

# International Rotating Equipment Conference

Pumps and Compressors

Düsseldorf, 28<sup>th</sup>–29<sup>th</sup> October 2008



**PROGRAMME**

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## Ladies and Gentlemen,

As a result of continuous research and development, the worldwide pump, compressor and compressed air technology sector now enjoys an excellent reputation for innovative pump and compressor technology and excellent product quality. The pump, compressor and compressed air sector is anxious to further enhance this reputation by effective communication with its customers and suppliers. This conference offers a unique possibility to present possible solutions of the sector, face up to discussions with users and manufacturers and accept suggestions for the coming years.

As the promoter, we are pleased to offer you the first “International Rotating Equipment Conference – Pumps and Compressors” with three International forums consolidated: the 9<sup>th</sup> Pump Users International Forum, the 2<sup>nd</sup> Compressor Users International Forum and the 6<sup>th</sup> EFRC (European Forum for Reciprocating Compressors) Conference. Together with our European partner associations EUROPUMP and PNEUROPE and with the additional support from many trade associations and professional bodies, it has enabled us to maximize the collaborative effect.

Whether you are a user, manufacturer, supplier, research & development, pump, compressor and compressed air expert or you are new to the sector, we are certain that you will find the depth and quality of the specialist programme compiled with the International “Call for Papers” of interest and value. On behalf of the VDMA and EFRC, it is with the greatest pleasure that we welcome you to the Conference.



Jürgen Arnold  
Chairman of VDMA Pumps + Systems Association



Thomas Kaeser  
Chairman of VDMA Compressors, Compressed Air and Vacuum  
Technology Association



Siegmund Cierniak  
Chairman of EFRC European Forum for Reciprocating Compressors

# Pump Users International Forum

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## 6<sup>th</sup> EFRC Conference

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HOERBIGER Kompressortechnik Holding

## **Technical Exhibition**

During the two days of the “International Rotating Equipment Conference – Pumps and Compressors” a Technical Exhibition will take place. Manufacturers and sub-suppliers will present a lot of product information in the CCD-Stadthalle within Düsseldorf Congress Center. Companies have the opportunity to present themselves in a kind of “meeting-point” (booth). For interested companies standard booths are offered including a qualified and uniform booth design. Please ask for the participation conditions VDMA Pumps + Systems Association, Frankfurt and indicate your request on the registration form.

### **Opening times of the Technical Exhibition**

Tuesday, 28<sup>th</sup> October 2008, 09.00 h until 18.00 h

Wednesday, 29<sup>th</sup> October 2008, 09.00 h until 16.00 h

Tuesday, 28.10.2008

**9.00 h, Room 1**

## **Opening Plenary Session**

### **Welcome**

by the Chairman  
of the VDMA Pumps + Systems Association  
Jürgen Arnold

by the Chairman  
of the VDMA Compressors, Compressed Air and  
Vacuum Technology Association  
Thomas Kaeser

and by the Chairman  
of the European Forum for Reciprocating Compressors  
Siegmond Cierniak

### **Welcome Address**

by the President of EUROPUMP  
Ken Hall

and by the President of PNEUROP  
Peter Seroczynski

### **Plenary Lectures**

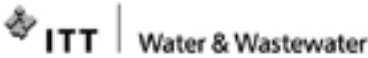
Helmut Langanger, OMV  
Executive Vice President  
The New Era for the Oil & Gas Industry – Challenges & Chances

Wilhelm Otten, Infracor  
Vice President Technology  
Trends in Technical Service – Sustainable Service Concepts for the  
Process Industry



**Pump Users**  
International Forum 2008

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**Monday, 27.10.2008**  
**13.00 h to 18.30 h, Room 26**

## **Training Seminar** **Safe operation of pumps and compressors –** **Focussing the interfaces between** **manufacturer and user\***

<b>Time</b>	<b>Topic</b>
<b>13.00–13.15</b>	Introduction to the Programme
<b>13.15–15.25</b>	Interfaces according to explosion protection (ATEX) – Scope, Marking, Inside-Outside, Documentation ... – Responsibilities of manufacturer/user – Maintenance/Retrofit-
<b>15.25–15.40</b>	Discussion
<b>15.40–16.00</b>	Coffee break
<b>16.00–17.50</b>	Interfaces according to the challenges by functional safety (EN 13849; EN 61511/61508, ...) – Scope of relevant standards – Which standard is applicable? – Consequences and responsibilities?
<b>18.00–18.15</b>	Discussion
<b>18.15–18.30</b>	Summary and Conclusions

For participation fee see page 63.

responsible:

Dr. Heino Bothe (PTB),  
Dr. Uwe Klausmeyer (PTB),  
Dr. Ulrich Johannsmeyer (PTB)  
Dr. Rainer Grätz (BAM),  
Dr. Heribert Oberhem (Bayer Crop Science),  
Konrad Brehm (Bayer Industries Services),  
Friedrich Klütsch (VDMA)

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\*Possible subject to modifications

## Training Seminar Where does research and development of pumps and compressors go?\*

Time	Topic
13.00–13.15	Introduction to the Programme
13.15–14.15	Condition monitoring for pumps and compressors
14.20–15.15	Rotodynamic pump design
15.15–15.30	Discussion
15.30–15.50	Coffee break
15.50–16.50	Pump and Compressor Systems – Cause and effects of pressure pulsation – Network philosophy and energy efficiency of pump and compressor systems
16.50–17.15	Options by using ionic liquids in pumps and compressors
17.15–17.45	Options and borderlines of simulation
17.50–18.30	Summary, discussion and conclusion

For participation fee see page 63.

responsible:

Prof. Paul-Uwe Thamsen (TU Berlin),  
Prof. Eberhard Schlücker (Universität Erlangen-Nürnberg),  
Prof. Günter Kosyna (TU Braunschweig),  
Prof. Peter Pelz (TU Darmstadt),  
Prof. Andreas Brümmer (Universität Dortmund),  
Prof. Rudolf Schilling (TU München)  
Harald Frank (VDMA)

\*Possible subject to modifications

## Oil, gas and refinery applications

**Chairmen:** Hannes Lünzmann  
Hans Georg Scholl

**1-1** Hans-Jürgen Schöner

Multiphase pumping – a contribution to the protection of climate and environment

**1-2** Eberhard Schlücker / Andrej Ruschel / Roland Maurischat

Investigation of the flow behaviour and cavitation phenomena in screw pumps using high-speed camera technique

**1-3** Charles de Marolles / Nicolas Lagas

Latest development on barrel multistage pumps for refinery application

**1-4\*** David Clark

The safe and reliable application of API 685 magnetic drive pumps

**1-5\*** Thomas Herbers / Michael Schedl

Reduction of maintenance costs by the use of magnet drive pumps in a refinery's bitumen plant

\* This Technical Paper will be published in the proceedings. Due to time limits a presentation during the Forum is not foreseen.

