

45<sup>TH</sup> TURBOMACHINERY & 32<sup>ND</sup> PUMP SYMPOSIA

# SHOW GUIDE



45<sup>TH</sup> TURBOMACHINERY & 32<sup>ND</sup> PUMP SYMPOSIA  
HOUSTON, TEXAS | SEPTEMBER 12 - 15, 2016  
GEORGE R. BROWN CONVENTION CENTER



**THE PREMIER CONFERENCE FOR TURBOMACHINERY & PUMP PROFESSIONALS,**  
DEVELOPED FOR THE INDUSTRY, BY THE INDUSTRY



## THANK YOU TO EVERYONE WHO MADE THIS EVENT POSSIBLE

Dr. Childs extends his sincere thanks to all of the advisory committee members, exhibitors, technical session leaders, staff and attendees for making this event a success. We are honored to bring you a world-class program and cutting-edge exhibit hall to foster an environment of peer and company networking, and to promote empirical education in the fields of pumps and turbomachinery.

Welcome to the 45<sup>TH</sup> Turbomachinery and 32<sup>ND</sup> Pump Symposium!

## SPONSORED BY



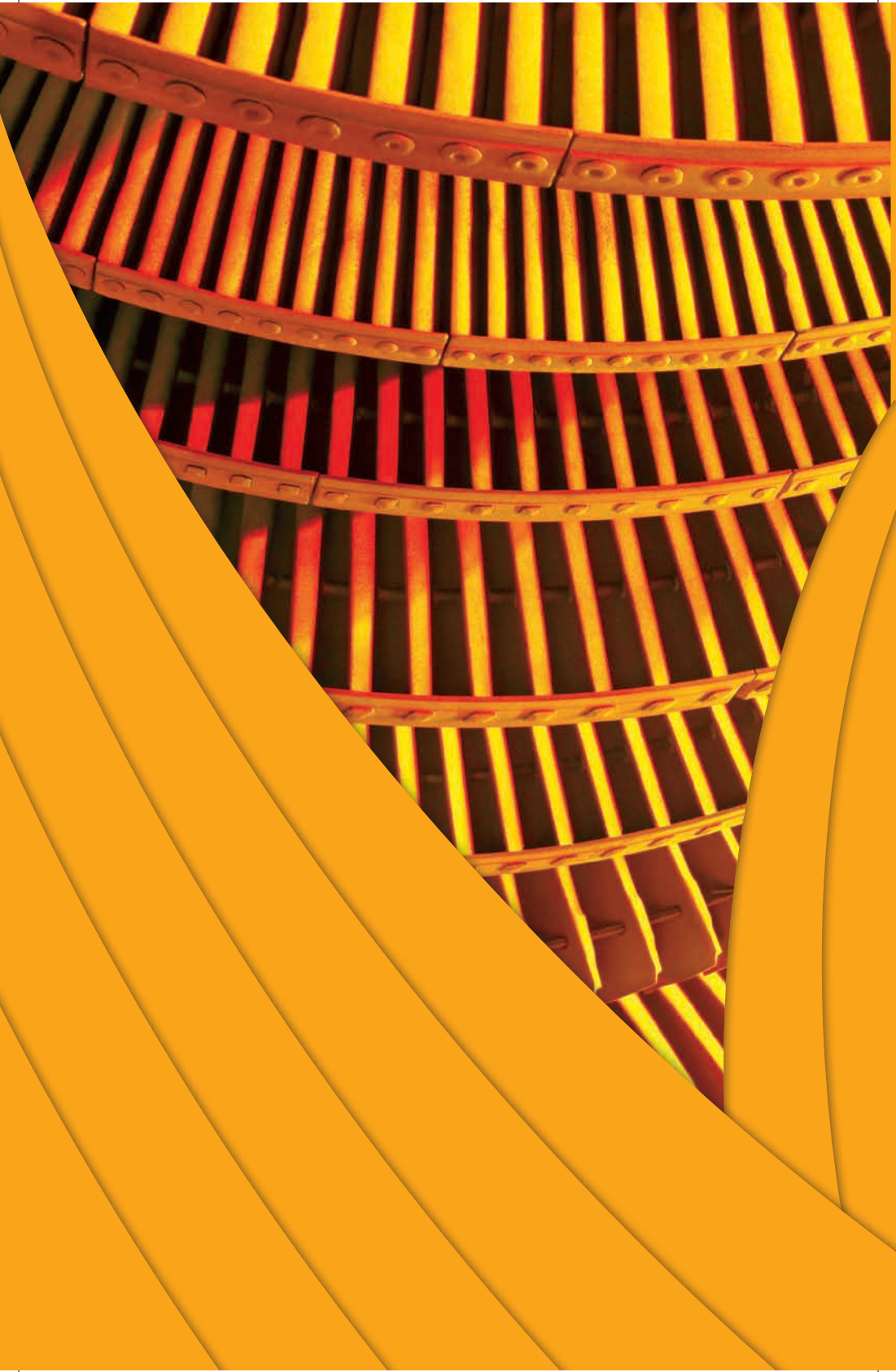
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**TURBOMACHINERY LABORATORY**  
TEXAS A&M ENGINEERING EXPERIMENT STATION

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[info@turbo-lab.tamu.edu](mailto:info@turbo-lab.tamu.edu)  
<http://turbolab.tamu.edu>





# INTRODUCTION









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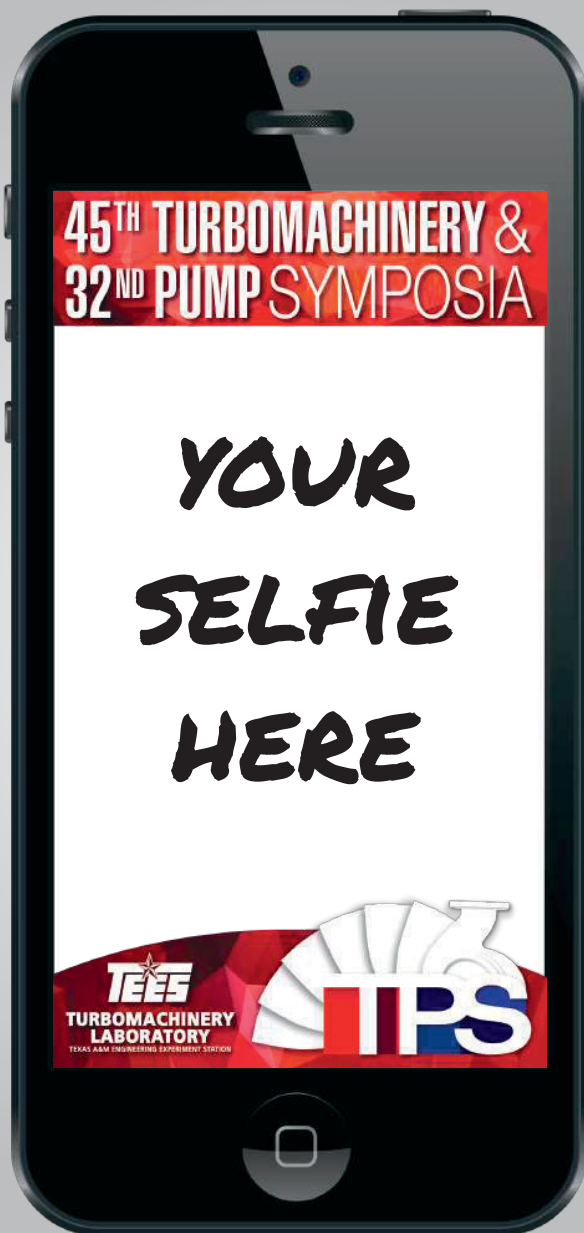
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3. Swipe left until you see the #TPS2016 filter.
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## HOW TO DOWNLOAD THE TPS MOBILE APP

Scan the QR code with your smart phone  
or tablet.

For iPhone and Android phones, visit your  
App Store and search for  
Pump Turbo.

For all other browser-enabled phones,  
point your mobile browser to  
<http://tps.tamu.edu/mobile>.



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# WI • FI

## CONNECTION

1. With a Wi-Fi enabled device, find the wireless network named **TurboPump**.
2. Connect to the wireless network name named **TurboPump**.
3. Once connected to the network, open up an Internet Browser.
4. You should be automatically redirected to the Splash Page, regardless of what your homepage is set to.
5. There is no password required; you should be free to browse the web via your device.

**If you have any problems, please contact our help desk at 888.243.5685**

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## SYMPOSIA BANQUET DINNER

Wednesday, September 16, 2015 7:30 P.M. - 9:00 P.M.

Hilton Ballroom of the Americas A

Doors open at 7:15 P.M. No admittance after 7:45 P.M.

Badges required; not open to free pass.

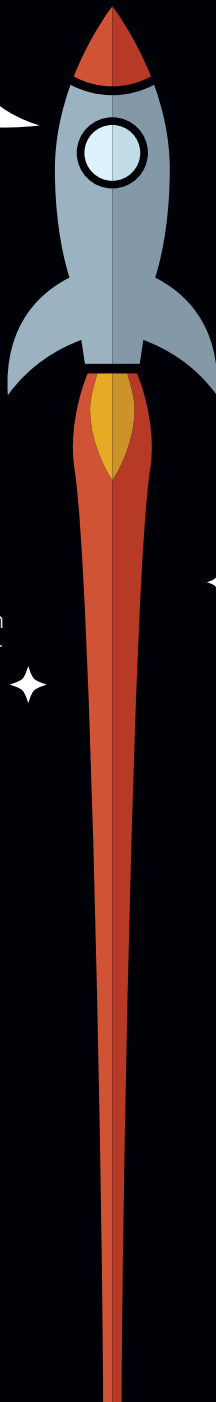


**Shayla Rivera**, class of '83, is not easily placed in any one category. She is an Aerospace Engineer by degree, a sales person by training, an educator by choice, a motivator by grace, and a comedian by design. Basically, Shayla Rivera could be the poster child for the STEAM (Science, Technology, Engineering, Arts and Math) initiative.

After a summer in Houston she went onto College Station where she attended Texas A&M University (Whoop!) and obtained her BS degree in Aerospace Engineering. While in school, she discovered her interest in Psychology and obtained many course credits in the same. "Growing up in Puerto Rico, common sense was king. Engineering and Psychology together has helped me put the whole picture together."

Shayla would prefer to not bore you with her resume because it could never be complete, however, she can claim some pretty cool achievements like being an award nominated actress for her One Woman Show **"Rocket Science and Salsa" directed by Debbie Allen**, an Award Winning Speaker, Named Funniest Latina Comedian, and also receiving the Presidential Volunteer Service Award. What she is most proud of in her career is bringing a little bit of home to our troops in more than 22 countries around the world.

She has never been and will probably never be what is 'expected'. Like most other comedians, Shayla is now obsessed with Quantum Physics.





# STAND-ALONE SHORT COURSES

## REGISTRATION NOW OPEN

Turbo Lab-administered stand-alone short courses are developed and presented by leading engineers throughout the year. Topics evolve regularly to meet the needs of working professionals in the turbomachinery industry.

**To register or learn more about stand-alone short courses, visit [turbolab.tamu.edu/short-courses/](http://turbolab.tamu.edu/short-courses/) or email [debbie@turbo-lab.tamu.edu](mailto:debbie@turbo-lab.tamu.edu).**



### **Qatar — October 2-4, 2016**

**Course:** Rotordynamics of Turbomachinery with Case Studies

**Instructor:** Dr. Dara W. Childs, Turbomachinery Lab director

### **Singapore — November 2016**

**Course:** Fundamentals of Fluid Film Bearings for Machinery Engineers

**Dates:** Nov. 15-17

**Instructors:** Dr. Minhui He & James M. Byrne of BRG Machinery Consulting, LLC

**Course:** Shaft Sealing Technology for Centrifugal Compressors

**Dates:** Nov. 15-17

**Instructors:** Daniel Goebel of EagleBurgmann

**Course:** Rotating Equipment Function Overview & Best Practices

**Dates:** Nov. 15-18

**Instructors:** Michael Forsthoffer of Forsthoffer Associates, Inc.

### **Houston — January 9-13, 2017**

**Course:** Machinery Vibrations & Rotordynamics

**Instructor:** Drs. Dara Childs and Luis San Andres of Texas A&M University; Dr. Brian Murphy of RMA, Inc.; Dr. John Vance of VAVCO; and Dr. Fouad Zeidan of Rotordynamic Technology

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### myPOWER Dashboard

February 22, 2016

#### 85% of Major Equipment Delivered to V.C. Summer Nuclear Power Plant Construction Site

According to Steve Byrne, COO of South Carolina Electric and Gas Co. (SCE&G), 85% of the major equipment necessary to build V.C. Summer Units 2 and 3 is onsite, and of the remaining components, a lot...

February 22, 2016

#### GE's Immelt: It's a World of "Slow Growth and Volatility"

We live in a world of "slow growth and volatility," said Jeffrey Immelt, chairman and CEO of General Electric, but there's an opportunity to "make a lot of money" if you have courage in such...

February 22, 2016

#### Nieto: Mexico's Energy Transition Will Persevere Despite Dismal Oil Prices

Mexico's ongoing energy reform is a "paradigm shift" in the way the country obtains, transforms, and exploits its energy resources, President Enrique Peña Nieto told attendees at IHS CERAWeek on February...

February 18, 2016

#### A Rollercoaster Week for the Clean Power Plan

In the week since the highest court in the U.S. issued an unprecedented ruling to stay the Clean Power Plan—as at least two states suspended compliance efforts—the passing of Supreme Court Justice...

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Chemical Engineering Facts at Your Fingertips Guidebook Series  
Chemical Engineering Features Report Guidebook Series  
Chemical Engineering's Process Water and Wastewater Treatment and Reuse Guidebook- Volume 1  
Chemical Reaction Engineering, 3rd Edition  
Compact Heat Exchangers  
Compressors: Selection and Cost Engineering- Volume One  
Compressors: Applications and Maintenance- Volume Two  
Concurrent / Simultaneous Engineering Methods, Tools and Case Studies Within a Lean Six-Sigma Quality Framework  
Control and Automation: Volume 1- Process Control  
Control and Automation: Volume 2- Process Automation  
Control and Automation: Volume 3- Sensors  
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CPI Plant Safety: Volume 2- Managing Explosion and Fire Risks  
CPI Plant Safety: Volume 3- Managing Safety Systems to Reduce Risk  
Crystallization and Related Operations  
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Heat Exchanger Fouling- Mitigation and Cleaning Technologies  
Heat Recovery Steam Generators  
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Instrumentation Guidebook- Volume 2  
Liquid-Liquid and Gas-Liquid Separation  
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Machine Shop Trade Secrets, 2nd Edition  
Machinery's Handbook 29th Edition - Large Print  
Managing Bulk Solids  
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Managing Steam: Volume 2 — Focus on Inlet Water Treatment and Energy Efficiency  
Metering Pumps Handbook  
Minimizing Corrosion and Fouling: Volume 1 — Strategies and Materials  
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Mixers and Mixing  
Mixing, Blending and Agglomeration: Volume 1 — Combining Liquids  
Mixing, Blending and Agglomeration: Volume 2 —Combining Bulk Solids  
Organic Chemistry Wall Chart  
Pipe Flow: A Practical and Comprehensive Guide  
Pipefitters Handbook, Third Edition  
Piping Design and Operations Guidebook- Volume 1  
Piping Design and Operations Guidebook- Volume 2  
Plant and Personnel Safety  
Plant Operation and Maintenance , Volume 1- Chemical Process Equipment  
Plant Operation and Maintenance, Volume 2- Procedures and Best Practices  
Positive Displacement Pumps: Wall Chart  
Pristine Processing  
Process Water and Wastewater Treatment and Reuse Guidebook- Volume 2  
Project Management and Cost Engineering: Strategic Planning and Implementation- Volume 1  
Project Management and Cost Engineering: Equipment-Specific Tips and Strategies - Volume 2  
Pumping Fundamentals— Volume 1: Design and Selection  
Pumping Fundamentals— Volume 2: Operations and Maintenance  
Reactors and Reaction Engineering: Volume 1 - Equipment and Instrumentation  
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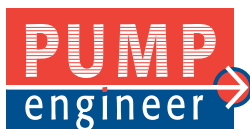
## MEDIA PARTNERS



Journal of Compressor









# SPOUSE PROGRAM

## JEWELRY MAKING CLASS - **Bling it on!**

TUESDAY, SEPTEMBER 13TH, 9AM-NOON

Enjoy crafting a custom pendant and other jewelry while learning to work with findings, leather sued, and more under an expert guide.

7:30 - 8:45 a.m. Continental Breakfast in the Spouse Hospitality Suite, Hilton of the Americas

8:45 a.m. Meet at Hilton (by gift shop). We will proceed to the George R. Brown Convention Center, room 352A.

9:00 a.m. Class begins.

## PAINTING WITH A TWIST

WEDNESDAY, SEPTEMBER 14TH, 9AM-NOON

Enjoy step-by-step instruction from experienced artists and leave with a one-of-a-kind masterpiece.

7:30 - 8:45 a.m. Continental Breakfast in the Spouse Hospitality Suite, Hilton of the Americas

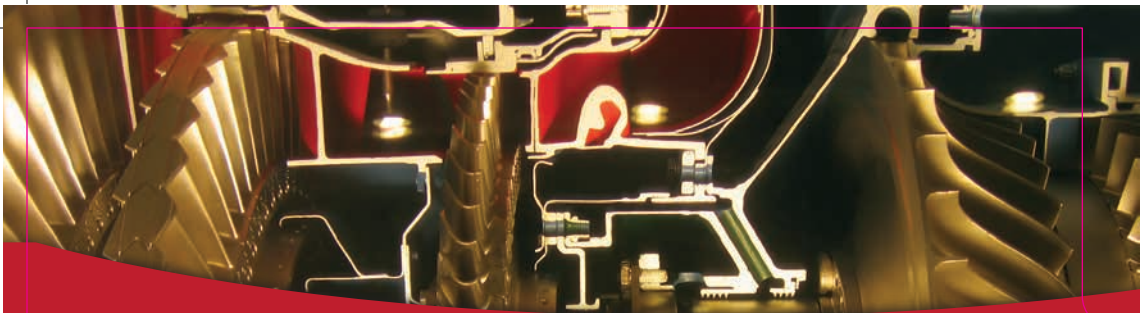
8:45 a.m. Meet at Hilton (by gift shop). We will proceed to the George R. Brown Convention Center, room 352A.

9:00 a.m. Class begins.

**\*\*Maximum class size is 20 persons.**

The spouse program is a social program and is not intended for individuals who wish to participate in the Symposia or work in the exhibits. Badges may be picked up with the sponsoring attendee's registration badge. Name badges must be worn for admission to the Exhibit Hall and for admission to daily events. There is no charge for spouse registration and hospitality suites. Please see the cashier on the 1st level for registration information.





# SCHEDULES

SCHEDULES

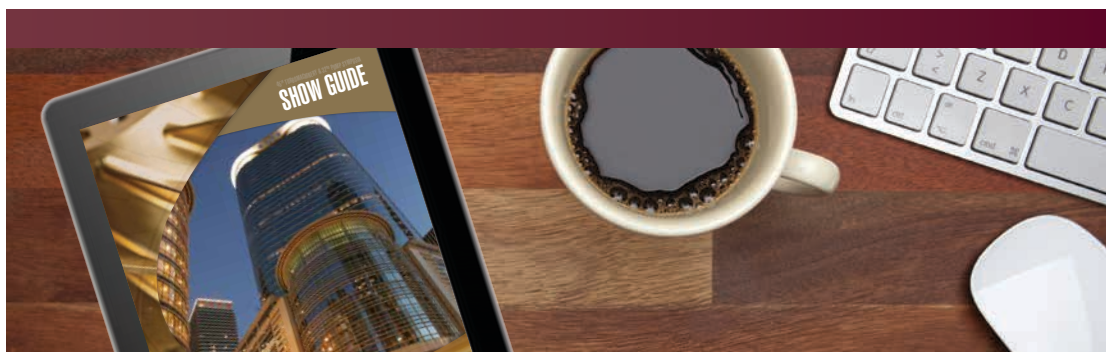








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# SCHEDULE

## AT A GLANCE

### Sunday, September 11, 2016

4:30 P.M. - 6:00 P.M.	Attendee and Exhibitor Registration	Level 1, Exhibit Hall C
4:30 P.M. - 6:00 P.M.	All Leader Registration	Level 3, Room 340A

### Monday, September 12, 2016

7:00 A.M. - 12:00 P.M.	Attendee and Exhibitor Registration	Level 1, Exhibit Hall C
7:00 A.M. - 12:00 P.M.	All Leader Registration	Level 3, Room 340A
8:30 A.M. - 5:00 P.M.	Short Courses	Level 3
12:00 P.M. - 1:15 P.M.	Short Course Luncheon	Level 3, George Bush Grand Ballroom C
1:30 P.M. - 5:00 P.M.	Attendee and Exhibitor Registration	Level 1, Exhibit Hall C
1:30 P.M. - 5:00 P.M.	All Leader Registration	Level 3, Room 340A
4:30 P.M. - 5:00 P.M.	Turbo Advisory Committee Meeting	Level 3, Room 330A
5:00 P.M. - 5:30 P.M.	Pump Advisory Committee Meeting	Level 3, Room 330A

## Tuesday, September 13, 2016

7:00 A.M. - 7:45 A.M.	Leader Breakfast	Level 3, Room 330A
7:30 A.M. - 5:00 P.M.	Attendee, Exhibitor and Non-Prepaid Registration	Level 1, Exhibit Hall C
7:30 A.M. - 5:00 P.M.	Prepaid Leader Registration	Level 3, Room 340A
8:00 A.M. - 8:35 A.M.	Welcome Address	Level 3, General Assembly Theater C
8:45 A.M. - 12:00 P.M.	Symposia Technical Sessions	Level 3
11:00 A.M. - 12:00 P.M.	Lunch for Exhibitors	Level 1, Exhibit Halls B,C,D
12:00 P.M. - 2:00 P.M.	Lunch & Exhibits Open to Paid Attendees	Level 1, Exhibit Halls B,C,D
2:00 P.M. - 3:30 P.M.	Symposia Technical Sessions	Level 3
2:30 P.M. - 7:00 P.M.	Exhibits Open Free to Public	Level 1, Exhibit Hall D
6:30 P.M.	Hospitality Suite	Hilton Americas, See Hospitality Suite Schedule on page 22
7:30 P.M. - 9:00 P.M.	Tex-Mex Buffet (Badges required – Not open to Free Pass)	Hilton Ballroom of the Americas A

## Wednesday, September 14, 2016

7:30 A.M. - 8:15 A.M.	Leader Breakfast	Level 3, Room 330A
8:00 A.M. - 5:00 P.M.	Attendee and Exhibitor Registration	Level 1, Exhibit Hall C
8:00 A.M. - 5:00 P.M.	All Leader Registration	Level 3, Room 340A
8:00 A.M. - 1:00 P.M.	Booth Selections for 2017	Hilton Ballroom of the Americas A
8:30 A.M. - 12:00 P.M.	Symposia Technical Sessions	Level 3
11:00 A.M. - 12:00 P.M.	Lunch for Exhibitors	Level 1, Exhibit Halls B,C,D
12:00 P.M. - 2:00 P.M.	Lunch & Exhibits Open to Paid Attendees	Level 1, Exhibit Halls B,C,D
2:00 P.M. - 3:30 P.M.	Symposia Technical Sessions	Level 3
2:00 P.M. - 4:00 P.M.	Booth Selections for 2017	Level 1, Exhibitor Registration Counter
2:30 P.M. - 6:30 P.M.	Exhibits Open Free to Public	Level 1, Exhibit Hall D
6:00 P.M. - 7:30 P.M.	TPS Connect (TAMU Current, Former Students & Exhibitors Networking Event)	Hilton Ballroom of Americas D
6:30 P.M.	Hospitality Suite	Hilton Americas, See Hospitality Suite Schedule on page 22
7:30 P.M. - 9:00 P.M.	Banquet (No entry after 7:45 P.M.   Badges required – Not open to Free Pass)	Hilton Ballroom of the Americas A

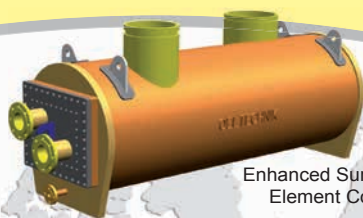
**Thursday, September 15, 2016**

7:30 A.M. - 8:15 A.M.	Leader Breakfast	Level 3, Room 330A
8:00 A.M. - 11:00 A.M.	Attendee, Exhibitor and Non-Prepaid Leader Registration	Level 1, Exhibit Hall C
8:30 A.M. - 12:00 P.M.	Symposia Technical Sessions – Case Studies	Level 3
9:30 A.M. - 11:00 A.M.	Booth Selections for 2017	Level 1, Exhibitor Registration Counter
9:30 A.M. - 12:00 P.M.	Exhibits Open Free to Public	Level 1, Exhibit Hall D
12:00 P.M. - 2:00 P.M.	Turbo and Pump Advisory Committee Luncheon	Level 3, Room 330A

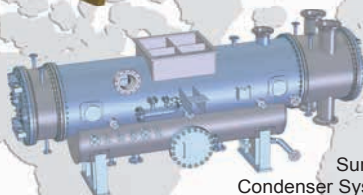
**SCHEDULE AT A GLANCE**

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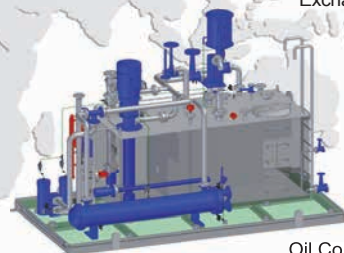
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# BONUS

## SHORT COURSES

Bonus short courses are presented by Texas A&M Engineering Experiment Station centers as an expanded program and are not directed by the TEES Turbomachinery Laboratory. The TEES Energy Systems Laboratory and the TEES Mary Kay O'Connor Process Safety Center are affiliated research centers working alongside the TEES Turbomachinery Laboratory performing cutting-edge research in a variety of specialized focus areas and providing practical answers to critical state and national needs.

**Monday, September 12, 2016**

**8:30 A.M. – 5:00 P.M.**

**BONUS SHORT COURSE B1**

Role of Mechanical Integrity Program in Design, Installation and Operation of Turbomachinery and Pumps

Room 352F

This short course is presented through the Texas A&M University Mary Kay O'Connor Process Safety Center in partnership with the TEES Turbomachinery Laboratory. For more on MKOPSC programs, visit: <http://process-safety.tamu.edu/>





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# TURBO

## STAGE SCHEDULE

### Tuesday, September 13, 2016

3:00 P.M. - 3:20 P.M.	Turbomachinery Laboratory – Mengke Liu “XLTRC2 – Updates”
3:30 P.M. - 3:50 P.M.	Empowering Pumps – Charli Matthews “Connecting with the Pump Industry”
4:00 P.M. - 4:20 P.M.	Prime Photonics / APEX Turbine Testing Technologies – Malcolm Laing “Uses for Prime Photonics Blade Tip Timing System”
5:00 P.M. - 5:20 P.M.	Weir Specialty Pumps (Roto-Jet) – Tom Maceyka “An API 610 Compliant Pump for Low Flow High Head Services”
5:30 P.M. - 5:50 P.M.	CFturbo – Ralph-Peter Muller “Axial Pump Optimization”

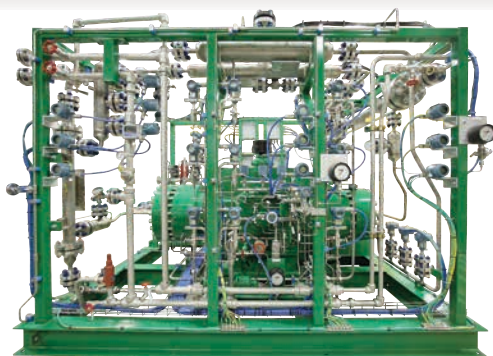
### Wednesday, September 14, 2016

3:00 P.M. - 3:20 P.M.	Applied Flow Technology – Reinaldo Pinto “Pump Sizing, Selection & Waterhammer Evaluation”
3:30 P.M. - 3:50 P.M.	Cryostar – Mr. Simon Hautdidier “Cryostar Expanders Design and Plant Efficiency”
4:00 P.M. - 4:20 P.M.	Windrock – Harold Goldston “Technological Advances in Condition Monitoring for Reciprocating Machinery”
4:30 P.M. - 4:50 P.M.	Concepts NREC – Jim McNamara “Elements of Successful ORC Development”

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# HOSPITALITY SUITES

## SCHEDULE

### Tuesday, September 13, 2016

6:30 P.M. - 10:00 P.M.	Afton Pumps, Inc.	340AB
6:30 P.M. - 10:00 P.M.	Burckhardt Compression (US), Inc.	337AB
6:30 P.M. - 10:00 P.M.	Voith Turbo Inc.	339AB
6:30 P.M. - 10:00 P.M.	MHI Compressor International Corporation	335AB
6:30 P.M. - 9:00 P.M.	Teikoku USA Inc.	BOA, E

### Wednesday, September 14, 2016

6:30 P.M. - 10:00 P.M.	York Process Systems	Presidential Suite #21029
6:30 P.M. - 10:00 P.M.	Compressor Controls Corporation	Presidential Suite #22029

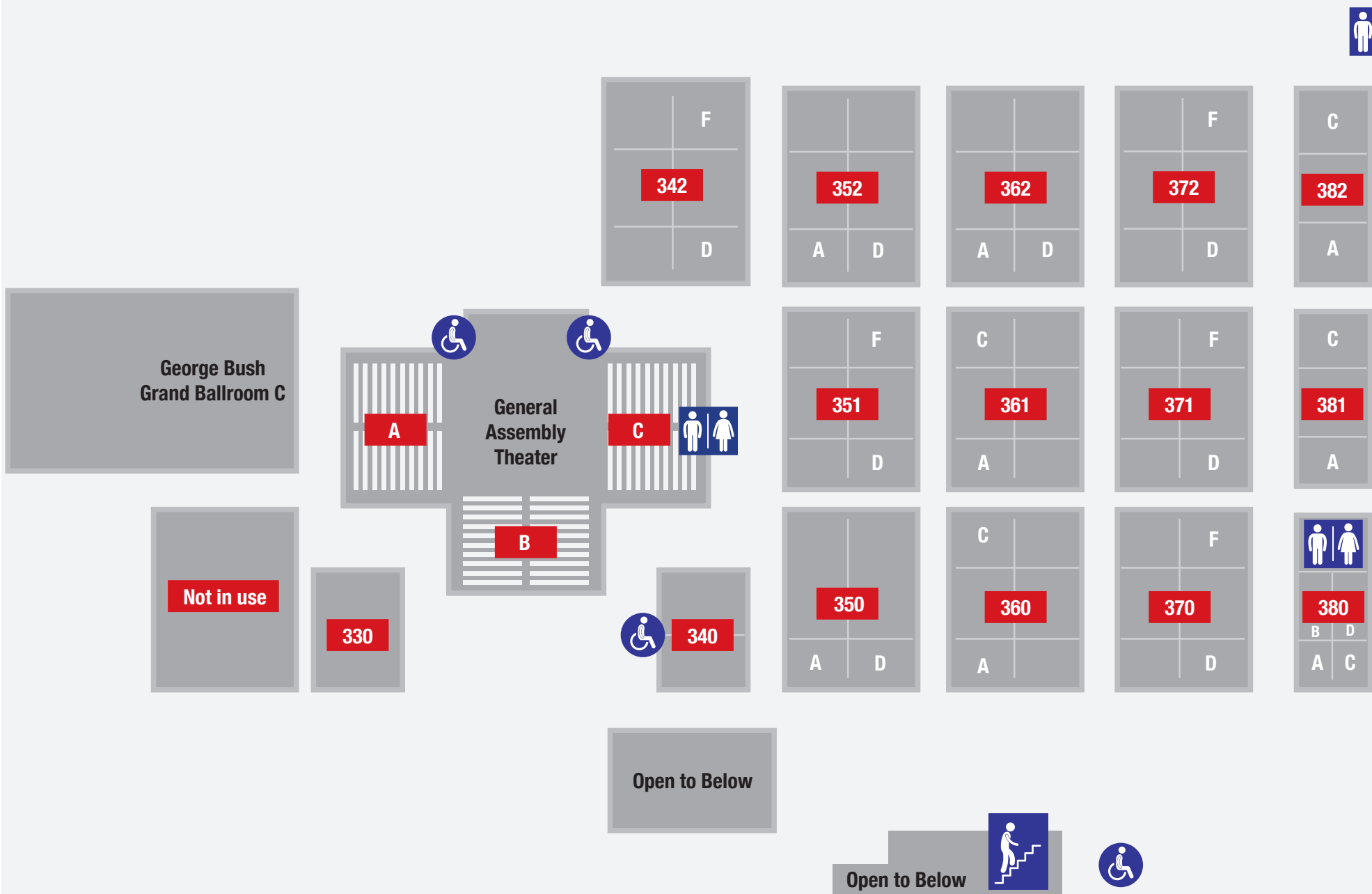
All Hospitality Suites are located in the Hilton Americas.

# PLAN YOUR SCHEDULE

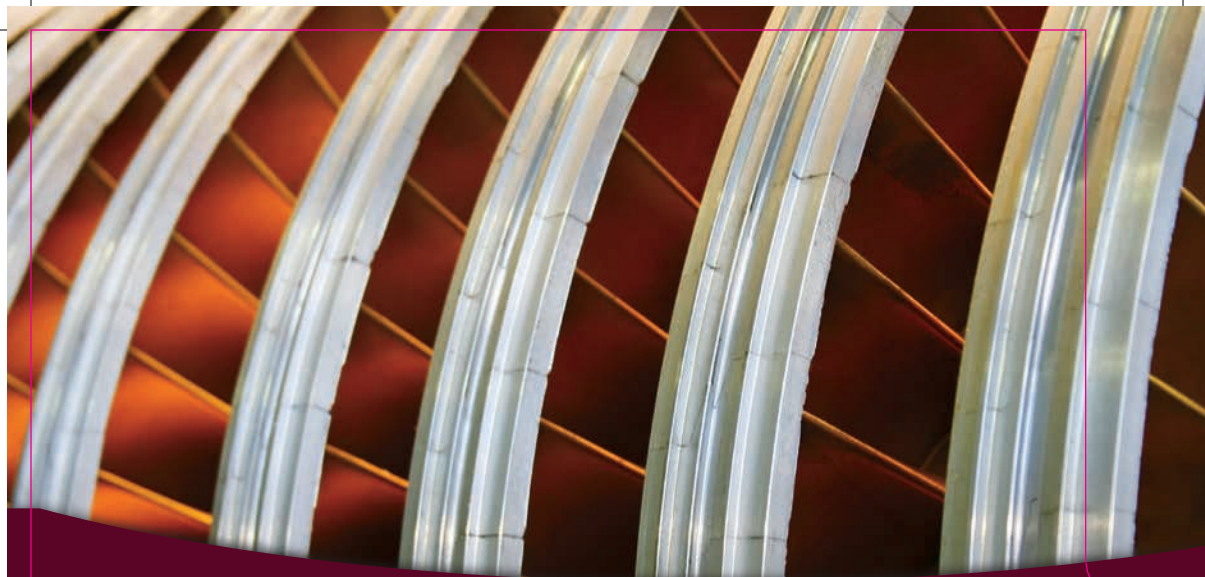
	TUESDAY	WEDNESDAY	THURSDAY
REGISTRATION	7:30 A.M. – 5:00 P.M.	8:00 A.M. – 5:00 P.M.	8:00 A.M. – 12:00 P.M.
<b>8:30 A.M. – 12:00 P.M.</b> LECTURES / TUTORIALS / DISCUSSION GROUPS / CASE STUDIES <small>* Tuesday Only due to Welcome Address, the first events will run from 8:45 A.M. – 10:15 A.M. with a refreshment break from 10:15 A.M. – 10:30 A.M.</small>	<b>8:00 A.M. – 8:35 A.M.</b> <b>Welcome Address</b>		<b>9:30 A.M. – 12:00 P.M.</b> <b>Exhibits Open</b>
<b>10:00 A.M. – 10:30 A.M.</b>	Refreshment Break	Refreshment Break	Refreshment Break
<b>12:00 P.M. – 2:00 P.M.</b>	Lunch & Exhibits Open to Paid Attendees	Lunch & Exhibits Open to Paid Attendees	<b>Symposia Ends at Noon</b>
<b>2:00 P.M. – 3:30 P.M.</b> LECTURES / TUTORIALS / DISCUSSION GROUPS			
<b>2:30 P.M. – 7:00 P.M.</b> Exhibit Hall will close at 6:30 P.M. on Wednesday	Exhibits Open	Exhibits Open	
<b>7:30 P.M.</b>	Buffet at Hilton	Banquet at Hilton	

# CONVENTION CENTER

## MAP LEVEL 3







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**Wednesday, Sept. 14<sup>th</sup> • 6 – 7:30 p.m.**  
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# TURBO

## DAILY SCHEDULE

### SUNDAY, SEPTEMBER 11, 2016

#### 4:30 P.M. – 6:00 P.M. | REGISTRATION

<b>Attendee and Exhibitor Registration</b>	Level 1, Exhibit Hall C
<b>All Leader Registration</b>	Level 3, Room 340A

### MONDAY, SEPTEMBER 12, 2016

#### 7:00 A.M. – 12:00 P.M. | REGISTRATION

<b>Attendee and Exhibitor Registration</b>	Level 1, Exhibit Hall C
<b>All Leader Registration</b>	Level 3, Room 340A

#### 8:30 A.M. – 5:00 P.M. | SHORT COURSES

<b>Short Course 1</b> Vibration Problems and Solutions for Pumps and Other Turbomachines	Level 3, Room 360A
<b>Short Course 2</b> Torsional Rotordynamics of Machinery Equipment Strings	Level 3, Room 350D
<b>Short Course 3</b> Centrifugal Compressors 101	Level 3, Room 360C
<b>Short Course 4</b> Centrifugal Compressors 201	Level 3, Room 351D
<b>Short Course 5</b> Couplings and Rotating Machines	Level 3, Room 351F
<b>Short Course 6</b> Lateral Rotordynamics of Petrochemical Equipment - Review, Examples and Problems	Level 3, Room 342D
<b>Short Course 7</b> Revamp/Re-Rate Design Considerations	Level 3, Room 342F
<b>Short Course 8</b> Gas Turbines – Fundamentals of Design, Operation and Maintenance	Level 3, Room 352D
<b>Short Course 9</b> Machinery Protection Systems - API 670 5th Edition - An In-Depth Review and Tutorial	Level 3, Room 361A
<b>Short Course 10</b> Recips 101: The User's Perspective	Level 3, Room 361C
<b>Short Course 11</b> Gas Bearings and Magnetic Bearings for Oil-Free Rotating Machinery	Level 3, 362A
<b>Short Course 12</b> LNG Liquefaction Plants - Overview, Design and Operation	Level 3, 362C

## 10:00 A.M. – 10:30 A.M. | BREAK

**Refreshment Break**

Level 3, Lounge Area

## 12:00 P.M. – 1:15 P.M. | LUNCH

**Short Course Luncheon**

Level 3, George Bush Grand Ballroom C

## 1:30 P.M. – 5:00 P.M. | REGISTRATION

**Attendee and Exhibitor Registration**

Level 1, Exhibit Hall C

**All Leader Registration**

Level 3, Room 340A

## 3:00 P.M. – 3:30 P.M. | BREAK

**Refreshment Break**

Level 3, Lounge Area

## 5:00 P.M. – 5:30 P.M. | PUMP COMMITTEE MEETING

**Turbomachinery Advisory Committee Meeting**

Level 3, Room 330A

## 5:30 P.M. – 6:00 P.M. | TURBO COMMITTEE MEETING

**Pump Advisory Committee Meeting**

Level 3, Room 330A

## TUESDAY, SEPTEMBER 13, 2016

## 7:00 A.M. – 7:45 A.M. | BREAKFAST

**Leader Breakfast**

Level 3, Room 330A

## 7:30 A.M. – 5:00 P.M. | REGISTRATION

**Attendee and Exhibitor Registration**

Level 1, Exhibit Hall C

**All Leader Registration**

Level 3, Room 340A

## 8:00 A.M. – 8:35 A.M. | WELCOME

**Welcoming Address**

Level 3, General Assembly Theater C



8:45 A.M. – 10:15 A.M.   TECHNICAL SESSIONS		
<b>Lecture 1</b> Full Speed String Test on GE LM6000PF Gas Turbine Driven Refrigeration Compressors	Level 3, Room 360A	
<b>Lecture 2</b> Development of Fuel-Flexible Gas Turbine Combustor		
<b>Tutorial 1</b> Centrifugal Compressor Configuration, Selection and Arrangement: A User's Perspective	Level 3, Room 351D	
<b>Tutorial 2</b> Comparison of Two- and Four-Pole VSD Motors up to 4000 RPM	Level 3, Room 351F	
<b>Discussion Group 9</b> Dry Gas Seals for Compressors	Level 3, Room 361C	
<b>Discussion Group 10</b> Integrally Geared Compressors	Level 3, Room 361A	
<b>Discussion Group 11</b> Turbomachinery Bearings and Annular Seals	Level 3, Room 350D	
10:15 A.M. – 10:30 A.M.   BREAK		
<b>Refreshment Break</b>	Level 3, Lounge Area	
10:30 A.M. – 12:00 P.M.   TECHNICAL SESSIONS		
<b>Lecture 3</b> Effect of Relative Journal Bearing and Honeycomb Seal Direct Stiffness on Radial Synchronous Vibrations of High-Pressure Centrifugal Compressors	Level 3, Room 360A	
<b>Lecture 4</b> Subsynchronous Vibrations on Turboexpanders Equipped with Magnetic Bearings Assessment, Understanding and Solutions		
<b>Tutorial 3</b> Gas Turbine Packaging Options and Features	Level 3, Room 351D	
<b>Tutorial 4</b> Your Gas Compression Application - Reciprocating, Centrifugal or Screw?	Level 3, Room 351F	
<b>Discussion Group 2</b> Couplings and Alignment	Level 3, Room 361A	
<b>Discussion Group 3</b> Gears	Level 3, Room 370F	
<b>Discussion Group 15</b> Steam Turbine Design, Operation, and Maintenance	Level 3, Room 350D	
11:00 A.M. – 12:00 P.M.   EXHIBITOR LUNCH		
<b>Lunch for Exhibitors</b>	Level 1, Exhibit Halls B,C,D	
12:00 P.M. – 2:00 P.M.   ATTENDEE LUNCH		
<b>Lunch &amp; Exhibits Open to Paid Attendees</b>	Level 1, Exhibit Halls B,C,D	

2:00 P.M. – 3:30 P.M.   TECHNICAL SESSIONS	
<b>Lecture 5</b> Coupling Guard Temperature and Windage Power Loss: CFD Analysis and Experiments	Level 3, Room 360A
<b>Lecture 6</b> Electromagnetic Effects on the Torsional Natural Frequencies of an Induction Motor Driven Reciprocating Compressor with a Soft Coupling	
<b>Tutorial 6</b> Basic Thermodynamics of Reciprocating Compression	Level 3, Room 351F
<b>Tutorial 5</b> Rotor Balancing Tutorial	Level 3, Room 351D
<b>Discussion Group 1</b> Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 361A
<b>Discussion Group 6</b> Reciprocating Compressors	Level 3, Room 350D
<b>Discussion Group 7</b> Advanced Topics in Centrifugal Compressor Design	Level 3, Room 361C
2:30 P.M. – 7:00 P.M.   EXHIBITS OPEN	
<b>Exhibits Open Free to Public</b>	Level 1, Exhibit Hall B, C, D
6:30 P.M.   HOSPITALITY SUITE	
<b>Hospitality Suite</b>	See Hospitality Suite Schedule on Page 22
7:30 P.M. – 9:00 P.M.   DINNER	
<b>Tex-Mex Buffet</b> (Badge required, not open to Free Pass)	Hilton Ballroom of the Americas A



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## WEDNESDAY, SEPTEMBER 14, 2016

### 7:30 A.M. – 8:15 A.M. | BREAKFAST

**Leader Breakfast**

Level 3, Room 330A

### 8:00 A.M. – 5:00 P.M. | REGISTRATION

**Attendee and Exhibitor Registration**

Level 1, Exhibit Hall C

**All Leader Registration**

Level 3, Room 340A

### 8:30 A.M. – 10:00 A.M. | TECHNICAL SESSIONS

**Lecture 7** Adapting Hermetically Sealed Compressor Technology to Deal With Sour and Corrosive Gases

Level 3, Room 360A

**Lecture 8** Impeller Stall Induced by Reverse Propagation of Non-uniform Flow Generated at Return Channel

**Tutorial 7** Vibration Analysis for Turbomachinery

Level 3, Room 351D

**Tutorial 8** A CFD Primer: What Do All Those Colors Really Mean?

Level 3, Room 351F

**Discussion Group 8** Turbo Expanders & PRTs

Level 3, Room 350D

**Discussion Group 14** Gas Turbine Operation and Maintenance

Level 3, Room 361C

### 10:00 A.M. – 10:30 A.M. | BREAK

**Refreshment Break**

Level 3, Lounge Area

### 10:30 A.M. – 12:00 P.M. | TECHNICAL SESSIONS

**Lecture 9** Application of Dynamic Pressure-Balanced Seals in a Multistage Centrifugal Compressor

Level 3, Room 360A

**Lecture 10** Full Scale Validation of a High Pressure Ratio Centrifugal Compressor

**Tutorial 9** Squeeze Film Dampers: A Further Experimental Appraisal of Their Dynamic Forced Performance

Level 3, Room 351D

**Tutorial 10** Subsea Compression - Current Technology and Its Use to Maximize Late Life Production

Level 3, Room 351F

**Discussion Group 1** Monitoring Vibration and Other Critical Machine Conditions

Level 3, Room 361A

**Discussion Group 13** Screw Compressors

Level 3, Room 361C

**Discussion Group 17** Torsional Vibration and Monitoring

Level 3, Room 350D

### 11:00 A.M. – 12:00 P.M. | EXHIBITOR LUNCH

**Lunch for Exhibitors**

Level 1, Exhibit Halls B, C, D

### 12:00 P.M. – 2:00 P.M. | ATTENDEE LUNCH

**Lunch & Exhibit Hall Open for Paid Attendees**

Level 1, Exhibit Halls B, C, D

2:00 P.M. – 3:30 P.M.   TECHNICAL SESSIONS	
<b>Lecture 11</b> Aero-Damping Measurements and Computation in a Full-Scale Multistage Centrifugal Compressor	Level 3, Room 360A
<b>Lecture 12</b> Performance Test of a Liquid Tolerant Impeller and Validation of Wet Compression Predictive Model	
<b>Tutorial 11</b> A Review of Aerodynamically Induced Forces Acting on Centrifugal Compressors, and Resulting Vibration Characteristics of Rotors	Level 3, Room 351D
<b>Tutorial 12</b> Compressor Loadsharing Control and Surge Detection Techniques	Level 3, Room 351F
<b>Discussion Group 4</b> Lubrication	Level 3, Room 361A
<b>Discussion Group 5</b> Overspeed Trip Systems	Level 3, Room 350D
<b>Discussion Group 12</b> Protection Systems Integrity	Level 3, Room 361C
<b>Discussion Group 16</b> Compressor Controls	Level 3, Room 362A
2:30 P.M. – 6:30 P.M.   EXHIBITS OPEN	
<b>Exhibits Open Free to Public</b>	Level 1, Exhibit Hall B, C, D
6:30 P.M.   HOSPITALITY SUITE	
<b>Hospitality Suite</b>	See Hospitality Suite Schedule on Page 22
7:30 P.M. – 9:00 P.M.   BANQUET (No entry after 7:45 P.M.)	
<b>Banquet</b> (Badge required, not open to Free Pass)	Hilton Ballroom of the Americas A

## THURSDAY, SEPTEMBER 15, 2016

7:30 A.M. – 8:15 A.M. | BREAKFAST

**Leader Breakfast**

Level 3, Room 330A

8:00 A.M. – 11:00 A.M. | REGISTRATION

**Attendee and Exhibitor Registration**

Level 1, Exhibit Hall C

**All Leader Registration**

Level 3, Room 340A

8:30 A.M. – 10:00 A.M. | TURBO CASE STUDY SESSION 1A

**Case Study 1** Resolving Cyclic Vibration on an Instrument Air Compressor

**Case Study 2** Sub-Synchronous Vibration on Centrifugal Compressor with Tilt-Pad Bearings

**Case Study 3** Analysis and On-Stream Countermeasures of Sub-Synchronous Vibration of a Centrifugal Compressor

Level 3, Room 360A

**Case Study 4** Torsional Instability of Cooling Tower Fan during Induction Motor Start-up

8:30 A.M. – 10:00 A.M. | TURBO CASE STUDY SESSION 1B

**Case Study 5** Redesign of Centrifugal Compressor Impeller by means of Scallopings

**Case Study 6** Improving Reliability and Reducing Steam Leakage in General Purpose Steam Turbines with Floating Brush Seals Process Phenomena

**Case Study 7** Continuous Control of Lube Oil Water Contamination – Never Get Surprised Again

Level 3, Room 350D

**Case Study 8** Integral Gear Compressor Gearbox Flooding Issue

9:30 A.M. – 12:00 P.M. | EXHIBITS OPEN

**Exhibits Open Free to Public**

Level 1, Exhibit Hall B, C, D

10:00 A.M. – 10:30 A.M. | BREAK

**Refreshment Break**

Level 3, Lounge Area

10:30 A.M. – 12:00 P.M. | TURBO CASE STUDY SESSION 2A

**Case Study 9** Asynchronous Motor - Failure of Rotor Lamination Teeth

**Case Study 10** A High Bearing Temperature Troubleshooting of Centrifugal Heat-Pump Compressor

**Case Study 11** New Control Method for Fixed Speed Compressors with Side Stream

**Case Study 12** Double Flow Refrigeration Compressor Inlet Piping Design and Analysis

Level 3, Room 360A



**10:30 A.M. – 12:00 P.M. | TURBO CASE STUDY SESSION 2B**

**Case Study 13** Why Proper Low Pass Filtering Settings on Crosshead Vibration Signals Are Crucial to Minimize Risk of Missed Detects

**Case Study 14** Investigation of Process Gas Compressor Shaft Vibration Phenomena

**Case Study 15** Investigation of Steam Turbine Blade Failure

Level 3, Room 350D

**12:00 P.M. – 2:00 P.M. | COMMITTEE LUNCH**

Advisory Committee Luncheon

Level 3, Room 330A

**SYMPOSIA AND EXHIBITS END AT NOON**



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# TURBO

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The 45<sup>TH</sup> Turbomachinery Symposium is sponsored by the Turbomachinery Laboratory of the Texas A&M Engineering Experiment Station. The Advisory Committee for this symposium is composed of engineers from various user and manufacturing corporations throughout the U.S. and abroad. The presenters of Lectures, Tutorials, Case Studies, and the Discussion Leaders are experts from the fluid-handling-equipment community. The Advisory Committee is greatly indebted to these individuals for their participation and outstanding contributions.

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# TURBO

## SHORT COURSES

### SHORT COURSE 1

#### Vibration Problems and Solutions in Pumps and Other Turbomachines

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 360A

##### Instructors

William Marscher, Eric J. Olson, Maki M. Onari,  
Paul Boyadjis (Mechanical Solutions, Inc.)

##### Description

This course presents analysis and testing methods for pumps and turbomachinery. Focus is on centrifugal pumps of all types, centrifugal compressors, axial compressors, fans, steam turbines and gas turbines. Rotordynamics and bladed disk vibration are included as modules as well as discussion of fluid-induced vibration (e.g. rotating stall and blade pass frequencies), acoustics, and mechanically induced vibration (imbalance misalignment, rubs, looseness). Troubleshooting methods and fixes are discussed with many detailed case histories.

### SHORT COURSE 2

#### Torsional Rotordynamics of Machinery Equipment Strings

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 350D

##### Instructors

Mark A. Corbo (No Bull Engineering, PLLC),  
Brian Pettinato (Elliott Group), Malcolm E.  
Leader (Applied Machinery Dynamics Company),  
Chris D. Kulhanek (Southwest Research  
Institute)

##### Description

One of the foremost concerns facing rotating equipment users today is that of torsional vibration. In contrast to lateral vibration, torsional vibration is rarely monitored. As a result, torsional failures can be especially

heinous since the first symptom of a problem is often a broken shaft, gear tooth, or coupling. In the past, torsional vibration problems were considered to be rare; however the number of torsional field problems has markedly increased recently with the advent of higher power, higher complexity variable frequency drives (VFDs). The increased risk plus the difficulty of detecting incipient failures in the field makes the performance of a thorough torsional vibration analysis an essential component of the turbomachinery design process.

There are three objectives to this Short Course. First, it will provide users with a basic understanding of steady-state torsional vibrations, their potential for generating problems, and methodologies that are commonly used to analyze and avoid these problems. This portion of the course is aimed at younger, less experienced users, although veteran users will also benefit from the review. Second, it will provide users with some understanding of the more complex issues related to transient torsional vibration and acceptance based on stress analysis. Third, it will educate users on VFDs and the unique torsional vibration problems that are associated with them. This portion will be beneficial to all users since modern VFDs are not well understood, especially by mechanical engineers.

The course will be based on practical examples starting from the simple to the complex. Among the topics that will be discussed include description of torsional vibration, modeling, undamped analysis, Campbell diagrams, excitations generated by various mechanical and electrical components, steady-state and transient analyses, synchronous motor startups, fatigue life analysis, and torsional testing. At the conclusion of this portion, the user should have a good grasp of the fundamentals of this topic.

A Short Course is a full-day training session presented concurrently with other sessions.

A significant portion of time will then be spent on VFDs. Topics covered will include VFD types, excitation frequencies generated by various VFDs, typical excitation amplitudes, control loop instabilities that can lead to problems, coupled electro-mechanical analyses, and design procedures for preventing VFD-related torsional issues up-front.

At the conclusion of this course, all users should have sufficient understanding of the relevant concepts so that they should be able to take the proper steps to prevent torsional vibration problems from occurring in their equipment, even when their system contains a VFD.

