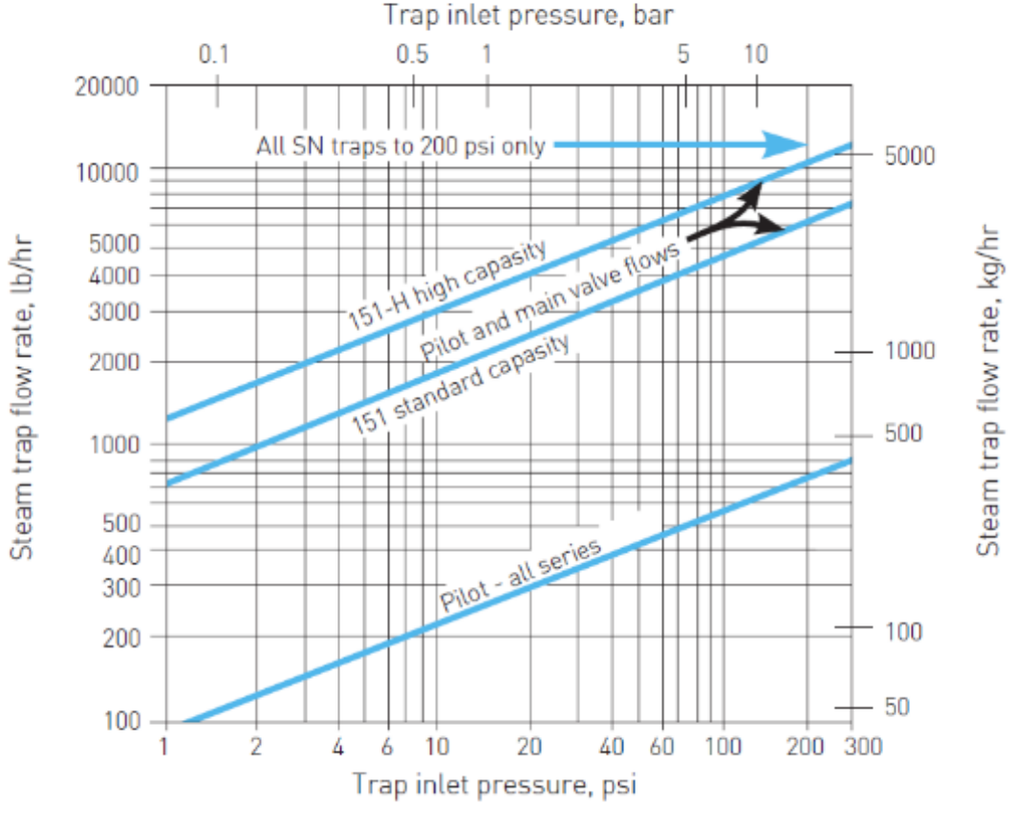
Operating Outlet Pressure: **0 bar**

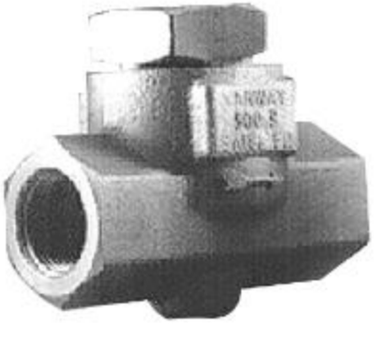
Operating Temperature: **171C (340F)**

Operating Condensate Load: **1000kg/h (2204lb/h)** (at max operating inlet)

Condensate Capacity Near Steam Temperature (for steam trap sizing)



SERIES 151 DUAL RANGE PROCESS TRAPS (OR HIGH CAPACITY AIR VENT)



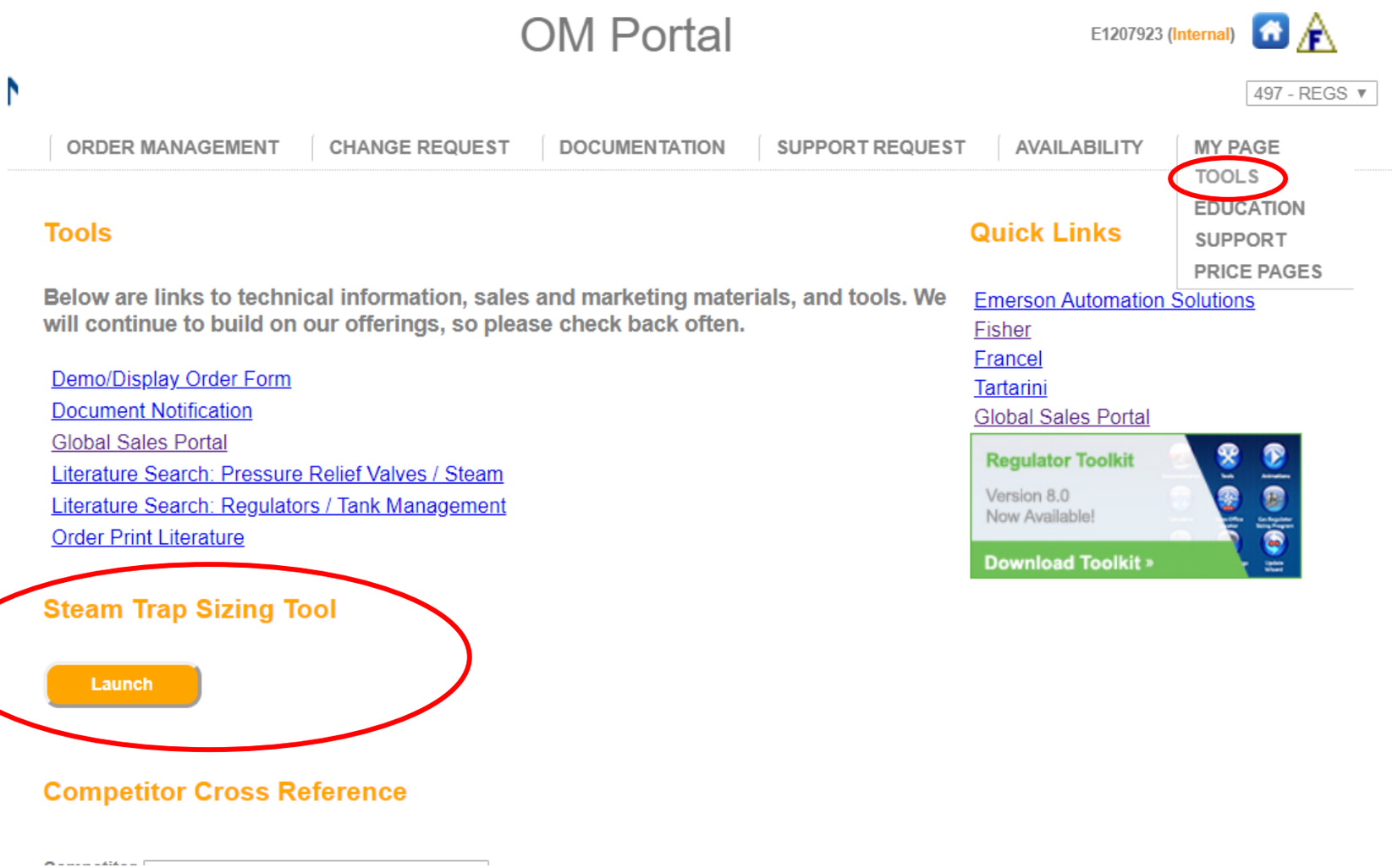
PRESSURE AND TEMPERATURE RATINGS

(All pressures are gage)