Tuesday, 28.10.2008

11.00 h, Room 1

## Session 2

### Wastewater pumps

**Chairmen:** Roland Jeschke  
Werner Kröber

**2-1** Michael Hirschberger / Jörg Kuhlmann / Friedrich-Karl Benra  
Computer based development of sewage water pumps for extreme operating conditions and high power consumption

**2-2** Brian De Souza  
Single-blade-impeller development using the design of experiments method

**2-3** Richard McEvoy  
Numerical simulation of a single-blade-impeller wastewater pump

Tuesday, 28.10.2008

11.00 h, Room 27

## Session 3

### Basic Research & Development

**Chairmen:** Klaus Oppermann  
Rudolf Schilling

**3-1** Oliver Schade / Eberhard Schlücker  
Cavitation in positive displacement pumps (– not a mystery any more –)

**3-2** Petra Perez Flores / Günter Kosyna / Detlev Wulff  
Performance curve stabilisation of axial flow pumps by passive flow control

**3-3** Rok Pavlin  
Solution of the suction piping design for the large fluid transport pumps

Tuesday, 28.10.2008

**14.00 h, Room 14**

**Session 4**

## Maintenance and safety operations

Chairmen: Jürgen Konrad  
Kurt Bieniek

**4-1** Matthias Himstedt

Explosion protection concept for liquid pumps of ATEX category 1

**4-2** Stephan Näckel / Per Karlsson

A 17m long submerged vertical pump as part of a new safety concept at the Kemira Kemi AB plant in Helsingborg, Sweden

**4-3** Michael Danitschek

“ReMain” Reliability centred maintenance

**4-4\*** Bernhard Dudenhöffer

Retrofit – Improve pump performance and efficiency

Tuesday, 28.10.2008

**14.00 h, Room 1**

**Session 5**

## Mixers

**Chairmen:** Frank Ennenbach  
Henning Hunecke

**5-1** Dieter-Heinz Hellmann / Lutz Urban / Peer Springer

Design of submersible mixers for highly viscous fluids in ponds of any shape

**5-2** Frank Holz / Franka Schneider / Frank-Hendrik Wurm

Optimization of mixers for sewage plants

**5-3** Peer Springer

Influence of aeration in activated sludge tanks on the operating conditions of the mixers used

\* This Technical Paper will be published in the proceedings. Due to time limits a presentation during the Forum is not foreseen.

Tuesday, 28.10.2008

14.00 h, Room 27

## Session 6

### CFD Technology

**Chairmen:** Frank-Hendrik Wurm  
Jochen Fritz

**6-1** Eberhard Schlücker / Stefan Blendinger / Matthias Sauter  
Computational fluid dynamics simulation of reciprocating pumps with respect to the fluid driven valve motion

**6-2** Philippe Dupont / Venkatesal Balakrishnan / Mike Cugal  
Usage of CFD in the analysis and the optimization of the hydraulic performance of vertical pumps

**6-3** Rudolf Schilling / Mathias Bogner / Benedikt Flurl/ Carsten Schmalhorst  
Development of a “numerical test rig” for hydraulic turbo-machinery

Tuesday, 28.10.2008

16.00 h, Room 14

## Session 7

### Special aspects of product development

**Chairmen:** Günter Kosyna  
Eberhard Schlücker

**7-1** Friedrich Fröhlig / Saban Caglar / Martin Gabi  
Investigations on semi open impellers using Stereo-Particle-Image-Velocimetry and computational fluid dynamics

**7-2** Matti Koivikko / Sami Virtanen / Reijo Karvinen  
Design procedure of pumps with high efficiency

**7-3** Valérie Bischof / Peter Pelz / Bernd Stoffel / Gerhard Ludwig  
Self optimisation of pumping modules with hydrodynamic interaction

**7-4\*** Eugeny Spiridonov  
Calculation and design of liquid-gas ejectors

\* This Technical Paper will be published in the proceedings. Due to time limits a presentation during the Forum is not foreseen.

Tuesday, 28.10.2008

**16.00 h, Room 1**

**Session 8**

## **Wastewater systems**

**Chairmen:** Frank Ennenbach  
Henning Hunecke

**8-1** Markus Detzler / Wolfram Kuhn

Practical test: Rubberised pump wins endurance test against chrome permanent mould casting and ceramic coating

**8-2** Paul Uwe Thamsen / Manfred Oesterle / Manfred Tornow

Optimization of sewage pumping station using system approach

**8-3** Werner Kröber / Torben Bubelach

Experiences with speed-controlled operation of sewage pumps at the Berliner Wasserbetriebe

Tuesday, 28.10.2008

**16.00 h, Room 27**

**Session 9**

## **Cleanability and careful conveying**

**Chairmen:** Falk Bahm  
Jochen Fritz

**9-1** Heiko Kipp / Dieter-Heinz Hellmann / Eberhard Schlücker / Rainer Pfeffer

Validation of velocity distributions in hygienic designed multistage centrifugal pumps

**9-2** Judith Brandmayer / Eberhard Schlücker

The Protist *Euglena gracilis* as a biological indicator for the hurtful effect of flow in Pumps and Piping Systems on sensitive biological process suspensions

**9-3** Simon Schneider / Dieter-Heinz Hellmann / Oliver Schuster

Investigation of the influence of back shroud blades on the axial thrust of half-open impellers for hygienic design

## Session 10

### Chemical and process industry

**Chairmen:** Andreas Höhler  
Lutz Mittelbach

**10-1** Axel Binder / Christoph Polzer

Novel centrifugal pump concept solves a major problem in micro process engineering

**10-2** Dieter Klefoth / Patrick Uebelherr / Stefan Seemer

Improving efficiency and reliability of a cooling water supply system in a wire manufacturing process by speed controlling the pumps

**10-3** Falk Bahm / Ulrich Rennett

First PFA/PTFE lined mag-drive process pumps for up to 550 m<sup>3</sup>/h – even for highly corrosive media

**10-4\*** Reinhard Kurtz / Katrin Abraham

Surface treatment in general – Pump applications for paintshop in the automotive industry

**10-5\*** Heinz Nägel / Qian Jinguo / Wang Xutao

Application of FELUWA coal slurry pumps in the pressurized coal slurry gasification process

**10-6\*** Dirk Kollmar / Katrin Abraham

Contribution to energy savings

\* This Technical Paper will be published in the proceedings. Due to time limits a presentation during the Forum is not foreseen.

