



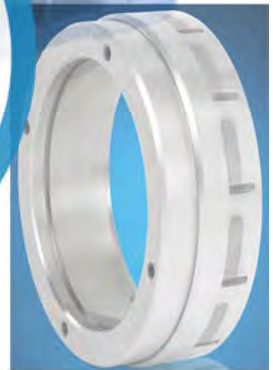
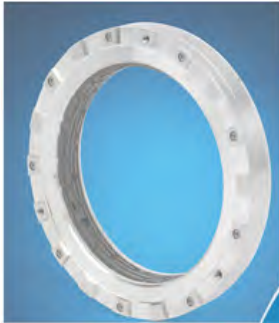
SHOW GUIDE 2018



47TH TURBOMACHINERY &
34TH PUMP SYMPOSIA

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THANK YOU TO EVERYONE WHO MADE THIS EVENT POSSIBLE

Dr. Petersen genuinely thanks every one of the advisory committee members, technical session leaders, exhibitors, staff and attendees for their efforts toward a successful TPS. We present this year another unparalleled exhibit hall and cutting-edge technical program while fostering an environment of networking and promoting continuous education in turbomachinery and pumps.

Welcome to the 47th Turbomachinery & 34th Pump Symposia!

ORGANIZED BY



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TEXAS A&M ENGINEERING EXPERIMENT STATION

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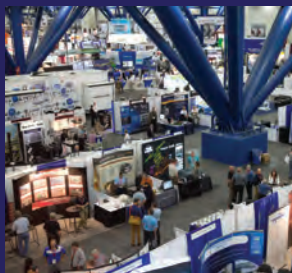
INTRODUCTION

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TURBOMACHINERY

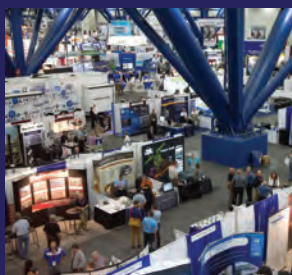
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THANK YOU SPONSORS



Floor Aisle Indicators



Aisle Signs
Tuesday Coffee Break



Hotel Key Cards



Social Media



Delegate Bags



Tuesday Water Station



Notepads



Pens



Escalator Runners



Lanyards



Post It Notes



Highlighters

WI • FI

CONNECTION



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

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

THANK YOU

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Society of Tribologists and Lubrication Engineers



SPOUSE PROGRAM

BRAZOS GLASSWORKS PRESENTS...

Ink art and acrylic pouring! Both techniques are fun, colorful, easy for even the novice, and provide totally unexpected results. Be prepared to get messy, have fun, and go home with multiple contemporary art pieces.

TUESDAY, SEPTEMBER 18

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 the Hilton by the gift shop

9 a.m.

Class begins in Room 352 A of the George R. Brown Convention Center

Noon

Class ends

DOWNTOWN AQUARIUM

MUST RSVP BY TUESDAY, SEPTEMBER 11

Spend the day at the Downtown Houston Aquarium! Participants will be transported to the aquarium and will receive All Day Adventure passes. Passes include the Aquarium Adventure Exhibit, Stingray Reef and all rides, including the Shark Voyage train ride that winds through the shark exhibit. Participants also get a \$10 off gift card to use for lunch or at the gift shop.

WEDNESDAY, SEPTEMBER 19

7:30 a.m. – 8:45 a.m.

Continental Breakfast in the Spouse Hospitality Suite, Hilton of the Americas, Room 342

9:45 a.m.

Meet at the Hilton by the gift shop

2:30 p.m.

Return to the Hilton

CLASSES ARE LIMITED TO 20 PERSONS

The spouse program is a social program—it is not intended for individuals who wish to participate in the Symposia or the exhibition. Badges may be claimed with the sponsoring delegate's registration badge. Badges must be worn for admission to the Exhibit hall and for admission to events. There is no charge for the spouse program. For more information, visit the delegate counter on Level 1, Hall D, in the George R. Brown Convention Center.

DOWNLOAD THE TPS MOBILE APP

Get access to the program schedule, speakers, exhibitors
and more, all from your Smartphone.

Visit the appropriate app store — Apple or Android. Search for and download
the “LOOPD Events” app.

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Once in the app, you will be prompted to enter an access code: 650085

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**Have questions or need assistance?
VISIT BOOTH #2022.**

Notice an error in the app? Send to bconrad@tamu.edu.

