

A Particular Medium

LESER Safety Valves for Urea Plants



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The-Safety-Valve.com

Application

Application requirements in Urea Plants

In the fertilizer industry and especially the Urea industry, components such as safety valves have to withstand severe production conditions like high pressures, high temperatures and corrosive media. High on-stream times are main targets of plant operators. Reliable technologies, equipment and machinery are a pre-requisite to guarantee the expected plant capabilities.

Safety valves are used for protection of the main sections in Urea plants like Ammonia and CO₂-supply, synthesis section, re-circulation section and also for secondary steam and cooling water supply.

In Urea high pressure synthesis sections, CO₂ and NH₃ react to carbamate which is an intermediate in the Urea production. Carbamate is highly corrosive and can easily crystallise. These major medium properties have to be considered for a proper safety valve design and the correct selection of materials of construction. Carbamate requires the use of special stainless steels. Special stainless steel grades such as 316L Urea Grade or 1.4466 – UNS S31050 are used for the highly corrosive carbamate at high pressures (up to 200 bar / 2900 psig) and high temperatures (up to 200°C / 392°F).

Regular servicing of the traditional design safety valves has been the common strategy in maintaining a reliable operation. The goal of the plant operator is to extend the time between servicing and reduce the probability of failure.

Customer Benefit

Feature	Benefit
Special stainless steel grades	Minimize service and maintenance costs
Minimized steam requirement	Operating cost reduction
Only one injection point	Less piping needed
Permanently steam purged	Avoid crevice corrosion and crystallisation

Since 2008 LESER has delivered more than 1500 safety valves in more than 50 urea plants world wide.

The following list shows references outside the synthesis section. For references of synthesis section valves, please see page 6.]

