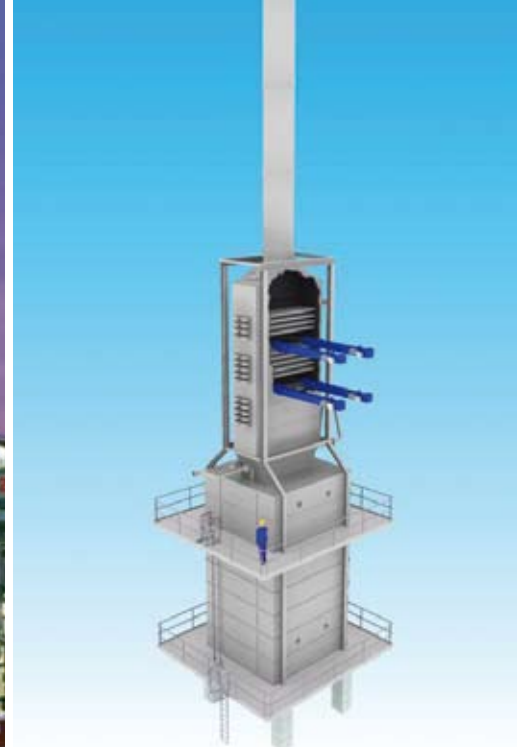




ON-LOAD CLEANING FOR HEAT EXCHANGER FOULING

Optimising heat transfer on
petrochemical plants and oil refineries





Experience across the globe



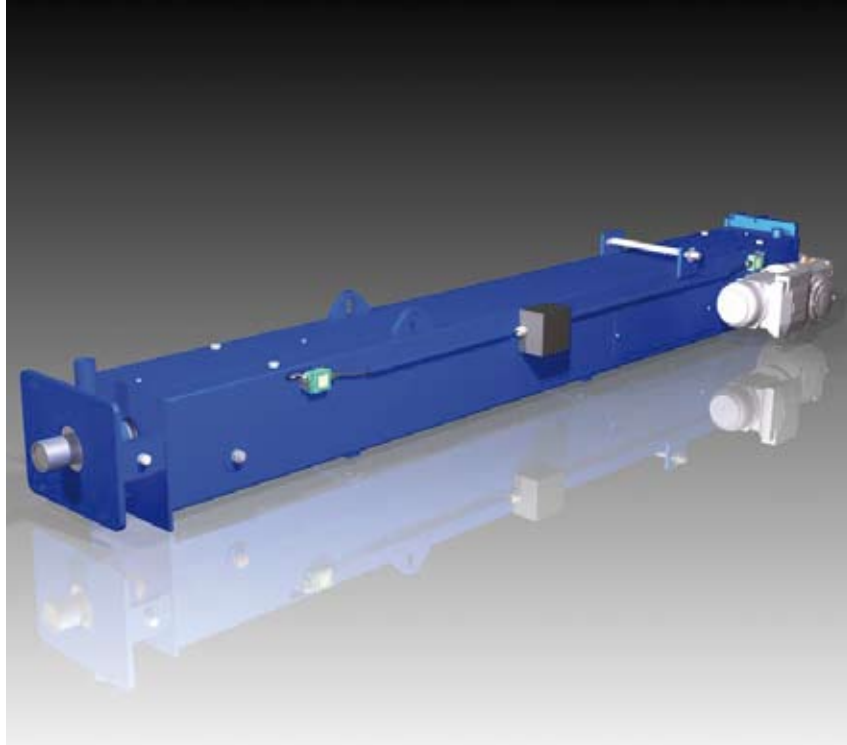
Maximising fired heater energy efficiency is a key consideration for designers and operators of oil refineries and petrochemical plants. The heat transfer surfaces of fired heaters (also known as process heaters or furnaces), waste heat boilers and auxiliary boilers must be kept clean with minimum operating costs to help increase crude oil throughput and process availability whilst conforming to the rigorous hazardous area requirements demanded. Clyde Bergemann sootblowers are designed to meet this challenge.

With over 85 years experience in boiler efficiency improvement and 40 years experience of on-load cleaning in the petrochemical market, our vast knowledge and expertise is key to our success in this market. Our proven technologies for on-load cleaning are installed in oil refineries and petrochemical plants across the world and as the demand for crude oil derived products increases, the need for more maximised throughput and increased capacity is clear.

