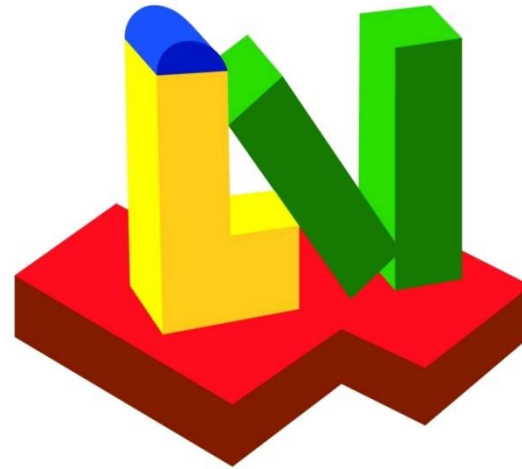




LAUTERBACH

VERFAHRENSTECHNIK GmbH



Engineering & Software



Lauterbach Verfahrenstechnik GmbH

Background

The company was founded in 1978 by Dipl.-Ing. Dietrich Lauterbach as an engineering office for process engineering.

At the beginning, the activity was mainly for refineries such as MOBIL / ESSO EXXON and OMW in basic and detailed engineering.

Lauterbach chemical engineering's many years of experience in this field are still in great demand today.



Lauterbach Verfahrenstechnik GmbH

LV Basic Engineering

Over 350 refinery projects have already been planned. The projects cover the entire plant spectrum from improvement measures to the planning of complete plants.

Starting with a project to recover of flare gas at ESSO refinery Karlsruhe and continue till actual finished projects at district heating of the town Karlsruhe.



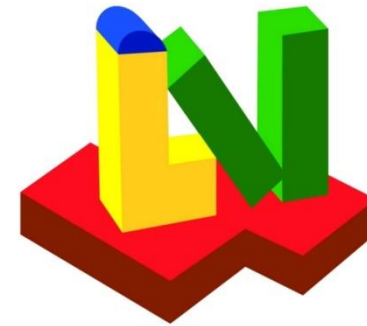
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The Team

The LV team has grown increasingly in recent years and consists of engineers with many years of experience in the fields of process engineering, mechanical engineering and information technology.

It is supported by partner companies if required, so that we can react quickly to customer requests.

LAUTERBACH
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Engineering & Software

Lauterbach Verfahrenstechnik GmbH

Research projects in cooperation with partners and universities

- **Development of novel medicinal tablets.**
 - FEA Simulations / Software development
- **AI based welding process.**
 - Software application
- **Design and optimization of a fermentation process.**
 - Process engineering



Lauterbach Verfahrenstechnik GmbH

Software

- VDI Heat Atlas
- Heat Exchangers
- Strength calculations
 - AD 2000 – EN 13445 - EN 13480 – ASME – FEM

Services

- Calculation
- Simulation
- Training
- Expertise

Since 1978



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<h1>Certificate</h1>	
Standard	ISO 9001:2015
Certificate Registr. No.	01 100 044763
Certificate Holder:	 LAUTERBACH VERFAHRENSTECHNIK GmbH Lauterbach Verfahrenstechnik GmbH Eugen-Langen-Str. 2 76227 Karlsruhe Germany
Scope:	Development of modular software for pressure vessel design and chemical engineering.
	Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.
Validity:	The certificate is valid from 2020-07-01 until 2023-06-30. First certification 1999
	2020-05-28
	 TUV Rheinland Cert GmbH Am Grauen Stein · 51105 Köln

