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 46TH Turbomachinery and 33RD Pump Symposia!

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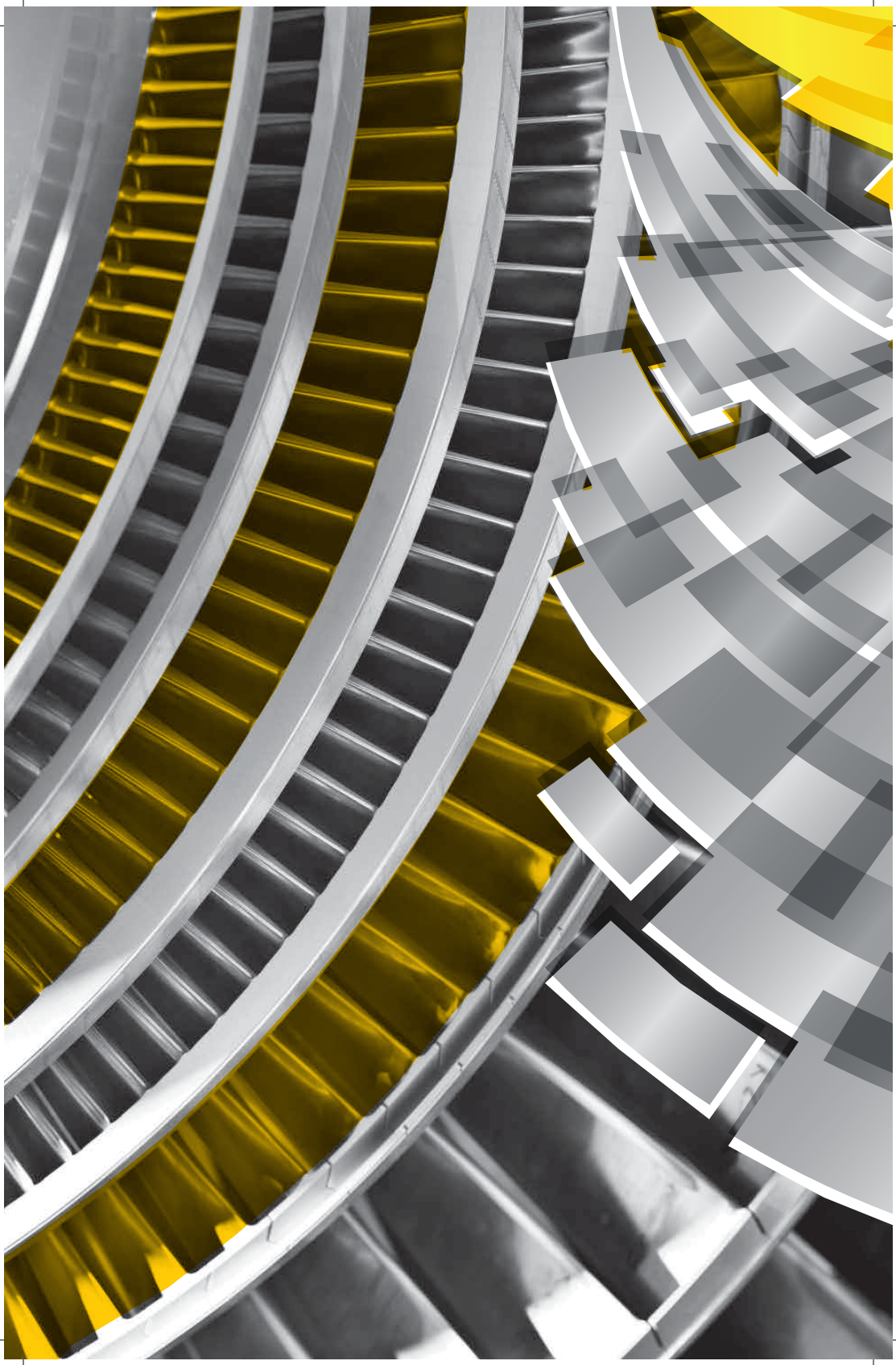

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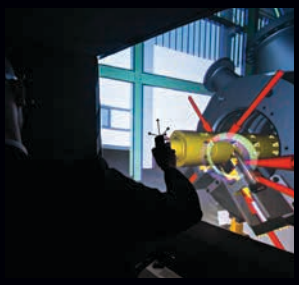

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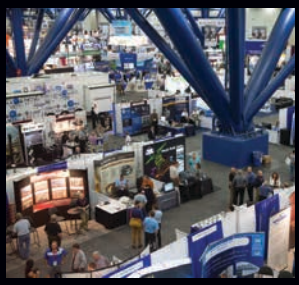

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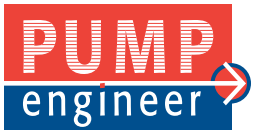
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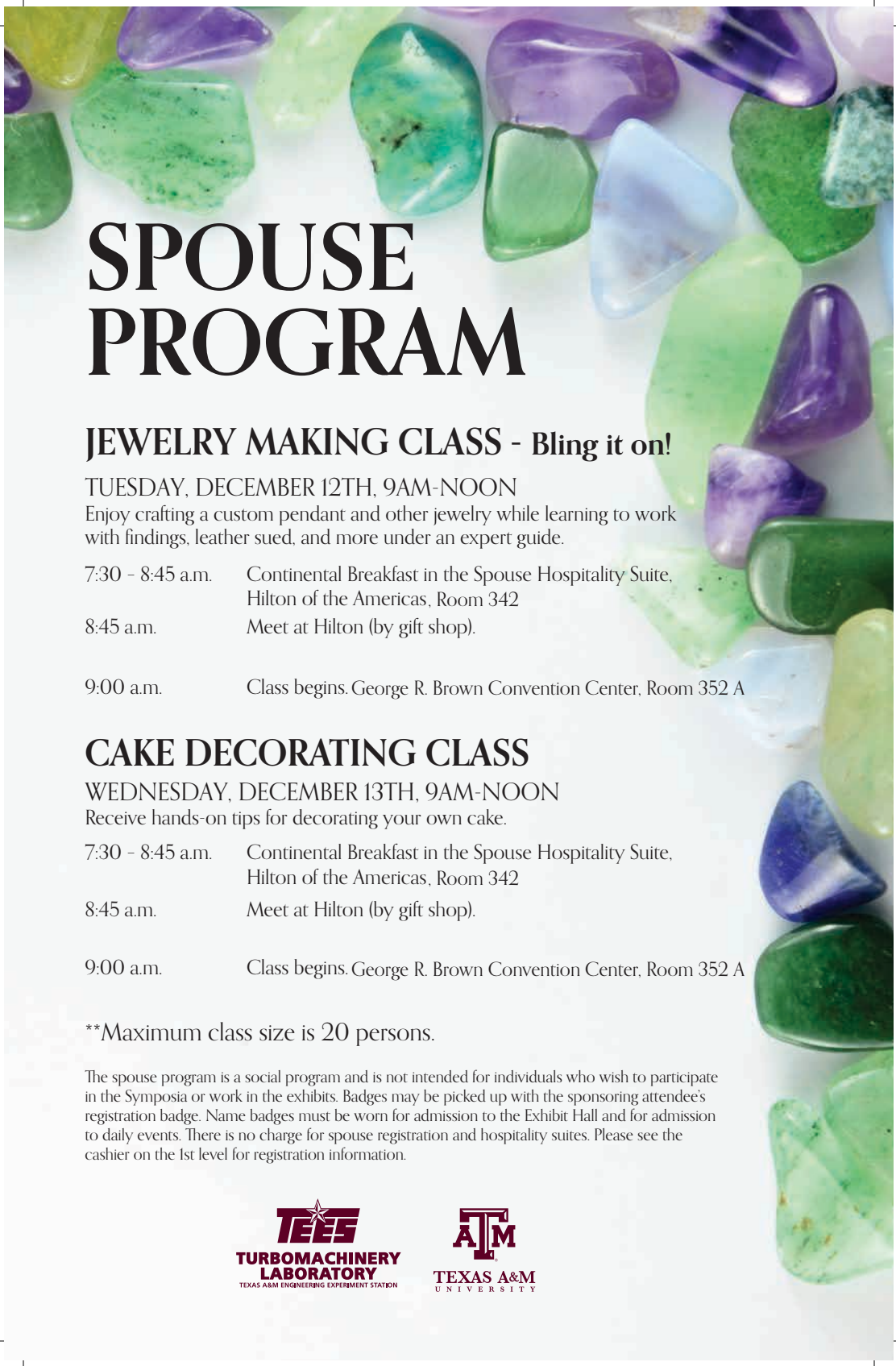

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JEWELRY MAKING CLASS - Bling it on!

TUESDAY, DECEMBER 12TH, 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, Room 342
8:45 a.m.	Meet at Hilton (by gift shop).
9:00 a.m.	Class begins. George R. Brown Convention Center, Room 352 A

CAKE DECORATING CLASS

WEDNESDAY, DECEMBER 13TH, 9AM-NOON

Receive hands-on tips for decorating your own cake.

7:30 - 8:45 a.m.	Continental Breakfast in the Spouse Hospitality Suite, Hilton of the Americas, Room 342
8:45 a.m.	Meet at Hilton (by gift shop).
9:00 a.m.	Class begins. George R. Brown Convention Center, Room 352 A

**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.

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Publications of our TPS 2017 media partners are located in the bins at the back of Hall B.

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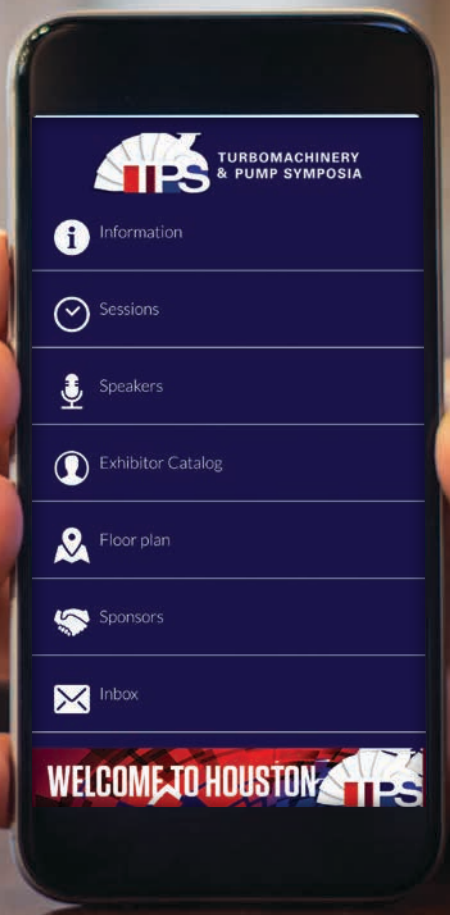

Let's Connect

HOW TO DOWNLOAD THE TPS MOBILE APP

For Apple and Android devices, visit your app store and search TPS2017.

Find the TPS logo and select "Get."

Allow push notifications for reminders and important updates throughout the symposia!

Need assistance downloading the app? Visit a Turbo Lab representative at Booth 2411

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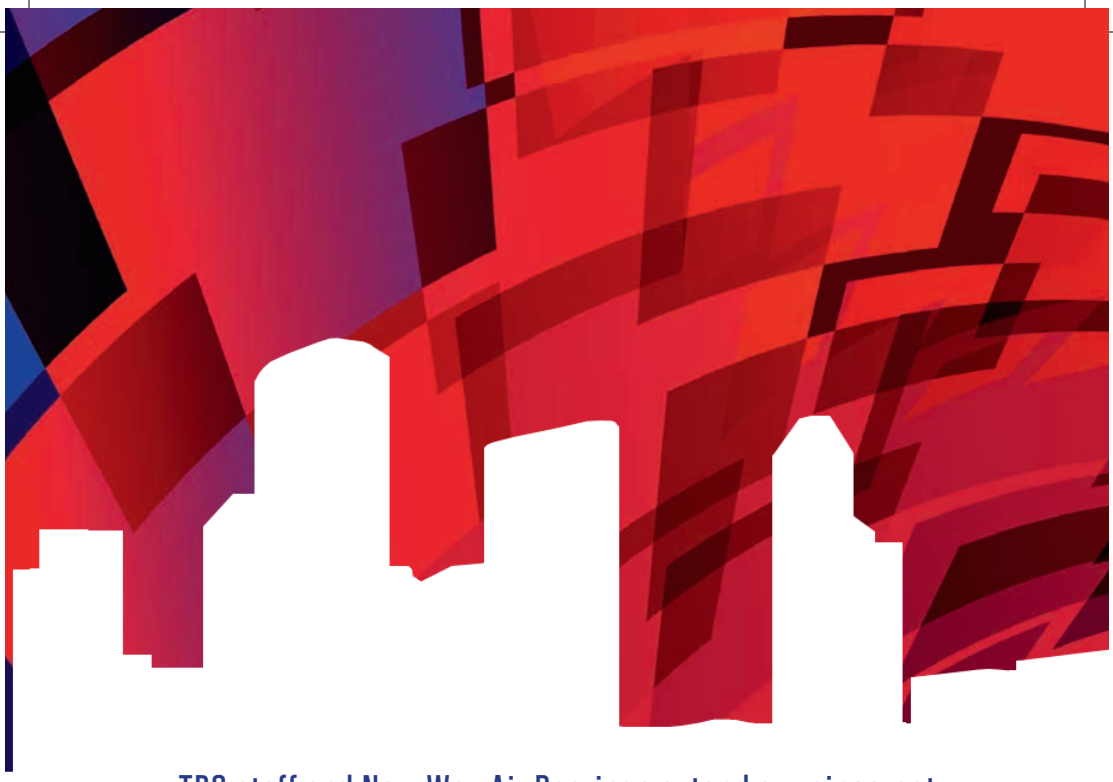

TPS staff and New Way Air Bearings extend our sincerest thanks to each of the companies and individuals who have contributed to the TPS Helps Houston relief effort in the aftermath of Hurricane Harvey. We are encouraged by your willingness to step up on behalf of our Houston friends. It is an honor to partner with you all, and to call Houston the home of the Turbomachinery & Pump Symposia.
We are **#HoustonStrong**.

tps.tamu.edu/updates #TPSHelpsHouston #HoustonStrong

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TURBOMACHINERY & PUMP SYMPOSIA

SCHEDULE
AT A GLANCE

Sunday, December 10, 2017

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

Monday, December 11, 2017

7:00 A.M. - 12:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
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.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
1:30 P.M. - 5:00 P.M.	All Leader Registration	Level 3, Room 340A
5:00 P.M. - 5:30 P.M.	Turbo Advisory Committee Meeting	Level 3, General Assembly C
5:30 P.M. - 6:00 P.M.	Pump Advisory Committee Meeting	Level 3, General Assembly C

Tuesday, December 12, 2017

7:00 A.M. - 7:45 A.M.	Leader Breakfast	Level 2, Hilton Ballroom of the Americas D
7:30 A.M. - 5:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
7:30 A.M. - 5:00 P.M.	All 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 Hall B
12:00 P.M. - 2:00 P.M.	Lunch & Exhibits Open to Paid Delegates	Level 1, Exhibit Hall B
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 C
6:30 P.M.	Hospitality Suites	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)	Level 2, Hilton Ballroom of the Americas A

Wednesday, December 13, 2017

7:30 A.M. - 8:15 A.M.	Leader Breakfast	Level 2, Hilton Ballroom of the Americas D
8:00 A.M. - 5:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
8:00 A.M. - 5:00 P.M.	All Leader Registration	Level 3, Room 340A
8:00 A.M. - 5:00 P.M.	Booth Selections for 2018	Level 1, Exhibit Hall B, Exhibitor Registration Counter
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 Hall B
12:00 P.M. - 2:00 P.M.	Lunch & Exhibits Open to Paid Delegates	Level 1, Exhibit Hall B
2:00 P.M. - 3:30 P.M.	Symposia Technical Sessions	Level 3
2:30 P.M. - 6:30 P.M.	Exhibits Open Free to Public	Level 1, Exhibit Hall C
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)	Level 4, Hilton Grand Ballroom

Thursday, December 14, 2017

7:30 A.M. - 8:15 A.M.	Leader Breakfast	Level 2, Hilton Ballroom of the Americas D
8:00 A.M. - 11:00 A.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
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 2018	Level 1, Exhibit Hall B, Exhibitor Registration Counter
9:30 A.M. - 12:00 P.M.	Exhibits Open Free to Public	Level 1, Exhibit Hall C
12:00 P.M. - 2:00 P.M.	Turbo and Pump Advisory Committee Luncheon	Level 3, Room 330A

HAVE YOU RESERVED YOUR BOOTH FOR TPS 2018?

Visit the Exhibitor Registration Counter in Hall B to book before you leave TPS 2017

Wednesday, 8 A.M. – 5 P.M.
Thursday, 8 – 11 A.M.

TPS

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, providing practical answers to critical state and national needs.

Monday, December 11, 2017

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	Level 3, 352A

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/**

TURBO
STAGE SCHEDULE

Tuesday, December 12, 2017

3:30 P.M. - 3:50 P.M.	EOS – Josh Dennis "Additive Manufacturing Solutions"
4:00 P.M. - 4:20 P.M.	Texas Business Radio – Matt Register "Your Business Exit May Not Look Like What You Have Pictured"
4:30 P.M. - 4:50 P.M.	SKF (Kaydon Ring & Seal Group) "Best Practices, Compressor Seal Removal & Installation"
5:00 P.M. - 5:20 P.M.	CFturbo GmbH – Ralph-Peter Mueller "Design and Optimization of Contra-Rotating Fans"
5:30 P.M. - 5:50 P.M.	Voith – Martin Tilscher "VECO Drive"

Wednesday, December 13, 2017

3:00 P.M. - 3:20 P.M.	Honeywell Performance Materials & Technologies – Bret Walter "Honeywell Experion PKS Turbomachinery Control Solution"
3:30 P.M. - 3:50 P.M.	Turbomachinery Laboratory – Dr. Brian Murphy "XLTRC2 – Updates"
4:00 P.M. - 4:20 P.M.	Burckhardt Compression – Heinz Meier "Advanced Service for High Pressure Compressors"
4:30 P.M. - 4:50 P.M.	Alta Solutions Inc. – Robert Mihata "Next Generation API 670 Machinery Protection System"
5:00 P.M. - 5:20 P.M.	Exact Metrology Inc. – Michael Trudeau "3D Scanning"
5:30 P.M. - 5:50 P.M.	Concepts NREC – George Zitka "Fine/Agile™ for Pumps"

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HOSPITALITY SUITES
SCHEDULE

Tuesday, December 12, 2017		
6:00 P.M. - 11:00 P.M.	Afton Pumps, Inc.	340AB
6:30 P.M. - 9:30 P.M.	Compressor Controls Corporation.	Presidential Suite #22029
6:30 P.M. - 10:00 P.M.	MHI Compressor International Corporation	BOA D

Wednesday, December 13, 2017		
6:30 P.M. - 10:00 P.M.	York Process Systems	Presidential Suite #21029

All Hospitality Suites are located in the Hilton Americas.

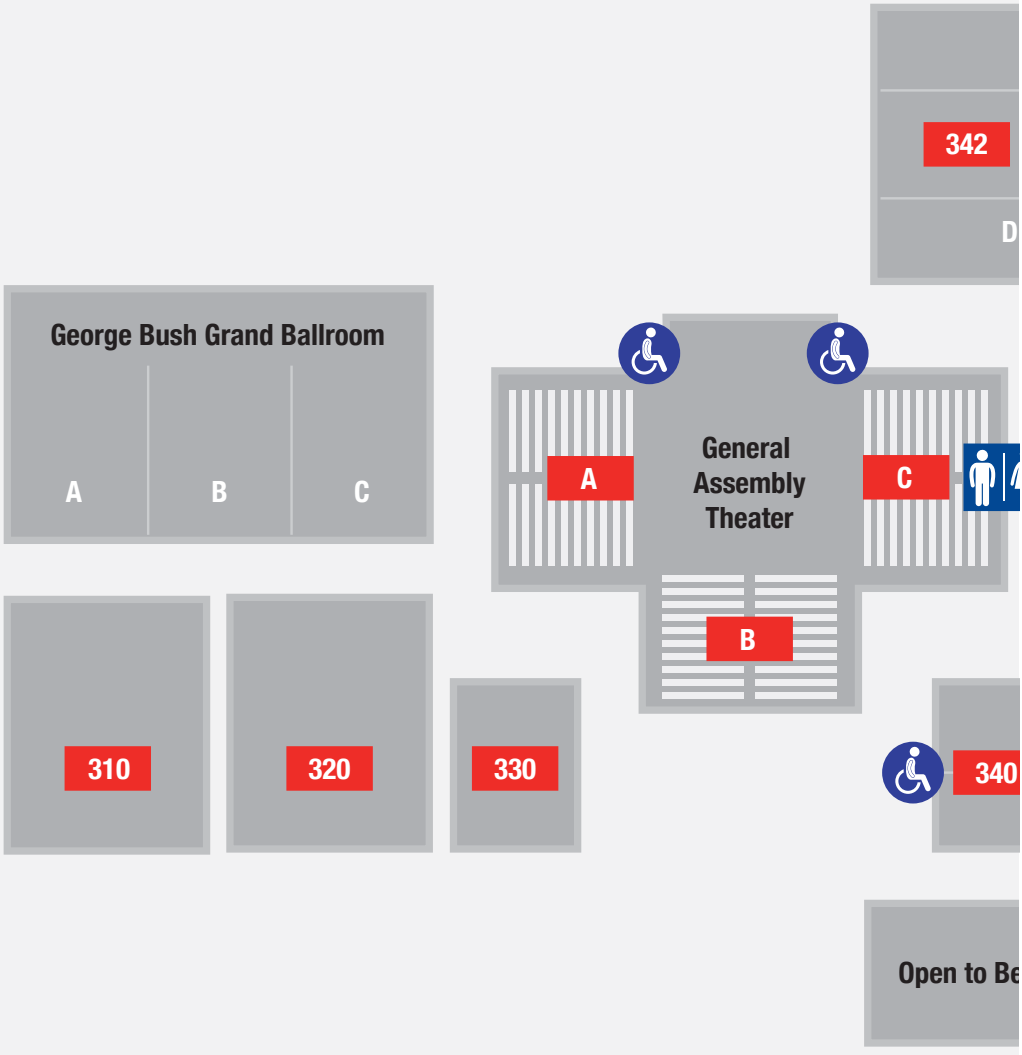
PLAN YOUR SCHEDULE

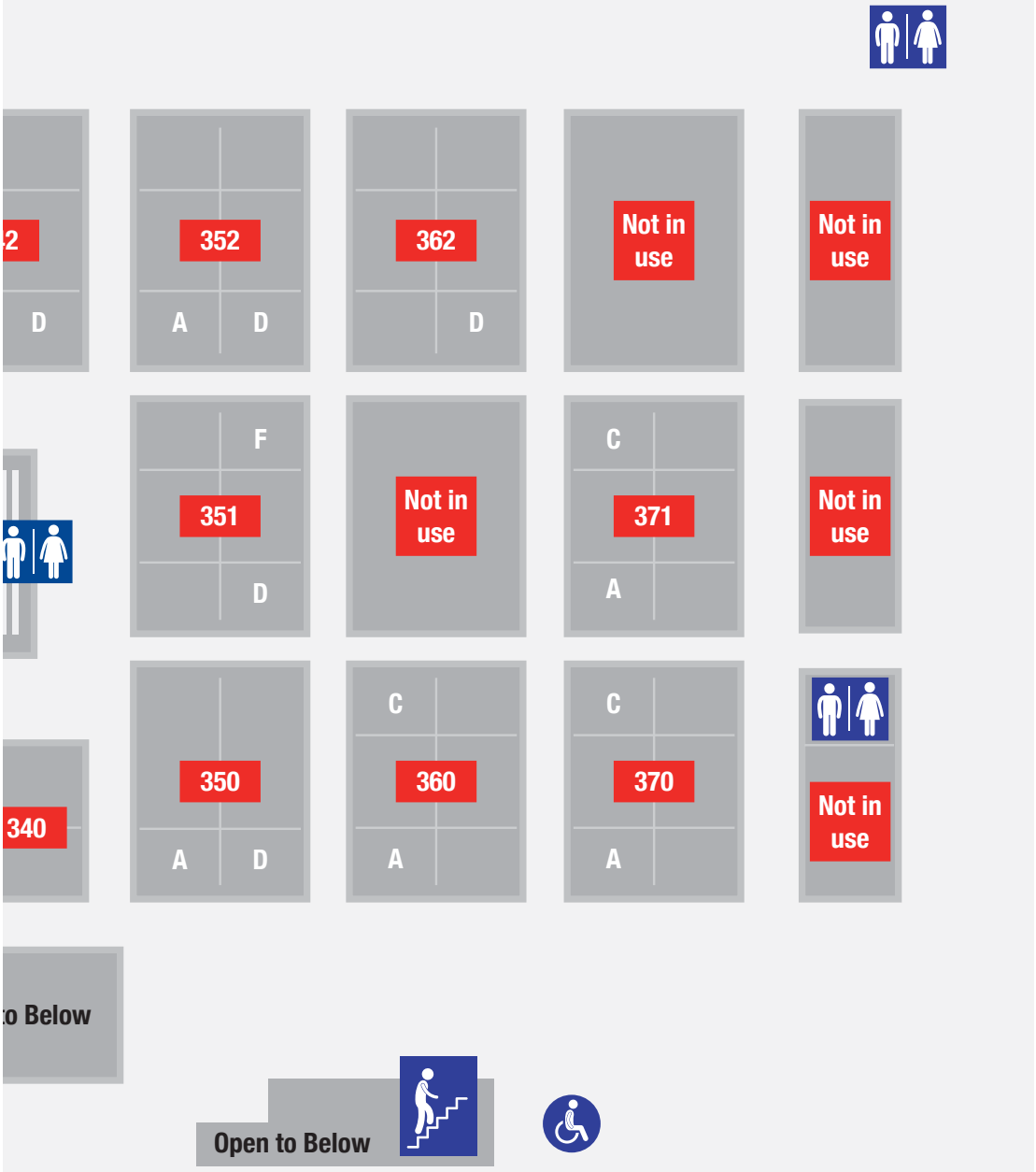
TUESDAY

REGISTRATION	7:30 A.M. – 5:00 P.M.
8:30 A.M. – 12:00 P.M. LECTURES / TUTORIALS / DISCUSSION GROUPS / CASE STUDIES * 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.	**8:00 A.M. – 8:35 A.M.** **Welcome Address**
10:00 A.M. – 10:30 A.M.	**Refreshment Break**
12:00 P.M. – 2:00 P.M.	**Lunch & Exhibits Open to Paid Delegates**
2:00 P.M. – 3:30 P.M. LECTURES / TUTORIALS / DISCUSSION GROUPS	
2:30 P.M. – 7:00 P.M. Exhibit Hall will close at 6:30 P.M. on Wednesday	**Exhibits Open**
7:30 P.M.	**Buffet at Hilton**

WEDNESDAY	THURSDAY
8:00 A.M. – 5:00 P.M.	**8:00 A.M. – 12:00 P.M.**
	9:30 A.M. – 12:00 P.M. **Exhibits Open**
Refreshment Break	**Refreshment Break**
Lunch & Exhibits Open to Paid Delegates	**Symposia Ends at Noon**
Exhibits Open	
Banquet at Hilton	

CONVENTION CENTER
MAP LEVEL3

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WEDNESDAY | 7:30-9 P.M.

LEVEL 4, HILTON GRAND BALLROOM

DOORS OPEN AT 7:15 P.M.

NO ADMITTANCE AFTER 7:45 P.M.

BADGES REQUIRED; NOT OPEN TO FREE PASS.

Dr. Childs will retire following the completion of the 46th Turbomachinery & 33rd International Pump Users Symposia (TPS 2017).