- ASME Class 300
- Max. Design Temp.: 750°F (400°C)
- Operating Pressure: 1-300 psi (0.07-21 bar)
- Max. Operating Temp.: 500°F (260°C)

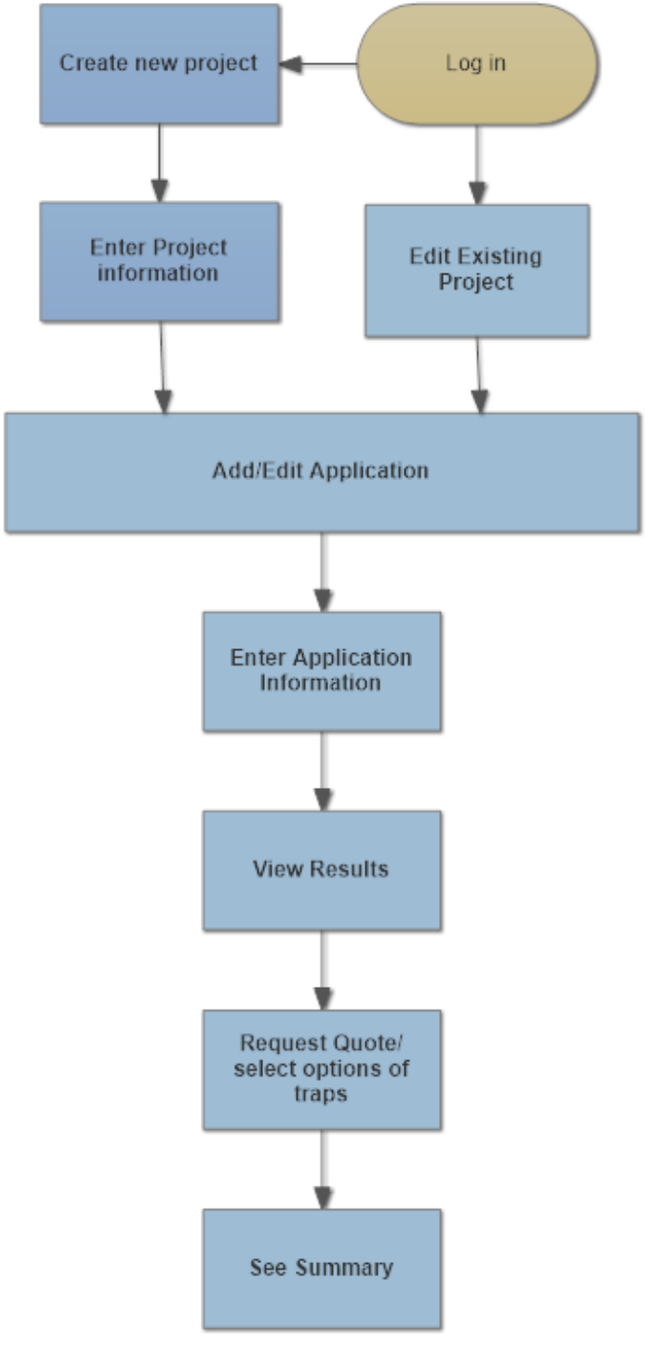
Steam Trap Sizing Tool

OM Portal - Tools



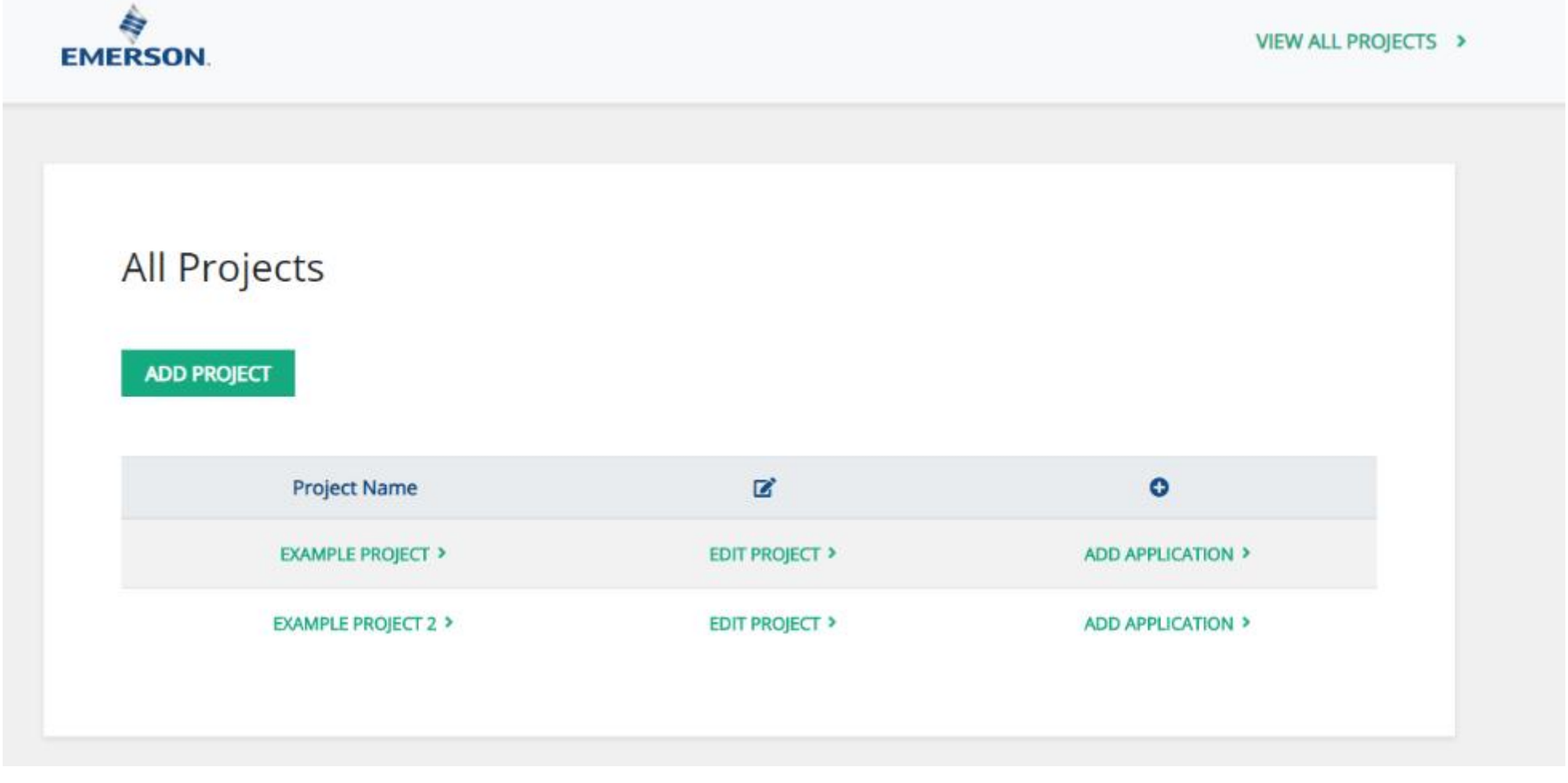
http://regulatorportal.emersonprocess.com/RegsOmPortal/Pages/MyPage.aspx?Id=1