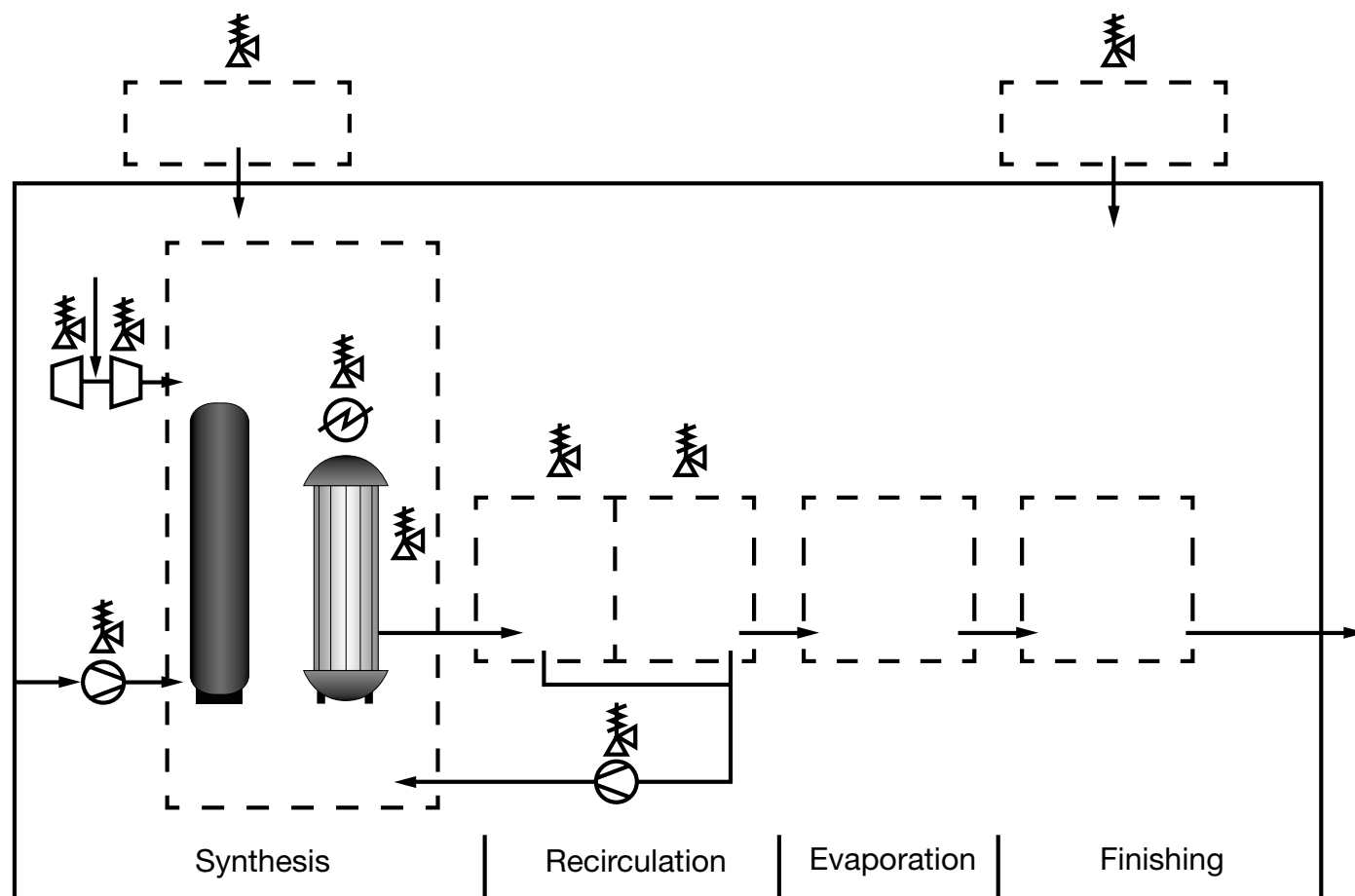
Short list of References of

Urea Plant Safety Valves (non synthesis section safety valves)

Customer	Location	Country	Type
Ekano Baltja	ACRON	Russia	526,441
GEDIK DÖKÜM ve VANA	Istanbul	Turkey	441
various	Urumqi Erdos Tarim Basin Daqing Cangzhou Qinghai Ningxia	China	526, 459, 441, 447
Shahjalal Fertilizer Project (SFP)	Shah Jalal	Bangladesh	438, 441
Petrobras Rio de Janeiro	Tres Lagos Rio de Janeiro	Brazil	526
Namavarani Delvar Engineering	Pardis	Iran	526
Pardis Petrochemical Co.	Pardis	Iran	526,459
Uhde GmbH	Damietta	Egypt	526
Uhde GmbH	Arzew	Algeria	459
Uhde GmbH	Iowa (various) Louisiana	USA	526, 459, 441
Uracia		Russia Germany	459, 441, 526
YARA	Brunsbüttel	Germany	526

Application

Urea Plant Section



Protected Section	Typical Pressure	Typical Temperature	Typical Safety Valves	Typical Used Material
Steam turbine of CO ₂ - Compressor	40 or 110 bar at inlet, 25 bar at extraction and condensation part		API 526 1D2	WCB/1.0619 for dry medium 316L/1.4404 for wet medium
CO ₂ - Compressor last stage	150 bar	120 °C	API 526 1D2	WCB/1.0619 for dry medium 316L/1.4404 for wet medium
NH ₃ - Pump (liquid)	150 - 180 bar	120 °C	API 1x2 and 3x4	316L/1.4404
Urea Synthesis section	Up to 170 bar	Up to 190 °C	API 526 3x4 with heating jacket, depending of plant capacity	Carbamate corrosion resistant material, e.g. 316L UG, 1.4462, 1.4466, SAFUREX®
Stripper	Steam side protection up to 30 bar	Up to 230 °C	API 526 8x10	WCB/1.0619
Recirculation MP	Up to 30 bar	Up to 190 °C	API 526 8x10	316L/1.4404 for temperature < 150 °C 316L UG/1.4404 UG for temperature > 150 °C
Recirculation LP	Up to 7 bar	Ambient temperature	API 526 8x10	WCB/1.0619
Recirculation Carbamate pump	Up to 150 bar	Up to 120 °C	API 526 3x4 and 1x2 with heating jacket, erosion	316L/1.4404 Duplex/1.4462
Sub section Steam supply	Variable pressure	Variable temperature	API 526	WCB/1.0619
Sub section Cooling water	Variable pressure	Ambient temperature	API 526	WCB/1.0619

Application

LESER Industry Solution for the Urea Synthesis

The safety valve designs described are intended for the application in Urea plants for the protection of high pressure synthesis sections. For other sections of the Urea plant and for the ammonia plant, LESER also has different application-specific safety valve designs available.