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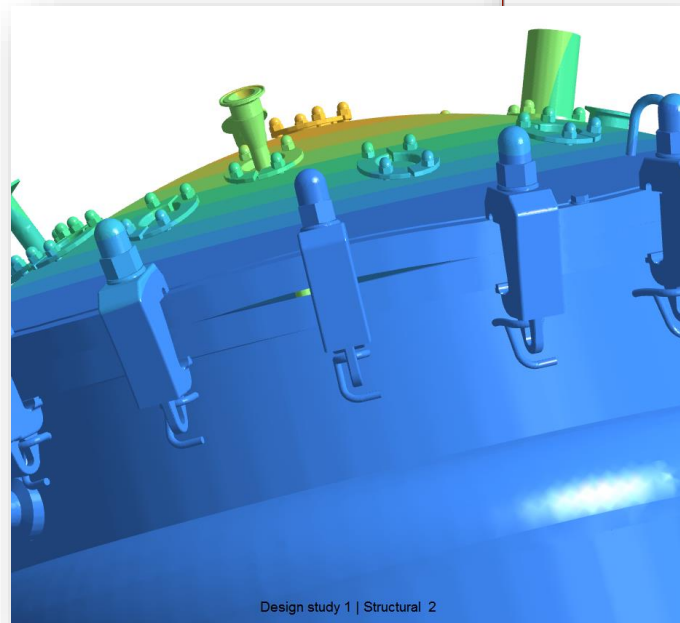


PROJECTS

Pressure Vessel Design

Software and Engineering by Lauterbach

- EN 13445-3
- EN 13480
- AD 2000
- ASME VIII Div. 1 / 2
- FEM
- etc.



Design study 1 | Structural 2

File ATLAS Module Help

New Project New Module

Recalculate Project Quicksheet Value suggestion To connection list To current cell Recalculate
Cancel Calculation Variable Connections Delete Variable Delete connections From current cell Expert mo
Delete all connections Synchronize Check play

Project explorer

1 Project
2 ZIEH
3 B3
6 UG32
4 EN07

Quick Navigation

4 EN07 — Kloepper type heads under internal and external pressure — DIN EN 13445-3/7: DIN EN 14025: 2018-09

Limit skirt height $0.2 \cdot \sqrt{(D_i \cdot e)}$ acc. 7.5.3.4	h	17.83	mm
Actual skirt height	h_a	28	mm
Required skirt height	h	18.74	mm
Crown height	h_2	286.6	mm
Allowable unreinforced opening (completely in crown area)	d_{A1}	900	mm

Load case Operation

Strength condition fulfilled ✓

Geometrical conditions fulfilled ✓

The requirements acc. EN 13445-3 are fulfilled. ✓

Equations

Nominal design stress for the selected load case

$$f = \frac{K}{S} = \frac{K}{S} = 152.3 \text{ MPa}$$

$$e_s = \frac{P \cdot R}{(2 \cdot f \cdot z - 0.5 \cdot P) \cdot (2 \cdot 152.3 \text{ MPa} \cdot 1 - 0.5 \cdot 0.5 \text{ MPa})} = 2.464 \text{ mm} \quad (7.5-1)$$

$$e_y = \frac{\beta \cdot P \cdot (0.75 \cdot R + 0.2 \cdot D_i)}{f} = \frac{1.01 \cdot 0.5 \text{ MPa} \cdot (0.75 \cdot 1500 \text{ mm} + 0.2 \cdot 1484 \text{ mm})}{152.3 \text{ MPa}} = 4.713 \text{ mm} \quad (7.5-2)$$

The auxiliary values for β (X, Y, Z, N at the end of mask) have been calculated iteratively with the required thickness e.

$$e_b = (0.75 \cdot R + 0.2 \cdot D_i) \cdot \left[\frac{P}{111 \cdot f_b} \left(\frac{D_i}{r} \right)^{0.825} \right]^{\frac{1}{1.5}} \quad (7.5-3)$$

$$e = \text{Max} \begin{cases} e_b \\ e_y \\ e_s \end{cases} = \text{Max} \begin{cases} 5.353 \text{ mm} \\ 4.713 \text{ mm} \\ 2.464 \text{ mm} \end{cases} = 5.353 \text{ mm}$$