Program Flow



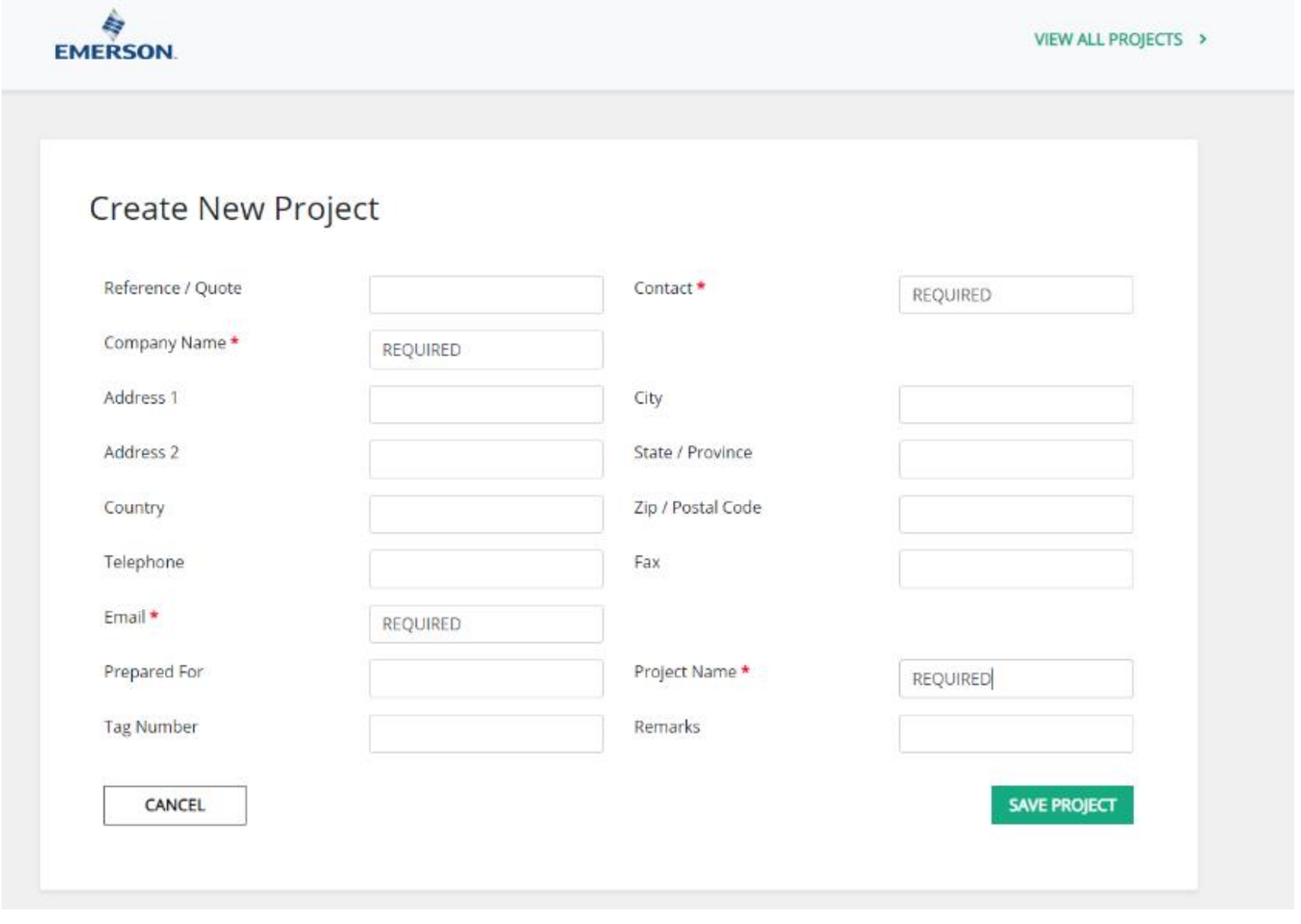
All Projects Screen

- Add a new project by clicking on the “ADD PROJECT” button
- View traps by selecting the project name
- Edit project information by selecting “EDIT PROJECT”
- Add applications to a project by selecting “ADD APPLICATION”



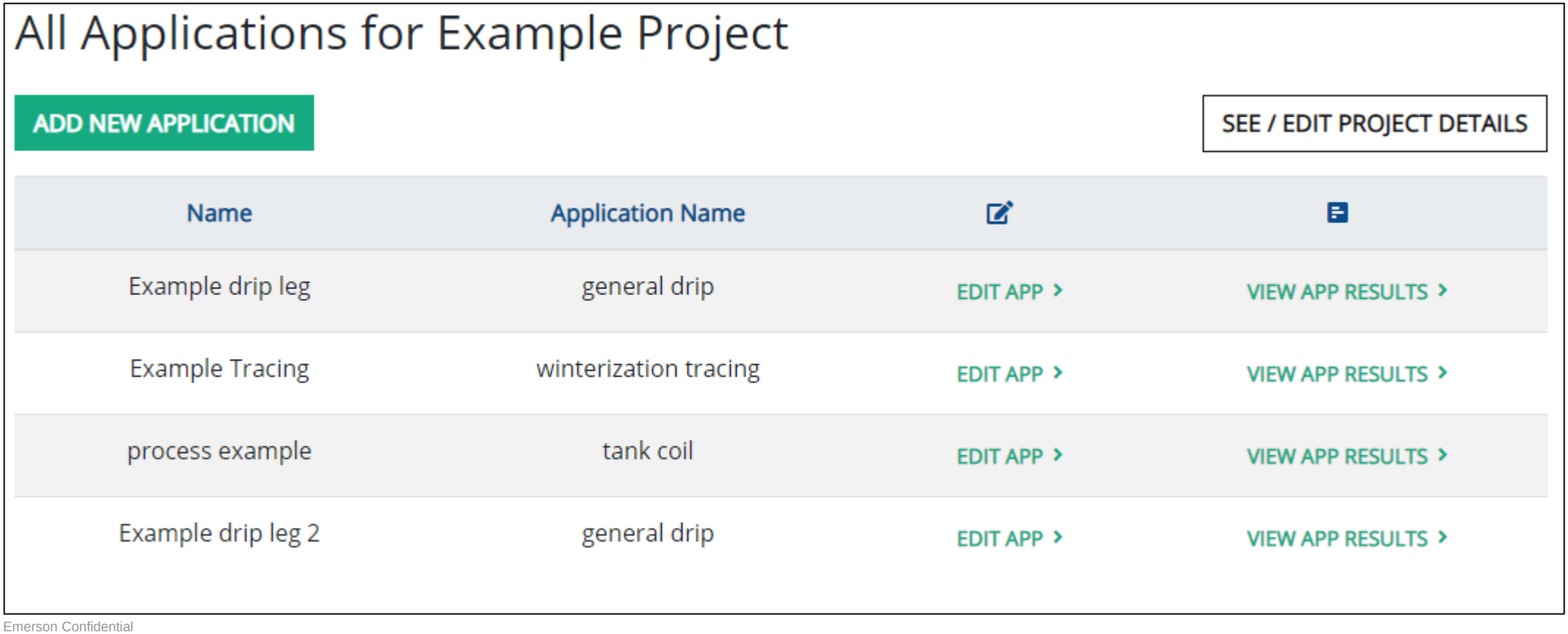
Add Project Screen

- Provide information about the project
- The 4 required fields are: Company Name, Email, Contact, and Project Name