The safety valve design described shows the steam purging design. LESER already has more than ten years of experience in melamine plants with steam purging design of safety valve to avoid the crystallisation. This design was the basis for the innovative LESER Flushing design for Urea synthesis protection system (see figure 1 and 2).

LESER has optimised the steam purging design for Urea plants. The amount of steam needed is minimized by means of a special nozzle design. Additionally, only one injection point is required to generate an optimal steam purge which reaches all critical areas. With the upwards flowing steam, the critical areas for crevice corrosion and crystallisation are permanently purged with steam.

Practice has proven that these LESER Flushing safety valves do not show any form of corrosion or crystallisation in the critical areas. Furthermore no crystallisation of carbamate was found in the outlet chamber and outlet line of maintained safety valves after two years of plant operation.

Material used in Urea Synthesis depending on Licenser

Materials
316L Urea Grade
1.4466 - UNS 31050
1.4462 - UNS 31803
SAFUREX® - UNS 32906 / Code Case 2295

Safety valve knowledge

Design and Function

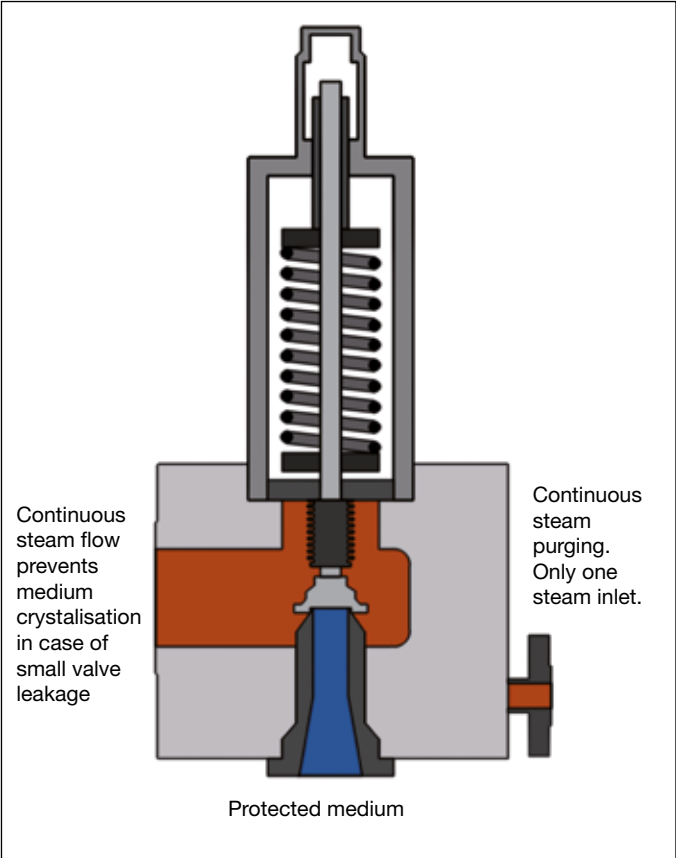


Figure1: Valve closed

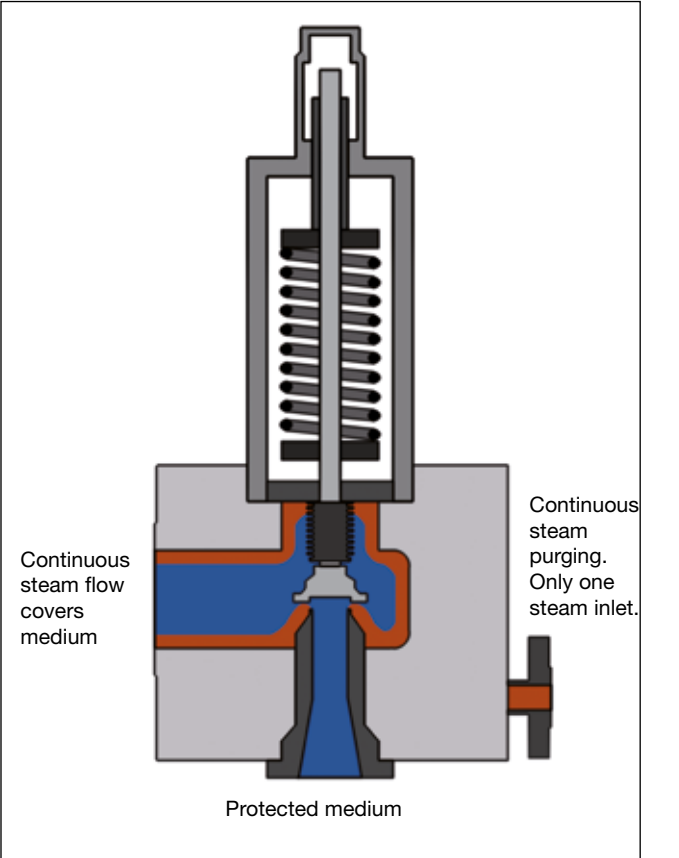


Figure 2: Valve open

Product solution

LESER Flushing Safety Valve Designs

The safety valves are application-oriented configurations and constructions based on the LESER Type 526 and have the following versions.

Design	Type	Specification	Application	Particularity
1	Block Body	Without heating jacket	Often in new plants	Complete process media area in high corrosion resistant material
2	Block Body	With heating jacket	Often in new plants with low ambient temperature	Complete process media area in high corrosion resistant material
3	Cast Body	Without heating jacket	Often as replacement valve in existing plants	Only high pressure process media area in high corrosion resistant material

LESER Flushing safety valves with specific flushing technology are approved by PED and by ASME VIII (fixed blowdown).

ASME VIII (fixed blowdown) approval is unique with focus to optimal steam purging.