Our experienced team of engineers ensure the highest quality of service is provided to our global customer base from initial enquiry right through to the commissioning of the equipment. In addition to this, our after sales team are on hand to provide quick delivery spare parts and product life extension services to global installations.

Benefits

- **Efficiency**
 - Sootblowing maintains balanced heat transfer as close as possible to design parameters
 - Sootblowing maximises thermal efficiency and reduces flue gas exit temperature
 - Clyde Bergemann designs optimise cleaning effect and minimise consumption of steam
- **Availability**
 - Prevent blockage in convection sections
 - Avoid unplanned outages and loss of production
 - Reliable and easy to maintain technology
- **Plant safety**
 - Manual operation and lance retract in the event of power supply failure
 - Electrical components certified for hazardous area installation
 - Designs are optimised to avoid tube erosion
- **Environmental**
 - Improved environmental impact with less fuel burned (reduced SOx and NOx and other pollutants)



Increased efficiency of petrochemical and refinery applications

High quality solutions for effective cleaning

Energy costs represent up to 65% of the cost of running a petrochemical or refining complex. Fired heater fuel may be the largest component of this cost. Correct use and placement of sootblowers to reduce fouling can conserve the amount of fuel used and maximise heater efficiency.

For heavy fouling conditions, Clyde Bergemann's fully retractable FH series sootblowers provide the most effective means of cleaning heating surface banks, and are particularly recommended for extended surface tubes and wide tube bank configurations.

Two opposed venturi nozzles at the end of the rotating lance tube form a helical movement during the forward and reverse travel. The Clyde Bergemann FH sootblower design achieves a steam flow of 4537kg/hr (10,000lb/hr) meeting recognised standards such as API 560 and EN ISO 13705:2006 for fired heaters thereby ensuring good cleaning penetration of these tube banks.

The reliability of the FH series is based on a strong and durable chain drive mechanism powered by an external fixed electric motor and gearbox providing ease of access for maintenance purposes. The fully retractable design allows the lance tube and nozzles to be fully withdrawn from the hot gas stream when in the rest position.

In the case of moderate fouling Clyde Bergemann rotating fixed element sootblowers are often the simplest and most economical solution for cleaning during boiler or furnace operation. Clyde Bergemann venturi nozzles are designed for optimum cleaning effect.

Clyde Bergemann sootblowers are also employed in CO boilers and power plant boilers. CO boilers require positive pressure wallboxes to prevent the accumulation or escape of entrained catalyst particles from the boiler.

Power plant and auxiliary boilers may be used for the combustion of various heavy hydrocarbon residues and other fuels, and the resulted fouling of the heat transfer surfaces can be mitigated by using Clyde Bergemann sootblowers.



Our key technologies: The FH series and model D92



Key FH series design features

- reliable, heavy duty chain drive mechanism
- convergent-divergent nozzle design
- easily maintained
- partial retract option
- emergency manual operation from a fixed position

Operation data

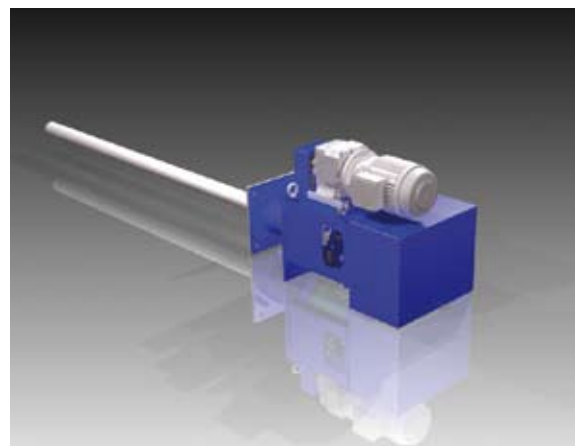
blowing medium	steam or air
blowing medium pressure	typically 7 to 70 barg supply
typical steam consumption	54 - 76 kg/min per nozzle
blowing time	operating time minus 30 seconds
blowing arc	360°
approx. weight: FH/E/2	(270 + 37S) kg, where S is the stroke
approx. weight: FH/E/3	(140 + 80S) kg, where S is the stroke