Strength condition $e_s \geq e \Leftrightarrow 8 \text{ mm} \geq 5.353 \text{ mm}$ ✓

Geometrical conditions ✓

$$\text{Max} \begin{cases} 0.06 \cdot D_i \\ 2 \cdot e_s \end{cases} \leq r \leq \frac{D_i}{5} \Leftrightarrow \text{Max} \begin{cases} 89.04 \text{ mm} \\ 16 \text{ mm} \end{cases} \leq 150 \text{ mm} \leq 296.8 \text{ mm}$$

PROJECTS

Heat Exchanger Design

Software and Engineering by Lauterbach

- Aircoolers
- Shell and Tube
- Coil-Type
- Fired
- Electrically-heated
- Double-Pipe
- Plate
- Flue gas, etc.



Courtesy of Alfa Laval Aalborg A/S, Marine Division

PROJECTS

Stability against collapse

- Static calculations of columns
- Challenge: Earthquake loads and Wind loads (Hurricane area)
- 350 ft (104 m) high



PROJECTS

Leakage proof of flange connection

- Leakage Proof of deep sea piping flanges
- Critical load case: Installation process: S-Lay
- Calculation performed by analytic and FE simulation



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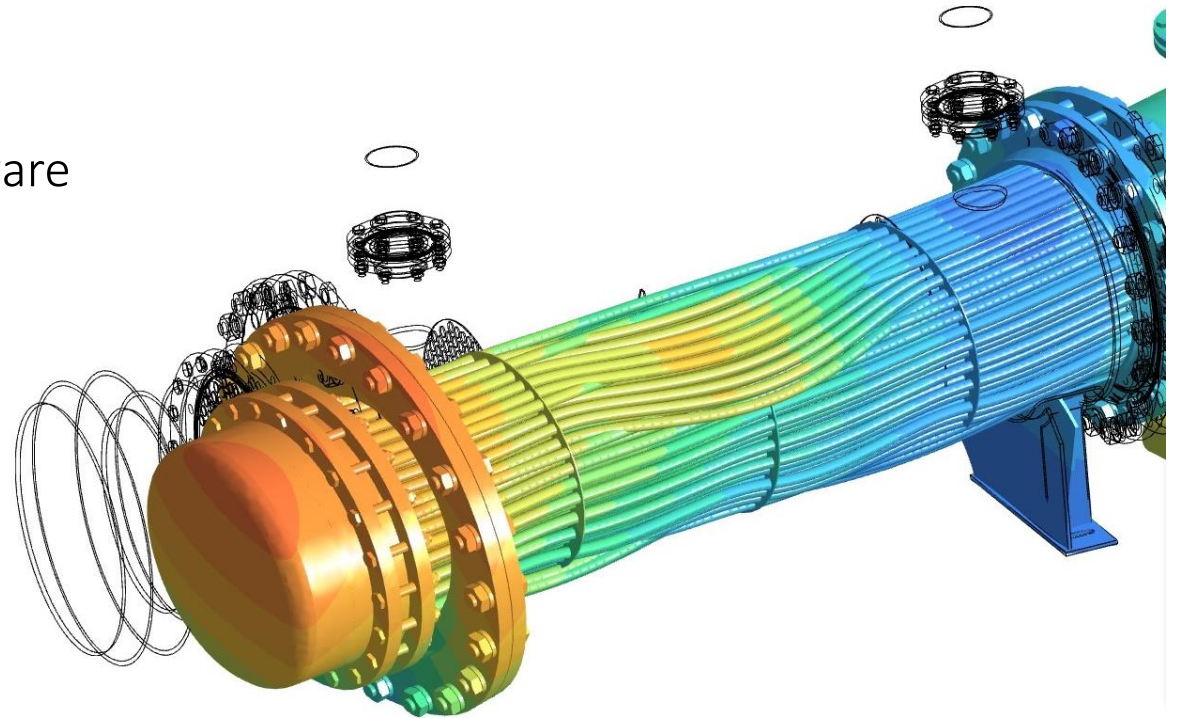
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PROJECTS