TURBO
DAILY SCHEDULE

SUNDAY, DECEMBER 10, 2017

4:30 P.M. – 6:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A

MONDAY, DECEMBER 11, 2017

7:00 A.M. – 12:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:30 A.M. – 5:00 P.M. | SHORT COURSES	
Short Course 1 Vibration Problems and Solutions for Pumps and Other Turbomachinery	Level 3, Room 330A
Short Course 2 Steam Turbine 101/201 Combined, Basic Knowledge of Steam Turbine	Level 3, Room 350D
Short Course 3 Centrifugal Compressors 101	Level 3, Room 360A
Short Course 4 Centrifugal Compressors 201	Level 3, Room 360C
Short Course 5 An Introduction to Hydrodynamic Bearings as Used in Industrial Turbomachinery	Level 3, Room 351D
Short Course 6 Lateral Rotordynamics of Petrochemical Equipment - Review, Examples and Problems	Level 3, Room 351F
Short Course 7 LNG Liquefaction Plants - Overview, Design and Operation	Level 3, Room 352 D
Short Course 8 Gas Turbines – Fundamentals of Design, Operation and Maintenance	Level 3, Room 342 D

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	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
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. | TURBO COMMITTEE MEETING	
Turbomachinery Advisory Committee Meeting	Level 3, General Assembly C
5:30 P.M. – 6:00 P.M. | PUMP COMMITTEE MEETING	
Pump Advisory Committee Meeting	Level 3, General Assembly C

TUESDAY, DECEMBER 12, 2017

7:00 A.M. – 7:45 A.M. | BREAKFAST	
Leader Breakfast	Level 2, Hilton Ballroom D
7:30 A.M. – 5:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:00 A.M. – 8:35 A.M. | WELCOME	
Welcome Address	Level 3, General Assembly Theater C

8:45 A.M. – 10:15 A.M. | TECHNICAL SESSIONS	
Lecture 1 Torsional Modal Damping of a LCI Driven Geared Moto-Compressor Train: Evaluation, Optimization Criteria and Active Control	Level 3, Room 360A
Lecture 2 Forced Response Analysis in a Full-Scale Multistage Centrifugal Compressor: Impeller Vibration Prediction and Validation	
Tutorial 1 Optimizing Component Selection in Synchronous Motor Compressor Trains Based on Technical and Financial Considerations	Level 3, Room 351D
Discussion Group 4 Lubrication	Level 3, Room 370A
Discussion Group 9 Dry Gas Seals for Compressors	Level 3, Room 362D
Discussion Group 10 Integrally Geared Compressors	Level 3, Room 371C
10:15 A.M. – 10:30 A.M. | BREAK	
Refreshment Break	Level 3, Lounge Area
10:30 A.M. – 12:00 P.M. | TECHNICAL SESSIONS	
Lecture 3 A More Comprehensive Evaluation of Equation of State influences on Compressor Performance Determination	Level 3, Room 360A
Lecture 4 Improving LNG Facility Reliability and Operability Via OEM integrated Compressor Controls	
Tutorial 2 Torsional Excitation Upon Short-Circuit in Induction Motors in Conventional and High-Speed Trains	Level 3, Room 351D
Tutorial 3 Turbomachinery Overview for Supercritical CO2 Power Cycles	Level 3, Room 351F
Discussion Group 3 Gears	Level 3, Room 370A
Discussion Group 14 Gas Turbine Operation and Maintenance	Level 3, Room 370C
Discussion Group 15 Steam Turbine Design, Operation, and Maintenance	Level 3, Room 371A
12:00 P.M. – 2:00 P.M. | LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall B
2:00 P.M. – 3:30 P.M. | TECHNICAL SESSIONS	

Lecture 5 High Frequency Vibrations on Gears	Level 3, Room 360A
Lecture 6 Experimental Evaluation of Mechanical Reliability of the Impeller Blade for Large Integrally Geared Compressors	
Tutorial 4 Tutorial on Large Steam Turbine Systems in Oil & Gas Applications	Level 3, Room 351D
Tutorial 5 Assessing and Computing the Safety Integrity Level (SIL) for Turbo Machinery Protection	Level 3, Room 351F
Discussion Group 1 Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 371A
Discussion Group 2 Couplings and Alignment	Level 3, Room 370A
Discussion Group 6 Reciprocating Compressor	Level 3, Room 371C
Discussion Group 7 Advanced Topics in Centrifugal Compressor Design	Level 3, Room 362D
2:30 P.M. – 7:00 P.M. | EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall C
6:30 P.M. | HOSPITALITY SUITE	
Hospitality Suite	See Hospitality Suite Schedule on Page 20
7:30 P.M. – 9:00 P.M. | DINNER	
Tex-Mex Buffet (Badge required, not open to Free Pass)	Level 2, Hilton Ballroom A

WEDNESDAY, DECEMBER 13, 2017

7:30 A.M. – 8:15 A.M. | BREAKFAST	
Leader Breakfast	Level 2, Hilton Ballroom D
8:00 A.M. – 5:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:00 A.M. – 1:00 P.M. | BOOTH SELECTION	
Booth Selections for 2018	Level 1, Exhibit Hall B, Exhibitor Registration Counter
8:30 A.M. – 10:00 A.M. | TECHNICAL SESSIONS	
Lecture 7 Design and Testing of a High-Pressure-Ratio Centrifugal Stage Probing the Aerodynamic & Mechanical Limit	Level 3, Room 360A
Lecture 8 Advancing Compressor Dynamic Simulation Fidelity with Use of Field Data	
Tutorial 6 Electric-Motor-Driven Gas Compressor Packages: Starting Methods for Large Electrical Motors and Torsional Integrity	Level 3, Room 351D
Tutorial 7 Turbomachinery Control Valves - Sizing and Selection	Level 3, Room 351F
Discussion Group 8 Turbo Expanders & PRTs	Level 3, Room 370C
Discussion Group 11 Turbomachinery Bearings and Annular Seals	Level 3, Room 371C
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 Electrical Damping of VFD Induced Torsional Torque Pulsations in a LCI Driven Compressor Drive Train	Level 3, Room 360A
Lecture 10 Subsynchronous Shaft Vibration in an Integrally Geared Expander-Compressor Due to Vortex Flow in an Expander	
Tutorial 8 A CFD Primer: What Do All Those Colors Really Mean?	Level 3, Room 351D
Tutorial 9 Strategies to Prevent Sudden Catastrophic Compressor Failures During Transient Operating Conditions	Level 3, Room 351F
Discussion Group 13 Screw Compressors	Level 3, Room 371C
Discussion Group 16 Compressor Controls	Level 3, Room 370C

12:00 P.M. – 2:00 P.M. | LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall B
2:00 P.M. – 3:30 P.M. | TECHNICAL SESSIONS	
Lecture 11 Rotordynamic Test Results From a High Flexibility Ratio - High Pressure Fully instrumented Centrifugal Compressor Test Vehicle	Level 3, Room 360A
Tutorial 10 Centrifugal Compressor Performance Making Enlightened Analysis Decisions	Level 3, Room 351D
Tutorial 11 Range v. Efficiency -- Striking the Proper Balance	Level 3, Room 351F
Discussion Group 1 Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 371A
Discussion Group 4 Lubrication	Level 3, Room 370A
Discussion Group 5 Overspeed Trip Systems	Level 3, Room 370C
Discussion Group 12 Protection Systems Integrity	Level 3, Room 371C
2:30 P.M. – 6:30 P.M. | EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall C
6:30 P.M. | HOSPITALITY SUITE	
Hospitality Suite	See Hospitality Suite Schedule on Page 20
7:30 P.M. – 9:00 P.M. | BANQUET (No entry after 7:45 P.M.)	
Banquet (Badge required, not open to Free Pass)	Level 4, Hilton Grand Ballroom

THURSDAY, DECEMBER 14, 2017

7:30 A.M. – 8:15 A.M. | BREAKFAST	
Leader Breakfast	Level 2, Hilton Ballroom D
8:00 A.M. – 11:00 A.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:00 A.M. – 11:00 A.M. | BOOTH SELECTION	
Booth Selections for 2018	Level 1, Exhibit Hall B, Exhibitor Registration Counter
8:30 A.M. – 10:00 A.M. | TURBO CASE STUDY SESSION 1A	
Case Study 1 Torsional Failure on Reciprocating Compressor Package	Level 3, Room 360A
Case Study 2 Pelletizer Motor Bearing Damage Detection Based on Vibration Data	
Case Study 3 Prediction and Mitigation of High Radial Vibrations During Hot Restart of Centrifugal Compressors	
8:30 A.M. – 10:00 A.M. | TURBO CASE STUDY SESSION 1B	
Case Study 4 Thrust Balance Line Bolts Failure	Level 3, Room 350D
Case Study 5 Reliability Improvement for Booster Reciprocating Compressor in CCR Reformer	
Case Study 6 Reciprocating Compressor Optimization	
Case Study 7 Severe Corrosion on Rotor Blades of Back Pressure Type Steam Turbine Due to Unique Reason - What Went Wrong?	
9:30 A.M. – 12:00 P.M. | EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall C
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 8 Damaged Compressor Stator Parts Resulting from Operation in Deep Choke	Level 3, Room 360A
Case Study 9 Compander Vibration Troubleshooting	
Case Study 10 Eliminating a Rotordynamic Instability of a 12 MW Overhung, Radial Inflow Expander	
Case Study 11 Gas Turbine With Rotor Crack – Vibration Diagnostics	
12:00 P.M. – 2:00 P.M. | COMMITTEE LUNCH	
Advisory Committee Luncheon	Level 3, Room 330A

SYMPOSIA AND EXHIBITS END AT NOON

TURBO
ADVISORY COMMITTEE

The 46th Turbomachinery Symposium is sponsored by the Turbomachinery Laboratory of the Texas A&M Engineering Experiment Station, The Texas A&M University System. 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 leaders 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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College Station, TX

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PETROBRAS SA
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James Huber
Air Liquide Large Industries
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TURBO
SHORT COURSES

SHORT COURSE 1

Vibration Problems and Solutions in Pumps and Other Turbomachines

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 330A

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

Steam Turbine 101/201 Combined, Basic Knowledge of Steam Turbine

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 350D

Instructors
Matt Walton, Kyoichi Ikeno, William Poppe, Kazuaki Sugimoto (Mitsubishi Heavy Industries Compressor Corporation)

Target Audience
This short curse is aimed at engineers, operations and maintenance personnel who need a broad-based introduction to mechanical drive steam turbine design, have a firm foundation in the basics associated with turbomachinery and mechanical engineering. This short course will provide the basic minimum knowledge of steam turbines from the design to the operation in half and more detail technical information, which will be useful design audit, trouble shooting, enhance participants, their own machines, how to approach in other half.

Description
It is shown as the outline in this short course that the role of steam turbine, history, classification, basic structure, components and their function, manufacturing and design process and control system. And also, the basic thermal cycle, flow dynamics, strength analysis are explained as the academic knowledge. Finally, the trend of development and the state-of-the-art technology as the latest technical information and the typical root cause analysis as the example of troubleshooting are provided.

SHORT COURSE 3

Centrifugal Compressors 101

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 360A

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, the attendees will hold a strong understanding of basic concepts. This knowledge will act as a springboard to further growth 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, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 360C

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

II. Performance and Mechanical Testing

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

III. 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

An Introduction To Hydrodynamic Bearings As Used In Industrial Turbomachinery

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 351D

Instructors
John Whalen (Consultant), Scan DeCamillo (Kingsbury Bearings), Barry Blair (Waukesha Bearings)

Description
This course is intended for engineers and technicians working with critical rotating equipment, it will also benefit managers and supervisors that have some rotating equipment responsibility.

While most of the material is introductory it will still provide a great refresher and perhaps some new information for the more experienced engineers.

Those attending will learn about the fundamentals of hydrodynamic lubrication and how that is utilized with bearings in industrial and power generation turbomachinery.

SHORT COURSE 6

Lateral Rotordynamics of Petrochemical Equipment - Review, Examples and Problems

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 351F

Instructors
John Kocur (ExxonMobil Research & Engineering), C. Hunter Cloud (BRG Machinery Consulting LLC)

Target Audience
This course is aimed at machinery and project engineers and technicians that need a basic understanding of critical speeds, response to unbalance, and stability of rotating machinery. The course is intended for the layman's approach to rotordynamics and its application to turbomachinery. The focus of the course will be the rotordynamic behavior of petrochemical gas handling rotating equipment; centrifugal/ axial compressors, pumps, steam/gas turbines and motors. However, the concepts presented can be applied to virtually any class of rotating equipment.

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, recently updated with several new case studies, 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 a key feature. 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

LNG Liquefaction Plants - Overview, Design and Operation

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 352D

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

Description
This short course is designed to provide attendees a practical overview of LNG Liquefaction covering the market, processes, key elements in a liquefaction plant with a focus on LNG turbomachinery. Operation and Maintenance issues will also be addressed. While the main focus will be on large scale LNG plants, mid and small scale facilities will also be addressed. Topics covered will include- drivers and compressors, the importance of efficiency and emissions, compressor design compromises, and operational and reliability issues. The area of DLN/DLE operation and tuning and fuel systems will also be covered.

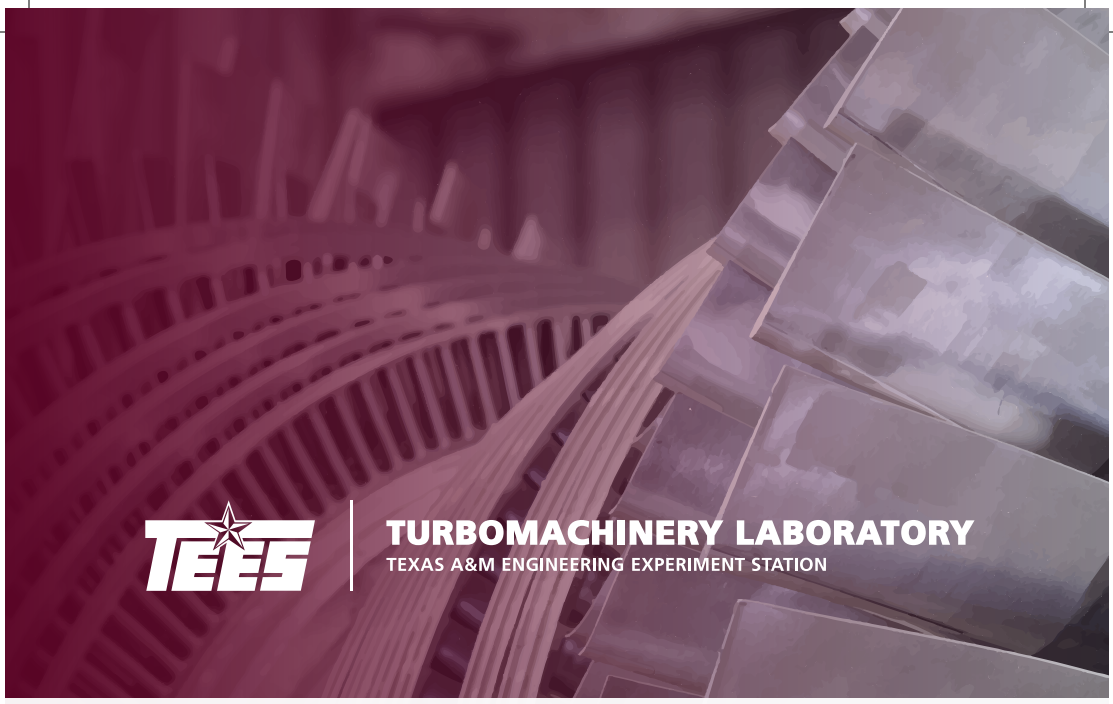
SHORT COURSE 8

Gas Turbines – Fundamentals of Design, Operation and Maintenance

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 342D

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.



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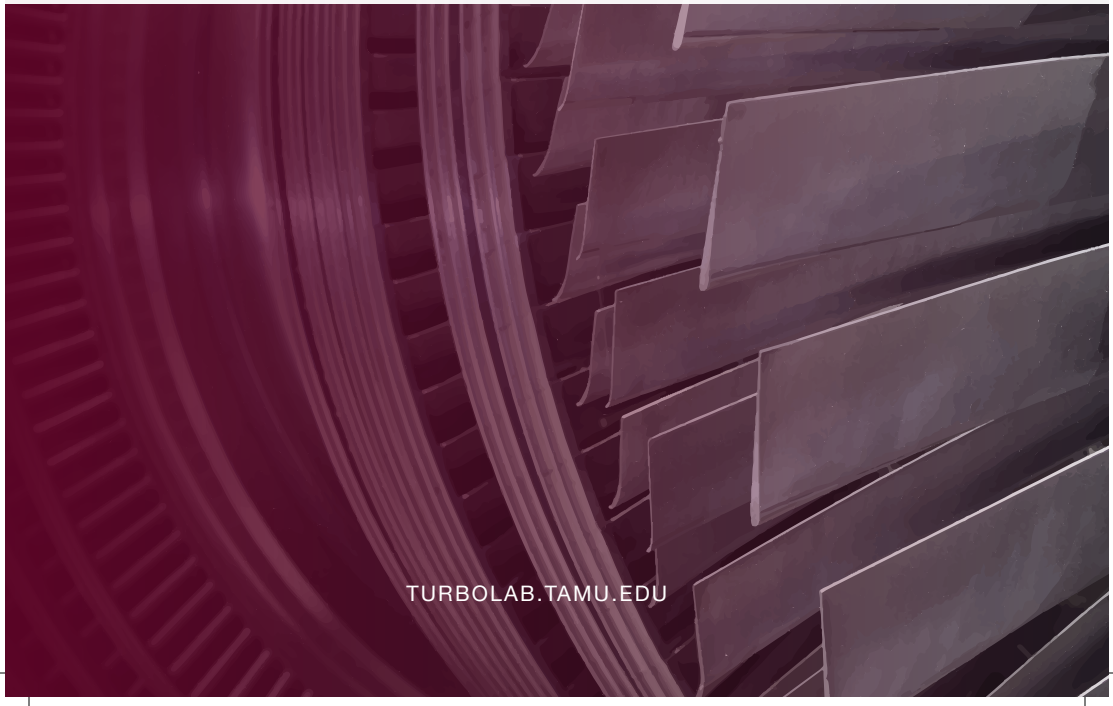

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TURBO LECTURES

LECTURE 1

Torsional Modal Damping of A LCI Driven Geared Moto-Compressor Train: Evaluation, Optimization Criteria and Active Control

Tuesday, December 12, 2017
8:45 A.M. – 10:00 A.M. | Room 360A

Instructors
Paolo Calore, Gaspare Maragioglio, Daniele Sgrò, Lorenzo Failla (GE Oil & Gas), Pierluigi Tenca (GE Global Research Center)

Description
This paper provides a comprehensive analysis of the key systems and parameters affecting the torsional modal response of a Load Commutated Inverter (LCI) driven motor-compressor, and gives practical guidelines for system design optimization. Besides, when the equipment inherent damping properties are not sufficient to achieve demanding vibration performances, an active control could be required: the real implementation of an active damping control system acting on the VSDS is therefore presented, showing its effectiveness on the torsional behavior of a real string by means of experimental results.

LECTURE 2

Forced Response Analysis In a Full-Scale Multistage Centrifugal Compressor: Impeller Vibration Prediction and Validation

Tuesday, December 12, 2017
8:45 A.M. – 10:00 A.M. | Room 360A

Instructors
Lorenzo Toni, Alberto Guglielmo, François Moyroud, Giuseppe Gatta, Tommaso Rubino, Giacomo Scarabello (GE Oil & Gas)

Description
This paper shows the results of an aeromechanical analysis conducted on a full-scale multistage centrifugal compressor. The predictive capability of impellers vibratory response is assessed: numerical results are validated against test data.

Three impeller modes are considered, two disk modes and one blade flexural mode. The predicted response matches remarkably well with tested data, demonstrating a significant progress in the prediction capability of aeromechanic phenomena. Both design and off-design conditions have been considered and the tested trends and absolute values are correctly captured. Together with aerodynamic damping prediction, numerical forced response analysis allowed building a “numerical” Goodman diagram.

This work confirms the level of maturity and accuracy of the prediction of forced response for impellers, which is fundamental to avoid mechanical failure and ensure reliability.

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

A More Comprehensive Evaluation of Equation of State Influences On Compressor Performance Determination

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 360A

Instructor
Mark Sandberg (Sandberg Turbomachinery Consulting, LLC)

Description
A previous paper addressed the impacts of using a number of different equations of state to calculate compressor performance parameters. Several more recent databases have become available in the literature that extend PVT data to higher pressures.

This investigation will provide relevant information on the following topics:

I. Provide an expanded evaluation and comparison between a number of commonly utilized equations of state and PVT data available in the open literature for a number of different gases and gas mixtures.

II. Describe a novel method to derive empirical departure enthalpy and entropy estimates from PVT data, effectively allowing a comparison between predicted and derived values.

III. Present a comparison of calculated compressor performance parameters for a range of typical compressor applications using the different equations of state examined.

LECTURE 4

Improving LNG Facility Reliability and Operability Via EM Integrated Compressor Controls

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 360A

Instructors
Daniele Galeotti, Antonio Baldassarre, Leonardo Baldassarre (GE Oil & Gas), Dave Ramlakhan, Hans Weyermann, Paul Broadway (ConocoPhillips)

Description
This paper will discuss a multi-string LNG compressor system's availability and reliability impact using an integrated compressor control and protection system. Leveraging knowledge gathered with operating LNG plants, several operability, system availability and reliability improving opportunities were identified and implemented in a new grass roots facility. The paper will present the execution of the control systems project from the early concept select phase to, front-end to detail engineering, testing, commission and start-up. It will also show the close integration for the control system design with the plant EPC activities.

LECTURE 5

High Frequency Vibrations on Gears

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 360A

Instructors
Dietmar Sterns (RENK), Michael Elbs (ISMB Dautermann)

Description
In the past, resonances in the acceleration signal of gear units were reported on rare occasions. The efforts to simulate those resonances analytically were not fully successful. Some of the frequencies observed could not be explained. And the thesis that they do not cause damage to the gears could not be proven.

Analytical and experimental investigations on high frequency vibrations and resonances on gear units. These investigations revealed that the Doppler effect has to be taken into account in order to understand the signature of the resonances of gear discs and proved that high acceleration peaks at gear mesh frequencies and their sidebands are not causing high stresses in the gears.

LECTURE 6

Experimental Evaluation of Mechanical Reliability of the Impeller Blade for Large Integrally Geared Compressors

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 360A

Instructors
Takuya Iwata, Yoshitaka Baba, Keiichi Saeki, Yuki Kameyama (Kobe Steel, Ltd.), Tsukasa Shiga (Kobelco Compressors America, Inc.)

Description
In this paper, using a non-contact blade vibration measurement that needs less effort to implement than strain gauges, the confirmation of the accuracy of the dynamic blade stress evaluation method and then mechanical reliability evaluation of large IGCs' impellers were described.

LECTURE 7

Design and Testing of a High-Pressure-Ratio Centrifugal Stage – Probing the Aerodynamic & Mechanical Limits

Wednesday, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 360A

Instructors
Jim Sorokes, Mark Kuzdzal, Dave Peer, Kirk Lupkes, Silvano Saretto, Ravi Srinivasan (Dresser-Rand – a Siemens Business)

Description
The design, manufacture and testing of a novel high-pressure-ratio, single-stage centrifugal compressor targeted for use in high molecular weight applications. The stage was designed to deliver a minimum pressure ratio of 10:1 while also providing sufficient flow range to ensure stable operation, i.e., usable surge margin and overload capacity. The paper describes the motivation for the work, as well as the aerodynamic and mechanical design processes employed including a brief review of the analytical tools used. The paper provides an overview of the test compressor, instrumentation, test loop and the data acquisition system, and addresses the "shake-down" testing performed. Test results from an enhanced design developed via aerodynamic optimization are also discussed.

LECTURE 8

Advancing Compressor Dynamic Simulation Fidelity With Use of Field Data

Wednesday, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 360A

Instructors
George Talabisco (Siemens/Dresser-Rand), Jon VanBuskirk (Dresser-Rand a Siemens Business)

Description
The ability of a dynamic simulation model for a centrifugal compressor train to accurately predict the compressor operating point and performance behavior with rapid speed decay during an emergency shutdown event is a complex task. The use of actual operating data to fine tune the transient behavior of a centrifugal compressor train simulation model during an emergency shutdown event is presented. Some of the important points required to obtain a higher degree of accuracy in a compressor dynamic simulation model are also presented.

LECTURE 9

Electrical Damping of VFD Induced Torsional Torque Pulsations In a LCI Driven Compressor Drive Train

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 360A

Instructors
Vijay Anantham Ganesan, Peter Kalbfleisch, Max Beuermann, Martin Hilscher (Siemens AG)

Description
The interharmonics pulsating torque excitations of the LCI drives are seen as a major limitation of such drives in regard to the torsional characteristics. The interharmonic behavior of a LCI drive will be explained together with the typical torsional characteristics of typical drive train involving turbo compressors. The currently employed methods by the turbomachinery engineers to overcome the interharmonic problems will be summarized. This paper then proposes a novel concept using active electrical damping, to eliminate the interharmonic torque components of a LCI drive. The results of employing this active damping technique in real plant are shown to demonstrate the effectiveness of the proposed damping concept.

LECTURE 10

Subsynchronous Shaft Vibration in an Integrally Geared Expander-Compressor Due to Vortex Flow in an Expander

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 360A

Instructors
Daisuke Hirata (Mitsubishi Heavy Industries Compressor Corporation (MCO)), Hirotaka Higashimori (MHI Solution Technologies CO., Ltd.), Naoyuki Nagai (Mitsubishi Heavy Industries, Ltd.)

Description
Subsynchronous shaft vibration was observed in an integrally geared expander-compressor when the machine was operated with a partial load in the course of plant start up. The root cause of the synchronous shaft vibration was identified as the vortex flow which was generated in the downstream piping of the gas expander wheel, by means of CFD analysis. OEM installed an object, called “vortex breaker”, in the piping in order to eliminate the excitation force of the vortex flow, and as the result, the subsynchronous shaft vibration disappeared. This paper provides the detailed shaft vibration data, root cause analysis, countermeasure and the result from the countermeasure.

LECTURE 11

Rotordynamic Test Results From a High Flexibility Ratio - High Pressure Fully Instrumented Centrifugal Compressor Test Vehicle

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 360A

Instructors
Giuseppe Vannini, Antonio Pelagotti, Emanuele Rizzo, Carmine Carmicino (GE Oil & Gas)

Description
The need for "Power Density" centrifugal compressors has increased in the recent years so the Authors' Company has developed a Centrifugal Compressor Test Vehicle (CCTV) to perform an extensive full speed-full load test campaign aimed to reinforce rotordynamic predictability and to push the current technology boundaries. The CCTV is a dedicated test article configured with a casing designed for 650bar and an interchangeable bundle to easily switch among different test configurations. The test program has spread over several years and allowed to validate different components and mechanical configurations such as: direct lube journal bearings, swirl brakes equipped impeller eye laby seals, Integral Squeeze Film Damper. An extensive set of instrumentation (e.g. clearance probes on honeycomb seal) was instrumental for this effort.

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TURBO TUTORIALS

TUTORIAL 1

Optimizing Component Selection In Synchronous Motor Compressor Trains Based On Technical and Financial Considerations

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 351D

Instructors
Martin Maier, Garry Studley (Dresser-Rand Business, Part Of Siemens Power and Gas)

Description
Compressor trains driven by constant speed synchronous motors need to be designed to withstand high levels of oscillating torque when started across-line. The importance of accurately predicting peak torque levels at resonance is critical for proper component selection to produce a technically acceptable design in the most cost effective manner. This procedure is illustrated using a 6 MW, 4-pole, synchronous motor train as an example. Eleven different means were investigated to address the peak torques and associated stress levels. The size and cost of each major train component were evaluated to determine the best solution for the client. The results of the preliminary evaluation, traditional torsional analysis and coupled torsional-lateral analysis were compared and discussed.

TUTORIAL 2

Torsional Excitation Upon Short-Circuit in Induction Motors - In Conventional and High-Speed Trains

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 351D

Instructors
Tuomo Aho, Christopher Baum (MAN Diesel & Turbo Schweiz AG), Janne Nerg (Lappeenranta University of Technology)

Description

Short-circuit excitation torque when the induction motor is either Direct On-Line connected or supplied by a VFD is discussed. A special focus is put on the on the high-speed induction motor application. Tutorial explains influence of the motor equivalent circuit parameters on the short-circuit torque. Different methods for the short-circuit excitation torque calculation and influence on the mechanical torsional rotor-dynamic system are presented. Modeling and parameters of the torsional calculation as well as design considerations required by different train configurations are discussed.

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

TUTORIAL 3

Turbomachinery Overview for Supercritical CO2 Power Cycles

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 351F

Instructors
Tim Allison, Jeff Moore, Jason Wilkes, Klaus Brun (Southwest Research Institute)

Description
Supercritical CO2 (sCO2) power cycles offer high efficiency and power density relative to the incumbent Steam Rankine and Air Brayton cycles for power generation over a wide range of applications, including waste heat recovery, concentrating solar power, nuclear, and fossil energy. The compact machinery reduces material costs and is also beneficial in low-space and potentially low-weight applications. The combinations of pressure, temperature, and density in sCO2 power cycles are outside the experience base of existing turbomachines, and sCO2 turbomachinery design is a significant challenge for realizing these cycles. This tutorial provides an overview of sCO2 cycles and associated turbomachinery, including specific details for common challenges including rotordynamics, pressure containment, sealing, thermal management, and transient/off-design operation are presented.

TUTORIAL 4

Tutorial On Large Steam Turbine Systems In Oil & Gas Applications

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 351D

Instructors
Mounir Mossolly, Emmanuel Bustos, Guillaume Herve (TechnipFMC)

Description
This tutorial provides an overview on large steam turbines systems and their auxiliaries in oil and gas applications from a Contractor perspective. The tutorial is introduced by discussing the basics of steam turbine systems including thermodynamics background, principles of operation, and the different classifications of steam turbines. The steam turbine arrangements are discussed explaining differences in casings and internals design and also the various possibilities of shaft line arrangements. Then all the auxiliary systems; and their sub-systems, that are associated with steam turbines are illustrated in details. Particular issues such as plot plan constraints, precautions for offshore applications, human factors and safety are also addressed with explanations in this tutorial. And finally shop testing, installation, pre-commissioning and commissioning of large steam turbine systems are clarified.

TUTORIAL 5

Assessing and Computing the Safety Integrity Level (SIL) for Turbo Machinery Protection

Tuesday, December 12, 2017
2:00 PM – 3:30 PM | Room 351F

Instructors
Curtis Miller (SIS SILverstone LLC), Justin Kassie (Tesoro), Daniel Poston (LyondellBasell)

Description
The application of Safety Integrity Level (SIL) to support risk management strategy on turbo machinery protection systems is relatively new to the process industry. Few end users and manufacturers fully understand the methodology used for determining, assessing and computing the SIL of protection systems on their machines.

TUTORIAL 6

Electric-Motor-Driven Gas Compressor Packages: Starting Methods for Large Electrical Motors and Torsional Integrity

Wednesday, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 351D

Instructors
Rainer Kurz, Balaji Venkataraman (Solar Turbines Incorporated), Ge Juan Cole (Williams Gas Pipeline), Michael Glasbrenner (Voith)

Description
Electric Motor Drives in the power range from 1,000 to 60,000 HP are often used for turbomachinery applications. The electric drive systems used include electric motors with variable frequency drives (VFD), electric motors with variable speed planetary gear hydraulic drives (VSHD), and constant speed electric motors.

First, the startup has to be accomplished without exceeding the maximum permissible voltage dip limits at the point of common coupling (PCC). Second, the choice of drive impacts the train's torsional characteristics, shaft endurance limits and operational flexibility. Torsional integrity of the electric motor driven trains are critical to safe and reliable operation, and must be considered during the design, selection and packaging of the train's key components. Both topics are explained and discussed in detail.

TUTORIAL 7

Turbomachinery Control Valves - Sizing and Selection

Wednesday, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 351F

Instructors
Medhat Zaghloul and Wayne Jacobson (Compressor Controls Corporation)

Description
Turbomachinery controls dedicated to centrifugal and axial compressors use several types of control valves, such as: antisurge (recycle), suction throttle, hot-gas bypass and quench control valves. As the final control element in its control loop, these control valves are vital to implementing good turbomachinery controls. This tutorial will examine the control objective of each type of valve, its ideal location relative to the compressor and the optimum performance characteristics for the valve. Valve selection criteria and sizing methodologies with examples will be addressed and recommendations for valve noise abatement will be provided, as well as valve noise-abatement pitfalls that should be avoided will be identified.