Wednesday, 29.10.2008

09.00 h, Room 28

Session 11

## Energy efficient pump components

**Chairmen:** Lars Kampmeier  
Thomas Herbers

**11-1** Rok Pavlin  
Cooling water pumps retrofit

**11-2** John Veness  
Minimising power losses in sealless pumps

**11-3** Ilie Rachieru / Liviu Gheorghiu / Marjan Silovic  
Improving efficiency of a district heating system by modernizing the pump operation

Wednesday, 29.10.2008

09.00 h, Room 14

Session 12

## Power generation

**Chairmen:** Michael Hirschberger  
Stefan Krämer

**12-1** Sohail Ahmed / Reinhard Leithner / Detlev Wulff / Günter Kosyna  
Increasing life time and reliability of a large boiler feed water pump by means of coupled FEM-CFD simulations

**12-2** Gerd Witte / Manfred Stollenwerk / Klaus Buttman  
Energy saving of cooling water pumps for fossile power plants using adjustable propeller blades

**12-3** Stefan Dötsch  
Pumps by KSB for FGD in CPS-Design

Wednesday, 29.10.2008

11.00 h, Room 27

## Session 13

### Pumping of special liquids

**Chairmen:** Rüdiger Nagel  
Peter Pelz

**13-1** Andrew Maxwell / Grant Kenworthy / Ken Naylor  
Latex pumping

**13-2** Siegfried Liegat / Dirk Küllmey  
Development on magnetic driven pumps for toxic and critical fluids

**13-3** Henning Mollenhauer  
New designed pumps for LPG! Technical solutions, advantages

**13-4\*** Stefan Dötsch  
Pumps for heat transfer applications

Wednesday, 29.10.2008

11.00 h, Room 28

## Session 14

### Energy efficient pump systems

**Chairmen:** Christof Plum  
Lars Kampmeier

**14-1** Peter Janknecht  
Frequency converters and hydrodynamic couplings as pump drives

**14-2** Heinz Bohn  
Additional energy savings with speed-controlled pumps by optimized impeller trim and adapted switching

**14-3** Trinath Sahoo  
Strategies to improve energy efficiency of centrifugal pumps

**14-4\*** Bernhard Dudenhöffer  
Retrofit – Improve pump performance and efficiency

\* This Technical Paper will be published in the proceedings. Due to time limits a presentation during the Forum is not foreseen.

Wednesday, 29.10.2008

11.00 h, Room 14

Session 15

## Building applications; Innovative solutions

**Chairmen:** Jürgen Frisch  
Rüdiger Nagel

**15-1** Carsten Skovmose Kallesoe / Niels Bidstrup  
Adaptive control of domestic circulators

**15-2** Joachim Diede  
A novel pump management concept saves energy in heating and climatization systems

**15-3** Rainer Hirschberg  
Decentral pumps in heating systems – a new hydraulic approach

Wednesday, 29.10.2008

14.00 h, Room 27

Session 16

## New technology for SiC components for mechanical seals and sealless pumps

**Chairmen:** Jürgen Konrad  
Thomas Herbers

**16-1** Martin Kirchhof / Michael Rieger / Andreas Schrüfer  
Diamond coating for mechanical seals in bad-actor applications – pumping gas-containing fluids and slurry

**16-2** Stefanie Wildhack / Josef Kracker / Maria Opyd / Andreas Rendtel  
SSiC-materials for highly stressed components in sealing and bearing applications

**16-3** Anja Dwars / Maïke van Geldern / Jürgen Gröschel  
Polycrystalline diamond coatings for extreme tribological applications

Wednesday, 29.10.2008

14.00 h, Room 28

## Session 17

### Analysis and improvement of system performance

**Chairmen:** Peter Pelz  
Thomas Scheuring

**17-1** André Eijk / Carsten Weiß / Gerhard Nendzig / Ulrich Theurer

Static and dynamic optimisation design of the piping of a coal liquefaction plant

**17-2** Jan Smeulers

Root cause analysis and reduction of high frequency vibrations in three propane pumps

**17-3** Frank-Hendrik Wurm

Optimization of pumping systems

**17-4\*** Bas Tilborghs / Harry Korst

Discharge damper failure of a triplex plunger pump

Wednesday, 29.10.2008

14.00 h, Room 14

## Session 18

### Building applications; Energy efficiency

**Chairmen:** Jürgen Frisch  
Heiner Kösters

**18-1** Niels Bidstrup / Markus Teepe

Circulators in buildings as EuP's

**18-2** Dieter Wolff

Efficiency in practice: TOP-A-Level pumps at the Maritim Hannover Airport. Much more savings in future by raising quality of planning and installation

**18-3** Rainer Hirschberg

Annual European part load profile of heating pumps in non-residential buildings

\* This Technical Paper will be published in the proceedings. Due to time limits a presentation during the Forum is not foreseen.