## SHORT COURSE 3

### Centrifugal Compressors 101

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 360C

#### Instructors

Mark Kuzdzal (Dresser-Rand business, Siemens Power and Gas Division), Jay M. Koch (Dresser-Rand)

#### Description

This course is aimed at engineers and technical professionals who need a broad-based introduction to centrifugal compressor design and analysis. This course starts with the basics and builds to provide a full understanding of a centrifugal compressor. The course will include the following topics: reciprocating, axial and centrifugal compressor similarities/differences; centrifugal compressor configurations; design consideration; and balancing aerodynamic, rotordynamic, and mechanical consideration. The course will answer the question, “How do they work?” factory testing, and future challenges.

At the completion of the course, attendees will hold a strong understanding of basic concepts. This knowledge will act as a springboard

to further understanding of more complex centrifugal compressor concepts. An emphasis is placed on providing practical information with minimal theory. This is NOT a centrifugal compressor operations and maintenance class.

- Reciprocating, axial and centrifugal compressor similarities/differences
- History of compressors
  - Timeline, major advances
  - Configurations, straight-through, back-to-back, compound, side streams, double flow, overhung, integrally geared.
  - How do they work? (potential energy, kinetic energy, PE, KE, ...)
- Markets served
- Pressure containment
  - Case
  - Nozzles and flanges
- Selection process
  - Frame selection
  - Impellers
  - Coupling size
  - Bearing and seal sizes
- Impeller
  - Basic of creating velocity—tie back to “How do they work?”
  - Blade design
  - Shrouded and unshrouded
- Stationary aero components
  - Single stage:
    - Inlet, inlet guide
    - Diffuser, vaned and vaneless, LSD
    - Volute and collector



- Multistage:
  - Return bend
  - Return channel
- Aerodynamics
  - Head, efficiency, work input, stall, surge, overload, stability
  - Gas variations—affect on aero
  - Operation—recycle loop
- Rotordynamics
  - Critical speed maps
  - Synchronous unbalance response
  - Stability, log decrement
  - Damper seals
  - Bearings, seals
  - TP, sleeve, magnetic
  - Squeeze film damper
  - Steady-state and transient torsional
- Stress analysis
  - Impeller dynamics
- Acoustics
  - Sound power, sound pressure
- Seals
  - Gas seals
  - Oil film seals
  - Laby
- API requirement
  - Performance testing
  - Mechanical testing
- Vibration signatures of classic problems, surge, stall, bearing whirl, SSV, forced vibration
- Materials considerations
- Effects of fouling
  - Wear

## SHORT COURSE 4

### Centrifugal Compressors 201

**Monday, September 12, 2016**

**8:30 A.M. – 5:00 P.M. | Room 351D**

#### Instructors

Jeffrey Moore (Southwest Research Institute), James M. Sorokes, Nate Keim (Dresser-Rand), Rainer Kurz (Solar Turbines, Inc.), James Hardin (Elliott Group)

#### Description

This course supplements the Centrifugal Compressor 101 course by covering in greater detail four key areas related to compressors: aerodynamics, rotordynamics, performance and mechanical testing, and surge control. It is intended for those who attended the 101 course and wish to learn more about these topics. The course is also structured for those practicing rotating machinery engineers who have a basic understanding of the topics covered in CC101 but wish to further their understanding in these key areas.

#### I. Aerodynamics

- Compressor design and analysis
- CFD and its role
- Performance issues

#### II. Rotordynamics

- Basic vibration theory
- Modeling procedures
- Bearing and seal analysis
- API requirements
- Instrumentation used
- Sample vibration phenomena and case studies

#### III. Performance and Mechanical Testing

- API 617 and ASME PTC-10 requirements
- Instrumentation and test methods
- Test gas considerations
- Sample testing pitfalls
- Aerodynamic case studies

#### IV. Surge Control

- What is Surge?
- Scenarios
- Surge Control system components
- Surge control system operation in different scenarios
- Modeling of the Surge Control System
- Surge control system design considerations
- Integration of compressor and compression system

### SHORT COURSE 5

#### Couplings and Rotating Machines

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 351F

##### Instructors

Steve Pennington, Adam Thompson, Richard Walker (John Crane)

##### Description

This course covers the application of couplings and rotating machines. Initially, the driver and driven machines are analyzed, the various types are next. The oil and gas industry requirements are investigated and why certain couplings are preferred. Selection is next including shaft end, balancing alignment and API standards. The course concludes with failure analysis.

### SHORT COURSE 6

#### Lateral Rotordynamics of Petrochemical Equipment - Review, Examples and Problems

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 342D

##### Instructors

John Kocur (ExxonMobil Research & Engineering)

##### Description

Reliability and operability of rotating equipment is strongly tied to its dynamic behavior. High vibrations resulting from poorly designed machinery can lead to bearing damage, efficiency loss due to internal rubbing, cyclic failure of rotating components and protracted unplanned shutdowns. Knowledge of the rotordynamic behavior and the impact of components on that behavior is critical in determining the success of new equipment, rerates of existing equipment or retrofitting components in the field. This short course will present the basics of rotordynamics and its application to turbomachinery. Shaft stiffness considerations, tilting pad journal bearing influence on stiffness and damping coefficients, influence of support stiffness and labyrinth and honeycomb seal impact on stability are some of the concepts covered. Basic rotordynamic analyses; undamped critical speeds, response to unbalance and rotor stability will be presented and their use in understanding the rotor behavior explained. Case studies showing problem solving using rotordynamic analysis are also included. The student should come away from the course with an appreciation for rotordynamic behavior, an ability to interpret rotordynamic predictions and an awareness of when this tool should be applied to ensure operability and reliability of equipment.

## SHORT COURSE 7

### Revamp/Re-Rate Design Considerations

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 342F

#### Instructors

James M. Sorokes, Edmund Memmott (Dresser-Rand), Pete Rasmussen (Rasmussen Machinery Consulting, LLC)

#### Description

This short course describes the mechanical and aerodynamic factors that must be considered when revamping, re-rating or upgrading a centrifugal compressor or compressor train and the associated drivers, piping, control systems, etc. The possible motivations for choosing to revamp existing turbomachinery rather than purchasing new equipment are also offered.

## SHORT COURSE 8

### Gas Turbines – Fundamentals of Design, Operation and Maintenance

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 352D

#### Instructors

Meherwan Boyce (The Boyce Consultancy), Francisco Gonzalez (Cheniere)

#### Description

The course covers the new advanced technology gas turbines by outlining all the major components of gas turbines, such as axial flow compressors, axial flow turbines, and dry low NOx combustors. The components of a gas turbine will be addressed from a design, operation, and maintenance point of view as well as their effect on plant operation, plant availability, and reliability. Also covered will be the best practices in operating the new advanced technology gas turbines at variable loads obtaining best efficiencies with minimal down time.

## SHORT COURSE 9

### Machinery Protection Systems - API 670 5th Addition - An In-Depth Review and Tutorial

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 361A

#### Instructors

Timothy J. Hattenbach, Steve Sabin (SETPPOINT Vibration), Matthew House (GE Oil & Gas), Wilfried Blotenberg (MAN Diesel & Turbo SE), Ray McKinney (Bently), Rich Kamphaus (Woodward Inc.), Deane Horn (Emerson), Brian Howard (General Electric), David J. McWhirter (Compressor Controls Corporation)

#### Description

670 remains one of the top-selling and most widely used of API's standards. First introduced in 1976, machinery, control system, and reliability engineers have historically turned to 670 as the primary international standard of its kind when defining requirements for a machinery protection system (MPS) covering vibration, bearing temperature, and speed / overspeed. The standard has now been revised to encompass surge detection and emergency shutdown (ESD) systems, along with extensive new content on condition monitoring software, reciprocating compressor monitoring, Safety Instrumented System (SIS) considerations, and wireless technology. In addition to hardware requirements, the standard also covers installation, documentation, and testing. The differences between distributed and integrated system architectures are also covered. Combined, API 670 5th Edition introduces an additional 160 pages comprising 7 new annexes, 58 new figures, 15 new tables, and 150 new definitions.

Whether you are new to API 670, or a veteran user, this session is highly recommended due to the amount of new content introduced in 5th edition. Focus will be placed not only on reviewing existing and new material, but also on live demonstrations of the technology and systems discussed in the standard, presented by those that actually participated on the task force.

## SHORT COURSE 10

### Recips 101: The User's Perspective

**Monday, September 12, 2016**  
8:30 A.M. – 5:00 P.M. | Room 361C

#### Instructors

Kenneth Atkins (Engineering Dynamics Incorporated), Bruce McCain (Oxy Oil & Gas Corporation), Robert C. Eisenmann Jr. (BP), Benjamin White (Southwest Research Institute)

#### Description

This course will present the basic concepts of reciprocating compressor applications from a user's perspective. There is an introductory section on applications basics (why recip?), including selection criteria and industry standards (API 618, etc.). Compressor components, the basic compression cycle, capacity control, pistons, rings, rods and lubrication essentials are covered.

Technical details including PV diagrams, rod loads, rod reversal, torsional vibration as well as skid and foundation considerations are discussed. Some basic information on pulsation and vibration control is presented, including a discussion of the various API design approaches. Vibration and pulsation measurements are also included.

The course is then summarized with basic "must have" design rules of thumb, life cycle considerations, layout and maintenance considerations, and several case histories to illustrate these concepts.

## SHORT COURSE 11

### Gas Bearings and Magnetic Bearings for Oil-Free Rotating Machinery

**Monday, September 12, 2016**  
08:30 AM - 5:00 PM | Room 362A

#### Instructors

Daniel Lubell (Oil-Free Machinery), Luis San Andrés (Turbomachinery Laboratory, Texas A&M University)

#### Description

Gas bearings (GBs) are an efficient alternative for load support of high speed (microturbo) machinery (< 400 kW, +1000°F, +3M DN). These bearings are compliant surface

hydrodynamic bearings using ambient air as the working fluid media. Oil-free systems have lesser part count, footprint and weight and are environmentally friendly and (nearly) maintenance free, thus saving costs and resources. Current commercial applications include, air cycle machines, cryogenic turbo expanders and micro gas turbines. Other upcoming applications include auxiliary power units, automotive turbochargers and aircraft gas turbine engines for regional jets.

Successful implementation of GBs in commercial rotating machinery involves a three-tier effort with (a) selecting and designing bearing structural components and solid lubricant coatings to improve the bearing load carrying capacity with reduced friction, (b) having accurate performance engineering prediction models anchored to dependable (non commercial) test data, and (c) integration with secondary flow, operating profile, and the rotor-bearing dynamic system.

The short course provides practicing engineers with a comprehensive review of existing gas bearing technologies including their principle of operation, analysis and experimental verification, comparison amongst other gas bearing types, as well as the integration of gas bearings, foil bearings in particular, into actual rotor-bearing systems (hot and cold). The course also includes an introduction to magnetic bearings and their applications.

## SHORT COURSE 12

### LNG Liquefaction Plants - Overview, Design and Operation

**Monday, September 12, 2016**  
8:30 AM - 5:00 PM | Room 362C

#### Instructors

Cyrus B. Meher-Homji, Pradeep Pillai (Bechtel Corporation), Rainer Kurz (Solar Turbines, Inc.), Pete Rasmussen (Rasmussen Machinery Consulting, LLC)

#### Sections:

1. Introduction and Overview of LNG
2. LNG Process Overview
3. LNG Gas Turbines and Compressors
4. Small and Midscale LNG
5. Operations and Maintenance
6. Special Topics/ Q&A

# TURBO LECTURES

## LECTURE 1

Full Speed String Test on GE LM6000PF Gas Turbine Driven Refrigeration Compressors

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 360A

### Instructors

Sameer Patwardhan, Feroz Meher-Homji (Bechtel Oil, Gas & Chemical), Mark Weatherwax (Chevron Energy Technology Pty Ltd), Davide Cappetti, Antonio Musardo, Gianni Iannuzzi (GE Oil & Gas)

### Description

Chevron Australia, as part of the Wheatstone Project, constructed a two train liquefied natural gas (LNG) facility and domestic gas plant at the Ashburton North Strategic Industrial Area, 12 kilometers west of Onslow on the Pilbara coast of Western Australia. A driver selection study was performed based on the ConocoPhillips Optimized Cascade® natural gas liquefaction process. Details of this driver selection study are covered by Shah et al [1]. This driver study evaluated a variety of project-specific parameters and resulted in the selection of a General Electric LM6000 PF aeroderivative gas turbine.

The final decision to use the LM6000 engine was based on a detailed technology qualification program. Following the completion of the technology qualification, a detailed risk mitigation plan was developed. The plan was incorporated into the purchase order of the equipment and, subsequently, incorporated into the equipment manufacturer's Failure Mode Effects Analysis (FMEA) process. The risk mitigation plan highlighted extensive testing requirements during the full-load, full-speed (FLFS) string test. This paper covers the details of the FLFS testing that was performed in the fourth quarter of 2013.

## LECTURE 2

Development of Fuel-Flexible Gas Turbine Combustor

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 360A

### Instructors

Tomohiro Asai, Keisuke Miura, Yasuhiro Akiyama, Mitsuhiro Karishuku, Keita Yunoki, Satoschi Dodo, Nobuyuki Horii (Mitsubishi Hitachi Power Systems, Ltd.)

### Description

This lecture focuses on a state-of-the-art dry low-NO<sub>x</sub> and flashback-resistant combustion technology for fuel-flexible gas turbine combustors. This lecture will be particularly suitable for the audience who are interested in or addressing fuel flexibility issues and dry low emissions gas turbines. The contents cover the advanced burner concept and three development steps: burner development, combustor development, and feasibility demonstration in practical plants, mainly for the combustor operating with hydrogen content syngas fuels in IGCC. They also include applications of this combustion technology to a wide variety of fuels and a numerical simulation technology for development of gas turbine combustors.

## LECTURE 3

Effect of Relative Journal Bearing and Honeycomb Seal Direct Stiffness on Radial Synchronous Vibrations of High-Pressure Centrifugal Compressors

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 360A

### Instructors

Michele Fontana, Leonardo Baldassarre, Andrea Bernocchi, Michele Moretti (GE Oil & Gas)

A Lecture is a presentation of a technical paper detailing cutting-edge, emerging technology. Two lectures may be presented consecutively in one 90-minute timeslot.

#### **Description**

These dynamic coefficients developed by a honeycomb seal on a very high pressure centrifugal compressor have measurable effects on rotor vibrations. In particular, the direct stiffness of the honeycomb can get close to that of the journal bearings, causing major variations of the system's natural frequencies and associated mode shapes; as a result, synchronous rotor vibrations may show undesired dependency on compressor operating parameters. The present study analyzes this phenomenon with the aid of two case studies. Criteria based on references and rotordynamic calculations are proposed, to assess the sensitivity of a centrifugal compressor design to such effect.

## **LECTURE 4**

### **Subsynchronous Vibrations on Turboexpanders Equipped with Magnetic Bearings Assessment, Understanding and Solutions**

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 360A

#### **Instructors**

Houman Shokraneh (L.A. Turbine), Laurent Richaume, Bernard QuoiX (TOTAL), Matthieu Oliva (SKF Magnetic Mechatronics (S2M))

#### **Description**

End-users, operators, plant designers and engineers will benefit from a discussion about the effect nozzles and liquid presence have on creating non-synchronous vibration on a turboexpander equipped with active magnetic bearings (AMB).

New process conditions and power demands required a revamp of two AMB turboexpanders used for liquid natural gas (LNG) rejection and gas injection on a floating barge. Because of heavier gas components and lower inlet temperature, liquid presence after nozzles caused subsynchronous vibration and tripped

the units several times before reaching operating speed. Detailed root cause analysis, effect of nozzle openings, liquid entrapment and solutions are presented.

## **LECTURE 5**

### **Coupling Guard Temperature and Windage Power Loss: CFD Analysis and Experiments**

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 360A

#### **Instructors**

Adam Thompson (John Crane), Tianbo Zhai, Alan Palazzolo (Texas A&M University), Amir Keshmiri (Manchester Metropolitan University)

#### **Description**

High temperatures inside coupling guards can cause machinery down time and revenue loss. Adding a shroud (windage flange) around bolt heads is considered an effective method of reducing guard temperature. However, current studies have cast doubt on the effectiveness of this feature.

In this study, CFD analysis, validated by physical testing, is used to predict coupling guard temperature.

This paper investigates the effectiveness of windage flanges and the effect of guard radial clearance on heat generation inside coupling guards, and resultant guard temperature.

This study hopes to validate other windage mitigation features and provide guidelines for future anti-windage structure design.



## LECTURE 6

### Electromagnetic Effects on the Torsional Natural Frequencies of an Induction Motor Driven Reciprocating Compressor with a Soft Coupling

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 360A

#### Instructors

Troy Feese (Engineering Dynamics Incorporated), Aleksander Kokot (WEG Equipamentos Elétricos SA)

#### Description

People working with VFD motors and reciprocating compressors will find this paper of interest. A case history is given where a torsional natural frequency was measured within the operating speed range due to electromagnetic (EM) effects.

The EM interaction can be important and simple analytical methods can be used to estimate the EM stiffness at the motor.

Comparisons of field data are made with theoretical predications showing the results with and without EM effects.

It is recommended that the EM stiffness be included in future torsional vibration analyses, especially when the coupling is torsionally soft.

## LECTURE 7

### Adapting Hermetically Sealed Compressor Technology to Deal With Sour and Corrosive Gases

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 360A

#### Instructors

Marcel Buse (Dresser-Rand A Siemens Business), Mark van Aarsen (Dresser-Rand), Eyad Al-Khateeb, Bader Al-Jughaiman (Saudi Aramco)

#### Description

Compressor manufacturers have responded to Oil & Gas industry's sustainable challenges with the development of hermetically sealed compressors. The main feature in all these designs is integration of driver and driven unit into a single casing, thus avoiding the need

for dry gas seal systems. It has brought a design challenge as electrical components are introduced in a process gas environment. When compressing clean, export-quality gas this may not be so detrimental but for non-clean, toxic or corrosive applications the electrical components require either special treatment or need to be separated from the process gas. This paper is about adapting the technology to deal with these applications.

## LECTURE 8

### Impeller Stall Induced by Reverse Propagation of Non-uniform Flow Generated at Return Channel

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 360A

#### Instructors

Keizo Yoneda, Shinji Iwamoto, Akihiro Nakaniwa, Shinichiro Tokuyama, Hirofumi Higuchi (Mitsubishi Heavy Industries Compressor Corporation), Bryan Barrington (LyondellBasell Global Engineering Services)

#### Description

In the case of centrifugal compressors, minor non-uniform flow upstream of the impeller is induced by an asymmetrical configuration in the circumferential direction at the compressor suction casing. This non-uniform flow is transmitted to the impeller discharge, but this minor non-uniform flow does not usually cause an adverse effect on the impeller stage performance. However, we found this is amplified at the return channel due to flow separation at reduced flows (depending on return channel geometry), and the amplified non-uniform flow did induce impeller stall by reverse propagation from the return channel to the impeller.

These non-uniform flows caused a significant operating range reduction for a large flow coefficient impeller. The aerodynamics issues were mitigated using CFD analysis techniques, and eventually confirmed by the compressor performance during shop performance testing.

The OEM conducted the CFD analyses using two return channel geometries with several CFD models to verify the effect of the return channel geometry on impeller stall and to confirm the

most suitable CFD modeling method for stall evaluation. Shop performance tests utilizing both return channel geometries were conducted and compared to the CFD analyses. These studies were conducted while collaborating with the end-user.

## LECTURE 9

### Application of Dynamic Pressure-Balanced Seals in a Multistage Centrifugal Compressor

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 360A

#### Instructors

Mark Kuzdzal (Dresser-Rand business, Siemens Power and Gas Division), David Stiles (Hess Oil), John Justak (ATGI), Harry Miller, Charles Rohrs (Dresser-Rand), Ed Wilcox (Chevron ETC), Mark R. Sandberg (Sandberg Turbomachinery Consulting, LLC)

#### Description

Test results for an ASME PTC10 Type 1 test of a 4,500 psia (310 Bara) discharge pressure centrifugal compressor outfitted with dynamic pressure-balanced seals at the impeller eyes; shaft interstage and division wall locations are presented and compared to the same testing with labyrinth seals. Both aerodynamic performance and rotor dynamic stability are presented.

With the DPB seals installed the test results indicate 2.8 percent lower power was required for the same head level. Rotordynamic stability tests showed the dynamic pressure-balanced seals exhibited log decs similar to labyrinth seals. The foregoing demonstrates the aerodynamic and rotordynamic integrity of the dynamic pressure-balanced seals for turbomachinery applications.

## LECTURE 10

### Full Scale Validation of a High Pressure Ratio Centrifugal Compressor

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 360A

#### Instructors

Stefano Falomi, Giuseppe Iurisci, Stefano Fattori, Angelo Grimaldi, Carlo Aringhieri, Giuseppe Sassanelli, Gianni Iannuzzi (GE Oil & Gas)

#### Description

The OEM tested a full scale centrifugal compressor prototype with an innovative architecture (built-up rotor with unshrouded impellers and high speed bearings), which is able to deliver a higher pressure ratio in a single casing with respect to traditional configurations. For the prototype case, the pressure ratio required from the process can be achieved with one compressor casing instead of two, resulting in lower weight and footprint and increasing compressor reliability through the reduction of equipment and related auxiliaries. Considering these benefits, the proposed design matches CTQs of off-shore applications.

## LECTURE 11

### Aero-Damping Measurements and Computation in a Full-Scale Multistage Centrifugal Compressor

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 360A

#### Instructors

Lorenzo Toni, François Moyroud, Giuseppe Gatta, Dante Tommaso Rubino, Alberto Guglielmo (GE Oil & Gas), Kishore Ramakrishnan (GE Global Research)

#### Description

This paper shows the results of an extensive aeromechanical test campaign conducted on a full-scale multistage centrifugal compressor.

Thorough aeromechanics knowledge is necessary for the advanced design of centrifugal compressors, to ensure reliability and life time.

Impeller forcing amplitudes and aeromechanical damping must then be properly predicted, since they both contribute to vibratory response level: present work is focused on aero-damping computations.

A very good agreement between measurements and predictions was found for different operating conditions.

The computational approach demonstrated to be robust and reliable, capable of correctly predicting both aero-damping trends and absolute values, even in somewhat off-design conditions.

## LECTURE 12

### Performance Test of a Liquid Tolerant Impeller and Validation of Wet Compression Predictive Model

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 360A

#### Instructors

Stefano Falomi, Luca Scarbolo, Matteo Bertoneri, Veronica Ferrara (GE Oil & Gas)

#### Description

The possibility of compressing gas containing a significant amount of liquid allows reducing size and costs of the liquid removal equipment, with a consequent positive impact on the layout of off-shore and subsea compression stations. Standard centrifugal compressors are designed to process gas with limited liquid content, since liquid may be responsible of rapid components' erosion and it may influence machine performance and operability. The OEM has thus developed a family of stages with centrifugal impellers specifically designed to process gas containing non negligible amounts of liquid, increasing the erosion resistance and promoting the liquid droplets breakup for subsequent stages.

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# TURBO TUTORIALS

## TUTORIAL 1

### Centrifugal Compressor Configuration, Selection and Arrangement: A User's Perspective

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 351D

#### Instructors

Mark R. Sandberg (Sandberg Turbomachinery Consulting, LLC)

#### Description

The detailed sizing and selection of centrifugal compressors may be a mystery to the typical user. Once the suction and discharge process conditions and required flow rates are established, they are submitted to an equipment supplier for sizing and selection. The resulting combination of impeller diameters, casing sizes and operating speed determined by the equipment supplier can be puzzling to the user. This tutorial is intended to introduce methods that can be utilized to perform an independent, equivalent selection for a compression application or provide a more thorough evaluation of the selections provided by an equipment supplier along with additional information on compressor configuration and arrangement.

## TUTORIAL 2

### Comparison of Two- and Four-Pole VSD Motors up to 4000 RPM

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 351F

#### Instructor

Timo Holopainen, Olli Liukkonen (ABB Motors and Generators), Pieder Joerg (ABB Drives and Controls)

#### Description

This tutorial compares two- and four-pole motors in variable speed applications up to 4000 rpm. First, the characteristic features of these motor types are described. After that, the pros

and cons of these designs are explained and compared. Finally, the end-user advantages of two- and four-pole concepts are evaluated.

This comparison indicates strongly that the four-pole motor is superior in variable speed applications. The most remarkable advantages are obtained with larger motors (> 1000 HP). Thus, the increased application of this four-pole concept seems to be dependent mainly on the end-user approval and open-minded thinking by motor and converter manufacturers.

## TUTORIAL 3

### Gas Turbine Packaging Options and Features

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 351D

#### Instructors

Klaus Brun (Southwest Research Institute), Rainer Kurz, Bernhard Winkelmann (Solar Turbines, Inc.), Joseph Thorp (Aramco Services Company)

#### Description

Industrial and aeroderivative gas turbines are commonly employed in oil and gas applications where high power to weight ratio, low emissions, and high availability requirements are very advantageous compared to other drivers. Industrial gas turbines are frequently used as mechanical drivers for natural gas centrifugal compressors and as generator set for oil field power generation. Due to their operational flexibility, low maintenance requirements, and good speed match with the driven equipment, they are ideally suited for this service. As with any machinery, gas turbines require a significant number of on-skid and off-skid (also known as ancillary and auxiliary) equipment, such as lube oil systems, controls and instrumentation, fire-detection and suppression systems, fuel forwarding and filtration systems, starter and crank motors, and inlet/exhaust systems for

A Tutorial is a mini short course/workshop. It is a teaching process. Each tutorial is 90 minutes long.

their safe and efficient operation. Given a specific application, an optimal set of ancillary and auxiliary equipment options must be selected. This selection is not just based on the type of application and utilities available at the site, but the operator's requirements for operating profile, reliability, and/or availability, and the environmental conditions at the site must also be considered.

For many compression and power generation applications, gas turbines are located in unmanned stations with limited service access and are required to operate over wide ranges of loads and speeds while providing high availability and reliability. Air, fuel, and lube oil quality maintenance and monitoring are very important, but can be a challenge for these applications. The proper selection of ancillary/auxiliary equipment is critical to assure operation within the required operating parameters of output power, efficiency, reliability, availability, and emissions.

This paper will describe the standard ancillary/auxiliary equipment options for gas turbine driven compressor and generator systems and their relative advantages and disadvantages in pipeline applications. Some discussion on API standards and how they relate to packaging options is also provided.

## **TUTORIAL 4**

### **Your Gas Compression Application - Reciprocating, Centrifugal or Screw?**

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 351F

#### **Instructors**

Ben Williams, Greg Phillippi (Ariel Corporation), Bruce McCain (Oxy Permian), Tim Manthey (Aerzen USA), Jonathan Sutter (Elliott Group)

#### **Description**

Choosing the proper compressor type for an application is a critical decision. An unin-

formed choice will invariably lead to increased operating and maintenance costs. This tutorial provides guidelines and comparative information to be used by contractors and users to determine which of these three compressor types may be the best fit for their particular application. Offering the OEM perspectives, along with that of an end user, this tutorial is ideal for rotating equipment engineers, project managers and project engineers who are new to the industry, as well as those with years of experience.

## **TUTORIAL 5**

### **Rotor Balancing Tutorial**

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 351D

#### **Instructors**

Dustin Pavelek, Ray Kelm, Walter Kelm (Kelm Engineering, LLC)

#### **Description**

Successful operation of all rotating machinery requires some attention to rotor balance. This tutorial provides an overview of both shop and field balancing methods, required calculations, acceptance criteria, and safety considerations. Greater emphasis is placed on the practical application of field balancing methods including case studies covering real-world applications. Advanced balancing methods using multiple planes and speeds are discussed.

This tutorial will serve as an excellent reference for anyone involved in shop or field rotor balancing from the maintenance engineer observing a shop balancing technician, to those developing software to conduct flexible rotor balancing.



## TUTORIAL 6

### Basic Thermodynamics of Reciprocating Compression

**Tuesday, September 13, 2016**

2:00 PM – 3:30 PM | Room 351F

#### Instructors

Greg Phillippi (Ariel Corporation)

#### Description

This tutorial provides a straightforward explanation of how a reciprocating compressor works relying heavily upon the pressure-volume diagram (P-V diagram) as a point of reference. The discussion begins with a thorough review of the diagram. Next, how capacity is determined and calculated is discussed, which requires an explanation of volumetric efficiency. How much power is required to compress a certain volume of gas is then explained. The tutorial will then delve into discussions of compression efficiency and how changes in pressure and rotating speed affect the diagram. The tutorial should be an excellent introduction for the inexperienced and a solid refresher for the experienced.

## TUTORIAL 7

### Vibration Analysis for Turbomachinery

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 351D

#### Instructor

Ed Wilcox (Chevron ETC)

#### Description

Turbomachinery requires a higher level of vibration analysis than general purpose machinery. This includes identifying natural frequencies or modes of a system to determine if a potential resonance occurs. The complexity of turbomachinery requires this higher level of vibration analysis, which includes understanding the importance of transient data (i.e. start-up/shutdown), the role of rotordynamics, advanced signal processing, and many other concepts. Likewise, a different array of plotting configurations is required to extract the necessary data for an accurate assessment of the machinery (i.e. Bode, Nyquist, Waterfall, Cascade, shaft centerline, and time waveform plots). An essential part of machinery troubleshooting is using measured

vibration to “tune” a rotordynamic model so that it can accurately predict both stability and forced response changes. This will allow the engineer to make design changes to the equipment to potentially reduce the vibration to an acceptable level.

## TUTORIAL 8

### A CFD Primer: What Do All Those Colors Really Mean?

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 351F

#### Instructors

James M. Sorokes (Dresser-Rand), Jim Hardin (The Elliott Group), Brad Hutchinson (ANSYS, Inc.)

#### Description

This tutorial is intended for engineers, rotating equipment specialists and any others that might be interested in obtaining some fundamental knowledge on computational fluid dynamics (CFD) as applied to compressors. These complex numerical methods have been around for over 30 years. Once a tool used only by aircraft engine or air frame designers, CFD, in recent years, has become an integral part of the design processes used by process centrifugal compressor developers. In fact, many OEMs are now using these numerical results to predict the performance of new flow path components or to validate the corrective measures that will be applied to a mal-performing compression system. The goal of this tutorial is to give the CFD novice a basic understanding on:

- a) The basic principles behind such numerical simulations;
- b) How the choices made by the analyst might impact the accuracy of the results;
- c) What steps an analyst can take to increase the accuracy of his/her results;
- d) The confidence one can have on the qualitative v. quantitative results;
- e) Why it is important to ground CFD analyses on sound data; and
- f) What questions you might ask to uncover shaky numerical results.

This tutorial will not provide a deep, theoretical understanding of CFD methods but will rather

focus on the practical applications of this sophisticated simulation technique. Sample applications will be presented to illustrate the strengths and weaknesses of the various modeling approaches.

## TUTORIAL 9

### Squeeze Film Dampers: A Further Experimental Appraisal of Their Dynamic Forced Performance

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 351D

#### Instructor

Sung-hwa Jeung (Texas A&M University), Luis San Andrés (Turbomachinery Laboratory, Texas A&M University), Sean Den (Formosa Plastics Corp.), Gregory Savelle (Pratt & Whitney Engines, UTC)

#### Description

Squeeze Film Dampers (SFDs) are effective means to ameliorate rotor vibration amplitudes and to suppress instabilities in rotor-bearing systems. A SFD is not an off-the-shelf mechanical element but tailored to a particular rotor-bearing system as its design must satisfy a desired damping ratio. The tutorial reviews how SFDs work, placing emphasis on certain effects largely overlooked by practitioners who often regard the SFD as a simple non-rotating journal bearing. These effects are namely fluid inertia amplification in the supply or discharge grooves, pervasive air ingestion at high whirl frequencies, and effective end sealing means to enhance damping. The bulk of the lecture presents for various SFD configurations comparisons of experimentally identified damping (C) and inertia or added mass (M) coefficients versus amplitude of motion (orbit size) and static eccentricity position, both ranging from small to large. The experiments, conducted over six plus years of continued work give an answer to the following fundamental practitioners' questions:

- (a) Dampers don't have a stiffness (static centering capability), how come?
- (b) Why is there fluid inertia or added mass in a damper? Isn't a damper a purely viscous element?
- (c) How much do the damping and added mass change when the film length is halved? What about increasing the clearance to twice its original magnitude?

(d) How much more damping is available if the damper has end seals?

(e) Is a damper with feed holes as effective as one containing a groove that ensures lubricant pools to fill the film? What if a hole plugs, is a damper still effective?

(f) Does a flooded damper offer same force coefficients as one lubricated thru feed holes?

(g) Do the amplitude and shape of whirl motion affect the damper force coefficients?

(h) What happens if the damper operates largely off-centered; does its performance become nonlinear?

(i) Is air ingestion a persistent issue with an open ends SFD?

(j) How do predictions from accepted engineering practice SFD models correlate with the experimental record? Is an idealized SFD geometry representative of actual practice?

## TUTORIAL 10

### Subsea Compression - Current Technology and Its Use to Maximize Late Life Production

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 351F

#### Instructors

Markus Dettwyler, Dirk Büche, Urs Baumann (MAN Diesel & Turbo Schweiz AG)

#### Description

This tutorial illustrates the current state of technology in subsea compression. Adding compression for depleting fields boosts the production and may extend it for several years. Background information as well as historical developments for the world's first subsea compressor are outlined. The machine concept relies on a hermetically-sealed compressor with an integrated electric motor and an active magnetic bearing system, which has been a standard solution for topside applications for almost 30 years and formed an ideal design basis for the subsea motor-compressor.

Different approaches for subsea compression are compared. These are (1) separate compression and pumping of gas and liquid phases, (2) well-stream compression, and (3) multiphase pumping. Limitations of the concepts are outlined.

An illustrative example case of late life gas field production is given. The evolution of the required compression and pumping is estimated and the importance of the compressor selection in maximizing total field recovery is discussed.

## TUTORIAL 11

### A Review of Aerodynamically Induced Forces Acting on Centrifugal Compressors, and Resulting Vibration Characteristics of Rotors

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 351D

#### Instructors

James M. Sorokes, Mark Kuzdzal (Dresser-Rand business, Siemens Power and Gas Division), Fred Marshall (Dresser-Rand)

#### Description

There are several sources of non-synchronous forced vibration of centrifugal compressor rotors. Many of them are aerodynamic phenomena, created within the gas path of the compressor. Phenomena such as impeller stall, diffuser stall (with and without vanes), and flow instabilities caused by impeller to diffuser misalignment, are all characteristic flow disturbances that can cause forced vibration. In fact, often the only indications of these phenomena are found in the resulting rotor vibration signals. Several phenomena that can cause non-synchronous vibration are reviewed, and for each one, background information, as well as detailed descriptions of the flow field, or other source of the excitation, is provided. This includes the use of CFD analytical results to describe the flow where applicable.

The review also includes, when available, dynamic pressure transducer test data that can be used to verify the presence of the phenomena, and rotor vibration data indicating the presence of such phenomena. This includes test data of actual machines, indicating characteristics such as frequency and amplitude.

## TUTORIAL 12

### Compressor Loadsharing Control and Surge Detection Techniques

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 351F

#### Instructors

Wayne Jacobson, Medhat Zaghloul, Serge Staroselsky, Michael Tolmatsky (Compressor Controls Corporation), Jeff McWhirter (Independent Consultant)

#### Description

This tutorial describes control methods for centrifugal compressors in parallel and series networks. It explains how proper overall design of these systems is important for safe and efficient operation. The tutorial also discusses surge detection techniques and provides recorded examples of compressor surge for various process applications. Guidelines for implementing surge detection and requirements for surge detector design are also discussed. This tutorial is for rotating equipment engineers, reliability engineers and process control engineers who operate or design systems with centrifugal and axial compressors.

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# TURBO

## DISCUSSION GROUPS

### DISCUSSION GROUP 1

Monitoring Vibration and Other  
Critical Machine Conditions

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 361A

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 361A

#### Instructors

William Marscher, Juan Gamarra, (Mechanical Solutions, Ltd.), Steve Locke (The Chemours Company), Ron Adams (Sulzer Pumps), Dag Calafell (ExxonMobil), Simon Bradshaw (ITT Goulds Pumps), Al Miller (Flowserve), Jack Claxton (Patterson Pump Company), Ed Watson (Dupont), Hemanth Satish (TransCanada Corp.)

#### Description

- Condition monitoring methods
- Effectiveness of condition monitoring on rotating equipment
- Value and ROI of condition-based monitoring
- Vertical pump monitoring
- Below ground monitoring in vertical pumps
- Vertical pump vibration standards
- Vertical turbine pump structural resonance analysis
- Vibration test methods and proper use
- Standard locations for vibration measurement on horizontal machinery
- Wireless devices: radio noise, effectiveness, experiences, security
- Troubleshooting methods and fix options
- Operation Deflection Shapes and integration with condition-based monitoring
- Finite element analysis application in support of selection, and troubleshooting
- Rotordynamics

- Hydraulically-induced vibration: structural, system, rotor
- Hydraulic and aerodynamic system issues, including acoustics
- Measurement of severity of unsteady cavitation conditions
- Effect of high GVF (gas volume fraction) in centrifugal pumps
- Mechanical installation (e.g. piping, foundation, alignment) issues
- Modular pump installations, i.e. experience with non-grouted baseplates
- Seals and bearings - how they affect vibration

### DISCUSSION GROUP 2

#### Couplings and Alignment

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 361A

#### Instructors

Terry Roehm (Marathon Oil Company), Chris Rackham (John Crane Flexibox), Mark Oneil (Altra Couplings), Tom Davidson (Linde LLC)

#### Description

- Coupling guard design
- Shaft alignment and tolerances
- Balancing methods
- Coupling selection and specifications
- Shaft alignment methods
- Thermal growth considerations
- Application of optical alignment
- Hub/shaft fits and keys
- Coupling types and applications
- Startup problems
- 8th Edition recommendations
- Allowable nozzle loads



- Warm up piping procedures
- Case deflection, temperature, and pressure
- Piping alignment
- Pipe strain

## DISCUSSION GROUP 3

### Gears

**Tuesday, September 13, 2016**  
10:30 A.M. – 12:00 P.M. | Room 370F

#### Instructors

Joseph A. Silvaggio, Jr. (Siemens), Robert C. Eisenmann Jr. (BP), Mark Brooker (LyondellBasell), Scott Franks (LUFTEX GEARS), Dietmar Sterns (RENK), Ed Martin (Lufkin, Part of GE Oil & Gas)

#### Description

- New gear applications
- Rotordynamics
- Bearings for gear drives
- Installation questions
- Metallurgy/heat treat methods
- Contamination
- Overhaul frequency
- Instrumentation/Monitoring
- Lubrication
- Efficiency

## DISCUSSION GROUP 4

### Lubrication

**Wednesday, September 14, 2016**  
2:00 P.M. – 3:30 P.M. | Room 361A

#### Instructors

Brian Pettinato, Alex Schaefer (Elliott Group), Leslie Thilagan (S&B Engineers and Constructors, Ltd.), Jeff Buck (Shell Projects and Technology), Jeff Haught (Anadarko Petroleum), Ken Shifflett (Motiva)

#### Description

Introduction  
Plant Wide Maintenance and Problems

- Effective Maintenance Programs
- Best Practices
- Oil Varnish

Oil / Grease

- Type and Selection
- Testing and Maintenance Including Frequency
- Mixing and Compatibility

Lubrication Systems and Auxiliaries

- API 614 Systems
- Oil Mist Systems
- Grease Systems





## DISCUSSION GROUP 5

### Overspeed Trip Systems

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 350D

#### Instructors

Bruce Bayless (Valero), Kevin Yates, Scott Shane, Donald Kautz, Josh Autenrieth (Dow)

#### Description

- Electronic overspeed detection system (speed sensors and logic devices)
  - Number, logic
  - Speed sensing gear
  - Sensor type
- Electro-hydraulic solenoid valves
  - De-energize to shutdown (API default)
  - Number, location, orientation (vertical or horizontal)
  - Built in position sensor
  - Detection system to alarm on failure of the coil; change online
  - Capable of on-line testing without defeating trip protection
- Emergency trip valve(s)/combined trip and throttle valve(s)
  - “Mechanical latch type” and “Oil operated/actuated type”
  - Periodic online exercising - partial stroke test (frequency)
  - Full instrument loop “proof” test (frequency)
  - Valve overhaul (repair shop, overhaul frequency, etc.)
  - Systems with duplicate trip valves arranged in parallel
  - OEM upgrades (i.e. metallurgy, etc.)

- Non-return valve on extraction turbines
  - Overspeed initiates a signal to close non-return valve
  - Types (spring-loaded hydraulic actuated cylinder; pneumatic actuated cylinder)
  - Valve overhaul (repair shop, overhaul frequency, etc.)
  - Testing
- Mechanical overspeed system
  - Test frequency
- Exhaust vacuum breaker
- “Back up” coupling feature for steam turbine applications to stay coupled to load/inertia upon main coupling failure
- Other API 612, 611, 670 and ASME PTC 20.2 items

## DISCUSSION GROUP 6

### Reciprocating Compressors

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 350D

#### Instructors

Bruce Bayless (Valero), Robert C. Eisenmann Jr. (BP), Bruce McCain (Oxy Oil & Gas Corporation), Kenneth Atkins (Engineering Dynamics Incorporated)

#### Description

- Industry standards - API 618, Fifth Edition; API 688; ISO 13631; etc.
- Maintenance strategy
- Process gas quality and conditioning
- Wear components - design, reliability, and failures
- Condition monitoring
- Pulsation and vibration issues
- Valve design, reliability, and fouling
- Installation and installation design

## DISCUSSION GROUP 7

Advanced Topics in Centrifugal Compressor Design

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 361C

### Instructors

Mark R. Sandberg (Sandberg Turbomachinery Consulting, LLC), Leonardo Baldassarre (GE Oil & Gas), Urs Baumann (MAN Diesel & Turbo), Mark Kuzdzal, James M. Sorokes, Norbert Wagner (Dresser-Rand business, Siemens Power and Gas Division), Jeffrey Moore (Southwest Research Institute), Brian Pettinato (Elliott Group)

### Description

- Meeting current rotordynamics stability standards
- CO2 Compressors
- High flow coefficient/Mach number impellers
- Coupling and alignment impacts on asymmetric rotordynamics
- Sour gas/Chloride implications on material selection
- Complicated high pressure gas properties
- Validity of CFD modeling
- Modern manufacturing/forming methodologies
- Simulation and dynamic process modeling
- Helmholtz Resonators/Acoustic Attenuation
- Testing in extreme overload/choke conditions
- Tripping of compressors in surge conditions
- Future compressor design/development challenges
- Control challenges associated with sophisticated cent. compr. design
- Performance and mechanical monitoring of compressors

## DISCUSSION GROUP 8

Turbo Expanders & PRTs

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 350D

### Instructors

Lil Kassie (BP), Bob Kranz (Valero), Justin Kassie (Enterprise Products LLC), George Seamon (Dresser-Rand), Don Shafer (Rotating Machinery Services), Dave Linden (D.H. Linden Associates, Inc.), Vince Orlando (PRTs Global)

### Description

- Group Input - Topics from attendees
- Turbo Expanders - High temperature corrosion
- Design Tools
- Process Recovery Machines
- Isokinetic Testing - Result accuracy
- Dehydration Units
- Pipeline Recovery Turbines
- Nitric Acid Trains
- Turbo Expanders - new technologies
- Hot Seals - What's working
- Abrasive Cleaning
- Inlet Temperature Measurement - Skin/ Nosecone
- Performance Monitoring
- Tip rubs
- Recovery Units - Packages

## DISCUSSION GROUP 9

### Dry Gas Seals for Compressors

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 361C

#### Instructors

Hans Weyermann (ConocoPhillips), Bernard Quoix (Total E&P), Rich Wilson, Leonardo Baldassarre (GE Oil & Gas), Joe Delrahim (John Crane), John Marta (Flowserve), Daniel Goebel (EagleBurgmann)

#### Description

- DGS operating characteristics
- Unidirectional versus bidirectional
- Seals faces and seats, O rings materials
- Explosive decompression
- Primary seal failure detection
- Primary seal gas vent to flare control system
- Secondary seal failure detection
- Tertiary seal types, carbon rings versus labyrinth
- Buffer gas and associated control
- Separation gas, air or nitrogen and associated controls
- Tandem versus double seals application
- Field problems and experiences

## DISCUSSION GROUP 10

### Integrally Geared Compressors

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 361A

#### Instructors

Bradley Addison (Chemours), Stanley Stevenson (Siemens), Kevin Kisor (MAN Diesel & Turbo), Terryl Matthews (Shell), Tushar Patel (Atlas Copco Complete LLC), Carl Schwarz (Praxair)

#### Description

- How to specify an integrally geared compressor
- Typical process applications
- Controlling an integral gear compressor - IGV, VFD
- Rotordynamic considerations

## DISCUSSION GROUP 11

### Turbomachinery Bearings and Annular Seals

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 350D

#### Instructors

John Whalen (John Crane), Malcolm E. Leader (Applied Machinery Dynamics), Alan Mathis (Dow), Tom Davidson (Linde, LLC), Norbert Holscher (RENK)

#### Description

- Turbomachinery bearings
- Sleeve and tilting pad journal bearings
- Babbitt bearing failures
- Bearing upgrades
- Clearances
- Installation
- Oil
- Annual seals
- Polymer seals
  - Centrifugal compressor applications
  - Designing an upgrade
- Polymer material selection
  - Temperature concerns
  - Chemical compatibility
- Oil film seals
- Labyrinth seals

## DISCUSSION GROUP 12

### Protection Systems Integrity

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 361C

#### Instructors

Lil Kassie (BP), Steve Locke, Ed Watson (DuPont), Robert Kranz (Valero), Stanley Stevenson (Siemens), George Seamon (Dresser-Rand), Justin Kassie (Enterprise Products LLC), Curt Miller (Exida)

#### Description

- Attendees' topics of interest
- Reliability limits of components and systems

- Considerations for new systems
- Interlocks integrity
- Interlocks testing
- Surge system integrity and testing
- LOPA (Layer Of Protection Analysis)
- SIL (Safety Integrity Levels)
- Verifying reciprocating compressor protection systems
- Liquid level integrity
- Critical pump protection systems

## DISCUSSION GROUP 13

### Screw Compressors

**Wednesday, September 14, 2016**  
10:30 A.M. – 12:00 P.M. | Room 361C

#### Instructors

Terryl Matthews (Shell), Kenneth Atkins (Engineering Dynamics Incorporated), Kevin Kisor (MAN Diesel & Turbo), Bruce McCain (Oxy Oil and Gas)

#### Description

- API Standard 619 for screw compressors
- Wet and dry
- Silencers for dry screw compressors
- Noise reduction methods
- Lubricants and lubricant carryover for flooded screw compressor
- Over-compression and under-compression
- Pulsation and vibration issues

## DISCUSSION GROUP 14

### Gas Turbine Operation and Maintenance

**Wednesday, September 14, 2016**  
8:30 A.M. – 10:00 A.M. | Room 361C

#### Instructors

Meherwan Boyce (The Boyce Consultancy), Rainer Kurz (Solar Turbines, Inc.), Francisco Gonzalez (Cheniere), Jeff Haught (Anadarko), Dag Calafell (ExxonMobil Upstream)

#### Description

- Preventive/predictive maintenance
- Condition monitoring
- Air filtration onshore and offshore
- Fogging/evaporative cooling/inlet chilling
- Liquid fuel handling and storage
- Gas fuel issues
- Lean premix combustion and emissions issues
- Repair techniques
- Matching of driver and driven equipment
- Auxiliary systems reliability
- Noise
- Maintenance and spare parts philosophies, including LTSAs, OEM versus non-OEM, engine exchange
- Component failures

## DISCUSSION GROUP 15

### Steam Turbine Design, Operation, and Maintenance

**Tuesday, September 13, 2016**  
10:30 A.M. – 12:00 A.M. | Room 350D

#### Instructors

Vinod Patel (KBR), Stanley Stevenson (Siemens), Gampa Bhat (Gampa Bhat & Associates, LLC), Robert D. Fisher (ExxonMobil), Arun Kumar (HPCL--Mittal Energy Ltd., India), Joe Moreno (LyondellBasell)

#### Description

- Overhaul intervals
- Maintenance practices
- Solid particle erosion
- Contract versus in-house maintenance
- Mechanical driver turbine issues - design et al
- Steam path repairs
- Turbine casing and alignment issues
- Steam turbine performance, degradation, etc.
- Reliability/availability

## DISCUSSION GROUP 16

### Compressor Controls

**Wednesday, September 14, 2016**

2:30 P.M. – 3:30 P.M. | Room 362A

#### Instructors

Steven Judd, Keith Craggs (ExxonMobil), Mark R. Sandberg (Sandberg Turbomachinery Consulting, LLC), Henry Borchard (Chevron Energy Technology Co.), Jeff McWhirter (Independent Consultant), Rainer Kurz (Solar Turbines, Inc.)

#### Description

- Surge Detection Logic - Trip or not on Surge Detection?
- Compressor Control Redundancy Requirements
- Is the primary purpose of an anti-surge valve a control or protection?
- Check valve locations and their impact on controllability
- Fallback strategies of surge control flow transmitter failure
- Suction throttling experience - Inside or outside of the recycle loop
- Cost vs benefit of implementing load sharing
- Controls Obsolescence

## DISCUSSION GROUP 17

### Torsional Vibration and Monitoring

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 350D

#### Instructors

Jeffrey Moore (Southwest Research Institute), Brian Pettinato (Elliott Group), Thomas Eldridge (Shell), John Kocur(ExxonMobil), Troy Freese (Engineering Dynamics Inc.)

#### Description

Introduction

“Last significant Safety, Health, and Environment threat to rotating equipment that we don’t measure,” J.Kocur, Turbosymposium ’13

#### Recent Torsional Related Incidents

- Torsionally Induced Coupling Slips and Failures
- VFD induced torsional failures
- Other Incidents

#### Contractual Requirements

- FAT Measurement, Commissioning Measurement, or Continuous Monitoring?
- End user mandates of torsional verification - What’s important?
  - Verify natural frequency?
  - Verify separation margin?
  - Verify absence of destructive excitation sources?

#### Torsional Measurement

- Mean Torque vs Dynamic Torque Measurement
- Measurement devices currently available
  - Permanent vs Temporary
  - Frequency vs Amplitude and Frequency
- Development efforts

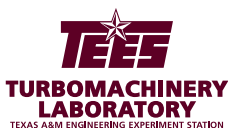


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# TURBO

## CASE STUDIES



### TURBO CASE STUDY SESSION 1A

**Thursday, September 15, 2016**

8:30 A.M. – 10:00 A.M. | Room 360A

#### CASE STUDY 1

**Resolving Cyclic Vibration on an Instrument Air Compressor**

##### **Instructors**

Amit Sharma, Nicolas Peton (GE Oil & Gas - Bently Nevada)

##### **Description**

This Case Study is relevant for Reliability & Condition Monitoring Specialists. Instrument Air Compressors are considered critical equipment in the plants, supplying compressed air to the instrumentations in the field. This case study focuses on cyclic vibration phenomena observed in the 2nd and 3rd stages of an Instrument Air Compressor, part of an Integral Gear Compressor train driven by a motor. The machine train is equipped with an online vibration monitoring and protection system with online diagnosis software, which was used to diagnose the phenomena and forward path for the resolution.

#### CASE STUDY 2

**Sub-Synchronous Vibration on Centrifugal Compressor with Tilt-Pad Bearings**

##### **Instructors**

John J. Yu (GE Oil & Gas), Nicholas Hanson (Flint Hills Resources)

##### **Description**

This presentation provides a success story that sub-synchronous vibration was eliminated on a centrifugal compressor. The sub-synchronous vibration originally occurred at high operational speed on this 5-stage hydrogen recycle centrifugal compressor supported by tilt-pad bearings. Vibration data is reviewed to find its root-cause. Each possible malfunction is discussed to see if it was likely the root-cause. It is shown that sub-synchronous vibration not caused by surge or stall could still happen even with tilt-pad bearings. A solution was implemented to successfully resolve the issue.

A Case Study is a short presentation describing the successful implementation of established technology to solve a real-world problem. Multiple case studies are run consecutively per 90-minute timeslot.



### **CASE STUDY 3**

#### **Analysis and On-Stream Countermeasures of Sub-Synchronous Vibration of a Centrifugal Compressor**

##### **Instructors**

Sangjoo Lee (SK Energy)

##### **Description**

The sub-synchronous vibration could be attributed to many causes such as gas-whirl, oil whirl, looseness and so on. To prevent sub-synchronous vibration, manufacturer analyzes stability during design stage. But field condition can be changed because of process issues. Based on actual experience of sub-synchronous vibration in recycle gas compressor of MDU (Middle Distillation Unit) plant, this case study will show how to analyze and reduce vibration without compressor shut down by applying on-stream countermeasure.

### **CASE STUDY 4**

#### **Torsional Instability of Cooling Tower Fan during Induction Motor Start-Up**

##### **Instructors**

Akira Adachi (Toyo Engineering Corporation),  
Brian Murphy (Rotating Machinery Analysis, Inc.)

##### **Description**

This work is oriented for those interested in the troubleshooting of turbomachinery. The work discusses torsional instability during starting of an induction motor, which eventually led to gearbox pinion teeth failure in a cooling tower fan train. Torsional instability appeared due to a steep slope of the induction motor starting torque curve, combined with a torsionally soft driveshaft and a large moment of inertia of the driven fan. Mechanisms of torsional instability occurrence during startup of an induction motor in a cooling tower fan train are discussed, as well as details of the investigation outcomes, including field measurements and analyses.

## TURBO CASE STUDY SESSION 1B

Thursday, September 15, 2016

8:30 A.M. – 10:00 A.M. | Room 350D

### CASE STUDY 5

#### Redesign of Centrifugal Compressor Impeller by means of Scalloping

##### Instructors

Kirill Grebinnyk (Sulzer), Rob Widders (BOC)

##### Description

Impellers of centrifugal compressors may experience resonance with vane passing frequencies, especially when operated away from the design conditions. Resonance can cause a serious structural damage to impeller. Complete redesign of an impeller to avoid resonance often requires major changes of the compressor stage design.

This case study illustrates alternative approach to redesigning an impeller - scalloping of its coverplate and backplate. Scalloping changes impeller's natural frequencies and allows achieving a separation margin from resonance, which is sufficient for reliable operation. At the same time, scalloping does not have a detrimental effect on impeller's performances and allows to maintain existing configuration of compressor stage.