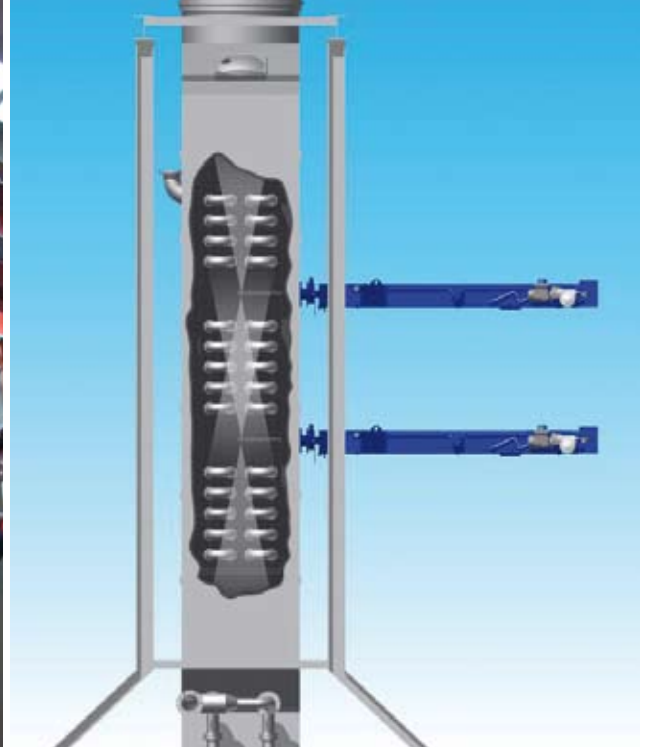
Key D92 design features

- low maintenance design
- minimised spare parts stock
- emergency manual operation
- choice of wall boxes
- minimal external space requirement

Operation data

blowing medium	steam or air
blowing medium pressure	typically 7 to 40 barg supply
typical steam consumption	3.4 kg/min per nozzle
blowing time	up to 56 secs
blowing arc	30° to 360°
approx. weight	120 kg





Hazardous area control systems

Customised for the market

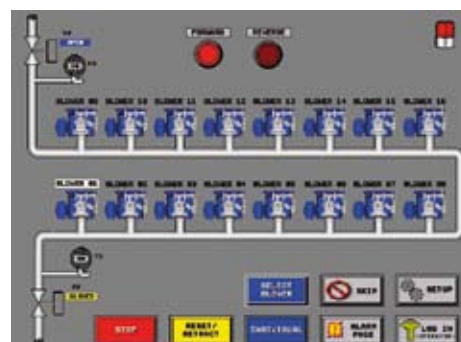
A key part of our on-load cleaning technology is the control and monitoring of the sootblower motor and limit switches as well as the system associated pipework valves and instrumentation. The flexibility of our design approach allows us to cost effectively custom build systems to meet our customers requirements and project specifications. We have provided sootblower control systems to petrochemical and refinery sites worldwide, e.g. to Russia with the requirement for GOST certification and ambient temperatures of -49°C and to Saudi Arabia with ambient temperature of $+50^{\circ}\text{C}$.

In the petrochemical and refining industries, we can supply local sootblower control panels suitable for use in any typical hazardous area environment. Area classifications where our control panels are typically located would be in a NEC Class 1 Division 2 gas group C&D T3 or ATEX Zone 2 gas group IIC T3. All our control panels are supplied with the relevant hazardous area certification confirming the equipment is suitable for use in that environment.

Design basis

The sootblower control panel generally comprises a PLC (Programmable Logic Controller), power transformer, three phase motor contactors, safety interlocks and field wiring terminals. The range of controls panels we supply includes:

- ATEX combination EExd (flameproof) and EExe (increased safety) panels with the sparking equipment housed in the EExd panel and the field terminals housed in the EExe panel
- ATEX ExnP (simplified) purge panel for Zone 2
- Z-type purged panel with a NEMA 4X stainless steel enclosure, manufactured in line with NFPA-496
- Safe area IP65 panel located in non hazardous areas





On and off-site services for increased availability of your on-load cleaning technology



Round the clock support

Our experienced team of service engineers are available to offer you support for all types of on-load cleaning technology. With a range of after sales options from on and off-site services, spare parts, overhauls and upgrades, we can ensure optimised availability of your on-load cleaning technology.

We pride ourselves on our extensive knowledge of on-load cleaning technologies and our ability to provide a first-class service to our valuable customers. Our specialist team of engineers travel the globe to ensure our equipment is operating at maximum performance.

Time and access permitting, our free site service audit report team can review current practices and make recommendations for improved maintenance and system upgrades to further enhance the facility effectiveness. This service is designed to ensure our continued after market support is maintained and that our customers experience a full and beneficial experience with us.