Valve Nominal Sizes and Performance Definition

LESER Flushing Safety Valve

The following sizes are typical examples from our current references in Urea plants.

Design	Type	Article No.	Nominal size (inch)	Orifice
1	Block Body	based on 5264.2012	1-fold 3x4 per 1000 mtpd Urea	J
2	Block Body	based on 5264.2012	1-fold 3x4 per 1000 mtpd Urea	J
3	Cast Body	based on 5264.1572	3-fold 2x3 per 1000 mtpd Urea	H
3	Cast Body	based on 5264.1162	3-fold 1,5x3 per <1000 mtpd Urea	G

Extension of the Safety Valve

Performance Spectrum for larger Urea plants

In cases of larger Urea plants additional LESER Flushing safety valves can be added. The total performance to be discharged via the safety valves of the synthesis section typically depend on the size of the HP stripper.

For example, for the future 5000+ plants (5000t/d) e.g.

5x 3J4 are needed. Specific sizing and selection will be done for each individual plant situation.

ASME VIII (fixed blowdown) approval is unique with focus to optimal steam purging.

Product solution

LESER Flushing Safety Valve Designs

Sizing of the Safety Valve

The sizing can be done with the LESER sizing program VALVESTAR®. Add-ons of the sizing program are not necessary if the existing basis type numbers are used. For documentation the as build drawings and parts lists are not included. VALVESTAR® is free of charge and can be ordered on a CD-ROM as a desktop version or use the online version on www.leser.com/en/services/valvestar.html.

Special remarks concerning the Operation

The LESER Flushing safety valves should only be applied with connected permanent steam purging. If there is no steam purging, contact corrosion between body and nozzle as well as crystallisation of the carbamate are possible. A loss of function or the complete inoperation can be the consequence.

Customer Benefit

The main benefits are longer maintenance intervals and lower requirements for cleaning internal parts, such as the seat area and no risk of crystallisation in the outlet chamber of the safety valve. The result is a higher level of plant safety and reliability.

Since 2008 more than 70 LESER Flushing system safety valves are in service worldwide.