### CASE STUDY 6

#### Improving Reliability and Reducing Steam Leakage in General Purpose Steam Turbines with Floating Brush Seals

##### Instructors

Jongsoo Kim, Peter Zanini (Waukesha Bearings), Jeff Sandridge (RCM Sales & Services), Billy Gilmore Jr. (Chevron Pascagoula Refinery)

##### Description

This case study examines four different applications where brush seals were introduced into the gland boxes of process steam turbines where conventional carbon rings and mechanical seals were previously applied. The resulting observations and data are presented to highlight the impacts to gland box reliability, steam losses, and bearing life.

### CASE STUDY 7

#### Gear Lateral Vibrations Caused by VSD Interharmonic Interference with Torsional Natural Frequencies

##### Instructors

Steve Locke (The Chemours Company)

##### Description

High water contamination of lube oil damaged a turbine driven process blower on multiple occasions. Traditional solutions are to visually monitor oil appearance, off free water and run lab samples. However, lab samples are often slow and by the time an operator found milky oil, machine damage was often already underway. A better solution is to monitor oil humidity continuously with on-line moisture probes and to purge bearings and reservoirs with a dry gas to continuously remove water. Like continuous vibration monitoring, on line moisture probes gives plant personnel and machinery OEMs the tools to intervene before machines are damaged.

### CASE STUDY 8

#### Integral Gear Compressor Gearbox Flooding Issue

##### Instructors

Daryl L. Callan (Air Products and Chemicals, Inc.)

##### Description

This case study discusses a series of integral gear compressor trips and machine damage that resulted from a sudden increase in motor power not related to process changes. After testing it was determined that the increase in power was the result of oil accumulation in the gearbox. Interestingly the oil accumulation was not in the bottom of the gearbox but in the top. After modifications to the gearbox were made, the flooding phenomenon was prevented from occurring.

## TURBO CASE STUDY SESSION 2A

Thursday, September 15, 2016

10:30 A.M. – 12:00 P.M. | Room 360A

### CASE STUDY 9

#### Asynchronous Motor - Failure of Rotor Lamination Teeth

##### Instructors

Alain Gelin, Bernard Quoix, Antoine Lucas (TOTAL), Xavier Coudray, Guillaume Delhaye, Nicolas Velly (GE Power Conversion)

##### Description

During the commissioning activities of the variable speed driven electrical compressors on TOTAL CLOV FPSO, several failures occurred on HP Compressor electric motors. Several rotor lamination teeth were liberated and were found in the bottom part of the motor. The root cause analysis evidenced a high cycle fatigue on the rotor lamination teeth.

Due to particular aspects of the electrical motor design, a coincidence was created between one tangential mode on the rotor lamination teeth and the stator slots passing frequency at in the operating range of the motor.

The particular aspects of the design highlighted in the root cause are a combination of the motor nominal speed (1800 rpm) and the selection of the rotor teeth numbers vs. the stator slot numbers. These features were dictated by acoustic criteria from the project and a compact design selection.

The studies performed on this phenomenon have created a validation path for the engineering of the electric motor within GEPC. Aim is to precisely investigate on the coincidental modes between rotor and stator in conjunction with the analysis of stresses computed on the rotor lamination teeth feet.

### CASE STUDY 10

#### A High Bearing Temperature Troubleshooting of Centrifugal Heat-Pump Compressor

##### Instructors

Woonsil Lee, Chi Hyuk Kim (Hyundai Oilbank co. Ltd), An Sung Lee (KIMM)

##### Description

On September 2013, a centrifugal heat-pump compressor began showing an abnormal temperature rise in its tilting pad journal bearing (DE-side). The phenomenon appeared when increasing the rotor speed following a process of load-up.

This case study presents the chronology of the investigation conducted to identify the root cause of the unacceptable temperature rise: Troubleshooting the cause of High Bearing Temperature.

The troubleshooting process took several months while there were severe economic losses as the compressor could not deliver its full load.

### CASE STUDY 11

#### New Control Method for Fixed Speed Compressors with Side Stream

##### Instructor

David Rossi, Marco Pelella, Laurence Casali (GE Oil & Gas)

##### Description

A new patented control algorithm has been developed to solve operability issues experienced on flash gas back-to-back compressors with lower molecular weight side stream, driven by fixed speed electric motor. This solution permits to mitigate the reduction of compressor performance due to the presence of internal labyrinth leakages. The developed control strategy and algorithm have been tested and validated through advanced dynamic simulation. The most relevant scenarios have been simulated to optimize the control software performance and the process production parameters. The implementation at site of this solution, confirming simulation findings, allowed the correct operability of the compressors, improving the process production.

## CASE STUDY 12

### Double Flow Refrigeration Compressor Inlet Piping Design and Analysis

#### Instructors

Jeremy Hayes, Vince Mankowski (ExxonMobil  
Research & Engineering), Pablo Bueno  
(Southwest Research Institute)

#### Description

The use of CFD for the design of an inlet piping system for double flow centrifugal compressors is presented. The impacts on compressor performance and mechanical operation are evaluated to understand the sensitivity between unsymmetrical flow distributions on either end of the double flow compressor.

Results of the CFD analysis for the various inlet configurations will be presented to demonstrate how the CFD modeling software was leveraged to quickly understand the effects of geometry changes in the piping system.

This study will highlight the lack of design guidance for double flow compressor inlet piping while offering an alternative approach.

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## TURBO CASE STUDY SESSION 2B

Thursday, September 15, 2016

10:30 A.M. – 12:00 P.M. | Room 350D

### CASE STUDY 13

Why Proper Low Pass Filtering Settings on Crosshead Vibration Signals Are Crucial to Minimize Risk of Missed Detects

#### Instructors

Oliver Franz (PROGNOST Systems, Inc.), Robert C. Eisenmann Jr. (BP)

#### Description

The presenters will describe the importance of proper low pass filter setting to get the most effective machinery protection on reciprocating compressors using crosshead guide acceleration signals.

Knowledge surrounding proper low pass filter settings for acquisition systems performing critical shutdown function is very limited and often misapplied.

This case study illustrates why the common practice of setting low pass signal filters at 2 kHz introduces risk that serious failure modes go undetected compromising plant safety, health and the environment and will conclude with practical guidance on how to best set low pass filters.

### CASE STUDY 14

Investigation of Process Gas Compressor Shaft Vibration Phenomena

#### Instructors

Ashutosh Vengurlekar (ExxonMobil Research & Engineering, Singapore), Teo Woon Lip (ExxonMobil, Singapore), Nathan Little (ExxonMobil Research & Engineering), Satoru Yoshida (Mitsubishi Heavy Industries Compressor Corporation)

#### Description

This paper presents details of investigation results of issues observed during plant start-up on a centrifugal compressor. Compressor was operated with air/ nitrogen during start-up and high shaft vibration (approx. 75  $\mu$ m) were observed on DE side of compressor accompanied by high levels of coast down vibration levels (exceeding alarm levels). This paper presents subsequent detailed rotor dynamics analysis to understand root cause of the high vibrations.

### CASE STUDY 15

Investigation of Steam Turbine Blade Failure

#### Instructors

Ashutosh Vengurlekar (ExxonMobil Research & Engineering, Singapore), Robert D. Fisher (ExxonMobil Research & Engineering), Yuki Nakamura, Yuichi Sasaki, Satoshi Hata, Kyoichi Ikeno (Mitsubishi Heavy Industries Compressor Corporation)

#### Description

Blade failure was observed on a backpressure steam turbine (driving a centrifugal compressor) after it was in service for more than one year.

This paper presents details of observations, inspections carried out and root cause analysis of the turbine blade failure.





46<sup>TH</sup> TURBOMACHINERY & 33<sup>RD</sup> PUMP SYMPOSIA  
GEORGE R. BROWN CONVENTION CENTER | HOUSTON, TEXAS  
SEPTEMBER 11-14, 2017

# CALL FOR PAPERS

Petrochemical | Oil Refining | Oil & Gas Production | Utility | Power | Aerospace | Related Industries

The Turbomachinery Laboratory is soliciting 1-3 page detailed abstracts for lectures, tutorials, case studies, and short courses to be presented at and published in the Proceedings of the 46<sup>th</sup> Turbomachinery & 33<sup>rd</sup> Pump Symposia.

## TPS 2017 PUBLICATION CALENDAR

<b>October 17, 2016</b>	1-3-page Abstracts Due
<b>March 20, 2017</b>	Full Manuscripts Due
<b>March 20, 2017</b>	Short Course titles, authors, outlines Due
<b>May 29, 2017</b>	Final, Monitor-Approved Manuscripts and Author Forms Due

## ABSTRACTS DUE OCTOBER 17, 2016

### AUTHOR GUIDELINES

Papers must be free of commercialism. References to commercial products, trade names, and manufacturing companies must be avoided. Be mindful of who your audience is: the end user. Previously published works will not be accepted. Submissions should be field tested and share practical – not theoretical – information.

### LECTURES

A Lecture is a presentation of a technical paper detailing cutting-edge, emerging turbomachinery or reciprocating compressor technology. The described technology should have been successfully field tested at least once and include field experience. A lecture presentation is 45 minutes long, including time for Q&A.

### TUTORIALS

A Tutorial is a mini short course/workshop. It is a teaching process. Presenters are encouraged to bring in equipment for hands-on instruction. Tutorials consist of 75-80 minutes of presentation and 10-15 minutes of questions and discussion.

### SHORT COURSES

A Short Course is a full-day training session presented concurrently with other short courses on the first day of the Symposium. Short Courses run from 8:30 am to 5:00 pm with a 90-minute luncheon and two 30-minute breaks. Please submit a detailed abstract, including a course philosophy and goal, an outline, and a written summary of who the audience is and what they will learn.

### CASE STUDIES

A Case Study is a short informational PowerPoint presentation describing the successful implementation of established turbomachinery technology to solve a real-world problem. Case studies concisely relate a Problem, its Solutions, and the Lessons Learned. Each invited case study is limited to 10 minutes to relate their experiences with an additional five minutes for questions. Presentations consist of an abstract and approximately 15 slides. Stories relating the failure of others, such as manufacturers or suppliers, will not be permitted.

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**Files will be accepted in Adobe Acrobat PDF only.** Faxed or mailed submissions will not be accepted.

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PUMP

PUMP



# XLTRC<sup>2</sup>

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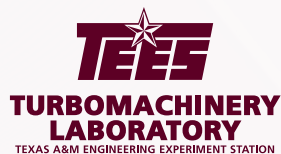
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# XLTRC<sup>2</sup>

## Q&A SESSION

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TUESDAY, SEPT. 13<sup>TH</sup>

3:30 - 4:30 P.M. | 370 HALL D

DR. BRIAN MURPHY,  
XLTRC<sup>2</sup> SOFTWARE ORIGINATOR

# PUMP

## DAILY SCHEDULE

### SUNDAY, SEPTEMBER 11, 2016

#### 4:30 P.M. – 6:00 P.M. | REGISTRATION

**Attendee and Exhibitor Registration** Level 1, Exhibit Hall C

**All Leader Registration** Level 3, Room 340A

### MONDAY, SEPTEMBER 12, 2016

#### 7:00 A.M. – 12:00 P.M. | REGISTRATION

**Attendee and Exhibitor Registration** Level 1, Exhibit Hall C

**All Leader Registration** Level 3, Room 340A

#### 8:30 A.M. – 5:00 P.M. | SHORT COURSES

**Short Course 2** Mechanical Seal Fundamentals Level 3, Room 370D

**Short Course 3** Pumps 101 Level 3, Room 370F

**Short Course 4** Fundamentals of Centrifugal Pump and System Interaction Level 3, Room 371D

**Short Course 5** Pump Cavitation - Physics, Prediction, Control, Troubleshooting Level 3, Room 371F

**Short Course 6** Failure Analysis and Troubleshooting Mechanical Seals and Systems Level 3, Room 372D

**Short Course 7** Key Features of Topsides and Subsea Multiphase Pumps Level 3, Room 372F

**Short Course 8** Pumping Systems Optimization: Offers Lower Maintenance Costs, Improved Reliability, and Higher Profitability Level 3, Room 382C

#### 10:00 A.M. – 10:30 A.M. | BREAK

**Refreshment Break** Level 3, Lounge Area

#### 12:00 P.M. – 1:15 P.M. | LUNCH

**Short Course Luncheon** Level 3, George Bush Grand Ballroom C



## 1:30 P.M. – 5:00 P.M. | REGISTRATION

### Attendee and Exhibitor Registration

Level 1, Exhibit Hall C

### All Leader Registration

Level 3, Room 340A

## 3:00 P.M. – 3:30 P.M. | BREAK

### Refreshment Break

Level 3, Lounge Area

## 5:00 P.M. – 5:30 P.M. | PUMP COMMITTEE MEETING

### Pump Advisory Committee Meeting

Level 3, Room 330A

## 5:30 P.M. – 6:00 P.M. | TURBO COMMITTEE MEETING

### Turbomachinery Advisory Committee Meeting

Level 3, Room 330A



**KNOW WHAT COMPANY YOU  
WANT TO VISIT, BUT DON'T  
KNOW HOW TO FIND THEM?**

PAGE 107

Please go to page 107  
for more information



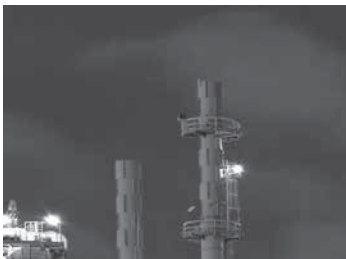


<b>TUESDAY, SEPTEMBER 13, 2016</b>	
<b>7:00 A.M. – 7:45 A.M.   BREAKFAST</b>	
<b>Leader Breakfast</b>	Level 3, Room 330A
<b>7:30 A.M. – 5:00 P.M.   REGISTRATION</b>	
<b>Attendee and Exhibitor Registration</b>	Level 1, Exhibit Hall C
<b>All Leader Registration</b>	Level 3, Room 340A
<b>8:00 A.M. – 8:35 A.M.   WELCOME</b>	
<b>Welcoming Address</b>	Level 3, General Assembly Theater C
<b>8:45 A.M. – 10:15 A.M.   TECHNICAL SESSIONS</b>	
<b>Lecture 1</b> The Influence of Impeller Wear Ring Geometry on Suction Performance	Level 3, Room 370D
<b>Lecture 2</b> The Application of Ultrasonic Technology to Improve the Reliability of Magnetic-Drive Centrifugal Pumps	
<b>Tutorial 1</b> Applying the Energy Institute and GMRC/PRCI Guidelines for the Avoidance or Reduction of Vibration Problems in Small Diameter Piping Branch Connections	Level 3, Room 371F
<b>Discussion Group 8</b> Vertical Pump Problems and Solutions	Level 3, Room 370F
<b>Discussion Group 10</b> Pipeline Applications	Level 3, Room 372D
<b>10:15 A.M. – 10:30 A.M.   BREAK</b>	
<b>Refreshment Break</b>	Level 3, Lounge Area
<b>10:30 A.M. – 12:00 P.M.   TECHNICAL SESSIONS</b>	
<b>Lecture 3</b> Feasibility Study on the Use of Side Channel Pumps for Low Viscosity Fluids, with Fracking or other Hydrocarbon Processing Applications	Level 3, Room 370D
<b>Tutorial 2</b> Highlights of Draft of API 610 12th Edition	Level 3, Room 371D
<b>Tutorial 3</b> An End-User's Guide to Centrifugal Pump Rotordynamics	Level 3, Room 371F
<b>Discussion Group 2</b> Couplings and Alignment	Level 3, Room 361A
<b>Discussion Group 3</b> Gears	Level 3, Room 370F
<b>Discussion Group 6</b> Mechanical Seals	Level 3, Room 372D

<b>11:00 A.M. – 12:00 P.M.   EXHIBITOR LUNCH</b>	
<b>Lunch for Exhibitors</b>	Level 1, Exhibit Halls B, C, D
<b>12:00 P.M. – 2:00 P.M.   ATTENDEE LUNCH</b>	
<b>Lunch &amp; Exhibits Open to Paid Attendees</b>	Level 1, Exhibit Halls B, C, D
<b>2:00 P.M. – 3:30 P.M.   TECHNICAL SESSIONS</b>	
<b>Lecture 4</b> High Pressure, High Temperature Shaft Seal for a Multiphase Subsea Pump	Level 3, Room 370D
<b>Lecture 5</b> Using Finite Element Analysis (FEA) to Estimate Reed Frequency of Vertical Motors for Pump Applications	
<b>Tutorial 4</b> Barrier and Buffer Fluid Selection and Considerations for Mechanical Seals	Level 3, Room 371D
<b>Tutorial 5</b> Pulsation Analysis in Positive Displacement Pump Systems Using Waterhammer, Modal and Animation Software	Level 3, Room 371F
<b>Discussion Group 1</b> Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 361A
<b>Discussion Group 5</b> Centrifugal Pump Operation, Maintenance, and Reliability	Level 3, Room 370F
<b>Discussion Group 13</b> Downhole Pumping	Level 3, Room 372D
<b>2:30 P.M. – 7:00 P.M.   EXHIBITS OPEN</b>	
<b>Exhibits Open Free to Public</b>	Level 1, Exhibit Hall B, C, D
<b>6:30 P.M.   HOSPITALITY SUITE</b>	
<b>Hospitality Suite</b>	See Hospitality Suite Schedule on Page 22
<b>7:30 P.M. – 9:00 P.M.   DINNER</b>	
<b>Tex-Mex Buffet</b> (Badge required, not open to Free Pass)	Hilton Ballroom of the Americas A

<b>WEDNESDAY, SEPTEMBER 14, 2016</b>	
<b>7:30 A.M. – 8:15 A.M.   BREAKFAST</b>	
<b>Leader Breakfast</b>	Level 3, Room 330A
<b>8:00 A.M. – 5:00 P.M.   REGISTRATION</b>	
<b>Attendee and Exhibitor Registration</b>	Level 1, Exhibit Hall C
<b>All Leader Registration</b>	Level 3, Room 340A
<b>8:30 A.M. – 10:00 A.M.   TECHNICAL SESSIONS</b>	
<b>Tutorial 6</b> Mechanical Seal and Support System Considerations for Negative Temperature Hydrocarbon Services: NGL Processing and Ethylene Production Focus	Level 3, Room 371D
<b>Tutorial 7</b> Navigating the Department of Energy (DOE) Energy Conservation Standard and Test Procedure for Pumps	Level 3, Room 371F
<b>Discussion Group 7</b> Improving Mean Time Between Pump Failures	Level 3, Room 370F
<b>Discussion Group 11</b> Panel Session Subsea Pumps and Drivers	Level 3, Room 372D
<b>10:00 A.M. – 10:30 A.M.   BREAK</b>	
<b>Refreshment Break</b>	Level 3, Lounge Area
<b>10:30 A.M. – 12:00 P.M.   TECHNICAL SESSIONS</b>	
<b>Tutorial 8</b> Compression Packing: A Traditional Sealing Method Achieving High Levels Of Performance With Modern Technology	Level 3, Room 371F
<b>Tutorial 9</b> API 682 Arrangement 2 Configurations - Considerations for Outer Seal and Support System Design	Level 3, Room 371D
<b>Discussion Group 1</b> Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 361A
<b>Discussion Group 9</b> Sealless Pumps	Level 3, Room 370F
<b>11:00 A.M. – 12:00 P.M.   EXHIBITOR LUNCH</b>	
<b>Lunch for Exhibitors</b>	Level 1, Exhibit Halls B, C, D
<b>12:00 P.M. – 2:00 P.M.   ATTENDEE LUNCH</b>	
<b>Lunch &amp; Exhibit Hall Open for Paid Attendees</b>	Level 1, Exhibit Halls B, C, D

<b>2:00 P.M. – 3:30 P.M.   TECHNICAL SESSIONS</b>	
<b>Tutorial 10</b> Selection and Design of Dual Pressurized Liquid Sealing Systems	Level 3, Room 371D
<b>Tutorial 11</b> Maintenance Philosophy	Level 3, Room 371F
<b>Discussion Group 4</b> Lubrication	Level 3, Room 361A
<b>Discussion Group 12</b> Cryogenic Fluid Pumping Applications	Level 3, Room 370F
<b>2:30 P.M. – 6:30 P.M.   EXHIBITS OPEN</b>	
<b>Exhibits Open Free to Public</b>	Level 1, Exhibit Hall B, C, D
<b>6:30 P.M.   HOSPITALITY SUITE</b>	
<b>Hospitality Suite</b>	See Hospitality Suite Schedule on Page 22
<b>7:30 P.M. – 9:00 P.M.   BANQUET (No entry after 7:45 P.M.)</b>	
<b>Banquet</b> (Badge required, not open to Free Pass)	Hilton Ballroom of the Americas A




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THURSDAY, SEPTEMBER 15, 2016	
7:30 A.M. – 8:15 A.M.   BREAKFAST	
Leader Breakfast	Level 3, Room 330A
8:00 A.M. – 11:00 A.M.   REGISTRATION	
Attendee and Exhibitor Registration	Level 1, Exhibit Hall C
All Leader Registration	Level 3, Room 340A
8:30 A.M. – 10:00 A.M.   PUMP CASE STUDY SESSION 1A	
Case Study 1 Potassium Carbonate Pump Failure – High Axial Movement Due To Uncontrolled (Unbalanced) Forces	Level 3, Room 370D
8:30 A.M. – 10:00 A.M.   PUMP CASE STUDY SESSION 1B	
Case Study 2 Solving an Acoustic Resonance in Crude Oil Pump Internals	Level 3, Room 370F
Case Study 3 High Vibration Analysis of Eddy Current Drum Coupled Motor to a Vertical Centrifugal Pump – Solution Based on EMA, ODS and FEA	
Case Study 4 Solving a Vibration Problem in the Downstream Piping of a Gear Pump	
9:30 A.M. – 12:00 P.M.   EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall B, C, D
10:00 A.M. – 10:30 A.M.   BREAK	
Refreshment Break	Level 3, Lounge Area
10:30 A.M. – 12:00 P.M.   PUMP CASE STUDY SESSION 2A	
Case Study 5 Eliminating Damage of Retaining Rings by Using Redesigned “Profiled” Keys	Level 3, Room 370D
Case Study 6 Using Engineered Composite Materials in Sealless Magnetic Drive Pumps to Eliminate Eddy Current Losses and Improve Reliability	

## 10:30 A.M. – 12:00 P.M. | PUMP CASE STUDY SESSION 2B

**Case Study 07** Thermal Load Effect on Vibration on a Reactor Feed Water Pump (FWP)

**Case Study 08** Winter Vibration Problems on VS6 Booster Pumps and Solutions

**Case Study 09** Improved Mechanical Seal Design for High Temperature/Light Slurry Applications

Level 3, Room 370F

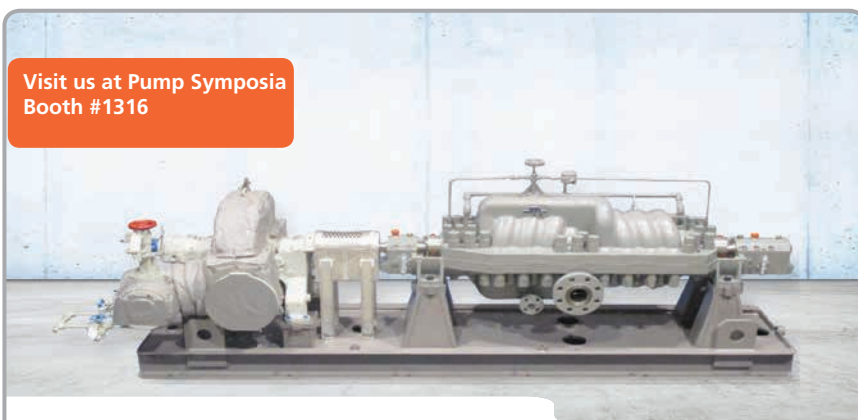
## 12:00 P.M. – 2:00 P.M. | COMMITTEE LUNCH

Advisory Committee Luncheon

Level 3, Room 330A

## SYMPOSIA AND EXHIBITS END AT NOON

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# PUMP

## ADVISORY COMMITTEE

The 32<sup>ND</sup> Pump Users Symposium is sponsored by the Turbomachinery Laboratory of the Texas A&M Engineering Experiment Station. The Advisory Committee for this symposium is composed of engineers from various user and manufacturing corporations throughout the U.S. and abroad. The presenters of Lectures, Tutorials, Case Studies, and the Discussion Leaders are experts from the fluid-handling-equipment community. The Advisory Committee is greatly indebted to these individuals for their participation and outstanding contributions.

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# PUMP

## SHORT COURSES

### SHORT COURSE 1

#### Vibration Problems & Solutions for Pumps and Other Turbomachines

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 360A

##### Instructors

William Marscher, Eric J. Olson, Maki M. Onari,  
Paul Boyadjis (Mechanical Solutions, Inc.)

##### Description

This course presents analysis and testing methods for pumps and turbomachinery. Focus is on centrifugal pumps of all types, centrifugal compressors, axial compressors, fans, steam turbines and gas turbines. Rotordynamics and bladed disk vibration are included as modules as well as discussion of fluid-induced vibration (e.g. rotating stall and blade pass frequencies), acoustics, and mechanically induced vibration (imbalance misalignment, rubs, looseness). Troubleshooting methods and fixes are discussed with many detailed case histories.

### SHORT COURSE 2

#### Mechanical Seal Fundamentals

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 370D

##### Instructors

Henri Azibert (A.W. Chesterton Company), John Merrill (EagleBurgmann), Brian Kalfrin (John Crane), Jose Martin (Flowserve)

##### Description

Operating principles

- Classification of mechanical seals
- Dual gas seals
- Containment seals

Materials of Construction

- Secondary Seals

- Arrangements of Mechanical Seals

Plans defined in API-682

- Piping Plan application
  - Single seals (and the inboard of Dual Unpressurized seals)
- Plans 01, 02, 11, 12, 13, 14, 21, 23, 31, 32, 41, 51, 62, 65
  - Dual Unpressurized Seals (outboard support only)
- Plans 52, 72, 75, 76
  - Dual Pressurized Seals
- Plans 53(A, B, and C), 54, 74

Seal Chamber

- Seal Installation
- Energy Consumption of Sealing Systems
- Life Cycle Costs

### SHORT COURSE 3

#### Pumps 101

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 370F

##### Instructors

Daniel Wood (Chemours), John P. Joseph, II  
(Rotating Equipment Systems, LLC)

##### Description

This course is aimed at engineers and technical professionals who need a broad-based introduction to basic pump selection, application, and operation. This course starts with the basics and builds to provide a full understanding of centrifugal, rotary, and reciprocating pumps. The course will include the following topics: centrifugal, rotary, and reciprocating pump similarities/differences; centrifugal, rotary, and reciprocating pump configurations; nine fundamental principles for reliable pump operation; developing pump specifications; understanding pump curves;

A Short Course is a full-day training session presented concurrently with other sessions.

developing system curves; choosing a type of pump for a specific application. The course will answer the question, "What are the things I need to worry about when selecting, specifying, and operating pumps?" At the completion of the course, attendees will hold a strong understanding of basic concepts. This knowledge will act as a springboard to further growth of understanding of more complex pump concepts. An emphasis is placed on providing practical information with minimal theory; comprehension of the information presented requires little to no mathematical skills in hydraulic or mechanical design. This is NOT a pump design and/or maintenance class.

## **SHORT COURSE 4**

### **Fundamentals of Centrifugal Pump and System Interaction**

**Monday, September 12, 2016**

**8:30 A.M. – 5:00 P.M. | Room 371D**

#### **Instructors**

Mike Volk (Volk & Associates)

#### **Description**

- Are you confused by the variety of pumps? Know how to properly size pumps?
- Did you know that proper pump selection can reduce maintenance & energy costs?
- Do you understand what causes cavitation in pumps and how it can be avoided?
- Do you know how a pump responds to changes in tank level or pressure, or to corrosion build-up in pipes?
- What are the factors that should be considered in setting the minimum continuous flow rate for a pump?
- How do you deal with systems involving multiple pumps, variable speed, or viscous liquids?

Pumps are an integral part of your industry,

yet engineers, operators, and maintenance technicians are seldom fully trained to handle the pump problems they encounter daily. A good understanding of proper pump application, selection, and operation, and how the pump responds to changes in the system are vital to the success of your company. Now you can learn everything you need to know about these topics at a one-day course in pump and system interaction taught by a recognized pump expert.

Topics covered in the course include:

- basic and advanced hydraulic principles
- pump selection and sizing
- pump system design and analysis
- energy savings in pump selection and operation
- effects of operating pumps away from the Best Efficiency Point
- minimum flow determination for centrifugal pumps
- computer software to design and analyze piping systems

## SHORT COURSE 5

### Pump Cavitation - Physics, Prediction, Control, Troubleshooting

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 371F

#### Instructors

Instructors: Bruno Schiavello, Frank C. Visser (Flowserve)

#### Description

This short course deals with cavitation in general and rotodynamic pump cavitation in particular. It gives an introduction to the subject matter and provides insights in particulars like cavitation inception, 3% head drop, and 40,000 hours impeller life, as well as NPSH scaling laws. It further devotes attention to the effect of dissolved gases, and thermal suppression (i.e. thermodynamic effect) when pumping hot water or hydrocarbons. For (hydrocarbon) mixtures it will also be outlined that cavitation intensity can be expected to be far less than with pure fluids. With regard to numerical prediction capabilities the use of Computational Fluid Dynamics (CFD) shall be discussed, and empirical correlations will be presented.

Furthermore, some guidance for cavitation damage diagnosis shall be given, including prediction of cavitation erosion rate, and assessment of impeller life expectancy. Also addressed are suction specific speed, and how this dimensionless group tends to cause bias and give rise to misunderstanding and misinterpretation. In this context also the corrected suction specific speed will be presented, and the concept of suction energy will be discussed. Furthermore, NPSHR criteria and establishing NPSHA margins will be outlined. As special modes of operation, the effect of fluid transients will be highlighted, demonstrating that such may yield excessive cavitation. Furthermore, a qualitative “Cavitation Modes Map” will be presented, which reflects five decades of fundamental cavitation observations and experimental facts (laboratory research and field data) published in the years 1941 – 1991. In particular, the typical shape of the erosion curve versus flow – seemingly peculiar, but fully supported by cavitation physics for all types of rotodynamic pumps – is discussed by highlighting an absolutely striking departure

from the shape of conventional NPSHR3% curve (universally used for decades) at part flows. This deviation, which has been fully ignored in the past and is today still often neglected at various stages (pump specifications and selection, pump design, and field root cause analysis) is a primary reason of the majority of cavitation pump problems, as will be explained in this short course. The course further includes four Field Case Studies demonstrating the practical application of “Cavitation Failure Analysis – Methodology (Diagnosis and Solution Strategy)”, covering low and high energy, single- and multistage, pumps.

## SHORT COURSE 6

### Failure Analysis and Troubleshooting Mechanical Seals and Systems

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 372D

#### Instructors

Michael Huebner (Flowserve)

#### Description

Any piece of equipment which has been in operation has a story to tell. The condition of the equipment can uncover a rich set of information which reveals the way the equipment was operated, maintained, and eventually, degraded. Noticing that equipment has failed is only the beginning. Understanding how and why it failed can be more useful since it gives the user the opportunity to eliminate or mitigate the causes of failure. Unfortunately, this is not a casual exercise and requires a structured approach. Fortunately, the methods of problem solving can be demonstrated and extrapolated to a wide variety of applications.

This course will introduce Root Cause Analysis (RCA), function evaluation, and mechanism identification in the context of mechanical seal failure investigations. In addition, these same techniques will be applied to monitoring opportunities for mechanical seal piping plans in operations. All of these techniques will focus on identifying true root causes and creating effective corrective actions to prevent the reoccurrences of failures.

## SHORT COURSE 7

### Key Features of Topsides and Subsea Multiphase Pumps

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 372F

#### Instructors

Pierre-Jean Bibet (Total E&P), Paul Cooper, Mike Moore (ITT Bornemann), Bob Heyl (Independent Consultant), Ravi Balasubramanian (GE Oil & Gas)

#### Description

This short course targets Rotating Equipment engineers, Process engineers, and Project engineers interested in gaining a better understanding of the unique characteristics of Multiphase Pumps. The agenda is built to go through the key features of Topsides and Subsea Multiphase Pumps (MPP), for both Twin-screw and Helicoaxial technologies. The program will start with the definition of the main parameters describing a multiphase flowing process. Then for each MPP technology, the presenters will go through the working principles, the design/construction features, operational behavior, operational methodology, and typical control and protection strategies. At the end of this session, the attendees will have gained a working knowledge of both volumetric and a rotodynamic MPPs, realistic benefits of their application on a producing field, and what is the state-of-the-art of these technologies, for both Topsides and Subsea.

## SHORT COURSE 8

### Pump Systems Optimization: Offers Lower Maintenance Costs, Improved Reliability, and Higher Profitability

**Monday, September 12, 2016**

8:30 A.M. – 5:00 P.M. | Room 382C

#### Instructors

Mark Sullivan (Hydraulic Institute), William Livoti (WEG Electric)

#### Description

The Hydraulic Institute has developed this one-day pumping system optimization course that focuses on improving reliability while reducing operating costs. Presented in conjunction with WEG Electric, this joint training session will focus on fundamental and key concepts

related to pump system optimization, providing engineers, pump end-users, pump OEMs, and distributors a better understanding of basic pump system interaction and the importance of screening pump systems to identify those for performance improvements. The proposed agenda for the pumping system optimization course includes discussion on:

Benefits of improving the performance of pumping systems

System optimization approach and basic pump system interaction

How motors and variable frequency drives are important components to overall pumping system (Variable frequency drives in pump systems are a mature technology that can generate large benefits in cost savings and reliability improvements in the correct applications. Benefits of using VFDs include:

- Accommodating varying operating conditions, e.g., change of flow and system head for process control
- Possibility to reduce and/or optimize system components
- Potential of energy savings and life cycle cost reduction, both mechanical and electrical
- Can convert single-phase power to three-phase power
- Can reduce inrush current at start-up
  - Screening pumping systems as improvement candidates
- Large systems
- Systems with high operating hours
- Problem systems
- Production-critical systems
  - How to identify and implement basic performance improvement opportunities



# PUMP LECTURES

## LECTURE 1

The Influence of Impeller Wear Ring Geometry on Suction Performance

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 370D

### Instructors

Simon Bradshaw, David Cowan, Thomas Liebner (ITT Goulds Pumps)

### Description

Wear rings are a necessary feature of a enclosed centrifugal impeller design. The purpose of the wear ring is to limit the leakage of fluid from the high pressure zone at the impeller outlet to the low pressure region at the impeller inlet. Several different wear ring geometries may be employed for this purpose. The choice of which geometry is utilized depends on which of the following goals are ranked most important:

- Pump efficiency
- Rotor dynamic coefficients: stiffness and damping
- Preventing contact during thermal or suction transients
- Resistance to wear from abrasive particles
- Allow later adjustment to recover original clearances as the pump wears

There have been many papers published on the effect of wear ring geometry on leakage, efficiency and rotor dynamic coefficients. However, less is known about how specific wear ring geometries affect the suction performance of an impeller.

This paper seeks to examine several different wear ring geometries in common use. It will then quantify how each of these geometries affect the suction performance of the impeller over the full design flow range.

## LECTURE 2

The Application of Ultrasonic Technology to Improve the Reliability of Magnetic-Drive Centrifugal Pumps

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 370D

### Instructors

Sam Tomlinson, David Clark (Sundyne HMD Kontro Sealless Pumps Ltd.), Andrew Hunter (Tribosonics Ltd.)

### Description

By constantly monitoring the condition of the pumped liquid present in the internal flow regime of a magnetic-drive pump, it is possible to rapidly identify potential issues and react to them accordingly. Ultrasonic technology has been utilised to quickly and accurately detect the presence of gas in the liquid stream from outside the confines of the pump pressure boundary.

This paper presents an overview of the ultrasonic technology that has been utilised, including highlights of extensive testing that has been carried out and some real world examples involving the application of this technology on volatile light hydrocarbon processes.

A Lecture is a presentation of a technical paper detailing cutting-edge, emerging technology. Two lectures may be presented consecutively in one 90-minute timeslot.

## LECTURE 3

### Feasibility Study on the Use of Side Channel Pumps for Low Viscosity Fluids, with Fracking or other Hydrocarbon Processing Applications

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 370D

#### Instructors

Sebastian Fleder, Martin Böhle (Technical University Kaiserslautern), Frank Hassert, Beate Zientek-Strietz (Sero PumpSystems GmbH)

#### Description

Side channel pumps are closing the gap between positive displacement pumps and centrifugal pumps, combining the advantage of both pump types, for low flows-high-head applications. This lecture will explain the working principle with giving some educational background on side channel pumps (SCP). Although SCP have a long tradition, some key features for reliable pump operation had to be improved for the use of low viscosity fluid applications: First and foremost new journal bearings and a new low NPSH first stage impeller, which were designed and tested. Furthermore the theoretical influence of gas-liquid-mixtures and some reference applications for the use of SCP are shown.

## LECTURE 4

### High Pressure, High Temperature Shaft Seal for a Multiphase Subsea Pump

**Tuesday, September 13, 2016**

2:00 PM - 3:30 PM | Room 370D

#### Instructors

Simon Gassmann, Marcelo Inforsati, Thomas Felix (Sulzer), Bernhard Gilch, Peter Dröschner (EagleBurgmann)

#### Description

The sealing of the shaft in Multiphase Pumps

for subsea oil exploration is a very demanding application of mechanical seals. The service requires extraordinary reliability, longevity and safety of the applied product. Subsea multiphase applications, planned for the near future will exceed the capability of state-of-the-art mechanical seals. Available engineered mechanical seals for subsea applications are typically equipped with shrinked seal faces which are pressurized from the inside and elastomer as secondary sealing elements. These seals have limitations in regards to absolute pressure and are not capable to take reverse pressure during operation.

A mechanical seal has been developed for absolute pressure level of 1035 bar and the capability to handle reverse pressure at static and dynamic condition.

With the high pressure requirements the application of elastomer secondary seals was considered to be critical. For both, static and dynamic secondary seals, spring-energized polymer gaskets using a specific design for enhanced reverse pressurization capability were selected.

To achieve enhanced robustness of the seal faces in transient dry running condition or reverse pressure, the design was optimized for adopting micro-crystalline diamond coated seal faces.

The lecture describes the design process, starting from the project description with definition of targets followed by a theoretical evaluation of the seal performance and a description of the final design features. It includes final seal qualification testing.

This sealing solution has proven excellent performance during the rigorous test program. The test results approved the expectations with regard to operating stability and robustness.

## LECTURE 5

### Using Finite Element Analysis (FEA) to Estimate Reed Frequency of Vertical Motors for Pump Applications

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 370D

#### Instructors

Edward Chen, Robert Glover, Bryan Evans  
(TECO-Westinghouse Motor Company)

#### Description

A recent trend has shown that end users are requesting more accurate prediction of motor reed frequency (+/- 10%), that enables better pump base design with less potential for base rework. This study describes the use of Finite Element Analysis (FEA) as a tool in the prediction of vertical motor reed frequency. During the study, one of the parameters of interest is the stator core modulus. Because of its laminated structure, the core modulus is not uniform, which can affect the motor reed frequency. Through the use of parametric and sensitivity studies, one can effectively determine the response of each parameter. This study describes the background behind the analysis, the FEA verification process, and test validation.



**LOOKING FOR A PLACE  
TO TAKE NOTES?**

PAGE **307**

Please go to page 307 in  
the General Section.

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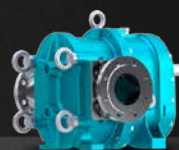
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The screenshot shows the 'Weekly EQUIP-ALERT' newsletter. The header features the title 'OIL, GAS & petrochem equipment' and a background image of an oil pumpjack. Below the header, there are several sections: 1. 'Reduce Your Carbon Footprint' with a sub-headline 'Make your own Nitrogen with an in house gas generator' and a 'View Now' link. 2. 'Product Showcase' featuring 'Norbar Tools for Oil, Gas & Petrochemical Bolting' with a 'View Now' link. 3. 'SPECTRO' with a sub-headline 'New white paper: sulfur determination from crude oil to gasoline' and a 'View Now' link. 4. 'MIDLAND' with a sub-headline 'Trying to maximize crude-by-rail flow rates? Ask the Experts at Midland.' and a 'View Now' link. 5. A footer section titled 'Oil & Gas Computers Video / Field Meters / Rig Meters & Roads / Pipeline Leak Detection' with a 'View Now' link.

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# PUMP TUTORIALS

## TUTORIAL 1

Applying the Energy Institute and GMRC/PRCI Guidelines for the Avoidance or Reduction of Vibration Problems in Small Diameter Piping Branch Connections

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 371F

### Instructors

Sarah Simons, Francisco Fierro, Benjamin White (Southwest Research Institute)

### Description

Pump piping systems typically have small diameter branch connections that can develop vibration related fatigue failures due to mechanical excitation. Many installations do not take time to design small diameter piping to avoid this issue. However, the risk of fatigue failure of small diameter branch connections can be reduced using two alternative guidelines developed by the Energy Institute and GMRC/PRCI. This tutorial will show that the guidelines can be used in two ways. In the design stage, it will show the user how to design small diameter piping in a way that reduces the risk of vibration problems. For piping that is already installed, the tutorial will show the end user how to screen branch lines for susceptibility to fatigue failure and reduce or eliminate the vibration problems by adding clamps, changing the piping diameter, or changing the number or type of valves. Case studies of real world small bore piping connections will be used to demonstrate the method an end user would use to screen branch lines and, if necessary, reduce vibration problems in the piping and avoid future fatigue failures. Both guidelines will be applied to all case studies, and the resulting recommendations will be compared to demonstrate the benefits, assumptions, and limitations of both guidelines and give the user a better understanding of the screening criterion used.

## TUTORIAL 2

Highlights of Draft of API 610 12th Edition

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 371D

### Instructors

Frank Korkowski (Flowserve), Roger L. Jones (Rotating Equipment Consultant), Jeremy Cooper (Bechtel Corporation)

### Description

The API Standard - 610 "Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services" is being updated from the 11<sup>th</sup> edition to the 12th edition.

The process of how the standard is being updated, the participants involved, and the projected timeline for producing the API 610 12th edition will be addressed. The majority of the paper is a narration covering the significant changes and additions proposed as an update to the 11th edition, along with various discussion points that were covered to date as part of the review process for producing the 12th edition. Background to the changes will also be highlighted.

This paper provides the industry with a unique insight into the final agreed upon version of API 610 12th Edition, which is expected to be published in 2016, along with a comparison to ISO 13709 Second Edition / API 610 Eleventh Edition.



A Tutorial is a mini short course/workshop. It is a teaching process. Each tutorial is 90 minutes long.

## TUTORIAL 3

### An End-User's Guide to Centrifugal Pump Rotordynamics

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 371F

#### Instructors

William Marscher (Mechanical Solutions, Inc.)

#### Description

This tutorial discusses concepts and methods involved in performing and evaluating centrifugal pump rotordynamic analysis. The presentation includes Lomakin Effect, Gyroscopic Effect, Cross-Coupling, Rotordynamic Stability, Critical Speeds and their Mode Shapes, Forced Response, common Excitation Forces (both hydraulic and mechanical), and typical plant rotordynamic problems and solutions. Case Histories are included to provide examples of successful use of rotordynamic analysis.

## TUTORIAL 4

### Barrier and Buffer Fluid Selection and Considerations for Mechanical Seals

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 371D

#### Instructors

Michael Huebner (Flowserve)

#### Description

The increased use of pressurized and non-pressurized dual mechanical seals has driven more installations to require the use of barrier and buffer fluids. While some end users have viewed the selection of barrier fluids as an afterthought, their selection is a critical aspect of the seal operation and reliability. A thorough application review requires an understanding of the mechanical seal, sealing system, pump, and process. Fortunately there is a large installed base of successful installations to guide barrier and buffer fluid selections. Through the careful selection of fluids and good operating practices, barrier and buffer fluids can help provide reliable dual seal operation.





## TUTORIAL 5

### Pulsation Analysis in Positive Displacement Pump Systems Using Waterhammer, Modal and Animation Software

**Tuesday, September 13, 2016**

2:00 PM - 3:30 PM | Room 371F

#### Instructors

James Blanding (Dupont Company), Trey Walters (Applied Flow Technology, Inc.)

#### Description

Steady state pressure and flow pulsation is a common problem in positive displacement (PD) pump systems. This paper describes a methodology to computer model pulsation using a combination of general-purpose and readily available, widely used software. This represents an alternative to expensive services offered by high-tech engineering consulting firms. While the learning curve is substantial, the methodology is straightforward and practical. Good candidates to acquire this expertise are those who operate or design high pressure pumping systems involving PD pumps. The successful practitioner will need solid academic foundations in second-order linear differential equations, waterhammer, and digital signal processing.

## TUTORIAL 6

### Mechanical Seal and Support System Considerations for Negative Temperature Hydrocarbon Services: NGL Processing and Ethylene Production Focus

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 371D

#### Instructor

Brian Kalfrin (John Crane)

#### Description

Light hydrocarbon handling is an important growth area in many regions around the world today. The volatile nature of many process fluids yields the requirement of negative temperature (less than zero Fahrenheit or Celsius) operation so that the fluids may be processed and handled by different types of rotating equipment to achieve a desired result.

At the forefront of most equipment selections is the associated method of shaft sealing, and with negative temperature fluids, there are especially unique challenges with applying mechanical seals. The process of selecting mechanical seal types and associated support systems for negative temperature applications requires a thorough evaluation of all aspects associated with functionality and ultimately long term reliability of these installations. The intent of the tutorial is to present quantitative engineering data and practical applications of negative temperature services to users to extend the range of knowledge about seals and support systems in these difficult applications.

## TUTORIAL 7

### Navigating the Department of Energy (DOE) Energy Conservation Standard and Test Procedure for Pumps

**Wednesday, September 14, 2016**

8:30 A.M. – 10:00 A.M. | Room 371F

#### Instructors

Peter Gaydon (Hydraulic Institute)

#### Description

The tutorial will give an overview on the energy conservation standard rulemaking process for pumps and the impacts to the industry. The scope of products covered will be detailed along with the procedures to test the pumps and methods to calculate the compliance metrics. The complexity of the standard and inexperience in the United States leaves many pump manufacturers, engineering procurement contractors, consultants, and end users with uncertainty regarding the requirements and impact of the regulation. Since this is a first for the United States, this paper will address the contents of the energy conservation standard and test procedure, to provide an understanding of the scope; implications to the manufacturer, end users, and other interested parties; and the benefits of the rule and future voluntary product energy labeling initiatives. The audience for this tutorial will be all pump manufacturers, pump users and energy utilities.

## TUTORIAL 8

Compression Packing: A Traditional Sealing Method Achieving High Levels Of Performance With Modern Technology

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 371F

### Instructor

Chuck Tanner (SEPCO), Henri Azibert (Fluid Sealing Association)

### Description

The oldest and still quite common sealing device for pumps is compression packing. This tutorial will explain the technology and also clarify some deep-rooted misconceptions.

The principal topics to be covered will include:

- Carbon yarn impregnated with PTFE or graphite dispersion
- PTFE yarns impregnated with PTFE dispersion or other lubricant
- PTFE or ePTFE/graphite yarns with lubricants or anti-extrusion corner fibers
- Flexible graphite yarns with lubricants or anti-extrusion corner fibers
- Blends of the above fibers or other synthetic fibers impregnated with dispersions or lubricants
- Quality pump packings constructions: Interbraid - Square braid - Braid-over-braid
- Careful selection of packing materials to meet the specific application requirements of the application.
- Complete consideration of surface speeds, pressures, temperatures, and media being sealed
- Proper attention to good installation and break-in procedures
- High standards of equipment maintenance
- Correct design of the stuffing box
- Pump Packing testing Standard - Pump Packing Power Consumption - Pump Packing Environmental Controls

## TUTORIAL 9

API 682 Arrangement 2 Configurations - Considerations for Outer Seal and Support System Design

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 371D

### Instructors

Brian Kalfrin (John Crane), Luis Gonzalez (S&B Engineers and Constructors, LTD)

### Description

API 682, now in its 4th Edition, has made a concerted effort to accurately define and distinguish between different types of seal configurations available under the designation of 'Arrangement 2', including 2CW-CW, 2CW-CS, and 2NC-CS. While the differences between the available types of seals associated with this designation are reasonably well-understood by those in the industry, there are still questions end users have when considering an Arrangement 2 seal for an application; in particular, there are specific concerns regarding reliability and integrity of dry containment seals when compared to wet buffer outer seals. The process of selecting the configuration, and the associated support system (piping plan) requires an evaluation of all aspects associated with the functionality and interaction between these elements. The tutorial will address and discuss the following aspects to consider when evaluating the outer seal design in API 682 arrangement 2 configurations.

## TUTORIAL 10

### Selection and Design of Dual Pressurized Liquid Sealing Systems

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 371D

#### Instructors

Michael Huebner, Kent Appleman (Flowserve)

#### Description

Dual pressurized mechanical seals are a common solution to many challenging seal applications and there are a number of well-defined piping plans to support these seal selections. While the basic definitions of these plans are well-understood, the implications of selecting one plan over the others is not. This tutorial will explore the similarities and differences in the Plan 53 and Plan 54 systems and discuss the inherent characteristics of each. This will give the reader a better background to select a system for their specific application.

## TUTORIAL 11

### Maintenance Philosophy

**Wednesday, September 14, 2016**

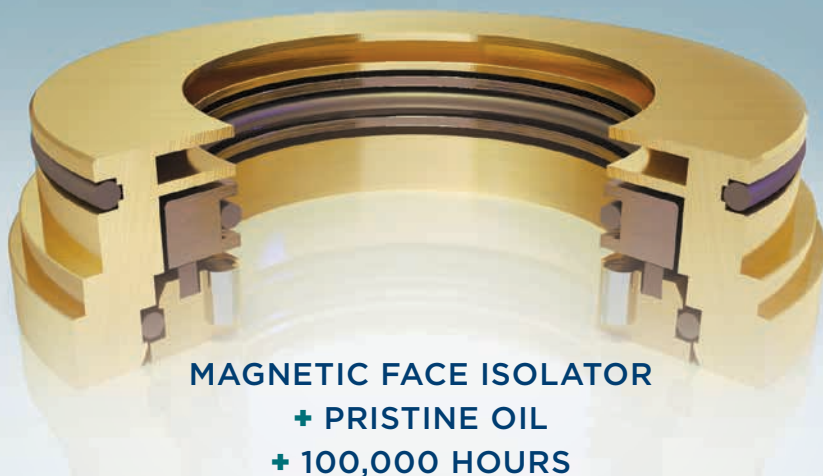
2:00 P.M. – 3:30 P.M. | Room 371F

#### Instructors

John P. Joseph, II (Rotating Equipment Systems, LLC)

#### Description

This tutorial is relevant to both Turbo and Pump users. It will teach you how to develop a maintenance program that will assure the safety of your personnel and equipment, engage in environmental compliance, and promote long-term business profit for your shareholders.



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# PUMP

## DISCUSSION GROUPS

### DISCUSSION GROUP 1

#### Monitoring Vibration and Other Critical Machine Conditions

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 361A

**Wednesday, September 14, 2016**

10:30 A.M. – 12:00 P.M. | Room 361A

#### Instructors

William Marscher, Juan Gamarra, (Mechanical Solutions, Ltd.), Steve Locke, Ed Watson (DuPont), Ron Adams (Sulzer Pumps), Dag Calafell (ExxonMobil), Simon Bradshaw (ITT Goulds Pumps), Al Miller (Flowserve), Jack Claxton (Patterson Pump Company), Hemanth Satish (TransCanada Corp.)

#### Description

- Condition monitoring methods
- Effectiveness of condition monitoring on rotating equipment
- Value and ROI condition-based monitoring
- Vertical pump monitoring
- Below ground monitoring in vertical pumps
- Vertical pump vibration standards
- Vertical turbine pump structural resonance analysis
- Vibration test methods and proper use
- Standard locations for vibration measurement on horizontal machinery
- Wireless devices: radio noise, effectiveness, experiences, security
- Troubleshooting methods and fix options
- Operation Deflection Shapes and integration with condition-based monitoring
- Finite element analysis application in support of selection and troubleshooting
- Rotordynamics
- Hydraulically-induced vibration: structural, system, rotor
- Hydraulic and aerodynamic system issues, including acoustics

- Measurement of severity of unsteady cavitation conditions
- Effect of high GVF (gas volume fraction) in centrifugal pumps
- Mechanical installation (e.g. piping, foundation, alignment) issues
- Modular pump installations, i.e. experience with non-grouted baseplates
- Seals and bearings - how they affect vibration

### DISCUSSION GROUP 2

#### Couplings and Alignment

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 361A

#### Instructors

Terry Roehm (Marathon Oil Company), Chris Rackham (John Crane Flexibox), Mark Oneil (Altra Couplings), Thomas Davidson (Linde, LLC)

#### Description

- Coupling guard design
- Shaft alignment and tolerances
- Balancing methods
- Coupling selection and specifications
- Shaft alignment methods
- Thermal growth considerations
- Application of optical alignment
- Hub/shaft fits and keys
- Coupling types and applications
- Startup problems
- 8th Edition recommendations
- Allowable nozzle loads
- Warmup piping procedures
- Case deflection, temperature and pressure
- Piping alignment
- Pipe strain

A Discussion Group is a forum in which leaders and attendees can address problems brought to the floor by attendees and find solutions to those problems through dialogue. Suggested Topics are to start the conversation; actual topics discussed will be determined by each session's attendees. Each Discussion Group is 90 minutes long.