TUTORIAL 8

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

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 351D

Instructors
Jim Sorokes (Dresser-Rand), James Hardin (The Elliott Group), Brad Hutchinson (Ansys, Inc. - Retired)

Description
This tutorial provides a general overview of computational fluid dynamics (CFD). It is not intended for CFD experts but rather for those seeking answers to questions such as:

- What is the role of CFD in the design / analysis process?
- What is CFD?
- What benefits can be derived from CFD?
- What are the typical deliverables from CFD?

In addition to answering the above questions, the session will also offer several sample cases illustrating some practical applications of CFD in day-to-day design, analysis and trouble-shooting processes.

TUTORIAL 9

Strategies To Prevent Sudden Catastrophic Compressor Failures During Transient Operating Conditions

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 351F

Instructor
Patrick Smith (Air Products & Chemicals)

Description
Many compressor failures occur during transient operating conditions. In this tutorial four case studies will be presented. Each case study will describe a different compressor failure that occurred during a transient operating condition. And in each case, it will be described how simple changes in machinery condition monitoring, machinery protection and maintenance strategies could have prevented these failures. The purpose of this tutorial is to describe how these strategies can be applied to other compressors to prevent failures or minimize damage if a problem occurs, without adding significant cost or complexity, or causing nuisance trips.

TUTORIAL 10

Centrifugal Compressor Performance Making Enlightened Analysis Decisions

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 351D

Instructors
Fred Evans and Spencer Huble (Chiyoda International Corp.)

Description
Historical background of centrifugal compressor aerodynamic analysis development introduces eight calculation methods for polytropic performance. The results are shown via a direct comparison of examples illustrating trends. The small stage method is shown to be a highly accurate, easy to implement, real gas alternative to current test code methods. Additionally, the importance of understanding fluid properties as they relate to compressor performance is illustrated.

TUTORIAL 11

Range v. Efficiency - Striking the Proper Balance

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 351F

Instructor
Jim Sorokes (Dresser-Rand)

Description
The paper addresses the balance between peak attainable efficiency and overall operating range that must be addressed when specifying, designing and/or selecting centrifugal compressors. The relative roles of the various compressor components; i.e., impellers, diffusers, guide vanes, and return channels; in achieving the proper balance are discussed. Finally, the importance of proper component and stage aerodynamic matching is emphasized.

TURBO
DISCUSSION GROUPS

DISCUSSION GROUP 1
Monitoring Vibration and Other Critical Machine Conditions

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 371A

Wednesday, December 13, 2017
2:00 A.M. – 3:30 P.M. | Room 371A

Instructors
William Marscher (Mechanical Solutions, Inc.), Ron Adams (Sulzer Pumps), Dag Calafell (Technical Opus Solutions), Simon Bradshaw, Monroe Voyles (ITT Goulds Pumps), Jack Claxton (Patterson Pump Company), Juan Gamarra, Maki Onari (Mechanical Solutions, Ltd.), Morg Bruck (HMIC), Ken Atkins (Engineering Dynamics Incorporated), Hemanth Satish (TransCanada Corp.)

Suggested Topics
- Condition monitoring methods
- Effectiveness of condition monitoring on rotating equipment
- Value of, 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
- Operating 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, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 370A

Instructors
Jeff Haught (Anadarko Petroleum Company), Chris Rackham (John Crane Flexibox - Retired), Mike LeBlanc (John Crane), Mark Oneil (Altra Couplings), Thomas Davidson (Consultant), Michael Johnson (NRG Energy)

Suggested Topics
- 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

A Discussion Group is a forum in which leaders and delegates can address problems brought to the floor by delegates 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 delegates. Each Discussion Group is 90 minutes long.

- 8th Edition recommendations
- Allowable nozzle loads
- Warmup piping procedures
- Case deflection, temperature, and pressure
- Piping alignment
- Pipe strain

DISCUSSION GROUP 3
Gears

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 370F

Instructors
Joseph A. Silvaggio, Jr. (Siemens), Robert C. Eisenmann Jr. (BP), Mark Brooker (LyondellBasell)

Suggested Topics
- 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

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 370A

Wednesday, December 13, 2017
2:00 A.M. – 3:30 P.M. | Room 370A

Instructors
Leslie Thilagan (Independent Pump Consultant), Brian Pettinato (Elliott Group), Jeff Haught (Anadarko Petroleum), Jeff Buck (Shell Projects and Technology), Alex Schaefer (Elliott Group), Ken Shifflett (Motiva)

Suggested Topics
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, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 370C

Instructors
Bruce Bayless (Valero), Kevin Yates and Scott Shane (Dow)

Suggested Topics
- 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

DISCUSSION GROUP 6
Reciprocating Compressors

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 371C

Instructors
Bruce Bayless (Valero), Bruce McCain (Oxy Oil & Gas Corporation), Ben White (Southwest Research Institute)

Suggested Topics
- Advanced Condition monitoring
- Modern wear components design, reliability and failures
- Maintenance strategy / Best Practices
- Industry standards API 618, API 688, API 670 annex P, ISO 13631,etc.
- Capacity Control speed, recycle, unloaders (all types)
- Process gas quality and conditioning
- Couplings
- Pulsation, vibration and torsional issues
- Valve design, reliability, and fouling
- Packaging / Size and Speed Considerations / Installation Type
- Field Testing
- Synchronous motor starting issues

DISCUSSION GROUP 7
Advanced Topics in Centrifugal Compressor Design

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 362D

Instructors
Mark Sandberg (Sandberg Turbomachinery Consulting, LLC), Leonardo Baldassarre (GE Oil & Gas), Urs Baumann (MAN Diesel & Turbo Schweiz AG), Mark Kuzdzal (Dresser-Rand), Jeffrey Moore (Southwest Research Institute), Brian Pettinato (Elliott Group), Jim Sorokes (Dresser-Rand)

Suggested Topics
- 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, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 370C

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

Suggested Topics
- 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 - Whats working
- Abrasive Cleaning
- Inlet Temperature Measurement - Skin/ Nosecone
- Performance Monitoring
- Tip rubs
- Recovery Units – Packages

DISCUSSION GROUP 9
Dry Gas Seals for Compressors

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 362D

Instructors
Hans Weyermann (ConocoPhillips), Bernard Quoix (Total E&P), Leonardo Baldassarre (GE Oil & Gas), Joe Delrahim (John Crane), Emery Johnson (Flowserve) and Chris Auzenne (EagleBurgmann)

Suggested Topics
- 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, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 371C

Instructors
Bradley Addison (DuPont), Stanley Stevenson (Siemens), Kevin Kisor (MAN Diesel & Turbo), Terryl Matthews (Shell), Carl Schwarz (Praxair)

Suggested Topics
- 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

Wednesday, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 371C

Instructors
John Whalen (Consultant), Chris Stewart (John Crane) Malcolm Leader (Applied Machinery Dynamics), Thomas Davidson (Linde, LLC), Michelle Guedry and Alan Mathis (Dow)

Suggested Topics
- 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, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 371C

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

Suggested Topics
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, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 371C

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

Suggested Topics

- 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

Tuesday, December 12, 2017
10:30 A.M. – 12:00 p.m. | Room 370C

Instructors
Meherwan Boyce (The Boyce Consultancy), Rainer Kurz (Solar Turbines, Inc.), Francisco Gonzalez (Cheniere), Jeff Haught (Anadarko)

Suggested Topics

- 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, December 12, 2017
10:30 A.M. – 12:00 A.M. | Room 371A

Instructors
Vinod Patel (KBR), Stanley Stevenson, Gerry DiOrio (Siemens), Gampa Bhat (Mitsubishi Compressor International), Arun Kumar (HPCL - Mittal Energy Ltd., India), Joe Moreno (LyondellBasell)

Suggested Topics

- 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

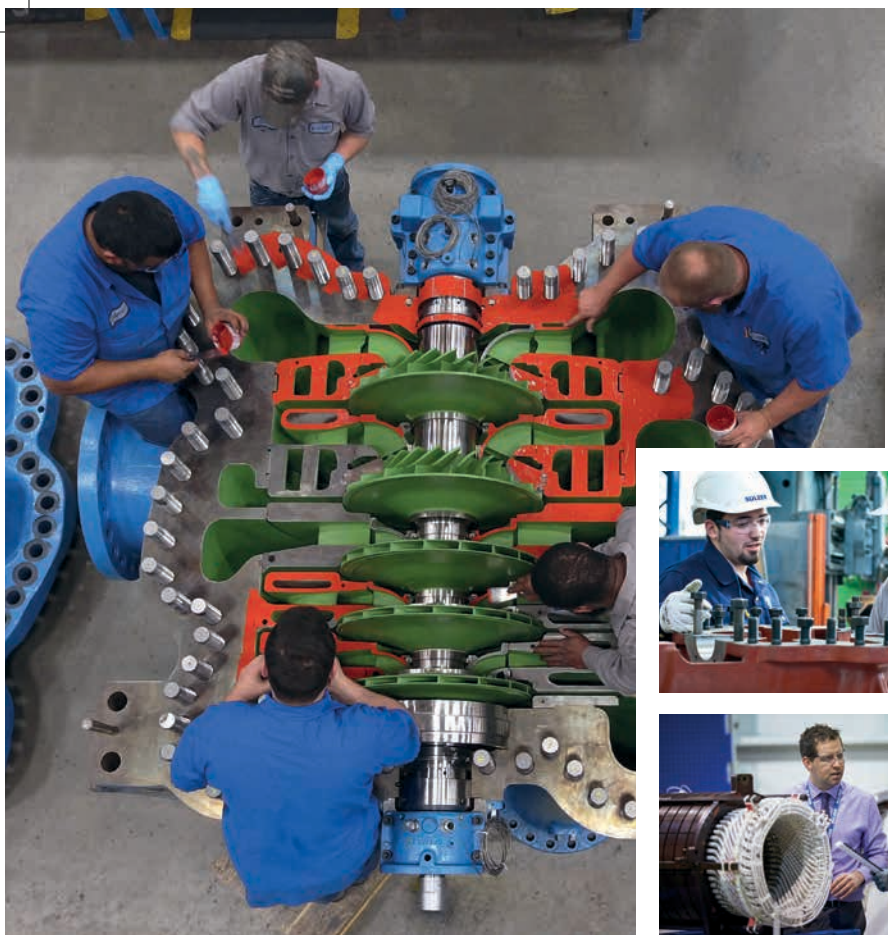
Compressor Controls

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 370C

Instructors
Mark Sandberg (Sandberg Turbomachinery Consulting), Rainer Kurz (Solar Turbines), Henry Borchard (Chevron), Jeff McWhirter (Dresser-Rand), Meera Day (SwRI), David Downing (Elliott Group)

Suggested Topics

- 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



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TURBO
CASE STUDIES

TURBO CASE STUDY SESSION 1A

Thursday, December 14, 2017
8:30 A.M. – 10:00 A.M. | Room 360A

CASE STUDY 1

Torsional Failure on Reciprocating Compressor Package

Instructors
Ken Atkins and James Clark (Engineering Dynamics, Inc.)

Description
This case history describes a vibration problem on a skid mounted high-speed reciprocating compressor package. The initial concern was high vibration on the motor. When the coupling guard was removed for further testing, a 45-degree crack was noticed on the motor shaft. This is a classic indication of a torsional fatigue failure.

A spare motor was installed and torsional measurements were made. This confirmed the problem as a torsional resonance. The flywheel was modified to de-tune the resonance. Follow-up testing was conducted and confirmed the success of the modifications.

CASE STUDY 2

Pelletizer Motor Bearing Damage Detection Based on Vibration Data

Instructors
John Yu, Nicolas Peton, Haibo Lin, Jun Quan (GE), Carl Feng Wang, Tony Wei Zhou (Shanghai SECCO Petrochemical Co)

Description
This presentation provides a case study that pelletizer motor bearing damage on an extruder was detected from on-line remote monitoring vibration data. Though vibration level was well below the acceptable limit, its abnormal signatures warranted a shutdown action. It was then observed that for each bearing, the whole outer raceway was spalled circumferentially into a "washboard" pattern. This was caused by electrical corrosion or fluting due to poor insulation resulted from damaged insulating washers. After replacing the bearings with insulated ones , vibration level and signatures have then become normal ever since its restart.

CASE STUDY 3

Prediction and Mitigation of High Radial Vibrations During Hot Restart of Centrifugal Compressors

Instructors
Michele Fontana, Leonardo Baldassarre, Andrea Bernocchi, Gianluca Conte and Mirko Libraschi (GE Oil & Gas)

Description
Rotor thermal bowing is a common cause of high radial vibrations for turbomachinery; it may occur during hot restart, i.e. when a rotor is restarted before reaching thermal equilibrium.

A real case of high vibrations due to thermal bowing, occurred on a natural gas centrifugal compressor driven by a fixed speed electric motor, is analyzed in detail. The solution selected for the case study (replacement of the original journal bearings with new ones, featuring integrated squeeze-film dampers) is discussed in detail together with other possible alternatives. A comparison of vibration data before/after the intervention shows the resolution of this site 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.

TURBO CASE STUDY SESSION 1B

Thursday, December 14, 2017
8:30 A.M. – 10:00 A.M. | Room 350D

CASE STUDY 4
Thrust Balance Line Bolts Failure

Instructors
Felix A. Cestari (Siemens Energy, Inc.), Robert Briggs (Mount Vernon Pipeliner), Regis Fowler (MTO), Ge Jiangang (PWPC PetroChine)

Description
The flange bolts of the thrust balance pipe failed on two different RF36 centrifugal compressors at a natural gas transmission station. One such failure resulted in high gas leakage inside the building leading to an unsafe condition as well as significant damage to the compressor internals due to changes in the thrust loading. Bolt failure was attributed to high-cycle fatigue as a result of excessive nozzle loading and high structural vibration due to a weakened pipe supporting system.

CASE STUDY 5
Reliability Improvement for Booster Reciprocating Compressor in CCR Reformer

Instructors
Sang Uk Lee, Bumsu Kim, Sangjoo Lee, Sangsuk Lee (SK energy)

Description
CCR(Continuous Catalyst Regeneration) Reformer process inherently creates viscous liquid called green oil. When reciprocating compressor are selected as booster compressor for process, green oil creation and carry-over must be taken into consideration. This case study includes root cause analysis & its countermeasures in various aspects of process, mechanical design, condition monitoring system. It is based on actual experience to improve the reliability of the compressor in CCR Reformer.

CASE STUDY 6
Reciprocating Compressor Optimization

Instructors
Bruce McCain (Oxy Oil and Gas Corporation), Kelsy Holmes, Pablo Castillo (Oxy Permian)

Description
Reciprocating compressor optimization does not mean the same thing to all operators. Maximizing efficiency, gas throughput, frame horsepower, full load amps and/or motor winding temperatures, rod loads, temperatures, pressures, and torque, are just a few examples of parameters that may be included in an optimization effort. This case study explores a field analysis performed on mulitple reciprocating compressors along with some unexpected findings.

CASE STUDY 7
Severe Corrosion On Rotor Blades of Back Pressure Type Steam Turbine Due To Unique Reason. What Went Wrong?

Instructors
Arun Kumar, Anurag Chopra (HPCL-Mittal Energy Ltd., India)

Description
The case study depicts an unique reason for corrosion on blades of a Back Pressure Turbine (BPT) for Generator drive leading to huge maintenance cost within 4 years of turbine installation and commissioning.

Based on the observations collected during overhauling and analysis thereafter, it was concluded that reason for the corrosion on turbine blading was wet ambiance inside the turbine casing during machine idle condition.

Action plan was prepared and implemented to avoid re occurrence and is discussed in detail in the case study.

TURBO CASE STUDY SESSION 2A

Thursday, December 14, 2017
10:30 A.M. – 12:00 P.M. | Room 360A

CASE STUDY 8
Damaged Compressor Stator Parts Resulting from Operation in Deep Choke

Instructors
Urs Baumann, Jean-Claude Pradetto (MAN Diesel & Turbo Schweiz AG)

Description
The internal stator parts of a high-speed, oil-free, integrated motor compressor used in gas storage service were found severely damaged. The analysis of the operational trend data suggested prolonged operation in deep choke condition. Additional CFD calculations confirmed that severe flow separations and flow reversals had to be expected. Concluding from the RCA a recalibration of the anti-choke control to move the response line to higher pressure ratios was implemented. Instruction were given to the operators to switch from serial mode to parallel mode operation if the compressor is operated beyond the response line of the anti-choke controller. After repair (no design changes) the machine is now in service for more than one year without any problems.

CASE STUDY 9
Compander Vibration Troubleshooting

Instructors
Sébastien Jaouen, Alain Gueraud (Cryostar), Stéphane Berger (Flender Graffenstaden), Cliff Bower (MOL)

Description
The “compander” is an integrally-geared turbo machine with three warm compressor stages and one cryogenic expander stage. It’s used on LNG carrier to liquefy the boil off gas.(Brayton cycle)

The factory acceptance test (FAT) troubleshooting concerns the last compander in a series of 8 identical machines.

It started with the GBM troubleshooting RCA that concerned pinion 2 vibration level.

Then during OEM FAT, Gear Box casing axial vibration was higher than acceptance and pinion number 2 radial displacement tripped.

After the resolution of the previous issues, the motor vibration level was found to be unacceptable.

CASE STUDY 10

Eliminating a Rotordynamic Instability of a 12 MW Overhung, Radial Inflow Expander

Instructor

Joseph Lillard (Atlas Copco Gas and Process), J. Jeffrey Moore, Chris Kulhanek (Southwest Research Institute), Grant Nordwall (Atlas Copco Mafi-Trench Company), Greg Elliott (GE Oil & Gas), Tom Shoup (GE Lufkin)

Description

A rotordynamic instability was observed for an overhung, unshrouded, radial inflow expander in a geared generator train. A rotordynamic model was developed to assess stability as well as evaluate the potential design modifications. A transient CFD analysis was found to predict an amount of cross-coupling greater than that predicted by the Alford force equation. Implementation of a swirl brake for the labyrinth seal and modified journal bearings on the expander rotor produced acceptable vibration levels. A unique implementation of a squeeze film damper bearing was employed which reduced the vibration at low loads and enabled reliable operation at all required conditions.

CASE STUDY 11

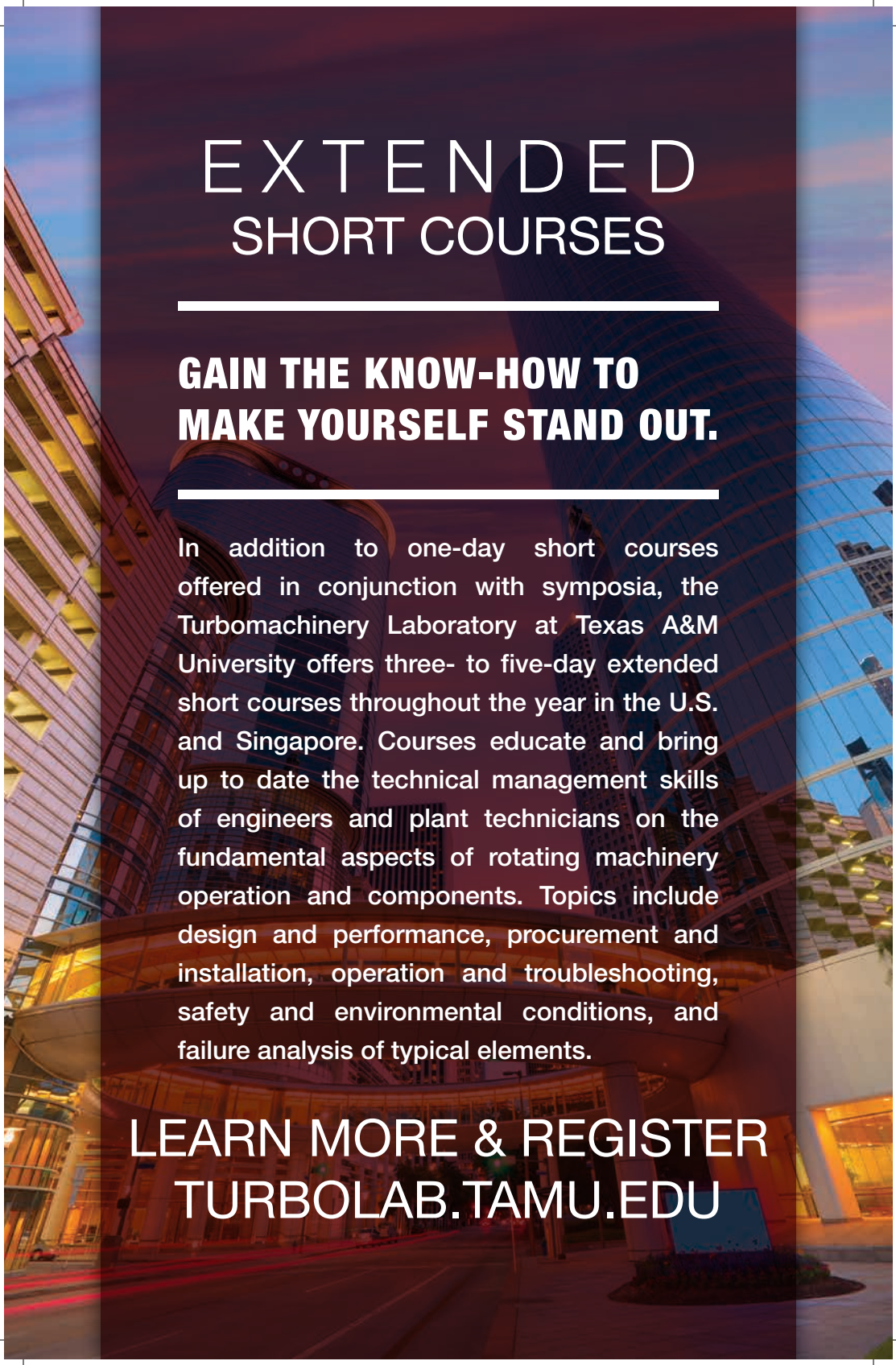
Gas Turbine With Rotor Crack – Vibration Diagnostics

Instructors

Peter Popaleny, Nicolas Peton (GE Bently Nevada)

Description

The case study describes rotor crack detection using vibration measurements, documented on real case of heavy duty Gas Turbine. The study highlights the complexity of rotor crack diagnostics as the primary problem as it can be often masked by other existing machine malfunctions, such as unbalance, misalignment, bearing looseness or soft foot. The paper describes the detected symptoms of rotor crack: increase of rotor bow demonstrated by changes in slow roll vectors, decrease in rotor modal stiffness demonstrated by decrease in resonance frequency, the decrease in effective damping, appearance of the split resonance in the rotor shut down not present during the start-up, the unidirectional changes in the rotor bow and the repeatability of abnormal-unidirectional rotor response.



EXTENDED
SHORT COURSES

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PUMP
DAILY SCHEDULE

SUNDAY, DECEMBER 10, 2017

4:30 P.M. – 6:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A

MONDAY, DECEMBER 11, 2017

7:00 A.M. – 12:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:30 A.M. – 5:00 P.M. | SHORT COURSES	
Short Course 1 Vibration Problems and Solutions in Pumps and Turbomachinery	Level 3, Room 330A
Short Course 2 Mechanical Seal Fundamentals	Level 3, Room 370A
Short Course 3 Pumps 101	Level 3, Room 370C
Short Course 4 Fundamentals of Centrifugal Pump and System Interaction	Level 3, Room 371A
Short Course 5 Pump Cavitation – Physics, Prediction, Control, Troubleshooting	Level 3, Room 371C
Short Course 6 Key Differences in the Design of Piping Systems for Reciprocating and Centrifugal Pumps	Level 3, Room 362D
Short Course 7 Optimizing Pumping Systems with Proven Engineering Assessment Processes and Methodologies	Level 3, Room 362F
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	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
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. | TURBO COMMITTEE MEETING	
Turbomachinery Advisory Committee Meeting	Level 3, General Assembly C
5:30 P.M. – 6:00 P.M. | PUMP COMMITTEE MEETING	
Pump Advisory Committee Meeting	Level 3, General Assembly C

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

TIPS

PAGE 100

Please go to page 101 in the Exhibitors Section for more information

TUESDAY, DECEMBER 12, 2017

7:00 A.M. – 7:45 A.M. | BREAKFAST	
Leader Breakfast	Level 2, Hilton Ballroom D
7:30 A.M. – 5:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
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	
Lecture 1 Pump Cavitation Severity Evaluation Using Accelerometers and Dynamic Pressure Transducers After Installation	Level 3, Room 350D
Lecture 2 Transient Events in Pump Piping Systems	
Tutorial 1 Caustic Processes: application and Implementation of Successful Sealing Strategies	Level 3, Room 352D
Discussion Group 4 Lubrication	Level 3, Room 370A
Discussion Group 8 Vertical Pump Problems and Solutions	Level 3, Room 370C
Discussion Group 10 Pipeline Applications	Level 3, Room 371A
10:15 A.M. – 10:30 A.M. | BREAK	
Refreshment Break	Level 3, Lounge Area
10:30 A.M. – 12:00 P.M. | TECHNICAL SESSIONS	
Lecture 3 Bearing Wear in Electric Motors and Rotating Equipment Under the Aspect of VSD Converter Operation	Level 3, Room 350D
Lecture 4 Fiber Optical Sensing of Bearing Performance and Pump Conditions	
Tutorial 2 An End-User's Guide to Centrifugal Pump Rotordynamics	Level 3, Room 352D
Discussion Group 3 Gears	Level 3, Room 370A
Discussion Group 6 Mechanical Seals	Level 3, Room 371C
12:00 P.M. – 2:00 P.M. | DELEGATE LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall B

2:00 P.M. – 3:30 P.M. | TECHNICAL SESSIONS	
Lecture 5 Development of a Single Mechanical Seal Equipped With API Piping Plan 11/66a For Large Mainline Crude Oil Pipeline Pumps	Level 3, Room 350D
Lecture 6 Challenges with a Large High Pressure Water Pump	
Tutorial 3 Precision Grouting: Skid-Mounted Equipment	Level 3, Room 352D
Discussion Group 1 Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 371A
Discussion Group 2 Couplings and Alignment	Level 3, Room 370A
Discussion Group 5 Centrifugal Pump Operation, Maintenance, and Reliability	Level 3, Room 370C
2:30 P.M. – 7:00 P.M. | EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall C
6:30 P.M. | HOSPITALITY SUITE	
Hospitality Suite	See Hospitality Suite Schedule on Page 20
7:30 P.M. – 9:00 P.M. | DINNER	
Tex-Mex Buffet (Badge required, not open to Free Pass)	Level 2, Hilton Ballroom A

WEDNESDAY, DECEMBER 13, 2017

7:30 A.M. – 8:15 A.M. | BREAKFAST	
Leader Breakfast	Level 2, Hilton Ballroom D
8:00 A.M. – 5:00 P.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:00 A.M. - 1:00 P.M. | BOOTH SELECTION	
Booth Selections for 2018	Level 1, Exhibit Hall B, Exhibitor Registration Counter
8:30 A.M. – 10:00 A.M. | TECHNICAL SESSIONS	
Lecture 7 Atypical Results from Improperly Sized & Charged Pulsation Dampeners	Level 3, Room 350D
Lecture 8 A Study on the Operation of Pitot Tube Pumps	
Tutorial 4 HF Acid Alkylation Processes: Pump and Mechanical Seal Application and Design Considerations for Increased Reliability	Level 3, Room 352D
Discussion Group 7 Improving Mean Time Between Pump Failures	Level 3, Room 371A
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 Superimposing Planetary Gears as Variable Speed Drives for Rotating Equipment	Level 3, Room 350D
Lecture 10 Pump Affinity Laws Modified to Include Viscosity and Gas Effects	
Tutorial 5 Field Troubleshooting Common Mechanical Seal Piping Plans	Level 3, Room 352D
Discussion Group 9 Sealless Pumps	Level 3, Room 371A
Discussion Group 11 Cryogenic Fluid Pumping Applications	Level 3, Room 370A
12:00 P.M. – 2:00 P.M. | LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall B

2:00 P.M. – 3:30 P.M. | TECHNICAL SESSIONS	
Lecture 11 Sub-Synchronous Vibrations on a Vertical Electrcal Motor During Factory Testing – Observed Phenomenon, Interpretation and Resolution	Level 3, Room 350D
Lecture 12 Effect of Gas Presence on Erosive Wear of Split-Vane Electrical Submersible Pump	
Discussion Group 1 Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 371A
Discussion Group 4 Lubrication	Level 3, Room 370C
2:30 P.M. – 6:30 P.M. | EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall C
6:30 P.M. | HOSPITALITY SUITE	
Hospitality Suite	See Hospitality Suite Schedule on Page 20
7:30 P.M. – 9:00 P.M. | BANQUET (No entry after 7:45 P.M.)	
Banquet (Badge required, not open to Free Pass)	Level 2, Hilton Ballroom A