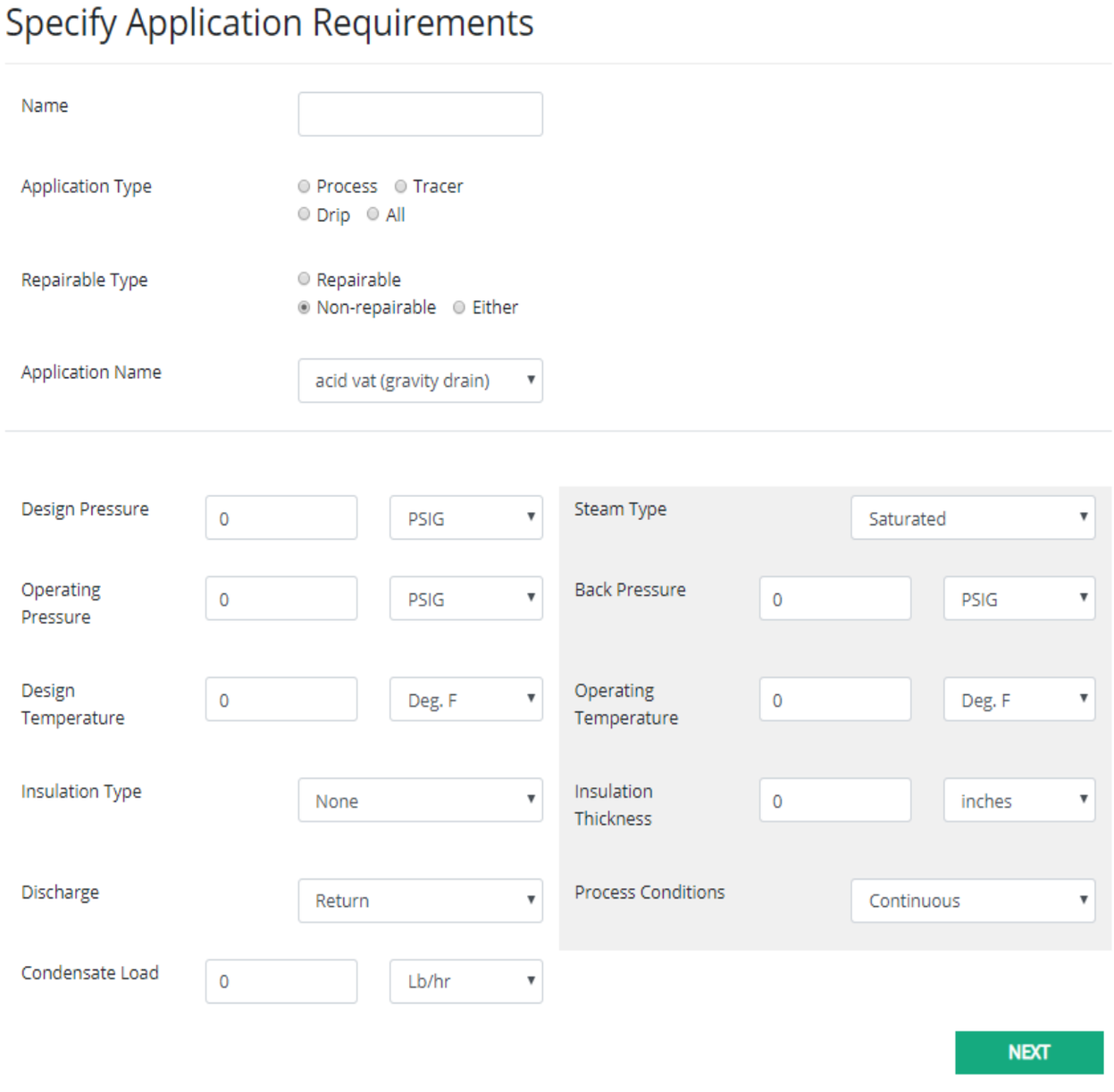


Specific Project Page

- After selecting the project, applications can be added by clicking the “ADD NEW APPLICATION” button
- Project details can be seen and edited through the “SEE / EDIT PROJECT DETAILS” button
- Existing applications can be edited by selecting the “EDIT APP”
- Results of existing applications can be viewed through “VIEW APP RESULTS”



Application Information



Required / Critical Fields

- **Name**: Identifies trap
- **Application Type**: Drip, tracing, or process
- **Repairable Type**: Repairable or non-repairable
- **Design Press**: Max pressure steam trap could see
- **Operating Press**: Typical pressure trap will see
- **Design Temp**: Max temperature trap could see
- **Condensate Load**: Water trap must remove at op. press
- **Back Pressure**: Pressure downstream of trap