## DISCUSSION GROUP 3

### Gears

**Tuesday, September 13, 2016**

10:30 A.M. – 12:00 P.M. | Room 370F

#### Instructors

Joseph A. Silvaggio, Jr. (Siemens), Robert C. Eisenmann Jr. (BP), Mark Brooker (LyondellBasell), Scott Franks (LUFTEX GEARS), Dietmar Sterns (RENK), Ed Martin (Lufkin, part of GE Oil and Gas)

#### Description

- New gear applications
- Rotordynamics
- Bearings for gear drives
- Installation questions
- Metallurgy/heat treat methods
- Contamination
- Overhaul frequency
- Instrumentation/Monitoring
- Lubrication
- Efficiency

## DISCUSSION GROUP 4

### Lubrication

**Wednesday, September 14, 2016**

2:00 P.M. – 3:30 P.M. | Room 361A

#### Instructors

Brian Pettinato, Alex Schaefer (Elliott Group), Leslie Thilagan (S&B Engineers and Constructors, Ltd.), Jeff Buck (Shell Projects and Technology), Jeff Haught (Anadarko Petroleum), Ken Shifflett (Motiva)

#### Description

Introduction  
Plant Wide Maintenance and Problems

- Effective Maintenance Programs
- Best Practices
- Oil Varnish

Oil / Grease

- Type and Selection
- Testing and Maintenance Including Frequency
- Mixing and Compatibility

Lubrication Systems and Auxiliaries

- API 614 Systems
- Oil Mist Systems
- Grease Systems

## DISCUSSION GROUP 5

### Centrifugal Pump Operation, Maintenance, and Reliability

**Tuesday, September 13, 2016**

2:00 P.M. – 3:30 P.M. | Room 370F

#### Instructors

Katie Strautman (Chevron), David DePaolis (Flowserve), Richard Donley (PBF Energy), Adam Gottlieb (Celanese Clear Lake Plant), Jamie Lucas (Marathon Petroleum), Paul Paimore (Flint Hills Resources Houston Plant), Arun Kumar (HPCL--Mittal Energy LTD.)

#### Description

- Repair specs, use, in house repair specs
- Lube oil storage and usage
- Mechanical seals and bearings issues
- Pump monitoring – how are we doing this and how do we want to do this
- Craft training – precision maintenance
- Best practices for pump maintenance; Back pullout vs. pulling entire pump:
- Open bearing housings vs. sealed – wet sump
- Seal plan which was not expected – wrong for the application
- Preventive/predictive technologies
- Off design operation
- Mean time between failure (MTBF), other KPIs – how do we measure, and how do we use the metrics

- How to create pump reliability in an unreliable plant
- Seal-less versus sealed pump reliability, canned motor pumps versus mag drive pump reliability
- Mechanical Integrity Inspections of VS 6 pumps in hydrocarbon service
- Seals in light hydrocarbon service – operations, risk, leak response, maintenance
- Pump predictive/preventive maintenance program elements – philosophy, frequencies
- Measures of effectiveness of preventive and predictive programs for pumps
- Roles of operations and maintenance/ reliability in improvements and data collection
- Reliability experience with liquid versus non contacting gas seals applications
- Maintenance philosophy for pumps – what constitutes “best practices”
- Spare parts – OEM versus non-OEM
- Repairs – OEM versus non-OEM service facilities
- Pump foundation, alignment and pipe strain influence of reliability
- Impact of corporate purchasing alliances on pump reliability
  - a. Repair facilities alliances
  - b. New equipment purchasing alliances
- Repair techniques and material improvements
- Portable and on-line monitoring – impact on reliability
- Wireless monitoring – impact on reliability and risk of failure
- Optimization of thrust bearings configuration
- Lubrication system impact on reliability – oil mist versus flood, oil selection
- Mechanical Seals
- Use of non-metallic vs metallic materials for stationary wear rings
- LLDS (Look Listed Feel Smell) – how to build effective daily surveillance by operators and maintenance
- Epoxy coating of pump foundations
- Bearing isolators – what is the best practice (magnetic vs. others)
- Hot alignment – how applied, when needed, application with the current LOTO procedures

## DISCUSSION GROUP 6

### Mechanical Seals

**Tuesday, September 13, 2016**

10:30 AM - 12:00 PM | Room 372D

#### Instructors

Michael Huebner (Flowserve), Henri Azibert (Fluid Sealing Association), Shifeng Wu (A.W. Chesterton Company), Eric Vanhie (EagleBurgmann), Brian Kalfrin (John Crane), Todd Monroe (LyondellBasell), Judy Hodgson (Hodgson Consulting)

#### Description

Mechanical seals are the most common method of sealing industrial centrifugal pumps and other rotary equipment. Although the basic concept of a seal is simple, successfully using seals requires an understanding of the selection and operational requirements which can be unique for a specific application. In this discussion group, we will cover many of these considerations along with other application experiences from end users and seal OEMs. The discussion group will actively solicit topics from the attendees so the discussions will address real-world problems and challenges faced by the group. Typical topics covered in this discussion group include:

- Changes in upcoming API 682 4th edition
- Air testing of seals in pumps prior to installation
- Challenges with low temperatures sealing
- Effective leakage containment of single seals
- Strengths and weaknesses in Plan 53A, 53B, and 53C piping plans
- Considerations when sealing abrasive slurries
- How to apply dual pressurized gas seals
- Mechanical seals for multiphase applications
- Advances in seal face materials
- Process for handling problem pump and seal applications



- Definition of mean time between failure and industry best practices
- How and when to use split seals

## DISCUSSION GROUP 7

### Improving Mean Time Between Pump Failures

**Wednesday, September 14, 2016**

8:30 AM - 10:00 AM | Room 370F

#### Instructors

John P. Joseph, II (Rotating Equipment Systems, LLC), Bill Litton (Magellan Midstream Partners LP), David Depaolis (Flowserve), Morg Bruck (HMIC, LLC)

#### Description

- Mechanical/Metallurgical design requirements for pump components
- Design and installation for pump baseplates
- Proper hydraulic fit of pumps
- Mechanical alignment targets/procedures
- Pump repair criteria

## DISCUSSION GROUP 8

### Vertical Pump Problems and Solutions

**Tuesday, September 13, 2016**

08:45 AM - 10:15 AM | Room 370F

#### Instructors

Paul Behnke, Howard Wright (ITT Goulds Pumps), Jim Kilgore (Motiva Enterprises, LLC), Eric Vanhie (EagleBurgmann), Jeremy Cooper (Bechtel OG&C), Becky Owston (Southwest Research Institute), Hemanth Satish (TransCanada Corp.)

#### Description

- Petrochemical industries
- Installation
- NPSH
- Materials
- Bearings
- Maintenance
- Vibration
- Lubrication
- Paper industries

- Power industries
- Tolerances
- Nozzle loads

## DISCUSSION GROUP 9

### Sealless Pumps

**Wednesday, September 14, 2016**

10:30 AM - 12:00 PM | Room 370F

#### Instructors

Daniel Wood, Greg Frantz (Chemours), Gene Baker (LyondellBasell), James Lobach (Teikoku), Matt Moy (Flowserve), Judy Hodgson (Hodgson Consulting)

#### Description

- Types of sealless pumps and application limitations such as HP, pressure, temperature, solids, etc.
- Applications where sealless pumps have been successfully applied, and where they have failed
- Environmental performance in VOC or HON services
- New developments to improve reliability or extend where they can be applied

## DISCUSSION GROUP 10

### Pipeline Applications

**Tuesday, September 13, 2016**

8:45 A.M. – 10:15 A.M. | Room 372D

#### Instructors

Bill Litton (Magellan Midstream Partners LP), Bruce Weber (Champion), Morg Bruck (Hydraulic, Measurement, and Inspection Consulting, LLC), Mike Nigro (Weir Services), Bryce Dreger (Pumps at Enbridge Pipelines), George Maddox (Best PumpWorks)

#### Description

- Operation (single, series, batch products, parallel)
- Maintenance (mechanical seals, bearings, pigging, vibration)
- Hydraulic rerates (destaging, volute chipping, volute inserts, impeller underfilling)

# DISCUSSION GROUP 11

## Panel Session: Subsea Pumps and Drivers

Wednesday, September 14, 2016

8:30 AM - 10:00 AM | Room 372D

### Instructors

Bob Heyl (Independent Consultant), Pierre-Jean Bibet (Total E&P), Ron Adams (Sulzer Pumps), Thomas Eldridge (Shell), Thomas Kyander (One Subsea), Roland Maurischat (Leistritz), Nickolas Necker (EagleBurgmann), John Byeseda (Cameron), David Harrold (FMCTI)

### Description

#### A. Applications:

1. What does the future of Subsea Seabed Pumping look like?
2. How does one decide what technology to use for an application? Separation and pumping, multiphase boosting, single phase boosting?
3. What is the most critical operating condition for a subsea multiphase pump seal?
4. How Pumps vendors and/or Operators mitigate risk of sand?
5. How long are the step-outs that are now in operation?
6. Industry needs cost effective subsea pumping solutions. What is a cost effective pumping solution? What are the constraints of having two MPP in series?
7. What are the constraints of a Brown Field application?
8. Redundancy Philosophy: "Wet Storage" or "Dry Storage"?

#### B. Pumps and Motors Themselves:

9. What maximum pressure differentials can they generate, for a GVF of let's say 60%?
10. What is the minimum suction pressure required for an MPP?
11. What size motors are being used today subsea?
12. What industry standards are used to design these pumps?
13. Expectation and limits of shaft power available – both, motor and electrical power supply?
14. What kind of mechanical seals are used and how do they function?
15. Where are the absolute pressure limits for the mechanical seals in future, as the secondary sealing elements (O-rings) need attention?
16. What issues are encountered with HP/HT applications?

17. How does viscosity effect different subsea pumps?

18. Which mechanical seal arrangement and API 682 Flush plan is used for Subsea Pumps?

19. What kind of material is used for the mechanical seals?

20. What is the most sensitive (weak) equipment of a subsea motor/pump system?

21. Barrier fluid: oil or water/Glycol?

#### C. Qualification Testing

22. What are the issues in qualification of boosting and pumping systems?
23. What kind of qualification test is carried out by the seal manufacturers?

#### D. FAT and EFAT

24. What are the inevitable Acceptance Tests to be performed on a subsea motor/pump system?

#### E. Monitoring and Control

25. Can we develop a 'normal' proximity probe for subsea applications, or is there another solution for condition monitoring?
26. How are the pumps controlled?
27. Can MPP be protected from big terrain slugs?
28. Do we need a fast-acting minimum flow valve?
29. Do we need a Multiphase flow meter to protect the pump?
30. What are the pros and cons of minimum instrumentation vs. full-blown condition monitoring?

#### F. Interfaces

31. Can we standardize the interface between the pump and the subsea system (mechanical, electrical, hydraulically, control system)? (Not standardize the pumps, but the interfaces)?
32. What is client's experience with topside supply system installations?

#### G. Asset Development

33. What do you see concerning the future of subsea pumping and asset development with the low price of oil these days? Delays? Scrapping?
34. How about other subsea applications, not only multiphase, how about water injection?

Attendees: Please come prepared by choosing your questions from the above prior to the time of the Discussion Group Session. At the very beginning of the Discussion Group Session a vote of which questions to discuss will be taken.

Of course, spinoff questions on related topics will be entertained as well.

## DISCUSSION GROUP 12

### Cryogenic Fluid Pumping Applications

**Wednesday, September 14, 2016**  
2:00 P.M. – 3:30 P.M. | Room 370F

#### Instructors

Enver Karakas, Lonn Hall (Ebara Intl), Wayne Guest, Dag Calafell (ExxonMobil), Vinod Patel (KBR)

#### Description

- Calculating efficiency, power & considerations
- Condition monitoring
- Cryogenic pump system components
- Accessories to cryogenic pump systems
- Shaft supports: bushings, bearings
- Rotordynamics
- Balance requirements for rotating components
- Bearing life and how to extend it
- Materials of construction & specifications
- Preventative maintenance (PM) requirements
- Vibration standards & monitoring
- Pump testing requirements & applicable test tolerances
- Troubleshooting
- Pump installation – steps and challenges
- Pump sizing for various cryogenic applications
- Motor sizing for cryogenic pumps
- Different kinds of cryogenic pumps and where they should be applied
- Cryogenic pump specific speed
- Marine & floating applications for cryogenic pumps
- Submerged motor design and its benefits
- Hazardous area classification for cryogenic pumps & systems
- Preservation and long-term storage of cryogenic pumps
- System design requirements
- Pressure vessel design

- Cryogenic pumping applications
- Pros and cons of conventional pump design versus Cryogenic submerged pump
- Pump columns/column diameters determination and benefits

## DISCUSSION GROUP 13

### Downhole Pumping

**Tuesday, September 13, 2016**  
2:00 PM - 3:30 PM | Room 372D

#### Instructors

Rebecca Owston (Southwest Research Institute), Ravi Balasubramanian, Michael Hughes (GE Oil & Gas), Pierre-Jean Bibet (Total E&P), Hector Casillas (Shell), Jacob Herriman (Baker Hughes), Bob Heyl (Independent Consultant)

#### Description

Average life of ESPs, and what is being done to address reliability concerns (erosion, corrosion, bearing wear, etc.)

- Highest failure modes for downhole pumps and their support systems (operator viewpoint)
- Alternate ESP configurations
- Intervention strategies for subsea retrieval/maintenance
- Future of ESPs for artificial lift in current economic climate, both onshore and offshore
- Challenges of high viscosity applications (reliable pump performance curves, motor cooling, startup power requirements, etc.)
- Performance/efficiency lessons from recent shale applications
- Recommended design practices/trade-offs for ESPs (higher RPM vs. reliability, longer pumps vs. maneuverability for placement, etc.)
- Downhole pump performance under transient well conditions (GVF, watercut, flow rate, abrasive wear, wax, scale, asphaltenes, etc.)
- Control methods for mitigating vibration issues
- Current capabilities in landing equipment with precision (horizontal/vertical travel, radius of travel, small degree curvature for placement)
- Novel applications of materials for high-risk ESP components (seals, bushings, etc.)

# PUMP CASE STUDIES

## PUMP CASE STUDY SESSION 1A

**Thursday, September 15, 2016**

8:30 A.M. – 10:00 A.M. | Room 370D

### CASE STUDY 1

**Potassium Carbonate Pump Failure – High Axial Movement Due to Uncontrolled (Unbalanced) Forces**

#### Instructors

Hatem AbdelRahman, Ibrahim AbdAl-Wahab (MOPCO)

#### Description

A 1.4 MW multi stage pump was in operation, until it came to a standstill for a mean period without any failure symptoms. All last measurements (casing vibration, pressure, flow) were OK, when the pump operated again after two weeks from standstill. One day, sudden failure occurred due to high axial movement which was established from axial thrust without any track alarm (no online monitor system as axial probe bearing temperature or discharge pressure, all parameters are local). This axial thrust is typically an effect of the Benfield process. The axial thrust was followed by damage of drive end mechanical seal. This failure resulted in silicon carbide powder entering between DE throat Bushing with shaft. The overheating initiated at the mechanical seal area causing melting and sticking for DE throat Bushing with shaft sleeve of the mechanical seal.

Our case study discusses the root cause analysis and how to deal with potassium carbonate pumps. It also addresses the reasons of damage, how to solve the problem and repair the damaged parts, as well as the corrective actions taken to avoid repeating this failure in the future.

## PUMP CASE STUDY SESSION 1B

**Thursday, September 15, 2016**

8:30 A.M. – 10:00 A.M. | Room 370F

### CASE STUDY 2

**Solving an Acoustic Resonance in Crude Oil Pump Internals**

#### Instructors

Sarah Simons, Francisco Fierro (Southwest Research Institute)

#### Description

A crude oil pump installation experienced vent tubing failures along with a significant increase in vibration. A field study was performed with data indicating unusually high vibrations at 300 Hz. Further investigation determined that the fluid properties of the crude oil had changed over time due the addition of new wells. This resulted in a shift in the speed of sound of the fluid such that the acoustic natural frequencies of the pump internal passages were now resonant with the blade pass frequency of the pump. This case study will describe the problem in further detail and outline the steps taken to resolve the vibration.

### CASE STUDY 3

**High Vibration Analysis of Eddy Current Drum Coupled Motor to a Vertical Centrifugal Pump – Solution Based on EMA, ODS and FEA**

#### Instructors

Juan D. Gamarra (Mechanical Solutions, Inc.), Jody Barksdale, Juan R. Oquendo (Gresham, Smith and Partners), Jack Ferras, James Hennessy (City of Tampa Florida)

#### Description

Centrifugal non-clog pump systems were installed in 1985 at the City of Tampa's San Carlos lift station during a time when the pumps' capacity exceeded the demand. As the City grew and historical weather trends changed, so did the pumps' normal operating

A Case Study is a short presentation describing the successful implementation of established technology to solve a real-world problem. Multiple case studies are run consecutively per 90-minute timeslot.

demands and with this change came vibration issues that did not exist for over thirty years of the pumps' existence. This case study demonstrates the effectiveness in machinery root cause investigations including thorough vibration testing including combined Operating Deflection Shape (ODS), Experimental Modal Analysis (EMA), and finite element analysis (FEA) rather than traditional troubleshooting and intuitive fix approaches.

## **CASE STUDY 4**

### **Solving a Vibration Problem in the Downstream Piping of a Gear Pump**

#### **Instructors**

Eugene "Buddy" L. Broerman, Benjamin White (Southwest Research Institute), Fahad Al-Khaldi (Al-Bayroni Jubail Fertilizer Company)

#### **Description**

A solution was developed for an extreme discharge piping vibration problem on an 80 hp gear pump piping system. Maximum field-measured vibration levels were over 4 ips 0-pk (200 mm/sec pk-pk). Most gear pumps are not equipped with the typical pulsation dampeners that are found on plunger pumps because the relatively high frequency pulsations that gear pumps generate typically do not result in piping vibration problems. Modeling predictions indicated that the vibrations were primarily driven by pulsations. After implementation of a new gas-liquid dampener, the system vibrations were significantly reduced.

## **PUMP CASE STUDY SESSION 2A**

**Thursday, September 15, 2016**

**10:30 AM - 12:00 PM | Room 370D**

## **CASE STUDY 5**

### **Eliminating Damage of Retaining Rings by Using Redesigned "Profiled" Keys**

#### **Instructors**

Joseph A. Silvaggio, Jr. (Siemens Demag Delaval Turbomachinery, Inc.)

#### **Description**

Retaining rings are used to locate pump impellers axially on the shafts of high speed, high pressure Siemens Delaval boiler feed pumps. Upon repairing and refurbishing the inner barrels, the retaining rings were found to be badly worn and in some instances broken. This damage was eliminated by using a "profiled" key. This case study discusses the pump design, the location and function of the retaining rings, the location and function of the keys and the failures observed. The reason for redesigning the key to a "profiled" is presented. The new key design shields the leading edge of the retaining from impinging water and this is discussed in detail. No damaged retaining rings were observed after implementing "profiled" keys.

## **CASE STUDY 6**

### **Using Engineered Composite Materials in Sealless Magnetic Drive Pumps to Eliminate Eddy Current Losses and Improve Reliability**

#### **Instructors**

Ian Guthrie (Sundyne, LLC), Samuel Stutz (Greene, Tweed & Co. (Suisse) SA)

#### **Description**

This case study details how engineered composite materials can be used as a material of construction for a sealless pumps containment shell. The case study shows the

clear benefits of this technology as a material in a challenging API685 compliant pump application.

It will show a comparison between the use of a more traditional high-alloy metallic containment shell material vs. the engineered composite material. The case study will provide details on root cause analysis of a pump failure, including actual test data, which was resolved by applying an engineered composite material and the other fringe benefits shown with the application of this technology.

## PUMP CASE STUDY SESSION 2B

**Thursday, September 15, 2016**

10:30 AM - 12:00 PM | Room 370F

### CASE STUDY 7

#### Thermal Load Effect on Vibration on a Reactor Feed Water Pump (FWP)

##### Instructors

Maki M. Onari (Mechanical Solutions, Inc.)

##### Description

Three reactor feed water pumps (FWP) driven by 16,500 HP induction motors, through a gear increaser, (designated as Alpha, Bravo, and Charlie) installed at a nuclear power plant in NY had been reported to have repetitive failure of the mechanical seals since pump installation in 1987 (MTBF of 6 months, mostly on the Alpha pump). Based on analysis performed by the OEM, it was concluded that the legacy pump Byron Jackson 20x20x22 HSB – 2 stage required modification in order to improve seal reliability and also increase plant capacity by 15% (EPU). The modification consisted of redesigning the mechanical seals, the impellers, the flow path to the first stage impeller (smoother suction passage), and also the inboard (IB) suction cover.

In spring 2012, the FWPs were tested after implementing additional modifications during the refueling outage (tri-land radial bearings and implementing an API Plan 23 for seal lubrication and cooling). This new seal plan eliminated condensate injection through the throttling bushings (~11 GPM per seal). The former seal water injection was causing deformation of the inboard end cover of the pump due to cooling water accumulating at

the bottom of the pump casing with lower temperature than the reactor feed water. The distortion of the inboard cover plate was in turn leading to internal misalignment at the IB bearing. The shaft vibration at the IBB, which used to be approximately 6.0 mils pk-pk, was reduced significantly after outage to approximately 2.3 mils pk-pk.

### CASE STUDY 8

#### Winter Vibration Problems on VS6 Booster Pumps and Solutions

##### Instructors

Paul Behnke, Abhi Gandhi, Landon Worrell (ITT Industrial Process, Goulds Pumps ESLA), Bryce Dreger (Enbridge Pipelines Inc.)

##### Description

Three multistage canned vertically-suspended pumps are installed at Kerrobert, Canada to transfer crude oil.

The pumps are driven by 1000 HP vertical motor at 885 RPM.

The installed pumps vibrate in the winter but run fine the rest of the year.

Several attempts to fix the problem at site did not yield success.

After many years, the Pump User asked the Pump Supplier to analyze the problem.

### CASE STUDY 9

#### Improved Mechanical Seal Design for High Temperature, Light Slurry Applications

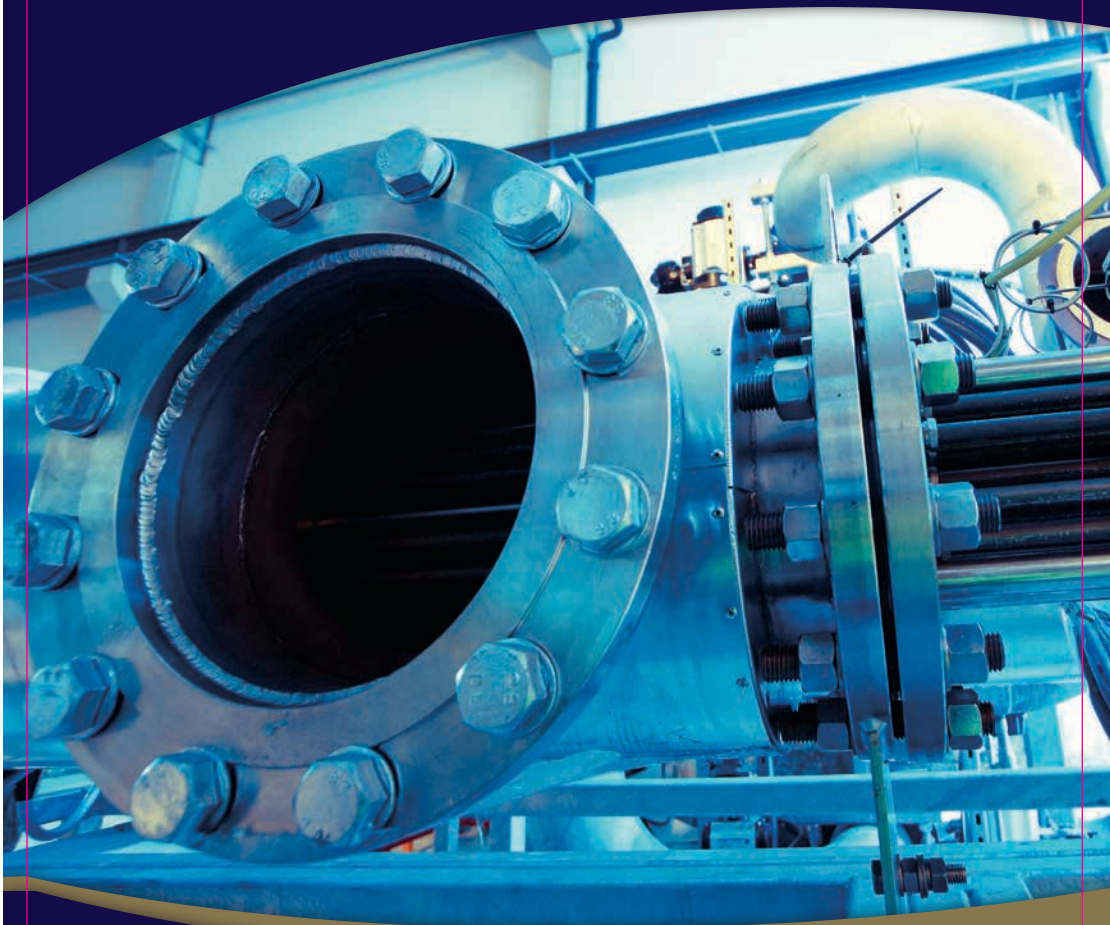
##### Instructors

Chris Riché, Jose Martin (Flowserve)

##### Description

This case study reviews the history of an difficult application where a conventional seal design was replaced by a hybrid seal design to handle a high temperature, light slurry process while still providing low barrier fluid consumption. The presentation reviews the history of the application, the development of the new seal and the results of the new installation.





EXHIBITORS

EXHIBITORS





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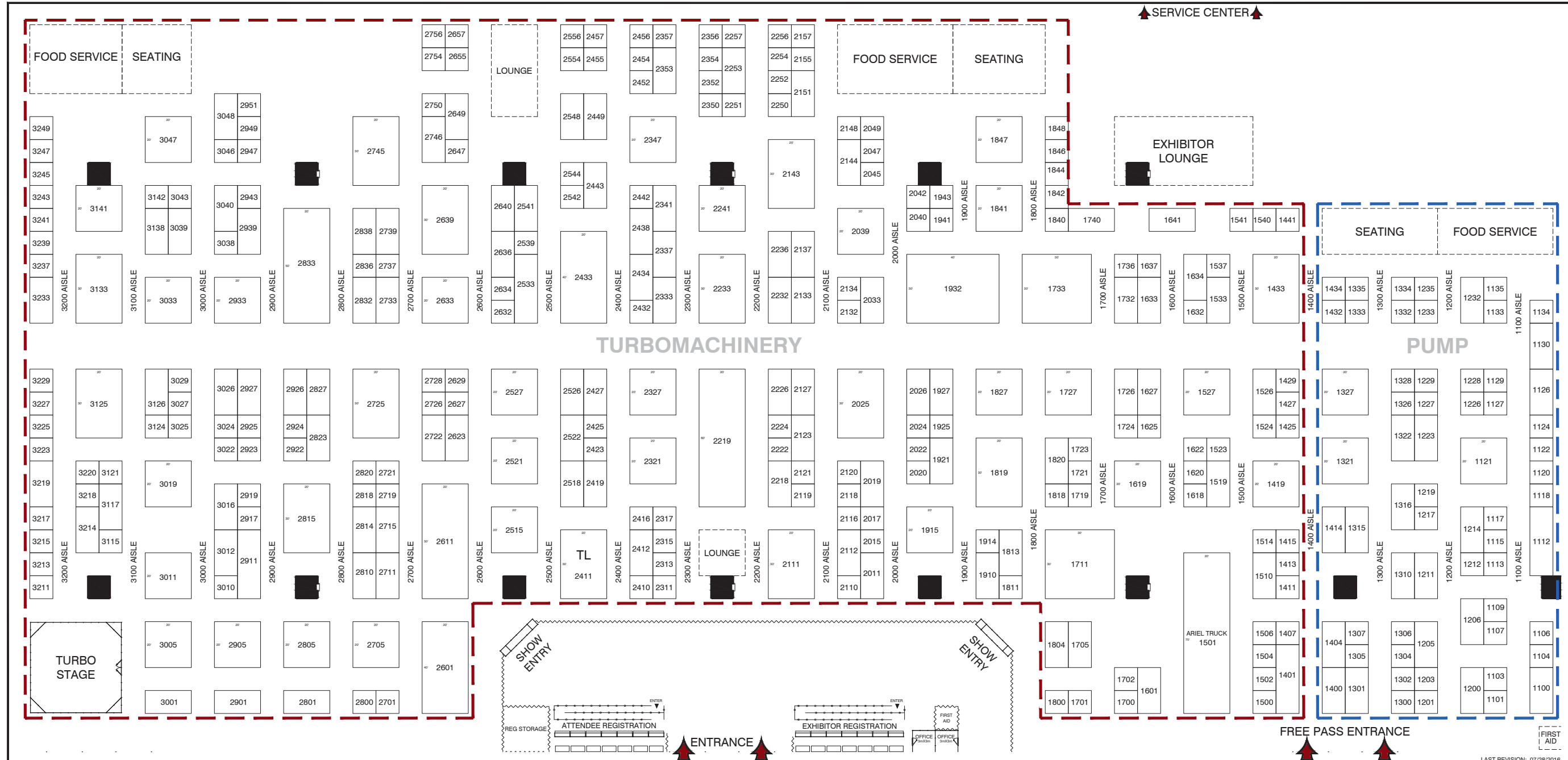
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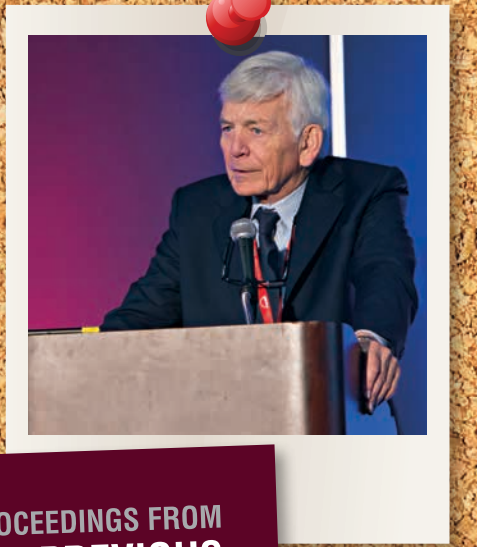


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AAF International	2121
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ACQUIP Powered.Empowering	2443
ACS (Alloy Coating Supply)	2352
ACTech. North America, Inc.	1413
AcuCut, Inc.	1723
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Adams Valves	1332
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Advanced Compressor Technology	2019
Advanced Design Technology	1724
Alpha Order	
Advanced Turbine Support, LLC	1524
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Hebei Metals & Minerals Corp. Ltd.	1326
Henkel Loctite Corporation	1702
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HILCO	2218
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Houston Dynamic Service, Inc.	2333
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Hunan Sund	1846
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HydroTex Dynamics, Inc.	1321
Hydrothrif	1429
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IMMI Turbines	2701
Industrial Info Resources	3001
Industrial Reliability & Alignments, LLC	2313
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Integrated TurboMachinery, Inc.	1914
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ITT Corporation	2241
ITW Engineered Polymer	3027
JAQUET	1918
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Mary Kay O' Connor Process Safety Center	2040
Maudlin & Sons Mfg. Co., Inc.	1502
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Napoleon Engineering Svcs	2047
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National Pump Company	1306
NES Company	3237
Netsch Pumps North America LLC	1434
Neuman & Esser	3011
New England Braiding Company, Inc.	1432
New Way Air Bearings	3005
NGC Transmission Equipment (America), Inc.	2253
Nidec Industrial Solutions	2347
Nord-Lock Inc.	2927
NUMECA-USA	3225
Oeltechnik	3029
Oil, Gas & Petrochem Equipment	2119
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Optech4D	3243
OROS Inc.	2148
PDC Machines, Inc.	1705
Peerless PROCORE	2251
Pentair	3215
Permabond Engineering Adhesives	1104
PetroPages.com, Inc.	2832
Petrotech, Inc.	2132
Philadelphia Gear	1910
Piller TSC Blower Corp.	3040
Praxair Surface Technologies	2022
Precision Polymer Engineering	3223
Prime Photonics/APEX Turbine Testing Technologies	1411
Prognost Systems, Inc.	2011
ProMinent Fluid Controls Inc.	1126

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1641

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2352

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1413

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2019

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1724

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3026

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1400

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1523

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1925

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<http://www.apalloy.com>

1107

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API SmartBrief is news for the oil and natural gas industry created in partnership with the American Petroleum Institute. API SmartBrief provides a daily snapshot of the industry with news from FuelFix, the Oil & Gas Journal, and The Hill among others. Written by expert editors, API SmartBrief is the smarter way to stop on top of oil and natural gas industry news!

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1415

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Located in Colorado Springs, Colorado, USA, our professional staff consists of engineers with extensive experience in both the design and construction of piping systems and the development of analytical modeling methods.

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## ARIEL CORPORATION

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1606

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3124

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1328

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1827

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<http://www.atlascopco-gap.com>

Atlas Copco Gas and Process is a division within the Atlas Copco Group's Compressor Technique business area. It develops and manufactures turbocompressors, reciprocating compressors, expansion turbines, and solutions for Organic Rankine Cycle power plants, and for oil and gas applications. In addition, Gas and Process offers a matching range of aftermarket products. The Division's solutions are used in oil and gas and chemical/petrochemical processes, power generation, renewables, and the industrial-gases sector. The divisional headquarters is located in Cologne, Germany, and the production centers are in the United States, China and India. Learn more at [www.atlascopco-gap.com](http://www.atlascopco-gap.com).

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# B

## **BADGER METER**

1206

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3141

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<http://www.bearingsplus.com>

Bearings Plus® (BPI®) is an industry-leading provider of repairs and custom technology upgrades for critical turbomachinery components. BPI designs and manufactures integrated solutions that meet the specific requirements of each end user and operating environment, applying the latest fluid film bearing and high-performing seal technology to legacy equipment to optimize performance. BPI provides expert rotordynamic analysis and responsive, localized support to a broad range of customers, including independent overhaul shops, OEMs and end users in the Gulf Coast and around the globe. BPI is a Waukesha Bearings® business. Waukesha Bearings is an operating company of Dover.

**BEIJING ZHONGXING SHIQIANG CERAMIC BEARING CO., LTD.****2754**

No.A38#, Weishanzhuang Industry District  
Daxing District, Beijing, 102611 Beijing China  
PH: +861089233753 | FX: +861089233713  
[http:// www.zxsq.com.cn](http://www.zxsq.com.cn)

Beijing Zhong Xing shi Qiang Ceramic Bearing Co. Ltd. (ZXSQ) is the first high-tech enterprise of its kind in China, which is specialized in research, development and production of rare-earth ceramic. Our products made of high performance rare-earth ceramics, such as Si3N, SSiC, ZrO2, Al2O3... Our ceramic products have been exported worldwide since more than 10 years, and win a good fame. We have business friends and partners the world over.

**BENSTONE INSTRUMENTS****2544**

32905 Northland Court  
Lindstrom, MN 55245 USA  
PH: 651-257-6500  
<http://www.benstone.com>

Benstone Instruments is a world leading company providing measurement solutions for sound and vibration problems. We understand your needs and the challenge you face when taking sound and vibration measurements in different and many times harsh and inconvenient environments - in a factory, on a ship or in the lab.

Benstone is here to help you solve your sound and vibration problems with the best measurement instruments in the industry and the necessary technical support.

We offer our customers state-of-the-art solutions with continuous improvements and innovation. Find out how Benstone Instruments is advancing signal science.

## **BERGEN CABLE TECHNOLOGY, LLC**

**3239**

343 Kaplan Dr.  
Fairfield, NJ 07004 USA  
PH: 973-276-9596 | FX: 973-276-9566  
<http://www.bergencable.com>

For over 60 years Bergen Cable continues to be the name associated with wire rope and mechanical cable assemblies. We are a leader in providing solutions in the development of new products as well as providing value engineering assistance to existing products. Our long-standing reputation for excellence stems from our experienced team of professionals. Operators to engineers are supported with the best equipment, fine-tuned manufacturing techniques and the highest standard of quality assurance.

Some of the most demanding product applications rely on Bergen Cable, that's why many of the top OEMs refer to us as their "Cable Connection."

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## **BIC ALLIANCE**

**PUB BIN**

PO Box 40166  
Baton Rouge, LA 70835 USA  
PH: 225-751-9996 | FX: 225-752-0140  
<http://www.bicalliance.com>

With over 100,000 readers, BIC Magazine is the Western Hemisphere's largest multi-industry, multi-departmental energy publication. BIC Magazine targets key decision makers in the downstream, midstream and upstream energy sectors.

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## **BOEDEKER PLASTICS, INC.**

**1335**

904 West 6th Street  
Shiner, TX 77984 USA  
PH: 800-444-3485  
<http://www.boedeker.com>

Boedeker Plastics, Inc. specializes in service offering a 10 million dollar inventory of engineering plastic and composite shapes that are available with cut to size service with same day shipping. Our inventory is backed by an ISO certified precision machine shop that specializes in machining plastics and composites. We offer engineering plastic and composite materials and precision machined parts that have a proven history of increasing mean time between repair in compressor, pump, and valve applications. We stand ready to put our vast inventory, precision machine shop and experience to work for you. PEEK, Torlon, Fluorosint, CIP Composites and more.

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## **BOERGER, LLC**

**BÖRGER® 1333**

2860 Water Tower Place  
Chanhassen, MN 55317 USA  
PH: 612-435-7300 | FX: 612-435-7301  
<http://www.boerger.com>

Boerger specializes in reliable and cost effective Rotary Lobe Pumps and Macerating Technology for the conveyance of low to high viscous and abrasive materials.

**BO-GE ASSEMBLY, INC.**

1407

1123 Church Street  
Crosby, TX 77532 USA  
PH: 281-462-0073 | FX: 281-462-0085  
<http://www.bo-ge.com>

BO-GE Assembly is a rotating machinery repair/overhaul facility. We regularly work on steam turbines, compressors, pumps, cryogenic expanders and gearboxes. BO-GE also manufactures and repairs babbitted bearings, labyrinth seals and other turbo machinery related components.

BO-GE Assembly has long been highly regarded in the air separation field for extremely accurate balancing of high speed expander rotors and is certified for oxygen cleaning.

BO-GE is located in Crosby, Texas, with convenient access to US Highway 90 northeast of Houston.

**BOLL FILTER CORPORATION**

3126

22635 Venture Drive  
Novi, MI 48375 USA  
PH: 248-773-8200 X11 | FX: 248-773-8201

Boll Filter Corporation is the U.S. subsidiary of the renowned BOLL & KIRCH Filterbau GmbH headquartered in Germany. BOLL has been a market leader in providing liquid and gas filtration products and systems since 1950, with a global support network around the world.

**BOULDEN COMPANY INC.**

1633

1525 Lakeville Drive  
Kingwood, TX 77339 USA  
PH: 281-348-0888 | FX: 281-749-8116

Dupont™ Vespel® CR-6100 is “the next generation composite material” for use in pumps as wear rings, line shaft bearings, center bushings, etc. Outstanding run-dry performance, cryogenic to +500F service temperatures, broad chemical compatibility, and exceptional machining and installation characteristics lead to improved pump reliability.

Boulden Cermatec™ Cermatec™ is a fiber reinforced ceramic composite material which can replace silicon carbide, carbon, graphite, or metal bushings, bearings, wear rings, and thrust plates.

DuPont™ Krytox greases and oils deliver nonreactive, non-flammable, long-lasting performance under the demanding temperatures and pressures of reactive gas service. Krytox® lubricants are compatible with oxygen and other reactive chemicals.

**BURCKHARDT COMPRESSION, INC.**

2705

19750 FM 362 RD  
Waller, TX 77484 USA  
PH: 832-312-0622 | FX: 281-582-1060

Burckhardt Compression is committed to becoming the first choice manufacturer of reciprocating compressors. Throughout a worldwide network we provide all products and services required during a reciprocating compressor's life cycle. Burckhardt Compression is a market leader in the area of Reciprocating Technology. We are recognized worldwide for our outstanding achievements in Machine Design, Fabrication, Service and Customer Support. We as Burckhardt Compression are devoted to being the customer preferred supplier of Reciprocating Compressor Systems. Our customers can benefit from 170 years of experience and Competence. For the people of Burckhardt Compression, Customer Satisfaction has a special meaning.

## **B-W GRINDING SERVICE INC.**

7405 Major St

Houston, TX 77061 USA

PH: 713-644-5595 | FX: 713-644-6334

2419

B-W Grinding Service Inc. is a full service manufacturing, coating and grinding facility using state of the art machinery and coating techniques. B-W's highly skilled craftsmen specialize in manufacturing OEM replacement parts, certified master taper gauges, lapping gauges and repair of parts such as gas and steam turbines, pumps, shafts, sleeves, impellers, compressor rods, plungers, etc. B-W has one of the largest (98 inch swing) purpose built OD grinders for turbomachinery in the world with the experience to accomplish customer objectives 24 hours a day 7 days a week.







## **CALNETIX**

16323 Shoemaker Ave  
Cerritos, CA 90703 USA  
PH: 562-293-3197 | FX: 562-293-1689  
<http://www.calnetix.com>

Focused on Innovation That Drives Industries™, Calnetix specializes in high-performance, high-speed motor generators and best-in-class advanced control systems and magnetic bearings. Calnetix's patented, underlying technologies, which have been in use since the company's inception in 1998, have made Calnetix a world leader in the design and production of high-speed machines.

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## **CAMFIL POWER SYSTEMS**

3025 Joseph A. Bombardier  
LAVAL, QC H7P 6C5 Canada  
PH: 450-967-6777 | FX: 450-629-5847  
<http://camfil.com/ps>

Camfil Power Systems is a global leader in clean air solutions for turbomachinery. We manufacture high quality filters and auxiliary equipment for gas turbines and turbomachinery equipment used for power generation and oil & gas applications.

Our complete solutions include air inlet, exhaust, noise reducing systems and ventilation as well as dampers and diverters; retrofit services, filter upgrade and spare parts. By offering the right solution for your specific environment, we optimize the process, resulting in lower operating costs, improved efficiency and lower environmental impact.

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## **CANADA PIPELINE ACCESSORIES**

10653 46 ST SE  
Calgary, AB T2C5C2 Alberta Canada  
PH: 403-472-7583  
<http://www.cpacl.com>

Canada Pipeline Accessories Co. Ltd. is dedicated to the improvement of fluid flow through pipe. This includes inlet fluid flow correction for pumping applications. Pump flow conditioners are used to provide the proper pipe flow to ensure the pump replicates the pump curve design conditions. Our engineering staff are experts at system design and flow diagnostics. Computational and/or test lab verification of pump efficiencies and performance is offered as well. Understanding fluid flow allows for educated solutions to flowing challenges throughout fluid handling industries.

2623

2541

1134

## **CANGZHOU YONGXING FOUNDRY CO., LTD.**

**2118**

No.3 Road Botou Industrial and Development Zone  
Cangzhou, 062150 Hebei China  
PH: +863178313698 | FX: +863178313798  
<http://www.yongxingcasting.com>

Cangzhou Yongxing Foundry Co.,Ltd which founded in 1985.We produced compressor parts,elevator parts,high speed rail accessories, auto parts,wind power parts, machine tool accessories,drain valve parts, mining machinery,reducer parts, engineering machinery parts, pump body system components, fire fighting system components, etc., are exported to the United States, Germany, Italy, France, Canada, Japan and other dozens of countries.

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## **CASCADE ANALYTIC, LLC**

**2357**

1705 Gill Rd  
Dickinson, TX 77539 USA  
PH: 513-939-8352 | FX: 832-201-0346  
<http://www.cascademvs.com>

Cascade Analytic, LLC was organized to fill the gap between the instrumentation manufacturers, machinery condition monitoring, instrumentation application, practical knowledge and total support in the matters of machinery vibration, alignment, dynamic balancing and acoustic. We are incorporating all of these elements for world wide access on a 24/7 basis. Our premier group of consultants will solve your problems from inception to the finish products and/or services.

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## **CAVALIER INDUSTRIAL SPECIALTIES**

**2116**

11715 Charles St  
Houston, TX 77041 USA  
PH: 713-983-0055 | FX: 713-983-0058  
<http://www.GoCAV.com>

Cavalier Industrial Specialties is a manufacturing supplier of industrial studs, custom fasteners, and assembly components. The manufacture of precision forgings, machined CNC parts and bolting items for extreme service environments defines Cavalier. Whether the need is a part per engineered drawing, emergency response and delivery, or hard to find raw materials for your field service needs The CAV response and delivery will meet your demands! High temperature and extreme corrosion resistant applications are our specialty and "Precision is our Passion".

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## **CBB-CSC**

**1217**

64 Dalkeith Drive  
Brantford, ON N3P 1N6 Ontario Canada  
PH: 519-752-5471 | FX: 519-752-7890  
<http://www.cbb.ca>

CBB refurbishes & manufactures new pump & compressor bearings as well all types of thrust and journal bearings. We have state-of-the art babbitting, machining & inspection equipment and spray metal facilities.

Canadian Specialty castings provides pump castings up 6,000lbs to all pump. We cast over 300 alloys with specialties in stainless, duplex, wear & corrosion resistant alloys.

**CD-ADAPCO**

1533

60 Broadhollow Rd.  
 Melville, NY 11747 USA  
 PH: 631-549-2300 | FX: 631-549-2654  
<http://www.cd-adapco.com>

CD-adapco is the world's largest independent CFD-focused provider of engineering simulation software, support and services. We have over 30 years of experience in delivering industrial strength engineering simulation to a wide range of industries and application areas.

**CEROBEAR GMBH**

1941

Kaiserstrasse 100  
 Herzogenrath, 52134 NRW Germany  
 PH: +49240795560 | FX: +49240796224  
<http://www.cerobear.com>

CEROBEAR is a specialized manufacturer of high performance hybrid and all-ceramic bearings with highly customized solutions for the aerospace, race car, fluid machinery, machine tool and food and beverage machinery. Its major product families include hybrid and all-ceramic ball and roller bearings of all types as well as needle and thin section bearings made from high performance ceramics and steels.

CEROBEAR's core capabilities include an extensive heritage of hybrid and all-ceramic bearing design, fast and flexible high precision production of steel and ceramic rollers and rings, and a continuous drive for innovation of design, materials, and manufacturing methods.

**CFTURBO SOFTWARE ENGINEERING GMBH**

1427

Unterer Kreuzweg 1  
 DRESDEN, 01097 Sachsen Germany  
 PH: +491722362235 | FX: +4989189414520  
<http://www.cfturbo.de>

CFTurbo Software & Engineering GmbH was founded in 2008 as spin-off from Munich based CFDnetwork GmbH. The company offers sophisticated software solutions for conceptual design of Turbomachinery components like impellers, vaned and vaneless stators and volutes.

CFTurbo® can be used to design axial, radial and mixed-flow pumps, blowers, compressors and turbines, as well as for diffusers, stators, return channels and volutes. Especially all new developed modules to create axial fans, axial turbines, axial pumps and inducers will allow a much wider range of applications for CFTurbo® then before. Additionally our company offers a wide range of CAE-consulting and engineering services.

**CHAMPION HI-TECH MFG. CO., INC.**

1740

5565 Maudlin Street  
 Houston, TX 77087 USA  
 PH: 713-644-2181 | FX: 713-644-1257

Champion Hi-Tech Mfg. Co., Inc. manufactures a complete line of mechanical seals, auxiliary equipment, and gaskets. Champion's strength is their mechanical seals designed for high pressure and temperature applications. These specialty seals are complemented by a full line of mechanical seals used to meet standard applications in operations worldwide.

Champion is the champion of innovation and reliability.

## **CHANG YUAN SPRAY TECHNOLOGY LTD**

**3024**

1960 Williams Street  
San Leandro, CA 94577 USA  
PH: 415-533-7191

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## **CHEM SHOW, THE**

**1441**

15 Franklin St  
Westport, CT 06880 USA  
PH: 203-221-9232 | FX: 203-221-9260  
<http://www.chemshow.com>

Held every two years since 1915, The 57th Chem Show is the largest North American event focused exclusively on the processing of fluids, powders, and gases throughout the Chemical Process Industries (CPI). The Chem Show provides a platform to solidify professional relationships and enhances awareness of the latest processing technology, while promoting the innovation and advancement of the CPI. We invite you to join us, and over 5,000 of your colleagues to view the newest and most innovative processing equipment that will be displayed by industry leaders at the 2017 event in New York, October 31st to November 2nd.

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## **CHEVRON**

**2807**

125 Waterstone Dr.  
Montgomery, TX 77356 USA  
PH: 281-546-1119  
<http://www.chevronlubricants.com>

Chevron is a global finished lubricants supplier. We are focused on premium products for rotating equipment. Chevron focuses on reliability based lubricants and services. Please stop by booth #2807 to learn more about our ISOCLEAN products and services. We can extend the life of your equipment.

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## **CINCINNATI GEAR REPAIR**

**2933**

301 Milford Parkway  
Milford, OH 45150 USA  
PH: 513-527-8600  
<http://www.cincinnati gearsystems.com>

As a division of Cincinnati Gearing Systems, Cincinnati Gear Repair (CGR) is focused on aftermarket needs and the end user. With a dedicated 28,000 square foot rebuild and repair facility, state of the art equipment and expert staff, Cincinnati Gear Repair is prepared to handle the largest and most complicated gearboxes regardless of the make or model. Advantages include: 24 Hour Support, Fully Warranted Rebuilds, International & Domestic Availability, A Full Service Manufacturing Facility, Heat Treating Division, Engineering & Design Support, Inspection & Testing.

**CINCINNATI GEARING SYSTEMS**

2933

5757 Mariemont Avenue  
Cincinnati, OH 45227 USA  
PH: 513-527-8600 | FX: 513-527-8635  
<http://www.cincinnati gearing systems.com>

CINCINNATI GEARING SYSTEMS Inc. is a recognized leader in precision power transmission design.

More than just a gear manufacturer, CGS offers customers over 100 years of experience in producing high quality, reliable and cost effective gear units for a wide range of power transmission applications. Configurations: Epicyclic Gear Units, Multiple Pinion Gear Units, Parallel Shaft Designs, Vertical and Horizontal Offsets, Dual and Single Input, Hybrid Designs, Single & Double Helical, Spur Gears.

**COBEY, INC.**

2133

One Ship Canal Parkway  
Buffalo, NY 14218 USA  
PH: 716-362-9550 | FX: 716-362-9551  
<http://www.cobey.com>

Cobey Inc. designs and manufactures modular piping packages and auxiliary equipment for the petrochemical, energy, oil & gas, and air separation industries. Engineered products such as lube oil consoles, dry gas seal panels, rundown tanks and rotating equipment packages are custom designed in accordance with customer specifications and applicable ISO/API standards.

**COGENERATION & ON-SITE POWER PRODUCTION MAGAZINE**

PUB BIN

1455 W Loop S.  
Houston, TX 77027, USA  
PH: +441992656652 | FX: +441992656700  
<http://www.cospp.com>

Cogeneration & On-Site Power Production (COSPP) magazine, website and e-newsletter are recognized as authoritative and reliable sources of information for the global CHP / cogeneration / distributed energy industry, promoting the use of cleaner, more efficient distributed energy worldwide.

With the focus now firmly on the low-carbon production of electricity and heat, the relevance of COSPP has never been greater.

COSPP, is distributed directly to an average of 15,477\* industry decision makers worldwide, and continues to work with many of the leading trade associations, including the World Alliance for Decentralized Energy (WADE). \*Source June 2014 BPA Worldwide Average Circulation Statement

**COLFAX - RELIABILITY SERVICES**

2226

2320 West 8th St  
Erie, PA 16505 USA  
PH: 814-459-2443 | FX: 814-459-6862  
<http://www.colfaxfluidhandling.com/reliability-services>

Colfax Fluid Handling's Reliability Services provides industry leading lubrication solutions and chemical cleaning services designed to keep your critical equipment operating at peak performance. Discover the many ways Reliability Services can help your facility achieve world-class lubrication excellence by visiting Booth 2226 or by contacting us at 888.478.6996.

## **COLUMBIA INDUSTRIAL PRODUCTS**

**1335**

29538 Airport Road, Unit A  
Eugene, OR 97402 USA  
PH: 888-999-1835  
[www.cipcomposites.com](http://www.cipcomposites.com)

Columbia Industrial Products (CIP) is the manufacturer and global supplier of custom composite bearing materials. CIP Composites is a dependable, long wearing, and high quality water lubricated bearing material ready to meet the demands of your pump applications. CIP material can run wet (even in poor water quality) or dry, is commonly used to replace greased bronze, and is stable in elevated temperatures. CIP Composites are chemically resistant to a wide variety of fluids and corrosive environments. Providing quick delivery and custom manufacturing ability, CIP is ready to help solve your design or service problems. [sales@cipcomposites.com](mailto:sales@cipcomposites.com)

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## **COMPRESSOR CONTROLS CORPORATION**

**2233**

4725 121st Street  
Des Moines, IA 50323  
PH: 515-270-8705 | FX: 515-270-1331  
[www.cccglobal.com](http://www.cccglobal.com)

Compressor Controls Corporation (CCC) is a leading supplier of turbomachinery control solutions. We employ the most knowledgeable and comprehensive team of turbomachinery professionals in the world, fast and robust automation platforms, and field-proven control applications to deliver tangible economic benefits to our customers. Visit our booth #2233 or visit our webpage at [www.cccglobal.com](http://www.cccglobal.com)

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## **COMPRESSORTECH TWO MAGAZINE**

**2711**

20855 Watertown Road, Suite 220  
Waukesha, WI 53186 USA  
PH: 262-754-4100 | FX: 262-754-4175  
<http://www.compressortech2.com>

COMPRESSORtech2 is the only machinery-oriented magazine serving the natural gas and process industries from wellhead to city gate. Recognized as the leading authority on gas and process compression products and applications, the magazine covers the design, manufacturing, application, installation, operation and maintenance of compressor systems. Coverage also includes controls, components and accessories. We publish ten issues each year, plus an annual Compression Technology Sourcing Supplement that is mailed with the March issue and available online at [www.compressortech2.com](http://www.compressortech2.com). Diesel & Gas Turbine Worldwide ([www.diesलगasturbine.com](http://www.diesलगasturbine.com)) is an international website and e-newsletter covering engine room products and technologies for power generation, rail traction, oil & gas and marine propulsion markets.

**CONCEPTS NREC**

2526

217 Billings Farm Road  
White River Junction, VT 05001-9486 USA  
PH: 781-937-4686 | FX: 978-596-0622  
<http://www.conceptsnrec.com>

For over 50 years Concepts NREC has been a strategic partner to many of the world's leading manufacturers seeking to improve the performance and manufacturability of their turbomachinery components. We help our clients push past the boundaries of what has been done to explore the possibilities of what can be done. Solutions include:

- Design audits and scoping studies
- Complete original engineering designs
- In-house laboratory testing and R&D
- Engineering optimization
- Computer Aided Engineering (CAE) software
- Computer Aided Manufacturing (CAM) software
- Prototype and production manufacturing
- Proprietary products manufacturing
- Reverse engineering
- Professional development courses
- Custom training
- Textbooks

**CONTEC GMBH INDUSTRIEAUSRÜSTUNGEN**

3142

Heideweg 24  
53604 Bad Honnef, DE 53604 NRW Germany  
PH: +49222498930 | FX: +492224989320  
<http://www.contec-filtration.de>

As an internationally operating technology company headquartered in Bad Honnef, we have increasingly focused on quality engineering and system solutions in the segments of air and gas filtration, duct collectors, oil mist filtration, liquid filtration and level measurement, since its foundation in 1972.