THURSDAY, DECEMBER 14, 2017

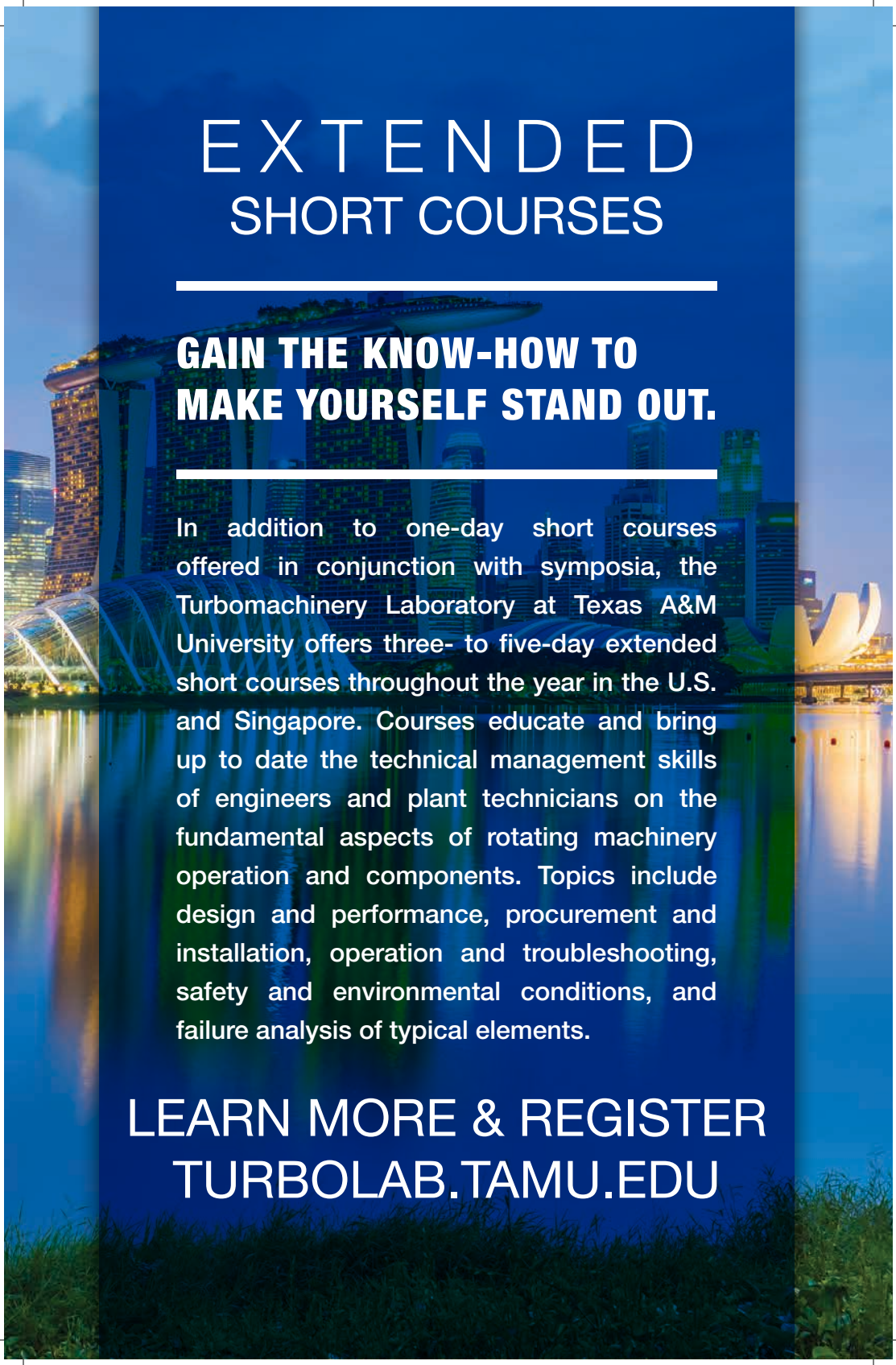
7:30 A.M. – 8:15 A.M. | BREAKFAST	
Leader Breakfast	Level 2, Hilton Ballroom D
8:00 A.M. – 11:00 A.M. | REGISTRATION	
Delegate and Exhibitor Registration	Level 1, Exhibit Hall B
All Leader Registration	Level 3, Room 340A
8:00 A.M. – 11:00 A.M. | BOOTH SELECTION	
Booth Selections for 2018	Level 1, Exhibit Hall B, Exhibitor Registration Counter
8:30 A.M. – 10:00 A.M. | PUMP CASE STUDY SESSION 1A	
Case Study 1 Vertical Seawater Lift Pump Reversible Performance Deterioration	Level 3, Room 351D
Case Study 2 Elevated Epoxy Grout Pumping	
Case Study 3 Mitigating Unstable Condensate Process Conditions	
8:30 A.M. – 10:00 A.M. | PUMP CASE STUDY SESSION 1B	
Case Study 4 Resolving Structural Vibration Issues on a Water Flood Pump	Level 3, Room 351F
Case Study 5 Predictive Diagnostics for Pump Seals: Field Trial Learnings	
Case Study 6 Benefits of Installing Restrictive Orifice Plates on the Suction of Reciprocating Pumps:1D Pulsation and CFD Studies	
9:30 A.M. – 12:00 P.M. | EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall C
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 7 Plunger Pump Station - Vibration-Induced Cracks in Piping	Level 3, Room 351D
Case Study 8 Material Challenges and Suggestions for Pumps in Hot Napthenic Acid Containing Crude Oil Services	
Case Study 9 Inlet Bay Flow Turbulence	

10:30 A.M. – 12:00 P.M. | PUMP CASE STUDY SESSION 2B	
Case Study 10 Resolving Structural Vibration on a Pump	Level 3, Room 351F
12:00 P.M. – 2:00 P.M. | COMMITTEE LUNCH	
Advisory Committee Luncheon	Level 3, Room 330A

SYMPOSIA AND EXHIBITS END AT NOON

PUMP
ADVISORY COMMITTEE

The 33rd Pump Users Symposium is sponsored by the Turbomachinery Laboratory of the Texas A&M Engineering Experiment Station, The Texas A&M University System. 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 leaders from the fluid-handling-equipment community. The Advisory Committee is greatly indebted to these individuals for their participation and outstanding contributions.



EXTENDED
SHORT COURSES

GAIN THE KNOW-HOW TO MAKE YOURSELF STAND OUT.

In addition to one-day short courses offered in conjunction with symposia, the Turbomachinery Laboratory at Texas A&M University offers three- to five-day extended short courses throughout the year in the U.S. and Singapore. Courses educate and bring up to date the technical management skills of engineers and plant technicians on the fundamental aspects of rotating machinery operation and components. Topics include design and performance, procurement and installation, operation and troubleshooting, safety and environmental conditions, and failure analysis of typical elements.

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PUMP
SHORT COURSES

SHORT COURSE 1
Vibration Problems and Solutions In Pumps and Turbomachinery

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 330A

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, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 370A

Instructors
Henri Azibert (A.W. Chesterton Company), John Merrill (EagleBurgmann), Brian Kalfrin (John Crane), Chris Riche (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

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

SHORT COURSE 3

Pumps 101

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 370C

Instructors
Daniel Wood (The Chemours Company), 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; 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, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 371A

Instructor
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, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 371C

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

Key Differences In the Design of Piping Systems for Reciprocating and Centrifugal Pumps

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 362D

Instructors
Kelly Eberle, Mena Ghattas (Wood Group)
Tom Newman (SPX Flow)

Background
Designers of pump packages and the associated piping system are generally familiar with centrifugal pump best practices that ensure a safe and reliable installation. Reciprocating pump installations, however, require special design considerations beyond those typically included in a centrifugal pump installation design.

An incomplete design basis for reciprocating pump installations can lead to costly remedial actions after commissioning, significant downtime or more serious problems which, if undetected, can lead to failures of pump components, requiring a major redesign of the pump installation.

Objectives
The goal of this short course is to provide insight into the design considerations and industry best practices for reciprocating pump installations, to maximize system integrity and avoid costly redesigns and repairs.

Participants will gain an understanding of:

- Centrifugal vs reciprocating working principles
- Typical centrifugal pump design practices
- Operational & reliability problems when applied to reciprocating pump systems
- Reciprocating pump best design practices including foundation preparation
- Approaches, tips and tricks to employ in the design phase, including specialty studies
- Key issues, challenges, and lessons learned when designing reciprocating pump installations

Who should attend
This short course is for engineers, managers and technical staff involved in the design, commissioning and installation of industrial centrifugal and positive displacement pump and piping systems.

SHORT COURSE 7

Optimizing Pumping Systems With Proven Engineering Assessment Processes and Methodologies

Monday, December 11, 2017
8:30 A.M. – 5:00 P.M. | Room 362F

Instructors
Peter Gaydon and Mark Sullivan (Hydraulic Institute)

Description
When pump systems are not optimized for best efficiency, they drain corporate profits with higher energy and maintenance costs, shorten mean time between repairs and increase CO2 emissions. Optimized pump systems are more energy efficient and reliable overall. Using information gained from this course, pump users can learn how to run their systems more efficiently and conduct a pump system assessment that identifies problematic areas where the greatest opportunities for improvement exist.

This course/workshop can benefit companies in various industries including: wastewater, power generation, oil & gas, building services, steel, chemical processing, pulp & paper, food & beverage as well as mining.

PUMP
LECTURES

LECTURE 1

Pump Cavitation Severity Evaluation Using Accelerometers and Dynamic Pressure Transducers After Installation

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 350D

Instructors
William D. Marscher, Maki Onari, Juan Gamarra (Mechanical Solutions Inc.)

Description
This lecture demonstrates the effectiveness of using accelerometers versus dynamic pressure transducers to investigate cavitation root cause problems, and quantify the cavitation severity. The technique presented allows for a minimally invasive test of the pump system. The lecture includes examples of several sources of cavitation in various pumps and services, including cases where the mean suction pressure readings indicated sufficient NPSHA (Net Positive Suction Head Available), but large pressure pulsations entering the pump suction drove instantaneous NPSHA below the NPSHR (Net Positive Suction Head Required).

LECTURE 2

Transient Events In Pump Piping Systems

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 350D

Instructors
Sarah Simons, Frank Fierro, Augusto Garcia (Southwest Reasearch Institute)

Description
Pump piping systems are frequently subject to transient events such as slugs, water hammer, and cavitation that can create high amplitude forces and pressure spikes. Liquid systems are more susceptible to damaging forces during transients than gas systems due to the high density and incompressibility of the operating fluid. These events often result in high vibrations--and sometimes failures--that can be prevented in the design process or resolved in the field using a multi-angle approach. This lecture will discuss three case studies showing the need for using transient analysis of the flow in combination with mechanical and structural analyses and/or a sensitivity analyses to resolve on-site problems and predict the likelihood of failures in the design stage.

LECTURE 3

Bearing Wear In Electric Motors and Rotating Equipment Under the Aspect of VSD Converter Operation

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 350D

Instructor
Hans Tischmacher (Siemens AG)

Description
Bearings are integral part of all rotary equipment incorporating electric motors. However, the bearing wear issue due to arc discharges through oil film has been often recorded in converter supplied motors and can decisively reduce bearing lifetime. This paper highlights this issue, describes thoroughly the corresponding phenomena and proposes a systematic approach for early detection of bearings damage. Both electrical (bearing current) and mechanical (bearing vibration) measurements should be exploited for determining the bearing condition. Finally, a comparative study on different vibration measurement methods is presented and a classification of the bearing condition state concerning these results is proposed.

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 4

Fiber Optical Sensing of Bearing Performance and Pump Conditions

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 350D

Instructors
Lars Kahlman (SKF), Eric van Genuchten (SKF B.V.)

Description
Fiber optical sensing is an emerging technology for monitoring, tuning and controlling pumps and other rotary machineries. This can be done with either external attached sensors, into the equipment integrated sensors, or a combination of both. These methods are intrinsic safe, insensitive to electric and magnetic fields, and can sense and transmit signals at high-speeds over very long distances. The methods applied are highly sensitive. Therefore, it is an ideal technology to apply in oil & gas installations and is in use today for static equipment. In the near future it will be used for rotating equipment such as pumps, gears and screw compressors. In addition, fiber optical sensing is potentially very cost effective for rotary machineries due to anticipated low installation and equipment costs.

LECTURE 5

Development of a Single Mechanical Seal Equipped with API Piping Plan 11/66a for Large Mainline Crude Oil Pipeline Pumps

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 350D

Instructors
Andreas Pehl (EagleBurgmann Germany), Hemanth Satish, Michael Szwarz (TransCanada Corp.), Eric Vanhie (EagleBurgmann USA)

Description
A first of its kind API plan 66A was deployed in a large MOL pump in 2015. Our lecture describes the critical design aspects, laboratory verification testing and field validation experience of a single mechanical seal with an integrated containment system in the spirit of API piping plan 66A. Of particular importance is the shaft diameter - pressure relationship of the MOL pumps in this development project (155 mm x 100 bar). Besides the typical qualification testing of such engineered seals, a specific laboratory test of the piping plan 66A was carried out. The tests resulted in a special containment bushing to mitigate the release of any oil to the atmosphere at 100 bar.

LECTURE 6

Challenges With a Large High Pressure Water Injection Pump

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 350D

Instructors
Ed Wilcox (Chevron), Martin Uere (Sulzer)

Description
In 2009, a project was initiated to install two large high pressure water injection pumps producing 586 bar (8500 psig) discharge at 9.3MW (12,500 hp) on an existing deep water offshore platform. After installation and commissioning, the pumps have operated with a mixture of both good reliability and rather drastic failures. The paper will detail the pulsation testing that was completed during the FAT of the pump and how the pulsation levels were evaluated and addressed. An in-depth look at a significant shaft failure, its causes, and the design changes taken to address it are provided in detail.

LECTURE 7

Atypical Results From Improperly Sized & Charged Pulsation Dampeners

Tuesday, December 12, 2017
8:30 A.M. – 10:00 A.M. | Room 350D

Instructors
Nathan Poerner, Eugene Broerman, Trenton Cook (Southwest Research Institute),Tappan Souther (Liberty Resources LLC)

Description
At a facility using pulsation dampeners to control pulsations in the discharge line, the initial dampeners were both undersized and undercharged for the application. As a result, in addition to some typically expected results, including high pulsations and frequent failures of the internal bladders, the effective volumes of the dampeners and lengths of piping in the system set up an acoustic natural frequency that caused significant safety concern and limited system operability. This natural frequency was in a range that could be excited by the pumps such that the presence of the dampeners in the system was actually causing even higher pulsation levels. This paper will look at the troubleshooting efforts including field testing and acoustic simulations as well as results from the modified system.

LECTURE 8

A Study on the Operation of Pitot Tube Pumps

Tuesday, December 12, 2017
8:30 A.M. – 10:00 A.M. | Room 350D

Instructor
Bryce Neilson (Weir Specialty Pumps)

Description
While pitot tube pumps have been commercially available since 1970 little is known and less is published about their internal operation and design principles especially when operating off design. This paper is a culmination of research conducted over the past several years aimed at understanding the internal operation of pitot tube pumps in their different configurations. This research includes computational fluid dynamic (CFD) studies, and laboratory testing. While pitot tube pumps are classified as centrifugal pumps since they add energy to the fluid by increasing the fluid angular momentum and such follow many of the same laws. However, due to their unique construction they operate differently that typical "impeller" pumps. Understanding these differences is imperative in their successful application.

LECTURE 9

Superimposing Planetary Gears As Variable Speed Drives for Rotating Equipment

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 350D

Instructors
Martin Tilscher, Bernd Lauter, Jochen Lindenmaier (Voith Digital Solutions GmbH)

Description
There are many high-power pumps installed in power plants, oil & gas applications and petrochemical industry consuming a considerable amount of energy. Significant interest exists within operators to improve efficiency in order to save energy and operating cost. There is a new method to improve efficiency of variable speed drives by power splitting. An epicyclic gear is designed as revolving planetary gear where all three shafts can turn. This principle allows using only a small percentage of rated power as control power to be generated by servo motors. A 7500 horse power prototype of an electrically controlled superimposing planetary gear was built and tested extensively. Its efficiency is up to 2.5 percent higher than conventional variable speed systems.

LECTURE 10

Pump Affinity Laws Modified to Include Viscosity and Gas Effects

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 350D

Instructors
Gerald Morrison, Abhay Patil (Texas A&M University)

Description
The pump Affinity Laws have been modified to include the effects of viscosity. The results are simple 2D curves that represent the head-flow rate and efficiency-flow rate relationships for a specific pump. The new Modified Affinity Laws were validated using experimental data from several different types of pumps and CFD simulations of a mixed flow pump. An additional similitude relationship was developed to obtain a 2D curve showing how the addition of gas changes the head generation. Since gas volume changes with each stage due to pressure rise, this relationship can be used along with the Modified Affinity Laws to predict the performance of a single stage pump or the stage by stage performance of a multi stage pump operating with gas and varying viscosity.

LECTURE 11

Sub-Synchronous Vibrations On a Vertical Electrical Motor During Factory Testing – Observed Phenomenon, Interpretation and Resolution

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 350D

Instructors
Bernard Quoix (TOTAL E&P), C. Hunter Cloud, Minhui He (BRG Machinery Consulting LLC), Alain Gelin (TOTAL E&P)

Description
This lecture deals with a particular type of electrical motors used to drive de-ballasting pumps for oil & gas floating offshore platforms. During factory tests of a vertical electric driven de-ballasting pump, casing vibrations were observed on the motor, mainly on the motor non-drive end. Supported by fluid film journal bearings, this motor is cooled and lubricated by a low viscosity fluid. After extensive investigations, including theoretical and experimental modal and rotordynamcis analysis and full testing of the electric motor, it became clear that the root cause of the casing subsynchronous vibrations was a rotor whirl instability exciting the motor's reed frequency mode near half the rotating frequency.

The paper describes how the bearings were modified to solve the observed sub-synchronous shaft instability.

LECTURE 12

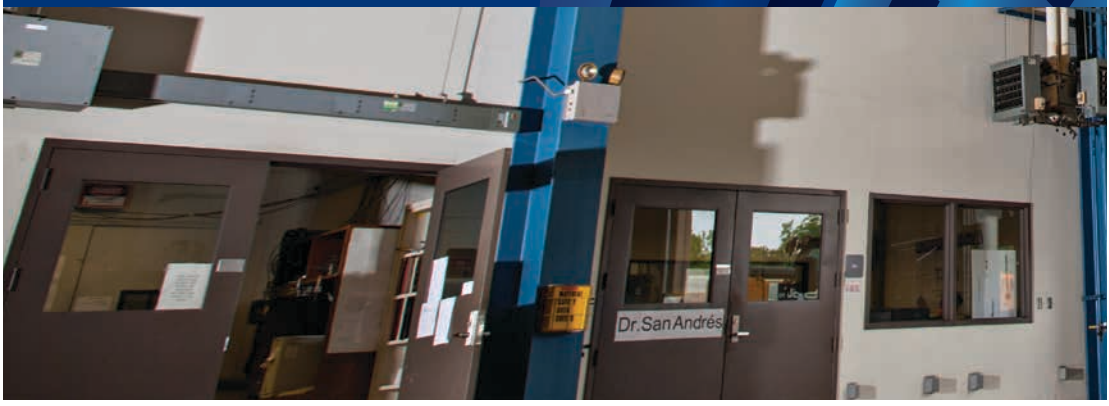
Effect of Gas Presence on Erosive Wear of Split-Vane Electrical Submersible Pump

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 350D

Instructors
Abhay Patil, Gerald Morrison, Yi Chen, Daniel Steck, Changrui Bai, Yiming Chen (Texas A&M University)

Description
Split vane pumps are designed to improve the gas handling capability in gaseous wells by inducing large levels of turbulence using split impeller vanes. This may adversely affect the pump life if abrasives are present in the wellfluid. Experimental investigation was carried out to evaluate the combined effect of gas and sand presence on the wear mechanism in a split vane pump. The hydraulic path as well as the secondary flow path was severely eroded showing how sand and gas both contribute to the performance degradation. CFD simulations were employed to characterize the erosion across the hydraulic path for single phase flow. The study concludes with validation of CFD results using experimental data.

PUMP
TUTORIALS



TUTORIAL 1

Caustic Processes: Application and Implementation of Successful Sealing Strategies

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 352D

Instructors
Kyle Stoner (John Crane Inc.), Daniel Grooms (Akzo Nobel Functional Chemicals, LLC)

Description
Caustic applications have proven to be a common source of concern in almost every industry, and each application in each facility can present different complications due to concentrations, desired purity levels, and even pump design. Just as there are many different types of caustic applications, there are also many different ways to seal it.
This tutorial will discuss the guidelines of API 682 for caustic applications, the difficulties in sealing caustic processes, the material compatibility concerns, the different seal types utilized, and the piping plans required to support those seal types. Examples of implemented solutions will be incorporated into the discussion to provide visual explanations for the different options discussed.

TUTORIAL 2

An End-User's Guide to Centrifugal Pump Rotordynamics

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 352D

Instructor
William D. Marscher (Mechanical Solutions, Inc.)

Description
This tutorial discusses concepts and methods involved in performing and evaluating rotordynamic analysis, focusing on centrifugal pumps. 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.

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

TUTORIAL 3

Precision Grouting: Skid-Mounted Equipment

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 352D

Instructors
Dan Termunde, Fred Goodwin, Rick First (BASF Construction Chemicals)

Description
Rotating equipment being installed in power and industrial environments, including refineries and chemical processing plants, are critically aligned with exact tolerances. When in operation, this equipment experiences heavy dynamic and repetitive loading with high vibration, and in some cases high temperatures and chemical exposure. Due to these extreme forces and environments, this equipment requires maximum support by using a high quality precision grout able to properly transfer those forces, providing a long term solution resulting in maximum operation efficiency, increased reliability, and reduced maintenance. Techniques to utilize epoxy grouts will be described to provide adequate equipment support.

TUTORIAL 4

HF Acid Alkylation Processes: Pump and Mechanical Seal Application and Design Considerations for Increased Reliability

Wednesday, December 13, 2017
8:30 A.M. – 10:00 A.M. | Room 352D

Instructors
Brian Kalfrin (John Crane), Jonathan O'Brien (Monroe Energy LLC)

Description
Hydrofluoric (HF) acid is an extremely corrosive solution commonly found in many oil refineries where it is used as a catalyst in the production gasoline blending stock. HF acid is almost synonymous with the alkylation unit where the processing takes place within the refinery process flow. This tutorial will focus on HF alkylation and the challenges associated with handling this solution and the process streams. The HF alkylation process uses HF acid which is dangerous and requires special treatment, particularly in the area of shaft sealing along with pump design. This tutorial will attempt to address several topics centered on reliable operation of pumps in an HF alky unit, including pump and mechanical seal design and construction, along with mechanical seal support system considerations.

TUTORIAL 5

Field Troubleshooting Common Mechanical Seal Piping Plans

Wednesday, December 13, 2017
10:30 A.M. – 12:00 P.M. | Room 352D

Instructors
Michael Huebner, Ronald Hurst (Flowserve Corporation)

Description
Piping plans are standardized strategies which enhance the capabilities and performance of mechanical seals. They provide a wide variety of functions including heat transfer from the seal chamber, cleaning the seal environment, capturing and disposal of seal leakage, and providing external fluids. The initial selection and operation of these plans are a critical aspect in the reliability of centrifugal pump sealing system. It however can be difficult to determine if a piping plan is functioning properly in the field. There is often limited instrumentation and many of the parameters which can be monitored are influenced by process conditions, available utilities, and ambient temperatures.

PUMP
DISCUSSION GROUPS

DISCUSSION GROUP 1
Monitoring Vibration and Other Critical Machine Conditions

Tuesday, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 371A

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 371A

Instructors
William Marscher (Mechanical Solutions, Inc.), Ron Adams (Sulzer Pumps), Dag Calafell (Technical Opus Solutions), Simon Bradshaw, Monroe Voyles (ITT Goulds Pumps), Jack Claxton (Patterson Pump Company), Juan Gamarra, Maki Onari (Mechanical Solutions, Ltd.), Morg Bruck (HMIC), Ken Atkins (Engineering Dynamics Incorporated), Hemanth Satish (TransCanada Corp.)

Suggested Topics
- Condition monitoring methods
- Effectiveness of condition monitoring on rotating equipment
- Value of, 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
- Operating 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, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 370A

Instructors
Jeff Haught (Anadarko Petroleum Company), Chris Rackham (John Crane Flexibox - Retired), Mike LeBlanc (John Crane), Mark Oneil (Altra Couplings), Thomas Davidson (Consultant), Michael Johnson (NRG Energy)

Suggested Topics
- 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 delegates can address problems brought to the floor by delegates 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 delegates. Each Discussion Group is 90 minutes long.

DISCUSSION GROUP 3
Gears

Tuesday, December 12, 2017
10:30 A.M. – 12:00 P.M. | Room 370A

Instructors
Joseph Silvaggio, Jr. (Siemens), Robert Eisenmann (BP), Mark Brooker (LynodellBasell)

Suggested Topics
- 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

Tuesday, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 370A

Wednesday, December 13, 2017
2:00 P.M. – 3:30 P.M. | Room 370A

Instructors
Leslie Thilagan (Independent Pump Consultant), Brian Pettinato (Elliott Group), Jeff Haught (Anadarko Petroleum), Jeff Buck (Shell Projects and Technology), Alex Schaefer (Elliott Group), Ken Shifflett (Motiva)

Suggested Topics
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, December 12, 2017
2:00 P.M. – 3:30 P.M. | Room 370C

Instructors
David DePaolis (Flowserve), Richard Donley (PBF Energy), Adam Gottlieb (Celanese Clear Lake Plant), Calvin Stevenson, Paul Pairmore, Nick Krauel (Flint Hills Resources), Arun Kumar (HPCL - Mittal Energy Ltd.), Katie Strautman (Machinery Engineer)

Suggested Topics

- Vertical Canned Pumps (VS6 Pumps)
- MI Inspections of pumps - (casing thickness)
- How do we know what thickness is good, base line?
- Predictive maintenance – how is info recorded
- What oil are we using for lubrication bearing housings (oil type, replacement frequencies)
- Pump maintenance practices – pull all pump vs just back pullout assy.
- Parallel pumping – practices, pump switchover
- Motor greasing and use of UT
- Practices for Mothballed Pumps
- 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 KPI's – 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
  - Repair facilities alliances
  - 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, December 12, 2017
10:30 AM - 12:00 PM | Room 371C

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.

Suggested Topics
- 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, December 13, 2017
8:30 AM - 10:00 AM | Room 371A

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

Suggested Topics
- 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, December 12, 2017
08:45 AM - 10:15 AM | Room 370C

Instructors
Howard Wright (Goulds Pumps), Jim Kilgore (Consultant), Eric Vanhie (EagleBurgmann), Mike Smith (Flowserve), Clint Zentic (Sulzer), Justin Hollingsworth (Southwest Research Institute), Hemanth Satish (Trans Canada Corp.)

Suggested Topics
- Petrochemical industries
- Installation
- NPSH
- Materials
- Bearings
- Maintenance
- Vibration
- Lubrication
- Paper industries
- Power industries
- Tolerances
- Nozzle loads

DISCUSSION GROUP 9

Sealless Pumps

Wednesday, December 13, 2017
10:30 AM - 12:00 PM | Room 371A

Instructors
Daniel Wood (The Chemours Company), Denny Fegan (Powerdyne), Gene Baker (LyondellBasell), Keith Yutzy (Teikoku), Matt Moy (Flowserve), Judy Hodgson (Hodgson Consulting)

Suggested Topics
- 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, December 12, 2017
8:45 A.M. – 10:15 A.M. | Room 371A

Instructors
Bill Litton (Magellan Midstream Partners LP), Bruce Weber, Bryce Dreger (Champion), George Maddox (Best Pumpworks), Morg Bruck (HMIC, LLC), Ralph Dickau (ROD Engineering Ltd.)

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

DISCUSSION GROUP 11

Cryogenic Fluid Pumping Applications

Wednesday, December 13, 2017
10:30 A.M. - 12:00 P.M. | Room 370A

Instructors
Dag Calafell (Technical Opus Solutions. LLC), Vinod Patel (KBR), Lonn Hall, Enver Karakas (Ebara Intl), Bill Bailey, David Loughman, Yousef Jarrah (Nikkiso Cryo Inc.)

Suggested Topics
- 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

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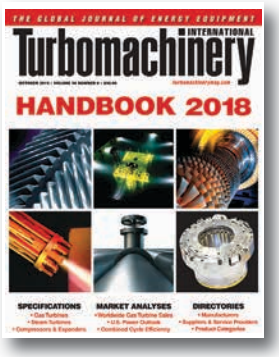

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PUMP
CASE STUDIES

PUMP CASE STUDY SESSION 1A

Thursday, December 14, 2017
8:30 A.M. – 10:00 A.M. | Room 351D

CASE STUDY 1
Vertical Seawater Lift Pump Reversible Performance Deterioration

Instructors
Ameer Khader, Luis Rojas (ExxonMobil), Alessia Sonzogni, Eligio Lo Cascio (Adriatic LNG)

Description
Reversible performance deterioration of one of four parallel seawater vertical lift pumps has limited the pump's ability for continuous operation. Given the pump's flat performance characteristics curve, a systematic approach to field troubleshooting was required. Non-conventional inspections, inclusive of online video inspection, revealed performance deterioration caused by marine fouling. This case study will describe the troubleshooting steps, highlighting limitations of typical troubleshooting theories, and recovery through the use of an air lift pump.

CASE STUDY 2
Elevated Epoxy Grout Pumping

Instructors
Kermit Palmer (Five Star Products, Inc.), Gene Baker (Lyondell Chemical Company)

Description
A major petrochemical company was faced with the dilemma of grouting a primary component on the 4th deck of process unit during a turn-around. The machinery engineer required the use of epoxy grout for setting the equipment but was faced with numerous problems.
In developing a grout plan the engineer had to address:

- Limited access to the equipment
- Crane time to deliver materials was limited and not always available
- Limited work area around the equipment for a crew of 8-10 workers with associated equipment, i.e. mortar mixer and wheelbarrows
- Grating structure was designed for personnel traffic and not adequate for tons of material to be assembled.

Timing was of the essence.

CASE STUDY 3
Mitigating Unstable Condensate Process Conditions

Instructors
Jason Jakubiak (Peroni Pumps America), Luigi Mascherpa (Peroni Pompe)

Description
Reciprocating plunger pumps can only operate with single phase liquids as the main process fluid. Unstable or two-phase process conditions can pose problems to reciprocating plunger pumps. Pumping hydrocarbon condensates is an application where the reciprocating plunger pump manufacturer must take extra caution to ensure proper performance even if the process is unstable. This case study shows the audience that standard sealing and lubrication systems for packing is not an effective approach for reciprocating plunger pumps in hydrocarbon condensate process services. The manufacture must consider special materials and auxiliary systems to mitigate this process instability.

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.