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**Compressor Users**  
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Monday, 27.10.2008  
13.00 h to 18.30 h, Room 26

## Training Seminar Safe operation of pumps and compressors – Focussing the interfaces between manufacturer and user\*

Time	Topic
13.00–13.15	Introduction to the Programme
13.15–15.25	Interfaces according to explosion protection (ATEX) – Scope, Marking, Inside-Outside, Documentation ... – Responsibilities of manufacturer/user – Maintenance/Retrofit
15.25–15.40	Discussion
15.40–16.00	Coffee break
16.00–17.50	Interfaces according to the challenges by functional safety (EN 13849; EN 61511/61508, ...) – Scope of relevant standards – Which standard is applicable? – Consequences and responsibilities?
18.00–18.15	Discussion
18.15–18.30	Summary and Conclusions

For participation fee see page 63.

responsible:

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## Training Seminar

### Where does research and development of pumps and compressors go?\*

Time	Topic
13.00–13.15	Introduction to the Programme
13.15–14.15	Condition monitoring for pumps and compressors
14.20–15.15	Rotodynamic pump design
15.15–15.30	Discussion
15.30–15.50	Coffee break
15.50–16.50	Pump and Compressor Systems – Cause and effects of pressure pulsation – Network philosophy and energy efficiency of pump and compressor systems
16.50–17.15	Options by using ionic liquids in pumps and compressors
17.15–17.45	Options and borderlines of simulation
17.50–18.30	Summary, discussion and conclusion

For participation fee see page 63.

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Tuesday, 28.10.2008

**11.00 h, Room 26**

**Session 19**

## Drive technologies

**Chairmen:** Friedrich Justen  
Matthias Zelinger

**19-1** Markus Sauerborn

Energy recovery by adapting turboexpander stages to integrally geared centrifugal compressors in hydrogen peroxide production process

**19-2** Wolfgang Sautter

Selecting the most economical drive system for centrifugal compressors

Tuesday, 28.10.2008

**11.00 h, Room 18/19**

**Session 20**

## Energy efficient systems – a successful approach\*\*

**Chairmen:** Gerhard Berge  
Christoph Singrün

The VDMA/dena campaign:

Energy efficient pump systems in trade and industry

- Introduction and description (dena/VDMA)
- Assessment process
- Realised energy savings presented by industry partners:
  - Grundfos
  - KSB
  - Sulzer
  - Wilo

\*\* Simultaneous interpretation from English to German will be provided.

Tuesday, 28.10.2008

14.00 h, Room 26

## Session 21

### Oil and gas applications

**Chairmen:** Hans-Georg Janssen  
Andreas Brümmer

**21-1** Jan Smeulers / Stefan Belfroid / René Peters / Marco Giachi / Gilbert Habets

Resolving flow induced pulsations and vibrations in the suction line of a large volume axial compressor

**21-2** Paul Hancock / Hilde Fosse / Bente Egeland

Gas compression modifications for late life conditions on the Statfjord A. Plattform

**21-3** Henning Struck

Special requirements on compressors on LNG Carriers

Tuesday, 28.10.2008

14.00 h, Room 18/19

## Session 22

### Energy efficiency in compressors and compressed air systems I\*\*

**Chairmen:** Volker Thomassen  
Werner Brinkhoff

**22-1** Mercedes Hernandez

Scroll compressors: a unique and value adding technology for many compressed air applications

**22-2** Peter Radgen

Compressor splitting and/or speed control – improving energy efficiency efficiently

**22-3** Jürgen Hütter

Efficient compressed air production

\*\* Simultaneous interpretation from English to German will be provided.

Tuesday, 28.10.2008  
16.00 h, Room 26

**Session 23**

## Research & Development

**Chairmen:** Andreas Brümmer  
Hans-Georg Janssen

**23-1** Tim Predel / Eberhard Schlücker / Robert Adler  
Ionic liquids as operating liquid in oxygen compressors

**23-2** Zeynep Yigit  
Functional Safety at Turbo Machinery

**23-3** Dominik Surek / Silke Stempin  
Dynamic pressure oscillations of the impeller in the side channel compressor

Tuesday, 28.10.2008  
16.00 h, Room 18/19

**Session 24**

## Energy efficiency in compressors and compressed air systems II\*\*

**Chairmen:** Peter Radgen  
Andreas Weiß

**24-1** Reinhard Albert  
Environmental and cost advantages through energy efficiency measures in compressed air facilities

**24-2** Erwin Ruppelt  
Increase availability and reduce costs

**24-3** Urban Pettersson  
Identify and Implement Energy Savings within a compressed air network

\*\* Simultaneous interpretation from English to German will be provided.

Wednesday, 29.10.2008  
09.00 h, Room 26

## Session 25

### Sealing technologies

**Chairmen:** Stefan Bosen  
Wolfgang Zacharias

**25-1** Detlev Steinmann  
Separation seal – the seal behind the dry gas seal

**25-2** Michael Schiller / Detlev Steinmann  
Dry gas seal in high pressure service

**25-3** Michael Sattler  
Robust dry gas seal “MDGS” for process gas screw and centrifugal compressors

Wednesday, 29.10.2008  
09.00 h, Room 18/19

## Session 26

### Vacuum pump design and manufacturing\*\*

**Chairmen:** Reinhard Maaz  
Friedrich Justen

**26-1** Ronald Sachs / Aleksandr Shirinov  
OnTool™ Booster – A molecular pump working against atmosphere

**26-2** Andreas Brümmer / Knut Kauder / Dirk Stratmann  
Operating performance of screw vacuum pumps – experimental and theoretical analysis

\*\* Simultaneous interpretation from English to German will be provided.

Wednesday, 29.10.2008

11.00 h, Room 26

Session 27

## Compressor design and manufacturing I

**Chairmen:** Reinhard Maaz  
Thomas Scheuring

**27-1** Paul Lefley / Ian Currington / Andrew Hogbin  
Energy efficiency advantages of a brushless DC motor for a variable speed compressor

**27-2** Ian Currington / Bernard Whicher  
Design considerations of a sealless compressor for hazardous duties

**27-3** Jürgen Bohn / Ion Ispas / Patrick Peters  
Impeller shroud seal influence on performance of centrifugal compressor stages

Wednesday, 29.10.2008

11.00 h, Room 18/19

Session 28

## System design and monitoring\*\*

**Chairmen:** Susanne Fulko  
Roland Schuhmann

**28-1** Lee Alexander / Xavier Huin  
The development of non intrusive compressor monitoring systems

**28-2** Herman Geyskens  
Efficient operation of turbo compressor systems

**28-3** Erwin Ruppelt  
Optimisation of systems with intelligent control – modern compressed air management reduces operational costs

\*\* Simultaneous interpretation from English to German will be provided.