Our oil mist separators (COMS) comply with all the statutory regulations and significantly below the statutory limit of the German TA Luft.

The filter elements excel with an separation efficiency of 99.98%. The residual oil content is reported as less than 0.1 mg/m<sup>3</sup> and does not contain any particles between 0.2 µm and 0.9 µm in clean gas.

**CONTINUOUS CONTROL SOLUTIONS**

2412

11275 Aurora Ave  
Des Moines, IA 50322 USA  
PH: 515-278-9655 X111 | FX: 515-278-9686

CONTINUOUS CONTROL SOLUTIONS (CCS) provides designs, implements and commissions control systems for TURBO MACHINERY control applications. CCS provides turbo machinery control solutions to the Oil and Gas, Chemical, Petrochemical, Metallurgy and Power Generation Industries worldwide.

CCS Turbomachinery Control Solutions are implemented on multiple hardware platforms including Allen Bradley ControlLogix, Honeywell C300/C200, Yokogawa Stardom, Siemens S7, ABB AC800M and Emerson DeltaV. Due to its excellence and proven advanced technology, CCS has partnered with global DCS giants such as Honeywell and Yokogawa to offer turbo machinery control solutions integrated seamlessly with existing DCS at site.



## **COOK COMPRESSION**

11951 North Spectrum Blvd  
Houston, TX 77047 USA  
PH: 713-234-0702  
<http://www.cookcompression.com>

Cook Compression® is a worldwide source for reciprocating compressor components, monitoring technology, diagnostics, repair and field services. Cook provides engineered solutions that enable customers to increase machine reliability, improve compliance and enhance efficiency. Technical expertise includes in-house engineering teams and extensive research and development programs. Cook Compression has ISO 9001:2000-certified manufacturing centers in North America and Europe, plus strategically located repair centers and technical sales representatives around the world. Cook Compression is an operating company of Dover.

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## **COOLING TECHNOLOGY INSTITUTE**

**1203**

3845 Cypress Creek Parkway  
Houston, TX 77268 USA  
PH: 281-583-4087  
<http://www.cti.org>

As a broad based industry association, our mission is to advocate and promote, for the benefit of the public, the use of all environmentally responsible, cooling technologies, such as wet cooling towers, air-cooled condensers, dry coolers, indirect cooling, and hybrid systems, by encouraging: Education on these technologies. Development of codes, standards, and guidelines. Development, use, and oversight of independent performance verification and certification programs. Research to improve these technologies.

Advocacy and dialog on the benefits of cooling technologies with Government Agencies and other organizations with shared interests. Technical information exchange.

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## **COOLING TOWER DEPOT, INC.**

**1800**

421 Rankin Circle N.  
Houston, TX 77073 USA  
PH: 281-685-8735  
<http://CoolingTowerDepot.com>

Cooling Tower Depot® (CTD) is a proven cooling tower supplier for field-erected mechanical draft cooling towers. We have decades of experience in cooling tower design, engineering, project management, and construction. CTD provides clients with innovative turnkey solutions while keeping cost and performance a priority.

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## **COUPLING CORPORATION OF AMERICA**

**1622**

250 N Main Street  
Jacobus, PA 17407 USA  
PH: 717-428-0570 | FX: 717-428-2865  
<http://www.couplingcorp.com>

Since 1968, CouplingCorp has provided high-performance flexible couplings for refineries, process plants, and power plants. CouplingCorp also designs and manufactures the unique Anderson Clamp Hub, which is a keyless interference hub. It can be easily removed and installed without heat or hydraulics. Also, look for the new Vertical Clamp Coupling which can help reduce seal wear on vertical pumps.

**CPC PUMPS INTERNATIONAL**

1404

5200 Mainway  
Burlington, ON L7L 5Z1 ON Canada  
PH: 905-599-2530 | FX: 289-288-4782

CPC Pumps International Inc. has built a reputation as a provider of unique and differentiated engineered solutions to some of the most demanding applications in the API 610 industry. Our reputation for quality, reliability, ability to customize pump features and hydraulic performance has made CPC a premier name on the list of highly engineered product suppliers. Our customer base includes most major global players in the Oil and Gas industry, which provides CPC with a continuously expanding global footprint, coupled with growing product offering and hydraulic coverage range.

**CRADLE NORTH AMERICA INC.**

2224

70 Birch Alley, Ste 240  
Beavercreek, OH 45440 USA  
PH: 937-912-5798 | FX: 513-672-0523  
<http://www.cradle-cfd.com>

Software Cradle is a leading provider of Computational Fluid Dynamics (CFD) software including SC/Tetra (general purpose unstructured mesh), scSTREAM (general purpose Cartesian mesh), and HeatDesigner (Cartesian mesh for electronics). Since inception in 1984, Cradle has established itself as a major innovator that is advancing the role of simulation in engineering design. Our software products are well known for ease of use, exceptionally fast and powerful meshing, efficient solvers, sophisticated physical models, and professional post processing. Cradle's worldwide presence consists of offices in Japan, North America, France, and a network of distributors servicing and supporting all parts of the globe.

**CREARE LLC**

2655

16 Great Hollow Rd.  
Hanover, NH 03755  
PH: 603-640-2303  
<http://www.creare.com>

Creare LLC is an engineering research and development firm located in Hanover, New Hampshire. Founded in 1961, we provide industrial and government clients in the medical, aerospace/defense, energy, process, and manufacturing industries with services ranging from applied research to prototype design, fabrication and testing. Core areas of expertise include fluid dynamics, heat and mass transfer, electronics and software development, sensors and control systems, and CFD/FEA analysis.

## **CRYOSTAR SAS**

1813

2 rue de l'Industrie, ZI, BP 48  
Hesingue, 68220 France  
PH: 389-702-727 | FX: 389-702-777  
<http://www.cryostar.com>

Cryostar supplies Turbo-Expanders for natural gas processing, PDH plants, ethylene and fertilizer plants. Particularly robust, reliable and highly efficient, they are built to the latest standards such as API 617.

Cryostar provides also Process Pumps for industrial gas applications, offering increased reliability and product life, operational safety, ease of installation and reduced maintenance costs.

Cryostar's wide range of expansion turbines is used for all types of gas, with a choice of brakes adapted to every process (ASU, NLU, and N2 generators).

Three Cryostar USA locations: Houston (TX), Whittier (CA) and Bethlehem (PA) for sales, after sales, maintenance and production capabilities.

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## **CRYSTAL INSTRUMENTS**

2737

2370 Owne Street  
Santa Clara, CA 95054 USA  
PH: 408-986-8880  
<http://www.crystallinstruments.com>

Crystal Instruments (CI) is a leading worldwide manufacturer of systems and software for machine monitoring, dynamic measurement, vibration testing, and acoustic testing. CI's products are used for machine diagnosis, design verification, product testing and process improvement by manufacturers of all types of electronic and mechanical products.

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## **CTS, INC.**

1223

10904 Deerfield Road  
Cincinnati, OH 45242 USA  
PH: 561-301-0686 | FX: 973-379-3007  
<http://www.cts-inc.net>

CTS provides high technology coatings to improve the performance of products throughout a variety of industries. We provide solutions in the form of thermal spray coating, dry film lubricants, porcelain enamels, anti-corrosion paints, and protective sealers, along with turnkey service to machine and coat a final product.

**D&S ENGINEERED PRODUCTS**

3115

1231 County St  
Attleboro, MA 02703 USA  
PH: 508-431-1228 | FX: 508-222-6555  
<http://www.d-sep.com>

D&S Engineered Products designs and manufactures engineered products such as fluid film (hydrodynamic) journal and thrust bearings, and squeeze film dampers for the industrial, oil and gas, and energy sectors worldwide. We also provide vacuum brazing and hard facing service.

All the product are designed and built to suit a particular application. Our engineering staff evaluates each application and offers the best product using our more than 30 years of industry experience. Product is fabricated with quality in our US based, ISO 9001 certified manufacturing facility in a timely and cost-effective manner.

**DAEDONG METAL INDUSTRY CO., LTD**

2455

#40 Namhangnam-ro, Yeongdo-gu  
Busan, 606-033 Busan South Korea  
PH: +821079222291

Daedong Metal Industry is the most experienced Fluid Film Bearings for Turbomachinery market. Founded in 1983, continuously evolving for supporting turbomachinery and customers with Tilting Pad Bearing and Fixed Geometry Bearings. Investing research and development projects for retrofit and analysis of the bearings for customers' requirement, such as PEEK Bearings.

**DAVID BROWN SANTASALO**

1804

5110 Great Divide Drive  
Austin, TX 78738 USA  
PH: 512-961-2810 | FX: 606-298-7220

David Brown Santasalo delivers high efficiency, reliable gear systems for industrial applications in the oil & gas, power generation, mining, sugar and cement processing industries. With a class-leading product range and extensive service capability, David Brown Santasalo can deliver the gearing solutions you need to keep your plant running at maximum capacity.

David Brown Santasalo recognizes that maximizing production is crucial, whether that be for an oil rig, power station, metals processing plant or mine. They now have 7 manufacturing plants and 23 service centres globally to ensure they are there, wherever and whenever you need them.

## DEKKER VACUUM TECHNOLOGIES

2636

935 S Woodland Ave  
Michigan City, IN 46360 USA  
PH: 219-861-0661 x167 | FX: 219-861-0662  
<http://www.dekkervacuum.com>

Dekker Vacuum Technologies, Inc. is a privately held company located in Michigan City, IN. with worldwide distribution. DEKKER manufactures liquid ring vacuum pumps and compressors used in the chemical, petrochemical, refinery and power marketplaces for a diverse range of applications including Vacuum distillation, evaporation, stripping, drying, deaeration, reactors, filtration, solvent recovery and condenser exhausters. Liquid ring compressor applications include; VRU's, flare gas recovery and waste gas compression. DEKKER also offers rotary vane and rotary piston vacuum pumps for laboratory, cryogenic tank evacuation, leak detection, refrigeration evacuation, freeze drying, vacuum furnaces, and impregnation applications.

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## DICKOW PUMP COMPANY, INC.

1300

1738 Sands Place #200  
Marietta, GA 30067 USA  
PH: 770-952-7903 | 800-880-4442  
[www.dickow.com](http://www.dickow.com)

Dickow Pump Company has manufactured centrifugal pumps for more than 100 years, always with an emphasis on precision, longevity in service and hydraulic efficiency. Today we offer the broadest and most technologically advanced range of magnetic drive seal-less pumps. Dickow Pump Company is a major supplier of pumps for the process industries including the following engineered products. [sales@dickow.com](mailto:sales@dickow.com)

- NMB: Close coupled seal-less process pumps.
- NCR: API 610
- PRM: API 685
- NMW: Seal-less high temperature pumps especially designed for handling heat transfer fluids with no cooling water required.
- SCM: Seal-less side channel pumps for low capacities and high differential heads.
- HZM: Seal-less multistage diffuser type pumps
- NHL: Hot water pumps

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## DIVERSIFIED MANUFACTURING INC

1719

410 Ohio St  
Lockport, NY 14094 USA  
PH: 716-204-9580 | FX: 716-204-9593  
<http://www.ipacinc.com>

Diversified Manufacturing Inc., is a provider of compressed air system treatment products. Water cooled and Air Cooled Aftercoolers as well as Moisture separators are our main products. In addition we produce a wide range of sheetmetal components and enclosures for a diverse customer base.

IPAC also designs and produces process water cooling systems. IPAC offers standard catalog products as well as design build options to customer specifications. We produce to ASME specifications. We can also offer China Code, PED and CRN certifications packages.

**DONGYING HAIHE MACHINERY CO., LTD.**

1113

No. 25 Qilian Shan Road Shengli Industry Zone  
 Dongying, 257000 Shandong China  
 PH: +8613561046112 | FX: +865468185133  
<http://www.haihecasting.com>

Dongying Haihe Machinery Co.Ltd is a leading lost-wax casting factory specialized in stainless steel casting,carbon steel casting and alloy steel castings. We have own strong casting ability with 100ton per month and strong machining ability with 5 sets working centers, 15 CNC, 6 wire cuttings and so on.

**DONGYING HENGCHENG MACHINE CO., LTD.**

2120

No.295 Zhongxing Road Kenli Economic Development  
 Dongying, 257599 Shandong China  
 PH: +8605462667888 | FX: +8605462883586  
<http://www.hc-casting.cm>

Our company have investment casting, resin sand casting, lost foam casting, vacuum process these four product lines and our own machining workshop. The material we can do including stainless steel castings, carbon steel castings, alloy steel castings, heat-resistant steel castings, copper castings, ductile iron, gray iron castings. The product are widely used in machinery equipment, chemical equipment, auto parts, marine hardware, hardware tools, medical and foodstuff appliance, construction hardware, mining machine parts. We own the advanced spectra analysis instrument, CMM, UT, MT and mechanical property equipment. Our company passed ISO 9001:2008, TS16949, ISO14000 & OHSMS 18000, and we have established a full set of quality assurance system.

**DONGYING YICHENG PRECISION METAL CO., LTD.**

1334

No.92, Xianhe Road, Shengli Industry Park  
 Dongying, 257081 Shandong China  
 PH: 86-546-8236501/8232367 | FX: 86-546-8230406  
<http://www.cast-nl.com>

Dongying Yicheng Precision Metal Co., Ltd. founded in 1988, is one of the earliest manufacturers in investment castings (lost wax process) in China. Our company takes up the area of 6000m<sup>2</sup> with annual capacity of 1200 tons. There are more than 200 employees in our company, including 12 design engineers and 15 quality control engineers. According to Customers' drawings, samples or models, we can supply "One-stop Service" from products verifying, designing, pattern developing and technique finalizing to final machining. The products' development period is about 4-8 weeks. Welcome to our company!

## **DRAKE CONTROLS**

3033

8731 Fallbrook Drive  
Houston, TX 77064 USA  
PH: 713-996-0190

Drake Controls is Woodward's largest channel partner globally. Our company is a Woodward Recognized Turbine Retrofitter as well as the Authorized Woodward Sales & Service Center for Texas, California, Oklahoma, Kansas, New Mexico & Nevada. In addition to our U.S. operations Drake Controls is also responsible for Woodward products and services within the country of Mexico. Drake Controls also represents Dynalco Controls throughout our U.S. and Mexico territories. Our goal at Drake Controls is to provide quality products, solutions and technical services to the Turbomachinery industry and our customers.

## **DRESSER-RAND BUSINESS**

299 Lincoln St.  
Worcester, MA 01606 USA  
PH: 508-595-1753 | FX: 508-595-1781



**DRESSER-RAND** 1932  
A Siemens Business

The Dresser-Rand business, part of Siemens Power and Gas (PG), is a leading supplier of mission-critical, high-speed rotating equipment solutions to the worldwide oil, gas, petrochemical, and process industries. As part of the global Siemens family, the Dresser-Rand business offers an equipment portfolio that includes turbo and reciprocating compressors; steam turbines; industrial and aero-derivative gas turbines; high-speed engines; and modular power substations. With the world's largest installed base, one of the world's largest technical support and service center networks, and a presence in more than 150 countries worldwide, the Dresser-Rand business delivers local solutions and services on a global scale.

## **DUECHTING PUMPS**

1103

P.O. Box 181148  
Forth Smith, AR 72918 USA  
PH: 617-459-5963  
<http://www.duechting.com>

## **DUPONT KALREZ**

1542

974 Lancaster Pike  
Wilmington, DE 19805 USA  
PH: 251-621-1831  
<http://www.kalrez.dupont.com>

DuPont™ Kalrez® perfluoroelastomer parts (FFKM) resist over 1,800 different chemicals and are used in highly aggressive chemical processing, semiconductor wafer fabrication, pharmaceutical, oil and gas recovery, and aerospace applications. The long-term, proven performance of Kalrez® parts can mean less frequent seal changes, repairs and inspections, increasing process and equipment uptime for greater productivity and yield.



**E+A ELEKTROMASCHINEN UND ANTRIEBE AG**

3241

Bachstrasse 10  
 Mohlin, 4313 Switzerland  
 PH: 925-685-0227 | FX: 925-685-0211  
<http://www.eandausa.com>

e+a makes motor elements (rotors and stators) that OEM customers use to build motors and generators for high speed and high power applications: cryogenic compressors, LNG pumps, NG compressors, fuel cell blowers, micro-turbines, turbo-alternators, turbochargers, generators for organic Rankine cycle machines (supercritical CO<sub>2</sub>), auxiliary power units, gas turbine engine alternators, portable energy generation, traction motors, vacuum pumps, waste water treatment, HVAC chillers, machine tool spindles and medical applications. The product line ranges from 1/2 KW at 500K RPM through 2 MW; examples include 500KW @24K RPM, 400KW @30K RPM, 1.6MW @25K RPM, 100KW @60K RPM, 12KW @180K RPM.

**EAGLEBURGMANN**

2722

10035 Brookriver Drive  
 Houston, TX 77040-3193 USA  
 PH: 713-485-7594  
<http://www.EagleBurgmannNow.com>

Sealing technology by EagleBurgmann is used worldwide in oil and gas industries, refineries, the petrochemical, chemical, and pharmaceutical industries, food processing, energy, water, mining, paper, aerospace, and other industries. Close to 6,000 employees provide their ideas, solutions, and commitment so that customers can rely on our sealing technology. What makes us stand out is our excellent quality, great innovative capacity, and an extensive product portfolio for nearly all industrial processes and fields of application. Our product portfolio includes everything from mechanical seals and seal supply systems to magnetic couplings, carbon floating ring seals, expansion joints, gaskets and packings.

**EASTERN ALLOY, INC.**

1818

1138 Meldon Ave  
 Donora, PA 15033 USA  
 PH: 724-379-5776 | FX: 724-379-3540

Eastern Alloy Inc. custom designs and manufactures nitrogen filled shipping and long term storage containers. The protective containers are designed to be stored horizontal and vertical. Equipment shipped and stored include; Roters, Bundles, Expanders, Gear Sets, Armatures, Couplings, Gear Boxes, Seals, Bearings, Pumps and many other components.

## **EBTEC-EDAC TECHNOLOGIES**

**3233**

120 Shoemaker Lane  
Agawam, MA 01001 USA  
PH: 413-310-3210 | FX: 413-789-2851  
<http://www.edactechnologies.com>

EBTEC has, for 50-plus years, been a supplier of Industrial Gas and Steam Turbine components.

EBTEC can take the fabrication of your Turbine Stators and Diaphragms from start to finish. Our facilities house Electron Beam Welding, Laser Welding, Laser Cutting, Laser Drilling, EDM Split, Heat Treating, and Abrasive Waterjet Cutting, as well as conventional machining techniques. EBTEC is equipped to handle everything, from materials acquisition through finished machining and shipment, with the highest efficiency, precision, and cost savings for the customer. We eliminate long lead times and multiple source contracting.

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## **EGC CRITICAL COMPONENTS**

**2746**

8103 Rankin Rd  
Humble, TX 77396 USA  
PH: 281-774-6100 | FX: 281-913-8286  
<http://www.egccomponents.com>

EGC Critical Components designs, engineers, and manufactures thermoplastic and elastomeric components that make critical applications work. EGC provides innovative, high-performance polymer solutions with world-class capabilities for a variety of industries including energy, general industry, refinery, chemical processing, nuclear, aerospace and defense, semiconductor, and medical.

Experts work closely from design to final product and can create the design to match your specifications, or make your design into a reality. EGC compliance with ISO 9001, ISO 14001, and OHSAS 18001 underscores the commitment to quality and dedication to health, safety, and the environment.

EGC's capabilities ensure a reliable, responsive resource for success, whatever the challenge.

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## **EGGER TURO PUMPS NORTH AMERICA, INC.**

**1232**

PO Box 26787  
Salt Lake City, UT 84126-0787 USA  
PH: 801-972-9591 | FX: 801-972-9374  
<http://www.eggerpumps.com>

Providing customized engineered pump solutions for multiphase liquids charged with abrasives/solids/gas.

- EO series: capable of handling multi-phase liquids with up to 25% VOL. air/gas entrainment. High temperature and high pressure designs are available and utilized for example in reactors for hydrogenation
- TURO series: capable of handling liquids with large solids at high efficiency, with low wear rate and with low shear loads.
- RPP series: axial flow pump for large flows and low heads, high temperature designs are available.
- IRIS Diaphragm Control Valve: specialty valve with low pressure drop and extremely precise flow control from virtually 0% - 100% opening

**EKATO CORPORATION**

48 Spruce Street  
Oakland, NJ 07436 USA  
PH: 201-785-4259  
<http://www.ekato.com>

2805

The EKATO GROUP is a leading agitator manufacturer with U.S. Operations based in Oakland, New Jersey. EKATO's Global Headquarters is located in Schoppfheim, Germany. EKATO has been a leader in the development and manufacture of industrial agitators, reactors, mechanical seals as well as vacuum process mixers and dryers for more than 80 years. EKATO offers a wide spectrum of products and services for customers' processes ranging from engineering services, process development and process optimization. EKATO can guarantee the availability and operational reliability of our agitators and processing plants based on a global network of subsidiaries and service centers.

**ELDEC LLC**

3355 Bald Mountain Rd., Suite 30  
Auburn Hills, MI USA  
PH: 248-630-7755 | FX: 275-630-7755

2922

As a globally active company, we develop, produce and sell highly efficient induction heating technology for a wide variety of industrial applications. Besides our well proven energy sources, we also offer complete system solutions. The centerpieces and our key areas of expertise are our MF, HF, DF and SDF® generators and inductors specially customized to the tasks at hand.

Customer- and application-oriented innovation drives us forward. Our focus is the perfect solution. Outstanding generator technology and comprehensive expertise in all facets of the inductor, combined with sound systems engineering, let us enhance proven applications and develop new ones.

**ELLIOTT GROUP**

901 N 4th Street  
Jeannette, PA 15644 USA  
PH: 724-600-8260 | FX: 724-620-8442



2025

Elliott Group designs, manufactures and services compressors and steam turbines for oil & gas, LNG, refining, petrochemicals, and power applications. Elliott's global service network provides installation, maintenance, repair, overhauls, and rerate services. Elliott employs 2400 people in 38 global locations. Elliott Group is a subsidiary of Ebara Corporation, Tokyo, Japan.

**EMERSON PROCESS MANAGEMENT**

835 Innovation Drive  
Knoxville, TN 37932 USA  
PH: 865-672-1052



3219

Emerson offers a comprehensive line of condition monitoring technologies for improving reliability in your facility. This year we are please to feature the CSI 6500 ATG protection system - a stand-alone machinery protection system with embedded prediction capabilities to deliver greater return on your monitoring system. The new CSI 6500 ATG utilizes wireless technology to communicate prediction date to the ATG View mobile app. The embedded OPC UA services simplifies installation. Multifunctional cards are easily reconfigured for a wide range of measurements.

## EMNOR MECHANICAL INC.

3247

20 Depew Street  
Hamilton, ON L8L 7H8 Ontario Canada  
PH: 905-520-4955 | FX: 905-312-9990  
<http://www.emnor.com>

Since 1977 Emnor Mechanical Inc. has been making quality pump parts. Emnor uses 3D models and CNC machining to produce cast parts in most alloys.

## EMPOWERING PUMPS, LLC

PO Box 2313  
Tuscaloosa, AL 35403 USA  
PH: 205-614-8601



## EMPOWERING PUMPS™ 1200

Connecting The Global Pump Industry

Empowering Pumps is the information and connection hub for the global pump industry. The pump community connects through websites, eNewsletters, and social media channels to exchange ideas, news stories, product information, case studies, videos, event information and more. Our mission is to Connect, Inform, and Educate the Global Pump Industry.

## EMPOWERING VALVES

1202

P.O. Box 2313  
Tuscaloosa, AL 35403  
PH: 205-614-8601  
<http://www.EmpoweringValves.com>

Empowering Valves is the information and connection hub for the global valve industry. Part of a digital community of websites, eNewsletters, and social media channels it connects professionals within the pump and valve industries. It is an industry resource for news, product information, case studies, training videos, event information and more.

## ENERGY CONTROL TECHNOLOGIES, INC.

2810

2751 99th St  
Urbandale, IA 50322 USA  
PH: 515-868-6836 | FX: 515-223-1638

Energy Control Technologies (ECT) delivers control solutions for turbocompressors, steam turbines, gas turbines, turboexpanders, screw compressors, reciprocating compressors, and centrifuges. ECT provides solutions using Rockwell Automation Allen-Bradley ControlLogix and CompactLogix hardware platforms in the Oil & Gas, Industrial/Manufacturing, and Biofuels markets including full duplex and SIL 2 systems. ECT solutions increase energy efficiency and production while improving machine protection.

Solutions include: surge control, performance control, loadsharing, steam turbine speed and extraction control, overspeed trip systems, gas turbine fuel control and sequencing, turboexpander control, vibration protection, plant air network control, simulation services, and centrifuge control and protection systems.

**ENERGY-TECH MAGAZINE**

801 Bluff St  
Dubuque, IA 52001, USA  
PH: 563-588-3858 | FX: 563-588-3848  
<http://www.energy-tech.com>

Energy-Tech is dedicated to the engineering, operations and maintenance of electric power plants, and provides quality technical information to approximately 15,000 engineers, plant maintenance and operations personnel, and senior level management in the power generation industry. Energy-Tech officially partners with the American Society of Mechanical Engineers' Power Division (ASME-PD) on editorial content and serves as official media sponsor of their annual ASME Power Conference. In addition, Energy-Tech maintains an editorial alliance with the Electric Power Research Institute (EPRI).

PUB BIN

**ENERSTAFF**

1036 Hercules Ave  
Houston, TX 77058 USA  
PH: 281-282-1300 | FX: 281-282-1306  
<http://www.enerstaffusa.com>

EnerStaff, LLC offers a wide range of staffing services that focus on the quality, maintenance, and ongoing integrity of critical process equipment. We can assist with recruiting and the hiring process of permanent and temporary personnel. Our multi-craft technicians have extensive experience and knowledge in the petrochemical and energy industries. EnerStaff specializes in situations where safety, qualifications, stability, and reliability are a priority.

1620

**ENGINEERING DYNAMICS, INC.**

16117 University Oak  
San Antonio, TX 78249 USA  
PH: 210-492-9100 | FX: 210-492-9586

Engineering Dynamics Inc. is an independent engineering firm serving industry with the expert technical support to solve and prevent dynamics problems. Founded in 1982, EDI has become a recognized leader in providing engineering expertise in the petrochemical, refinery, power generating & gas processing industries. Wide variety of capabilities & advanced instrumentation.

2820

**EPIC INDUSTRIAL SOLUTIONS**

13720 FM 529, Bldg 200  
Houston, TX 77041 USA  
PH: 713-805-1750  
<http://www.epicindsolutions.com>

EPIC Industrial Solutions LLC, was founded with the notion of "Redefining Excellence in Aftermarket". Our name defines our focus and expertise. Engines, Pumps, and Industrial Compression is our passion and our team is committed to serving all of your aftermarket needs while providing you with a customer service experience that is unparalleled.

3048

## **ETHOS ENERGY GROUP**

1915

34444 East Pasadena Frwy  
Pasadena, TX 77503 USA  
PH: 713-472-3444 | FX: 713-472-8428

Ethos Energy Group is a joint venture between Wood Group GTS and Turbo Care. Ethos Energy Group will deliver a new standard of service excellence with a broader portfolio, increased global reach, greater choice, flexibility and responsiveness, and well-engineered value-added solutions. Serving the Petrochemical, Refinery and Power markets through optimization and upgrades of gas and steam turbines, pumps, compressors and other high-speed rotating equipment. With the combined years of experience in the maintenance of gas turbines and other rotating equipment, supporting clients in over 50 countries, we apply our knowledge to deliver better service excellence to the market place.

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## **EXAMINER.COM**

PUB BIN

13223 Salem Cir  
Montgomery, TX 77356, USA  
PH: 832-229-0685 | FX: 832-229-0685  
<http://www.examiner.com>

Examiner.com launched in April 2008, to provide freelancers across the United States with a platform to share their knowledge and expertise through informative and entertaining content.

Examiner.com is a top 100 website, reaching over 37 million unique visitors a month. Examiner.com is wholly owned by The Anschutz Corporation, one of the largest sports and entertainment companies in the world. Headquartered in Denver, CO, Examiner.com is guided by an executive team comprised of veterans of numerous start-ups, established media outlets and online leaders including Gannett, Disney, AOL, Yahoo! among others. ComScore, February 2012, Omniture, February 2013

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## **EXHEAT INDUSTRIAL LTD**

2647

Threxton Rd, Industrial Estate  
Watton, Norfolk, IP25 6NG Norfolk United Kingdom  
PH: +4401953886204 | FX: +4401953883853  
<http://www.exheat-industrial.com>

Exheat Industrial is a manufacturer of electric heating and temperature sensing products designed for Hazardous Area & Industrial locations.

Internationally recognised accreditation to ATEX, IECEx, CSA and UL standards through a world renowned approval and testing body, LCIE, allows the business to deliver products globally and gain local approval such as KGS(Korea), CCOE (India), CNEX (China), INMETRO (South America) and GOST R/K (Russia & Kazakhstan).

**EXONE**

127 Industry Blvd  
North Huntingdon, PA 15642 USA  
PH: 724-863-9663  
<http://www.exone.com>



ExOne is a global provider of three-dimensional ("3D") printing machines and printed products to industrial customers. ExOne manufactures its 3D printing machines and prints customer products to specification through Production Service Centers, located in the United States, Germany and Japan. Services include training and technical support, as well as a variety of pre- and post-print offerings. ExOne has industry-leading printing capacity. Available materials include silica sand, ceramics, stainless steel, tungsten, iron and bronze.



**LEARN MORE ABOUT  
XLTRC<sup>2</sup>**

BACK OF PUMP  
**DIVIDER**

TPS



# F

## **FW. GARTNER**

2341

PO Box 451509  
Houston, TX 77245 USA  
PH: 713-225-0010 | FX: 713-229-9841

FW Gartner (a business unit of Curtiss Wright Surface Technologies) is an ISO 9001 (2008) qualified provider of a broad range of surface technologies utilized for the protection and reclamation of critical components, and a fixture in the Houston area since 1923. By combining FW Gartner's Thermal Spray, Laser/PTA cladding, comprehensive machining and grinding shop, full metallographic lab, staff metallurgist and on-site third party QC inspection, FW Gartner is ready to partner with you in delivering the innovative solutions you need and the company's many customers, across a broad range of industries, have come to expect.

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## **FARO TECHNOLOGIES**

2454

250 Technology Park  
Lake Mary, FL 32746 USA  
PH: 407-333-9911  
<http://www.faro.com>

FARO develops and markets portable CMMs (coordinate measuring machines) and 3D imaging devices to solve dimensional metrology problems.

Technology from FARO permits high-precision 3D measurement, imaging and comparison of parts and compound structures within production and quality assurance processes. The devices are used for inspecting components and assemblies, production planning, documenting large volume spaces or structures in 3D, and more. FARO's 3D measurement technology allows companies to maximize efficiencies and improve processes.

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## **FELUWA PUMPEN GMBH**

1124

Beulertweg 10  
Muerlenbach, 54570 Rhineland-Palatinate Germany  
PH: +496594-100 | FX: +496594-10200  
<http://www.feluwa.com>

FELUWA technology offers hermetically sealed pump systems for abrasive, aggressive and toxic media and various applications in the mining sector, like hydrotransport, ash disposal and dewatering. The FELUWA pumps are able to convey media with flow rates up to 1,000 m<sup>3</sup>/h and pressures up to 400 bar. A reliable overall diagnostic system for permanent condition monitoring is available.

**FIL SEP EQUIPMENTS PVT LTD.**

2925

19, GIDC, Makarpura  
Baroda, 390010 India  
PH: +919328813001  
<http://www.filsep.com>

Fil Sep Equipments Pvt Ltd is ISO-9001:2008 company approved by TUV NORD & can meet the requirement of ASME Boiler and Pressure Vessel Code (ASME U Stamp), engaged in Design, Engineering, Manufacturing, Fabrication and Supply of Lubrication & Fluid System; Filtration & Separation Systems; Pressure Vessel; Package Systems like Gas Conditioning Skid, Fuel Forwarding Skid, Brine Filtration Package and Services having own setup in Vadodara, Gujarat, India since 1996. We are the specialists in performance filtration, separation & lubrication technologies in challenging environments that maximize fluid, air or gas quality while simultaneously minimizing operating costs.

Fil Sep has a hard earned reputation through its ability to produce systems and components that deliver outstanding operational and marker performance. A highly qualified team of engineers provides functionality and economy of design, so crucial to effective applications engineering.

**FISHER PRODUCTS**

3229

1320 West 22nd Place  
Tulsa, OK 74107 USA  
PH: 918-582-2204 | FX: 918-582-2026

Supporting the Pump Industry since 1965 with Hard Surface Overlayed Coatings. Hard Coating Processes are HVOF, Plasma, Oxy-Fuel Rod Weld and Metalizing applications. Robotically applied Tungsten Carbide, Chromium Carbide and Ceramic Coatings. Precision Turnkey Machining of Pump Shafts, Wear Rings, Sleeves, Bushing, Stage Pieces and Plungers. Quick Turnaround Services available on request.

**FIVE STAR PRODUCTS, INC.**

2425

60 Parrott Drive  
Shelton, CT 06484 USA  
PH: 203-336-7900 | FX: 203-336-7930  
<http://fivestarproducts.com>

A worldwide provider of high performance, versatile, specified non shrink cement and epoxy based construction solutions for use in the industrial, infrastructure and marine markets. Five Star's products include versatile precision, non-shrink grouts and structural repair products; highly chemical resistant coatings, patches and grouts; pile and column repair systems; concrete restoration and advanced vibration dampening products, waterproof coatings, adhesives and machinery foundation systems for rapid turnaround.

## **FLENDER-GRAFFENSTADEN**

**2033**

c/o RTS Corporation  
Trumbull, CT 6611 USA  
PH: 203-459-9835

Flender-Graffenstaden has acquired the know-how and the experience to be a leader in the field of high speed gears.

FG Gears are used in all processes in power plants, refineries, offshore and onshore oil and gas installations, petrochemical and industrial process plants.

FG provides turbo parallel shafts and integral gear units with centerline distances ranging from 150 to 1500 mm. Designed to meet specific customer needs, our products can reach powers up to 110 MW. With Local support for Application Engineering and Field service support for startup and commissioning through FGGS Corp.

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## **FLEXELEMENT TEXAS INC.**

**2919**

8889 W Monroe Rd  
Houston, TX 77061 USA  
PH: 713-910-3839

FlexElement (TM) manufactures flexible-element power transmission couplings typically for use on critical, un-spared turbomachinery in the refining, petrochemical, chemical and power generation industries.

Since 1980, standard and special coupling designs have been supplied for machines generally ranging between 1000 h.p. and 100,000 h.p. Resources include Rotor Dynamic Analysis\* (R.D.A.) and Finite Element Analysis\*\* (F.E.A.) to provide a complete system review when couplings are supplied as retrofits for existing equipment.

Main offices and manufacturing facilities are located in Houston; services include inspection, repairs, dynamic balancing, on-site seminars and installation assistance.

\*Provided by Applied Machinery Dynamics Company

\*\*Provided by Ray Kelm Engineering

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## **FLOWSERVE CORPORATION**

**2639**

2100 Factory St  
Kalamazoo, MI 49001 USA  
PH: 269-226-3499

Flowserve Corporation is one of the world's leading providers of fluid motion and control products and services. Operating in more than 55 countries, the company produces a wide variety of engineered and industrial pumps, seals, valves, and specialty equipment. Flowserve also provides a broad range of consultative, engineering and technical support services. Primary markets served include: oil and gas; power generation; chemical; water resources; mining and ore processing; and general industries. More information about Flowserve can be obtained by visiting the company's website at [www.flowserve.com](http://www.flowserve.com).

**FLUID ENERGY CONTROLS, INC.**

3010

6431 Flotilla Street  
Los Angeles, CA 90040 USA  
PH: 323-721-0588 | FX: 323-721-8368  
<http://www.fecintl.com>

OEM manufacturer of Lube Oil System Accumulators (LOSA). Stainless Steel and Carbon Steel construction with option of Buna-n, Viton, Butyl, EPR and Hydrin bladders. ASME Sec VIII, Div I, with options of CRN, NR-13, SELO/SQL/ML, AS-1210, DOSH, and CE/PED.

Emergency supply of Lube Oil for high speed bearings in Turbo-Machinery including Turbo-Expanders, Turbo-Compressors, Gas and Steam Turbines during a lube pump switch-over or lube supply failure.

Other applications include Surge Suppressors to minimize pressure spikes in Pipelines; Pulsation Dampeners to alleviate pressure pulses from Positive Displacement Pumps, and Suction Stabilizers to prevent Pump Cavitation.

**FLUID HANDLING**

PUB BIN

Marshall House, 124 Middleton Road,  
Morden, Surrey SM4 6RW UK  
PH: +4402086487092 / FX: +4402086874130  
<http://www.fluidhandlingmag.com>

Fluid Handling magazine, a publication dedicated to liquid handling and transfer equipment in the food & beverage, pharmaceutical, wastewater and oil & petrochemical industries.

The magazine, launched in 2013, brings you updates to regulations, the latest technology developments and technical articles exploring market challenges.

The digital magazine is sent to over 12,000 utilities, plant engineers, managers and operations directors. The Fluid Handling website is updated daily. Sign up for free at [www.fluidhandling.com](http://www.fluidhandling.com) to receive the magazine and fortnightly newsletter.

**FLUID SEALING ASSOCIATION**

1302

994 Old Eagle School Rd, Ste 1019  
Wayne, PA 19087-1866 USA  
PH: 610-971-4850 | FX: 610-971-4859  
<http://www.fluidsealing.com>

Founded in 1933, the FLUID SEALING ASSOCIATION® (FSA) is an international trade association. Member companies are involved in the production and marketing of a wide range of fluid sealing and containment devices primarily targeted to the industrial market. FSA membership includes a number of companies in Europe and Central and South America, but is most heavily concentrated in North America. FSA members account for a majority of the manufacturing capacity for fluid sealing and containment devices in the Americas market.

**FONDA PUMP**

1848

West Heping Industrial Zone, Yuhong District  
Shenyang, 110141 Liaoning China  
PH: +8613898869815 | FX: +862489362260  
<http://www.fondapump.com>

Fonda Pump specializes in manufacturing API 610 standard overhung, between-bearings and vertically suspended centrifugal pumps and components. We are bringing our customers better experience on pump performance with reliable products and quality services.

## FORMOSA HEAVY INDUSTRY CORP

3138

1015 Ashley Road  
Lake Forest, IL 60045 USA  
PH: 773-401-2053 | FX: +88673721748  
<http://www.fhi.com.tw>

Formosa Heavy Industries (FHI) is a leading gear manufacturer in Asia located in Kaohsiung, Taiwan. FHI is equipped with state of the art machine tools. Most of the tools are (CNC) controlled. FHI can hob gears up to 8.0 meters in diameter, skive spiral bevel gears up to 1.15 meters in diameter and precision grind gears up to 4.0 meters in diameter.

FHI performs most heat-treating processes within its own shop such as; carburizing, ion-nitriding, and induction hardening.

Quality assurance is guaranteed with the aid of modern inspection equipment, trained professionals, and the procurement of high quality raw materials.

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## FRAMO AS

1130

P.O. Box 23  
Florvagvegen, NO 5329 Norway  
PH: +4748040040 | FX: +47999380  
<http://www.framo.com>

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## FRONTLINE AEROSPACE, INC.

1541

14004 Quail Ridge Dr.  
Broomfield, CO 80020 USA  
PH: 720-887-8171  
<http://www.frontlineaerospace.com>

Frontline Aerospace, Inc. is in the Cleantech and Defense markets, with a primary focus on commercial gas turbine efficiency through our IsoCool™ and MicroFire™ aftermarket retrofit products. Our technology is poised to revolutionize the ground-based power generation and aviation industries by dramatically improving fuel efficiency of widely deployed turbo-shaft gas turbine systems around the globe. This capability can increase capability, reduce pollution, and improve the value of existing equipment.

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## FS-ELLIOTT CO., LLC

1619

5710 Mellon Rd  
Export, PA 15632-8948 USA  
PH: 724-387-3200  
<http://www.fs-elliott.com>



FS-Elliott is a leading manufacturer of centrifugal air and gas compressors with sales, service and manufacturing locations around the world. First introduced to the market over 50 years ago; our energy-efficient machines incorporate the latest aerodynamic and control system technologies to ensure optimum performance.

1732

**FUSION, INC.**

6911 Fulton  
Houston, TX 77022 USA  
PH: 713-691-6547

Fusion, Inc. is a coating & grinding facility offering HVOF, plasma and electric twin arc wire coating capabilities and is known for quick-turn repairs on rotating and reciprocating components such as turbine rotors, shafts, piston rods, impellers and crankshafts to name a few. Fusion has also become recognized for the application and finish polishing of carbide on downhole mud motor rotors and drill cones.





## **GARTNER COATINGS**

1229

2433 Max Rd  
Pearland, TX 77581 USA  
PH: 281-997-3500 | FX: 281-997-3610  
<http://gartnercoatings.com>

Gartner Coatings is primarily an applicator of high performance and specialty coatings. Experienced with air dry and bake-on materials such as zincs, epoxies, urethanes, xylan, Teflon, Kynar and Halar. Our capabilities also include shot peening, metallizing, powder coating and architectural coating on aluminum.

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## **GAS & AIR SYSTEMS, INC.**

2632

1304 Whitaker Street  
Hellertown, PA 18055 USA  
PH: 610-838-9625 X201

Gas & Air Systems, Inc. (GAS) is the factory authorized compressor packager and distributor of Howden BC (formerly Burton Corblin) Process Gas Compressors in North America. GAS provides application and package engineering, design and fabrication. Packages incorporate Howden BC Process Piston Compressors and Metal Diaphragm Compressors. In addition, GAS maintains a large inventory of genuine, factory approved spare parts for immediate delivery, and provides qualified Field Service, troubleshooting assistance, reapplication and overhaul service.

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## **GAS COMPRESSION MAGAZINE / THIRD COAST PUBLISHING**

**GAS COMPRESSION**  
magazine

3025

15814 Champion Forest Drive, Ste 409  
Houston, TX 77379 USA  
PH: 832-271-7300  
<http://www.gascompressionmagazine.com>

Gas Compression Magazine is your link to the gas compression industry. Published monthly, Gas Compression Magazine provides in-depth coverage of the products, systems, technologies, and news that affect the global gas compression industry. Upstream, midstream, and downstream, Gas Compression Magazine is your source for gas compression news and information.



**GE OIL & GAS**

2433

4425 Westway Park Blvd  
Houston, TX 50127 USA  
PH: +390554238391  
<http://www.geoilandgas.com>

GE Oil & Gas is a world leader in advanced technologies and services with 43,000 employees in more than 100 countries supporting customers across the industry—from extraction to transportation to end use. Our unrelenting commitment to the environment, health and safety, quality and integrity defines us: it's The Way We Work. We develop smart solutions for our customers across the oil and gas value chain delivering the innovation, customized service solutions, training programs and technology that helps them to maximize their efficiency, productivity and equipment reliability.

**GEA**

3475 Board Road  
York, PA 17406 USA  
PH: 717-767-6411 | FX: 717-764-3627  
<http://www.gea.com>

**GEA 2633**

GEA's proven, world-class process refrigeration and gas compression solutions include screw compressor packages, chiller systems, condensing units, shell & tube heat exchangers, pressure vessels, and controls. Our expertise also extends to disk-stack and decanter centrifuges, as well as gas jet compressor systems.

GEA prioritizes value and functionality throughout the lifecycle of its products and service support includes parts as well as predictive & preventive maintenance. Talk with us to learn why industry-leading companies worldwide choose GEA, and how we can meet your process-critical requirements. Booth #2633, on the center aisle.

GEA - engineering for a better world.

**GEAR SOLUTIONS**

PUB BIN

266-D Yeager Pkwy  
Pelham, AL 35124, USA  
PH: 800-366-2185 | FX: 205-380-1580  
<http://www.gearsolutions.com>

Gear Solutions is a B2B magazine containing articles, profiles, interviews, and columns relating to machines, services, and tooling within the gear manufacturing industry. The monthly print edition – also available in digital format – is complemented by an online presence at [gearsolutions.com](http://gearsolutions.com). Gear Solutions also engages its audience through a mobile app, monthly E-newsletters, and a robust social media presence on Facebook, Twitter, and LinkedIn.

## **GENERAL ATOMICS**

16969 Mesamint St  
San Diego, CA 92127 USA  
PH: 858-964-7058 | FX: 858-676-7190

2911

General Atomics Electromagnetic Systems (GA-EMS) designs and manufactures unique electric power technologies to meet the most demanding specifications and extreme operating environments in the oil and gas, mining, marine and onshore, energy and defense industries. From permanent magnet motors and generators, linear motors, modular power conversion drives, and automation and data management hardware and software products, GA-EMS' solutions help customers improve overall system performance and reduce lifecycle costs. With extensive manufacturing capabilities, we combine highly skilled experts, cutting-edge equipment, and proven manufacturing processes to meet the most exacting component and product specifications and conformance to the highest quality standards.

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## **GORE (R) TURBINE FILTERS**

101 Lewisville Rd  
Elkton, MD 21921 USA  
PH: 410-392-3300 | FX: 410-398-6624  
<http://www.gore.com>

1637

At Gore, we take our reputation for product leadership seriously. Our products are designed to be the highest quality in their class and revolutionary in their effect.

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## **GOVERNOR CONTROL SYSTEMS, INC.**

2022 Tamvest Court  
Mandeville, LA 70448 USA  
PH: 985-626-8707 | FX: 985-626-8732  
<http://www.govconsys.com>

2049

GCS specializes in innovative control system integration and monitoring solutions. Our unmatched 24/7 service, technical support, training, and engineering services ensure that GCS is your partner for the lifecycle of your control, monitoring and measuring systems.

As the largest authorized Woodward channel partner, the GCS sales, service and engineering teams are recognized as Woodward governor and controls system specialists. We are certified to perform Woodward warranty evaluations, training, repair, and field service worldwide. Governor repairs, engineering service, competitive prices and parts inventory are available at our strategically located facilities in the Southeast, Gulf Coast, Mid-Atlantic, Pacific Northwest, and the Bahamas.

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## **GRAHAM CORPORATION**

20 Florence Avenue  
Batavia, NY 14020 USA  
PH: 585-343-2216 X338

1625

With world-renowned engineering expertise in vacuum and heat transfer technology, Graham Corporation is a designer, manufacturer, and global supplier of vacuum pumps, ejectors, vacuum systems, condensers and heat exchangers. Graham has built a reputation (74 years) of top-quality, reliable products, and high standards of customer service. Sold either as components or complete systems, the principle markets served are petrochemical, oil refining, & electric power generation industries, including cogeneration and geothermal plants. Graham equipment can be found in diverse applications including metal refining, pulp & paper processing, shipbuilding, desalination, food processing, pharmaceutical, refrigeration, and in HVAC service.

**GRAND VIEW MEDIA GROUP**

200 Croft Street, Suite 1  
 Birmingham, AL 35242-1824 USA  
 PH: 205-980-5654  
<http://www.processflownetwork.com>

1101

Processing is a new product magazine featuring product reviews on the latest technology and products in the pharmaceutical, chemical, petrochemical and food industries. Readers consist of engineering and plant operations professionals, who recommend, specify, or purchase equipment. Processing periodically publishes equipment/application-specific supplements throughout the year. Flow Control is the only magazine dedicated exclusively to fluid handling professionals. It focuses on technologies and best practices for the design, operation, and maintenance of industrial fluid handling systems. Flow Control serves professionals in any industry in which the containment, control, or measurement of fluid is imperative.

**GRAPHITE METALLIZING CORPORATION**

1050 Nepperhan Avenue  
 Yonkers, NY 10703 USA  
 PH: 914-968-8400 X824  
<http://www.graphalloy.com>



1414

GRAPHALLOY, a graphite/metal alloy from Graphite Metallizing Corporation, is a uniform, solid, self-lubricating bushing and bearing material for pumps that permits dry starts, survives frequent loss of suction, reduces vibration and extends pump life for continuous service. GRAPHALLOY's unique non-galling and self-lubricating properties enable a pump to handle fluids and survive upsets that would seize a metal fitted pump.

Graphalloy is normally supplied in finished form and can be installed without additional machining. Graphite Metallizing has over 100 years of experience solving the toughest bearing problems. Most of our products are custom designed to unique requirements of the specific application.

**GULF PUBLISHING COMPANY**

2 Greenway Plaza, #1020  
 Houston, TX 77046 USA  
 PH: 713-520-4470 | FX: 713-525-4655  
<http://www.GulfPub.com>

1701

Gulf Publishing Company is the publisher of World Oil and Hydrocarbon Processing magazines, as well as upstream and downstream data, books and software. Gulf Publishing Company events include the Eastern Mediterranean Gas Conference and the ShaleTech conference. Learn more at GulfPub.com.



## **HAHN & CLAY**

2629

PO Box 15521  
Houston, TX 77220 USA  
PH: 713-980-1320 | FX: 713-672-9420

Hahn & Clay, established in 1908, is the most versatile fabrication and machining facility in the United States.

Hahn & Clay has been an industry leader in shop and field manufacturing, and repair and maintenance of industrial equipment.

Hahn & Clay's Gulf Coast facility has over 250,000 square feet under roof.

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## **HAMMELMANN CORPORATION**

1504

436 Southpointe Dr  
Miamisburg, OH 45342 USA  
PH: 937-859-8777

Hammelmann manufactures extremely compact 3, 5 and 7 cylinder pumps for injection service with input capabilities up to 1500HP. The latest variation of this pump series is the "Zero Emission Pump" where the pumped fluid is hermetically sealed within the pump, preventing leakage to atmosphere during operation. Hammelmann pumps produce maximum performance from a minimal footprint which is the result of combining a compact integral speed reduction gear end with the concept of a vertical configuration. The vertical configuration channels oscillating forces directly downwards into the base structure. Unwanted lateral oscillations as produced by horizontal pumps do not occur.

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## **HANGZHOU GUONENG STEAM TURBINE ENGINEERING CO., LTD.**

2449

No. 357, Shiqiao Road  
Hangzhou, 310022 Zhejiang China  
PH: +8657185781633 | FX: +8657185781632  
<http://www.htac.com.cn>

Best steam turbine and compressor auxiliaries' supplier in China, full experience in engineering and manufacturing for water cooled condenser, air cooled condenser, oil unit and pressure vessel. Familiar with ASME/HEI/GB/TEMA standard, qualified by world first class compressor and engineering company. In recent years, HTAC delivered more than 100 sets of condenser units per year in China and worldwide. HTAC will be your most competitive supplier for your supply chain.

**HANGZHOU STEAM TURBINE CO., LTD.**

3019

No. 357 Shiqiao Road  
Hangzhou, 310022 Zhejiang China  
PH: +8657185780259 | FX: +8657185780250  
<http://www.htc.cn>

Hangzhou Steam turbine Co., Ltd. (HTC) is the biggest manufacturer as well as the key R&D organization for industrial steam turbine in China, who can design and tailor-make industrial steam turbine in line with the special requirements of customers for all applications.

**HBM TEST AND MEASUREMENT**

1721

19 Bartlett St  
Marlborough, MA 01752 USA  
PH: 800-578-4260 | FX: 508-485-7480  
<http://www.hbm.com>



HBM Test and Measurement offers accurate real-time measurement solutions for optimizing electric machines, pumps, motors, inverters and generators including accelerated motor mapping and Clarke and Park Transformations for improving drivetrain efficiency by incorporating world class data acquisition systems and torque transducers. See eDrive details at [www.hbm.com/edrive](http://www.hbm.com/edrive). With over 65 years of experience and professional measurement services, HBM offers an extensive range of test and measurement solutions worldwide. HBM is a leading global supplier of high-performance torque meters, data acquisition systems, sensors, transducers and amplifiers as well as software for structural durability investigations, tests and analysis.

**HEBEI ANJI HONGYE MACHINERY CO., LTD.**

1127

No. 461 Nancang Street  
Botou City, 032150 HEBEI China  
PH: +863175569015 | FX: +863178262299  
<http://www.hbhongye.com>

Hebei Anji Hongye Machinery Co.,Ltd is founded in 1947.It's a big specialized foundry in China dedicated to both casting and machining,having quality certification of ISO9001:2000,CE certification,PED certification and self-operated export and import right.

Our company depends on its advanced casting technique,domestic military quality assurance and a lot of top rating casting expert,providing customers with sophisticated products of high technology,short leading time and facilitating customers with professional services.

**HEBEI METALS & MINERALS CORP. LTD.**

1326

No. 448 West Heping Road.  
Shijianzhuang, China  
PH: +8630087051240 | FX: +8631187049231  
<http://www.hebcasting.com>

## **HENKEL LOCTITE CORPORATION**

1702

One Henkel Way  
Rocky Hill, CT 06067-3582 USA  
PH: 860-571-5100

Loctite technologies can be used in all stages of pump maintenance to prevent common failures, both major and minor, allow for the recycling of parts to avoid scrap replacement costs, assist in disassembly, and help ensure reliability and a consistent running condition. In addition to the trusted Loctite brand products, Henkel also offers maintenance training workshops. These in-plant workshops are hands-on and teach maintenance technicians how to solve the most common maintenance problems and prevent future breakdowns.

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## **HERMETIC PUMPS INC.**

1841

PO Box 2047  
Humble, TX 77347 USA  
PH: 281-443-0905 | FX: 281-443-0960

Hermetic Pumps, Inc. is a world leader in sealless pumps including canned motor, magnetic drive, liquid ring vacuum, positive displacement and submersibles. All canned motor pumps offer the electronic monitoring system MAP that checks the rotor position and detects upset conditions. New and standard for all pumps is the rotation protection ROM! Canned motor pumps are available up to 1000 HP, operating pressures up to 18000psig and temperatures from -200F to 850 degrees Fahrenheit. The company is a division of Hermetic Pumpen GmbH Germany.

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## **HFW INDUSTRIES**

2943

196 Philadelphia St  
Buffalo, NY 14207 USA  
PH: 716-875-3380 | FX: 716-875-3385  
<http://www.hfwindustries.com>

HFW Industries manufactures and reconditions industrial equipment. Capabilities include CNC machining, precision grinding, thermal spray coatings, and weld overlays.