PUMP CASE STUDY SESSION 1B

Thursday, December 14, 2017
8:30 A.M. – 10:00 A.M. | Room 351F

CASE STUDY 4
Resolving Structural Vibration Issues On a Water Flood Pump

Instructors
Sergey Drygin, Nicolas Peton (GE Bently Nevada), Dmitry Leonov (Sakhalin Energy Investment Company Ltd)

Description
Water flood modules consists of Gas turbine, Gearbox, Sea water injection pump, Booster gearbox and pump. During units operating Power Turbine Shaft relative vibration exceeded OEM alarm level close to Trip level. This tendency was repeated during operating at speed close to maximum operation speed. At selected load condition, a 4 channels Portable data collector was used to collect data with roving 3 axial transducer. The created ODS, Operational Deflection Shape allowed localization of problem and correction action was to change supporting system natural frequency to increase supporting system stiffness. Increasing supporting legs stiffness in the axial direction was done during overhaul to move natural frequency away from operation speed range. It allowed Unit to reach full load with acceptable shaft relative and casing vibration levels.

CASE STUDY 5
Predictive Diagnostics for Pump Seals: Field Trial Learnings

Instructors
Matthew Miller, Brad Lewis (John Crane)

Description
Predictive maintenance provides obvious benefits to the industry in terms of cost savings and efficiency, but today many critical assets like pumps are not monitored. A system based on artificial intelligence techniques for automatic fault classification has been developed. Diagnostic algorithms for key failure modes are tracked concurrently, and a preprogrammed fault tree and Bayesian Network Model are used to infer the most likely future failure modes and root causes. This case study details the results of an early field trial.

CASE STUDY 6
Benefits of Installing Restrictive Orifice Plates on the Suction of Reciprocating Pumps:1D Pulsation and CFD Studies

Instructors
Zixiang Chen, Cajetan Ijeomah, Jordan Grose, Kelly Eberle (Wood Group Vibration, Dynamics & Noise (formerly BETA Machinery Analysis)

Description
To conserve NPSHA, pump designers rely on rules of thumb that resist the addition of pressure drop elements such as restrictive orifice plates, choke tubes and line-size reductions to inlet piping of pumps.

Can there be a balance between pulsation control benefits of pressure drop elements and the need to meet NPSHA?

This paper challenges industry resistance to pressure drop elements in the suction piping of reciprocating pumps by, first, outlining the virtues achieved in terms of pulsation and vibration control, and second, presenting results from numerical simulations. Recent field data from a quintuplex pump installation shows that well-designed orifice plates and other pressure drop elements are reducing pulsations and cavitation risks; and can be used efficiently in the suction piping of reciprocating pumps.

PUMP CASE STUDY SESSION 2A

Thursday, December 14, 2017
10:30 AM - 12:00 PM | Room 351D

CASE STUDY 7
Plunger Pump Station - Vibration-Induced Cracks in Piping

Instructors
Kelly Eberle, Mena Ghattas (Wood Group - Vibration, Dynamics & Noise)

Description
Demonstrate the risks and costs of excluding a pulsation analysis from a pump installation as well as ways to mitigate the pulsation and cavitation risks.

Analysis approach: Field-measured pulsations and numerical simulations (1-D pulsation model).

CASE STUDY 8
Material Challenges and Suggestions for Pumps in Hot Napthenic Acid Containing Crude Oil Services

Instructors
Aaron Burton (Sulzer Pumps Services (US) Inc.), Ricky Trahan (Motiva Enterprises)

Description
This case study will list the challenges and discuss the changes in material selection, dimensional stabilization procedures, machining methods and suggestions for changes to process start-up and shut-down procedures to improve reliability of the pumps.

CASE STUDY 9
Inlet Bay Flow Turbulence

Instructors
Monroe Voyles (ITT Industrial Process), Paul Behnke (ITT Industrial Process, Goulds Pump ESLA), Landon Worrell (ITT Goulds Pumps Canada Inc.), Lisa Buttar (SaskPower Corporation)

Description
A 58,000gpm single-stage vertically suspended cooling water pump experienced power and discharge pressure oscillations. Vibration and performance testing indicated power and pressure oscillations were caused by turbulence and vortex formation in the inlet bay. Physical hydraulic model testing confirmed that the flow entering the pump suction bell was indeed turbulent and unsteady. A vortex suppressor was used to straighten the flow from the inlet bay structure. The power and TDH variations with time were essentially eliminated.

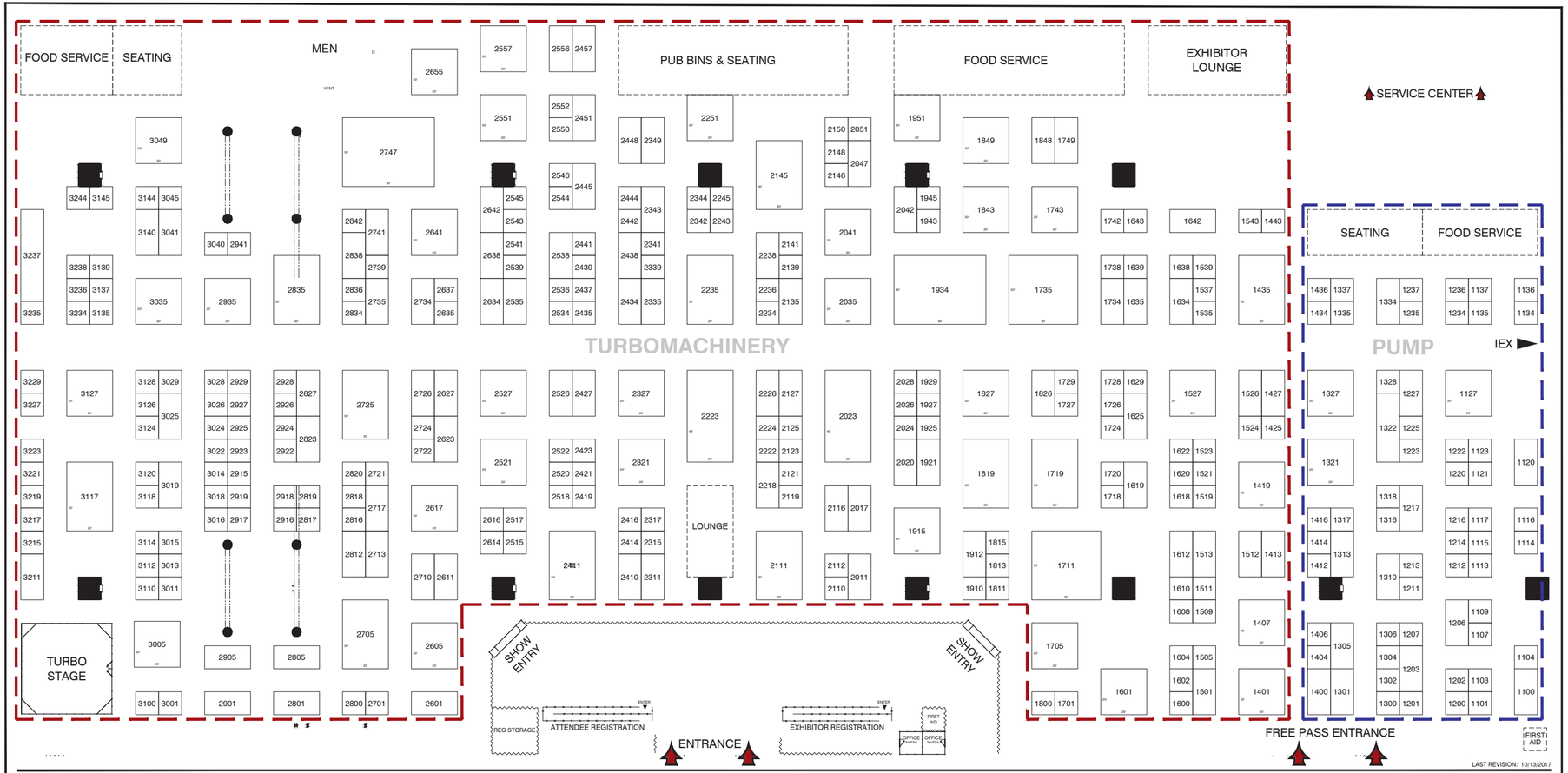
PUMP CASE STUDY SESSION 2B

Thursday, December 14, 2017
10:30 AM - 12:00 PM | Room 351F

CASE STUDY 10
Resolving Structural Vibration On a Pump

Instructors
Sankar Ganesh, Nicolas Peton (GE Bently Nevada)

Description
This case study is designed to outline how the high vibration issue was successfully diagnosed, the root cause for the high vibration and finally how it was mitigated using some of the structural analysis techniques (modal analysis, Operating Deflection Shape etc). Lessons learned are also discussed on the discovery methodology using expert system available at site, project point of view as well as from design point of view, which will be very much useful for the audience.



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Brüel & Kjær Vibro is the world's leading independent provider of condition monitoring product and services with a comprehensive portfolio that includes API 670-compliant protection systems, sensors, route-based portable data collectors, compact monitoring system for balance-of-plant machinery, and extensive service offerings. We are also the world's leading supplier for condition monitoring systems and remote monitoring services for wind turbines. Our recent acquisition of SETPOINT™ Vibration provides customers with the industry's most innovative API 670-compliant machinery protection system along with award-winning condition monitoring software that uses your OSIsoft PI Sytem for full-featured condition monitoring.

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904 West 6th Street
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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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2860 Water Tower Place
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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. 1618

1123 Church Street
Crosby, TX 77532 USA
PH: 281-462-0073
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, TX, with convenient access to US Highway 90 northeast of Houston.

BOLL FILTER CORPORATION 2823

22635 Venture Drive
Novi, MI 48375 USA
PH: 248-773-8200
http://www.bollfilter.com

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 comprehensive support network strategically positioned around the globe . Filter specialties include simplex, duplex and fully automatic self-cleaning variations. ASME/API/PED compliant, with most geographical certifications possible.

BOULDEN COMPANY 1427

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Conshohocken, PA 19428 USA
PH: 610-825-1515 | FX: 610-825-5544
http://bouldencompany.com

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.

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No. 48 USA Industry Zone
Guangzhou, GuangDong, Huadu District China
PH: (+)862037707173 | FX: (+)862086873078
http://www.bskfluid.com/index.asp

Since, 1989, as a family enterprise in US, BSK Fluid Technology LLC. has been engaged in research and development of pneumatic diaphragm pumps for more than two decades.

Our headquarter is in TX of U.S.A. Till now, we have sales offices and factory in Guangzhou of China.

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http://www.burckhardtcompression.com

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. 2427

5807 Nunn St
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PH: 713-641-0888
http://www.bwgrinding.com

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.

C

C AND T INTERNATIONAL, LLC 1103

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PH: 713-261-1028
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U.S. Distributor of Dawson Downie Lamont Pumps. Pump Repair, Sales & Service

CALNETIX TECHNOLOGIES 2116

16323 Shoemaker Ave.
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PH: 562-293-1660 | 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.

CAMFIL POWER SYSTEMS 2445

3025 Joseph A Bombardier
Laval, Quebec H7P 6C5 Canada
PH: 855-275-2377
http://www.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.

CANGZHOU HELI MACHINERY CO., LTD. 1109

Jiuhe East Road 11,Cangzhou Economical Development Zone, Hebei, China
Cangzhou, China 061000 China
PH: (+)863173092360 | FX: (+)863173093308
http://www.czheliltd.com

Cangzhou Heli Machinery was founded in 1997, has a history of 20 years. We are a professional manufacturer in China for ball valves, pipe fittings . We have passed the ISO and PED by TUV Rheinland in 2002. 100% of our products are exported to the USA, Europe, Australia . our sales amount was 6.2 million dollars in 2016. Our company own investment casting lines with 60tons monthly capacity, 36 CNC machine tools and more than 50 auxiliary equipments for testing and assembly. We can produce 40000pcs valves and 600000pcs pipe fittings per month. We always adhere to the stability of product quality, the concept of customer first.

CASCADE ANALYTIC, LLC 2311

1705 Gill Rd.
Dickinson, TX 77539 USA
PH: 281-482-2727 | FX: 281-402-3476
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.

CEROBEAR GMBH 1211

Kaiserstr. 100
Herzogenrath, NRW 52134 Germany
PH: (+)49240795560
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 GMBH 1511

Unterer Kreuzweg 1
Dresden, Sachsen 1097 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. 1642

5565 Maudlin Street
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PH: 713-644-2181 | FX: 713-644-1257
http://www.chmpgrp.com

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.

CHEMICAL ENGINEERING MAGAZINE 3041

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CHEMICAL PROCESSING 1202

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CINCINNATI GEAR REPAIR 2641

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Milford, OH 45150 USA
PH: 513-527-8600
http://www. cincinnatigearingsystems.com

Cincinnati Gear Repair is a division of Cincinnati Gearing Systems focusing on the aftermarket and end user. CGR provides complete rebuild or repairs on any make and model gear unit. International & Domestic Availability.

CINCINNATI GEARING SYSTEMS 2641

5757 Mariemont Ave.
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COMPRESSOR CONTROLS CORPORATION 2111

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http://www.ccglobal.com

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PH: 281-598-1873
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Rotating Equipment Repair

COMPRESSORTECH2 2135

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http://www.compressortech2.com

COMPRESSORtech2 magazine covers highly engineered natural gas and process gas-handling machinery and the compressors, drivers, controls, on-skid pumps and auxiliary devices and services required to specify, design, build, operate and maintain a gas compression package.

CONCEPTS NREC 2127

217 Billings Farm Road
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http://www.conceptsnrec.com

For over 60 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

CONTINUOUS CONTROL SOLUTIONS 2638

11275 Aurora Ave
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PH: 917-568-1132
http://www.ccsia.com

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 2327

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PH: 713-433-2002
http://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 part of Dover Corporation.

COOLING TECHNOLOGY INSTITUTE 3020

3845 Cypress Creek Parkway #420
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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.

COOLING TOWER DEPOT, INC. 2817

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Software Cradle is a leading provider of Computational Fluid Dynamics (CFD) software including SC/Tetra and scFLOW (general purpose unstructured mesh), scSTREAM (general purpose Cartesian mesh), and HeatDesigner (Cartesian mesh for electronics). Since 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.

CRYOSTAR 2538

2 rue de l'industrie ZI BP48
HESINGUE, FRANCE 68220 France
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1223

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Cincinnati, Ohio 45242 USA
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http://cts-inc.net

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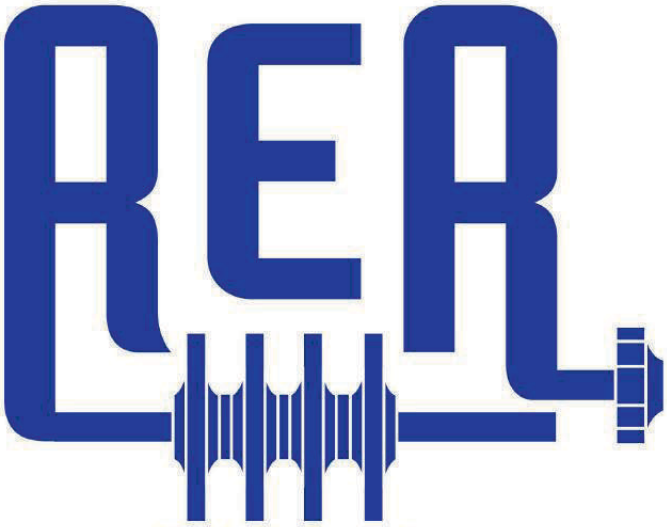

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RER provides 24 hour service consisting of comprehensive repair, refurbishment, and maintenance on rotating equipment to the petrochemical and refining industry of Houston and the entire Gulf Coast area. Our goal is to be one of the primary non-OEM providers of turbine and pump repair, while offering trustworthy, reliable and efficient solutions to problems on all types of rotating equipment. We utilize intelligent resources built from relationships in the industry to increase the reliability and production of all equipment. We supply first-rate quality, combined with extensive experience and competitive pricing due to low overhead costs. Our services include but are not limited to Dynamic Balancing, Turbine Repairs, Pump Repairs, Compressor Repairs, Centrifuge Repairs, Gearbox Repairs, and Fan Repairs.

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D&S ENGINEERED PRODUCTS 3128

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David Brown Santasalo delivers high efficiency, reliable gear systems for industrial applications in the oil & gas and power 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 and they now have 7 gearbox manufacturing plants and 25 service centres globally to ensure they can support you, wherever and whenever you need them.

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PH: 888-925-5444 | FX: 219-861-0662
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DICHTOMATIK AMERICAS 2614

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DICKOW PUMP COMPANY, INC. 1300

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PH: 770-952-7903
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sales@dockow.com 800-880-4442 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. 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.

DIVERSIFIED MANUFACTURING 2141

410 Ohio St.
Lockport, NY 14094
PH: 716-434-5585
www.dmimfg.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.

DIXON PUMPS 1234

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PH: 239-319-7400
http://www.dixonpumps.com

Manufacturer and provider of fluid handling solutions through innovative positive displacement transfer pumps, filtration sytems and tank cleaning units.

DONGGUAN SHENPENG ELECTRONICS CO.,LTD 1222

Dapu Industry Zone, Gangzi, Changping Town
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PH: (+)8676982550950 | FX: (+)8676981868633
http://www.spminipump.com

Dongguan Shenpeng Electronics Co., LTD was founded in 2004,we are the top one mini DC pumps manufacturer in China. with 200 skilled workers. It covers an area of more than 7200 square meters; 5 automatic assembly lines and daily production capacity is 10000pcs brushless DC pumps .with our own injection molding workshops and mold department.Our company has passed ISO9001 and TS16949 quality management system certification. “Quality is our culture". all of mini dc pumps will be controlled strictly in design, technology and production three stages.

DRAKE CONTROLS 2551

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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 TX, 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 INDUSTRIES 1934

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http://www.dresser-rand.com

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; modular power substations and more. Visit our experts at the Siemens booth #1934.

DURACOATINGS 2800

5710 N.W. 4th Street
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PH: 405-947-2863
http://www.dciind.com

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DYNAMICS SPC USA 2655

801 Travis, Suit #2025
Houston, TX 77002 USA
PH: 713-227-0780
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.

E

EAGLEBURGMANN INDUSTRIES LP 1843

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PH: 713-485-7594
https://www.eagleburgmann.de/

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. 1634

1138 Meldon Ave. | P.O. Box 261
Donora, Pennsylvania 15033 USA
PH: 724-379-5776
http://www.easternalloy.com

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.

EGC CRITICAL COMPONENTS 1513

8103 Rankin Road
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PH: 281-774-6100
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.

EKATO 2616

48 Spruce Street
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PH: 201-825-4684
http://www.ekato.com

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.

ELLIOTT GROUP 1819

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PH: 724-527-2811
http://www.elliott-turbo.com

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 2601

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EMPOWERING BRANDS 1305

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PH: 205-614-8601
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Empowering Brands is a digital media company that has created the leading online information and connection hub for the global pump industry, EmpoweringPumps.com. As strategic business partners to our clients, Empowering Brands creates tailored programs to support our clients' marketing campaigns, providing flexible and responsive service. With broad industry knowledge and a respected brand, Empowering Brands provides best-in-class digital media, content development, and social media strategy to empower our clients to cost-effectively reach and engage with a diverse industrial audience across multiple market industry platforms: Empowering Pumps, Empowering Compressors, Empowering Valves, Empowering Motors.

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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.

ENERSTAFF LLC 2121

1036 Hercules Ave
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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.

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PH: 510-845-0029
http://www.ennova.tech

Ennova Technologies develops leading edge grid generation software for computational fluid dynamics (CFD). At Ennova our goal is simple: To enable the CFD engineer to build models in hours that previously took months without sacrificing quality or accuracy. We accomplish this by deploying leading edge geometry healing and grid generation on a client/serve/parallel architecture that allows the pre- and post- processing to access the same compute resources that are used for the CFD solver.

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http://www.enproindustries.in

Enpro is a rapidly growing company engaged in design and manufacture of API lube consoles, Seal-Gas systems, Water-Wash systems, Cooling-Water consoles, Water-Injection systems, Fuel-Forwarding and Filtration skids, Gas-Processing skids, Jacking-Oil skids, Chemical-Injection systems and Pressure Vessels to ASME code for last 27 years. Enpro is an ISO 9001, ISO 14001 and OHSAS 18001 certified company with a 450 strong team comprising specialists for manufacturing, quality assurance, process, mechanical, electrical and instrumentation design, project management, global sales and service and global sourcing. Enpro has a world class 140,000 sq. ft. manufacturing facility in India with capability of packaging compressors and pumps.

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http://www.eos.info

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Exact Metrology is a 3D scanning company offering contracted services, equipment sales (new and used), rental, training and support. With technologies such as industrial 3D CT scanning, blue/white light laser, laser trackers, terrestrial LIDAR, and an array of point cloud and CAD software we can provide your dimensional inspections, porosity analysis or reverse engineering CAD creation data. Having capabilities of scanning micro-sized parts, to miles-wide cities and everything in-between Exact Metrology will do the job.

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PH: (+)4401953886210
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).

EXIDA.COM, LLC 1929

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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 USA, 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.

F

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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

FLOW CONTROL MAGAZINE 1701

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PH: 646-617-9301
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Flow Control Magazine http://www.flowcontrolnetwork.com 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 the chemical, food and beverage, oil and gas, pharmaceutical, semiconductor, and water and wastewater industries, or any industry in which the containment, control, or measurement of fluid is imperative. Processing is a new product magazine featuring reviews on the latest technology and innovations in the pharmaceutical, chemical, petrochemical and food industries. Readers consist of engineering and plant operations professionals who recommend, specify or purchase equipment. Processing features guest columns from some of the top minds in the industry, along with case histories and tutorials, as well as equipment/application-specific supplements throughout the year.

FLOWSERVE CORPORATION 1435

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http://www.flowserve.com

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.

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FLUID SEALING ASSOCIATION 1200

994 Old Eagle School Road Suite 1019
Wayne, PA 19087 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.

FRAMO AS 1227

P.O. Box 23
Florvagvegen, Norway/Florvag NO 5329 Norway
PH: (+)4748040040
http://www.framo.com

Framo AS is a pump manufacturer based in Bergen. The company was founded in 1938 and is now a worldwide organization with departments on three continents. Today, the company has 1,100 employees and is a leading manufacturer of pump systems for the chemical tanker market, the oil and gas industry and pumps used for oil spill recovery. Framo AS is part of the Alfa Laval group, and Bergen is the business center for marine pumping systems. Framo AS sells and carries out maintenance of all Framo products.

FS-ELLIOTT

2419

5710 Mellon Road
Export, PA 15632 USA
PH: 724-387-3200
http://www.fs-elliott.com

FS-Elliott is a global leader in the engineering and manufacturing of oil-free, centrifugal compressors with operations in over 90 countries. Building on a 50-year tradition of excellence, FS-Elliott combines an unwavering commitment to quality with the desire for advancing technology to bring value to our customers, allowing them to increase their productivity and lower system operating costs. For more information, please visit www.fs-elliott.com.

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1526

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PH: 713-691-6547
http://www.fusionhouston.com

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.

G

GARTNER COATINGS, INC. 1425

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http://www.gartnercoatings.com

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http://www.gasair.net

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, Metal Diaphragm Compressors, and Periflow Centrifugal 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.

GAS COMPRESSION MAGAZINE 1742

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GENERAL ATOMICS

3237

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GLOBAL POWER & PROPULSION SOCIETY (GPPS)

3137

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San Antonio, TX 78238-5166 USA
PH: 210-262-2213
http://www.gpps.global

GORE TURBINE FILTERS

1639

101 Lewisville Road
Elkton, MD 21921 USA
PH: 410-392-3300
http://www.gore.com/turbinefilters

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GORMAN-RUPP PUMPS

1123

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PH: 419-755-1207
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GOVERNOR CONTROL SYSTEMS, INC.

3029

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GRAHAM CORPORATION

1519

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PH: 585-343-2216
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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.

GUIZHOU JIANGNAN AEROSPACE COMMUNICATION & NETWORK CO., LTD. 3236

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PH: (+)861068594934

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GULF PUBLISHING COMPANY 2816

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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.

H

H & M PLATING COMPANY, INC. 2441

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http://www.hmplating.com

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HAHN EQUIPMENT CO., INC. 3045

5636 Kansas St.
Houston, TX 77007 USA
PH: 281-658-9414 | FX: 713-868-9725
http://www.hahnequipment.com

Hahn Equipment supplies and services pumps, grinders, mixers, controls and SCADA 24/7 and has been serving South East TX since 1971.

HAMMELMANN CORPORATION 1505

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HANGZHOU GUONENG STEAM TURBINE ENGINEERING CO.,LTD. 2448

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PH: (+)8657185780133 | FX: (+)8657185781632
http://www.htac.com.cn

Hangzhou Steam Turbine Auxiliary Equipment Co., Ltd, as a subsidiary of Hangzhou Steam Turbine Co., Ltd and a Long-term partner of SIEMENS, GE, MAN, MHI, ELLIOTT, is the China's leading turbine auxiliary equipment manufacturer. As the key products, air cooled condenser, water cooled condenser and lube oil unit, with its excellent quality and good service, and have won the trust from domestic and foreign customers.

HANGZHOU SEALCON FLUID MACHINERY CO., LTD 3215

No. 106 Qilinwu, Xinanjiang, Jiande
Hangzhou, China 311600 China
PH: (+)86057164791108 | FX: (+)86057164791958
http://www.china-sealcon.com

Hangzhou Sealcon Fluid Machinery CO.,Ltd was established in 2011,with Sealcon trademark we specialized in mechanical seal design,manufacturing,maintenance and sales,as well as the pump spare parts sales.The main products are mechanical seals, include cartridge seals, rubber bellow seals, metal bellow seals and o-rings seals,those products are applicable to different working condition.

Factory equipped with advanced CNC processing equipment, quality inspection, and also has the professional technician and experienced sales team.Product conforming to the standard of DIN24960, EN12756, ISO3069 API610, API682.It is widely used in the area of petroleum, chemical industry, machinery, metallurgy, shipbuilding, water treatment, printing and dyeing, food, automobile etc.

HANGZHOU STEAM TURBINE CO., LTD. 3005

No. 357 Shiqiao Road
Hangzhou, China/Zhejiang 310022 China
PH: (+)8618072820188
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.

HANWHA TECHWIN 2835

11757 Katy Frwy
Houston, TX 77079 USA
PH: 802-291-0411
http://www.hanwhatechwin.com

HENKEL CORPORATION 2721

One Henkel Way
Rocky Hill, CT 06067 USA
PH: 860-571-5100
http://www.na.henkel-adhesives.com/mro

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.

HERMETIC PUMPS INC. 1849

18847 Intercontinental Crossing Drive
Houston, TX 77033 USA
PH: 281-443-0905

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.

HILCO 1635

100 W. Fourth Street
Elmira, New York 14901 USA
PH: 607-733-7121
http://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 out performed 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.

HITACHI AMERICA, LTD. 2935

50 Prospect Ave
Tarrytown, NY 10591 USA
PH: 914-332-5800
http://www/hitachi-america.us/

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 deign. Hitachi utilizes advanced technology to reduce initial and operational costs for compressor installations.

HOERBIGER COMPRESSION TECHNOLOGY 1619

1358 West Newport Center Drive
Deerfield Beach, Florida 33442 USA
PH: 954-422-9850
http://www.hoerbiger.com

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, TX campus includes: rebuilds, rerates, overhauls, dehumidified storage for steam turbines, reciprocating and centrifugal compressors, pumps, gearboxes, and expanders.

HONEYWELL PROCESS CONTROLS 2701

1250 W Sam Houston Parkway S
Houston, TX 77042 USA
PH: 832-252-3500
http://www.honeywell.com

Industrial Process Control, Steam & Gas Turbine Controls, Compressor Controls.

HOOSIER PATTERN 2112

906 N 10th St
Decatur, Indiana 46733 USA
PH: 260-724-9430 | FX: 260-724-9433
http://www.hoosierpattern.com

Known for our quality of workmanship and commitment to “On Time Delivery”, HPI has gained recognition as a premier pattern shop. With some of the latest tools in technology HPI is able to provide you with the best quality, pricing and timing. A highly experienced staff will assist your company with “out of the box” concepts for every need. Hoosier encourages constant research for new products and procedures to stay profitable and further capabilities. Additions of 3D sand printers and an FDM/ABS plastic printer truly keep HPI on the cutting edge of technology.

HOUSTON DYNAMIC SERVICE 2335

8150 Lawndale
Houston, TX 77012 USA
PH: 713-928-6200 | FX: 713-928-2903
http://www.houstondynamic.com

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.

HOWDEN ROOTS 2905

900 West Mount Street
Connersville, IN 47331 USA
PH: 800-557-6687 | FX: 765-827-9317
http://www.howdenroots.com

Howden is a global company that brings the innovators and developers of the world's most advanced compressor technologies together under one organizational structure. Building on a philosophy of continual research and development, and a thorough understanding of the applications and industries we serve, we have become an acknowledged leader in the science and engineering of compressors and related equipment, including centrifugal, reciprocating, screw, rotary blowers and turbo fans to name a few. In any sector, in every application where reliable, round-the-clock operation is paramount, Howden's innovation and technology keeps the world's industries running.

HR POWER DESIGN LLC 2637

2744 SW Villa West Suite 301
Topeka, KS 66614 USA
PH: 913-486-6676
http://www.hrpowerdesign.com

Since 2002 HR Power Design has been engineering innovative custom designs in nitrogen purge systems. Original projects created solutions for the corrosion resistant shipping and storage of spare parts and later grew to encompass economical alternatives for much larger mission critical components. HR Power Design supplies rigid steel nitrogen purge storage containers suitable for power, medical, refinery, research, and alternative energy industries. Whether shipping domestically or internationally customers rely on our containers to keep their parts and assemblies in pristine condition.

HUANGSHAN RSP MANUFACTURING CO,. LTD. 1107

Jiulong Industry Park
Huangshancity, Anhui 245021 China
PH: (+)865592567755 | FX: (+)865592568248
http://www.rsppump.com

RSP is specialized in screw pumps including three-screw pump, twin-screw pump and single-screw pump with more than 20 series and 500 specifications. It has build reputation in metallurgy, power, oil & gas, shipbuilding, etc.

RSP pump products can be widely used in turbomachinery for lubrication, cooling, circulation, etc.

HUNAN SUND INDUSTRIAL AND TECHNOLOGICAL CO., LTD. 3135

No.9 Chayuan Road Yuetang DIstrict
Xiangtan, Hunan 411101 China
PH: (+)8673158550222
http://www.hnsund.com

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.