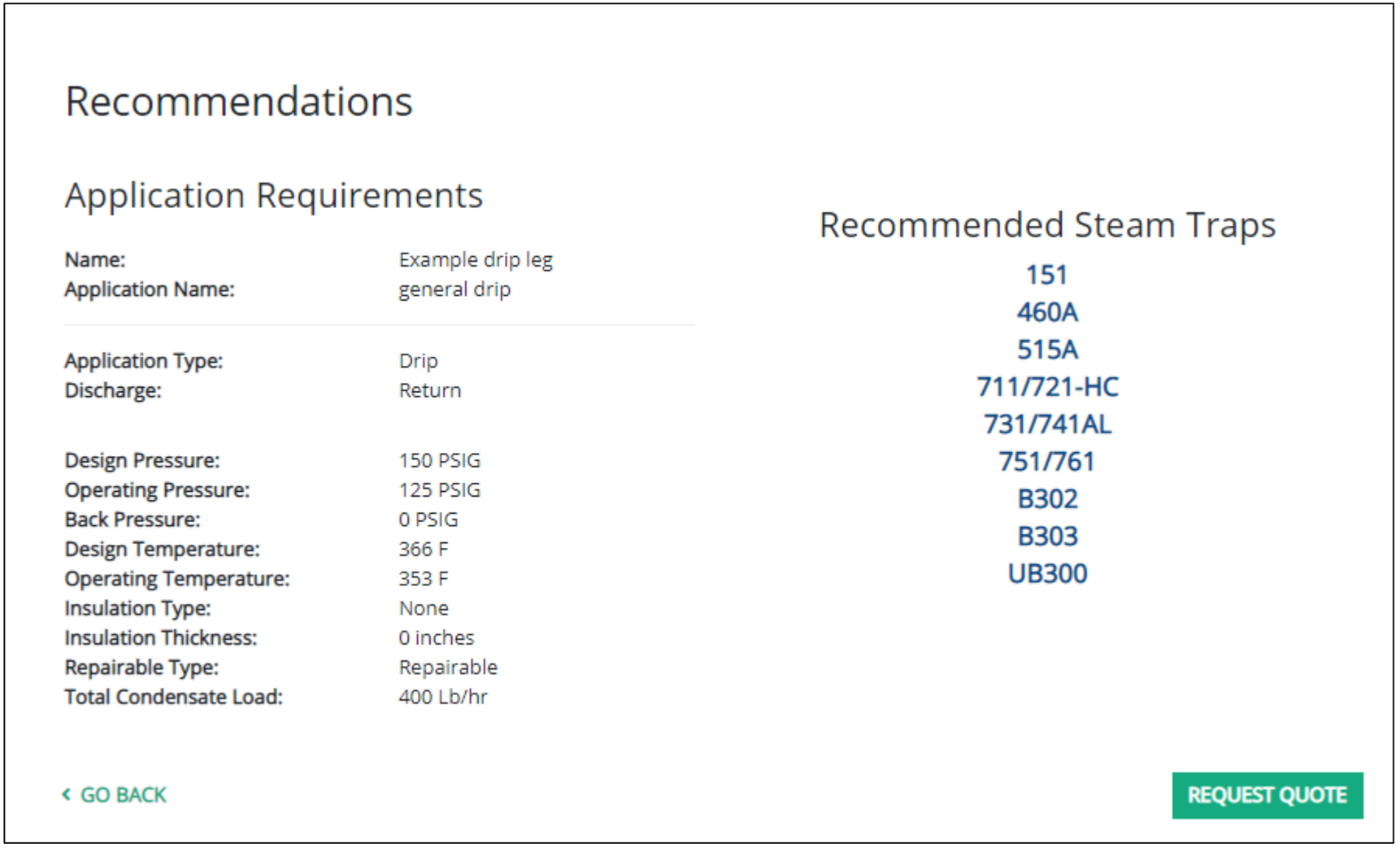
Other Fields

- **Application Name**: Type of steam trap application
- **Operating Temp**: Typical temperature trap will see
- **Steam Type:** Saturated / superheated
- **Insulation Type**: Insulation material
- **Insulation Thickness**: Thickness of insulation
- **Discharge**: Return / atmosphere
- **Process Conditions**: Continuous/batch/maintain temperature

*If information is not known enter 0

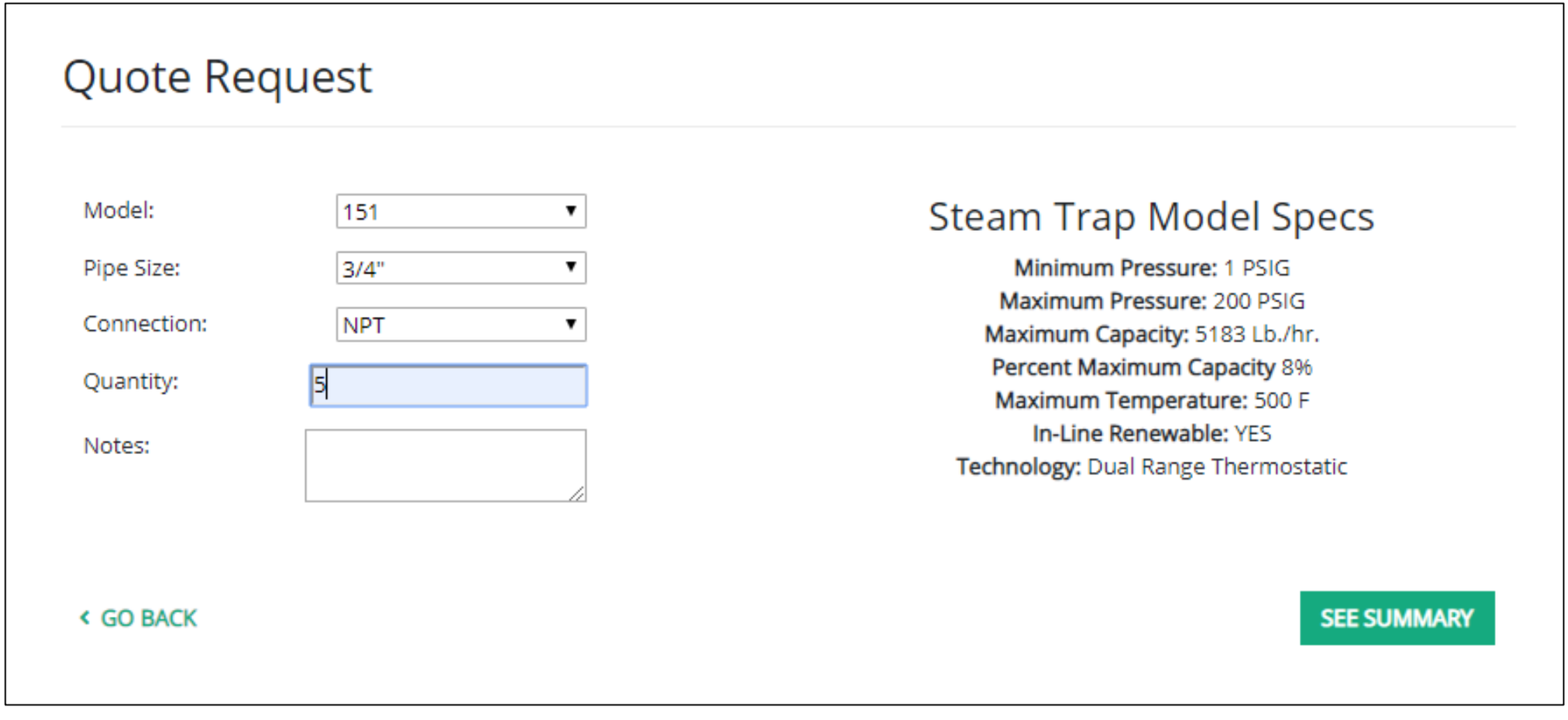
Recommendations

Once the application information is entered and “Next” or “View Results” is selected for an existing trap, a list of recommended traps is generated based on the application requirements