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## **HILCO**

2218

100 W Fourth Street  
Elmira, NY 14901 USA  
PH: 607-733-7121 | FX: 607-735-0946  
<http://www.hilliardcorp.com>

Hilco, a division of The Hilliard Corporation, has been engineering and manufacturing filtration systems for Turbo-Machinery Equipment since 1925. Hilco filtration cartridges have superior dirt holding capacity and have continually outperformed its competitor's cartridges. Some of the company's systems include Oil Mist Eliminators with an efficiency rating of 99.97% at .03 micron, Lube Oil Conditioners, Duplex/Simplex Filters, Transfer Valves with zero leak pads, Process Equipment, Patented Dry Resin Ion Exchange, Varnish Prevention/Removal equipment as well as Engine Starting systems. Hilco welcomes your most challenging filtration needs.

**HIMA AMERICAS INC.**

2838

5353 West Sam Houston Parkway North  
Houston, TX 77041 USA  
PH: 713-482-2070 | FX: 713-482-2065  
<http://www.hima-americas.com>

Founded in Germany in 1908, HIMA has a long history of safety system innovation that began in 1970 when we introduced the world's first TÜV-certified safety system. HIMA is the world's leading independent designer of automated safety solutions used in the process industry and over the past 45 years, more than 35,000 HIMA systems have been installed worldwide to protect the assets of the world's major oil & gas processing companies, which is more than any other safety system supplier. The top 10 global oil & gas companies are all HIMA customers.

**HITACHI AMERICA, LTD.**

1847

1717 St James Place Ste 315  
Houston, TX 77056 USA  
PH: 713-782-0529

Hitachi, a world leader in electronics and industrial machinery, has manufactured over 3,000 compressors, including 1,000 sets of the centrifugal type, during the past 99 years. Its compressor clients benefit from various technological features, including in-house design automation (CAD) system, high performance and high efficiency impellers and vaned diffusers, and the recent implementation of sophisticated rotor dynamics analysis and high pressure compressor design. Hitachi utilizes advanced technology to reduce initial and operational costs for compressor installations.

**HOERBIGER COMPRESSION TECHNOLOGY****2016 SPONSOR**

2521

1358 W Newport Centr Dr.  
Deerfield Beach, FL 33442 USA  
PH: 954-246-1352 | FX: 954-422-9872

HOERBIGER Compression Technology provides a wide range of reciprocating and rotating equipment services to the refining, chemical, gas transmission, power generation and steel industries.

Services from its 17-acre La Porte, Texas campus includes: rebuilds, rerates, overhauls, dehumidified storage for steam turbines, reciprocating and centrifugal compressors, pumps, gearboxes, and expanders.

**HOOSIER PATTERN INC.**

1634

PO Box 7  
Decatur, IN 46733 USA  
PH: 260-724-9430 | FX: 260-724-9433  
<http://www.hoosierpattern.com>

Hoosier Pattern, based in Decatur, Indiana, has been a patternmaking shop providing quality service to the foundry industry since 1997.

Our employees come from a wide range of occupations in the foundry industry. We combine their diverse talents with the latest in technology to produce cutting-edge tooling, rapid prototyping models, core boxes, foundry match plates and permanent molds. We have recently added an ExOne SMax™ 3D Sand Printer to our "toolbox" and are proud to add the ability to produce complex cores and molds, as well as prototype molds with quick turnaround time to the array of services that we offer.



## **HOUSTON DYNAMIC SERVICE, INC.**

**2333**

8150 Lawndale  
Houston, TX 77012 USA  
PH: 713-928-6200

Houston Dynamic Service, Inc. is a privately held corporation and one of the largest independent facilities in the region. HDS, has been providing service for over 37 years of the repair of rotating equipment. This includes all types and manufacturers of pumps, compressors, blowers, gearboxes, centrifuges and turbines. HDS can also assist with field service. In addition, HDS is the largest independent provider of seal strip for all type of applications. The HDS complex is located in the Houston Ship Channel area and provides services to the petrochemical, refining, power generation, mining and off-shore industries.

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## **HOWDEN ROOTS**

**2634**

900 West Mount Street  
Connersville, IN 47331 USA  
PH: 765-827-9285 | FX: 765-827-9317  
<http://www.howden.com>

Howden ExVel™ turbo-fans are the proven, highly reliable, and better economic alternative to compressors and multistage blowers for air and gas movement and process applications. Our turbo-fans are single-stage, low speed, centrifugal products capable of volume flows up to 400,000 acfm with compression ratios up to 1.8 based on standard air, and up to 2.6 in a 2-stage configuration. Each Turbo-Fan is custom engineered and fabricated from ductile steels, SS, Duplex, nickel alloys, and titanium to the project and application needs. ExVel™ turbo-fans are used in many industrial processes applications handling air, steam, and other gases.

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## **HUNAN SUND**

**1846**

Shuang ma Industrial Park, Yue Tang District  
XiangTan, 411101 Hunan China  
PH: +8618673302290  
<http://www.hnsund.com/home.html>

Hunan SUND Industrial and Technological Co., Ltd. (also known as Hunan SUND Industrial Science & Technology Co., Ltd., and SUND), is an integrated solution supplier for rotating machinery bearings and transmission systems.

SUND has been focusing on hydrodynamic fluid film sliding bearing design and manufacture since 1996. With decades of endeavor, SUND can provide highly reliable rotating machinery supporting systems and professional services for global market.

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## **HUNAN TANE OCEAN PUMP CO., LTD.**

**1844**

806#, Tianyue Avenue North  
Pingjiang, 414500 Hunan province China  
PH: +8607306261515 | FX: +8607306261516  
<http://www.taneax.com>

HUNAN TANE OCEAN PUMP CO.,LTD is one professional API pumps manufacturer since 1958, Special for API BB1,BB2,BB3,BB5 and OH type,and VS1 and VS6. Welcome our viewing.

**HYDRAULIC INSTITUTE**

3213

6 Campus Drive  
Parsippany, NJ 07054 USA  
PH: 973-267-9700 | FX: 973-267-9055  
<http://www.pumps.org>

The Hydraulic Institute serves pump manufacturers, engineering consulting firms, and pump users worldwide by developing and delivering comprehensive industry standards; expanding knowledge by providing education and tools for the effective application, testing, installation, operation, maintenance, and performance optimization of pumps and pumping systems; and by serving as a forum for the exchange of industry information. HI established Pump Systems Matter as its educational annex in providing webinars and courses on the benefits to pump systems optimization and energy efficiency to improve bottom-line savings of end-user companies. For more information on HI, visit [www.Pumps.org](http://www.Pumps.org).

**HYDROCARBON ENGINEERING**

PUB BIN

15 South Street, Farnham  
Surrey, UK, GU9 7QU  
PH: +441252718999 | FX: +441251718992  
<http://www.energyglobal.com>

Hydrocarbon Engineering is the leading downstream international publication for the oil and gas processing industries. This monthly publication covers everything from petrochemicals to process analysers, sulfur to storage, maintenance to emissions monitoring. Hydrocarbon Engineering has global readership in over 120 countries and reflects the global nature of today's downstream industry showcasing the latest technologies as well as reporting on market trends.

**HYDROTEX DYNAMICS, INC.**

1321

6320 Cunningham Rd  
Houston, TX 77041 USA  
PH: 800-870-4221 | FX: 713-937-7319  
<http://hydroinc.com>

HydroTex Dynamics, part of Hydro's worldwide pump service organization, provides engineering solutions and value-added services to improve pump reliability, extend pump life and reduce overall life cycle costs. Hydro works hand-in-hand with pump users to optimize the performance and reliability of their pumping systems by evaluating and understanding root causes of pump degradation or failure and by providing unbiased engineering analysis, quality workmanship, pump performance testing, and responsive field service for improved plant operation. Visit Hydro's website [www.hydroinc.com](http://www.hydroinc.com) to learn more about our comprehensive pump services.

## HYDROTHRIFT CORP.

PO Box 1037

Massillon, OH 44648 USA

PH: 330-837-5141 | FX: 330-837-0558

<http://www.hydrothrift.com>

1429

HydroThrift is a leader in cooling systems applications. Since 1973 we have designed, engineered and built thousands of cooling systems that are being used all over the world. It is our job to translate your needs into a design that will meet your requirements.

- Dry type cooling systems (CD)
- Closed Loop Evaporative Cooling (CE)
- Liquid to Liquid cooling (PCX)
- Open Evaporative Cooling (OE)
- Chillers (CW)

HydroThrift also has heat exchanger repair and remanufacture capabilities. We can clean, repair, or remanufacture your fouled or broken heat exchanger for a fraction of the cost of a new unit.



**IMI SENSORS**

1632

3425 Walden Avenue  
Depew, NY 14043 USA  
PH: 716-684-0002

Whether involved with design evaluations, field testing, compressors and diesel engines, critical component or process monitoring, IMI Sensors provides comprehensive protection, condition, and performance monitoring solutions for all rotating machinery applications.

In particular, our instrumentation is ideally suited to detect and measure dynamic pressure and vibration for gas turbines in extreme heat environments. Our high-temperature pressure sensors and accelerometers are intrinsically safe for measuring combustion dynamics and vibration levels in gas turbines.

Manufacturing operations are certified to ISO 9001, AS9100 and calibration procedures accredited by A2LA to ISO 17025.

**IMMI TURBINES**

2701

1410 North Fraziers  
Conroe, TX 77301 USA  
PH: 936-788-2229 | FX: 936-788-2257

Since 1999, IMMI Turbines has been the supplier of choice for customer's seeking "the Best in Class" provider of OEM equivalent turbine parts and services to the world.

**INDUSTRIAL INFO RESOURCES, INC.**

3001

2277 Plaza Drive, Suite 300  
Sugar Land, TX 77479 USA  
PH: 713-783-5147

Industrial Info Resources (IIR) is the leading provider of global market intelligence specializing in the industrial process, heavy manufacturing and energy markets. In addition to our Plant & Project Databases, which provide market intelligence on industrial plants and major capital and maintenance projects throughout the world, IIR offers a range of products providing highly detailed information for thousands of installed and new-build turbines, combustion engines and compressor drives across the U.S. and Canada.

**INDUSTRIAL RELIABILITY & ALIGNMENT**

2313

PO Box 1379  
Palatka, FL 32177 USA  
PH: 386-546-5866 | FX: 386-267-3149  
<http://industrialreliability.net>

Our goal is to improve the productivity and profitability of our customers in the manufacturing industry through precision maintenance. We offer reliability analysis and reporting to suit your customized needs. We also offer alignment, balancing, turbine repairs, and other industrial related services.

## INGERSOLL RAND

3101 Broadway  
Buffalo, NY 14227 USA  
PH: 704-655-5679 | FX: 855-834-9430  
<http://www.ingersollrandproducts.com>



2823

Ingersoll Rand is a global leader in compressed air and gas systems specializing in design, manufacture, optimization and asset management. With a specialty in supplying complete system solutions, Ingersoll Rand offers a broad technology portfolio that includes centrifugal, screw and reciprocating compressors. Knowledgeable company experts conduct full site assessments to understand the customer's operating processes and design the most reliable and efficient solution for each application. Drawing on more than a century of industry experience, Ingersoll Rand has a legacy of helping customers be more competitive within their industries – including those in the petrochemical, air separation, LNG, power generation and general manufacturing sectors.

## INPRO/SEAL

4221 81st Ave W  
Rock Island, IL 61201 USA  
PH: 309-787-4971 / FX: 309-787-6190  
<http://www.inpro-seal.com>

Inpro/Seal®, the inventor of the Bearing Isolator, is an industry leader in system and bearing protection. Inpro/Seal products include the Bearing Isolator, providing permanent bearing protection on pumps, motors and other industrial applications, and the Sentinel® Floating Brush Seal, a drop-in replacement for carbon rings on process steam turbines that significantly extends maintenance intervals. Inpro/Seal technologies increase the reliability of rotating equipment and provide real cost savings by improving the mean time between repair. Inpro/Seal is a Waukesha Bearings® business. Waukesha Bearings is an operating company of Dover.

## INTEGRATED TURBOMACHINERY, INC.

7411 Telegraph Road  
Montebello, CA 90640 USA  
PH: 323-726-5200

Integrated TurboMachinery, Inc. is a critical-operation rotating equipment support technologies provider. Integrated Turbomachinery offers the pricing, flexibility and responsiveness required to create unparalleled value for demanding global customers.

1914

## ISOMAG CORPORATION

11871 Dunlay Lane  
Baton Rouge, LA 70809 USA  
PH: 225-752-0926 X221



2728

Isomag is the technological leader in industrial bearing seal protection. All Isomag bearing seals utilize precision lapped flat face sealing technology to provide an air and liquid tight seal. By preventing oil contamination, Isomag seals maximize bearing life and improve MTBF. Isomag seals are compact one-piece cartridge designs that are easy to install and will replace most lip seals and labyrinth seals. Seals are available for pump power frames, steam turbines, electric motors, gearboxes, and many other applications. Available in sizes to fit all shaft diameters from 3/4 inch to 13 inch.

**ITT CORPORATION**

240 Fall Street  
Seneca Falls, NY 13148 USA  
PH: 315-568-7492 | FX: 315-568-7759

2241

ITT is a diversified leading manufacturer of highly engineered critical components and customized technology solutions for the energy, transportation and industrial markets. Building on its heritage of innovation, ITT partners with its customers to deliver enduring solutions to the key industries that underpin our modern way of life. ITT is headquartered in White Plains, N.Y., with employees in more than 35 countries and sales in a total of approximately 125 countries.

**ITW ENGINEERED POLYMERS**

130 Commerce Drive  
Montgomeryville, PA 18936 USA  
PH: 267-646-1489  
<http://www.itwengineeredpolymers.com>

3027

ITW Engineered Polymers is a global supplier of chemical solutions targeting industrial manufacturers. Our core focus areas include: Alternative Energy, Wear and Abrasion, Oil and Gas, Marine and General Industrial.

We work closely with our customers to provide them with value-added solutions, and are committed to the continuous delivery of superior technical support and expertise, premium quality products and ongoing R&D initiatives.



# J

## **JAQUET NORTH AMERICA, INC.**

1918

25400 US Hwy 19 N, Ste. 192  
Clearwater, FL 33763 USA  
PH: 727-796-2040 | FX: 727-796-2031  
<http://www.jaquet.com>

JAQUET offers the world's most versatile and advanced range of solutions for the detection, measurement, diagnosis and management of rotational speed. Our industry and application specific expertise ensures that you will achieve an optimum solution. Completely matched to your individual requirements, meeting key industrial standards and certifications, our products help boost the performance of your machinery while reducing cost of ownership.

Products include: Speed Sensors, Tachometers, F-DC Convertors, Overspeed Modules, SIL3 2oo3 OSPA Systems and Diesel Engine Predictive Maintenance Systems. We also provide VR, Hall and Eddy Current Technologies for turbine, pump, compressor, expander and turbocharger RPM monitoring and control.

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## **JETSEAL, INC.**

2539

1024 N. Ralph St.  
Spokane, WA 99202  
PH: 509-467-9133 | FX: 509-467-9028  
<http://www.jetseal.com>

Jetseal is an industry leader in high-performance resilient metal seal technology. Whether your company is seeking a metal seal or a custom metallic seal assembly, Jetseal's team of engineers will work with you to develop a specifically engineered solution to meet your rigorous sealing requirements.

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## **JIASHAN HUANQIU MECHANICAL SEAL FACTORY**

1227

No. 22 Yinxiu Road, Weitang Industrail Park  
Jiaxing, 314100 China  
PH: +8657384062810 | FX: +8657384062800  
<http://en.hqmf.com/>

Jiashan Huanqiu Mechanical Seal Factory, HQMF, is a professional manufacturer of mechanical seals.

Main products are medium and large mechanical seals, welded metal bellows, rubber bellows etc, which are used for water pumps & centrifugal pumps & reaction kettles etc. They are in conformity with standard GB6556-86, DIN24960, ISO3069 and kettle standard HG5-752 & HG21571-95, etc.

HQMF, a big and famous name in the mechanical seal industry, which is bearing the company's dreams, remaining at the forefront of manufacturing mechanical seal in China.



## JOURNAL OF COMPRESSOR, BLOWER AND FAN TECHNOLOGY

No. 16, Kai Fa Road, Economic and Tech. and Develp

Shenyang, 110869 Liao Ning China

PH: +86013889842965

<http://www.cftn.cn>

2924

EXHIBITOR  
DESCRIPTIONS



**FIND PUMP DAILY  
SCHEDULE**

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Please go to page 74  
for more information

TPS



## **KAWASAKI HEAVY INDUSTRIES, LTD.**

2939

8829 N Sam Houston Pkwy W  
Houston, TX 77064 USA  
PH: 281-970-3255 | FX: 281-970-6465  
<http://www.kawasakigasturbines.com>

Kawasaki Heavy Industries is a major global supplier of integrated engineered products. Kawasaki Gas Turbines manufactures base load gas turbine generator packages from 1-30MWe, and standby packages from 600-4,800kWe. Our gas turbines have one of the lowest emissions ratings in the industry, and both series are available with customized options, including dual fuel systems, for use in onshore and offshore applications. Over 10,000 packages have been delivered globally.

Kawasaki Centrifugal Compressors are API617 compliant, and have been supplied globally to the upstream and downstream oil and gas markets, both onshore and offshore, for over 40 years. Solutions from single compressor trains to complete gas compression modules are available.

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## **KEENE TURBOMACHINERY SERVICES**

2315

5600 John Martin  
Baytown, TX 77521 USA  
PH: 281-427-8800 | FX: 281-427-0427

Keene Turbomachinery Services is a full-service sales and repair facility in Baytown, Texas, offering a large inventory of all brands of steam turbines and their associated parts. Its machine shop, weld shop, mechanic shop, field service, and balance departments are operated by some of the most experienced personnel in the industry. Surplus gearboxes and Woodward TG and PG style governors are also inventoried and repaired. The owner, Lendell Keene, has a worldwide reputation for his knowledge in this field and for offering quality parts, repairs, and re-rates at the most reasonable prices and quickest delivery times.

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## **KELM ENGINEERING, LLC**

1840

902 S Friendswood Dr  
Friendswood, TX 77546 USA  
PH: 281-993-3717 | FX: 281-648-2907

Kelm Engineering was formed in 1999. Its approach to solving equipment problems is to use a mixture of analytical modeling and field and/or shop testing to validate computer simulations and verify the effectiveness of solutions.

Although the company is based in the Greater Houston area, Kelm's projects continue to be located around the nation and the globe.

**KEY PUMP & GEAR, LLC.**

2626 Highway 146 S.  
Dayton, TX 77535 USA  
PH: 713-724-5461  
<http://www.keypumpandgear.com>

1219

Key Pump and Gear, LLC. founded in 2004 and having 30 years experience in rotating equipment repair. Designed and patented the KIRIS System which is a specialized tool system used to disassemble and assemble ANSI pumps the proper way by protecting the integrity of the critical components during this process. We also build complete skids to customers spec. as well as help size equipment to your needs. Sell parts both OEM and reverse engineered parts. We rework vacuum pumps to include liquid Ring, and rotary vacuum pumps.

**KINGSBURY, INC.**

10385 Drummond Road  
Philadelphia, PA 19154 USA  
PH: 215-824-4961 | FX: 215-824-4999  
<http://www.kingsbury.com>

2527

Kingsbury, in business since 1912, is the first and leading manufacturer of fluid-film thrust and journal bearings. Our products are used in a wide variety of turbo machinery, including steam and gas turbines, compressors, gearboxes and pumps, with shaft sizes ranging from 25 to 1400 mm, and sliding velocities up to 130 m/sec. Please visit [www.kingsbury.com](http://www.kingsbury.com) for more details.

**KOBELCO COMPRESSORS AMERICA, INC.**

1415 Louisiana Street, Suite 4111  
Houston, TX 77002 USA  
PH: 713-655-0015  
<http://www.kobelcocompressors.com>



2833

Kobelco Compressors America, Inc. began manufacturing compressors in 1915 and today is a global leader in compressor technology, engineering, and innovation. Kobelco designs, manufactures, and packages Screw (API619), Reciprocating (API618), and Centrifugal (API617) compressors for virtually any process gas application. Each system is custom engineered for optimum performance and outstanding return on investment. Through innovative technology and quality manufacturing, Kobelco offers solutions to boost productivity, reduce operating costs, and safeguard the environment. Visit us to speak with our compressor experts and learn more about our custom engineered compression solutions.

**KONGSBERG**

438 Crest Dr  
Northvale, NJ 7647 USA  
PH: 201-669-6857

2317

Passive Radar-Wireless/SAW technology, sensors for real-time temperature monitoring of crank pin and cross-head bearings. RADAR based, direct contact temperature sensor (NOT telemetry!). Passive intrinsically safe sensors installed in moving (rotating, reciprocating, orbiting, etc.) machinery components. Applications in safe or hazardous environments.

No batteries, no power inside or near the machine! Class 1, division 1/division 2 sensor. Class 1, division 2 electronics/signal processing unit. Automatic slow-down prevents machine damage, catastrophic failure. Installation of this system reduces risk of high cost damages, down time and injury, increases operational safety of large machines: reciprocating compressors, diesel engines, etc.

## **KRAL-USA, INC.**

1233

901A Matthews-Mint Hill Road  
Matthews, NC 28105 USA  
PH: 704-814-6164  
<http://www.kral-usa.com>

KRAL is a leading manufacturer of screw pumps and flowmeters with innovative solutions to meet industry demands. KRAL offers high quality, quick response and short lead times.

A wide portfolio including API pumps and custom engineered solutions help to assure a competitive edge for our customers within their area of business. We look far beyond our own product offerings to gain full understanding of the customer's requirements, applications and strategic plans. Professional customer service is affirmed with a certified QM system in compliance with EN ISO 9001:2000. After the purchase, a reliable and fast service team is there for you with product support.

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## **KRMEA**

1943

Bedel Hoegwan 101, 324-1, Yangjae-dong, Seocho-gu  
Seoul, South Korea  
PH: +8225796271 | FX: +8225796273  
<http://www.krmea.or.kr>

Korea Rotating Machinery Facility Maintenance Symposium is planned to help engineers share and exchange information on problems in each field and solutions. 18th KOREA Rotating Machinery Symposium will be held November 17-18, 2016 at The-K Seoul Hotel, Seoul, Korea.

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## **KTR CORPORATION**

2522

122 Anchor Rd  
Michigan City, IN 46360 USA  
PH: 219-872-9100 | FX: 219-872-9150  
<http://www.ktr.com>

KTR Corporation is a wholly owned and operated subsidiary of KTR Kupplungstechnik GmbH. Our extensive product line began over 50 years ago with the BoWex curved tooth gear and the ROTEX torsionally flexible jaw couplings. Today we have grown to 40 subsidiary companies in 21 countries, and 15+ complete coupling platforms.

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## **KTS TURBOBILLET X**

2923

11, Persinran KIP1, Tamon Perindustrian KIP  
Kuala Lumpur, 52200 Wilayah Persekutuan Malaysia  
PH: +60173060908 | FX: +60361393571  
<http://www.ktsturbobilletx.com>

KTS Turbobillet X (KTS) is a specialty manufacturer of high performance Machined-From-Solid (MFS) Compressor wheel, also known as Billet Impeller.

Our value proposition is eXcitement — all that we do revolves around Technology, Performance, Selection, Delivery and Lowest Risk. KTS billets are proven around the world and insisted by a discerning customer base consisting over 400 turbo specialist, turbo manufacturers, tuners and race teams.

L

**L.A. TURBINE CORP.**

2739

28557 Industry Drive  
Valencia, CA 91355 USA  
PH: 661-294-8290 | FX: 888-674-6503  
<http://www.laturbine.com>

L.A. Turbine (LAT) delivers innovative turboexpander design, manufacturing and testing of application-specific, highly engineered turboexpanders used in hydrocarbon processing, geothermal power generation and other industrial power recovery or refrigeration applications. In 2016 LAT produced its 100th turboexpander unit. The company also provides aftermarket field service, equipment repair and redesign, and produces spare parts for all brands and configurations of turboexpanders worldwide. A global field service team provides diagnostic, maintenance and consultative support 24/7/365 onsite and remotely via 855-FX-TURBO. LAT's world headquarters and manufacturing is in Valencia, California. Service centers are in California and LAT's European headquarters' location, Belgium.

**LANCER SYSTEMS**

2423

2800 Milford Square Pike  
Quakertown, PA 18951 USA  
PH: 610-973-2658 | FX: 610-973-2601  
<http://www.lancer-systems.com>

Lancer is an engineering and manufacturing firm trusted by customers in the defense, aerospace, natural gas and oil industries. The company deploys cutting edge plastic, fiber optic and CeraComp®, a patented ceramic matrix composite technology. Lancer Systems is accredited for developing innovative material solutions including composites and advanced weapons that are light weight, innovative and cost effective.

**LEISTRITZ ADVANCED TECHNOLOGIES CORP.**

1327

165 Chestnut Street  
Allendale, NJ 7401 USA  
PH: 201-934-8262 x13 | FX: 201-934-8266  
<http://www.leistritzcorp.com>

Leistritz manufactures Screw Pumps for the process, oil and gas, power generation and transportation industries. A complete line of two, three, five and multiphase screw pumps handle flow rates to 15,000 gpm and differential pressures to 2,100 psi. Leistritz has the expertise to deliver packages requiring custom engineered solutions.

## **LEWA-NIKKISO AMERICA, INC.**

1205

132 Hopping Brook Road  
Holliston, MA 01746 USA  
PH: 508-893-3218  
<http://www.lewa-inc.com>

For six decades we have set the technical standards for metering and process pumps, metering devices and complete systems for fluid metering. This is guaranteed by a solid technique, profound process and industry knowledge and the hermetically tight and absolute safe diaphragm technology. We design and manufacture efficient and customized solutions for virtually all metering, conveying, mixing, or odorizing tasks.

With proximity to our customers – from engineering to technical advice or to commissioning on site – some 1,000 experts around the world enable a successful implementation of projects.

High quality standards and a professional management ensure the best result.

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## **LIGHTBOURN EQUIPMENT CO.**

2951

PO Box 801870  
Dallas, TX 75380 USA  
PH: 972-233-5151 | FX: 972-661-0738

Lightbourn Equipment Company was established in Dallas, Texas in 1945 and is a family owned and operated business. We are a wholesale distributor committed to providing our customers with the highest quality products built by world class manufacturers. We are very fortunate to have an outstanding dealer network that supports our territory by providing professional service to consumers and end users.

Lightbourn Equipment has been associated with Honda since 1987, and we are very proud to be the Honda Engine Distributor for Texas, New Mexico and Oklahoma. Honda is the world's largest manufacturer of engines and one of the most respected brands on the planet.

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## **LNG INDUSTRY**

PUB BIN

15 South Street  
Farnham, Surrey, GU9 7QU, UK  
PH: +4401252718999 | FX: +4401252718992  
[www.lngindustry.com](http://www.lngindustry.com)

LNG Industry is the leading publication for the global LNG industry, focusing on the entire LNG value chain. The magazine provides a global perspective on the industry with regular regional overviews, expert analysis and case studies, as well as in depth technical features addressing all aspects of the LNG industry. Visit [www.lngindustry.com](http://www.lngindustry.com) for the latest LNG news.

**LOBEPRO ROTARY PUMPS**

1135

2610 Sidney Lanier Dr  
Brunswick, GA 31525 USA  
PH: 912-466-0304 | FX: 912-466-0086  
<http://www.lobepro.com>

LobePro Inc. manufactures 3 lines of rotary lobe pumps: S-Series: Sludge, Mud, & Slurries; C-Series: Corrosives & Chemicals; and D-Series: Abrasives & Corrosives. Each line is also available in an API-Series: API 676 Compliant version. LobePro Rotary Lobe Pumps handle abrasives, self-prime, pump thick viscous materials, and pump a steady GPM flow up to 2000 GPM at steady pressures up to 150 PSI. Pumps are used in oil and gas applications: pumping clean drilling fluid, feeding decanting centrifuges, booster pumps in pipelines for oil containing abrasives and waste oil, and pumping jet fuel and diesel from tanks requiring a suction lift.

**LUBE-POWER, INC.**

1301

50146 Utica Drive  
Shelby Township, MI 48315 USA  
PH: 586-247-6500 | FX: 586-247-6510

Established in 1979, Lube-Power is a world-class supplier of engineer-to-order lube, seal and control oil consoles for rotating equipment manufacturers. Lube-Power also provides exceptional aftermarket service and support for our equipment, or manufacturer's equipment.

**LUDECA, INC.**

2733

1425 NW 88th Avenue  
Doral, FL 33172 USA  
PH: 305-591-8935 | FX: 305-591-1537  
<http://www.ludeca.com>

Predictive and Proactive Maintenance Solutions including laser alignment, ultrasound testing, vibration and balancing equipment, as well as related software, rentals, services and training.

**LUNETARCM SALES & SERVICES, INC**

1514

P.O. Box 2044  
Deer Park, TX 77536 USA  
PH: 281-482-0034 | FX: 281-482-0075

The Luneta Corporation is a manufacturer of new and innovative lubrication accessories for all types of rotating equipment. The Condition Monitoring Pod is only their first of many innovations to come.

Over the last 27 years, RCM Sales & Services, Inc. has been a distributor of products to the process industries in Texas, Louisiana, and Oklahoma which have their focus on Reliability Centered Maintenance. RCM has 4 divisions: Fluid Sealing/Flow Controls, Power Transmission, Vibration & Alignment, and Safety.





## **MACEK POWER & TURBOMACHINERY ENGINEERING**

2554

PO Box 2480  
Friendswood, TX 77549 USA  
PH: 281-993-3737  
<http://www.macekpower.com>

Formed in 2003 and launched in 2007, Macek Power is an engineering and consulting firm based in the Houston, TX, USA vicinity. Services include: Power generation engineering with emphasis on the Rankine cycle and associated equipment specification, Steam turbine design and engineering, Turbomachinery consulting, Commissioning and field support, and Root cause failure analysis. Additionally, through a jointly owned manufacturing subsidiary, RIMAC Precision Machining, Macek Power supplies steam turbine and axial compressor blades to various repair facilities.

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## **MAGNADRIVE**

2410

14660 NE N Woodinville Way, Suite 100  
Woodinville, WA 98072 USA  
PH: 425-463-4700 | FX: 425-487-3700  
<http://www.hahnequipment.com>

MagnaDrive couplings and Adjustable Speed Drives replace the physical connection between motor and load with a gap of air. This air gap eliminates harmful vibration, wear and tear, enhances energy efficiency, increases motor life and protects equipment from overload damage. The motor and load are completely disconnected. What this disconnection accomplishes is lower total cost of ownership with increased seal and bearing life, cushioned start/stop, vibration elimination between the motor and the load, allowing misalignment increased seal and bearing life, all of this with a reduction in energy consumption.

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## **MAN DIESEL & TURBO NORTH AMERICA INC.**

1600A Brittmoore Rd  
Houston, TX 77043 USA  
PH: 713-780-4200 | FX: 713-780-2848



1711

MAN Diesel & Turbo SE, based in Augsburg, Germany, is the world's leading provider of large-bore diesel engines and turbomachinery for marine and stationary applications. The expansive turbomachinery product range includes a broad selection of gas compressors, expanders, steam turbines, and gas turbines up to 50 MW designed to meet a wide variety of industrial needs. Full train responsibility is a major corporate strength, together with high product efficiency and reliability over the complete life cycle. Customers receive worldwide after-sales services marketed under the MAN PrimeServ brand.

**MARY KAY O'CONNOR PROCESS SAFETY CENTER**

2040

3122 TAMU

College Station, TX 77843 USA

PH: 979-845-3489 | FX: 979-458-1493

<http://psc.tamu.edu>

The Center's mission is to promote safety as second nature in industry around the world with goals to prevent future accidents. In addition, the Center develops safer processes, equipment, procedures and management strategies to minimize losses within the process industry. Other functions of the center include that it serves all stakeholders, provides a common forum, and develops programs and activities that will forever change the paradigm of process safety. The Center also develops undergraduate, graduate, and continuing education programs. Its service to industry and government include accident investigation and analysis service, particularly for accidents suggesting new phenomena or complex technologies.

**MAUDLIN & SONS MFG. CO., INC.**

1502

1929 Highway 146

PO Box 699

Kemah, TX 77565 USA

PH: 281-334-7566 X238 | FX: 281-334-7560

Maudlin & Son Mfg offers full custom job shop capabilities including 5-axis water jet, metal stamping, wire EDM, laser cutting, and custom shims made to your specifications.

Maudlin & Son is now manufacturing aftermarket Gas Turbine Repair components. These components consist of picture frame Wear Strips and Impingement Sleeve Zippers used for repairs on transition pieces.

Maudlin Products offers a full product line of slotted shims, coil shim stock, stainless steel Tool Wrap, feeler gage, key stock, drill rod, and threaded rod.

Mauldin's Cantilevered Spring line includes the most standards in the industry, as well as the largest inventory of on-hand material.

**MAYEKAWA U.S.A., INC.**

1433

19745 Gramercy Place

Torrance, CA 90501 USA

PH: 310-418-8787 | FX: 310-328-8487

Mayekawa's gas compressors can handle a wide range of petrochemical industry gases including hydrogen, helium, carbon dioxide; raw material gases including vinyl chloride, methyl chloride; active gases including chlorine, hydrogen chloride, hydrogen sulfide; gas mixtures and VOC and associated gases from refinery processes. MYCOM gas compressors' performance and reliability have been proven over and over in petrochemical, oil and gas projects around the world. Our gas compressors are applied to various fuel gases for power generation and recovering oil, hydrocarbons and raw material gases contributing to energy-saving and environmental sustainability.

## **MECHANICAL REPAIR & ENGINEERING, LP**

2427

202 N 18th Street | PO Box 1542  
La Porte, TX 77571 USA  
PH: 281-471-1061

Mechanical Repair & Engineering, Inc. is an independent turbomachinery repair and service facility specializing in the reconditioning of high pressure, high energy, and multistage pumps, high speed gearboxes, steam turbines, and compressors.

Its mechanical engineering staff, metallurgist, and years of dedicated maintenance service and experience offer the industry the highest quality engineered repairs. Its 40,000 ft<sup>2</sup> facility is equipped with lathe swings to 112", dynamic balancing capabilities to 15,000 lb, and lifting capacity to 40 tons.

Mechanical Repair & Engineering is the only service center in the Gulf Coast area for Coperion Corporation, Lawrence Pumps, and U.S. Motors Gearboxes.

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## **MECHANICAL SOLUTIONS, INC.**

1425

11 Apollo Drive  
Whippany, NJ 07981 USA  
PH: 973-326-9920 X125  
<http://www.mechsol.com/>

MSI's reputation is founded on its ability to solve difficult rotating machinery problems using specialized vibration, strain, dynamic pressure, operating deflection shape (ODS), and surge/stall testing and analysis techniques. MSI also provides complete turn-key machinery and component development services, mechanical and fluid dynamic analysis services, and foil (air) bearing designs and products. In addition to specialized field and lab testing tools, computational tools regularly utilized by MSI include computational fluid dynamics (CFD), finite element analysis (FEA), and rotordynamics analysis packages. MSI's years of machinery experience have been leveraged to develop and support its physics-based Sentry™ condition based maintenance (CBM) system.

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## **MEGGITT SENSING SYSTEMS**

3012

Rte de Moncor 04  
Fribourg, CA 1701 FR Switzerland  
PH: +41264071804 | FX: +41264071301  
<http://www.meggittsensing systems.com>

Meggitt is the world's leading provider of high performance sensing and condition monitoring solutions for extreme environments. Our systems monitor rotating equipment from gas, steam, hydro and wind turbines to motors, fans and gearboxes. Protecting high-value turbomachinery and monitoring critical assets are essential to reducing maintenance costs, unexpected failures, repair and overhaul time, spare parts inventory and emissions. Our unmatched sensing capabilities include pressure, acceleration, velocity, displacement and partial discharge.

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## **MERIDIAN EQUIPMENT, INC.**

2801

12800 Fuqua Street  
Houston, TX 77034 USA  
PH: 281-484-7700 | FX: 281-484-7774

Portable machining equipment rentals and sales, offering a large selection of portable machining equipment to solve a wide variety of in-place machining tasks. Meridian prides themselves on same day shipping, international support, well maintained equipment, user friendly design, and 24 hours a day, 7 days a week support and service.

**METALTECH SERVICE CENTER**

1537

9915 Monroe  
Houston, TX 77075 USA  
PH: 713-560-4875 | FX: 713-991-7565

Metaltech Service Center is a stainless steel and alloy steel service center. Stainless inventories consist of plate, sheet, round bar, hex bar, square bar, flat bar, angles, and other commodities. Alloy steels consist of plate and round bar. Grades of stainless include 300 series, 400 series 17-4ph, Duplex, and Super Duplex stainless. Alloy steels include LF2 A105/A350, F22, F91, A36, and 516-70. In house processing includes plasma, hi-def plasma, water jet cutting, laser cutting, plate saw cutting, and production round bar cutting. Our latest process equipment includes a 10' X 16' water jet machine and a 25" round bar production cutting saw.

**METRIX INSTRUMENT CO.**

2233

8824 Fallbrook Dr  
Houston, TX 77064-9912 USA  
PH: 281-940-1748 | FX: 713-559-9432  
[www.metrixvibration.com](http://www.metrixvibration.com)

Metrix Instrument Co. has been providing machinery condition monitoring solutions for more than 50 years. Our vibration monitoring products include digital proximity systems, probes, sensors and transmitters, signal conditioners, transducers, high temperature velocity sensors, mechanical and electronic switches, impact transmitters, monitors, portable shakers and vibration meters. Visit us at [www.metrixvibration.com](http://www.metrixvibration.com)

**MITSUBISHI HEAVY INDUSTRIES LTD.**

2611

1221 McKinney Ste 4250  
Houston, TX 77010 USA  
PH: 713-652-0356 | FX: 713-658-0469  
<http://www.mhicompressor.com>

Mitsubishi Heavy Industries Compressor Corporation (MCO), a wholly-owned subsidiary of Mitsubishi Heavy Industries, Ltd. (MHI), is one of the world's largest compressor and steam turbine manufacturing companies, dedicated to providing advanced technology machinery and after-sales service to the Petrochemical and Oil & Gas industries.

**MODAL SHOP, THE**

3245

3149 E. Kemper Rd.  
Cincinnati, OH 45241 USA  
PH: 513-351-9919 | FX: 515-458-2172  
<http://www.modalshop.com>

The Modal Shop, A PCB Group Company, offers structural vibration and acoustic sensing systems and services to meet the application needs of engineers both in the design and test laboratory as well as in the manufacturing plant. Extending the PCB Piezotronics pledge for Total Customer Satisfaction, we serve you rapidly with innovative products. The Modal Shop is staffed with world-class expertise educated at the finest sound and vibration programs. We can share many recommendations for our products and services from globally known laboratories, corporations and universities around the world

## **MODERN POWER SYSTEMS**

**PUB BIN**

Progressive House, 2 Maidstone Rd, Foots Cray  
Sidcup, Kent DA14 5HZ, United Kingdom  
PH: +4402082697766  
<http://www.modernpowersystems.com/>

The international monthly magazine Modern Power Systems provides in-depth independent coverage of power plant and transmission and distribution technology. Widely read throughout the world of electricity generation, it specializes in presenting key engineering and commercial developments in an authoritative but accessible style. From advanced power plant and transmission design to repair and maintenance case studies, Modern Power Systems is unrivaled as a platform for exploring cutting edge developments in the power industry.

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## **MODERN PUMPING TODAY**

**1214**

312 Lorna Square  
Birmingham, AL 35216 USA  
PH: 866-251-1777 | FX: 205-795-0234  
<http://www.modernpumpingtoday.com>

Modern Pumping Today is a new publication providing solutions for the worldwide pump industry. The company's editorial mixes technical white papers and application solutions for the wide range of business sectors that pump and rotary equipment manufacturers need to reach each month. Visit [www.modernpumpingtoday.com](http://www.modernpumpingtoday.com) to get all of your pump industry news as it actually comes across the wire, plus see video demos from a wide variety of pump and related manufacturers. Also, anyone in the USA or abroad can subscribe free of charge to the company's digital edition of Modern Pumping Today to stay connected to the pump industry.

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## **MOMENTUM ENGINEERED SYSTEMS, INC.**

**2949**

8305 Monroe Rd  
Houston, TX 77061 USA  
PH: 832-804-7424 | FX: 832-804-9891  
<http://www.momentumsys.com>

Momentum Engineered Systems (MES) was formed in 2013 by a team of oil and gas equipment professionals to address a lack of supply and service in the rotating equipment support systems market. Our specialty is short lead-times, manufacturing engineered support systems for hydrocarbon processing applications with delivery of standard products in as little as four weeks. All MES Systems are designed, manufactured and tested in the USA from materials from the United States and Western Europe.

**NAPOLEON ENGINEERING SVCS**

2047

1601 Johnson St  
Olean, NY 14760 USA  
PH: 716-372-6532 | FX: 716-372-1448  
<http://nesbearings.com>

Napoleon Engineering Services is your one-stop shop for engineered bearing products and specializes in Custom Bearing Manufacturing, Bearing Testing, and Bearing Inspection, providing valuable products and services to many industries including; aerospace, drive train, agriculture, oil and gas, electric motor, automotive and heavy equipment, to name a few. Napoleon Engineering Services' primary goal is to provide solutions for your bearing related issues. Whether it be supplying a specialty bearing product or providing information regarding evaluation of bearing quality, NES is proud of the fundamental part it takes in providing solutions for customers' needs.

**NATIONAL INSTRUMENTS**

2452

11500 N MoPac Expwy  
Austin, TX 78759 USA  
PH: 512-683-6315  
<http://www.ni.com>

For more than 15 years, National Instruments has provided tools and solutions for asset condition monitoring applications spanning power generation, oil and gas, mining, transportation and heavy equipment, and manufacturing. Our extensive offering of products for machine diagnostics, online predictive maintenance, and test cell applications includes USB, PCI, and PXI acquisition devices and programmable automation controllers. It also includes software for vibration analysis and prognostics, available in both an interactive configuration-based environment and the NI LabVIEW graphical programming environment for monitoring critical and ancillary rotating equipment.

**NATIONAL PUMP COMPANY**

1306

7706 North 71st Avenue  
Glendale, AZ 85303 USA  
PH: 623-979-3560 | FX: 623-979-2177  
<http://www.nationalpumpcompany.com>

National Pump Company, ISO 9001 Certified, has delivered vertical turbine pump reliability, quality and service since 1969. Using a wide variety of materials, NPC manufactures high quality vertical turbine multistage lineshaft and submersible pumps. Product or oil lubricated construction with capacities to 25,000 GPM, pressures up to 2,000 PSI and horsepower up to 2,500 hp. Applications include fuel oil transfer and storage, water/brine injection, light hydrocarbon service, raw and potable water supply, pipeline boosters, cooling tower service, desalinization and dry docks. Custom pumps and retrofits are built to order at seven 7) service centers throughout the United States.

## NES COMPANY

3237

31 Fairfield Place  
West Caldwell, NJ 07006 USA  
PH: 917-557-6858  
<http://www.nescompany.com>

NES Company Inc. manufactures and distributes an extensive selection of pumping equipment for the industrial, commercial, and heating markets. We specialize in Nash\* liquid ring vacuum pumps. Our product lines include a large selection of replacement Nash\* pumps up to 42,000 CFM, engineered systems, as well as one of the largest selection of remanufactured Nash\* pumps.

## NETZSCH PUMPS NORTH AMERICA LLC

1434

119 Pickering Way  
Exton, PA 19341 USA  
PH: 610-363-8010 | FX: 610-363-0971  
<http://www.pumps.netzsch.com>

NETZSCH Pumps North America, LLC is the North American subsidiary of the operating group of NETZSCH companies. For over six decades NETZSCH has been manufacturing and supplying NEMO® Progressing Cavity Pumps and TORNADO® Rotary Lobe Pumps (Classic T1 version and T2, the most technologically advanced RLP market wide), NOTOS™ Multiple Screw pumps, macerators/grinders, metering systems, mobile pumps and accessory equipment for custom and challenging applications. NETZSCH's markets include Oil & Gas Upstream, Oil & Gas Downstream, Chemical, Pulp & Paper, Environmental & Energy, Metering Technology and Food & Pharmaceutical (FDA, 3A, EHEDG). Our innovative, quality products are valued globally.

## NEUMAN & ESSER

1502 E Summitry Circle  
Katy, TX 77449 USA  
PH: 713-554-9623  
<http://www.neuman-esser.de>



3011

NEUMAN & ESSER is a leading provider of reciprocating compressor solutions for the energy industry. More than 180 years of manufacturing heritage has positioned the company as one of the premier manufacturers, packagers and service providers of gas-separable, reciprocating compressors. As the OEM, NEUMAN & ESSER is responsible for the manufacturing, packaging, service and spare parts inventory of every compressor it delivers, giving customers the most integrated and efficient compressor solutions available. In addition, NEUMAN & ESSER provides the most advanced-engineered and robust compressor packages on the market, increasing performance, efficiency and reliability across all types of installations and end uses. This combination of quality, performance, integration and expertise results in improved reliability, reduced business risk and a lower total cost of ownership.



**NEW ENGLAND BRAIDING COMPANY, INC.**

1432

610 Gold Street  
Manchester, NH 3103 USA  
PH: 603-669-1987 | FX: 603-669-4121

Founded in 1979, New England Braiding Company, Inc. (NEBCO), the manufacturer of patented ANTI-KEystone® II Mechanical Packings, is committed to providing the highest quality compression packings available in the market today. In pursuit of providing a product with superior performance, we have developed our exclusive ANTI-KEystone® packing technology. Use of this ANTI-KEystone® packing technology has shown that in most applications our products routinely outperform competitor packings of similar material by lowering operational costs, reducing energy consumption, and increasing packing life.

**NEW WAY**

3005

50 McDonald Blvd  
Aston, PA 19014 USA  
PH: 610-364-3455 | FX: 610-494-0911  
<http://www.newwayairbearings.com>

New Way introduces porous carbon gas bearings for turbo equipment. Being externally pressurized they have the load capacity of oil bearings but without the oil. This enables high speed bearings operating at temperature extremes and on process gases. Zero contact starts and stops make reliability deterministic. Simplify and improve the design of your equipment by moving the bearings closer to the work being done. This technology has been licensed by Flowserve and is being made available for early adopters through New Way.

**NGC TRANSMISSION EQUIPMENT (AMERICA), INC.**

2253

5500 Alliance Gateway Freeway  
Fort Worth, TX 76177 USA  
PH: 954-552-2848 | FX: 817-567-7495  
<http://www.ngcamerica.com>

NGC, headquartered in Fort Worth, Texas, is a global manufacturer of gearboxes and power transmission solutions for the world's most demanding applications – serving customers in the cement, steel, wind, mining, rail, and oil & gas industries. Delivering personalized service, advanced technology and reliable quality has earned NGC a reputation for unparalleled service and support. With a brand new purpose-built facility, NGC is able to provide customers the service they expect, and houses only the latest technological advances in machining and tooling. Adhering to our corporate philosophy, NGC has accepted the challenge to make the world “Geared for a Better Future.”

## **NIDEC MOTOR CORPORATION**

2347

8050 W. Florissant Avenue  
St. Louis, MO 63136 USA  
PH: 888-637-7333  
<http://www.nidec-motor.com/>

Industrial Solutions is a Nidec Corporation business platform that offers a wide range of powerful, efficient and rugged power, motion and control products built to perform for the life of your plant. Whether your goal is to improve the efficiency of a manufacturing process, modernize aging equipment, or design a new site, Nidec engineers will help you create a solution that works the way you do. From stand-alone electric motors, drives and encoder, to complete industrial automation and control systems, Nidec design, manufactures and installs equipment that improves manufacturing process efficiency, increases flexibility and reduces operating costs.

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## **NORD-LOCK INC**

2927

1000 Gregg St  
Carnegie, PA 15106 USA  
PH: 412-279-1149 | FX: 412-279-1185  
<http://www.nord-lock.com>

The Nord-Lock Group is the world leader in bolt securing systems. Our products prevent loosening on critical bolted joints in the most extreme conditions. We safeguard human lives and customer investments with a combination of experience, expertise, and a wide range of products. Nord-Lock washers, Superbolt mechanical tensioners, and Boltight hydraulic tensioners are securing the world's most demanding applications today. Our products have documented success in every major industry and hold several certificates from independent institutes. Optimize your bolted connections. [www.nord-lock.com](http://www.nord-lock.com)

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## **NUMECA-USA**

3225

1044 Larkin Street  
San Francisco, CA 94109 USA  
PH: 415-503-9323 | FX: 415-558-8463  
<http://www.numeca.com>

Based on the most advanced technology, NUMECA software is largely recognized for its application-driven features and interface, optimal solutions, multi-physics models, high accuracy, speed, and general user-friendliness. NUMECA's FINE™/Turbo is the fastest CFD suite for rotating machinery with incompressible and compressible fluids, from subsonic to hypersonic flow regimes. All types of multi-stage axial, radial or mixed-flow configurations are supported: compressors, turbines, pumps, fans, propellers or contra-rotating propellers. From meshing to results visualization, the FINE™/Turbo graphical user interface is intuitive, enabling fast project set-up and analysis.

**OELTECHNIK**

Lessingstrasse 32  
 Waghäusel, D-68753 Baden-Wuerttemberg Germany  
 PH: +49072549810  
<http://www.oeltechnik.com>



3029

Private owned German based engineering & manufacturing company for turbine and compressor auxiliaries. Intercoolers, after coolers, surface condensers, lube-, seal- and control oil systems, seal gas panels, fin fan coolers, TEMA type shell & tube heat exchangers, nitrogen steam heaters, miscellaneous pressure vessels, high fin tubing with copper foot brazed fins or aluminium extruded fins. Certified for ASME Code, PED 97/23/EC, Chinese Manufacturing License for category A1 and A2 pressure equipment. Well re-known within all major international engineering companies and being familiar with their specification. Thermal design performed with in-house developed rating software. Results are checked against actual performance data.

**OIL, GAS & PETROCHEM EQUIPMENT**

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2119

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**OILTIZER**

PUB BIN

210 Park Ave #1110  
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<http://www.oiltizeronline.com>

Oiltizer is THE source for buying and selling equipment and services in the oilfield. With editions that reach a circulation of 45,000+ worldwide to active buyers and sellers, Oiltizer also distributes thousands of copies at major Oil and Gas Trade Shows and live oilfield equipment auctions. Oiltizer is published three (3) times a month with the largest classified section in the petroleum industry, display ads with frequency discounts of up to 30% and a one of a kind auction calendar of industry sales events, Oiltizer offers the advertising alternatives and the advertising value to meet your needs at the lowest cost per prospect.

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1506

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<https://www.oilmanmagazine.com>

Oilman Magazine - The Magazine for Leaders in American Energy. Honoring the proud history of the Oil & Gas industry and reporting the developing trends shaping the future of the industry.

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3243

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PH: 951-210-8507 | FX: 346-231-1665

<http://www.optech4D.com>

## **OROS INC.**

502 Shaw Rd B-101

Dulles, VA 20166-9435 USA

PH: 703-478-3204 | FX: 571-926-8082

<http://www.OTOS.com>



2148

OROS, measuring noise & vibration for nearly three decades, is spinning up to showcase its latest technology.

From acceptance tests to diagnostics to overhaul, OROS' do-it-all analyzers are renowned for their versatility.

Rotordynamics: ORBIGate turbomachinery vibration solution for orbits, shaft centerline, Bode, polar plots, etc.

Structural Dynamics: ODS (Operating Deflection Shape) software to easily visualize the vibes of the machine train.

Torsional Analysis & Torque: an integrated frequency-to-voltage converter captures multiple pulses per rev signals yielding angular velocity profiles, RPM variations, twist and more.

OROS reinforces its position as a trendsetter in portable analyzers with unparalleled versatility.

**PDC MACHINES, INC.**

1875 Stout Dr  
 Warminster, PA 18974 USA  
 PH: 215-443-9442 | FX: 215-443-8530  
<http://www.pdcmachines.com>



PDC Machines, an ISO 9001:2008 certified company, is a manufacturer of diaphragm compressors. PDC's compressors are ideal for compressing all types of gases where ultra-high purity gas is required. PDC is experienced in handling industrial gases, rare, pyrophoric, toxic, synthetic, corrosive and gas mixtures. Standard and custom-designed diaphragm compressor with a comprehensive assortment of options to meet any application can be provided. Discharge pressures range from 50 psi to 60,000 psi (3.4 bar to 4137 bar), power consumption from 3 hp to 200 hp. (2 Kw to 150 kW) and flow rates based on compression ratio to over 3,000 Nm<sup>3</sup>/hr.

**PEERLESS PROCORE**

2251

79 Perry St  
 Buffalo, NY 14203 USA  
 PH: 716-852-4784 | FX: 716-852-5458  
<http://peerlessprocore.com>

There is no single approach to a diverse and increasingly global marketplace. Regional requirements, like ATEX, PED, & CRN. Approved Manufacturers Lists, Country of Origin, NDE, PMI... and the list goes on. PROCORE understands and can manage the complexities of your project so you can deliver quality equipment, on time and under budget.

The PROCORE team was formed by employees of a 100-year-old industrial distribution and fabrication company, named Peerless Inc.. These individuals recognized that engineered equipment builders deserve more than what the traditional supplier typically provides, and created this dedicated supply chain service to meet that growing demand.

**PENTAIR**

3215

800 Airport Rd.  
 North Aurora, IL 60542  
 PH: 630-966-2714  
<http://www.pentair.com>

From the start, Pentair has been a company driven by vision, while grounded in the practical application of the best available ideas. Many of our acquired businesses and their products have a rich history that dates back more than 150 years. Stemmed in innovation, these organizations have designed and engineered some of the most important flow management and heat solution products in the industry.

We are a company comprising innovators and entrepreneurs. From the first self-regulated heat cable (Raychem) to the pilot-operated safety relief valve (Anderson Greenwood), we hold a number of patents for products essential to today's industries.

## **PERMABOND ENGINEERING ADHESIVES**

1104

223 Churchill Ave  
Somerset, NJ 08873 USA  
PH: 800-714-0170 | FX: 610-323-6980  
<http://www.permabond.com>

Permabond is a global manufacturer of engineering adhesives and sealants for assembly, manufacturing, repair, and maintenance. Product lines include anaerobic (threadlockers, retaining compounds, thread sealants, and form in place gaskets), cyanoacrylates, epoxies, polyurethanes, MS polymers, structural acrylics, and UV curable adhesives. The varied technologies provide design engineers with the ability to choose an adhesive that meets design specifications. Many of our products have specific certifications such as MIL spec.