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SCHEDULES



#GetSocialTPS

Social Media Scavenger Hunt

4 \$1000 cash prizes
are up for grabs!



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The Turbomachinery Laboratory and
Empowering Pumps & Equipment present the 2018
#GetSocialTPS scavenger hunt

For instructions and a list of participating companies, see the #GetSocialTPS directory in your show guide, or pick one up on the exhibit floor.

You can also visit [tps.tamu.edu/getsocialtps](https://tamu.edu/getsocialtps) for complete details.

Questions? Ask a Turbo Lab staff member in booth 2125 or 2022,
or an Empowering Pumps & Equipment representative in booth 1204.

SCHEDULE AT A GLANCE

Sunday, September 16, 2018

4:30 P.M. – 6:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
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4:30 P.M. – 6:00 P.M.	Leader Registration	Level 3, Room 340A
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Monday, September 17, 2018

7:00 A.M. – 12:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
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7:00 A.M. – 12:00 P.M.	Leader Registration	Level 3, Room 340A
------------------------	---------------------	--------------------

8:30 A.M. – 5:00 P.M.	Short Courses	Level 3
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12:00 P.M. – 1:15 P.M.	Short Course Luncheon	Level 3, George Bush Grand Ballroom C
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1:30 P.M. – 5:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
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1:30 P.M. – 5:00 P.M.	Leader Registration	Level 3, Room 340A
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5:30 P.M. – 6:00 P.M.	Turbo Advisory Committee Meeting	Level 3, Room 320A
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6:00 P.M. – 6:30 P.M.	Pump Advisory Committee Meeting	Level 3, Room 320A
-----------------------	---------------------------------	--------------------

Tuesday, September 18, 2018

7:00 A.M. – 7:45 A.M.	Leader Breakfast	Level 3, Room 330A
7:30 A.M. – 5:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
7:30 A.M. – 5:00 P.M.	Leader Registration	Level 3, Room 340A
8:00 A.M. – 8:35 A.M.	Welcome Address – Dr. Eric Petersen, Turbo Lab Director	Level 3, General Assembly 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 D
12:00 P.M. – 2:00 P.M.	Lunch & Exhibits Open to Paid Delegates	Level 1, Exhibit Hall D
2:00 P.M. – 3:30 P.M.	Symposia Technical Sessions	Level 3
2:30 P.M. – 7:00 P.M.	Exhibits Open Free to Public	Level 1, Exhibit Hall D
6:30 P.M.	Hospitality Suites See Hospitality Suite Schedule on page 24	Hilton Americas
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, September 19, 2018

7:30 A.M. – 8:15 A.M.	Leader Breakfast	Level 3, Room 330A
8:00 A.M. – 5:00 P.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
8:00 A.M. – 5:00 P.M.	Leader Registration	Level 3, Room 340A
8:00 A.M. – 5:00 P.M.	Booth Selections for 2019	Level 1, Exhibit Hall D, 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 D
12:00 P.M. – 2:00 P.M.	Lunch & Exhibits Open to Paid Delegates	Level 1, Exhibit Hall D
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 D
6:30 P.M.	Hospitality Suites	Hilton Americas
7:30 P.M. – 9:00 P.M.	Banquet featuring The Crescent Circus (No entry after 7:45 P.M. Badges required – Not open to Free Pass)	Level 2, Hilton Ballroom of the Americas A

Thursday, September 20, 2018

7:30 A.M. – 8:15 A.M.	Leader Breakfast	Level 3, Room 330A
8:00 A.M. – 11:00 A.M.	Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
8:00 A.M. – 11:00 A.M.	Booth Selections for 2019	Level 1, Exhibit Hall D, Exhibitor Registration Counter
8:30 A.M. – 12:00 P.M.	Symposia Technical Sessions - Case Studies	Level 3
12:00 P.M. – 2:00 P.M.	Turbo and Pump Advisory Committee Luncheon	Level 3, 330A

HAVE YOU RESERVED YOUR BOOTH FOR TPS 2019?

Visit the Exhibitor Registration Counter
in Hall D to book before you leave TPS 2018.

Wednesday, 8 a.m. – 5 p.m.
Thursday, 8-11 a.m.

TPS 2019: SEPTEMBER 10-12

BONUS

SHORT COURSE

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

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M.