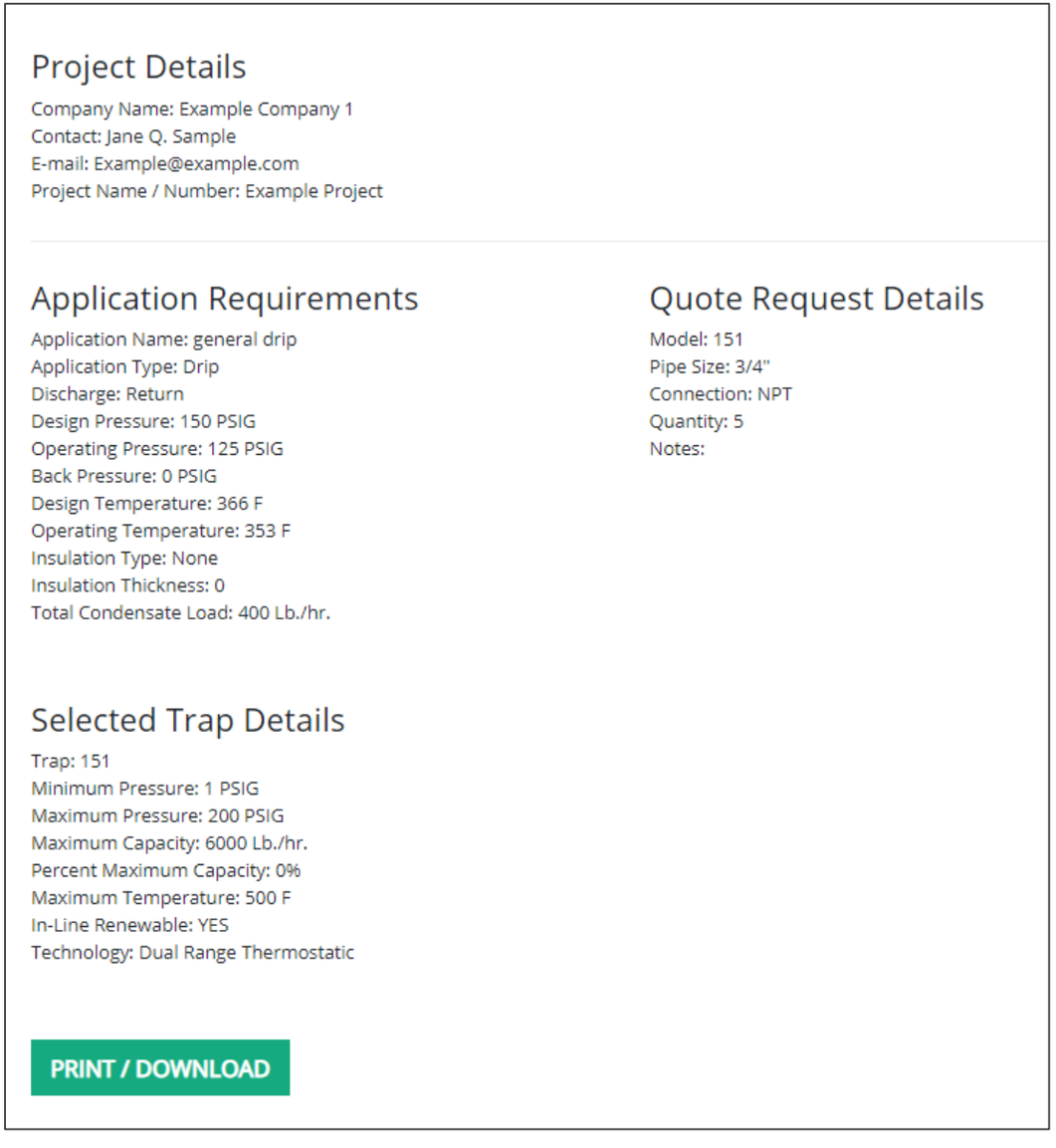
Quote Request

Select the desired steam trap model, size, connection and quantity to create a summary for the quote



Summary Page

A summary page is generated including the project details, application requirements, quote request details, and selected trap details based on the application requirements.



Project Details

Company Name: Example Company 1
Contact: Jane Q. Sample
E-mail: Example@example.com
Project Name / Number: Example Project

Application Requirements

Application Name: general drip
Application Type: Drip
Discharge: Return
Design Pressure: 150 PSIG
Operating Pressure: 125 PSIG
Back Pressure: 0 PSIG
Design Temperature: 366 F
Operating Temperature: 353 F
Insulation Type: None
Insulation Thickness: 0
Total Condensate Load: 400 Lb./hr.

Quote Request Details

Model: 151
Pipe Size: 3/4"
Connection: NPT
Quantity: 5
Notes:

Selected Trap Details

Trap: 151
Minimum Pressure: 1 PSIG
Maximum Pressure: 200 PSIG
Maximum Capacity: 6000 Lb./hr.
Percent Maximum Capacity: 0%
Maximum Temperature: 500 F
In-Line Renewable: YES
Technology: Dual Range Thermostatic

PRINT / DOWNLOAD

Sizing & Selection Examples

Drip Application

Design Temperature: **232C (450F)**
Operating Inlet Pressure: **6.9bar (100psi)**
Operating Temperature: **171C (340F)**
Design Pressure: **17bar (246psi)**
Operating Outlet Pressure: **0bar**
Operating Condensate Load: **100kg/h (220lb/h)**

Process Application

Outdoor Heat Exchanger with Control Valve for temperature control

Design Temperature: **232C (450F)**
Operating Inlet Pressure: **6.9bar (100psi)**
Operating Temperature: **171C (340F)**
Design Pressure: **13.8 bar (200psi)**
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Steam Trap Technology Comparison Summary

Criteria	Mechanical		Thermostatic		Thermodynamic			
	IB	F&T	Bimetallic	Bellows	Disc	V. Orifice	Lever	Orifice
Ease of checking								
Ease of Maintenance								
Sensitivity to back pressure								
Resistance to freeze damage								
Dirt sensitivity								
Orientation Limits								
Air venting								
Responsiveness to changing loads								
Resistance to vibration and water hammer								
Steam Trap discharge follows saturation curve								
Condensate Discharge	Intermittent	Continuous	Intermittent	Intermittent	Intermittent	Continuous	Continuous	Continuous
Capacity	Varies	Varies	Low	Varies	Low	Moderate	High	Low
Predominant failure mode	Open	Closed	Open	Depends	Open	Open	Open	Closed

Walkdown Info

Trap Number	Location	Situation	Application	Brand	Connection	P1	T1	Ok	B/O	B/C	O/S	Other	I.Valve	Strainer	Check	O.Valve	Comments
		Elevation	Work Rate	Model		P2	T2										
			Critical (Y/N)	Type		Differential Pressure	Differential Temperature										
Example	1st Floor Exhaust Off Turbine 1 - Tag 39	Indoors	Drip	ARM	1/2" NPT	9	237	X					X	X	X	X	Drip leg correct/leak on strainer/Thermal analysis only/picture123
		3ft	100%	811		0	203										
			No	IB		9	34										

Key Yarway Low / Medium Pressure Traps

Emerson Models

711 / 721 Disc

731 / 741 Piston

751 / 761 Bellows

B302 Bimetallic

B303 Bimetallic

UB300 Bimetallic

Yarway PB5/40, 29 and 129Y are also available for drip and tracing applications (light-weight / lower cost traps)

Competitor Models

Armstrong CD3300*

Spirax Sarco UTD52* / UTD30*

TLV P46SRN

Armstrong SH-900

Velan TSF

*Competitor universal 2-bolt trap

Emerson Highlights

- Various technologies for broader application scope
- Unibody Benefits
  - Ease of replacement (NPT capsules)
  - Wide range of technologies and capacities
  - Inventory management – one capsule regardless of line size
- Energy-efficient thermostatic steam traps
- Universal Connector available for competitive displacement

Emerson Offers Thermodynamic and Thermostatic Traps for Low / Medium Pressure Applications

Key Yarway Traps for High Pressure Drip Applications

Emerson Models

460 / 460D3

515 / 515D3

C-500 / C-546

B308 / B310

Competitor Models

Armstrong 5155G & 6155G

Armstrong SH-1500

Spirax Sarco TD120

Spirax Sarco DT300F

TLV JH Series

Emerson Highlights

- Typically used in power plants / high-pressure drips
  - Main steam and reheat steam lines
- Simple rugged design
- In-line repairable traps available
- Energy-efficient thermostatic steam traps available
- Strong Yarway reputation in Power industry

Emerson Offers Solutions for Up to 4500psi

Key Yarway Traps for Process Applications

Emerson Models

40 / 40D

151

F881/F883/F884

UF800

Competitor Models

Armstrong
314 / 983 / CS

Spirax Sarco
FT Series

TLV
JH3/JH5/JH7

Emerson Highlights

- Various technologies for broader application scope
- Smaller, compact design for 151 and 40/40D
- Solutions work well with superheated steam
- Pressure ratings cover most process applications
- In-line repairable options
- Universal float trap available for competitive displacement

Emerson Offers Mechanical, Thermodynamic and Thermostatic Traps for High Capacity Applications

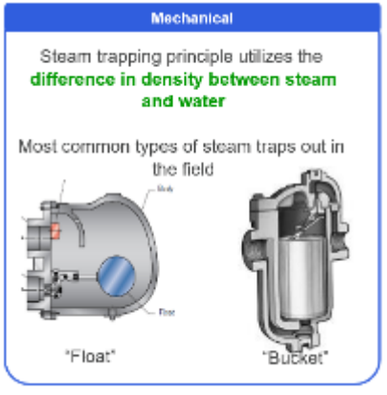
Other Factors To Consider For Steam Trap Selection