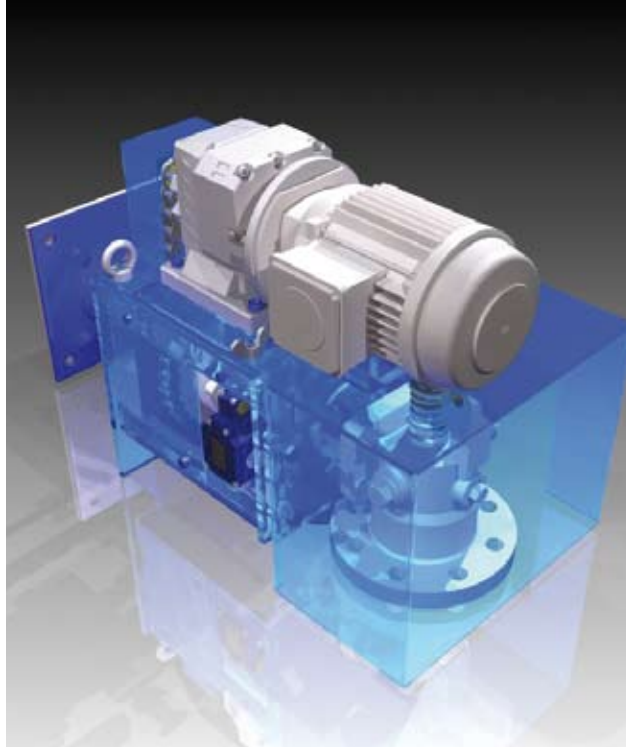
We also hold an extensive inventory of spare parts at our manufacturing facility in Scotland. Regular check-ups, maintenance and replacement will facilitate extended life and availability of the equipment and provide reliable operating systems for increased heat exchanger efficiency.

Our services include:

- installation, commissioning and start-up
- site surveys
- inspections
- maintenance and repair
- maintenance contracts
- control system upgrades
- on-load cleaning technology upgrades
- spare parts
- optimisation

⚙️ Your advantages

- increased availability, efficiency and throughput
- optimised performance
- quick response time
- just-in-time delivery of spare parts
- spare parts and service for all type of on-load cleaning technology



An example: 3% reduction in fuel consumption

The situation

An independent benchmarking process carried out at the SAMIR Mohammedia Refinery in Morocco identified several opportunities to improve efficiency and reduce operating costs. One of the areas highlighted in the study was the potential for fuel savings on the process heaters through improved heat transfer by eliminating heavy fouling. This would involve upgrading the original on-load cleaning systems to the latest technologies available in the market today.

Phase one of their modernisation programme involved the replacement of on-load cleaning technology on two identical fired heaters which were used on an atmospheric distillation process. It was decided that each heater would be undertaken as two separate projects by the refinery, the second of which would be dependent on the results of the first.

Following an on-site survey of the first heater, Clyde Bergemann was awarded the contract to supply 36-off D92 sootblowers in January 2003 and following the positive outcome of the first installation, the contract for the second heater was also received by Clyde Bergemann in February 2007.

The results

After the installation of sootblowers on the second heater, the refinery carried out a survey to determine the effectiveness of the D92's on the second process heater. This project also included 12-off D92's on six additional heaters (2-off per heater) which were also included in their upgrade programme.

As a result of increased heat transfer on the convection zone, fuel consumption was reduced by 3% per annum from 4,745 tonnes to 4,603 tonnes providing an overall fuel saving of US \$1.48 million per annum.

RESULTS	(US \$ per annum)
Investment	1.29 million
Fuel saving	1.66 million
additional consumption:	
- electrical (motors)	0.13 million
- steam	0.05 million
Fuel saving after deduction of additional consumption	1.48 million
PAYBACK PERIOD - 11 MONTHS	

Clyde Bergemann is represented in over 40 countries worldwide



- Clyde Bergemann Companies
- Clyde Bergemann Associates



Clyde Bergemann Ltd

47 Broad Street, Bridgeton
Glasgow G40 2QR
Scotland, UK

Tel: +44 (0) 141 550 5400
Fax: +44 (0) 141 550 5402

Internet: www.clydebergemann.co.uk
eMail: info@clydebergemann.co.uk

● Europe

Clyde Bergemann GmbH
Wesel / Germany
Tel: +49 281 815-0
eMail: sales@cbw.de

Clyde Bergemann
Materials Handling Ltd
Doncaster / England
Tel: +44 1302 552200
eMail: powersales@cbmh.co.uk