Picture: Urea plant

Short list of References of Urea Synthesis Valves based on Type 526

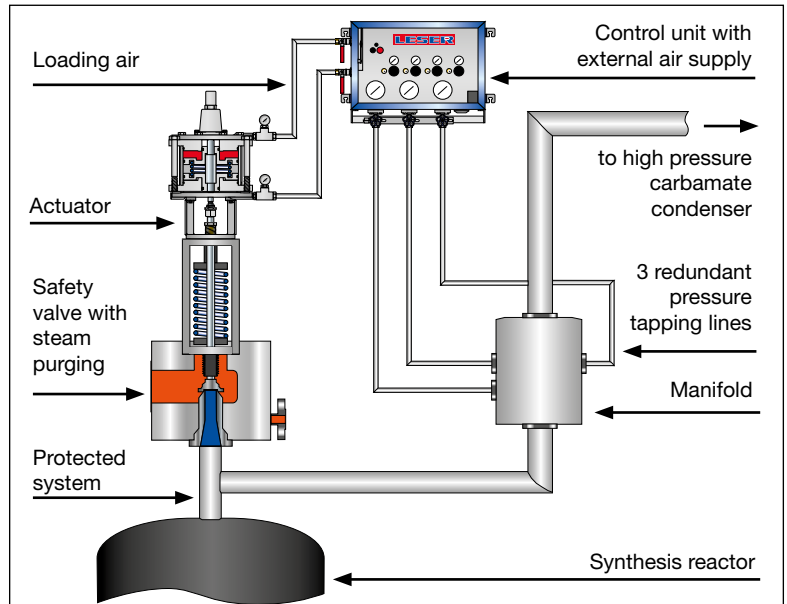
Customer	Location	Country
BHDT	Lordegan	Iran
Brunnbauer-Armaturen	Shaanxi Shanhua	China
Brunnbauer	Pardis	Iran
GEDIK DÖKÜM ve VANA	Izmit	Turkey
Hong Kong LESER Safety Controls Ltd	Erdos Talent	China
LESER Bahrain	Kuwait City	Kuwait
LESER China		China
LESER POLSKA Sp. z o.o.	Police	Poland
Räcklebe&Totz	Piesteritz	Germany
SPIRAX-SARCO s.r.l.	Iowa	USA
Stamicarbon B.V.	Hulun Buir Boda Shidi Hegang Huahe Jiangsu Linggu	China
Stamicarbon B.V.	Shahjalal	Bangladesh
Stamicarbon B.V.	Rio de Janeiro	Brazil
Stamicarbon B.V.	Texas	USA
Uhde GmbH	Iowa Louisiana	USA

Product solution

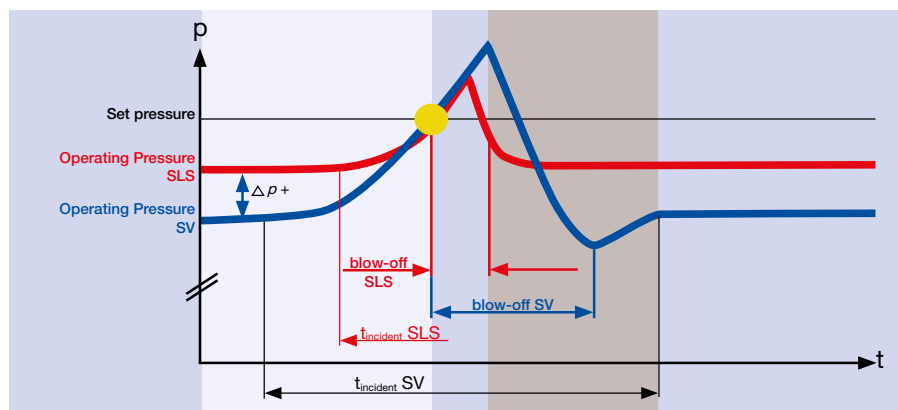
Optional added Supplementary Loading Systems

Supplementary Loading Systems to LESER Flushing Safety Valves

A Supplementary Loading System Safety Valve improves the opening and closing characteristic of a safety valve. With the supplementary loaded safety valve, the spring loaded reseating action is subjected to a supplementary force applied by a pneumatic actuator. A control system ensures that pneumatic pressure is supplied to the actuator through control lines. Impulses are transmitted to the control unit proper through redundant arranged medium-carrying pressure tapping lines. Especially for Urea synthesis section a customized Supplementary Loading System uses pressure transmitters located to the protected system instead of direct medium transmitted system located in the control unit. Only loading air is activated to ensure seat tightness up to the set pressure. It is approved by TÜV Nord Authorities in Germany according to European Pressure Equipment Directive and ISO 4126-5.