HUNAN TANE OCEAN PUMP CO., LTD. 3234

Pingjiang Tianyue Economic Development Zone Yueyang
Hunan, China 414500 China
PH: (+)867306261515
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 1214

6 Campus Drive, First Floor North
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.

HYDROTEX DYNAMICS

1321

6320 Cunningham Road
Houston, TX 77041 USA
PH: 713-937-9001
http://www.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 to learn more about our comprehensive pump services.

HYDROTHRIFT CORPORATION

2546

1301 Sanders Ave S.W. | PO Box 1037
Massillon, OH 44648 USA
PH: 330-837-5141 | FX: 330-837-0558
http://www.hydrothrift.com

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.

HY-PRO FILTRATION

3211

6810 Layton Road
Anderson, IN 46011 USA
PH: 317-849-3535
http://www.hyprofiltration.com

Hy-Pro Filtration manufactures cutting edge fluid contamination solutions for hydraulic and lube oils as well as diesel fuel. Our DFE rated filter elements and fluid conditioning equipment can address many issues including: lube oil varnish, phosphate ester fluid maintenance, servo valve failures, gearbox filtration, oil reclamation, particulate contamination, removing water from oil & diesel fuel, and many more.

Our expertise and shoulder to shoulder commitment to solving your fluid contamination challenges set Hy-Pro apart and enable us to optimize the reliability of your hydraulic and lubrication assets to keep your plant operating at peak productivity.

I

IDEAL ELECTRIC COMPANY 2146

330 E. First Street
Mansfield, OH 44902
PH: 409-522-3611
http://www.theidealelectric.com

Founded in 1903, IDEAL Electric Company, formerly known as Hyundai Ideal Electric Co., is a globally established American manufacturer of custom, high-power electric motors and generators, switchgear and control systems for all applications including industrial, oil, gas and petrochemical, water and infrastructure, pulp and paper, air handling, marine, mining, power generation and renewable energy.

In September 2017 it was announced that IDEAL was acquired by an affiliate of Gulf Electroquip Ltd of Houston, Texas, returning the company to private ownership and marking the next chapter in the more than 114-year history of the Company.

IMI SENSORS 2929

3425 Walden Avenue
Depew, New York 14043 USA
PH: 716-684-0001

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.

INDAR ELECTRIC 3235

Barrio Altamira, Poligono Txara S/N
Beasain, Gipuzkoa 20200 Spain
PH: (+)34943028200
http://www.indar.net

Since 1940 INDAR is a leading electrical rotating machine manufacturer that provides tailor made solutions in the field of energy generation. The Gas and Steam division, which focuses in providing solutions wwith eficient generators serving cogeneration, biomass, geothermal energy and waste to energy segments amongst others.

INDUSTRIAL INFO RESOURCES 1921

2277 Plaza Drive Suite 300
Sugar Land, TX 77479 USA
PH: 713-783-5147
http://www.industrialinfo.com

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 Platforms, 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 & ALIGNMENTS, LLC 2148

PO Box 1379
Palakta, FL 32177 USA
PH: 904-655-1082 | FX: 386-267-3149
http://www.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 2521

800 Beaty St
Davidson, NC 28036 USA
PH: 704-655-4000
http://www.IngersollRandProducts.com

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 2327

4221 81st Ave W
Rock Island, IL 61201 USA
PH: 309-787-4971
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 and part of Dover Corporation.

INTEGRATED TURBOMACHINERY 1622

7411 Telegraph Road
Montebello, CA 90640 USA
PH: 323-726-5200 | FX: 323-726-5206
http://www.integratedturbo.com

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.

ISOMAG CORPORATION 2922

11871 Dunlay Avenue
Baton Rouge, Louisiana 70809 USA
PH: 225-752-0926
http://www.isomag.com

Isomag is the technological leader in industrial bearing seal protection. All Isomag bearing seals utilize precision lapped flat face sealing technology to provide a 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 INDUSTRIAL PROCESS 1501

240 Fall Street
Seneca Falls, New York 13148 USA
PH: 315-568-2811
http://www.gouldspumps.com

ITT Industrial Process (IP) is a dynamic business expanding on a global scale. Headquartered in Seneca Falls, New York, IP offers a portfolio of world-leading brands in industrial pumps, valves and monitoring and control equipment, offshore water treatment systems, and plant optimization and efficiency systems, as well as aftermarket services and parts.

ITW ENGINEERED POLYMERS 2541

130 Commerce Dr.
Montgomeryville, PA 18936 USA
PH: 215-855-8450
http://www.ITWengineeredpolymers.com

ITW Engineered Polymers is a worldwide manufacturer of adhesives, sealants, coatings, lubrication, grout and cutting fluids for industrial, construction and consumer purposes - composed of two regional divisions (Europe and North America) with production facilities in Denmark, Ireland and USA.

Our Chockfast epoxy grout foundation systems and chocking compounds enhance rotating equipment reliability and improve mean time before failure.

J

JETSEAL, INC. 2444

10310 E. Buckeye Lane
Spokane Valley, Washington 99206 USA
PH: 509-467-9133 | FX: 509-467-9028
http://www.jetseal.com

JETSEAL, Inc. 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.

JOHN CRANE 1827

227 West Monroe Street Suite 1800
Chicago, IL 60606 Antigua And Barbuda
PH: 312-605-7800
http://www.johncrane.com

John Crane is a global leader in rotating equipment solutions, supplying engineered technologies and services to process industries. The company designs and manufactures a variety of products including mechanical seals and systems, couplings, bearings, filtration systems and predictive digital monitoring technologies. John Crane customer service is accessed through a global network of more than 200 sales and service facilities in over 50 countries.

JOURNAL OF COMPRESSOR, BLOWER AND FAN TECHNOLOGY 3139

No16, Kai Fa Road, Economic and Technology Development Zone
Shenyang, China/Liao Ning 110869 China
PH: (+)8602425800521
http://conference.cftn.cn

The Journal of Compressor, Blower and Fan Technology was established in 1959 as the first domestic journal of the Chinese turbomachinery industry. From then on, it has played a key role in introducing advanced foreign technology, spreading knowledge and sharing experience. The Journal is well known both in academic and engineering application for its collaborative spirit, knowledge sharing, skills development and for its contributions to turbomachinery industry in China.

K

KEENE TURBOMACHINERY SERVICES 2150

5600 John Martin Rd.
Baytown, TX 77521 USA
PH: 281-427-8800 | FX: 281-427-0427
http://www.keeneturbo.com

Keene Turbomachinery Services is a full-service sales and repair facility in Baytown, TX, 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.

KELM ENGINEERING, LLC 1604

13711 Banks View Ct
Houston, TX 77059 USA
PH: 281-993-3717
http://www.kelmengineering.com

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.

KINGSBURY, INC. 2527

10385 Drummond Road
Philadelphia, Pennsylvania 19154 USA
PH: 215-824-4961 | FX: 215-824-4999
http://www.kingsbury.com

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 for more details.

KOBELCO COMPRESSORS AMERICA, INC. 2746

1415 Louisiana St. Suite 4111
Houston, TX 77002 USA
PH: 713-655-0015 | FX: 713-982-8450
http://kobelcocompressors.com/

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 2522

438 Crest Drive
Northvale, NJ 07647 USA
PH: 201-669-6857
http://www.kongsberg.com

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. 1235

901A Matthews-Mint Hill Road
Matthews, North Carolina 28105 USA
PH: 704-814-6164

KRAL is a leading manufacturer of screw pumps and flowmeters with innovative solutions to meet industry demands. 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.

KULITE SEMICONDUCTOR PRODUCTS, INC.

3040

One Willow Tree Road
Leonia, New Jersey 07605 USA
PH: 201-461-0900
http://www.kulite.com

Kulite is the World's recognized Leader in the science and engineering of piezoresistive sensors and holds more than 340 patents in this area. ISO 9001 Certified, Kulite manufactures all welded, high pressure, intrinsically safe, current output, voltage out, pressure transducers for resource exploration including submersible, downhole and towed array.

L

LANCER SYSTEMS 2520

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.

LEADGO ELECTRIC MOTOR INC. 3024

5256 Brittmoore Road,
Houston, TX 77041 USA
PH: 832-770-4579
http://www.leadgomotor.com

Premium Efficiency 1---600HP NEMA Electric Motor

CSA Certification. Class 1 Division 2 Hazardous Location

Inverter Duty

LEISTRITZ ADVANCED TECHNOLOGIES CORP. 1327

165 Chestnut Street
Allendale, New Jersey 07401 USA
PH: 201-934-8262 | 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. 1334

132 Hopping Brook Road
Holliston, MA 01746 USA
PH: 508-429-7403
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.

LOBEPRO ROTARY LOBE PUMPS 1237

2610 Sidney Lanier Drive
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
http://www.lubepower.com

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 can now provide pressure vessels per ASME section VIII and seal reservoirs per API 682. Lube-Power also provides exceptional aftermarket service and support for our equipment, or manufacturer's equipment.

LUDECA, INC. 2735

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.

LUFTEX GEARS MANUFACTURING & SERVICES 1927

2612 US Highway 69 North
Lufkin, TX 75904 USA
PH: 936-632-3679
http://www.luftexgears.com

LUFTEX GEARS is a manufacturing company of Loose Gearing, Aftermarket Repairs of all Major Gear Reducers/Increasers, and Special Drop in New Units. We also have a Field Service Team where we provide onsite inspections, trouble shooting and complete over haul of all Major Brands.

LUNETA/RCM SALES & SERVICES, INC 2051

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 TX, 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.

M

MAAG PUMP SYSTEMS 1404

9401-Q Southern Pine Blvd.
Charlotte, NC 28273 USA
PH: 704-716-9044
http://www.MAAG.com

For more than 90 years, Maag has been renowned as a supplier of gear pumps of the highest quality that are used today for conveying polymer melts, chemicals and even lubricants. Thanks to our many years of process experience, we are able to adapt our pumps perfectly to our customers' requirements, achieving the best possible degree of effectiveness, the longest possible service life for the pumps and the shortest downtime possible for your systems.

MACHINE SAVER INC. 1509

16301 Blue Ridge Rd
Missouri City, TX 77489 USA
PH: 832-581-9908
http://www.machinesaver.com

CBM Enterprise Solutions LLC and VTBNet Inc. are MACHINE SAVERS. We supply patented automated machine conditioning monitoring software (CBMVision). Our patent pending sensors are intelligent wire less triaxial vibration and temperature sensors (VTBNet). Our low cost solution moves data and not people. Our unique products, software and service reduce cost of ownership thru simplified installation, lowered cost of maintenance, carefree data maintenance and auto analysis. Our goal is to provide our customers a low cost total machine advanced warning and protection solution for pumps, motors, fans, blowers, gearboxes and compressors by providing unique products, software and exceptional services. www.cbmenterprise.com

MAN DIESEL & TURBO NORTH AMERICA INC. 1735

MAN Diesel & Turbo

2017 SPONSOR

1600A Brittmoore Road
Houston, TX 77043 USA
PH: 713-780-4200 | FX: 713-780-2848
http:// www.mandieselturbo.us.com

MAN Diesel & Turbo SE, based in Augsburg, Germany, is the world's leading provider of large-bore diesel and gas engines and turbomachinery. The company's product portfolio includes two-stroke and four-stroke engines for marine and stationary applications, turbochargers and propellers as well as gas and steam turbines, compressors and chemical reactors. The range of services and supplies is rounded off by complete solutions like ship propulsion systems, engine-based power plants and turbomachinery trains for the oil & gas as well as the process industries. Customers receive worldwide after-sales services marketed under the MAN PrimeServ brand.

MARY KAY O'CONNOR PROCESS SAFETY CENTER 3217

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.

MASTER OF ENGINEERING TECHNICAL MANAGEMENT (METM) 3144

3367 TAMU | 005B Fermier Hall
College Station, TX 77843 USA
PH: 979-458-5083 | FX: 979-847-9397
http://engineering.tamu.edu

The Master of Engineering Technical Management (METM) is an online, professional, part-time graduate program offered by the Texas A&M College of Engineering. METM is designed to give ambitious technical professionals the business acumen and leadership skills needed to transition into project management.

MAUDLIN PRODUCTS 2224

1929 HWY 146
Kemah, TX 77565 USA
PH: 281-334-7566
http://www.maudlinproducts.com

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.

MECHANICAL REPAIR & ENGINEERING, LP 2020

202 N. 18TH | 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 ft2 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.

MECHANICAL SOLUTIONS, INC. 1629

11 Apollo Drive
Whippany, New Jersey 07981 USA
PH: 973-326-9920 x 125
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.

MEGGITT (VIBRO-METER) 1539

Rte de Moncor 04
Fribourg, FR 1701 Switzerland
PH: (+)41264071301
http://www.meggittsensing.com

Meggitt is the world's leading provider of high performance sensing and condition monitoring solutions for many industries and 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 vibration monitoring, pressure, acceleration, velocity, displacement and partial discharge. Visit our booth to learn how our products can help you achieve better outcomes.

MERIDIAN EQUIPMENT, INC. 1625

12800 Fuqua Street
Houston, TX 77034 USA
PH: 281-484-7700 | FX: 281-484-7774
http://www.meridianequipment.com

Offering a wide selection of portable machining equipment to solve a variety of in-place machining tasks. Priding ourselves on same day shipping, international support, well maintained equipment and user-friendly service.

METALTECH SERVICE CENTER, INC. 2236

9915 Monroe Road
Houston, TX 77075 USA
PH: 713-991-5100
http://www.metaltechsc.com

Metaltech Service Center is a stainless steel, nickel, and alloy steel service center. Stainless inventories consist of plate, sheet, round bar, flat bar, angles, and other commodities. Nickel Alloy inventory consists of Alloy C-276 and Alloy 400 plate. 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. Please take the virtual tour on our web site.

MID-AMERICA MACHINE INC. 2317

92 Pioneer Industrial Drive
Mayfield, KY 42066 USA
PH: 270-247-6909 | FX: 270-970-2885
http://www.midamericamachine.com

Mid-America Machine, Inc. is a privately owned company that was created by Paul & Sandra Crowell and has been producing quality products and dependable service since 1987. Our skilled employees have several decades of combined expertise and experience and are committed to customer satisfaction.

Mid-America Machine is one of the world's largest manufacturers of aftermarket centrifugal air compressor parts specializing in Centac™, Joy, Clark™, Elliott™, Atlas Copco™, and 5-axis impeller machining. We also specialize in repairing parts for all the compressors listed above.

We offer a variety of capabilities in our 30,000 sq. ft. facility including chroming, welding, CNC 3 thru 5-axis machining, reverse-engineering, polygon grinding, and specialty machining.

MITSUBISHI HEAVY INDUSTRIES 1711

14888 Kirby Dr
Houston, TX 77047 USA
PH: 832-710-4700
http://www.mhicompressor.com

Mitsubishi Heavy Industries group companies are recognized by our customers for our technology, quality, efficiency, and reliability. Mitsubishi Heavy Industries Compressor Corporation is a leading manufacturer of API compressors and mechanical drive steam turbines. Our products are widely used in the oil & gas and petrochemical markets and range in size from 300mm – 2000mm in impeller diameter. Our US based 180,000 ft² state-of-the-art packing and service center, Pearland Works, is conveniently located in the Gulf Coast, just outside of Houston, TX. Backed by local sales, engineering, and operations experts, the staff at Pearland Works focuses on supporting Mitsubishi turbomachinery, as well as other OEM brands.

MODERN PUMPING TODAY 1313

312 Lorna Square
Birmingham, Alabama 35216 USA
PH: 866-251-1777
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 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.

MOMENTUM ENGINEERED SYSTEMS, INC. 1512

8305 Monroe Rd
Houston, TX 77061 USA
PH: 832-804-7424 | FX: 832-804-9891
http://www.momentumsys.com

Momentum Engineered Systems Inc. designs and manufactures mechanical seal support, filtration and machinery lubrication systems. Based in Houston, TX, Momentum is focused providing customized solutions in industry best leadtimes. Our ASME U-Stamp and National Board Registration certification allow us to manufacture to the highest quality standards and tackle the industry's most challenging design problems. Whether it is a filtration system for pure ethane or a high production volume lubrication system, Momentum has a solution for the market.

N

NATIONAL COMPRESSOR SERVICES 2916

10349 Industrial Rd.
Holland, Ohio 43528 USA
PH: 855-627-5050 | FX: 419-868-4981
http://www.national-compressor.com

National Compressor Services offers a broad set of service solutions for industrial compressor applications, including both shop and field service experience, on all major compressor technologies (centrifugal, reciprocating and rotary) and other associated rotating equipment. To keep your facility running, we offer replacement parts, refurbished units and rentals to meet your needs in normal maintenance, planned shutdowns and emergency situations. We look forward to the opportunity to serve you.

NATIONAL PUMP COMPANY 1406

7706 N. 71st Ave.
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 up to 2,500 horse power. 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 USA.

NEOFLEX INDUSTRIAL 1412

P.O. Box 171
Stafford, TX 77477 USA
PH: 281-885-8718
http://www.neoflexind.com

Neoflex Industrial is a leading rubber products supplier, serving what is needed, when is need with flexibility. We offer rubber expansion joints, customized rubber molding and more.

NEW-SEAL

2710

50 McDonald Blvd
Aston, PA 19014 USA
PH: 610-497-6700
http://www.newwayairbearings.com

New-SealTM technology provides a “New Way” of sealing, using proven externally-pressurized porous gas bearing technology. New-SealTM enables non-contact shaft sealing, and can be used for sealing liquids, gases, fine powders, or slurries, with an easy path to retrofit. A variety of input gases in addition to air can be used – including process gas. New-SealTM is patented technology, owned by New Way Air Bearings®.

NIDEC INDUSTRIAL SOLUTIONS

3035

Via Fratelli Gracchi 39
Cinisello Balsamo, Milano 20092 Italy
PH: (+)390264451
http://www.nidec-motor.com

Nidec ASI was founded in December 2012 following the acquisition by Nidec Corporation of Ansaldo Sistemi Industriali SpA. As part of Nidec group, Nidec ASI now serves a large clients portfolio in a wide range of industrial markets including metals, energy, marine, oil & gas, ropeways, cranes, pulp and paper. (Salerno). From 2015 Nidec ASI is responsible for the Group's industrial platform, and operates in the US market as Nidec Industrial Solutions.

NORTHERN PUMP

1116

340 West Benson Ave
Grantsburg, WI 54840 USA
PH: 800-366-1410 | FX: 715-463-5174
http://www.northern-pump.com

Northern is a high pressure (up to 2000 psi) gear pump used by the O&G and CPI community.

NUMECA USA

2437

1044 Larkin Street
San Francisco, CA 94109 USA
PH: 415-558-8483
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.

O

OIL, GAS & PETROCHEM EQUIPMENT 2119

1421 S Sheridan Rd
Tulsa, Oklahoma 74112 USA
PH: 918-832-9351
http://www.ogpe.com

Oil, Gas & Petrochem Equipment / OGPE.com is the oil industry's only all-products-and-services print/online brand. Magazine, weekly e-Newsletters, website, social media — exclusive to oil and gas equipment, products, systems, and services. Our Pumps, Compressors, Engines, Turbines Special Report distributed at this 2013 Symposia. ogpe.com jba@pennwell.com Pennwell Corporation

OILMAN MAGAZINE 3100

PO Box 771872
Houston, TX 77215 USA
PH: 800-562-2340 | FX: 800-562-2340
http:// 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.

OROS 2243

502 Shaw Road B - 101
Dulles, VA 20166-9435 USA
PH: 703-478-3204
http://www.OROS.com

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.

P

PDC MACHINES, INC 1638

1875 Stout Drive
Warminster, PA 18974 USA
PH: 215-443-9442
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 Nm3/hr.

PEERLESS PROCORE 2026

15 Lawrence Bell Dr
Buffalo, NY 14221 USA
PH: 800-234-3033 | FX: 716-852-5458
http://www.peerless-inc.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.

PERONI POMPE SPA 1216

Via Tacito, 4
Milano, Corsico 20094 Italy
PH: (+)3902489401
http://www.peronipompe.com

Peroni Pompe designs and manufactures API 674 reciprocating pumps for the Oil & Gas and Chemical industries. All Peroni pumps are tailor-made to meet the specific needs of customers. Our expertise includes pumps for offshore topsides production facilities, critical refinery process units, gasification units and urea production facilities.

PETROPAGES 2827

102 Magellan Circle Suite A
Webster, TX 77598 USA
PH: 281-316-0353
http://www.petropages.com

PetroPages is a marketing company that specializes in the process and power industries. Our services include:Automated marketing, 3D animation, web design, search engine optimization, interactive presentations, graphic design (print and digital), company branding, logos, marketing consulting services. PetroPages.com maintains the most active industry specific online directory.

PETROTECH, INC. 2028

151 Brookhollow Esplanade
New Orleans, Louisiana 70123 USA
PH: 504-620-6600 | FX: 504-620-6601
http://www.petrotechinc.com

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.

PHILADELPHIA GEAR 2834

901 East 8th Ave Suite 100
King of Prussia, PA 19468 USA
PH: 800-766-5120 | FX: 610-337-5637
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.

PIONEER ENGINEERING 3013

912 Smithfield Suite 4
Fort Collins, CO 80524 USA
PH: 970-266-9005
http://www.pioneer-engineering.com

Reliability Services and Education

PIPE FLANGES & FITTINGS (FIELD INDUSTRIES) 2550

4906 Weeping Willow Rd.
Houston, TX 77092 USA
PH: 832-736-1839
http://www.fieldindustries.com

Field Industries is a supply house for steel & alloy flanges, fittings, fasteners, pipe, tubing, structural items, and centrifugal castings. We are also a general contractor for the fabrication, erection, and repair of pressure vessels, heat exchangers, tanks, and piping systems. We follow ASME, ANSI, ASTM, TEMA, NACE, API, OSHA, & ISO standards.

POK - COMPLEX CASTINGS AND PRECISION MACHINING 1943

Callejón Camichín #112
Tlajomulco de Zúñiga, Jalisco 45645 Mexico
PH: (+)523336860733
http://www.pok.com.mx

Complex Castings and Precision Machining - Investment casting and Sand casting Foundry and Machine Shop since 1894. Located in México, POK exports 85% of our turn-key products worldwide. Alloys: Inconel 718, High strength steel, Low alloy steels, bronzes, ductile iron and specialty alloys.

POWER ZONE EQUIPMENT, INC. 1436

46920 County Road E
Center, CO 81125 USA
PH: 719-754-1981 | FX: 719-754-1982
http://www.powerzone.com

Power Zone Equipment, Inc. is an industrial equipment and solutions provider for fluid handling applications. With thousands of pieces of equipment in stock and a full line of engineering, manufacturing and testing capabilities, we provide fast, quality solutions for numerous industries in over 40 countries around the world.

PRAXAIR SURFACE TECHNOLOGIES 2123

7615 Fairview Street
Houston, TX 77041 USA
PH: 713-849-9474
http://www.praxairsurfacetechnologies.com

Today, protective coatings are used on hundreds of parts in the turbomachinery marketplace. Praxair Surface Technologies understands the clearance, corrosion, oxidation, wear and thermal problems you encounter every day. Praxair's complete range of advanced coating services allows you to get new or refurbished equipment into production quickly, and keep it running longer. With unmatched quality and experience, we have pioneered the best-performing thermal spray (including HVOF and plasma), diffusion, Tribomet® electrodeposition, SermeTel™ engineered slurry, and vapor deposition coatings, and laser cladding overlays in the industry.

PRIME PHOTONICS 1335

1116 S Main St
Blacksburg, VA 24060 USA
PH: 540-961-2200 | FX: 540-961-2300
http://www.primephotonics.com

Prime Photonics produces instrumentation for making measurements on rotating equipment. This instrumentation includes blade tip timing sensors for making blade stress measurements and our new optical torque measurement system. Our optical torque and torsional vibration measurement system can be used to make measurement regardless of shaft material or surface finish.

Prime Photonics creates value for its customers, shareholders, employees and partners, by developing impactful sensor and materials technologies and products for test and measurement, inspection, control and health monitoring of commercial and military equipment, structures and turbomachinery.

PROCESS COMPLIANCE PRODUCTS, INC. 2917

P.O. Box 891472
Houston, TX 77289-1472 USA
PH: 713-248-5509
http://www.pcitx.us

Asset Modernization Programs, AMP, Upgrading of materials, processes and equipment for optimum reliability for our customers resulting in maximum profitability.

PROCESS FLOW NETWORK 1701

200 Croft St., Suite 1
Birmingham, AL 35242 USA
PH: 646-617-9301
http://grandviewmedia.com

Processing Magazine http://www.processingmagazine.com Processing is a new product magazine featuring reviews on the latest technology and innovations in the pharmaceutical, chemical, petrochemical and food industries. Readers consist of engineering and plant operations professionals who recommend, specify or purchase equipment. Processing features guest columns from some of the top minds in the industry, along with case histories and tutorials, as well as equipment/application-specific supplements throughout the year. Processing's website, www.ProcessingMagazine.com, is a GAMMA Gold Award Winner for Best Website. Visitors can read industry expert blogs, download white papers for free and view breaking news as it happens.

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 machinery protection and condition monitoring systems as well as diagnostic services based on over 25 years of experience in recording, analyzing and interpreting continuous high-resolution data for rotating equipment.

PSC COUPLINGS 1416

N56 W13855 Silver Spring Dr.
Menomonee Falls, WI 53051 USA
PH: 262-290-1904
http://www.psccouplings.com

PSC Couplings designs and produces high quality drop-out spacer disc couplings with industry leading ease of installation, no balancing required up to 3,600 rpm, API-610 / API-671 compliance, and use of standard fasteners. PSC's couplings have been specifically designed to allow for stiffness tuning which can offer lower cost and better performance in gas compression packages especially where detuners are needed or where a disc coupling is preferred over an elastomer coupling. PSC Couplings are interchangeable with all major brands of spacer style disc couplings.

PULSAFEEDER, INC. 1135

2883 Brighton Henrietta Town Line Rd.
Rochester, NY 14623 USA
PH: 585-292-8000
http://www.pulsa.com

In the early 1940's Pulsafeeder pioneered the hydraulically actuated diaphragm metering pump principle, and the company has been a global leader in fluid handling technology ever since. With experience in multiple industries, Pulsafeeder's reciprocating and rotary gear pumping technologies meet and exceed the industry requirements for safety, reliability and precise control.

PROFLOW SOLUTIONS 1127

5313 Gulf Freeway
LaMarque, TX 77568 USA
PH: 877-434-3700

ProFlow Solutions: The customer's pump company.

A pump and seal distributor with a difference, ProFlow Solutions partners with customers who want to attack rotating equipment/fluid handling reliability problems. In addition to a complete line of pumps, seals and auxiliaries from reliable name brands such as Shinhoo, Hevvy/Toyo, One-Eye and PeakFlow, ProFlow partners with customers to form on-site reliability programs to track failures, pinpoint problems, and ultimately introduce meaningful and long-lasting solutions to improve efficiency and profitability. ProFlow also provides complete repairs, parts, support, and training programs on site or at one of their Texas locations in the Houston and Odessa areas.

PRUFTECHNIK 2042

7821 Bartram Ave
Philadelphia, PA 19153 USA
PH: 844-242-6296
http://www.pruftechnik.com

PRUFTECHNIK, the makers of the ROTALIGN, OPTALIGN and PARALIGN systems, sets high standards in precision measurement to provide solutions for alignment and condition monitoring in the areas of industrial maintenance and quality assurance.

PRUFTECHNIK remains the market leader in shaft alignment and its multiple award-winning systems have become standards in many industrial sectors. PRUFTECHNIK makes sure that your rotating machines run with optimum efficiency to help you save costs and increase the reliability of your assets and plants.

PUMP ENGINEER MAGAZINE 1114

36 King Street E, Suite 701
Toronto, ON/Canada M5C 1E5
PH: 416-361-9810
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.

PUMPS & SYSTEMS MAGAZINE 1217

1900 28th Ave South
Birmingham, Alabama 35209 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.

PUMPWORKS 610 1304

8885 Monroe Rd.
Houston, TX 77061 USA
PH: 713-956-2002 | FX: 713-956-2141
http://www.pumpworks610.com

PumpWorks Industrial, also located in Houston, TX USA, manufacturers 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.

PUMPWORKS INDUSTRIAL 1306

65 Southbelt Industrial Dr.
Houston, TX 77047 USA
PH: 713-892-5887
http://www.pumpworksindustrial.com

PumpWorks Industrial, also located in Houston, TX USA, manufacturers 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.

Q

QCC 2926

7301 W. Wilson Ave
Harwood Heights, Illinois 60706 USA
PH: 708-887-5400
http://www.qccorp.com

QCC, a manufacturing services provider, specializes in precision machining, assembling, and testing products and machined components for OEMs and their suppliers worldwide. It offers manufacturing services, such as early stage services, growth stage and mature program support, and legacy product support. The company specializes in mechanical and electromechanical products and components, such as engine components and accessories, hydraulic fan drive systems, fuel pumps, hand pumps, hydraulic gear pumps, valves, motors, for aerospace and various industrial markets. It also offers actuators, speed switches, power driven units, pumps, and directional control, and aerospace components and assemblies.

QINGDAO VDV PRECISION METAL CO.,LTD. 3223

Dazhuge Industrial Park, Zhangying Town, Jiaozhou City,
Qingdao Shandong China, Shandong China 266331 China
PH: (+)8653285218027
http://www.qdvdv.com/

Qingdao VDV precision metal Co.,Ltd. is specialized in manufacturing stainless steel, carbon steel, duplex steel, alloy steel and other Ni base steel casting with the advanced precision casting technology, yearly produces 500T castings.

QUADRANT EPP 2041

2120 Fairmont Avenue | PO Box 14235
Reading, PA 19605 USA
PH: 610-320-6600
http://www.quadrantplastics.com

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 #2041 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+W COUPLING TECHNOLOGY

1134

1120 Tower Lane
Bensenville, IL 60106 USA
PH: 630-521-9911
http://www.rw-america.com

R+W designs and manufactures flexible disc couplings with pure friction drive for smooth running and maximum reliability. Along with standard API 610 and custom API 671 couplings, R+W offers a variety of traditional coupling designs to suit a broad range of applications.