Clyde Bergemann Ltd
Glasgow / Scotland
Tel: +44 141 550 5400
eMail: info@clydebergemann.co.uk

Clyde Bergemann Forest SA
Gosselies / Belgium
Tel: +32 71 91 94 10
eMail: cbfsales@cbw.de

Clyde Bergemann
Service GmbH
Grevenbroich / Germany
Tel: +49 2181 164809
eMail: sales@clydebergemann.de

Clyde Bergemann Eesti AS
Tallinn / Estonia
Tel: +372 625 9570
eMail: cbesales@cbw.de

Clyde Bergemann
DRYCON GmbH
Wesel / Germany
Tel: +49 281 815-0
eMail: sales@cbw.de

Clyde Bergemann
Scandinavia Oy
Espoo / Finland
Tel: +358 9 8330 0600
eMail: scandinavia@clydebergemann.fi

Clyde Bergemann
Polska Sp. z o.o.
Tychy / Poland
Tel: +48 32 216 8412
eMail: biuro@clydebergemann.com.pl

Endat Oy
Espoo / Finland
Tel: +358-4529 11111
eMail: info@endat.fi

Clyde Bergemann
TERMOTEC GmbH
Wilnsdorf / Germany
Tel: +49 2739 80719-0
eMail: info@termotec.de

Clyde Bergemann
Brinkmann GmbH
Wesel / Germany
Tel: +49 281 81534-0
eMail: info@clydebergemann.de

Clyde Bergemann
EP Tech S.r.l.
Battipaglia / Italy
Tel: +39 0828 305 421
eMail: info@clydebergemann.it

● Americas

Clyde Bergemann Inc.
Atlanta / GA-USA
Tel: + 1 770 557 3600
eMail: info@clydebergemann.com

Clyde Bergemann EEC
Baltimore / MD-USA
Tel: +1 410 368 7000
eMail: info@cbeec1.com

Clyde Bergemann
Delta Ducon Inc.
Malvern / PA-USA
Tel: + 1 610 695 9700
eMail: sales@deltaducon.com

Clyde Bergemann Canada Ltd
Cambridge, Ontario / Canada
Tel: +1 800 267 3068 toll free
eMail: csc@clydebergemann.com

Clyde Bergemann
Anthony Ross Company
Beaverton / Oregon
Tel: + 1 503 641 0545
eMail: sales@anthonyross.com

Clyde Bergemann Bachmann Inc.
Auburn / ME-USA
Tel: +1 207 784 1903
eMail: sales@bachmannusa.com

Clyde Bergemann do Brasil Ltda
Mogi Guacu / Brazil
Tel: +55 19 3841 5086
eMail: contato@clydebergemann.com.br

Clyde Bergemann Colombia SAS
Bogotá / Colombia
Tel: + 57 310 3251152
eMail: info@clydebergemann.com

● Asia

Shanghai Clyde Bergemann Machinery
Co., Ltd
Shanghai / China
Tel: + 86 21 65396385
eMail: sales@scbmc.com

Clyde Bergemann Huatong Materials
Handling Company Ltd
Beijing / China
Tel: + 86 10 58561956
eMail: sales@cbh.net.cn

Clyde Bergemann Energy &
Environmental Technology
(Beijing) Co., Ltd
Beijing / China
Tel: + 86 10 51650099
eMail: general@cbbeijing.com

Clyde Bergemann India Pvt. Ltd
Noida (Uttar Pradesh) / India
Tel: + 91 120 4073 101
eMail: sales@clydebergemann.in

Macawber Beekay Ltd
New Delhi / India
Tel: + 91 11 619 5563
eMail: rohit@bsbkgroup.com

PT. Clyde Bergemann Indonesia
Jakarta / Indonesia
Tel: + 62 21 532 8002
eMail: agustinus.tjhay@clydebergemann.com

● Australia

Clyde Bergemann Senior Thermal
Pty Ltd
Wetherill Park / Australia
Tel: +61 2 9757 7400
eMail: sales@cbst.com.au

● Africa

Clyde Bergemann Africa Pty Ltd
Kya Sands / South Africa
Tel: +27 11 704 0580
eMail: enquiry@cbz.co.za