Permabond offers custom formulating for unique requirements. Products are sold worldwide through authorized distributors. ISO 9001:2008 For information please visit our website at [www.permabond.com](http://www.permabond.com) or contact us. 800-714-0170 or 732-868-1372 [info.americas@permabond.com](mailto:info.americas@permabond.com)

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## **PETROPAGES.COM, INC.**

2832

1100 NASA Parkway, Suite 101  
Houston, TX 77058 USA  
PH: 281-957-0048 | FX: 866-430-0239

PetroPages is a marketing company that specializes in the process and power industries. Our services include: 3D animation, web design, search engine optimization, presentations, graphic design (print and digital), company branding, logos, marketing consulting services.

PetroPages.com maintains the most active industry specific online directory.

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## **PETROTECH, INC.**

2132

151 Brookhollow Esplanade  
New Orleans, LA 70123 USA  
PH: 504-620-6600 | FX: 504-620-6601

Petrotech, Inc. provides a range of products and services for turbomachinery and other rotating and plant control systems. Their products include control systems for gas, hydro and steam turbines, generators, reciprocating and centrifugal compressors, pumps and all ancillary systems. Their turnkey services include engineering design & project management (software and hardware), instrumentation's, control panel fabrication, site I&E services, commissioning, startup and all aftermarket and training services.

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## **PHILADELPHIA GEAR**

1910

901 East 8th Ave  
King of Prussia, PA 19406 USA  
PH: 800-874-0270  
<http://www.philagear.com>

Now part of The Timken Company, Philadelphia Gear has a global reputation for the design, manufacture and overhaul of critical gearbox applications, and for combining engineering know-how with innovative approaches to solving power transmission problems.

**PILLER TSC BLOWER CORP.**

445 Duane Ave  
Schenectady, NY 12604 USA  
PH: 518-372-2496 | FX: 518-372-0115  
<http://www.piller-tsc.com>



Piller TSC Blower Corp is a subsidiary of Piller Blowers & Compressors GmbH, Germany, established in 2008. Piller TSC is acting as the sales and service center for Piller Blowers & Compressors GmbH. We are also refurbishing, repairing and servicing turbo compressors of all kinds.

With over 20 years of experience in the compressor business by the former TSC company and more than a century of experience in fan business by Piller, the combination of both makes Piller TSC the first address in designing, serving and repairing rotating equipment.

**POLLUTION EQUIPMENT NEWS/RIMBACH PUBLISHING INC.****PUB BIN**

8650 Babcock Blvd.,  
Pittsburgh PA 15237  
PH: 800-245-3182 412-364-5366 | FX: 412-369-9720  
<http://www.pollutionequipment.com>

Features products and services used by those who design or are responsible for the pollution abatement systems and policies for their organization.

PEN informs and educates professionals in the air pollution control, water, wastewater, and hazardous waste disposal industries.

**PRAXAIR SURFACE TECHNOLOGIES****2022**

7615 Fairview St.  
Houston, TX 77041 USA  
PH: 713-849-9474

Praxair Surface Technologies is a globally recognized surface coating company that provides services to the turbomachinery marketplace. Product offerings include thermal spray coatings, laser cladding/welding, Slurry coatings, CVD & PVD coatings, along with AXCESS On-site coating capability. The global integration of Sermatech International, allows PST to offer its customers even more options, including our patented Zircoat™ DVC, D-Gun™, Sermalon™ and Sermetel® coatings. North American industrial service facilities include sites in Houston, Charlotte and New Castle. Corporate headquarters and Engineering is based in Indianapolis, Indiana.



## **PRECISION POLYMER ENGINEERING**

**3223**

4702 N. Sam Houston Pkwy W, Ste 100  
Houston, TX 77086 USA  
PH: 713-482-0123 | FX: 713-623-2332  
<http://www.prepol.com>

Precision Polymer Engineering (PPE) designs, develops and manufactures high performance molded rubber seals (elastomer seals), rubber gaskets and rubber components for industries around the world. PPE is trusted across a host of different industries, from oil and gas and aerospace through to food, pharma and semiconductors, delivering advanced sealing solutions for critical applications.

PPE develops novel elastomer materials to meet the most demanding sealing applications, including extreme temperatures and chemically aggressive environments. Our seal design experts can work with you to select the best materials and optimize customized sealing solutions for your needs.

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## **PRIME PHOTONICS/APEX TURBINE TESTING TECHNOLOGIES**

**1411**

1116 South Main St.  
Blacksburg, VA 24060 USA  
PH: 804-241-4573  
<http://www.primephotonics.com>

Prime Photonics & APEX Turbine Testing Technologies are industry leaders in measuring blade stress on compressor and turbine blades. Prime Photonics is a supplier of best in class optical blade tip timing solutions while APEX Turbine has developed a suite of software to not only analyze the optical blade tip timing measurement but also any strain gauges on rotor. Prime Photonics and APEX Turbine Testing Technologies have coupled to create this innovative solution to measure blade stress and characterize blade vibration on compressors, turbines, power extractors, turbo chargers and other form of rotating machinery.

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## **PROGNOST SYSTEMS, INC.**

**2011**

1018 Hercules Ave.  
Houston, TX 77058 USA  
PH: 281-480-9300  
<http://www.prognost.com>

Internationally, PROGNOST Systems is the No.1 partner for companies who strive to ensure safe, reliable, and economic operation of their rotating equipment.

PROGNOST Systems offers condition monitoring systems and diagnostic services based on over 20 years of experience in recording, analyzing and interpreting continuous high-resolution data for rotating equipment.

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## **PROMINENT FLUID CONTROLS, INC.**

**1126**

136 Industry Drive  
Pittsburgh, PA 15275 USA  
PH: 412-787-2484 | FX: 412-787-0704  
<http://www.prominent.us>

ProMinent Fluid Controls, Inc. is a global manufacturer of chemical metering pumps, water quality instrumentation, specialized disinfection equipment, and pre-engineered or custom skidded systems serving the water and wastewater industries. ProMinent has proudly served the industrial, municipal, aquatics, marine and OEM markets in the United States for over 30 years.

**PRUFTECHNIK INC.**

2353

33 West Church St.  
Blackwood, NJ 08012 USA  
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<http://www.pruftechnik.com>

**PTQ MAGAZINE**

PUB BIN

Crambeth Allen Publishing Ltd.  
Hopesay  
Craven Arms, S97 8H0, United Kingdom  
PH: +441588660776 | FX: +441588660668  
<http://www.crambethallen.com>

PTQ is the authoritative magazine covering process technology developments in the refining, gas and petrochemical industries. Each issue of PTQ carries at least 15 in-depth technical feature articles from around the world charting experiences under operating conditions in improving production or safety or meeting environmental targets. It is the practical and detailed nature of these articles that makes PTQ required reading for engineering decision makers everywhere.

Visit [DigitalRefining.com](http://DigitalRefining.com), the refining, gas and petrochemical processing industries reference library of choice.

**PUMP ENGINEER MAGAZINE**

1235

36 King St E, Ste 701  
Toronto, ON M5C 1E5 Canada  
PH: 416-361-7030  
<http://www.pumpengineer.net>

Pump Engineer magazine is geared to the needs of pump end users worldwide, bringing the very latest technology updates, end user and EPC interviews, technical articles, case studies, show previews, and more. The editorial content strongly focuses on end user experiences and practical applications. Pump Engineer magazine is published 6 times per year: February, April, June, August, October, and December. The magazine is backed up by several online web and social media sites, including Facebook, LinkedIn, Twitter, and the Pump Engineer Website.

**PUMPING SOLUTIONS**

1112

2850 139th Street  
Blue Island, IL 60406 USA  
PH: 708-272-1800 | FX: 708-272-1825

Pumping Solutions is one of the largest, independent, full-service pump companies in North America. We serve a wide variety of industries, with a team of accomplished engineers and industry experts approaching pump problems from multiple disciplines to help our customers find the best possible solutions. We are a new pump and mechanical seals company, distributing the many of the top brands available including our Pump Symposia partners, Allweiler Pumps, Shinhoo Pumps, and Scenic Seals. We are also a pump repair company, and an aftermarket pump parts machining company. Pumping Solutions is YOUR fluid handling equipment experts.

## **PUMPS & SYSTEMS MAGAZINE**

1322

2126 McFarland Blvd E  
Tuscaloosa, AL 35404 USA  
PH: 205-314-8276 | FX: 205-345-8027  
<http://www.pumpsandsystems.com>

For 20 years, Pumps & Systems has provided the most comprehensive coverage in the pump industry. Our monthly magazine and digital edition connect 40,000 qualified, BPA-audited subscribers with respected technical solutions to their pumping challenges. More than 55,000 unique browsers per month rely on pumpsandsystems.com to deliver the latest in industry news and market analysis. A cutting-edge suite of digital media enhances our reader engagement, from e-newsletters that reach more than 26,000 subscribers worldwide to effective webinars that average more than 300 high-quality leads for sponsors.

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## **PUMPWORKS 610**

1228

8885 Monroe Rd  
Houston, TX 77061 USA  
PH: 713-893-7121 | FX: 713-956-2141  
<http://www.pumpworks610.com>

Headquartered in Houston, Texas USA PumpWorks 610 manufacturer's exclusively current edition API 610 / ISO 13709 centrifugal pumps tailored specifically to the pumping needs of petroleum refinery, gas processing, petrochemical, offshore platform, hydrocarbon / crude oil pipeline and aviation (jet) fueling markets. PumpWorks 610 offers a current edition API single stage end suction overhung type OH2 pump and Upgrade Kit, current edition API vertical turbine type VS6 (can/barrel), current edition API bearing bracket or rigid coupled vertical in-line type OH3 and OH4, current edition API horizontal split, single stage BB1 and multistage between bearing type BB3 pumps.

What is unique about PumpWorks 610 is that their pumps are manufactured and tested in the USA with standard delivery time of 16 weeks and less (OH2, OH3, OH4 & VS6) 26 weeks BB1 & BB3.

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## **PUMPWORKS INDUSTRIAL**

1226

8885 Monroe  
Houston, TX 77061 USA  
PH: 713-239-1527 | FX: 713-956-2141

PumpWorks Industrial, also located in Houston, Texas USA, manufactures a wide variety of centrifugal process pumps exceeding ANSI B73.1 and other standards for the Chemical and Petrochemical, Pulp and Paper, Food and Beverage, Oil and Gas, Mining, Power Generation, Waste Treatment and General Industrial industries.

PumpWorks Industrial provides a full range of ANSI Standard, Low-Flow, Self-Priming and Vertical Inline pumps with superior design features compared to traditional ANSI manufacturers. All components are sourced, manufactured, and tested in the USA with strategic inventories located throughout the Northern Hemisphere, providing the very best quality, price and delivery.

**PUTMAN MEDIA**

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Schaumburg, IL 60173 USA  
PH: 630-467-1301 | FX: 630-467-0197  
<http://www.chemicalprocessing.com>  
[www.plantservices.com](http://www.plantservices.com)

1117

Chemical Processing, ChemicalProcessing.com and Chemical Processing E-Newsletters reach a monthly world wide audience of over 140,000 chemical industry professionals responsible for designing, operating and managing more than 40,000 chemical, petrochemical, refining, plastics and pharmaceutical facilities in North America and across the globe. Plant Services, PlantServices.com and Plant Services E-Newsletters reach a monthly world wide audience of over 150,000 manufacturing professionals responsible for optimizing the productivity, asset utilization and manufacturing reliability for more than 35,000 industrial plants, facilities and utilities in North America and across the globe.

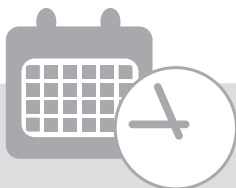
**PYROMATION, INC.**

5211 Industrial Rd.  
Fort Wayne, IN 46825 USA  
PH: 260-484-2580  
<http://www.pyromation.com>

2657

Pyromation is a top-tier manufacturer of temperature sensors in North America. The company began operations in 1962 and has become a world-class producer of thermocouples, RTDs, thermowells and sensor assemblies used in the power generation, oil & gas, chemical and other industries.

A Lean enterprise, Pyromation specializes in developing and making custom sensor designs per customer specifications. Decades of sales and engineering experience allow Pyromation to provide solutions for any temperature sensor application. The company's design-patented general-purpose and XP-rated connection heads; variety of transmitters; FM, CSA and ATEX certifications; product quality and fast delivery ensure that Pyromation can meet any request.



**IS YOUR SPOUSE LOOKING FOR  
SOMETHING FUN TO DO WHILE  
YOU ARE IN A SESSION?**

PAGE 14

Please go to page 14  
for more information

TPS

# Q

## QUADRANT ENGINEERING PLASTIC PRODUCTS

2137

2120 Fairmont Avenue  
Reading, PA 19605 USA  
PH: 610-320-6709 | FX: 610-320-6868

Quadrant Engineering Plastic Products is the global leader in engineered plastics used in static and dynamic HTHP applications such as seals, bushings, bearings and other rotational wear components. Booth #2137 will feature Ketron® PEEK (approved for NORSOK M-710), Fluorosint® PTFE, Duratron® PAI and PBI materials along with our proven turbocompressor seal material - Ketron® PEEK CM 1030 HT. Quadrant continues to meet or exceed end-user demands for performance and efficiency gains with engineered polymers.



# R

## **R. STAHL, INC.**

13259 N Promenade Blvd  
Stafford, TX 77477 USA  
PH: 832-539-6700  
<http://www.rstahl.com>

2917

## **REGAL POWER TRANSMISSION SOLUTIONS**

7120 New Buffington Rd  
Florence, KY 41042 USA  
PH: 859-727-5271  
<http://www.RegalPTS.com>

2111

Regal-Power Transmission Solutions with its Kop-Flex brand is your one source for integrated torque monitoring coupling solutions. Kop-Flex brand, is the global leader of high performance flexible couplings and torque meters for the turbomachinery market. Kop-Flex manufactures high performance disc, diaphragm, and gear couplings for API-671 applications and the high torque, KD series disc couplings for the API and ANSI pump markets. The Powerlign torque meter is the industry standard for critical equipment applications where continuous torque monitoring is required. Be sure to visit the Kop-Flex booth #2111 for our new energy efficient products servicing the Turbo Industry.

## **REINHART & ASSOCIATES, INC.**

13419A Immanuel Road  
Pflugerville, TX 78660 USA  
PH: 512-834-8911 | FX: 512-834-1266  
<http://www.reinhartassoc.com>

2719

Over the past 30 years Reinhart & Associates, Inc. (R&A) has provided independent inspections and remaining lifetime analysis services of gas and steam turbine units at power plants around the world. These inspections have used state-of-the-art nondestructive evaluation (NDE) techniques and equipment to obtain data to determine the integrity and remaining life of major turbine components including rotors, blading, retaining rings, etc. R&A has also provided the first NDE method or equipment available in the industry: first in-place remote video/eddy current NDE of L-1 turbine blades; and first independent NDE and life assessment of small bore generator rotors.

## **RELADYNE**

3310 Alice Street  
Houston, TX 77003 USA  
PH: 713-747-7411  
<http://www.reladyne.com>

2926

RelaDyne is a leading supplier of industrial lubricants and lubrication based reliability services. These include High Velocity Oil Flushing, Fluid Purification and Dehydration and Contract Lubrication Technicians and Engineers. Our services divisions Field Reliability Management provides our services to the major Gulf Coast and Midwest markets while our lubricant and fuel distribution have branches in 10 states and service over 18. Formed in 2010 from four strong, independent Fuel and Lubricant business, RelaDyne has grown to become a major supplier across the country.

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## **RELEVANT SOLUTIONS / SWITCH FILTRATION**

1423 E Richey Rd  
Houston, TX 77073 USA  
PH: 281-951-0202



**relevant.**

2337

The story of Relevant Solutions is really your story, because they exist for their customers. That means their job is to deliver the exact solution for whatever the critical situation is at hand. Relevant Solutions' legendary talent and in-house expertise offer cost-effective and risk-mitigated solutions to critical service applications in energy, industrial and commercial marketplaces. Relevant Solutions offers a diverse and dynamic portfolio of products, repair services and engineered systems for instrumentation and automation flow and control, rotating equipment, thermal equipment, process filtration, purification equipment and building solutions.

Their unique platform allows them to integrate their resources, capabilities and industry-specific experience to solve their customers' greatest needs – whatever the need, whatever the industry.

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## **RELIABLE EDM, INC.**

6940 Fulton Street  
Houston, TX 77022 USA  
PH: 713-692-5454

2721

EDM Service. We provide Wire, Ram, and Small hole EDM for production orders large and small. Large parts and High Quantities are our specialty. We have locations in Houston and Broussard, LA. We have over 80 EDM machines in operation. EDM questions? [www.reliableedm.com](http://www.reliableedm.com)



**RENK AG**

3125

Goegginger Strasse 73  
Augsburg, 86159 Bavaria Germany  
PH: +4982157000 | FX: +498215700460  
<http://www.renk.eu>

RENK Drive Technology for the Power Generating Industry:

- High speed gear units for generator drives up to 250 MW, for generators and blowers
- Variable speed drives up to 20 MW
- Windmill drives up to 10 MW
- Planetary gears for cooling water pumps up to 30 MW
- Epicyclic gears for water power turbines up to 20 MW
- Epicyclic gears integrated in electric machines
- Self synchronising clutches for marine applications and power generation up to 300 MW
- Turn drives with self synchronizing clutches
- Gear, flexible disk and diaphragm couplings
- Hydrodynamic and hydrostatic bearing solutions, especially for electric machines
- Revamp of existing equipment

**REXA**

1842

4 Manley Street  
West Bridgewater, MA 02379 USA  
PH: 508-436-6534  
<http://www.rexa.com>

REXA Electraulic™ Actuation offers unmatched accuracy and repeatability, allowing plants to optimize control of pressures, temperatures, air flow, and other key process loops; improving plant operations from unit turndown capability, to ramp rate, to reduced fuel consumption. REXA Linear and Rotary Actuators unmatched level of reliability allow power plant operations to minimize unplanned outages and maximize unit availability.

**REXNORD INDUSTRIES, LLC**

1401

4695 West Greenfield Avenue  
Milwaukee, WI 53214 USA  
PH: 414-935-9700 | FX: 414-643-2075

Rexnord® is a leading worldwide industrial company comprised of two strategic platforms: Process and Motion Control and Water Management. Within their platforms, Rexnord® serves a diverse array of growing global end markets by offering the broadest, most reliable product portfolios and trusted brands in their industries. Within Process and Motion Control platform, associates design, manufacture, market and service specified, highly engineered mechanical components used within complex systems where customers' reliability requirements and the cost of failure or downtime are extremely high. Diverse offerings include bearings, couplings, gears, industrial chain, conveying equipment, Flat Top and services. Brands offered include Rexnord®, Falk®, Link-Belt®, Rex®, Marbett®, MCC®, PSI®, Autogard, Berg®, Highfield® and Stearns®.

## **RF SYSTEM LAB**

2442

13919 S. West Bay Shore Drive  
Traverse City, MI 49684 USA  
PH: 231-943-1171 | FX: 989-688-5966  
<http://www.rfsystemlab.us>

RF System Lab is a worldwide leader in remote visual inspection and video borescope technology. Makers of leading edge, fully (360°) articulating, video borescopes like the innovative VJ-Advance; available in 2.8mm, 3.9mm, or 6.9mm insertion tube diameters. The VJ-Advance delivers the ideal features sought after by industry professionals. RF System Lab offers an industry-first no obligation demo program to allow companies to test the VJ-Advance on an inspection at their facility, for free.

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## **RHM FLUID POWER DIVISION OF FLODRAULIC GROUP**

2905

375 Manufacturers Dr  
Westland, MI 48186 USA  
PH: 810-623-2454  
<http://www.rhmfp.com>

RHM Fluid Power Division of Flodraulic Group designs and builds lubricating oil systems, primarily for oil and gas and power generation industries. Capabilities include expertise with virtually all API specifications. RHM systems are currently installed and supported around the world. RHM technologies extend to include design and build of electrical control, hydraulic, process, compressed air, test and coolant systems. ISO 9001:2008 registered continuously since 1996, RHM's commitment to quality is proven through a reputation for industry leadership, repeat customers and an internal quality system that documents a "do it right the first time" company culture.

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## **RIVERHAWK COMPANY**

1927

215 Clinton Road  
New Hartford, NY 13413 USA  
PH: 315-768-4855 X140 | FX: 315-768-4941

The Riverhawk Company offers auxiliary equipment such as hydraulic nuts for both traditional and high temperature applications; manual and air-driven hydraulic pressure pump kits and pusher assemblies for the installation of coupling hubs, thrust discs and compressor wheels. It also designs and manufactures hydraulically tensioned studs and nuts, tensioning tools, hydraulic couplers and ring/plug gage sets.

Riverhawk also specializes in the development of vibration monitoring systems. Its full line provides customers with one of the most diverse probe lines commercially available. Other products include torqueimeters, hot alignment, and web deflection detection systems.

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## **ROC CARBON COMPANY**

2110

1605 Brittmoore  
Houston, TX 77043-3107 USA  
PH: 713-468-7744 | FX: 713-465-2158

ROC manufactures carbon/graphite, metal, PTFE, PEEK, custom-seals (segmented, labyrinth etc), bearings, and high-compression wear parts for compressors, turbines, centrifugal pumps, industrial fans, blowers. ROC supplies parts to OEMs, industrial repair companies, end-users (refineries, petrochemical, power plants). ROC's engineering support includes capability to design/modify seals, meeting individual customers sealing application. ISO 9001:2008.

**ROPER TECHNOLOGIES INC.**

2233

8824 Fallbrook Dr  
Houston, TX 77064-9912 USA  
PH: 281-940-1748 | FX: 713-559-9432

Roper is a diversified technology company that provides engineered products and solutions for global niche markets. Compressor Controls Corporation (CCC), United Controls Group (UCG), SETPOINT, Trinity and Metrix are part of Roper's Energy Systems and Controls group.

**ROTATING EQUIPMENT REPAIR**

2144

PO Box 84809  
Pearland, TX 77584 USA  
PH: 281-485-2400

Specialty Rotating Equipment Repair, Inc., DBA Rotating Equipment Repair provides comprehensive repair, refurbishment, and maintenance on rotating equipment to the petrochemical and refining industry of the Houston and entire Gulf Coast area, as well as Oklahoma and Kansas. RER has become one of the primary non-OEM providers of turbine and pump repair, while offering trustworthy, reliable and efficient solutions to problems on all types of rotating equipment.

**ROTATING MACHINERY SERVICES, INC.**

2039

2760 Baglyos Circle  
Bethlehem, PA 18020 USA  
PH: 484-821-0702 | FX: 484-821-0710  
<http://www.RotatingMachinery.com>

Rotating Machinery Services (RMS) is an aftermarket engineering and services company located in Bethlehem Pa. We perform a wide range of services on turbomachinery, including; reliability improvements, performance optimization, repair, component replacement and supply of upgraded/overhauled surplus equipment. We have experience with repowering of turbomachinery packages and have supplied custom designed equipment skids and lube oil systems. Our primary experience is with axial and centrifugal compressors, expanders, gas turbines, power turbines and steam turbines.

**ROTH PUMP COMPANY**

1201

P.O. Box 4330  
Rock Island, IL 61204-4330 USA  
PH: 309-787-1791 | FX: 309-787-5142  
<http://www.rothpump.com>

ROTH PUMP is the leading developer and manufacturer of LOW NPSH regenerative turbine pumps. For over 80 years Roth has been handling high head up to 3200 feet/975 M TDH), low flow up to 150 GPM/34 M3/H) boiling point liquids. Use of Roth ONE FOOT /0.30 METER LOW NPSH pumps, significantly reduces required tank height which lowers design and construction costs. Roth Pump boiler feed/ deaerator/condensate return systems handle water at 212° F/100° C, 250° F/121° C, 350° F/177° C and 400° F/204° C, which result in substantial energy savings.

## ROYAL PURPLE

1 Royal Purple Ln  
Porter, TX 77365 USA  
PH: 281-577-5085  
<http://www.royalpurple.com>

2026

Royal Purple manufactures high performance lubricants for most automotive, industrial, marine, motorcycle and racing applications. It is considered the best synthetic oil by many end users.

Royal Purple synthetic oil and synthetic lubricants are formulated to maximize performance in real world applications.



**SCANSONIC PGS GMBH**

Schwarze-Pumpe-Weg 16  
 Berlin, D-12681 Berlin Germany  
 PH: +4930912074382 | FX: +493091207429  
<http://www.scansonic-pgs.de>

**power  
 generation  
 services** 3038

Seal Strips and Caulking Wires at its best - PGS develops, produces and delivers the world's widest range of seal strips for turbines of all manufacturers. PGS also delivers perfectly matching caulking wires, which help ensure the proper fit of the seal strips for the rotor turbines and casing elements. The combination of seal strips and caulking wires guarantee the steam passes only to where it belongs: on the turbine blades! Do you need customized seal strips in individual sizes? No worries. PGS designs and builds the proper tools, if necessary the suitable manufacturing equipment, and delivers your perfect seal strips.

**SCENIC PRECISE ELEMENT INC.**

1129

No.5 Sin-Jhan Rd., China-Jhen Dist.  
 Kaohsiung City, 80672 Taiwan  
 PH: +88678111359 ext 220 | FX: +88678221033

Established in 1986 and now member of both API (American Petroleum Institute) and FSA (Fluid Sealing Association), Scenic Precise Element, Inc. specializes in the design, manufacture, modification and repair of mechanical seals, including the development and application of silicon-carbide bearings for sealless pumps, as well as the application of anti-fretting materials, such as carbon graphite, silicon carbide, tungsten carbide and more.

**SCHENCK BALANCING DIAGNOSTIC SYSTEMS**

2750

535 Acorn Street  
 Deer Park, NY 11729 USA  
 PH: 631-242-4010 X257 | FX: 631-242-4147

Nearly anything that rotates, or is supported in bearings that allow it to rotate, needs balancing to insure quality performance. From the smallest rotors for dental drills to large power generating turbines and to the largest jet engines, all require accurate balancing techniques. Balancing since 1908!

## **SCHNEIDER ELECTRIC**

26561 Rancho Parkway South

Lake Forest, CA 92630 USA

PH: 713-329-8596

<http://www.schneider-electric.com/processautomation>



Schneider Electric is the global specialist in energy management and automation. With revenues of ~€27 billion in FY2015, our 160,000+ employees serve customers in over 100 countries, helping them to manage their energy and process in ways that are safe, reliable, efficient and sustainable. From the simplest of switches to complex operational systems, our technology, software and services improve the way our customers manage and automate their operations. Our connected technologies reshape industries, transform cities and enrich lives. At Schneider Electric, we call this Life Is On.

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## **SDMS SEAL CO., LTD.**

**1118**

No.222, Liangshuijing Road, Daan district, Zigong

Zigong, 643000 Sichuan China

PH: +868135843539 | FX: +868135843539

<http://www.sdmsseal.com>

SDMSSEAL® is one of the China market's leading providers in the design and manufacture of mechanical seals, committed to quality and local service since we were established in 1976. Our outstanding reputation for designing and engineering high-quality, durable, customized solutions is market recognized.

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## **SERO PUMPSYSTEMS, INC.**

**1106**

3727 Greenbriar Dr.

Stafford, TX 77477 USA

PH: 281-242-8080 | FX: 281-242-8089

<http://www.seropumps.com>

SERO PumpSystems is the world's leading manufacturer of side channel pumps. The side channel hydraulic is unique in it's ability to handle volatile process fluids with high vapor pressures and limited NPSHa. The focus is on low flow rates 1 to 180 (GPM) with MAWP up to 1450 psig. Both sealed and seal less designs are available. SERO side channel pumps provide a true solution for these challenging service requirements.

SERO North America is based in Stafford, TX. From this location, we provide sales assistance and technical support as well as aftermarket service activities. Please contact: SERO PumpSystems!

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## **SETPOINT™ VIBRATION**

**2233**

8824 Fallbrook Dr

Houston, TX 77064-9912 USA

PH: 281-940-1748 | FX: 713-559-9432

[www.metrixsetpoint.com](http://www.metrixsetpoint.com)

SETPOINT™ is a leading supplier of machinery protection and condition monitoring products and services to industrial customers worldwide. SETPOINT products and services improve machinery availability and reliability by delivering accurate mechanical condition information.

**SHACKELFORD-WATTNER**

2518

7405 Major St  
Houston, TX 77061 USA  
PH: 713-649-2599 | FX: 713-644-6334

Shackelford-Wattner aka Texas Custom Builders, LTD. Founded in 1975 and conveniently located in the shadow of Houston's Hobby Airport. With over 45 years experience Shackelford-Wattner has earned a reputation for producing the highest quality products and services which include manufacturing, balance, inspection, repair, replacement, special fasteners, lapping tools and plug/ring gauges for all types of gear, disc, and diaphragm couplings. Shackelford-Wattner takes great pride in being able to respond immediately to new and/or repair coupling needs with expedited service and factory support. Emergency service is always available.

**SHANGHAI EVP VACUUM TECHNOLOGY CO.,LTD**

1122

Room 502 Building 1st, No. 1295 New Jinqiao Road  
Shanghai, 201206 Shandong China  
PH: +862150878197  
<http://www.evpvacuum.com>

Shanghai EVP VACUUM Technology Company Located in Shanghai, China. which is a group company of vacuum products.

Such as liquid ring vacuum pumps (also use as Chinco brand for marketing) Rotary & Roots Vacuum pumps, Mechanical vacuum pumps and dry vacuum pumps etc. Recently we have developed our water pump business as well for horizontal split case pump.

With good quality and cheap price, we are winning more and more customers from so many countries! Welcome to visit us!

**SHANGHAI SHANTIN MECHANICAL & ELECTRICAL INC**

1212

Unit C.Floor 21 Yingdong Plaza, No.58 New Jinqiao R  
Shanghai, 201206 Shanghai China  
PH: +862161620683 | FX: +862161620695  
<http://www.shantin.com>

Shantin Group was founded in 2001 with the headquarter located in Shanghai China and a production base of 25000M2 in Anhui. Shantin is a professional metal component manufacturer and parts supplier, which provides its worldwide customers with a series of one-stop solution for metal components and parts such as forging, casting, machining, welding, assembling, heat treatment, surface treatment and so on. Shantin's products are widely used in Marine & Offshore, Oil & Gas, Construction & Mining machinery, Aerospace, Environmental Engineering etc.

**SHANLEY PUMP & EQUIPMENT**

1100

2525 S Clearbrook Drive  
Arlington Heights, IL 60005 USA  
PH: 847-439-9200 | FX: 847-439-9388

Shanley Pump is in suburban Chicago. We are a 35 year stocking supplier of positive displacement pumps for lube oil, fuel oil and hydraulic oil pumping applications. Our factory trained sales engineers offer immediate response to pump inquiries.



## **SHELL LUBRICANTS**

**3214**

910 Louisiana  
Houston, TX 77002 USA  
PH: 713-241-5289 | FX: 713-423-0285  
<http://www.shell.com>

Lubricants can have a huge impact on the operation of your business. Choosing, using and managing them correctly can bring significant rewards in terms of improved efficiency and profitability. Discover how Shell's technology-leading lubricants can help you to improve your business performance. Find out about the expert advice and support we provide through our lubricant-related services or read our case studies from various industries to see how Shell's products and services are helping companies like yours.

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## **SHIJIAZHUANG JINJIEBER IMP. & EXP. CORP. LTD.**

**1109**

368 North Youyi Street  
Zhongyuan Plaza 1104 Room.  
ShiJiazhuang, 050000 Hebei China  
PH: 972-900-0833  
<http://www.jinjieber.com>

Jinjieber has been focusing on providing pump casting parts for decades.

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## **SHIJIAZHUANG RETOOL STAINLESS STEEL PRODUCTS CO., LTD.**

**1736**

No.3 Mingzhu Road,Xinzhaidian Industry Area, Zhaoxian  
Shijiazhuang City, 050000 Hebei China  
PH: +8631184751639 | FX: +8631184751639  
<http://www.retoolss.com/>

Shijiazhuang Retool Stainless Steel Products Co., Ltd, was established in 1994. Our product covers valves, pumps, pipe fittings, automobile & railway vehicle parts, hardware parts and food machine, mining equipments, petrochemical engineering and many other industries, with the material of stainless steel, carbon steel, low alloy steel, heat resistant steel, high-chromium iron and so on. Our annual output is 1000 tons casting. We possess advanced wax lost precision casting production line, machining production line, and the assembling and testing equipments for valve and pump parts. At present, the maximum diameter size we can cast is up to 600mm, maximum weight 90kg.

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## **SHIN NIPPON MACHINERY**

**1419**

1335 Regents Park Drive,suite262  
Houston, TX 77058 USA  
PH: 281-990-8594 | FX: 281-990-8960

API611&612 Steam Turbine and API610 Centrifugal pump manufacturer. We manufacture them in one factory!!

**SHINHOO PUMPS C/O PUMPING SOLUTIONS****1115**

2850 139th Street  
Blue Island, IL 60406 USA  
PH: 708-272-1863 | FX: 708-272-1825  
<http://www.pump96.com>

Shinhoo Pumps is a leader in sealless pump technology. Shinhoo's Canned Motor Pump uses an ingeniously simple structural design in order to provide the highest level of operational safety in the most extreme applications. Shinhoo pumps effortlessly handle flammable, explosive, toxic, corrosive, high and low temperature, and high-pressure liquids with 100% leakage-free efficiency. Pumping Solutions in Blue Island, Illinois is the North American Master Distributor of Shinhoo Pumps.

**SICHUAN MIANZHU XINKUN MACHINERY MAKING CO. LTD.****3117**

No. 1, Nantang Rd, Jiangsu Industrial Park  
Mianzhu, 618200 Sichuan China  
PH: +8613689624180 | FX: +868386604896

XinKun machinery is one of the world-class blades, hub, wind power and automotive engine parts and other equipment manufacturing companies.

**SICHUAN SUNNY SEAL CO, LTD.****2901**

8#, Wuke West 4 Rd.  
Chengdu, 610045 China  
PH: +86-18980767975 | FX: +86-28-85366222  
<http://www.sns-china.com>

Sichuan Sunny Seal Co., Ltd. serves as the leading enterprise in fluid sealing industry of China. The products are widely used in fields such as petrochemical industry, coal chemical industry, natural gas industry, oil & gas transportation, electric power and metallurgy. The products are exported to Europe, Southeast Asia, etc.

Sichuan Sunny Seal's main products include mechanical seal, dry gas seal, metal bellows seal, silicon carbide, auxiliary system, control panel, etc.

**SIEMENS INDUSTRY****1527**

8850 Fallbrook Dr.  
Houston, TX 77064 USA  
PH: 281-949-3000 | FX: 832-679-8601

Siemens has the motors, drives, gearboxes, and couplings to serve the complete power conversion spectrum, driving both energy efficiency and productivity improvements. Our innovative motion control technologies decrease your time-to-market and increase overall productivity and reliability. We provide value-added services such as mechatronic support and online services for web-based preventive maintenance. Our award-winning product lines allow you to achieve your business goals, whether they are energy savings, energy capture, reduced time to market, process improvements or simply working with a service partner who can be there whenever and wherever you need them.

## SKF

890 Forty Foot Rd  
Lansdale, PA 19446 USA  
PH: 267-436-6000

1510

Learn how SKF 100+ years of knowledge, experience and solutions can benefit you. Check out SKF S2M Magnetic Bearings, leader in magnetic bearing technology. See a demo of the SKF Multilog On-line System IMx-M, SKF's latest API 670 complaint, integrated vibration Protection and Condition Monitoring system for critical, and semi-critical rotating machinery in a compact and cost effective package.

Kaydon Ring & Seal manufacture compressor shaft seals for centrifugal and oil free screw compressors in hydrocarbon gas applications. The product line includes low leakage Mechanical Oil Seals, dry running Multi-Ring Circumferential seals, Dry Gas Seals, and Circumferential Barrier Seals.

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## SKINNER POWER SYSTEMS LLC

8214 Edinboro Road  
ERIE, PA 16509 USA  
PH: 877-868-8577 | FX: 814-868-5299  
<http://www.SkinnerPowerSystems.net>

1700

Skinner Power Systems, A Division of Time Machine Inc., and a manufacturer of single-stage steam turbines up to 3,000 HP and turbine generator packages up to 2 megawatts. Over 10,000 Skinner turbines have been built to drive pumps, fans, generators, compressors, sugar-mill shredders--to name just a few applications. The Skinner turbine's simplicity and dependability make it one of the most popular machines of its kind in the world. We also service all kinds of turbines, especially Skinner, Dean Hill, Wing and Manubat steam turbines since we built them over the past century. A Skinner Vertical Single-Stage Steam Turbine is displayed in the booth.

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## SMARTUQ

1245 E. Washington Ave., Suite 210  
Madison, WI 53718 USA  
PH: 608-255-0074 | FX: 608-237-2258  
<https://www.SmartUQ.com>

2354

AAF Power and Industrial Gas Turbine Division is a global leader in gas turbine filtration, providing innovative solutions that deliver cleaner air, greater fuel efficiency and extended maintenance intervals. Our products are currently used in thousands of installations around the world, protecting gas turbines in arduous environments from soaking salt spray to blowing desert sand.

**SOFTINWAY, INC.**

2836

15 New England Executive Park  
Burlington, MA 01803 Switzerland  
PH: +41445861998 | FX: 781-685-4601

SoftInWay Inc. is a global engineering company specializing in the development of efficient turbomachinery. We offer extensive expertise through our training and consulting services along with our flagship software, AxSTREAM - for flowpath design, redesign, analysis, and optimization and AxCYCLE - for design and simulation of full thermodynamic cycle.

Founded in 1999, SoftInWay has offices in the US, Switzerland, India, and Ukraine and supports over 200 companies worldwide including OEMs, EPCs, and other service providers in power generation, oil and gas, aerospace, defense, automotive, and clean tech sectors. We also work closely with universities, research laboratories, and government and defense.

**SOHRE TURBOMACHINERY INC.**

2236

128 Main Street  
Monson, MA 01057 USA  
PH: 413-267-0590 | FX: 413-267-0592

Shaft grounding brushes to control stray electrical currents for electrical and nonelectrical turbomachinery (compressors, gears, turbines, generators, motors, ship propeller shafts), for electrostatic, electromagnetic, or other electrically induced stray currents. Depending on model, the current rating of the models is 1 to 100 DC amperes per year of bristle life. Brushes utilize special alloy bristles and are run directly on shaft, dry, or in oil. Cleaning or maintenance is generally not necessary.

**SOLAR TURBINES INCORPORATED**

2815

P.O. Box 85376  
San Diego, CA 92186-5376 USA  
PH: 619-544-5352 | FX: 619-544-2633  
<http://www.solarturbines.com>

Headquartered in San Diego, California, USA, Solar Turbines, a subsidiary of Caterpillar Inc., is one of the world's leading manufacturers of industrial gas turbines and compressors, with approximately 15,000 units with more than 2.3 billion operating hours in more than 100 countries.

Products from Solar play an important role in the development of oil, natural gas and power generation projects around the world. Solar's products include gas turbine engines, gas compressors, and gas turbine-powered compressor sets, mechanical-drive packages and generator sets.

**SOLBERG OIL MIST ELIMINATORS**

2542

1151 Ardmore Avenue  
Itasca, IL 60143-1387 USA  
PH: 630-616-4411

Solberg designs and manufactures vacuum assisted and static oil mist eliminator systems to capture the vented emissions from turbine and compressor lube oil systems, and engine crankcases. Our systems also protect the rotating equipment by preventing seal leakage and protect the surrounding environment by eliminating the oily emissions.

## **SOUTHERN STATES MILLWRIGHT**

1823

2015 Denning Way  
North Versailles, PA 15137  
PH: 412-475-0425  
<http://www.southernstatesmillwrights.org>

We are a Labor organization with an accredited apprenticeship.  
Our organization has a network of contractors that work in the turbo-machinery industries.  
We supply qualified journeyman millwrights and qualified apprentices for all job needs.

We are a member of the BIC Alliance.

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## **SOUTHWEST IMPREGLO**

2123

15014 Lee Rd  
Humble, TX 77396 USA  
PH: 281-441-2000 | FX: 281-441-1221

Applicators of High Performance Coatings for Industry to help solve the problems of Friction, Corrosion, Galling, and Non-Stick/Release, with capacity to handle the smallest of parts such as fasteners to the largest of parts, up to 90' risers supported by crane capacity of up to 50 tons. Located on the NE side of Houston we offer easy access to the airport as well as the freeway system.

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## **SOUTHWESTERN CONTROLS**

2827

6270 Sands Point #100  
Houston, TX 77210 USA  
PH: 713-904-0451  
<http://www.swcontrols.com>

Southwestern Controls is a cutting edge, technical distribution company, with over 50 years of success meeting ever-changing market needs. We represent and distribute technical products (fluid power and fluid conditioning) for 37 different manufacturers. Our current area of operations includes Texas, Oklahoma, and Mexico.

We hire only the best Sales and Customer Service people in industry. Our monthly training program is backed by a significant budget and other resources. We do all of this to assure our customers find the right products and solutions every time they purchase from us.

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## **SPC "DYNAMICS"**

3047

p/b 5223  
Omsk, 644043 Russian Federation  
PH: +73812254244 | FX: +73812254372  
<http://www.dynamicsru.com>

Scientific-and-Production Company "Diagnostics, reliability of machinery and complex automation"  
- Dynamics SPC is a developer, manufacturer and supplier of the stationary, portable and bench instruments and systems for vibration analysis, computer monitoring and automatic diagnostics of equipment COMPACS®, combined into an integrated diagnostic network Compacs-Net®, which constitute the ACS COMPACS® – the automated control system for safe money-saving operation of equipment in real time at all life-cycle phases. The systems realize all the main types of non-destructive testing (NDT), including vibration analysis, acoustic emission, electrical, optical, eddy current, thermal, ultrasonic, acoustic and other NDT methods.

**SPECTRA QUEST, INC.**

8227 Hermitage Road  
 Richmond, VA 23059 USA  
 PH: 804-261-3300 | FX: 804-261-3303  
<http://www.spectraquest.com>

Manufacturer of Machinery Fault Simulators for the Mechanical Engineering Community.

1921

**SPP PUMPS**

2905 Pacific Dr  
 Norcross, GA 30071 USA  
 PH: 770-840-6769

Kirloskar Ebara Pumps Limited – SPP Pumps (KEPL-SPP) is a leading companies in the Oil and Gas Rotary Equipment market. For more than 135 years, SPP Pumps has been a leading manufacturer of centrifugal pumps and associated systems. Now, with 7 facilities worldwide, SPP Pumps provides valuable high-integrity services for diverse industries across the globe such as oil and gas production, airports, hotels, water and waste treatment, construction, mines and for large industrial plants. SPP Pumps works with consultants, contractors, installers and end-users to achieve the most cost effective pumping system solutions and has built a reputation for quality and value that has made it unquestionably the leading supplier of Pumping Packages throughout the World.

1121

**SSS CLUTCH COMPANY, INC.**

610 W Basin Rd  
 New Castle, DE 19720 USA  
 PH: 302-322-8080

SSS Clutches- Propulsion systems for 44 navies; 650+ peak-load generators for synchronous condensing, combined cycle plants, steam turbines to 130 MW in CHP/Cogen, (CAES) plants, 500+ diesel engine driven rotating UPS generators, dual driven pumps, compressors, fans for energy recovery applications, thousands of turning gear and gas turbine starter drives.

2533

**STANDARD ALLOYS & MFG. CO.**

4415 Saellen Rd  
 Henrico, VA 23231 USA  
 PH: 409-983-3201 x338 | FX: 409-983-7837  
<http://www.standardalloys.com>



1316

Standard Alloys Inc., a KSB Company, is a full service solution provider offering replacement parts, repair and complete pump assemblies. Our factory and main repair center are certified ISO-9001:2008 by DNV. Our services include custom engineered solutions designed by our engineering staff. These designs are support with our in-house pattern shop, foundry and machine shop. We have the ability to pour over 300 alloys as well as develop custom alloys to fit your application. Parts manufactured at our Port Arthur, Texas foundry are supported by our extensive machine shop, which allows us to offer quick deliveries. Our three repair centers located in Vidor, Texas; Deer Park, Texas and Port Allen, Louisiana offers local part and pump repair support to meet your needs.

## **STATISTICS & CONTROL, INC.**

2627

4401 Westown Pkwy, Ste 124  
Des Moines, IA 50266 USA  
PH: 515-267-8700 | FX: 515-267-8701  
<http://www.statcontrolinc.com>

Statistics & Control, Inc., (S&C), a global software development company, delivers solutions in areas that include petroleum field management, advanced process control, and turbomachinery control. S&C provides oil and gas, chemical, and power companies with leading artificial intelligence software, real-time control applications, information technology, and services to increase the efficiency and profitability of existing assets.

S&C's integrated and adaptable software products include OptiRamp® Advanced Dispatch Control System (ADCS), Diagnostics, and Web Applications as well as a complete suite of real-time turbomachinery control applications for turbine and compressor, surge prevention, and station control.

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## **STEIN SEAL INDUSTRIAL DIVISION**

1920

375 E Church St  
Telford, PA 18969 USA  
PH: 215-256-0201 x414 | FX: 215-703-9864  
<http://steinsealind.com>

Over the past three years as Stein Seal Co continued to grow we recognized the need to develop a service based organization. We did see the repair and system redesign potential as an added service to our many customers. In our business plan we use the expression "partnering with customers" to explain the close relationship and sensitivity to customers' needs. Critical equipment is by definition essential to insure the successful operation of a chemical plant or refinery. The new company Stein Seal Industrial Division is uniquely positioned to service this market segment and concentrate on rapid repair and field service.

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## **STONE METALS AMERICA**

1304

2435 N. Central Expressway Ste 1200  
Richardson, TX 75080 USA  
PH: 214-712-7419  
<http://www.stonemetalsamerica.com>

We are a group of engineers and companies in mechanical engineering, providing our customers with assembled products and precision-engineered metal parts.

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## **STORK TURBO BLADING**

2020

334 Comfort Rd  
Ithaca, NY 14850 USA  
PH: 607-277-4968 X292 | FX: 607-277-1193  
<http://www.he-machinery.com>

Stork H&E Turbo Blading is the leading global manufacturer of steam turbine blades, buckets and nozzles, gas turbine compressor blades, stator vanes, inlet guide vanes, axial compressor and expander blades, axial blower and generator fan blades. Stork is the largest and oldest independent manufacturer of these spares in the world. All OEM model turbines are supported, including obsolete nameplates. Stork delivers world class quality, at pricing and delivery that will be a welcome improvement upon your usual OEM experience. Stork supplies turbine owners in the power, cogen, refinery, pipeline, petrochemical, WTE, biomass, pulp, paper, mining, sugar, marine and other industries.



**STRUCTURAL**

3046

10150 Old Columbia Rd.  
Columbia, MD 24046 USA  
PH: 410-850-7000 | FX: 410-850-4111  
<http://www.structural.net>

**SULLAIR**

2219

8700 W Bryn Mawr, St.400S  
Chicago, IL 60631 USA  
PH: 219-229-2927 | 800-SULLAIR  
<http://www.sullair.com>

Sullair - the name you've known for 50 years as specialists in air compressors. What you may not have known is since 1993 Sullair has been part of joint venture IHI-Sullair producing centrifugal compressors - and those compressors are now available through Sullair channels. Available in flows from 500 cfm to 140,000 cfm at pressures ranging from 20 psig to 950 psig with up to four-stage models, there's a Sullair powered by IHI Centrifugal Compressor to meet your Class Zero 100% oil free, high capacity needs.

**SULZER**

2601

11518 Old LaPorte Rd.  
LaPorte, TX 77573 USA  
PH: 713-567-2700 | FX: 713-567-2830  
<http://www.sulzer.com>

Sulzer Turbo Services provides full-service manufacturing, engineering, repair, reconditioning, balancing, and coating for turbomachinery; including steam and gas turbines, components, centrifugal, axial and screw compressors, expanders, and At-Speed Balancing. Our largest repair facility includes 500,000 square ft. of shop space, and is located in the Houston, TX area. Field Services are also available.

Sulzer Turbo Services provides a global service with local presence and is located in Houston, Texas, New Orleans, Louisiana, Edmonton, Canada, Buenos Aires, Argentina, Jakarta, Indonesia and Rotterdam and Venlo in the Netherlands.

**SUMITOMO HEAVY INDUSTRIES GEARBOX CO., LTD.**

2814

4200 Holland Blvd  
Chesapeake, VA 23323 Osaka USA  
PH: 757-485-3355 | FX: 757-487-3193  
<http://www.sumitomodrive.com>

Sumitomo Heavy Industries Gearbox Co., Ltd., formally called SEISA Gear Ltd., has a century of manufacturing experience in highly customized gear drives, highspeed acceleration and reduction gears for compressors and turbine generators, mill drives for cement and coal, and gear couplings. As a result, those geared products are trusted and used in various fields as key components.

## SUMMIT INDUSTRIAL PRODUCTS

1618

9010 CR 2120

Tyler, TX 75707 USA

PH: 903-534-8021 | FX: 903-534-3753

<http://www.klsummit.com>

Manufacturer of synthetic lubricants and greases, descalers, degreasers, and oil/water separators.

## SUMMIT STAFFING

2222

PO Box 135

Ranger, TX 76470 USA

PH: 254-647-1400 | FX: 254-647-5221

Summit Staffing boasts over 30 years of experience filling positions for special projects and contracts, or as temp to perm. Because of a large pool of skilled labor and millwrights, Summit will supply the customer with quality personnel that will help the customer get the job completed efficiently. Tradesmen provided by Summit Staffing are of the highest quality, pre-screened, background checked, drug tested and safety course certified. Best of all, they are experts in their fields such as:

- Centrifugal and Reciprocating Compression
- Turbines 100Mw Steam & Gas Engines
- Electric Utilities
- Hydrocarbon Processors
- Co-Generation Facilities
- Wind Turbine/Energy

## SUN COAST RESOURCES, INC.

3249

6405 Cavalcade Street

Houston, TX 77026 USA

PH: 800-677-3835

<http://www.suncoastresources.com>

Sun Coast Resources, Inc. is one of the largest wholesale petroleum marketers in the nation. Licensed in 39 states with 17 locations in Texas, Oklahoma & Louisiana, they offer a vast array of products and services including: fuels, lubricants, specialty chemical and crude oil transportation, emergency response fuel services and much more. Sun Coast has the breadth and depth of products, equipment and resources to support any energy need. Simply stated: Sun Coast delivers!

## SUNDYNE

2219

14845 W 64th Ave

Arvada, CO 80007 USA

PH: 303-425-0800 | FX: 303-425-0896

Sundyne manufactures highly reliable engineered process Pumps and Compressors. The Sundyne product line consists of Ansimag Magnetic Drive Non-Metallic Pumps, HMD/Kontro API-610/685 Pumps, Sundyne API-610 Pumps, Sundyne API-617 Process Compressors, Marelli API-610 Pumps, and Sunflo High Pressure Pumps. With facilities and expert Channel Partners around the world, Sundyne products are an integral part of the process industries that fuel life's basic needs.

**SWIFT-JB INTERNATIONAL, LLC**

3043

4560 Kendrick Plaza Drive  
Houston, TX 77032 USA  
PH: 281-227-0298 | FX: 281-227-0299  
<http://www.swift-jbinternational.com>

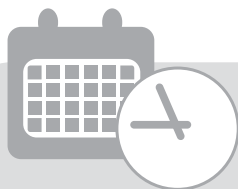
With over 65 years of combined filtration product manufacturing, Swift-JB Intl. can provide proven solutions from the routine to the most demanding applications in extreme environments. We look forward to all inquiries. Stop by 3043 and say hello!

**SWRI - SOUTHWEST RESEARCH INSTITUTE**

1820

6220 Culebra Rd  
San Antonio, TX 78238-5166 USA  
PH: 210-522-2086 | FX: 210-681-9661  
<http://www.machinery.swri.org>

Southwest Research Institute® (SwRI®) is an independent, nonprofit, applied research and development organization headquartered in San Antonio, Texas, with nearly 2,800 employees and an annual research volume of \$592 million. For almost 70 years, SwRI has provided quick-response field consultation and design services to solve vibration, pulsation, and performance problems associated with plant machinery and piping systems. SwRI also provides turbomachinery services from concept design to full-scale testing.



**SAVE THE DATE**  
**ASIA TURBOMACHINERY &**  
**PUMP SYMPOSIUM**

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for more information

TPS

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## **T.F. HUDGINS, INCORPORATED**

1627

4405 Directors Row  
Houston, TX 77092 USA  
PH: 713-682-3651

T.F. Hudgins, Inc. offers a full range of services to design, manufacture, install, maintain, and optimize the performance of oil mist systems, grease systems, and compressor lube systems.

## **TAMU - MEEN GRADUATE PROGRAM**

2042

200 Mechanical Engineering Bldg  
College Station, TX 77843-3123 USA  
PH: 979-862-7834

Texas A&M's Master of Engineering in Mechanical Engineering is available as a distance degree. This industry-oriented professional degree is a coursework-based master's degree for the student wanting to develop advanced and focused knowledge of engineering topics. All of the 30 credit hours of coursework can be completed online and there is no need for attending on-campus classes. The standards of the distance learning program for admission, coursework, graduation and diploma are the exact high standards Texas A&M maintains for on-campus learning. Students earn exactly the same degree as if they studied on campus in College Station, Texas.

## **TCR, INC.**

2017

3608 Pinemont Drive  
Houston, TX 77018 USA  
PH: 713-895-9551 | FX: 713-680-0070  
<http://www.tcrhouston.com>

TCR, Inc. is a machine job shop that specializes in short-run complicated machining. We provide machining and repair services for power generation, oil & gas, and many other industries. We pride our selves on customer satisfaction and quality on every part that leaves our door. We are ISO 9001:2015 ABS#54215 certified.