Opening Cycle Comparison



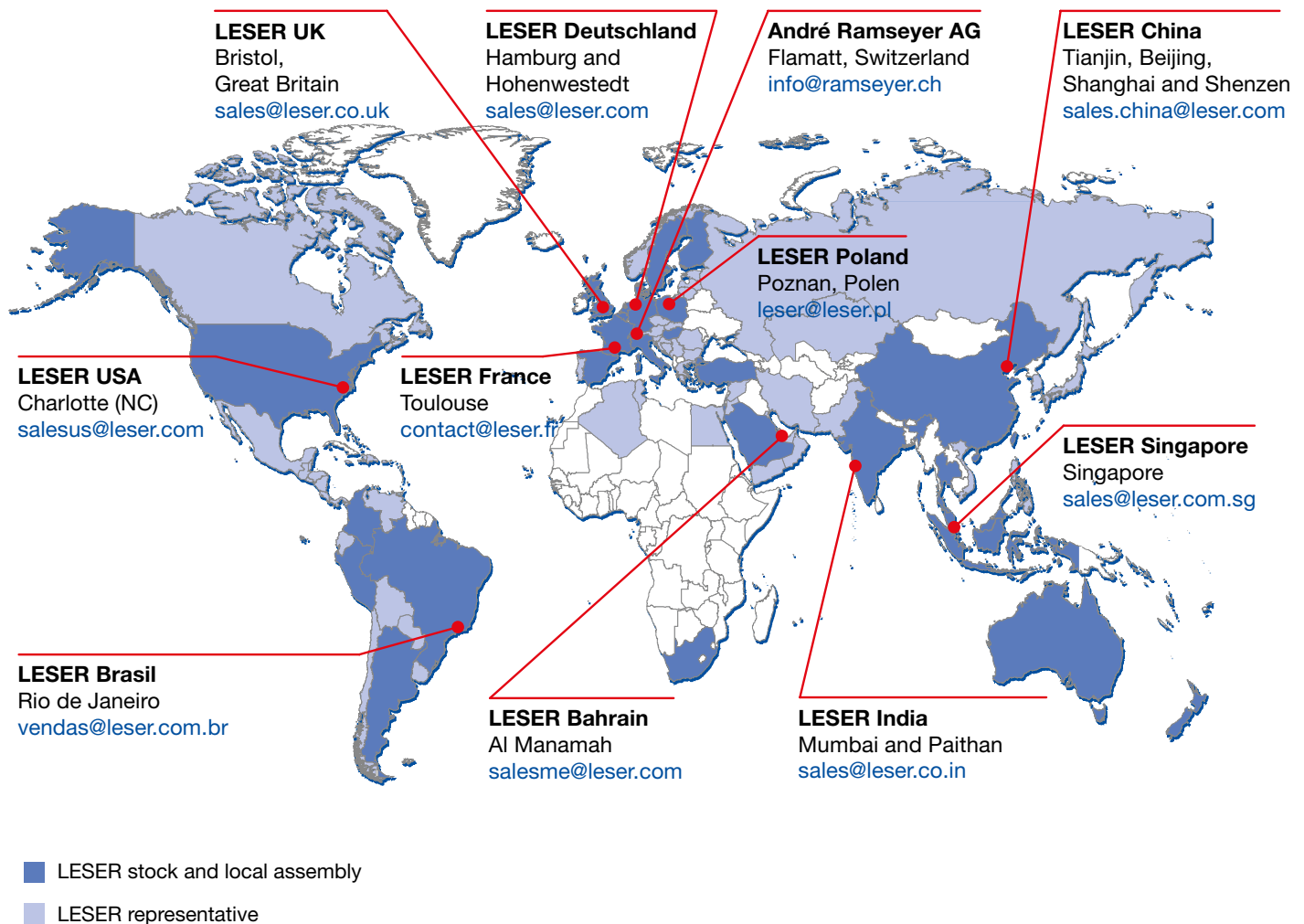
Comparison:
Opening cycle standard spring loaded safety valves versus added Supplementary Loading System technology for safety valves

Customer Benefit

Benefits for Urea Synthesis section with added Supplementary Loading System:

Feature	Benefit
Increase of safety and reliability	<ul style="list-style-type: none"> Lower emissions due to reduced blow-off time Less sensitive for pressure pulsations and piping vibrations No need to stop plant to do services after blow-off Independent of back pressure
Increase of the working pressure	<ul style="list-style-type: none"> Higher plant capacities Seat-tightness until opening Accurate commencing of lift Lower energy consumption
Lower investment costs	For the design of new urea plants the design pressure of the High Pressure equipment items can be reduced leading to lower investment figures
Less maintenance costs	Higher fitting availability result in significant longer inspection interval

LESER worldwide



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