RATHI NORTH AMERICA

1414

N56 W13855 Silver Spring Dr.
Menomonee Falls, WI 53051 USA
PH: 262-290-1904
http://www. rathicouplings.com

Rathi North America offers a comprehensive range of mechanical power transmission couplings including elastomeric, metallic, and rigid couplings.

RDI TECHNOLOGIES, INC.

2311

10301 Technology Dr., Suite A
Knoxville, TN 37932 USA
PH: 865-256-0105
http://www.rditechnologies.com

RDI's patented technology measures deflection, displacement, movement and vibration not visible to the human eye. Our revolutionary Iris M product utilizes video camera technology in conjunction with our software and processing algorithms to extract meaningful data. The Iris M turns every pixel in the camera's view into a sensor capable of measuring vibration or motion with high levels of accuracy. The results lend themselves to a visualization of the motion and a clearer understanding of the root cause of an issue.

REINHART & ASSOCIATES, INC.

2125

P.O. Box 140105
Austin, TX 78714 USA
PH: 512-834-8911 | FX: 512-834-1266
http://www.reinhartassoc.com

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http://www.statcontrolinc.com

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STEIN SEAL INDUSTRIAL DIVISION 2535

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http://www.steinisealind.com

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STRUCTURAL 3124

10150 Old Columbia Road
Columbia, MD 21046 USA
PH: 410-850-7000

STRUCTURAL, a Structural Group company, has industry-leading knowledge, services and experience to solve rotating equipment foundation challenges safely and efficiently. We use a variety of innovative methods to repair existing foundations as well as building high-performance foundations for new equipment.

SULZER 2023

11518 Old LaPorte Rd
LaPorte, TX 77571 USA
PH: 713-567-2700 | FX: 713-567-2830
http://www.sulzer.com

Sulzer is the leading worldwide, independent service provider for the repair and maintenance of rotating machines including turbomachinery, pumps and electro-mechanical equipment. With a global network of over 150 technically advanced manufacturing and test facilities, Sulzer offers a collaborative advantage that delivers high-quality, cost-effective, customized and turnkey solutions, providing its customers with the peace of mind to focus on their core operations. Sulzer Rotating Equipment Services, a division of Sulzer, can accommodate all brands of rotating equipment including turbines, compressors, generators, motors and pumps. With an enviable track record, dedicated teams of on-site engineers provide best-in-class solutions to ensure that the most effective service is delivered.

SUMITOMO HEAVY INDUSTRIES GEARBOX CO., LTD. 2838

3-33, Nakanoshima 3-chome, Kita-ku
Osaka-shi, Osaka 5300005 Japan
PH: (+)81676353662
http://www.shigearbox.com

Sumitomo Heavy Industries Gearbox Co., Ltd., formally called SEISA Gear Ltd., has more than 100 years 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 3022

9010 CR 2120
Tyler, TX 75707 USA
PH: 903-534-8021 | FX: 903-534-3753

Manufacturer of synthetic lubricants and greases, descalers, degreasers, and oil/water separators.

SUNDYNE, LLC 2223

14845 West 64th Ave.
Arvada, CO 80007 USA
PH: 303-425-0800
http://www.sundyne.com

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.

T

T.F. HUDGINS, INCORPORATED 1612

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 3221

3123 TAMU (Room - MEOB 211)
College Station, TX 77843-3123 USA
PH: 979-862-7834

TCR, INC. 1726

3608 Pinemont
Houston, TX 77018 USA
PH: 713-895-9551
http://www.tcrhouston.com

TCR, Inc. is a Specialty Machine Shop in Houston. Our shop is a Turn-key, Short Runs, Tight tolerances, and Quick Delivery shop staffed with expert Machinists & Production Managers that keep short runs on schedule and verify quality checks that ensure perfection. We proved machining and repair services for Power Generation, Aero Space, Oil & Gas, and many other industries. We are ISO 9001:2015 CERTIFIED.

TECO-WESTINGHOUSE MOTOR COMPANY 2901

5100 N IH-35
Round Rock, TX 78681 USA
PH: 512-255-4141
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.

TEES - TURBOMACHINERY LABORATORY

2411

TX A&M University 3254 TAMU
College Station, TX 77843-3254 USA
PH: 979-845-7417 | FX: 979-845-1835
http://tps.tamu.edu

The Turbomachinery Laboratory, part of The Texas A&M System, conducts theoretical and applied research intro reliability and performance of turbomachinery. The Turbo Lab impacts the industry through three pathways: 1) Research: The Turbomachinery Research Consortium was formed in 1983 to find answers to important questions of reliability and performance of turbomachinery for industrial companies who supply annual research grants. 2) Education: The Turbo Lab produces engineers ready to work by offering undergraduate and graduate engineering education. 3) Professional Workforce Development: The Turbo Lab organizes the annual Turbomachinery & Pump Symposia in Houston and the biennial Asia Turbomachinery & Pump Symposium in Singapore.

TEIKOKU USA

1206

959 Mearns Road
Warminster, Pennsylvania 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.

2234

200 W 34th Ave, # 1017
Anchorage, Alaska 99503 USA
PH: 907-522-2411
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, mechanical engineering and instrumentation 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 3219

3372 TAMU
College Station, TX 77843-3372 USA
PH: 979-458-0276

The TX 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 mulit-scale systems based approaches.

TEXAS A&M ENGINEERING EXPERIMENT STATION 3117

1470 Williams D. Fitch Parkway
College Station, TX 77845-4645 USA
PH: 979-458-7643

The TX 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 TX to be especially competitive for federal dollars and play a major role in strengthening research leadership across the state. Partner with TEES!

TEXAS BUSINESS RADIO 1951

1614 Louetta Rd. Ste 1
Spring, TX 77388 USA
PH: 713-302-3240
https://texasbusinessradio.com

Texas Business Radio is a syndicated radio show that covers news, events, and business happenings all over the great state of Texas. Host Matt Register, entrepreneur and investment banker, and Jay W. Curry, author and entrepreneurial coach, bring you special guests and experts from all over the business community. If you haven't guessed from listening to the show, Matt and Jay are not radio guys. They are business guys. Both have a passion for business growth and maximizing value in a business.

TEXAS ROTATING EQUIPMENT, INC. 2438

10959 Hwy 321
Dayton, TX 77535 USA
PH: 281-770-7438 | FX: 936-258-3620

TX Rotating Equipment is an independent turbomachinery repair and service shop. TX 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 Re-manufactured Steam Turbines, Governors, and Bearing Manufacturing. With over 50 years of collective management experience, we pride our business on Quality and Customer Service. Located in Dayton, TX we are the fastest growing independent Turbomachinery repair center in the World.

TORQUEMETERS LIMITED

2634

West Haddon Road
Ravensthorpe, Northamptonshire NN6 8ET UK
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, INC.

1220

2575 NW Graham Circle
Troutdale, OR 97060 USA
PH: 503-661-7700
http://www.ttu.com

Toyo Tanso has pursued innovative carbon products specialized for highly functional fields since 1941.

Carbon sliding materials are self-lubricating, heat resistant and chemical resistant. They are used at high temperatures where metal sliding materials cannot and where fluids and lubricants are avoided.

Toyo Tanso is a global supplier of quality carbon products for mechanical applications such as bearings, seal rings, packing, vanes, joint seals and valve seats. Stop by booth 1220 to learn more about our IG, KC and TUG product series that have been cultivated over many years for various mechanical applications.

TRAC-GLOBAL

3112

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Houston, TX 77043 USA
PH: 713-303-0151
http://www.trac-global.com

TRAC-GLOBAL provides OEM equivalent aftermarket parts for all of your AIR Compression needs. TRAC-GLOBAL has engineering support and OEM trained field service representatives, each with decades of experience ready to assist you with everything from your annual PM's to planned Overhauls. Your emergency is TRAC-GLOBALS emergency. We will provide "What You Need, When You Need It!"

TRI TRANSMISSION & BEARING CORP. 2928

PO Box 454
Lionville, PA 19353 USA
PH: 610-363-8570
http://www.turboresearch.com

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

TURBINE, PUMP AND COMPRESSOR, LLC 1608

3203 Lilac St.
Pasadena, TX 77505 USA
PH: 281-991-1997 | FX: 281-991-1564
http://www.t-p-c.net

We specialize in shop repair, field service repair and parts for all turbines, pumps, blowers, gearboxes, compressors including compressor packaging.

TURBO FILTRATION, LLC A RELADYNE COMPANY 2741

1490 Telegraph Rd.
Mobile, Alabama 36610 USA
PH: 251-457-8807
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. Varnish Mitagation Service.

TURBOGEN CONSULTANTS, INC. 2517

78 S Trooper Road
Norristown, Pennsylvania 19403 USA
PH: 610-631-3480 | FX: 610-631-3481

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.

TURBOMACHINERY INTERNATIONAL 1811

535 Connecticut Avenue
Norwalk, CT 06854 USA
PH: 203-523-7053

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.

TYCON ALLOY INDUSTRIES (HONG KONG) CO., LTD. 2342

8 Floor, 22-28 Cheung Tat Rd, Tsing Yi
Hong Kong 518114 China
PH: (+)8328656718
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.

U

UNITED TECHNOLOGIES 2035

104 Otis St.
Rome, New York 13441 USA
PH: 315-838-1418
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 2024

806 Seaco Court
Deer Park, TX 77536 USA
PH: 281-479-6000
http://www.universalplant.com

Universal Plant Services (UPS) is one of the largest comprehensive service providers for the energy industry, providing project management, installation, maintenance and repair services for rotating and fixed equipment for daily maintenance requirements, turnarounds and capital projects.

USA BORESCOPES 1523

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Clarksville, TN 37043
PH: 931-362-3304
http://www.USABorescopes.com

USA Borescopes is a global supplier of borescopes and pipe inspection cameras. In addition, we perform borescope repairs on any make or model borescope with no charge repair estimates.

V

VERISURF SOFTWARE, INC. 3244

4907 E. Landon Dr.
Anaheim, CA 92807 USA
PH: 714-970-1683
http://www.verisurf.com

Model based 3D measurement inspection software.

VIBRATION GUYS, LLC, THE 2818

PO Box 1944
Friendswood, TX 77581 USA
PH: 281-576-7212 | FX: 832-295-4840
http://www.thevibrationguys.com

The Vibration Guys™ is a world-class condition monitoring solutions company that specializes in vibration analysis, non-destructive testing, laser alignment, field balancing and other specialized services and diagnostic services for rotating equipment. We provide preventive and predictive maintenance for all industries utilizing rotating equipment including the oil & gas industry encompassing upstream, midstream, and downstream; petrochemical, chemicals, energy generation & transmission, food and beverage bottling and manufacturing, forestry, medical & specialty gases production, and other manufacturing specialties. We have pump specialists with over 30 years of field experience.

VIBRATION INSTITUTE 2539

2625 Butterfield Rd., Ste 128N
Oakbrook, IL 60523 USA
PH: 630-654-2254 | FX: 630-654-2271
http://www.vi-institute.org

The Vibration Institute is the premier provider of ISO 18436 vibration analysis certification and training. VI is dedicated to the dissemination of practical information on evaluating machinery behavior and condition without commercial interest and is the only vibration analysis certification provider accredited by the American National Standards Institute.

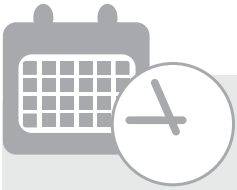
VISION MACHINE, INC. 2534

25045 Spring Ridge Rd.
Spring, 77386 USA
PH: 832-562-2112
http://www.visionmachine.com

VOITH TURBO INC. 2145

25 Winship Road
York, PA 17406 USA
PH: 717-767-3200
http://www.voith.com/usa/en

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.



SAVE THE DATE!
SPOUSE PROGRAM

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Please go to page 10 in the Introduction Section for more information

TIPS

W

WATER TECHNOLOGY MAGAZINE 1701

200 Croft, Suite 1
Birmingham, AL 35242
PH: 646-617-9301
https://www.watertechonline.com/

Water Technology serves professionals who are focused on industrial water and wastewater management, including treatment, monitoring, storage, disposal and reuse.

WATSON GRINDING & MANUFACTURING 2139

4525 Gessner Rd.
Houston, TX 77041 USA
PH: 713-466-3053 | FX: 713-466-8992
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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.

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Pewaukee, WI 53072 USA
PH: 262-506-3000
http://www.waukeshabearings.com

Waukesha Bearings® is a global leader in the design and manufacture of engineered hydrodynamic bearings and brush seals for high-performing turbomachinery. Backed by robust product development and years of application experience, Waukesha Bearings products are designed for optimized performance and engineered to provide low power consumption, reduced operating temperatures, and increased reliability and efficiency.

The differentiated technologies and services of fellow Dover brands Bearings Plus®, Cook Compression®, Inpro/Seal®, and Waukesha Magnetic Bearings® round out the company's portfolio. Facilities in North America, Europe, Asia and the Middle East enable a globally interconnected approach to serving our customers.

WEG/ELECTRIC MACHINERY 1401

6655 Sugarloaf Pkwy
Duluth, Georgia 30097 USA
PH: 678-249-2052
http://www.weg.net/us

Founded in 1961, WEG has grown into a global solutions provider of industrial electrical technologies. WEG is the largest industrial electric motor manufacturer in the Americas and one of the largest manufacturers of electric motors in the world producing more than 10 million units annually. Committed to growth on a global scale, WEG continually invests in state-of-the-art manufacturing facilities and processes, and the development of new and improved industrial electrical solutions. WEG offers a diverse and integrated product line that includes motors, drives, controls, transformers, and generators. WEG has committed to an R&D investment of 3% of annual global sales.

WEICHENG METAL PRODUCTS CO., LTD. (WAYSCAN METAL PRODUCTS CO., LTD.) 3015

No.388, Xinghai (N) Road, Ninghai Country
Ningbo, Zhejiang, 315000 China
PH: (+)8657465273750 | FX: (+)8657465357828

Weicheng Metal Products Co., Ltd, was established in 1991 in Ningbo, and we are a professional precision casting factory. Company currently employs 500 people, including more than 30 engineering and technical personnel . The company occupies 60,000 square meters, construction area of 40,000 square meters. Now we provide silica-sol investment casting, water glass investment casting, sand casting and machining, with full range services of Product Designing, Mold Making, Casting, Heat treatment, Surface treatment, Machining, Assembling, and Packaging. The company is now an annual output of more than 15,000 tons. Welcome to our company!

WEIFANG SUBTOR ROTATING PRECISION MACHINERY CO., LTD. 1121

East Side of Industry Second Road
Weifang Economy Development Zone, Weifang, Shandong, China 261000
PH: (+)865365070802
http://www.subtor.com.cn

Weifang Subtor Rotating Precision Machinery is an enterprise professional engaged in researching, developing and manufacturing products including Progressive Cavity Pump, Power Section, S-PCP down hold pump, Stator core, and relevant components.

WEIR SPECIALTY PUMPS (ROTO-JET) 1310

440 West 800 South
Salt Lake City, UT 84101 USA
PH: 801-359-8731 | FX: 801-530-7828
http://www.global.weir

Weir Specialty Pumps (formerly EnviroTech Pumpsystems) is a member of The Weir Group PLC, Glasgow Scotland. The Weir group, founded in 1871, is a worldwide leader in pumping technology. Weir Specialty Pumps, based in Salt Lake City, UT, manufactures pumps for wastewater, sludges & sewage, and high pressure applications. Important markets are water and wastewater, power/utility, chemicals/refining/pulp and paper, food and food processing and oil and gas markets. Products are marketed under the well-known trade names of Roto-Jet® and Wemco® pump. Weir is ISO 9001, ISO 14001, and OHSAS 18001 Certified.

WESTSIDE MECHANICAL SEAL LTD. 1443

2nd FL, NO.1, Alley 3, Lane 185, Sec.6, Chung Shiao E.Rd.
Taipei, 11557 Taiwan
PH: (+)886227859030
http://www.westside.com.tw

Westside Ltd. Has supplied quality-sealing products to the global industrial market place Since 1981. Located in Taiwan, we are committed to reducing pump parts life cycle cost for any pumping jobs. We have facilities in Taiwan and Shanghai for global and Asia market, and have been operating 2 factories in China since 1991. After 20 years of effort on quality, price, and delivery. Westside Ltd. Is proud to boasts the satisfaction of our clients.

Striving for excellence in production, we have developed full range of mechanical seals for a variety of different industrial applications.

WILCOXON SENSING TECHNOLOGIES 1537

20511 Seneca Meadows Parkway
Germantown, Maryland 20876 USA
PH: 301-216-3039
http://www.wilcoxon.com

In plants worldwide, rotating equipment engineers, technicians and predictive maintenance teams depend on Wilcoxon Research® vibration monitoring solutions to improve the reliability and reduce downtime of rotating machines. Our sensors provide reliable vibration analysis for machinery monitoring, balance-of-plant applications and predictive maintenance programs. We offer a lifetime warranty for a range of sensors, support from our vibration expert engineers, short lead times, competitive pricing. We also provide cables, connectors, enclosures, mounting accessories and more. Easy and convenient to shop online. www.wilcoxon.com. Visit our booth to find the right fit for your vibration monitoring application.

WINDROCK INC. 1602

1832 Midpark Road suite 102
Knoxville, TN 37921 USA
PH: 865-330-1100
http://www.windrock.com

Windrock is an expert in condition-based and performance-based monitoring solutions for compressors and engines across multiple applications. We design and manufacture portable analyzers and online systems. In addition to our products, Windrock's Technical Services team of analysts travel the world to help companies large and small by consulting and working with their reliability and maintenance programs.

WOLONG AMERICAS 2556

26410 Oak Ridge Dr. Suite 101
The Woodlands, TX 77380 USA
PH: 346-616-0103 | FX: 855-511-6620
http://www.wolong.com.cn

Global synchronous and asynchronous electric motors and generators, soft started and variable frequency drives manufacturer.

WOOD GROUP – vibration, dynamics and noise (formerly BETA Machinery Analysis) 2416

15115 Park Row Drive
Houston, TX 77084 USA
PH: 281-920-4442
http://www.woodgroup.com/VDN

Wood Group's new vibration, dynamics and noise service line (formerly BETA Machinery Analysis and SVT Engineering Consultants) is the largest provider globally in addressing vibration, reliability, integrity and noise issues on compressors, pumps, piping and associated equipment.

Specialist design and field services include pulsation, torsional, lateral, surge simulation, ODS, resonance, water hammer, piping transients, piping integrity checks, pipe stress, acoustic fatigue, FIV, FIT, AIV, and small-bore piping analyses for onshore, offshore and subsea facilities.

VDN also provides damping products and absorbers to control vibration.

Visit our lectures or check out our vibration demo at booth #2416!

WOODWARD 2321

1081 Woodward Way
Fort Collins, Colorado 80524 USA
PH: 970-962-7518

Woodward is the Turbomachinery Control Expert, providing outstanding control system, actuation, valve, and safety system technologies for steam turbine, gas turbine, and compressor equipment. Woodward strives to reduce total cost of ownership and improve system performance and reliability by increasing availability, efficiency, start performance, and operating range. Independently owned and publicly traded, Woodward provides products, services, support, and upgrades for any OEM's turbomachinery systems.

WUXI HONGTAI LIFTING DECTRIC MACHENIC CO., LTD 3120

No.17 Wanshou RD, Qianzhou industry park, Huishan
Wuxi, Jiangsu 214181, China
PH: (+)8651083390388
http://www.chinaomec.com

WUXI Hongtai Motor Company was founded in 1958. We are committed to making slip ring motors, various frequency speed-adjustable motors, roller motors, explosion proof motors and high voltage motors. Our products have a good reputation in China, are also shipped to USA, Russia, Japan, South Asia area and so on.

WUXI ORIGINAL MECHANICAL & ELECTRICAL CO., LTD.

3118

84 Luzhong Road Yangshan Town Wuxi
Jiangsu, China 214000 China
PH: (+)8651085187858 | FX: (+)8651085187858
http://www.chinaomec.com

OMEC mainly produce all kinds of high efficiency motors, frequency motors, high voltage motors, marine motors, and others with special requirements that its frames are from H56mm~H630mm, the power ranges are 0.18~3000KW. OMEC target is to provide products for domestic and overseas middle and high level market. At present, the products have been exported to German, Italy, Holland, Denmark, Belgium and other developed countries, with 75% in annual sales. In the developing domestic market, OMEC is striving to provide motors for different industries, for example, air compressor, pump, papermaking, metallurgy, electricity, shipping, etc.

X

XTEND PACKAGING, INC. 2642

519 Rankin Circle North
Houston, TX 77073 USA
PH: 281-784-2262 | FX: 832-827-2176
http://www.xtendpackaging.com

Intercept Technology products deliver superior, easy-to-use, cost effective, anti-corrosion packaging protection for machinery, spare parts, and finished goods. Intercept prevents corrosion and degradation during lengthy shipping or storage cycles without the use of volatiles, vapors, chemicals or coatings. Developed by Bell Labs, Intercept is green, clean, re-usable and recyclable. Intercept is proven 100% safe for all materials, is available in a variety of styles and sizes, as well as packaging on site for you. Intercept performs around the globe in many applications in the harshest of environments and saves money. Visit us at booth 2642.

Y

YORK PROCESS SYSTEMS 1527

100 CV Avenue
Waynesboro, PA 17268 USA
PH: 717-762-2121

Our highly technical and innovative engineering staff enables us to meet the needs of industries including chemicals & petrochemicals, fuel transportation & storage, industrial gases, power generation, carbon capture, climate test chambers and pharmaceuticals. Our YORK® Process System team provides you with complete, customized YORK® solutions that take you through design, manufacturing, assembly and testing. Our ability to match your industrial cooling process requirements with the most efficient equipment results in cost savings. Whether you need equipment, help with OEM products, parts, service, or even training support, YORK® solutions from Johnson Controls can help.

Z

ZEISS INDUSTRIAL METROLOGY 3114

6250 Sycamore Lane
Maple Grove, MN 55369
PH: 763-744-2400
http://www.zeiss.com/metrology

ZEISS is an internationally leading technology enterprise operating in the optics and optoelectronics industries. The Industrial Metrology business group is a leading manufacturer of multidimensional metrology solutions. These include coordinate measuring machines and metrology software for the automotive, aircraft, mechanical engineering, plastics and medical technology industries.

ZOLLERN NORTH AMERICA LP 2451

15825 state hwy 249 suite 27
Houston, TX 77086 USA
PH: 713-673-7902 | FX: 713-673-7950

With its 300 years of company tradition ZOLLERN belongs to the pioneers of the metal industry and has continuously determined the development since an early stage. 3.200 highly dedicated employees design, produce, sale and service a product range of innovative metal products at 15 production facilities and subsidiaries in Europe, Americas and Asia. The ZOLLERN group with its headquarters in Laucherthal/ Germany consists of the five business units:

- casting and forging technology (sand casting, investment casting, forging)
- drive technology (gears, winches, direct drive motors, automation)
- bearing technology (plain bearings, hydrostatic and airostatic bearings)
- steel profiles and
- engineering components.

CATEGORICAL LISTINGS

AFTER–MARKET SERVICES AND PRODUCTS

COMPRESSOR PARTS, REPAIR, OVERHAUL

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Advanced Compressor Technology	2218
Aerzen USA	2805
Atlas Copco Gas and Process	2725
Axis Mechanical Group	2950
Boedeker Plastics, Inc.	2245
Camfil Power Systems	2445
Cincinnati Gearing Systems	2641
Compressor & Turbine Services, LLC	2925
CTS, Inc.	1223
Dichtomatik Americas	2614
EGC Critical Components	1513
Epic International	2617
Ethos Energy	1915
F.W. Gartner Thermal Spraying / Curtiss-Wright	2343
Fisher Products LLC	1945
FS-Elliott	2419
Fusion Inc.	1526
Gas & Air Systems, Inc.	2722
GEA North America	2605
HOERBIGER Compression Technology	1619
HR Power Design LLC	2637
Ingersoll Rand	2521
Integrated TurboMachinery	1622
JETSEAL, Inc.	2444
Kobelco Compressors America, Inc.	2746

MAN Diesel & Turbo North America Inc.	1735
Meridian Equipment, Inc.	1625
Mid-America Machine, Inc.	2317
Mitsubishi Heavy Industries	1711
National Compressor Services	3010
PDC Machines, Inc	1638
Reliable EDM	1729
Riverhawk Company	1826
ROC Carbon Company	2110
Rotating Machinery Services, Inc.	1743
RPM Services	2801
SAMCO Enterprises, Inc.	3145
SES Global	2545
Shijiazhuang Qinye Trading Co., LTD	1113
Sichuan Sunny Seal Co., Ltd.	1718
SIEMENS	1934
SKF	1419
Solberg Oil Mist Eliminators	2544
Southwest Impreglon	2543
Standard Alloys Incorporated	1322
Statistics & Control, Inc	2927
Stein Seal Industrial Division	2535
Stork H&E Turbo Blading	1815
Sulzer	2023
TCR, Inc.	1726
TRAC-Global	3112
Turbine, Pump and Compressor, LLC	1608
Universal Plant Services	2024
Watson Grinding & Manufacturing	2139

COUPLING REPAIRS

Altra Industrial Motion, Inc.	2235
Artec Machine Systems	1724
Ethos Energy	1915
FlexElement Texas Inc.	2518
Leadgo Electric Motor Inc.	3024
PSC Couplings	1104
Reliable EDM	1729
Riverhawk Company	1826
Scott Rotary Seals	2341
Shackelford-Wattner	2526
Statistics & Control, Inc	2927
TCR, Inc.	1726
TRI Transmission & Bearing Corp.	2928
Universal Plant Services	2024

EXPANDER PARTS, REPAIR, OVERHAUL

Atlas Copco Gas and Process	2725
Cincinnati Gearing Systems	2641
Dichtomatik Americas	2614
Ethos Energy	1915
Fisher Products LLC	1945
Hahn Equipment Co., Inc.	3045
HR Power Design LLC	2637
RPM Services	2801
Stork H&E Turbo Blading	1815
Sulzer	2023
Universal Plant Services	2024

FIELD SERVICE

ACE Compressor Parts & Services	2557
ACQUIP Inc.	2734
Advanced Compressor Technology	2218
Aerzen USA	2805
Atlantic Group, Inc.	1328
Atlas Copco Gas and Process	2725

Camfil Power Systems	2445
David Brown Santasalo	2410
EagleBurgmann Industries LP	1843
Ekato	2906
Engineering Dynamics Inc.	2423
Epic International	2617
Ethos Energy	1915
Graham Corporation	1519
Hahn Equipment Co., Inc.	3045
HOERBIGER Compression Technology	1619
Howden Roots	2905
Integrated TurboMachinery	1622
Kingsbury, Inc.	2527
Kobelco Compressors America, Inc.	2746
LEWA-Nikkiso America, Inc.	1334
Luflex Gears Mfg. & Services	1927
MAAG Pump Systems	1404
MAN Diesel & Turbo North America Inc.	1735
Meridian Equipment, Inc.	1625
National Compressor Services	3010
Peroni Pompe SpA	1216
PROGNOST Systems Inc	2011
Pulsafeeder, Inc.	2448
PumpWorks 610	1304
Reinhart & Associates, Inc.	2125
RENK AG	1719
Riverhawk Company	1826
Roper Technologies, Inc.	2111
Rotating Machinery Services, Inc.	1743
RPM Services	2801
Schenck Trebel Corporation	1728
Scott Rotary Seals	2341
SES Global	2545
SKF	1419

Standard Alloys Incorporated	1322
Statistics & Control, Inc	2927
Sulzer	2023
Tern Technologies, Inc.	2234
TRAC-Global	3112
TRI Transmission & Bearing Corp.	2928
Turbine, Pump and Compressor, LLC	1608
Universal Plant Services	2024
Vibration Guys, LLC, The	2818
Voith Turbo Inc.	2145
Wood Group-vibration, dynamics and noise (formerly BETA Machinery Analysis)	2416
Woodward	2705

FUEL CONTROL

Honeywell Process Controls	2701
KRAL-USA, Inc.	1235
Petrotech, Inc.	2028

GAS TURBINE PARTS, REPAIR, OVERHAUL

Axis Mechanical Group	2950
Babbitting Service, Inc. (BSI)	2923
Camfil Power Systems	2445
Cincinnati Gearing Systems	2641
CTS, Inc.	1223
Dichtomatik Americas	2614
EBTEC - EDAC Technologies	1749
Ethos Energy	1915
F.W. Gartner Thermal Spraying / Curtiss-Wright	2343
Fusion Inc.	1526
HR Power Design LLC	2637
JETSEAL, Inc.	2444
Meridian Equipment, Inc.	1625
Reliable EDM	1729
Riverhawk Company	1826
Rotating Equipment Repair	2047
Scansonic PGS GmbH	3012

SES Global	2545
Solberg Oil Mist Eliminators	2544
Southwest Impreglon	2543
Statistics & Control, Inc	2927
Stork H&E Turbo Blading	1815
Sulzer	2023
TCR, Inc.	1726
Universal Plant Services	2024
Woodward	2705

GEAR BOX REPAIRS

Cincinnati Gearing Systems	2641
Compressor & Turbine Services, LLC	2925
CTS, Inc.	1223
David Brown Santasalo	2410
Ekato	2906
F.W. Gartner Thermal Spraying / Curtiss-Wright	2343
Integrated TurboMachinery	1622
Isomag Corporation	2922
Keene Turbomachinery Services	2150
Luftex Gears Mfg. & Services	1927
Meridian Equipment, Inc.	1625
Philadelphia Gear	2834
RENK AG	1719
Rotating Equipment Repair	2047
RPM Services	2801
Scott Rotary Seals	2341
SHIJIAZHUANG QINYE TRADING CO., LTD	1113
SKF	1419
Sumitomo Heavy Industries Gearbox Co., Ltd.	2838
Texas Rotating Equipment, Inc.	2438
TRAC-Global	3112
TRI Transmission & Bearing Corp.	2928
Turbine, Pump and Compressor, LLC	1608