Correct Trap for Application

Source: Matmach

- Ensure the trap meets the main **criteria for the application**
- Traps need to adequately perform the key functions required

Preferred Technology

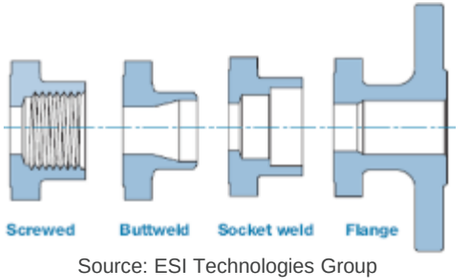


- Some customers have certain types of traps in **approved engineering documents**
- Some customers **prefer certain technologies** and will select those first, if option given

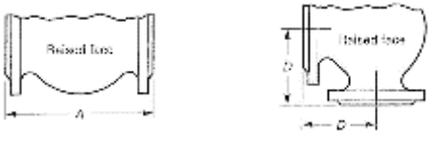
Competitive Displacement

- Replacement trap will need to handle the same conditions as the trap that is installed
- May require same type of steam trap technology

Connections and Face-to-Face



Source: ESI Technologies Group



Source: Valves for Oil and Gas

- Same connection sizes and type means less pipe modifications for the customer
- Face-to- face dimensions are sometimes important to customer

Additional Tools and Support

Additional Training Courses

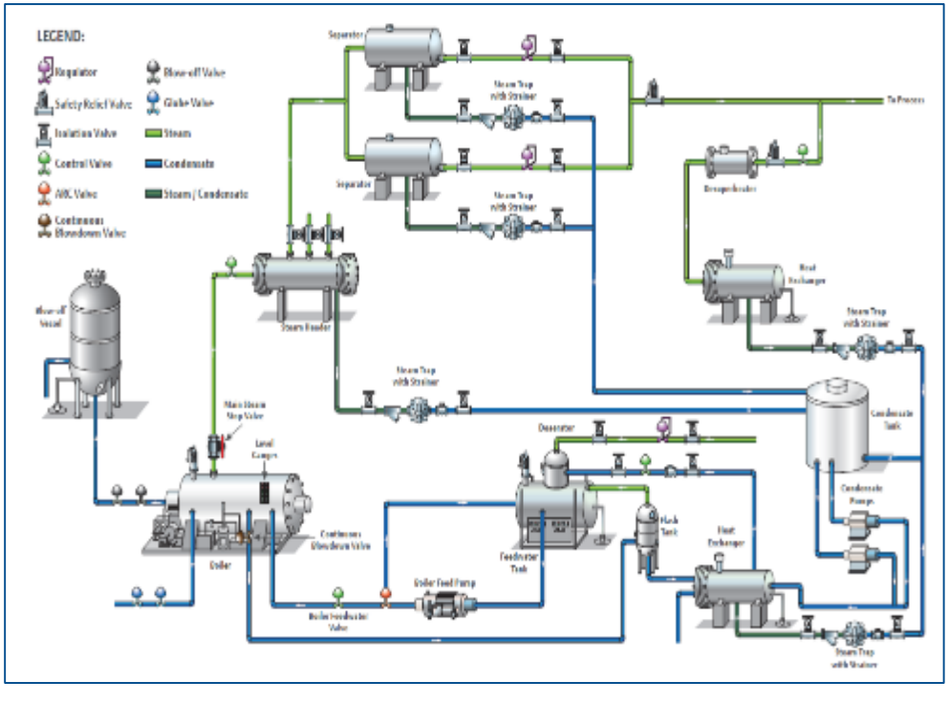
Webinars

- Upcoming Monthly Training Sessions
  - **July**: Steam Trap Applications
  - **August**: Steam Trap Surveys / Walkdowns
  - **September**: Troubleshooting Steam Systems
- Additional trainings being developed and available on-demand

Modules
What goes into Steam costs
Steam Trap Applications
Sizing and Selection
Condensate calculation
Survey Reporting
Survey Process
Common Issues with steam systems
Who to talk in steam facility
Competitive displacement
Basics on how to test/equipment
Walk down vs survey, what Emerson Sales channels are capable of

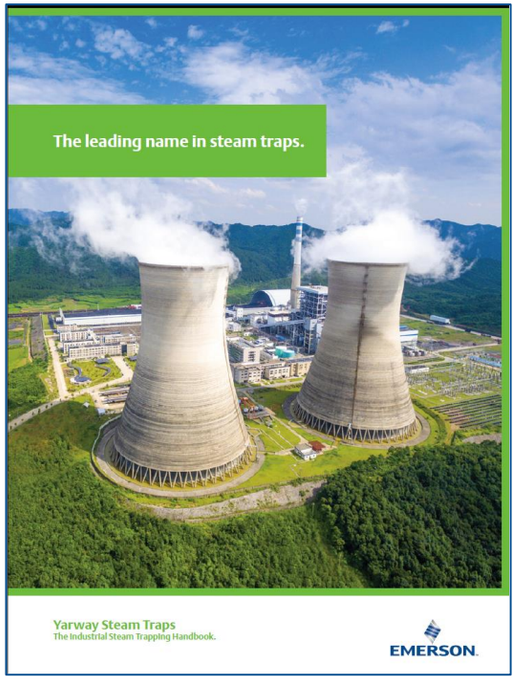
Intro to Steam

- Introduction to Steam Systems
  - Why we use steam
  - Types of steam
  - Boiler types
  - Steam system Overview
  - Common Challenges in Steam Systems
- Recording Available Soon!



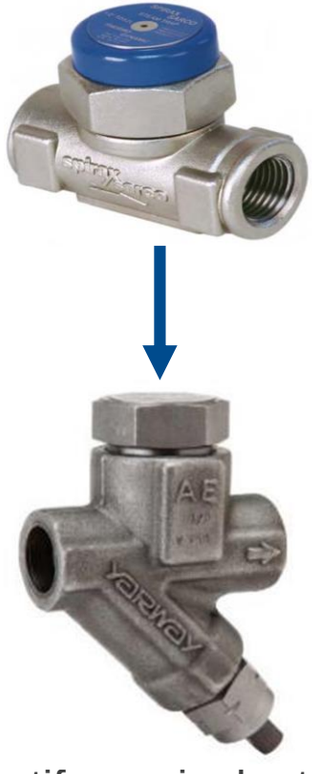
Steam Trap Selection Tools

Steam Engineering Handbook



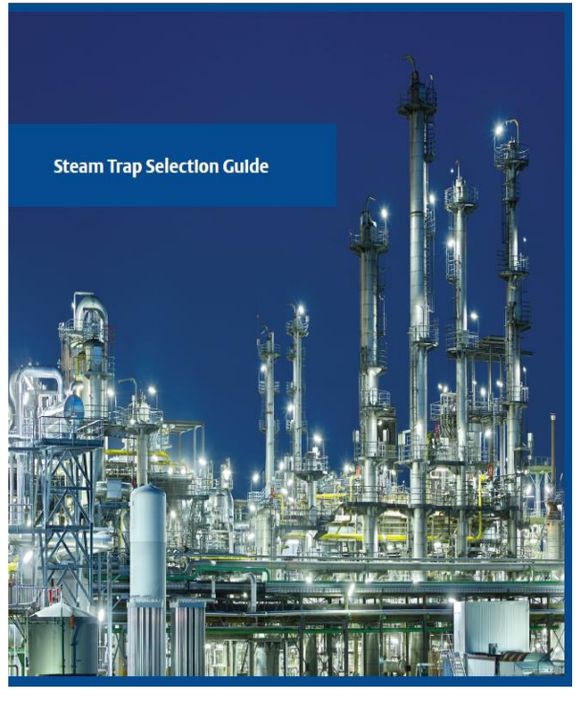
- Overview of steam and steam systems
- Steam trap applications, selection and installation
- Basic troubleshooting