Wednesday, 29.10.2008

## Session 29

14.00 h, Room 26

### Compressor design and manufacturing II

**Chairmen:** Thomas Scheuring  
Roland Schuhmann

**29-1** Markus Huhn

CAD-CAM process chain for an axial compressor blade from a designer's point of view

**29-2** Bernhard Spiegl / Gunther Machu / Peter Steinrück

New technologies for efficiency improvements on PET air compressors

**29-3** Tetsuya Kakiuchi

High pressure oil-injected screw compressor specifications

**29-4\*** Thomas B. Kordik

World novelty: spherical design of the reciprocating compressor, Hüttlin-Kugelkompressor (int. pat.)

Wednesday, 29.10.2008

## Session 30

14.00 h, Room 18/19

### Compressed air quality\*\*

**Chairmen:** Jürgen Hütter  
Koen Lauwers

**30-1** Jens Amberg

Early warning, auto-diagnosis and self-adjustment in compressed air humidity measurement

**30-2** Wolfgang Heikamp / Andreas Stephan / Markus Kolczyk

Energy saving with optimized air-oil-separation elements in the filtration chain

**30-3** Norbert Otto

Measuring of medical respective pharmaceutical compressed air – Comparison of pharmacopoeia, USP and ISO 8573

\* This Technical Paper will be included in the Preprints. A presentation during the Forum is not foreseen.

\*\* Simultaneous interpretation from English to German will be provided.

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<b>Machu, Gunther, Dr.</b> HOERBIGER Ventilwerke GmbH & Co KG A-1110 Wien	Ses. 29
<b>Oberhem, Heribert, Dr.</b> Bayer Crop Science D-41538 Dormagen	TraiSem
<b>Otten, Wilhelm, Dr.</b> Infracor GmbH D-45772 Marl	Plenary
<b>Otto, Norbert</b> C-tec Cleanroom-Technology GmbH D-72108 Rottenburg am Neckar	Ses. 30
<b>Pelz, Peter, Prof.</b> Technische Universität Darmstadt D-64289 Darmstadt	TraiSem
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<b>Peters, René, Dr.</b> TNO Science and Industry NL-2628 CK Delft	Ses. 21
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<b>Petterson, Urban</b> Atlas Copco Airpower n.v. B-2610 Wilrijk	Ses. 24
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<b>Sachs, Ronald, Dr.</b> Pfeiffer Vacuum GmbH D-35614 Asslar	Ses. 26
<b>Sattler, Michael</b> BURGMANN Industries GmbH & Co. KG D-82515 Wolfratshausen	Ses. 25
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<b>Sautter, Wolfgang</b> Voith Turbo GmbH & Co. KG D-74564 Crailsheim	Ses. 19
<b>Scheuring, Thomas, Dr.</b> DECHEMA D-60486 Frankfurt	AdvCom ProgCom Ses. 27, 29
<b>Schiller, Michael</b> Flowserve Dortmund GmbH & Co KG D-44388 Dortmund	Ses. 25
<b>Schilling, Rudolf, Prof.</b> TU München D-85747 Garching	TraiSem
<b>Schlücker, Eberhard, Prof.</b> Universität Erlangen-Nürnberg D-91058 Erlangen	TraiSem
<b>Schuhmann, Roland</b> BASF AG D-67056 Ludwigshafen	ProgCom Ses. 28, 29
<b>Seroczynski, Peter</b> Ingersoll Rand Industrial Technologies GB-CW4 8JA Cheshire	AdvCom Plenary
<b>Shirinov, Aleksandr, Dr.</b> Pfeiffer Vacuum GmbH D-35614 Asslar	Ses. 26
<b>Singrün, Christoph</b> VDMA Fachverband Kompressoren, Druckluft- und Vakuumtechnik D-60528 Frankfurt	AdvCom ProgCom Ses. 20
<b>Smeulers, Jan</b> TNO Science and Industry NL-2628 CK Delft	Ses. 21
<b>Spiegl, Bernhard, Dr.</b> HOERBIGER Kompressortechnik Holding GmbH A-1110 Wien	Ses. 29
<b>Steinmann, Detlev</b> Flowserve Dortmund GmbH & Co KG D-44388 Dortmund	Ses. 25

<b>Steinrück, Peter, Dr.</b> HOERBIGER Kompressortechnik Holding GmbH A-1220 Wien	Ses. 29
<b>Stempin, Silke</b> Fachhochschule Merseburg D-06217 Merseburg	Ses. 23
<b>Stephan, Andreas</b> MANN+HUMMEL GMBH D-67346 Speyer	Ses. 30
<b>Stratmann, Dirk</b> Universität Dortmund D-44227 Dortmund	Ses. 26
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# EFRC

6<sup>th</sup> EFRC

Conference 2008

Sponsored by



Monday, 27.10.2008  
13.00 h to 18.30 h, Room 28

## Training Seminar Pulsations – Fundamentals, Effects and Control Learn from the compression industry’s leading experts

Again EFRC offers a compressor training session focussing on Pulsations in compressor plants. Young engineers from operators, engineering companies and suppliers will be given an in-depth overview about pulsations from fundamentals to trouble shooting for safe and long lasting operation of the compressor unit.

Time	Topic
13.00–13.15	Introduction to the Programme
13.15–14.00	Fundamentals
14.00–14.45	Effects on compressor performance
14.45–15.30	Effects on compressor reliability
15.30–16.00	Coffee break
16.00–16.45	Effects on compressor valve performance
16.45–17.30	Pulsation control
17.30–18.15	Trouble shooting
18.15–18.30	Summary and Conclusions

For participation fee see page 63.

responsible:

- Dr. Peters (TNO Science and Industry)
- Harry Lankenau (NEAC Compressor Service)
- Andreas Allenspach (Burckhardt Compression)
- Dr. Gunther Machu (Hoerbiger Ventilwerke)
- Peter Duineveld (Thomassen Compression Systems)
- Lau Koop (Thomassen Compression Systems)
- Eike Drewes (PROGNOST Systems)

Tuesday, 28.10.2008  
11.00 h, Room 16/17

## Session 31

### Design and Engineering I

**Chairman:** Eike Drewes

**31-1** Lau G. M. Koop

The erection of very heavy 4- and 6-cylinder reciprocating compressors

**31-2** Burkhard Lenth / Ulrich P. Dirkmann

Use of modern control systems in compressor stations

**31-3** Thomas Kälin / Nicole Retz

Assembly- and operation-conditions for compressor valves and lanterns and optimization of the package for different operation conditions