Expertise

Case: Damage of heat exchanger

- Evaluation of Damage:
 - Vabriation Analysis by Lauterbach Software
- Optimization of design
to prevent damage in future



VDI Heat Atlas Software

Heat Transfer

- Flow through pipes and ducts
- Flow around bodies
- Free Convection
- Condensation and Evaporation

Pressure Loss / Hydrodynamics

- Pipes and fittings
- Fillings
- Multi-phase flows

Physical Properties



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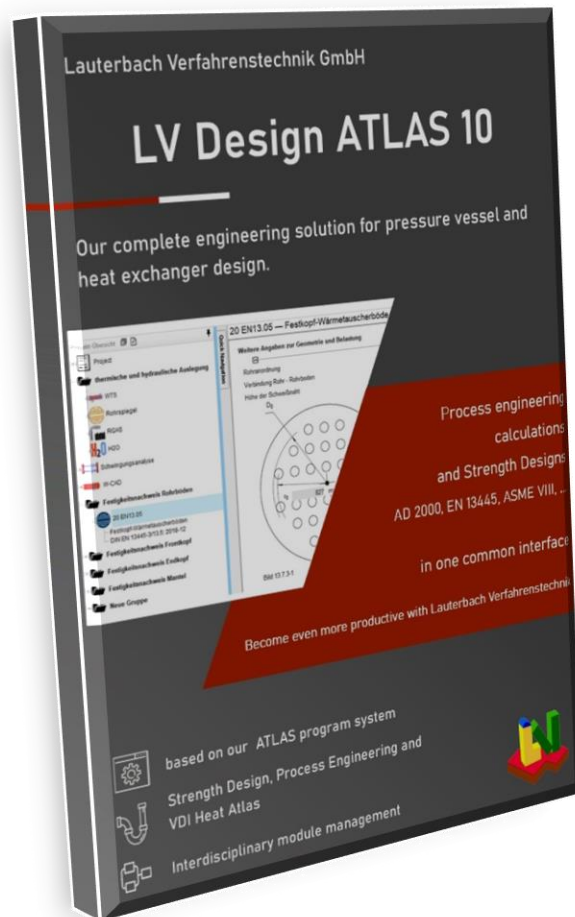
VDI-Wärmeatlas

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- Lauterbach Verfahrenstechnik is unique Software Provider of the VDI HEAT Atlas
- Since 1956 the standard work for thermal Process Engineering



New: LV Design ATLAS 10 and LV FEM Toolbox



- Our complete engineering solution for pressure vessel and heat exchanger design
- Process engineering calculations and strength designs according to AD 2000, EN 13445, EN 1591, ASME VIII, Eurocode and much more in one common interface
- Design Atlas 10 includes fully integrated FEM module with Comsol Solver

References



ABB Automation Groducts GmbH



APL Apparetebau GmbH



Aquafil Engineering GmbH



Bayer Antwerpen



BILFINGER

Bilfinger E.M.S GmbH
Bilfinger VAM Anlagentechnik GmbH



Bosch Industriekessel GmbH



BWT AQUA AG



Heat gas
technologies GmbH



Ernst Möschle
Behälterbau GmbH



Kelvion Germany GmbH



MAN Diesel & Turbo SE



Swiss Safety Cetner AG



Siemens VAI metals
Technologies GmbH



Uraca GmbH & Co. KG



Wecubex Rohrtechnik GmbH

Contact

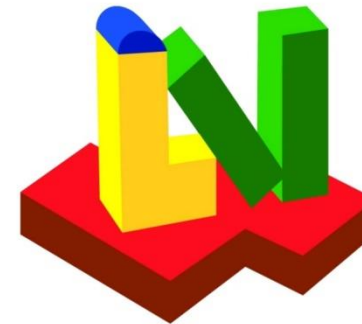
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