Competitor Cross-reference Guide



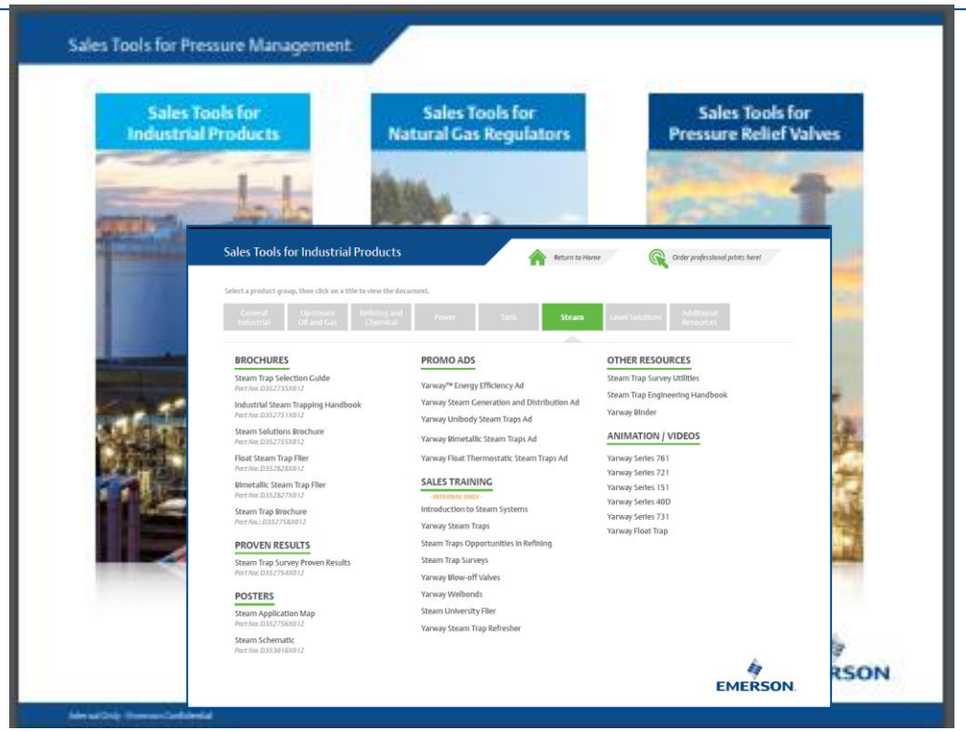
- Identify equivalent competitor models for key Yarway traps
- Initial focus on Spirax, Armstrong and TLV

Trap Selection Guide

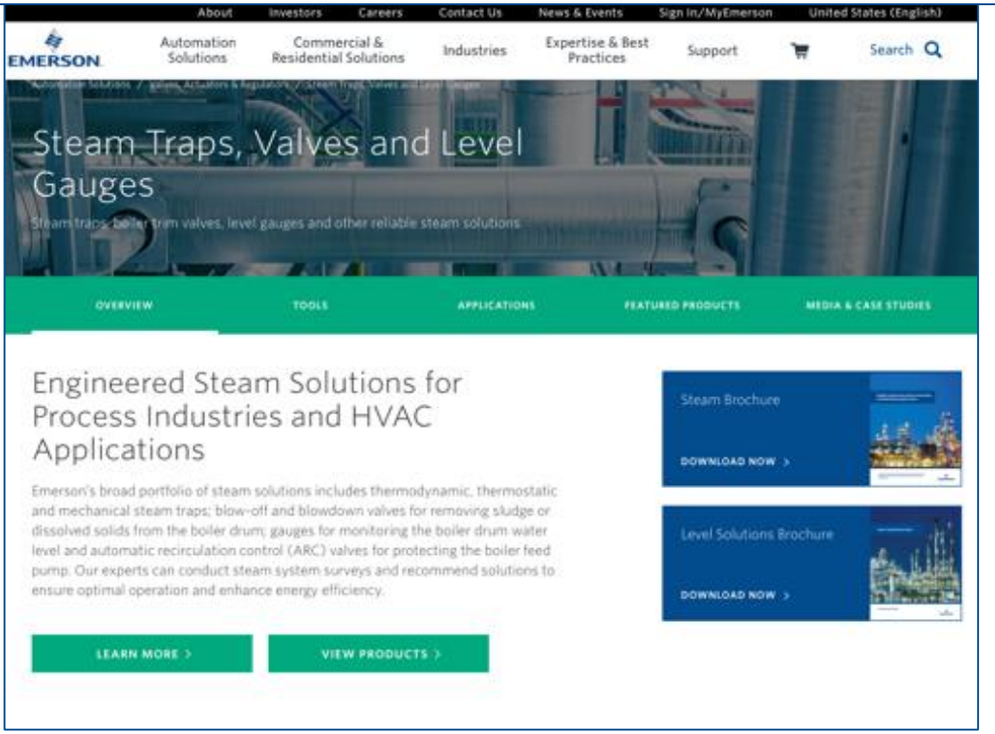


- Recommended Yarway models for specific applications
- Guidelines for estimating condensate flow rates
- Yarway portfolio summary

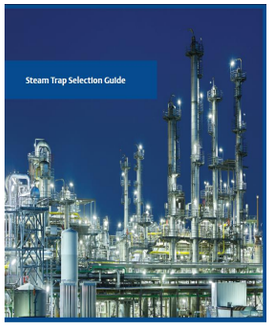
Additional Resources and Tools



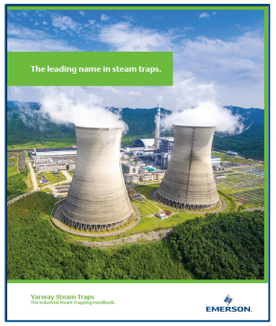
[PRM Sales Tool]



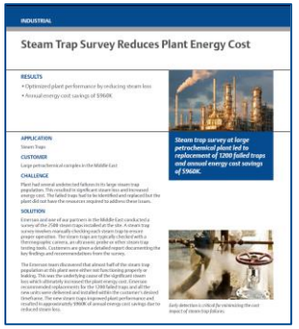
[Emerson Website]



[Selection Guide]

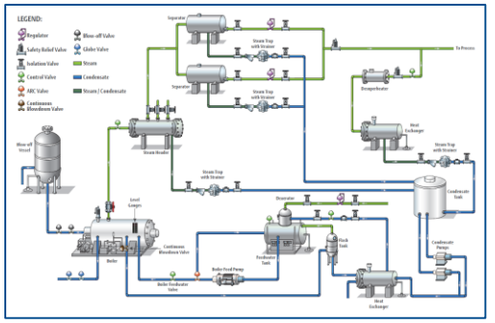


[Steam Handbook]



[Survey Proven Results]

[Animations]



[Steam Solutions Brochure]

Training and Collateral Available on the PRM Sales Tool