Tuesday, 28.10.2008  
11.00 h, Room 28

## Session 32

### Pulsations & Vibrations I

**Chairman:** Peter Steinrück

**32-1** Erik Slis / Henk Käyser

Piggyback riding on the FPSO Dumbarton and the power of acoustics

**32-2** Shelly Greenfield

Optimizing the pulsation control solution

**32-3** Klaus Brun / Edgar B. Bowles / Danny M. Deffenbaugh

Development of a transient fluid dynamic solver for compression system pulsation analysis

Tuesday, 28.10.2008  
14.00 h, Room 16/17

Session 33

## Design & Engineering II

**Chairman:** Klaus Hoff

**33-1** Georg Samland / Armin Gerland / Volker Peterseim  
Reliable sealing technology for high pressure CO<sub>2</sub> applications

**33-2** Steffen Gast  
Presentation of design versions of piston rods in reciprocating compressors

**33-3** Krunoslav Hercigonja  
ATEX: from the perspective of a compressor manufacturer

Tuesday, 28.10.2008  
14.00 h, Room 28

Session 34

## Fundamentals

**Chairman:** René Peters

**34-1** Stefan Tuma  
Taking the guesswork out of PTFE seals

**34-2** Rainer Kurz / Klaus Brun  
Universal efficiency definition for reciprocating and centrifugal compressors

**34-3** Herbert Kopecek / Helge Klockow / Michael Schmitz / Simone Pratesi / Carlo Mazzalli / Paolo Battagli  
Development and test of an electrical valve actuator for reverse flow capacity control of reciprocating compressors

Tuesday, 28.10.2008  
16.00 h, Room 16/17

## Session 35

### Design & Engineering III

**Chairman:** Georg Samland

**35-1** Klaus Hoff / Egidius Steinbusch  
Hydrodynamic calculation method for crosshead pin bearings especially under less rod load reversal loading

**35-2** Vassilaq Kacani / Ernst Huttar  
Simulation of reciprocating compressor start-up

**35-3** Riccardo Traversari / Marco Fareta  
Virtual prototyping technique applied to the design of a crank-mechanism of a process reciprocating compressor

Tuesday, 28.10.2008  
16.00 h, Room 28

## Session 36

### Operations & Maintenance I

**Chairman:** Heinrich Ochs

**36-1** Uwe Ladwig / Christian Steinkamp  
Avoidance of major secondary damages by early failure detection on a partially fractured piston rod

**36-2** Harry Lankenau  
Compressor Valves – How much liquid can they handle?

**36-3** Andreas Gottmer  
Comparison of calculated and measured torsional vibrations on recip cranks with evaluation of mechanical compressor efficiency

Wednesday, 29.10.2008

09.00 h, Room 1

Session 37

## EFRC Meeting

**Chairman:** Siegmund Cierniak

**37-1** Leonhard Keller / Peter Steinrück

EFRC – the international platform for reciprocating compressor manufacturers and users

**37-2** Siegmund Cierniak

Educating reciprocating compressors engineers at the EFRC

**37-3** André Eijk

EFRC Guideline with recommended vibration levels for reciprocating compressor systems

Wednesday, 29.10.2008

11.00 h, Room 1

Session 38

## Valves

**Chairman:** Peter Duineveld

**38-1** Kevin Durham

Development of elastomeric materials in reciprocating compressor valves: aerodynamics and springless valve design

**38-2** Andrea Raggi / Massimo Schiavone

Electromechanical actuator for reciprocating compressors stepless control

**38-3** Bernhard Spiegl

Material Design for valve applications

## Session 39

Wednesday, 29.10.2008  
11.00 h, Room 16/17

### Operations & Maintenance II

**Chairman:** Ernst Huttar

**39-1** Marcel Hempen / Bernd Wagner  
Case study of a bearing failure analysis

**39-2** Jan Bantjes / Andreas Gottmer  
Detection of damaged clearance pocket valve with online pV analysis

**39-3** Roland Schuhmann / Christian Prinz  
Machinery protection for reciprocating compressors – experiences and outlook

## Session 40

Wednesday, 29.10.2008  
14.00 h, Room 1

### Design & Engineering IV

**Chairman:** Leonhard Keller

**40-1** Horst Becker  
Usage of reciprocating compressors inside the liquefaction process in a LNG peak shaving plant

**40-2** Arend Jan Pol  
Technical and economical aspects in the evaluation for upgrading a reciprocating compressor installation

**40-3** Steffen Gast  
Reactivation and modernisation of the Bx series

## Pulsations & Vibrations II

**Chairman:** Siegmund Cierniak

**41-1** Georg Samland / Nicole Retz

Supporting vibration analysis for the commissioning of a high pressure compressor with foundation problems

**41-2** Eugene "Buddy" Broerman / Robert McKee / Christine Scrivner / Gary Bourn

Advancement in pulsation control for reciprocating compressors

**41-3** Brian Howes / Tony King / David Pearsall

Torsional vibration case study highlights design considerations

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Wednesday, 29.10.2008

**15.30 h, Room 1**

## **Final Plenary Session**

### **Best paper award**

Prior to the Epilogue the best paper awards will be handed over to the selected authors. The submitted papers will be assessed by the programme committee of each Forum. The awards are assigned for the following categories:

Pump Users International Forum:

- Best scientific paper
- Best industry paper

Compressor Users International Forum

- Best paper

### **Closing remarks**

by the Chairman  
of the VDMA Pumps + Systems Association  
Jürgen Arnold

by the Chairman  
of the VDMA Compressors, Compressed Air and Vacuum  
Technology Association  
Thomas Kaeser

and by the Chairman  
of the European Forum for Reciprocating Compressors  
Siegmond Cierniak

# General information

## Proceedings

Proceedings include the Technical Papers of all Sessions of either the Pump Users International Forum, Compressor Users International Forum or EFRC Conference. The proceedings are written in English language. A participation card for the International Rotating Equipment Conference includes one copy of the conference proceedings (Pump Users International Forum, Compressor Users International Forum or EFRC Conference). Additional proceedings have to be ordered on the registration form. (Fees for additional proceedings see below).

## Sessions – Technical Papers

After a short introduction by the chairman the author will give a presentation of his paper. His speaking time will be 20 minutes. Directly after the presentation the audience has the opportunity to ask the author for 10 minutes.