## **TECH CAST LLC**

1305

640 S Cherry St  
Myerstown, PA 17067 USA  
PH: 717-866-9009 | FX: 717-866-2369

Tech Cast is a non-union, ISO 9001 investment cast foundry. With "Casting The Difficult With Precision" as our foundation, we have built a business around specializing in the support of our customers with engineering expertise, exceptional quality, and customer service. Our Value Proposition To You - State of the art process controls drive the production of precision engineered parts to high quality with exceptional on time delivery. We provide consistent performance for difficult geometries including rapid prototyping to support our R&D and pump repair customers. Alloys include carbon steel, low alloy steel, stainless steel, duplex stainless, cobalt, and nickel based.

**TECO-WESTINGHOUSE****3016**

5100 N IH-35

Round Rock, TX 78681 USA

PH: 512-255-4141 | FX: 512-244-5502

<http://www.tecowestinghouse.com>

TECO-Westinghouse manufactures electric motors from 1/4 to 100,000 hp, and supplies motor controls, gear boxes and renewal parts. TWMC offers engineering services and large motor repairs.

**TEIKOKU USA****1310**

959 Mearns Road

Warminster, PA 18974 USA

PH: 267-485-4043

Sealless and Leakproof Canned Motor Pumps, as designed and manufactured by the global Teikoku Group, provide customers looking for high levels of mechanical reliability and fluid containment the ultimate in centrifugal pumps for the transfer of hazardous, expensive and environmentally sensitive fluids. Teikoku and Chempump products are loaded with features that help users reduce installation, maintenance and space-related costs.

**TERN TECHNOLOGIES, INC.****2432**

200 W 34th Avenue, Suite 1017

Anchorage, AK 99503 USA

PH: 907-522-2411 | FX: 907-522-2412

<http://www.terntech.com>

Tern Technologies, Inc. is a full service rotating equipment consulting group offering the best in optical and laser alignment precision measurement, vibration analysis and mechanical engineering support. Their personnel have extensive world-wide experience with a wide variety of rotating equipment. Industries serviced include power generation, petrochemical, pipeline, pulp and paper, mining and marine propulsion. Services include shaft alignment, thermal growth studies, internal alignment, routine periodic vibration surveys, field balancing, vibration analysis and permanent vibration monitoring system engineering, installation and maintenance. Rotating equipment engineers provide field service support for construction and start-up, failure analysis and design audit.

**TEXAS A&M ENERGY INSTITUTE****3119**

3372 TAMU

College Station, TX 77843-3372 USA

PH: 979-458-0276

The Texas A&M Energy Institute pursues and supports new approaches for multi-disciplinary energy research, education, and external partnerships. These approaches cross departmental and college boundaries and address all facets of the energy landscape that naturally connect engineering, sciences, technologies, economics, law, and policy decisions.

The institute offers a Master of Science in Energy degree and a Certificate in Energy. Designed to create the next generation of leaders in energy, this program will target both students and professionals who want to be educated on the high-impact and interdisciplinary facets of the energy research landscape through quantitative analytical methods and multi-scale systems based approaches.

## TEXAS A&M ENGINEERING EXPERIMENT STATION

3133

1470 William D. Fitch Parkway  
College Station, TX 77845-4645 USA  
PH: 979-458-7643

The Texas A&M Engineering Experiment Station (TEES) is in its 100th year of providing engineering research solutions and partnering with industry to commercialize technology and support workforce development through education and training. TEES specializes in solutions in energy and the environment, health and safety, materials and nanotechnology, homeland security, transportation and infrastructure, and Informatics. TEES serves as a catalyst for collaborations that position Texas to be especially competitive for federal dollars and play a major role in strengthening research leadership across the state. Partner with TEES!

## TEXAS ROTATING EQUIPMENT

2434

10959 Hwy 321  
Dayton, TX 77535 USA  
PH: 936-258-3090 | FX: 936-258-3620

Texas Rotating Equipment is a independent turbomachinery repair and service shop. Texas Rotating Equipment provides the following services, Steam Turbine Repair, Gearbox Repair, Pump Repair, Parts for all Makes and Models, Balancing, Engineered Turbine Packages, Re-Rate's/Supplied Engineered Remanufactured Steam Turbines, Governors, and Bearing Manufacturing. With over 50 years experience we pride our business on Quality and Customer Service. Located in Dayton, Texas we are the fastest growing independent Turbomachinery repair center in the World.

## TMEIC

2745

2060 Cook Drive  
Salem, VA 24153 USA  
PH: 540-283 -2099

Toshiba Mitsubishi-Electric Industrial Systems Corporation (TMEIC), headquartered in Tokyo, Japan, manufactures large three-phase electric motors and generators for a range of industrial applications, including synchronous motors and generators up to 100 MW, and induction motors up to 20 MW, with options for operation in hazardous areas. Also a family of voltage source, high-power variable frequency drives with power levels up to 120 MW, for driving induction and synchronous motors, and for special motors, allowing super-synchronous operation at speeds up to 12,000 rpm.

## TORQUEMETERS LIMITED



2232

West Haddon Rd  
Ravensthorpe, NN6 8ET Northamptonshire United Kingdom  
PH: +441604770232 | FX: +441604770778  
<http://www.torquemeters.com>

Measuring steady state torque and torsional vibration in a single product, their Torquetronic TM) Continuous Duty Torque measurement system is the recognized industry standard for accurate power measurement of mechanically driven turbo machinery in the Oil, Gas and Petrochemical industries.

Torquemeters' 800 family of display electronics provides a flexible platform to show real time continuous torque and torsional vibration analysis, including FFT capability.

**TOYO TANSO USA**

2556

2575 NW Graham Circle  
Troutdale, OR 97060 USA  
PH: 603-540-7569 | FX: 503-669-9107  
<http://www.TTU.com>

Toyo Tanso is the premier manufacturer of iso-molded graphite in the world. Toyo Tanso is known industry wide for quality and consistency. Toyo Tanso offers world class machining and purification as well as CVD silicon carbide coatings to protect our substrates. Our quality systems provide full traceability throughout our process to give you 100% confidence in the reliability of our products. We strive to keep in the forefront of the graphite industry by providing innovative materials and solutions to ensure you stay ahead of the competition. Toyo Tanso has been proudly servicing the semiconductor industry in the United States for over 25 years.

**TRADESMEN INTERNATIONAL**

3227

9760 Shepard Rd  
Macedonia, OH 44056 USA  
PH: 800-573-0850 | FX: 440-349-3432  
<http://www.tradesmeninternational.com>

Tradesmen International is a leading source for reliable, skilled craftsmen with more than 10,000 localized and traveling employees and more than 130 offices across North America. We help industrial clients and contractors maximize productivity for every dollar spent on skilled labor.

**TRI TRANSMISSION & BEARING CORPORATION**

3121

P.O. Box 454  
Lionville, PA 19353-0454 USA  
PH: 610-363-8570 | FX: 610-524-6326

Engineer, design, manufacture, install (1) Babbitted tilting-pad / fixed bore journal bearings to solve rotor-vibration problems, to 70 inches OD and 20,000 lbs, (2) Variable speed fluid drives to 40,000 hp, (3) Complex shaped impellers 40 inch dia, (4) Drive trains for Gas Turbine -Generators, (5) Synchronous condensers with self-start, (6) Upgrades for large thrust bearings, (7) Lube oil systems. Field services include: (1) Rebuild Fluid Drives (All Makes), (2) Repair Damaged Journals in Place, (3) Repair Damaged Babbitted Bearings, (4) Perform Vibration Analyses (ADRE®) and Rotor Balancing In Place, Extensive Machine Shop Maintenance and Manufacturing Services. See [www.turboresearch.com](http://www.turboresearch.com)

**TRINITY INTEGRATED SYSTEMS**

2233

8824 Fallbrook Dr  
Houston, TX 77064-9912 USA  
PH: 281-940-1748 | FX: 713-559-9432  
[www.trinitysystems.com](http://www.trinitysystems.com)

Trinity Integrated Systems provides engineering expertise and innovative software tools to Oil&Gas companies enabling them to achieve a sustainable and compliant lifecycle for their safety and control systems. Trinity's iDefine software is a powerful way of modelling multiple scenarios, allowing projects to be defined, simulated and validated up front, saving time and expense of discovering design errors at FAT.

## **TURBO FILTRATION, LLC**

2438

1490 Telegraph Rd  
Mobile, AL 36610 USA  
PH: 251-378-1138 | FX: 251-457-8897  
<http://www.tfcglobal.com>

Turbo Filtration Corporation (TFC) provides 24/7 quality turbine generator lube oil system cleaning services for Nuclear Turbines, Steam Turbines, Gas Turbines, Combined Cycle Turbines, Combustion turbines, Compressors and Diesel Engines. Services include High Velocity oil flushing from 100 gpm - 6000 gpm, Hydro Lazing of pipe 6K - 10K psi., EHC flushing, Pipe Pickeling, Chemical flushing, Oil Analysis and Consulting Services. Rental equipment available Filtration skids 100 - 850 gpm, Oil Dehydration equipment 1.5 - 30 gpm, Filter housings and replacement filters.

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## **TURBOCAM INTERNATIONAL**

2127

607 Calef Highway  
Barrington, NH 03825-0830 USA  
PH: 603-905-0200 | FX: 603-905-0211  
<http://www.turbocam.com>

TURBOCAM is a global engineering solutions company and world leader in the development and manufacture of turbomachinery flowpath components with over 150 multi-axis milling centers at 10 locations in 8 countries producing well over one million parts per year. TURBOCAM specializes in 5-axis milling, ECM, and DMLS of integrally bladed parts up to 1,100mm such as: blisks machined from solid forging, axial and centrifugal impellers, turbines, compressors, expanders, turbochargers, pumps, stators, diffusers, nozzles, individual blades, and more for industrial, automotive, power generation, and aerospace applications. TURBOCAM is ISO 9001:2008 and AS9100:2004 certified. We are also Nadcap® certified for aerospace coatings.

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## **TURBOGEN CONSULTANTS, INC.**

2045

78 S Trooper Road  
Norristown, PA 19403 USA  
PH: 610-631-3480

Turbine control expertise, parts, and complete retrofit packages. Turbogen specializes in providing services, parts, repairs and retrofits of turbine control systems. Expertise on Woodward and GE turbine controls for startup support, troubleshooting, repair, and training. Parts for legacy controls such as Woodward, GE, Bentley Nevada, and Siemens S5. Replacement controls.

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## **TURBOMACHINERY INTERNATIONAL PUBLICATIONS**

**Turbomachinery**  
INTERNATIONAL

1811

50 Day Street  
Norwalk, CT 06856 USA  
PH: 203-663-7814

Turbomachinery International covers industries engaged in all forms of energy, including power generation, electric utilities and cogeneration. It also covers oil & gas refining, gas processing, compression, drilling and exploration. The emphasis is on application where gas and steam turbines and related turbomachinery are used worldwide. Coverage includes maintenance, overhaul and repair of all turbines and rotating equipment, including pumps and compressors. Turbomachinery News/Blog is an interactive hub, featuring a daily newsletter loaded with the latest news, blogs, commentary from top experts around the world, engineering data and graphics, and cutting-edge stories that you won't find in print.



**TURBOMACHINERY LABORATORY**

3254 TAMU / 509 Spence St. MOEB Bldg.  
College Station, TX 77843 USA  
PH: 979-845-7417 | FX: 979-845-1835  
<http://turbolab.tamu.edu>



2411

The Turbomachinery Laboratory was established in 1971 to address the needs of the turbomachinery and pump industries. The Laboratory continues Texas A&M's land grant charter and tradition in continuing education and professional development; undergraduate and graduate education, and basic research. Toward this goal, the Turbomachinery Research Consortium was formed in 1983. Member companies pay a yearly membership fee to share in the sponsored research of the TRC. A research building was completed in 1993. This facility has 12 test cells and a high bay area. The Laboratory sponsors the Turbomachinery & Pump Symposium (TPS) annually in Houston and just successfully completed the 1st Asia Turbomachinery & Pump Symposium (ATPS) this past February in Singapore. The next ATPS event will be held 12-15 March 2018 at the Suntec Convention Center in Singapore.

**TYCON ALLOY INDUSTRIES (HONG KONG) CO., LTD.**

2726

8 Floor, 22-28 Cheung Tat Rd  
Tsing Yi, N/A Hong Kong China  
PH: +85224973300 | FX: +85224351162  
<http://www.tyconalloy.com>

Founded in 1995, Tycon Alloy Industries is specialized in the provision of stainless steel casting engineering solution and related technical and value-added services. Tycon has built a strong reputation in providing high-value precision and sand casting engineering solutions. Since its inception, Tycon has successfully logged over 10,000 different products from several 100g to more than 1000kg a piece. Tycon takes pride in being able to supply top quality products to our market leader customers. Tycon's casting standards are in conformity to international accreditation like ASTM, EN, BS, DIN, JIS, GB, etc., penetrating to Europe, USA, Japan & other Asia country.



## **UE SYSTEMS**

**3211**

14 Hayes St.  
Elmsford, NY 10523  
PH: 800-223-1325 | FX: 914-347-2181  
<http://www.uesystems.com>

For 40+ years, UE Systems has produced thousands of ergonomically designed portable, and incredibly accurate airborne/structure borne ultrasonic instruments. Used primarily for leak detection, mechanical analysis and electrical inspection, these instruments have saved our clients tens of thousands of dollars in premature failure detection, elimination of downtime, increased productivity, and overall replacement costs. UE System's digital Ultraprobe® instruments are supported by Ultratrend DMS, a powerful data management software that fully integrates all inspections for effective plant-wide reliability and energy conservation. This patented software is the first of its kind to report cost and carbon footprint reduction while enabling users to analyze, repair and report their savings.

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## **UNITED CONTROLS GROUP — UCG**

**2233**

8824 Fallbrook Dr  
Houston, TX 77064-9912 USA  
PH: 281-940-1748 | FX: 713-559-9432  
[www.unitedcontrolsgroup.com](http://www.unitedcontrolsgroup.com)

United Controls Group — UCG specializes in the design, engineering, test and support of control systems for turbines, reciprocating engines, compressors, generators, plant controls and functional safety systems.

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## **UNITED TECHNOLOGIES**

**2327**

104 Otis St  
Rome, NY 13441 USA  
PH: 315-838-1418 | FX: 315-838-1476  
<http://www.utas.utc.com>

UTC, formally Goodrich, delivers a combination of technologies that meet the most demanding industrial gas turbine applications. From power transmission couplings, fuel nozzles, blades and vanes UTC supports the design, engineering, manufacturing and repair of the critical components necessary to ensure the highest levels of operation to ensure reduced downtime. UTC's power transmission diaphragm couplings have set the standard for quality, reliability and performance in numerous OEM and retrofit applications meeting API-671 requirements.

**UNIVERSAL PLANT SERVICES**

806 Seaco Ct  
Deer Park, TX 77536 USA  
PH: 281-479-6000 | FX: 281-479-6273

Universal Plant Services (UPS) is a leading provider of millwright and field machining services to the refining, petrochemical and power generation industries specializing in the maintenance and repair of all types of rotating equipment including steam and gas turbines, compressors and pumps.

2715

**UTC OVERSEAS, INC.**

2 Northpoint Dr., Ste 200  
Houston, TX 77060 USA  
PH: 713-422-8819 | FX: 713-422-2869  
<http://www.utcoverseas.com>

UTC Overseas, Inc. is a knowledge-based company, focusing on developing innovative transport and logistics solutions for complex projects. UTC Overseas, Inc. has the resources and the expertise to help you move anything, anywhere in the world, regardless of its size, its weight and its complexity. Water, air, land or any combination of the three, we help you achieve critical timelines and work within budget parameters. We use our collective experience and expertise to come up with solutions that gets the job done.

3022





### **VISION MACHINE, INC.**

1307

25045 Spring Ridge Rd.

Spring, TX 77386 USA

PH: 832-562-2112 | FX: 832-562-2115

<http://www.visionmachine.com>

Vision Machine Inc. specializes in the production and repair of horizontal decanter centrifuges and has been doing so since 2004. Our centrifuges are versatile and come in a range of sizes: Type 1 (18x50 machine), Type 2 (14x48 machine), Type 3 (16-1/2x55 machine), and can adjust to many types of processes and materials. Our centrifuges are easy to operate and require minimal resources, providing an effective, low maintenance separation system solution. We can help in providing low cost and effective solutions, from the upgrade and redesign of used equipment to the repairing of basic bearings, seals, and balancing. We can also fully re-manufacture centrifuges to brand new condition.

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### **VOITH TURBO INC.**

2143

25 Winship Road

York, PA 17406 USA

PH: 717-767-3200 | FX: 717-767-3210

<http://www.usa.voithturbo.com>

The advanced technologies of Voith Turbo Inc. drive machines that move millions of people and goods throughout the world. These technologies safely and efficiently transmit and control power under extreme conditions. The company's extensive range of power transmission products are available for new and retrofit applications which include hydrodynamic variable speed turbo couplings, multistage variable speed drives, high speed and high powered API gearboxes, electrohydraulic actuators, I/P converters, and digital turbine control modules. Featured is the all new VoreconNX, a groundbreaking hydrodynamic power transmission that offers an 8% efficiency improvement in the lower power range.

W

## **WATSON GRINDING & MFG.**

4525 Gessner  
Houston, TX 77041 USA  
PH: 713-466-3053 | FX: 713-466-8992  
<http://watsongrinding.com>

For more than 50 years, Watson Grinding has reliably provided precision machined parts, thermal spray coatings and grinding services to the largest companies in the Oil & Gas, Chemical and Mining industries. In-house capabilities: Machining, Grinding, Fully-automated Thermal Spray facility, Non Destructive Testing, Metallurgical Lab.

2350

## **WATTS ON POWER**

1311 Colorado St  
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2024

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- steel profiles and
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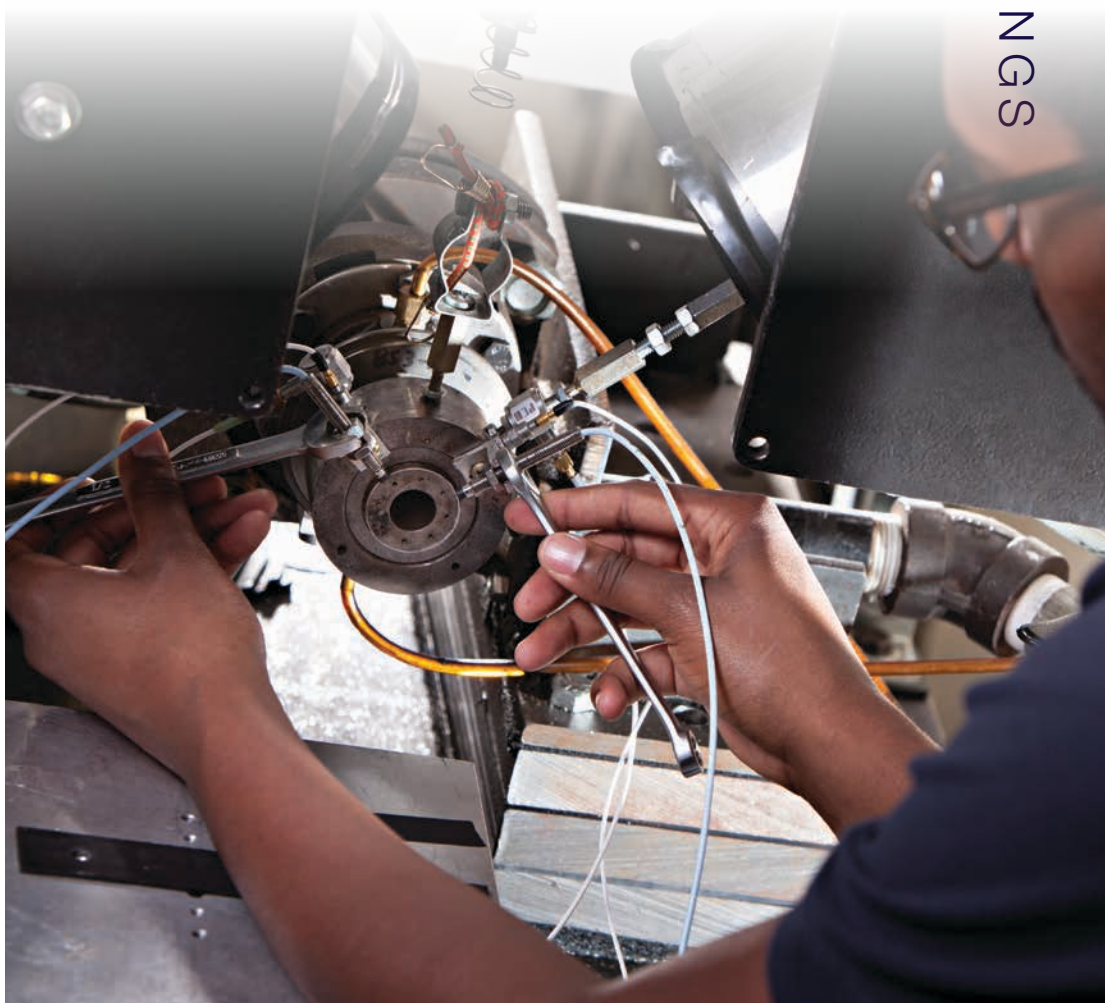
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Badger Meter	1206
Canada Pipeline Accessories	1134
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CFturbo Software & Engineering GmbH	1427
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Advanced Compressor Technology	2019
ANSYS, Inc.	2015
CD-adapco	1533
Engineering Dynamics, Inc.	2820
SoftInWay, Inc.	2836
TRI Transmission & Bearing Corporation	3121
Voith Turbo Inc.	2143

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Advanced Compressor Technology	2019
ANSYS, Inc.	2015
CD-adapco	1533
Engineering Dynamics, Inc.	2820
SoftInWay, Inc.	2836
TRI Transmission & Bearing Corporation	3121
Voith Turbo Inc.	2143

## GAS TURBINE WASHING

Advanced Compressor Technology	2019
ANSYS, Inc.	2015
CD-adapco	1533
Engineering Dynamics, Inc.	2820
SoftInWay, Inc.	2836
TRI Transmission & Bearing Corporation	3121
Voith Turbo Inc.	2143

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TRI Transmission & Bearing Corporation	3121
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Oeltechnik	3029
Relevant Solutions/ Switch Filtration	2337

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Hebei Anji Hongye Machinery Co., Ltd.	1127
HydroThrift Corp	1429
PumpWorks 610	1228
PumpWorks Industrial	1226

**HYDRAULIC FITTING**

ANSYS, Inc.	2015
Dongying Haihe Machinery Co., Ltd.	1113

## INLET COOLING FOR GAS TURBINES

ANSYS, Inc.	2015
Camfil Power Systems	2541
CD-adapco	1533
GEA	2633
SoftInWay, Inc.	2836

## INSTALLATION EQUIPMENT

Prognost Systems, Inc.	2011
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Colfax - Reliability Services	2226
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Oeltechnik	3029
Royal Purple	2026
TRI Transmission & Bearing Corporation	3121

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COBEY, Inc.	2133
Colfax - Reliability Services	2226
Fluid Energy Controls, Inc.	3010
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Oeltechnik	3029
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HydroThrift Corp	1429
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Hima Americas Inc.	2838
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TurboGen Consultants, Inc.	2045
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SWRI - Southwest Research Institute	1820

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DuPont Kalrez	1542
EagleBurgmann	2722
Flowserve Corporation	2639
Precision Polymer Engineering	3223
Scansonic PGS GmbH	3038
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Permabond Engineering Adhesives	1104
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Hima Americas Inc.	2838
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Maudlin & Sons Mfg. Co., Inc.	1502
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**SHIPPING CONTAINERS**

Maudlin & Sons Mfg. Co., Inc.	1502
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**SKIDS**

Turbo Filtration, LLC	2438
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**STARTERS AND STARTING MOTORS**

Governor Control Systems, Inc.	2049
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Hahn & Clay	2629
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WEG/Electric Machinery	2515
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**THERMOCOUPLES**

WIKA Instrument, LP	2649
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Key Pump & Gear, LLC.	1219
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KTR Corporation	2522
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Regal Power Transmission Solutions	2111
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David Brown Santasalo	1804
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NGC Transmission Equipment (America), Inc.	2253
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Voith Turbo Inc.	2143
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**USED EQUIPMENT, GENERAL**

David Brown Santasalo	1804
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NGC Transmission Equipment (America), Inc.	2253
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Voith Turbo Inc.	2143
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**VACUUM EQUIPMENT**

Dekker Vacuum Technologies	2636
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Key Pump & Gear, LLC.	1219
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T.F. Hudgins, Incorporated	1627
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Atlantic Group, Inc.	1328
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Cangzhou Yongxing Foundry Co., Ltd.	2118
Dongying Yicheng Precision Metal Co., Ltd.	1334
EGGER TURO PUMPS North America, Inc.	1232
Peerless PROCORE	2251
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T.F. Hudgins, Incorporated	1627
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WuHan Longshen Seal Manufacture Co.,Ltd	3218
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Baldor Electric Co.	3141
Continuous Control Solutions	2412
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## VIBRATION MEASURING, MONITORING, ANALYSIS

Alta Solutions, Inc.	1526
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IMI Sensors	1632
LUDECA, INC.	2733
Meggitt Sensing Systems	3012
OROS Inc.	2148
SKF	1510
Torquemeters Limited	2232



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# DISTRIBUTORS

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AP Alloy Industries Company Ltd.	1107
Atlantic Group, Inc.	1328
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Hunan Tane Ocean Pump Co., Ltd.	1844
HydroThrift Corp	1429
Maudlin & Sons Mfg. Co., Inc.	1502
Peerless PROCORE	2251
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Sichuan Mianzhu Xinkun Machinery Making Co. Ltd.	3117
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Dongying Yicheng Precision Metal Co., Ltd.	1334
Empowering Pumps, LLC	1200
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Fonda Pump	1848
Hermetic Pumps Inc.	1841
Hunan Tane Ocean Pump Co., Ltd.	1844
Key Pump & Gear, LLC.	1219
SERO PumpSystems, Inc.	1106
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Mary Kay O'Connor Process Safety Center	2040
Texas A&M Energy Institute	3119
TEES Turbomachinery Lab	2411

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Mary Kay O'Connor Process Safety Center	2040
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TEES Turbomachinery Lab	2411

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Cradle North America Inc.	2224
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Grand View Media Group	1101
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3022

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## 3D SCANNING AND INSPECTION

ACQUIP Powered.Empowering™

2443

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1818

FARO Technologies

2454

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ACQUIP Powered.Empowering™

2443

Cascade Analytic, LLC

2357

Industrial Reliability &amp; Alignments, LLC

2313

LUDECA, INC.

2733

Southern States Millwright

1823

Tern Technologies, Inc.

2432

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Cascade Analytic, LLC

2357

Mitsubishi Heavy Industries Ltd.

2611

Wood Group Vibration, Dynamics &amp; Noise (BETA Machinery Analysis)

2134

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1407

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Cryostar USA LLC

1813

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## EFFICIENCY IMPROVEMENT FOR GAS TURBINES

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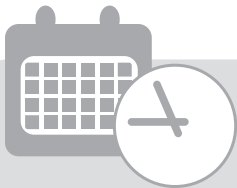
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Solar Turbines Incorporated	2815
Summit Industrial Products	1618
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York Process Systems	1727
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New England Braiding Company, Inc.	1432

Manufacturers (Continued)

**COMPRESSOR - LIQUID RING**

Dekker Vacuum Technologies	2636
Shanghai EVP Vacuum Technology Co.,Ltd	1122

**COMPRESSOR - RECIPROCATING**

Ariel Corporation	1606
Atlas Copco	1827
Burckhardt Compression, Inc.	2705
Gas & Air Systems, Inc.	2632
Hitachi America, Ltd.	1847
Ingersoll Rand	2823
Kobelco Compressors America, Inc.	2833
Mayekawa U.S.A., Inc.	1433
Neuman & Esser	3011
Quadrant Engineering Plastic Products	2137

**COMPRESSOR - SCREW**

GEA	2633
Ingersoll Rand	2823
Kobelco Compressors America, Inc.	2833
Mayekawa U.S.A., Inc.	1433
York Process Systems	1727

**ELECTRIC MOTORS**

Baldor Electric Co.	3141
Calnetix	2623
e+a	3241
Hitachi America, Ltd.	1847
Nidec Industrial Solutions	2347
Siemens Industry	1527
TECO-Westinghouse	3016

TMEIC	2745
wattsON Power	2024
WEG/Electric Machinery	2515
<b>EXPANDERS</b>	
Aikoku Alpha Co.	1523
Atlas Copco	1827
GE Oil & Gas	2433
Hammelmann Corporation	1504
KTS Turbobillet X	2923
L.A. Turbine Corp.	2739
Shanley Pump & Equipment	1100
<b>GEARS AND GEARBOXES</b>	
Baldor Electric Co.	3141
David Brown Santasalo	1804
NGC Transmission Equipment (America), Inc.	2253
Philadelphia Gear	1910
Sumitomo Heavy Industries Gearbox Co., Ltd.	2814
TECO-Westinghouse	3016
<b>GENERATORS</b>	
Baldor Electric Co.	3141
Calnetix	2623
e+a	3241
Isomag Corporation	2728
Shanley Pump & Equipment	1100
Skinner Power Systems LLC	1700
TMEIC	2745
wattsON Power	2024
<b>IMPELLERS</b>	
Aikoku Alpha Co.	1523

## Manufacturers (Continued)

AP Alloy Industries Company Ltd.	1107
KTS Turbobillet X	2923
TURBOCAM International	2127
<b>MECHANICAL SEAL</b>	
EagleBurgmann	2722
Gulf Publishing Company	1701
Precision Polymer Engineering	3223
Scansonic PGS GmbH	3038
Sdms Seal Co.,Ltd.	1118
Stein Seal Industrial Division	2151
<b>PUMP - CENTRIFUGAL</b>	
Aikoku Alpha Co.	1523
CPC Pumps International	1404
Dongying Hengcheng Machine Co., Ltd.	2120
EGGER TURO PUMPS North America, Inc.	1232
Fonda Pump	1848
Gulf Publishing Company	1701
Hebei Anji Hongye Machinery Co., Ltd.	1127
Hermetic Pumps Inc.	1841
Hunan Tane Ocean Pump Co., Ltd.	1844
ITT Corporation	2241
KTS Turbobillet X	2923
Oil, Gas & Petrochem Equipment	2119
Roth Pump Company	1201
SERO PumpSystems, Inc.	1106
Shin Nippon Machinery	1419
Sundyne	2219
Weir Speciatly Pumps	1315
Xianju Hongyi Hydraulic Components Factory	1133
Zhongshan Huafu Hardware Plastic Products Co., Ltd.	1500

## **PUMP - DISC FLOW**

EGGER TURO PUMPS North America, Inc.	1232
Gulf Publishing Company	1701
Industrial Info Resources, Inc.	3001
Oil, Gas & Petrochem Equipment	2119
Xianju Hongyi Hydraulic Components Factory	1133

## **PUMP - PITOT-TUBE**

Weir Speciatly Pumps	1315
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## **PUMP - POSITIVE DISPLACEMENT**

Boerger, LLC	1333
FELUWA Pumpen GmbH	1124
Hermetic Pumps Inc.	1841
ITT Corporation	2241
KRAL-USA, Inc.	1233
Leistritz Advanced Technologies Corp.	1327
LEWA-Nikkiso America, Inc.	1205
LobePro Rotary Pumps	1135
Netzsch Pumps North America LLC	1434
Roth Pump Company	1201
Turbomachinery Laboratory	2411
Xianju Hongyi Hydraulic Components Factory	1133

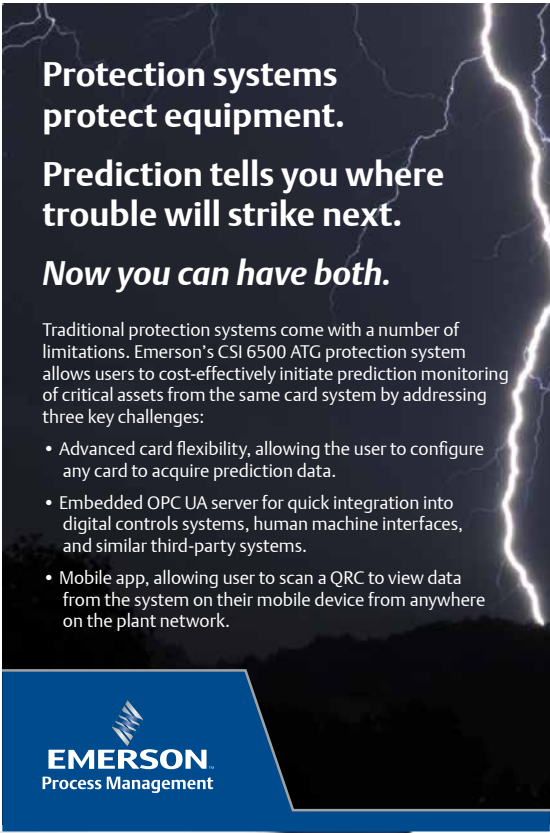
## **PUMP - SEALLESS**

EGGER TURO PUMPS North America, Inc.	1232
LEWA-Nikkiso America, Inc.	1205
Roth Pump Company	1201
Schenck Trebel Corporation	2750
SERO PumpSystems, Inc.	1106
Summit Industrial Products	1618
Sundyne	2219
Teikoku USA	1310



## Manufacturers (Continued)

Turbomachinery Laboratory	2411
<b>PUMP - VACUUM</b>	
Dekker Vacuum Technologies	2636
Hermetic Pumps Inc.	1841
Industrial Info Resources, Inc.	3001
Turbomachinery Laboratory	2411
Zhongshan Huafu Hardware Plastic Products Co., Ltd.	1500
<b>PUMP - VERTICAL TURBINE</b>	
Fonda Pump	1848
Industrial Info Resources, Inc.	3001
National Pump Company	1306
Roth Pump Company	1201
Shin Nippon Machinery	1419
Turbomachinery Laboratory	2411
Xianju Hongyi Hydraulic Components Factory	1133
<b>TURBINES - GAS</b>	
GE Oil & Gas	2433
KTS Turbobillet X	2923
Reinhart & Associates, Inc.	2719
SoftInWay, Inc.	2836
Solar Turbines Incorporated	2815
Stork Turbo Blading	2020
Summit Industrial Products	1618
<b>TURBINES - STEAM</b>	
Hangzhou Steam Turbine Co., Ltd.	3019
Reinhart & Associates, Inc.	2719
Shin Nippon Machinery	1419
Skinner Power Systems LLC	1700
Stork Turbo Blading	2020

A dark, stormy background with a bright lightning bolt striking down on the right side.

**Protection systems  
protect equipment.**

**Prediction tells you where  
trouble will strike next.**

***Now you can have both.***

Traditional protection systems come with a number of limitations. Emerson's CSI 6500 ATG protection system allows users to cost-effectively initiate prediction monitoring of critical assets from the same card system by addressing three key challenges:

- Advanced card flexibility, allowing the user to configure any card to acquire prediction data.
- Embedded OPC UA server for quick integration into digital controls systems, human machine interfaces, and similar third-party systems.
- Mobile app, allowing user to scan a QRC to view data from the system on their mobile device from anywhere on the plant network.

The Emerson logo, consisting of a stylized 'E' made of three slanted parallel lines.

**EMERSON**  
Process Management



## MANUFACTURING &amp; REPAIR SERVICES

## CASTINGS

ACTech. North America, Inc.	1413
AP Alloy Industries Company Ltd.	1107
CBB-CSC	1217
Dongying Hengcheng Machine Co., Ltd.	2120
Dongying Yicheng Precision Metal Co., Ltd.	1334
Emnor Mechanical Inc.	3247
ExOne	1519
Hebei Anji Hongye Machinery Co., Ltd.	1127
Hoosier Pattern Inc.	1634
Shanghai Shantin Mechanical & Electrical Inc.	1212
Shijiazhuang Jinjieber Imp. & Exp. Corp. Ltd.	1109
Stone Metals America	1304
Tycon Alloy Industries (Hong Kong) Co., Ltd.	2726
Zhejiang Carbo Bronze Co., Ltd.	3220

## COATINGS

Adhesive Services Company	2311
CTS, Inc.	1223
D&S Engineered Products	3115
Dickow Pump Company, Inc.	1300
Dongying Hengcheng Machine Co., Ltd.	2120
Emnor Mechanical Inc.	3247
Fisher Products	3229
Fusion, Inc.	1732
HFW Industries Inc.	2943
Industrial Info Resources, Inc.	3001

New England Braiding Company, Inc.	1432
Shijiazhuang Jinjieber Imp. & Exp. Corp. Ltd.	1109
Watson Grinding & Mfg.	2350
<b>FORGINGS</b>	
Cavalier Industrial Specialties	2116
Chang Yuan Spray Technology Ltd	3024
Dongying Hengcheng Machine Co., Ltd.	2120
Shanghai Shantin Mechanical & Electrical Inc.	1212
Shijiazhuang Jinjieber Imp. & Exp. Corp. Ltd.	1109
Stone Metals America	1304
Zhejiang Carbo Bronze Co., Ltd.	3220
<b>GRINDING</b>	
Advanced Turbine Support, LLC	1524
CTS, Inc.	1223
Fusion, Inc.	1732
HFW Industries Inc.	2943
Watson Grinding & Mfg.	2350
<b>IMPELLERS</b>	
Artec Machine Systems	3124
Cincinnati Gearing Systems	2933
Concepts NREC	2526
Dongying Hengcheng Machine Co., Ltd.	2120
ExOne	1519
Shanghai Shantin Mechanical & Electrical Inc.	1212
Shijiazhuang Jinjieber Imp. & Exp. Corp. Ltd.	1109
TURBOCAM International	2127
<b>IN-PLANT MACHINING</b>	
Tycon Alloy Industries (Hong Kong) Co., Ltd.	2726

Manufacturing &amp; Repair Services (Continued)

**LAPPING AND POLISHING**

Watson Grinding & Mfg.	2350
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**LASER MACHINING**

Maudlin & Sons Mfg. Co., Inc.	1502
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wattsON Power	2024
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**MACHINING**

ACTech. North America, Inc.	1413
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Burckhardt Compression, Inc.	2705
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Cavalier Industrial Specialties	2116
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CBB-CSC	1217
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CTS, Inc.	1223
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Daedong Metal Industry Co., Ltd	2455
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Emnor Mechanical Inc.	3247
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Fisher Products	3229
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Fusion, Inc.	1732
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HFW Industries Inc.	2943
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Hunan Sund	1846
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Shanghai Shantin Mechanical & Electrical Inc.	1212
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Shijiazhuang Jinjieber Imp. & Exp. Corp. Ltd.	1109
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Stone Metals America	1304
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TCR, Inc.	2017
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TURBOCAM International	2127
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Tycon Alloy Industries (Hong Kong) Co., Ltd.	2726
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Watson Grinding & Mfg.	2350
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**MILLING**

TURBOCAM International	2127
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Watson Grinding & Mfg.	2350
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**PLATING**

Shijiazhuang Retool Stainless Steel Products Co., Ltd.	1736
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WELDING	
Shijiazhuang Retool Stainless Steel Products Co., Ltd.	1736
wattsON Power	2024



## MATERIALS

## ALLOYS, METAL

Dongying Yicheng Precision Metal Co., Ltd.	1334
Emnor Mechanical Inc.	3247
Shijiazhuang Retool Stainless Steel Products Co., Ltd.	1736
Stone Metals America	1304
Tycon Alloy Industries (Hong Kong) Co., Ltd.	2726

## ALUMINUM TUBES

Shijiazhuang Retool Stainless Steel Products Co., Ltd.	1736
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## CARBON AND CARBON PRODUCTS

ROC Carbon Company	2110
Shijiazhuang Retool Stainless Steel Products Co., Ltd.	1736
Stone Metals America	1304

## CERAMICS

Beijing Zhongxing Shiqiang Ceramic Bearing Co., Ltd.	2754
Boulden Company Inc.	1633
CEROBEAR GmbH	1941

## EPOXY GROUT

BASF Corporation	2818
Five Star Products, Inc.	2425

## GRAPHITE

BASF Corporation	2818
Five Star Products, Inc.	2425

## GROUT, CEMENT

BASF Corporation	2818
Five Star Products, Inc.	2425

LUBRICANTS	
Royal Purple	2026
Sun Coast Resources, Inc.	3249
MAGNETIC MATERIALS	
Royal Purple	2026
Sun Coast Resources, Inc.	3249
PACKING	
Royal Purple	2026
Sun Coast Resources, Inc.	3249
POLYMERS	
Boedeker Plastics, Inc.	1335
Boulden Company Inc.	1633
DuPont Kalrez	1542
EGC Critical Components	2746
Precision Polymer Engineering	3223
SEALANTS	
Permabond Engineering Adhesives	1104
Precision Polymer Engineering	3223



## PUBLISHING

## BOOKS

Access Intelligence	1641
CompressorTech Two Magazine	2711
Hydraulic Institute	3213
Pump Engineer Magazine	1235

## MAGAZINES/PUBLICATIONS

Access Intelligence	1641
American Society of Mechanical Engineers (ASME)	1925
CompressorTech Two Magazine	2711
Gas Compression Magazine / Third Coast Publishing	3025
Grand View Media Group	1101
Journal of Compressor, Blower and Fan Technology	2924
Oilman Magazine	1506
Pump Engineer Magazine	1235
Pumps & Systems Magazine	1322
Putman Media	1117
TEES Turbomachinery Laboratory	2411

## WEB BASED PUBLICATIONS

Access Intelligence	1641
Empowering Pumps, LLC	1200
Grand View Media Group	1101
Journal of Compressor, Blower and Fan Technology	2924
Oilman Magazine	1506
PetroPages.com, Inc.	2832
Pump Engineer Magazine	1235
Putman Media	1117
TEES Turbomachinery Laboratory	2411

## OTHER

OTHER	
ACQUIP Powered.Empowering™	2443
Camfil Power Systems	2541
CHEM SHOW,The	1441
CompressorTech Two Magazine	2711
Cooling Technology Institute	1203
Enerstaff	1620
Gas Compression Magazine / Third Coast Publishing	3025
HydroThrift Corp	1429
LEWA-Nikkiso America, Inc.	1205
Maudlin & Sons Mfg. Co., Inc.	1502
Modal Shop, The	3245
Peerless PROCORE	2251
Permabond Engineering Adhesives	1104
PetroPages.com, Inc.	2832
Quadrant Engineering Plastic Products	2137
Royal Purple	2026
TEES Turbomachinery Laboratory	2411
Tradesmen International	3227
Tycon Alloy Industries (Hong Kong) Co., Ltd.	2726
UTC Overseas, Inc.	3022
Zollern North America LP	3039



GENERAL

GENERAL





# ABOUT THE TURBOMACHINERY LAB



The Turbomachinery Lab, a center of the Texas A&M Engineering Experiment Station (TEES), conducts basic and applied research into important problems of reliability and performance of turbomachinery—rotating machinery that extracts or adds energy to fluids. That's everything from the classic Dutch windmill to the space shuttle's main engine turbopumps and compressors that move natural gas through the distribution system.

The Turbo Lab, established in 1971, continues to address the needs of users and manufacturers of turbomachinery and pumps. We are proud to continue Texas A&M University's land-grant charter and tradition of attention to industry needs in three areas:

- Basic & Applied Research
- Undergraduate and Graduate Education
- Continuing Education & Professional Development

We offer graduate engineering coursework through Texas A&M's Department of Mechanical Engineering, and provide continuing education opportunities to users of turbomachinery and pumps all over the world. Opportunities include short courses led by world-renowned researchers and original equipment manufacturers and users, as well as highly-regarded symposia in Houston, Texas and Singapore.

The Turbo Lab also boasts a unique opportunity for turbomachinery developers and users to find answers to important questions about performance and reliability with the Turbomachinery Research Consortium (TRC).

**Visit [www.turbolab.tamu.edu](http://www.turbolab.tamu.edu) or email [info@turbo-lab.edu](mailto:info@turbo-lab.edu) for additional information.**

# TURBO LAB

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# STAND-ALONE SHORT COURSES

## REGISTRATION NOW OPEN

Turbo Lab-administered stand-alone short courses are developed and presented by leading engineers throughout the year. Topics evolve regularly to meet the needs of working professionals in the turbomachinery industry.

**To register or learn more about stand-alone short courses, visit [turbolab.tamu.edu/short-courses/](http://turbolab.tamu.edu/short-courses/) or email [debbie@turbo-lab.tamu.edu](mailto:debbie@turbo-lab.tamu.edu).**



### **Qatar — October 2-4, 2016**

**Course:** Rotordynamics of Turbomachinery with Case Studies

**Instructor:** Dr. Dara W. Childs, Turbomachinery Lab director

### **Singapore — November 2016**

**Course:** Fundamentals of Fluid Film Bearings for Machinery Engineers

**Dates:** Nov. 15-17

**Instructors:** Dr. Minhui He & James M. Byrne of BRG Machinery Consulting, LLC

**Course:** Shaft Sealing Technology for Centrifugal Compressors

**Dates:** Nov. 15-17

**Instructors:** Daniel Goebel of EagleBurgmann

**Course:** Rotating Equipment Function Overview & Best Practices

**Dates:** Nov. 15-18

**Instructors:** Michael Forsthoffer of Forsthoffer Associates, Inc.

### **Houston — January 9-13, 2017**

**Course:** Machinery Vibrations & Rotordynamics

**Instructor:** Drs. Dara Childs and Luis San Andres of Texas A&M University; Dr. Brian Murphy of RMA, Inc.; Dr. John Vance of VAVCO; and Dr. Fouad Zeidan of Rotordynamic Technology

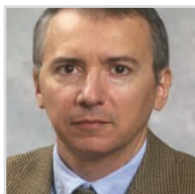
# TURBO LAB

## FACULTY



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Turbomachinery Laboratory Director  
Leland T. Jordan '29 Chair



**PAUL G.A. CIZMAS**

Professor  
Department of  
Aerospace Engineering



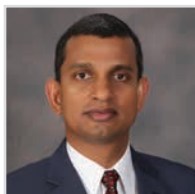
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Distinguished Professor  
Marcus C. Easterling '30 Chair  
Department of  
Mechanical Engineering



**ADOLFO DELGADO**

Associate Professor  
Department of  
Mechanical Engineering



**WARUNA KULATILAKA**

Associate Professor  
Department of  
Mechanical Engineering



**YONG-JOE KIM**

Associate Professor  
Department of  
Mechanical Engineering



**HONG (HELEN) LIANG**

Professor  
Department of  
Mechanical Engineering





**GERALD L. (JERRY)  
MORRISON**

Professor  
Department of  
Mechanical Engineering



**ALAN B. PALAZZOLO**

TEES Professor  
Department of  
Mechanical Engineering



**ERIC PETERSEN**

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Mechanical Engineering



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Department Head  
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Mechanical Engineering  
Turbomachinery Laboratory  
Associate Director



**TAHER M. SCHOEIRI**

Oscar S. Wyatt Jr.  
Professor  
Department of  
Mechanical Engineering

# Join TRC today

The Turbomachinery Research Consortium (TRC) is an exclusive organization of major turbomachinery developers and users who have united with the Turbo Lab to find answers to important questions about turbomachinery performance and reliability through cutting-edge research.

## TRC Members 2016 - 2017

Atlas Copco Comptec

BHEL Hyderabad

The Chemours Co.

Chevron

ConocoPhillips

Dresser-Rand Business, part of Siemens Power and Gas Division

Elliott Company Ebara Group

ExxonMobil Research and Engineering

FUNCAMP

GE Oil and Gas

Hanwha Techwin

Hess Corporation

Hitachi Plant Technologies

Honeywell

Hunan SUND Co. Ltd

Hyundai Heavy Industries

Ingersoll-Rand

John Crane UK

Kawasaki Heavy Industries

Keyyang Precision Co., Ltd.

Koch Industries

Lloyd's Register Consulting-Energy A/S

MAN Diesel & Turbo

Mitsubishi Heavy Industries

New Way Air Bearings

PETROBRAS

Pratt & Whitney

Praxair Inc.

Safran Aircraft Engines (SNECMA)

Shell Global Solutions

Shenyang Blower Works Group Corp

Solar Turbines Inc.

Southwest Research Institute

Statoil

Sulzer Pumps Ltd.

Torishima Pump Mfg. Co., Ltd.

Waukesha Bearings

**FOR MORE INFORMATION**  
[turbolab.tamu.edu/trc](http://turbolab.tamu.edu/trc)

Dara Childs, Director

Debbie Maggs, Program Coordinator

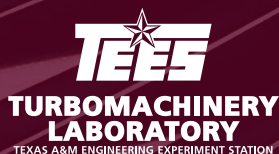
979-845-7417

[trc@turbo-lab.tamu.edu](mailto:trc@turbo-lab.tamu.edu)

# Expertise at your fingertips

TRC members have exclusive access to XLTRC<sub>2</sub>, a suite of high-speed, experimentally verified and user-friendly codes for executing a complete lateral and torsional rotordynamic analysis of rotating machinery, including pumps, compressors and turbines. XLTRC<sub>2</sub> is bundled with 25 or more examples of rotordynamic analysis, including rotors for compressors, pumps and gas turbines. Each model features distinctive bearing/seal support conditions and displays unique characteristics of rotordynamic behavior.

## Visit us in Booth 2411



# GENERAL INFORMATION

## EXHIBITION

In addition to our technical sessions, we encourage you to join us for our outstanding product show. Our exhibition will provide you the opportunity to engage with world-class technical personnel and view the latest in industry technology and full-sized equipment displays.

The exhibition for paid attendees will take place in Exhibition Halls B,C and D. The halls will be open during the following times:

- **Tuesday, September 13, 2016**  
Noon – 2 P.M.
- **Wednesday, September 14, 2016**  
Noon – 2 P.M.

## FREE PASS HOURS - EXHIBITION

Free Pass registration required.

- **Tuesday, September 13, 2016**  
2:30 P.M. – 7 P.M.
- **Wednesday, September 14, 2016**  
2:30 P.M. – 6:30 P.M.
- **Thursday, September 15, 2016**  
9:30 A.M. – Noon

## WELCOME ADDRESS

The welcome address is scheduled for Tuesday, September 13, 2016 from 8 - 8:35 A.M. in the General Assembly Theatre C in the George R. Brown, Level 3. This year's speaker is Lennart Nilsson, Siemens, CEO Compressors PG CP. Admission is granted to paid attendees, exhibitors, and press.

## LUNCHEONS

**Badge required, not open to Free Pass**

Lunch will be served on September 13<sup>th</sup> and 14<sup>th</sup> in Exhibit Hall B,C and D. Admission is granted to paid attendees, exhibitors and press. The one-day symposia registration fee includes admission to lunch for that day.

## TPS CONNECT

**Aggies & Exhibitors Networking Event**

TPS Connect is an opportunity for Aggies and Exhibitors to network. The event will take place Wednesday, Sept. 14, 2016, 6 P.M. – 7:30 P.M. at Hilton Americas-Houston, Ballroom of Americas D. Admission is granted to all Texas A&M University former and current students attending the symposia. Bring your business cards and we'll bring the h'ordeuvres!

## TEX-MEX BUFFET

**Badge required, not open to Free Pass**

The Tex-Mex Buffet is scheduled for Tuesday, September 13, 2016, 7:30 P.M. – 9 P.M. in the Hilton Ballroom of the Americas A. Admission is granted to paid attendees, exhibitors, and press.

## BANQUET

**Badge required, not open to Free Pass**

The Banquet is scheduled for Wednesday, September 14, 2016, 7:30 P.M. – 9 P.M. in the Hilton Ballroom of the Americas A. Admission is granted to paid attendees, exhibitors, and press. Additional admissions are available for purchase at Registration Counters in Exhibit Hall C (\$75). No admission after 7:45 P.M.

## SHUTTLE SERVICE

Complimentary shuttle service is provided between the George R. Brown Convention Center (GRB)/the Hilton Americas and the Hyatt Regency Downtown. The shuttle runs every 20 minutes. Please note the schedule below:

- Monday, September 12, 2016**  
 7:00 A.M. – 6:30 P.M. GRB/Hyatt  
 6:30 P.M. – 10:00 P.M. Hilton/ Hyatt
- Tuesday, September 13, 2016**  
 7:00 A.M. – 7:30 P.M. GRB/Hyatt  
 7:30 P.M. – Midnight Hilton/Hyatt
- Wednesday, September 14, 2016**  
 7:30 A.M. – 7:00 P.M. GRB/Hyatt  
 7:00 P.M. – 11:00 P.M. Hilton/Hyatt
- Thursday, September 15, 2016**  
 7:30 A.M. – 2:00 P.M. GRB/Hyatt

## Lost & Found

Lost & Found is located at the Ticket Office, Concourse B, with security.

## First Aid

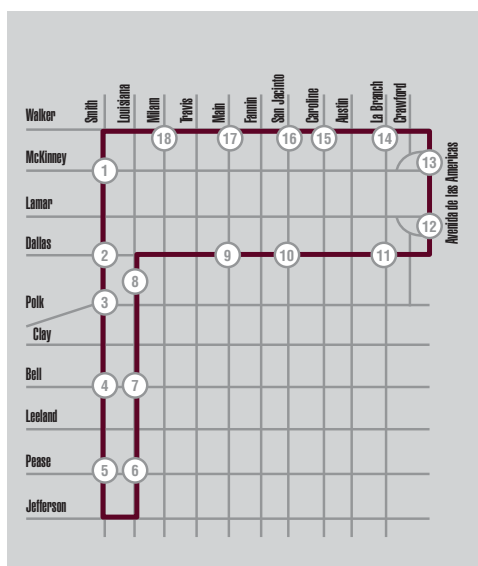
First aid is located in the front of Hall C.

## GREENLINK BUSES

### Free transportation in Downtown Houston

Seven buses operate in Downtown Houston Monday - Friday, 6:30 A.M. to 6:30 P.M., about 7-10 minutes apart. The route spans 2.5 miles with 18 stops and connects Metro transit stops, the convention corridor, hotels, restaurants, shopping and entertainment.

Greenlink buses stop at popular downtown destinations including GreenStreet, George R. Brown Convention Center, Discovery Green, Main Street Square, City Hall and the Central Library and connects to Metro Park & Ride services and to the Main Street MetroRail line. The buses run on Compressed Natural Gas (CNG), making them a cleaner transportation alternative. Features of the buses include a streamlined, modern design, low-floor access, perimeter seating, high-quality air conditioning, 28-seat capacity, a front-mounted bike rack. Buses are ADA compliant.



## SYMPOSIA PROCEEDINGS

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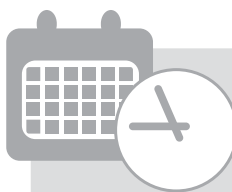
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