PUMP PARTS AND REPAIR

Afton Pumps, Inc.	1400
Babbitting Services, Inc. (BSI)	2923
Boulden Company	1427
BSK Fluid Technology LLC.	1212
C and T International, LLC	1103
Compressor & Turbine Services, LLC	2925
CTS, Inc.	1223
Dekker Vacuum Technologies	2812
Dichtomatik Americas	2614
EGC Critical Components	1513
F.W. Gartner Thermal Spraying / Curtiss-Wright	2343
Fisher Products LLC	1945
Fusion Inc.	1526
Hahn Equipment Co., Inc.	3045
Hammelmann Corporation	1505
Hangzhou Sealcon Fluid Machinery Co., Ltd	3215
Henkel Corporation	2721
HR Power Design LLC	2637
Huangshan RSP Manufacturing Co,. Ltd.	1107
HydroTex Dynamics	1321
Integrated TurboMachinery	1622
Isomag Corporation	2922
ITT Industrial Process	1501
JETSEAL, Inc.	2444
KRAL-USA, Inc.	1235
Leadgo Electric Motor Inc.	3024
LEWA-Nikkiso America, Inc.	1334
LobePro Rotary Lobe Pumps	1237
MAAG Pump Systems	1404
Meridian Equipment, Inc.	1625
Metaltech Service Center, Inc.	2236
Peroni Pompe SpA	1216
Power Zone Equipment Inc.	1436
Pulsafeeder, Inc.	2448

PumpWorks 610	1304
PumpWorks Industrial	1306
Reliable EDM	1729
ROC Carbon Company	2110
Rotating Equipment Repair	2047
RPM Services	2801
Sdms Seal Co.,Ltd.	1800
Shanley Pump & Equipment	1100
Shijiazhuang JinJieBer Ltd.	1600
SHIJIAZHUANG QINYE TRADING CO., LTD	1113
Shin Nippon Machinery Co., Ltd.	1705
Sichuan Sunny Seal Co., Ltd.	1718
SKF	1419
Source Pumps & Systems Co.,Ltd.	1115
SPX Flow	1316
Standard Alloys Incorporated	1322
Statistics & Control, Inc	2927
TCR, Inc.	1726
Texas Rotating Equipment, Inc.	2438
TRAC-Global	3112
TRI Transmission & Bearing Corp.	2928
Turbine, Pump and Compressor, LLC	1608
Watson Grinding & Manufacturing	2139
Weifang Subtor Rotating Precision Machinery	1121
Weir Specialty Pumps (Roto-Jet)	1310

REAPPLICATION SERVICES

Ekato	2906
Shanley Pump & Equipment	1100

SPIN TESTING

Prime Photonics, LC	1335
Schenck Trebel Corporation	1728

STEAM TURBINE PARTS, REPAIR, OVERHAUL

Axis Mechanical Group	2950
Babbitting Service, Inc. (BSI)	2923
Cincinnati Gearing Systems	2641
Compressor & Turbine Services, LLC	2925
Dichtomatik Americas	2614
F.W. Gartner Thermal Spraying / Curtiss-Wright	2343
Fusion Inc.	1526
HOERBIGER Compression Technology	1619
Integrated TurboMachinery	1622
Isomag Corporation	2922
JETSEAL, Inc.	2444
Keene Turbomachinery Services	2150
Mitsubishi Heavy Industries	1711
Riverhawk Company	1826
ROC Carbon Company	2110
Rotating Equipment Repair	2047
Rotating Machinery Services, Inc.	1743
Scansonic PGS GmbH	3012
SES Global	2545
Shin Nippon Machinery Co., Ltd.	1705
Skinner Power Systems	2342
Southwest Impreglon	2543
Stork H&E Turbo Blading	1815
Sulzer	2023
Texas Rotating Equipment, Inc.	2438
TRI Transmission & Bearing Corp.	2928
Turbine, Pump and Compressor, LLC	1608
TurboGen Consultants, Inc.	2810
Woodward	2705

SURFACE FINISHING/BLASTING & EQUIPMENT

Advanced Turbine Support	2222
CTS, Inc.	1223
Fisher Products LLC	1945
Gartner Coatings, Inc.	1425
Hahn Equipment Co., Inc.	3045
SIFCO ASC	3018
Southwest Impreglon	2543

TANK CLEANING

Dixon Pumps	1234
Hammelmann Corporation	1505
RelaDyne, LLC	2924
Turbo Filtration, LLC a RelaDyne Company	2851

TURBOCHARGER REPAIR

Reliable EDM	1729
TRAC-Global	3112

AUXILIARY EQUIPMENT

ACCUMULATORS (PULSATION DAMPENERS)	
Fluid Energy Controls, Inc.	1524

ACTUATORS	
Adqvalve Flow Control Industry Group Limited	1610
CIRCOR | Schroedahl	3016
Governor Control Systems, Inc.	3029
REXA, Inc.	1848
Woodward	2705

ALIGNMENT TOOLS AND EQUIPMENT	
LUDECA, INC.	2735
Maudlin Products	2224
SKF	1419
Tern Technologies, Inc.	2234

BALANCING MACHINES	
PumpWorks 610	1304
Schenck Trebel Corporation	1728

BASE PLATES	
Metaltech Service Center, Inc.	2236

BEARINGS, FLUID FILM	
Advanced Diamond Technologies, Inc.	1225
Babbitting Service, Inc. (BSI)	2923
Daedong Metal Industry Co., Ltd.	2915
Hunan SUND Industrial and Technological Co., Ltd.	3135
John Crane	1827
Kingsbury, Inc.	2527
Luftex Gears Mfg. & Services	1927
Renk AG	1719
Scott Rotary Seals	2341
Texas Rotating Equipment, Inc.	2438
Waukesha Bearings	2327

BEARINGS, ISOLATORS	
Waukesha Bearings	2327

BEARINGS, MAGNETIC	
Calnetix Technologies	2116
Hunan SUND Industrial and Technological Co., Ltd.	3135
Scott Rotary Seals	2341
Waukesha Bearings	2327

BEARINGS, PRESSURIZED	
Bently Bearings	2611
Hunan SUND Industrial and Technological Co., Ltd.	3135

BEARINGS, ROLLING-ELEMENT	
CEROBEAR GmbH	1211
Hunan SUND Industrial and Technological Co., Ltd.	3135
Luftex Gears Mfg. & Services	1927

BEARINGS, ROLLING-ELEMENT-PROTECTION	
CEROBEAR GmbH	1211
Hunan SUND Industrial and Technological Co., Ltd.	3135

BEARINGS, THRUST	
Babbitting Service, Inc. (BSI)	2923
Bently Bearings	2611
Boedeker Plastics, Inc.	2245
Daedong Metal Industry Co., Ltd.	2915
Kingsbury, Inc.	2527
Lancer Systems	2520
ROC Carbon Company	2110
Waukesha Bearings	2327

BLOWERS	
Aerzen USA	2805
Compressor & Turbine Services, LLC	2925
Howden Roots	2905
Journal of Compressor, Blower and Fan Technology	3042
ROC Carbon Company	2110
Rotating Equipment Repair	2047

BORESCOPES	
Advanced Turbine Support	2222
USA Borescopes	1523

CLUTCHES	
SSS Clutch Company, Inc.	2434

COMPRESSED AIR DRYERS	
Ingersoll Rand	2521

COMPRESSORS, AIR	
Aerzen USA	2805
Epic International	2617
FS-Elliott	2419
Ingersoll Rand	2521
SAMCO Enterprises, Inc.	3143

CONDITION MONITORING	
David Brown Santasalo	2410
Kongsberg	2522
PROGNOST Systems Inc	2011
Tern Technologies, Inc.	2234
Vibrant Technology	2442
Vibration Guys, LLC, The	2818
Windrock Inc.	1602

CONTROL & CONTROL SYSTEMS	
CIRCOR | Schroedahl	3016
GEA North America	2605
Governor Control Systems, Inc.	3029
HOERBIGER Compression Technology	1619
Honeywell Process Controls	2701
Kongsberg	2522
LUDECA, INC.	2735
National Compressor Services	3010
Nidec Industrial Solutions	3035
Petrotech, Inc.	2028
Power Zone Equipment, Inc.	1436

Roper Technologies, Inc.	2111
Torquemeters Limited	2634
Woodward	2705

CONTROLS

Epic International	2617
HOERBIGER Compression Technology	1619
Honeywell Process Controls	2701
Peerless PROCORE	2026
Petrotech, Inc.	2028
Pulsafeeder, Inc.	2448

CONTROLS, ELECTRIC MOTORS

General Atomics	3237
Honeywell Process Controls	2701
IDEAL Electric Company	2146
Leadgo Electric Motors, Inc.	3024
Nidec Industrial Solutions	3035
Petrotech, Inc.	2028
Wolong Americas	2556

COOLERS, AFTER

Camfil Power Systems	2445
Diversified Manufacturing	2141
Epic International	2617

COOLERS, INTER

Camfil Power Systems	2445
Diversified Manufacturing	2141
Epic International	2617

COUPLINGS, MAGNETIC

Voith Turbo Inc.	2145

COUPLINGS, MECHANICAL

Altra Industrial Motion, Inc.	2235
ATRA-FLEX Flexible Couplings	1136
Artec Machine Systems	1724
FlexElement Texas Inc.	2518
John Crane	1827
PSC Couplings	1104
R+W Coupling Technology	1134
Rathi, North America	1414
RENK AG	1719
Shackelford-Wattner	2526
Sumitomo Heavy Industries Gearbox Co., Ltd.	2838

DIAPHRAGMS

BSK Fluid Technology LLC.	1212
Torquemeters Limited	2634

DRIVERS - ELECTRIC MOTORS

Calnetix Technologies	2116
General Atomics	3237
Hahn Equipment Co., Inc.	3045
IDEAL Electric Company	2146
Leadgo Electric Motor Inc.	3024
Nidec Industrial Solutions	3035
Wolong Americas	2556

DRIVERS - STEAM TURBINES

Keene Turbomachinery Services	2150
REXA, Inc.	1848
Shenyang Blower Works Group Corp.	2349
Shin Nippon Machinery Co., Ltd.	1705
Skinner Power Systems	2342

EFFICIENCY IMPROVEMENT FOR GAS TURBINES

Camfil Power Systems	2445
Torquemeters Limited	2634
Vibration Guys, LLC, The	2818

ENERGY RECOVERY DEVICES

Calnetix Technologies	2116
HydroThrift Corporation	2546

EXPANSION JOINTS

EagleBurgmann Industries LP	1843
Neoflex Industrial	1412
Peerless PROCORE	2026
Seal & Design Inc.	3110

FASTENERS

Enduralock, LLC	2819
Pipe Flanges & Fittings (Field Industries)	2550

FILTERS & FILTRATION SYSTEMS

Boll Filter Corporation	2823
Camfil Power Systems	2445
Enpro Industries Pvt. Ltd.	3011
Gore Turbine Filters	1639
Hy-Pro Filtration	3211
John Crane	1827
Lube-Power, Inc	1301
MAAG Pump Systems	1404
Momentum Engineered Systems, Inc.	1512
Process Compliance Products, Inc.	2917
Solberg Oil Mist Eliminators	2544

FLOW CONTROL DEVICES

CIRCOR | Schroedahl	3016
Peerless PROCORE	2026
Petrotech, Inc.	2028
Qingdao VDV Precision Metal Co.,Ltd.	3223

FLOW METERS

Honeywell Process Controls	2701
KRAL-USA, Inc.	1235
LEWA-Nikkiso America, Inc.	1334
T.F. Hudgins Incorporated	1612

FLUID DRIVES	
Voith Turbo Inc.	2145

FLUID SAMPLING	
CIRCOR | Schroedahl	3016

GASKETS	
JETSEAL, Inc.	2444
Neoflex Industrial	1412
Seal & Design Inc.	3110

GEARS AND GEAR BOXES	
David Brown Santasalo	2410
Luftex Gears Mfg. & Services	1927
Philadelphia Gear	2834
RENK AG	1719
Sumitomo Heavy Industries Gearbox Co., Ltd.	2838
Voith Turbo Inc.	2145

GOVERNORS	
Governor Control Systems, Inc.	3029

HEAT EXCHANGERS	
Diversified Manufacturing	2141
Enpro Industries Pvt. Ltd.	3011
EXHEAT Industrial Ltd	2842
Graham Corporation	1519
Hangzhou Guoneng Steam Turbine Engineering CO.,LTD.	2843
HydroThrift Corporation	2546
Metaltech Service Center, Inc.	2236
National Compressor Services	3010
Pipe Flanges & Fittings (Field Industries)	2550

HEAT TRANSFER PRODUCTS & SERVICES	
EXHEAT Industrial Ltd	2842
Graham Corporation	1519
Hangzhou Guoneng Steam Turbine Engineering CO.,LTD.	2843
HydroThrift Corporation	2546
Momentum Engineered Systems, Inc.	1512

HYDRAULIC FITTING

Dalian Hya International Co.,Lrd	3238

INLET COOLING FOR GAS TURBINES

GEA North America	2605

INSTALLATION EQUIPMENT

Kongsberg	2522
Tern Technologies, Inc.	2234

LUBRICATION SYSTEMS

Cobey	1734
Enpro Industries Pvt. Ltd.	3011
EXHEAT Industrial Ltd	2842
Fluid Energy Controls, Inc.	1524
Hangzhou Guoneng Steam Turbine Engineering CO.,LTD.	2843
Huangshan RSP Manufacturing Co,. Ltd.	1107
Keene Turbomachinery Services	2150
Lube-Power, Inc	1301
Momentum Engineered Systems, Inc.	1512
Shell Lubricants	3025
T.F. Hudgins Incorporated	1612
Turbo Filtration, LLC a RelaDyne Company	2851

MAGNETS

General Atomics	3237

PACKING

A.W. Chesterton	2836
AESSEAL Inc.	1413

POLYMER PARTS & PRODUCTS

A.W. Chesterton	2836
Neoflex Industrial	1412

PRESSURE VESSELS	
Boll Filter Corporation	2823
Cobey	1734
Diversified Manufacturing	2141
Enpro Industries Pvt. Ltd.	3011
Fluid Energy Controls, Inc.	1524
Hangzhou Guoneng Steam Turbine Engineering CO.,LTD.	2843
Lube-Power, Inc	1301
Momentum Engineered Systems, Inc.	1512
Pipe Flanges & Fittings (Field Industries)	2550

RECIPROCATING MACHINE ANALYZER	
Windrock Inc.	1602

REFRIGERATION	
GEA North America	2605
HydroThrift Corporation	2546

SEALS, ANNULAR (LABYRINTH, CARBON)	
AESSEAL Inc.	1413
Babbitting Service, Inc. (BSI)	2923
Isomag Corporation	2922
Mid-America Machine, Inc.	2317
Scansonic PGS GmbH	3012
Southwest Research Institute	2726
Stein Seal Industrial Division	2535
Toyo Tanso USA, Inc.	1220
Waukesha Bearings	2327

SEALS, DRY GAS	
AESSEAL Inc.	1413
EagleBurgmann Industries LP	1843
John Crane	1827
New-Seal	2710
Sichuan Sunny Seal Co., Ltd.	1718
Southwest Research Institute	2726
Stein Seal Industrial Division	2535

SEALS, MECHANICAL

A.W. Chesterton	2836
Advanced Diamond Technologies, Inc.	1225
AESSEAL Inc.	1413
EagleBurgmann Industries LP	1843
Ekato	2906
Hangzhou Sealcon Fluid Machinery Co., Ltd	3215
John Crane	1827
Lancer Systems	2520
Process Compliance Products, Inc.	2917
PumpWorks 610	1304
PumpWorks Industrial	1306
Scansonic PGS GmbH	3012
Sdms Seal Co.,Ltd.	1800
Sichuan Sunny Seal Co., Ltd.	1718
Stein Seal Industrial Division	2535
Toyo Tanso USA, Inc.	1220
Westside Mechanical Seal Ltd.	1443

SEALS, NON-MECHANICAL

AESSEAL Inc.	1413
Boedeker Plastics, Inc.	2245
Isomag Corporation	2922
Lancer Systems	2520
Seal & Design Inc.	3110

SEALS, RESILIENT METAL

AESSEAL Inc.	1413
Scansonic PGS GmbH	3012
Southwest Research Institute	2726

SHAFT-CURRENT CONTROL EQUIPMENT

Sohre Turbomachinery Inc.	2627

SHIMS

Maudlin Products	2224
Tern Technologies, Inc.	2234

SHIPPING CONTAINERS	
Eastern Alloy Inc.	1634
SKIDS	
Eastern Alloy Inc.	1634
Enpro Industries Pvt. Ltd.	3011
EXHEAT Industrial Ltd	2842
Huangshan RSP Manufacturing Co,. Ltd.	1107
Power Zone Equipment, Inc.	1436
STARTERS AND STARTING MOTORS	
IDEAL Electric Company	2146
Nidec Industrial Solutions	3035
TOOLS	
USA Borescopes	1523
TORQUE METERS	
Prime Photonics, LC	1335
Torquemeters Limited	2634
TRANSMISSIONS	
Voith Turbo Inc.	2145
USED EQUIPMENT, GENERAL	
National Compressor Services	3010
Power Zone Equipment, Inc.	1436
VACUUM EQUIPMENT	
Graham Corporation	1519
Solberg Oil Mist Eliminators	2544

VALVES

Adams Valves	1521
Adqvalve Flow Control Industry Group Limited	1610
Atlantic Group, Inc.	1328
Cangzhou Heli Machinery Co., Ltd.	1109
CIRCOR | Schroedahl	3016
Dalian Hya International Co.,Lrd	3238
EGC Critical Components	1513
Fisher Products LLC	1945
Peerless PROCORE	2026
Qingdao VDV Precision Metal Co.,Ltd.	3223
SAMCO Enterprises, Inc.	3145
Shijiazhuang JinJieBer Ltd.	1600
SHIJIAZHUANG QINYE TRADING CO., LTD	1113
Weicheng Metal Products Co., Ltd. (Wayscan Metal Products Co., Ltd.)	3015

VIBRATION MEASURING, MONITORING, ANALYSIS

Cascade Analytic, LLC	2311
Governor Control Systems, Inc.	3029
OROS	2243
Prime Photonics, LC	1335
PROGNOST Systems Inc	2011
Schenck Trebel Corporation	1728
Torquemeters Limited	2634
Vibration Guys, LLC, The	2818
Windrock Inc.	1602

DISTRIBUTORS

PUMP RELATED EQUIPMENT

Adams Valves	1521
Atlantic Group, Inc.	1328
Boerger, LLC	1317
Boulden Company	1427
BSK Fluid Technology LLC.	1212
C and T International, LLC	1103
Dekker Vacuum Technologies	2812
Dongguan Shenpeng Electronics Co., Ltd	1222
Fluid Energy Controls, Inc.	1524
Hammelmann Corporation	1505
Hangzhou Sealcon Fluid Machinery Co., Ltd	3215
Leadgo Electric Motor Inc.	3024
Neoflex Industrial	1412
Process Compliance Products, Inc.	2917
PumpWorks 610	1304
PumpWorks Industrial	1306
Sdms Seal Co.,Ltd.	1800
Shanley Pump & Equipment	1100
Sichuan Sunny Seal Co., Ltd.	1718
Weifang Subtor Rotating Precision Machinery	1121

PUMPS

Boerger, LLC	1317
BSK Fluid Technology LLC.	1212
C and T International, LLC	1103
Dekker Vacuum Technologies	2812
Dongguan Shenpeng Electronics Co., Ltd	1222
Hammelmann Corporation	1505
Process Compliance Products, Inc.	2917
Power Zone Equipment, Inc..	1436
PumpWorks Industrial	1306
Shanley Pump & Equipment	1100
Weicheng Metal Products Co., Ltd. (Wayscan Metal Products Co., Ltd.)	3015
Weifang Subtor Rotating Precision Machinery	1121

EDUCATION/RESEARCH/TRAINING

CONSULTING - MAINTENANCE & RELIABILITY

Adhesive Services Company	1910
Cascade Analytic, LLC	2311
Cradle North America Inc.	3044
Equity Engineering, The	1101
Exida.com, LLC	1929
Kelm Engineering, LLC	1604
Philadelphia Gear	2834
PROGNOST Systems Inc	2011
Reinhart & Associates, Inc.	2125
Roper Technologies, Inc.	2111
SoftInWay Inc.	1813
TEES - Turbomachinery Laboratory	2411
TurboGen Consultants, Inc.	2810
Vibration Guys, LLC, The	2818
Vibration Institute	2539
Windrock Inc.	1602
Wood Group– vibration, dynamics and noise (formerly BETA Machinery Analysis)	2416

CONTINUING EDUCATION CREDIT COURSES

Exida.com, LLC	1929
Hydraulic Institute	1214
Mary Kay O'Connor Process Safety Center	3217
TEES - Turbomachinery Laboratory	2411
Vibration Institute	2539

EDUCATIONAL COURSES

Hydraulic Institute	1214
Mary Kay O'Connor Process Safety Center	3217
Master of Engineering Technical Management (METM)	3144
Pioneer Engineering	3013
Schenck Trebel Corporation	1728
SoftInWay Inc.	1813
TEES - Turbomachinery Laboratory	2411

RESEARCH - PUMPS/FLUID HANDLING

Exida.com, LLC	1929
TEES - Turbomachinery Laboratory	2411

RESEARCH - TURBINES/ROTATING EQUIPMENT

Concepts NREC	2127
Exida.com, LLC	1929
Industrial Info Resources	1921
TEES - Turbomachinery Laboratory	2411

TRAINING

ACQUIP Inc.	2734
Applied Flow Technology	2435
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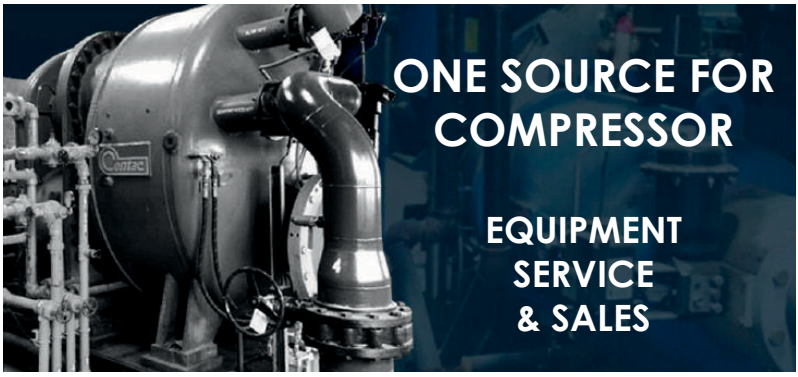

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- Undergraduate and Graduate Education
- Continuing Education & Professional Development

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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).

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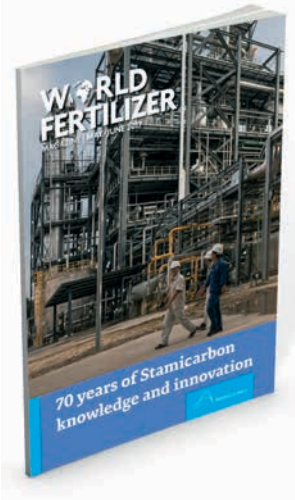

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Sulzer
Torishima Pumps
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FOR MORE INFORMATION
turbolab.tamu.edu/trc

Dara Childs, Director
Debbie Maggs, Program Coordinator
979-845-7417
trc@turbo-lab.tamu.edu

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TRC members have exclusive access to XLTRC$_2$, 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$_2$ 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.

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TEES
TURBOMACHINERY LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

TEXAS A&M UNIVERSITY

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 A, B and C. The halls will be open during the following times:

- **Tuesday, December 12, 2017**
  Noon – 2 P.M.
- **Wednesday, December 13, 2017**
  Noon – 2 P.M.

FREE PASS HOURS - EXHIBITION

Free Pass registration required.

- **Tuesday, December 12, 2017**
  2:30 P.M. – 7 P.M.
- **Wednesday, December 13, 2017**
  2:30 P.M. – 6:30 P.M.
- **Thursday, December 14, 2017**
  9:30 A.M. – Noon

WELCOME ADDRESS

The welcome address is scheduled for Tuesday, December 12, 2017 from 8 - 8:35 A.M. in the General Assembly Theatre C in the George R. Brown, Level 3. This year's speaker is Jody Elliott, President of Domestic Oil and Gas at Occidental Petroleum Corporation (Oxy). Admission is free and open to the public.

LUNCHEONS

Badge required, not open to Free Pass

Lunch will be served on December 12th and 13th in Exhibit Hall A, B and C. Admission is granted to paid attendees, exhibitors and press. The one-day symposia registration fee includes admission to lunch for that day.

TEX-MEX BUFFET

Badge required, not open to Free Pass

The Tex-Mex Buffet is scheduled for Tuesday, December 12, 2017, 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

This year's banquet will honor Dr. Dara W. Childs, director of the Turbomachinery Laboratory. He will retire following the symposia after serving the Turbo Lab for more than three decades.

The Banquet is scheduled for Wednesday, December 13, 2017, 7:30 P.M. – 9 P.M. in the Grand Ballroom Level 4. Admission is granted to paid attendees, exhibitors, and press. Additional admissions are available for purchase at Registration Counters in Exhibit Hall B ($125).

SHUTTLE SERVICE

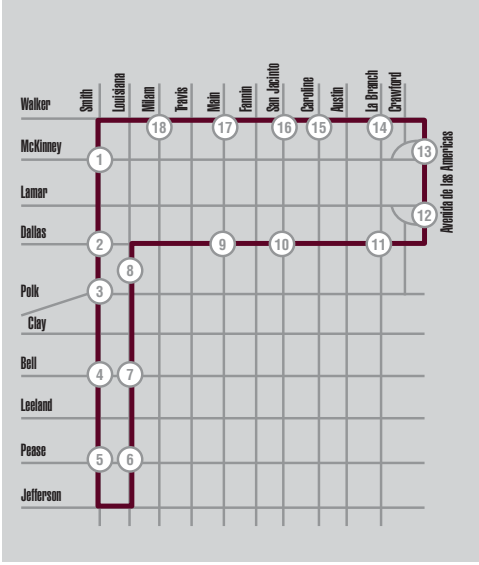
Complimentary shuttle service is provided between the George R. Brown Convention Center (GRB)/the Hilton Americas and the Hyatt Regency Downtown. The shuttle runs every 20 minutes. Please note the schedule below:

- **Monday, December 11, 2017**
  7:00 A.M. – 6:30 P.M. GRB/Hyatt
  6:30 P.M. – 10:00 P.M. Hilton/ Hyatt
- **Tuesday, December 12, 2017**
  7:00 A.M. – 7:30 P.M. GRB/Hyatt
  7:30 P.M. – Midnight Hilton/Hyatt
- **Wednesday, December 13, 2017**
  7:30 A.M. – 7:00 P.M. GRB/Hyatt
  7:00 P.M. – 11:00 P.M. Hilton/Hyatt
- **Thursday, December 14, 2017**
  7:30 A.M. – 2:00 P.M. GRB/Hyatt

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

The Turbomachinery Laboratory is proud to present the full technical program for this 46th Turbomachinery and 33rd International Pump Users Symposia. These Proceedings are included as part of the full and one-day symposia registration fee. To access the Proceedings documents on the Proceedings USB drive, insert the drive into your CPU or other computing device. Click on index, then browse through the Table of Contents on the main page and navigate to the full texts and/or author biographies of different technical sessions.

CONTINUING EDUCATION

UNITS/PROFESSION DEVELOPMENT HOURS (CEU/PDH)

The CEU/PDH is the nationally recognized unit designed to provide a record of an individual's continuing education achievements.

Symposia attendees earn .45 CEUs/4.5 PDHs Tuesday and Wednesday and .3 CEUs/3 PDHs Thursday or 1.2 CEUs/12 PDHs for full symposia. Short Course attendees can earn .6 CEUs/6 PDHs.

In order to receive a CEU/PDH certificate, you must complete and return the appropriate CEU/PDH request form to the Registration Counter during the symposia or via email to the CEU coordinator, debbie@turbo-lab.tamu.edu, or via fax to 979-845-1835. A certificate will be prepared and forwarded to participants 4-6 weeks after the symposia.

NOTE: Registration is verified prior to issuing certificate.

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AMERICANS WITH DISABILITIES

ACT AMENDMENTS ACT OF 2008 (ADAAA)

The Texas A&M University System welcomes you to the Turbomachinery & International Pump Users Symposia. If you require an accommodation under the Americans with Disabilities Act (ADA), please contact Jeannie Galindo at jgalindo@turbo-lab.tamu.edu or 979-862-1012 if you are an attendee, or Exhibitor Services at exhibit@turbo-lab.tamu.edu or 979-458-8878 if you are an exhibitor. Early notification is encouraged, and a request two weeks before the event you plan to attend will facilitate the provision of a reasonable accommodation.

CANCELLATION POLICY

Should symposia and/or short course cancellation be necessary, written refund requests (by fax or mail) must be received by the Turbomachinery Laboratory by midnight, December 4, 2017 for refund of registration fees. There will be a $100.00 USD administrative and banking fee charge to cancel registration. Substitutions are encouraged. We do request that substitutions be made in advance, as substitutions made onsite at the symposia will result in registration delays.

Late cancellations (after the cancellation date) will be reviewed on a case-by-case basis for personal hardships (death, injury, or illness of the attendee or an immediate family member). Refunds may also be extended for natural disasters (hurricanes, etc.) and national emergencies (9/11, etc.).

The TL does not refund for business decisions (after cancellation date) by the attendee's employer such as: job reassignment, plant emergencies, etc. However, we encourage substituting another employee so the attendees' company receives the benefit of training. In the event of a "no-show" cancellation, short-course/Symposium materials will be forwarded to the absent attendee.

The State of Texas does not allow the TL to extend credit to individuals or companies. Therefore, we cannot apply registration fees for a missed course to another subsequent course.

The TL reserves the right to cancel any short course or symposia and return all fees in the event of insufficient registration. We reserve the right to cancel due to unforeseen circumstances. The TL will not be responsible for any losses incurred by the registrants, including but not limited to airline cancellation charges or hotel deposits.

Tex-Mex BUFFET

7:30 - 9:00 p.m.

Level 2, Hilton Ballroom
of the Americas A

Badges required.
Not open to Free Pass.

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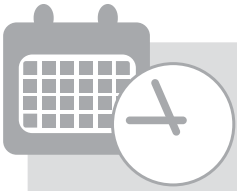

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