Please note that the titles of the Technical Papers and presentations may vary because of later changes made by the authors.

## Training Seminars – Explanations

Training Seminars give an in-depth overview about specific technical themes. They offer a good opportunity especially for young engineers from operators, engineering companies and suppliers but also manufacturers or universities to get acquainted with new technical fields. You are kindly asked to mark your request to participate at the registration form (additional fee required!)

## Final report

The final report includes the opening and plenary presentations in unabridged text as well as the full text of Technical Papers in English. The final report will be available early 2009 in form of a CD-ROM/DVD.

## **Languages**

The official conference language will be English. Simultaneous interpretation from English to German for the Sessions of the Pump Users International Forum will be offered. One of two Sessions will be simultaneously interpreted at the Compressor Users International Forum, too. You are kindly asked to mark your request for headphones at the registration form.

## **Internet**

You can find further Information about the Conference at <http://www.introequipcon.com>.

## **Confirmation and participation cards**

After paying your invoice you will get your participation card(s) at the Forum office in Düsseldorf.

## **Participant lists**

Participant lists as well as an exhibitions leaflet and documentation which have not been mailed will be made available in the Forum office.

## **Food and beverages during breaks**

Food and beverages will be offered in the CCD-Stadthalle. It includes a lunch snack on 28<sup>th</sup>/29<sup>th</sup> October 2008. Beverages during breaks are e. g. available in the Foyer. This is free of charge for participants at the conference.

## **Best Paper Award**

As recognition of excellence best paper awards will be given to selected authors. These awards are intended to honour the authors for their outstanding practice experience or well founded scientific paper. The best paper awards of the Pump Users International Forum and the Compressor Users International Forum will be handed over at the Final Plenary. The Best paper award for young engineers of the European Forum for Reciprocating Compressors will be handed over at the EFRC Meeting at Wednesday, 29.10.2008 (Session 37) 09.00 h in Room 1.

## Registration fees

Participation fee for two days\*

Early bird registration\* **(for two days participation only)**  
**until 31. 08. 2008**

EUR 750.– (plus VAT 19%)

Regular registration

EUR 795.– (plus VAT 19%)

Participation fee for one day  
for first day\*

EUR 550.– (plus VAT 19%)

for second day\*

EUR 450.– (plus VAT 19%)

Participation fee for one Training Seminar

EUR 195.– (plus VAT 19%)

The participation card is not transferable!

Possible bank charges are paid by the participant.

\* One issue of the conference proceedings is included.

Additional Proceedings with Technical Papers

EUR 95.– (plus VAT 19%)

Adverts (4c) in proceedings:

Half page

EUR 950.– (plus VAT 19%)

Full page

EUR 1.750.– (plus VAT 19%)

CD-ROM of Technical Papers and final report (only participants)

EUR 30.–

(plus VAT 19%)

The amounts are payable upon receipt of the invoice of the VDMA-Maschinenbau-Institut GmbH.

The participation fee for two days includes the participation at all events indicated in the Forum programme with the visit of the Technical exhibition, food and beverages, cocktail reception and use of simultaneous interpretation connection. The participation fee for one day is only valid for the day paid including the same offer indicated above.

If cancellation of registration arrives **until 10<sup>th</sup> October 2008** 30% of the registration fee will be reimbursed. After this date no reimbursement is offered.

**The participation card paid for the conference allows free entrance to all three Forums!**

Programme alterations may be possible. For information, contact the Forum office please.

## **Registration**

Your Forum attendance has to be confirmed by sending a registration form. Please mark the intended participation on the attached registration form! For registration of more participants please use copies of this registration form or ask for further copies.

Registration preferably on the attached registration form to be addressed to

**VDMA Pumps + Systems Association,  
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## **Room reservation**

Room reservation until **31<sup>st</sup> August 2008** on the attached form to be addressed to

Düsseldorf Marketing & Tourismus GmbH  
Mr. Manuel Kliese  
P. O. Box 10 21 63  
D-40012 Düsseldorf

Fax +49 211 17202-3220  
Phone +49 211 17202-851  
E-Mail [reservation@dus-mt.de](mailto:reservation@dus-mt.de)  
Internet [www.duesseldorf-tourismus.de](http://www.duesseldorf-tourismus.de)

## **Note:**

**Please be sure that you mention the International Rotating Equipment Conference at your room reservation.**

**The conditions of the hotels can change after 31<sup>st</sup> August 2008!**

## **How to get to the conference**

A map and a route description to the Congress Center Düsseldorf can be found at [http://www.duesseldorfcongress.de/download/anfahrt\\_ccdstadthalle\\_p5.pdf](http://www.duesseldorfcongress.de/download/anfahrt_ccdstadthalle_p5.pdf).

For further information, look at the website <http://www.duesseldorfcongress.de/en> of the Congress Center Düsseldorf.

## **Sightseeing**

For sightseeing arrangements please contact the Düsseldorf Marketing & Tourismus GmbH ([www.duesseldorf-tourismus.de](http://www.duesseldorf-tourismus.de)) or look at [http://www.duesseldorfcongress.de/en/destination\\_dus.php4](http://www.duesseldorfcongress.de/en/destination_dus.php4).

## **Forum office prior to the Forum**

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## **Forum office during the Forum**

The Forum office with organisation staff indicated above will be located in the Foyer of the Congress Centre Düsseldorf and will be open on 28<sup>th</sup> and 29<sup>th</sup> October 2008 from 8.00 to 18.00 h.

Enclosure:

- Registration form for participation
- Registration form for room reservation



Day 0: Monday, October 27 <sup>th</sup>	
	<b>Training Seminar</b>
<b>Time</b>	<b>Room 26</b>
13.00–18.30	<b>Safe operation of pumps and compressors – Focussing the interfaces between manufacturer and user</b>
	see pages 8, 32

Day 1: Tuesday, October 28 <sup>th</sup>			
	<b>Pump Users International Forum<sup>1</sup></b>		
<b>Time</b>	<b>Room 14</b>	<b>Room 1</b>	<b>Room 27</b>
09.00–10.30	Room 1		
	Opening Plenary Session; Welcome; Plenary Lectures		
10.30–11.00	Coffee break		
11.00–12.30	<b>Session 1:</b> Oil, gas and refinery applications	<b>Session 2:</b> Wastewater pumps	<b>Session 3:</b> Basic Research & Development
	see page 10	see page 11	see page 11
12.30–14.00	Lunch break		
14.00–15.30	<b>Session 4:</b> Maintenance and safety operations	<b>Session 5:</b> Mixers	<b>Session 6:</b> CFD Technology
	see page 12	see page 12	see page 13
15.30–16.00	Coffee break		
16.00–17.30	<b>Session 7:</b> Special aspects of product development	<b>Session 8:</b> Wastewater systems	<b>Session 9:</b> Cleanability and careful conveying
	see page 13	see page 14	see page 14
17.30	Break		
18.30	Cocktail Reception at Düsseldorf Congress Center		
22.00	End of day 1		

Day 2: Wednesday, October 29 <sup>th</sup>			
	<b>Pump Users International Forum</b>		
<b>Time</b>	<b>Room 27</b>	<b>Room 28</b>	<b>Room 14</b>
09.00–10.30	<b>Session 10:</b> Chemical and process industry	<b>Session 11:</b> Energy efficient pump components	<b>Session 12:</b> Power generation
	see page 15	see page 16	see page 16
10.30–11.00	Coffee break		
11.00–12.30	<b>Session 13:</b> Pumping of special liquids	<b>Session 14:</b> Energy efficient pump systems	<b>Session 15:</b> Building applications; Innovative solutions
	see page 17	see page 17	see page 18
12.30–14.00	Lunch break		
14.00–15.30	<b>Session 16:</b> New technology for SIC components for mechanical seals and sealless pumps	<b>Session 17:</b> Analysis and improvement of system performance	<b>Session 18:</b> Building applications; Energy efficiency
	see page 18	see page 19	see page 19
15.30–15.45	Room 1		
	Final Plenary Session: Best paper award; Closing remarks		
15.45	End of 2008 conference		

Note<sup>1</sup>: Simultaneous interpretation from English to German will be provided for any session.

Day 0: Monday, October 27 <sup>th</sup>	
Training Seminar	
Time	Room 27
13.00–18.30	<b>Where does research and development of pumps and compressors go?</b>
	see pages 9, 33

Day 1: Tuesday, October 28 <sup>th</sup>		
Compressor Users International Forum <sup>2</sup>		
Time	Room 26	Room 18/19
09.00–10.30	Room 1	
	Opening Plenary Session; Welcome; Plenary Lectures	
10.30–11.00	Coffee break	
11.00–12.30	<b>Session 19:</b> Drive technologies	<b>Session 20:</b> Energy efficient systems – a successful approach
	see page 34	see page 34
12.30–14.00	Lunch break	
14.00–15.30	<b>Session 21:</b> Oil and gas applications	<b>Session 22:</b> Energy efficiency in compressors and compressed air systems I
	see page 35	see page 35
15.30–16.00	Coffee break	
16.00–17.30	<b>Session 23:</b> Research & Development	<b>Session 24:</b> Energy efficiency in compressors and compressed air systems II
	see page 36	see page 36
17.30	Break	
18.30	Cocktail Reception at Düsseldorf Congress Center	
22.00	End of day 1	

Day 2: Wednesday, October 29 <sup>th</sup>		
Compressor Users International Forum		
Time	Room 26	Room 18/19
09.00–10.30	<b>Session 25:</b> Sealing technologies	<b>Session 26:</b> Vacuum pump design and manufacturing
	see page 37	see page 37
10.30–11.00	Coffee break	
11.00–12.30	<b>Session 27:</b> Compressor design and manufacturing I	<b>Session 28:</b> System design and monitoring
	see page 38	see page 38
12.30–14.00	Lunch break	
14.00–15.30	<b>Session 29:</b> Compressor design and manufacturing II	<b>Session 30:</b> Compressed air quality
	see page 39	see page 39
15.30–15.45	Room 1	
	Final Plenary Session: Best paper award; Closing remarks	
15.45	End of 2008 conference	

Note<sup>2</sup>: Simultaneous interpretation from English to German will be provided for Sessions 20, 22, 24, 26, 28, 30

**Day 0: Monday, October 27<sup>th</sup>**

Day 0: Monday, October 27 <sup>th</sup>	
Training Seminar	
Time	Room 28
13.00–18.30	<b>Pulsation – Fundamentals, Effects and Control</b>
	see page 48

**Day 1: Tuesday, October 28<sup>th</sup>**

Day 1: Tuesday, October 28 <sup>th</sup>		
6 <sup>th</sup> EFRC Conference		
Time	Room 16/17	Room 28
09.00–10.30	Room 1	
	Opening Plenary Session; Welcome; Plenary Lectures	
10.30–11.00	Coffee break	
11.00–12.30	<b>Session 31:</b> Design & Engineering I	<b>Session 32:</b> Pulsations & Vibrations I
	see page 49	see page 49
12.30–14.00	Lunch break	
14.00–15.30	<b>Session 33:</b> Design & Engineering II	<b>Session 34:</b> Fundamentals
	see page 50	see page 50
15.30–16.00	Coffee break	
16.00–17.30	<b>Session 35:</b> Design & Engineering III	<b>Session 36:</b> Operation & Maintenance I
	see page 51	see page 51
17.30	Break	
18.30	Cocktail Reception at Düsseldorf Congress Center	
22.00	End of day 1	

Technical Exhibition

**Day 2: Wednesday, October 29<sup>th</sup>**

Day 2: Wednesday, October 29 <sup>th</sup>		
6 <sup>th</sup> EFRC Conference		
Time	Room 1	Room 16/17
09.00–10.30	<b>Session 37:</b> EFRC Meeting	
	see page 52	
10.30–11.00	Coffee break	
11.00–12.30	<b>Session 38:</b> Valves	<b>Session 39:</b> Operation & Maintenance II
	see page 52	see page 53
12.30–14.00	Lunch break	
14.00–15.30	<b>Session 40:</b> Design & Engineering IV	<b>Session 41:</b> Pulsations & Vibrations II
	see page 53	see page 54
15.30–15.45	Room 1	
	Final Plenary Session: Best paper award; Closing remarks	
15.45	End of 2008 conference	

Technical Exhibition

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## EFRC

EUROPEAN FORUM  
for RECIPROCATING  
COMPRESSORS

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