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

Room 342F

Mechanical integrity (MI) is a critical element of process safety management (PSM) program. The high importance of turbomachinery equipment (e.g., pumps, compressors, turbines) handling hazardous materials in process industries requires the equipment to be included in a best-in-class mechanical integrity program. The Ciniza Oil Refinery explosion at Giant Industries in Jamestown, New Mexico can be taken as an example where the lack of a good MI program led to an incident causing major asset loss and severe injuries to employees. Many organizations of various sizes and shapes have severe shortcomings in the effective implementation of mechanical integrity program as well as competency in executing the program. To address such issues, this course will cover the following topics pertinent to turbomachinery and pumps: RAGAGEPS Inspection, Testing, and Preventive Maintenance (ITPM) including task planning, testing techniques, activities, and execution Loss of Primary Containment including Tier 1 Tier 4 definitions and consequences Mechanical Seals including how seals work, why they fail, and increasing seal life Risk Evaluation including basic assessment, and evaluating risk based on shaft annular area and sealing chamber pressure Risk-based Machinery Management Draft API STD 691, covering all aspects of the life cycle Several activities throughout the day will reinforce concepts.

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

Stay Connected



Twitter: @TurboLabTEES

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INNOVATION PRESENTS

SCHEDULE (FORMERLY TURBO STAGE)

Innovation Presents, formerly Turbo Stage, is a platform in the front corner of the exhibit hall (house left, near booth 3111) where exhibiting companies provide 20-minute commercial presentations.

Tuesday, September 18, 2018

3:00 P.M. – 3:20 P.M.	Turbomachinery Laboratory – Turbo Lab Representative XLTRC2 Update
3:30 P.M. – 3:50 P.M.	CoorsTek – Lloyd Sobel High-Performance Ceramics in Mechanical Seal Assemblies
4:00 P.M. – 4:20 P.M.	Armadillo Energy Services LLC – Sergio Lopez Material Fatigue on Centrifugal Compressor Inspection & Evaluation Before Reassembling the Compressor
4:30 P.M. – 4:50 P.M.	Bently Nevada – Chris McMillen Wireless Monitoring: Achieve Asset Security & Fewer Unplanned Failures
5:00 P.M. – 5:20 P.M.	Petasense – Arun Santhebennur IoT-based Asset Reliability & Optimization System
5:30 P.M. – 5:50 P.M.	Exact Metrology – Michael Trudeau Options for 3D Scanning and Reverse Engineering for Turbo Machinery

Wednesday, September 19, 2018

3:00 P.M. – 3:20 P.M.	L.A. Turbine – Tadeh Avetian ARES: Industry-First AMB Turbomachinery Solution Featuring On-Skid Controller
3:30 P.M. – 3:50 P.M.	Macek Power & Turbomachinery Engineering – Michael Macek Steam Turbine Re-rating
4:00 P.M. – 4:20 P.M.	John Crane – Paul Hosking Technologies for improving reliability and reducing gas emissions from centrifugal compressors
4:30 P.M. – 4:50 P.M.	Burckhardt Compression – Lukas Stirnemann & Jay T. Hedlund Laby® Compressor in Petrochemical Applications
5:00 P.M. – 5:20 P.M.	Rexnord Industries – Emmet Stiff Coupling Guard Design Recommendations to Minimize Surface & Internal Temperatures
5:30 P.M. – 5:50 P.M.	PRUFTECHNIK – Barry Jeffcote PRUFTECHNIK reliability and maintenance solutions

HOSPITALITY SUITES

SCHEDULE

All Hospitality Suites are located at Hilton Americas-Houston.

Monday, September 17, 2018

6:30 P.M.	Ingersoll Rand	Ballroom of Americas - A
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Tuesday, September 18, 2018

6:30 P.M. - 10:00 P.M.	MHI Compressor International Corporation	Ballroom of Americas - D
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6:30 P.M. - 9:30 P.M.	Compressor Controls Corporation	Suite #22029
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Wednesday, September 19, 2018

6:30 P.M. - 10:00 P.M.	York Process Systems	Suite #21029
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Banquet

featuring

The Crescent Circus

7:30 P.M. – 9:00 P.M.

Level 2

Hilton Ballroom of the Americas A

PLAN YOUR SCHEDULE

TUESDAY

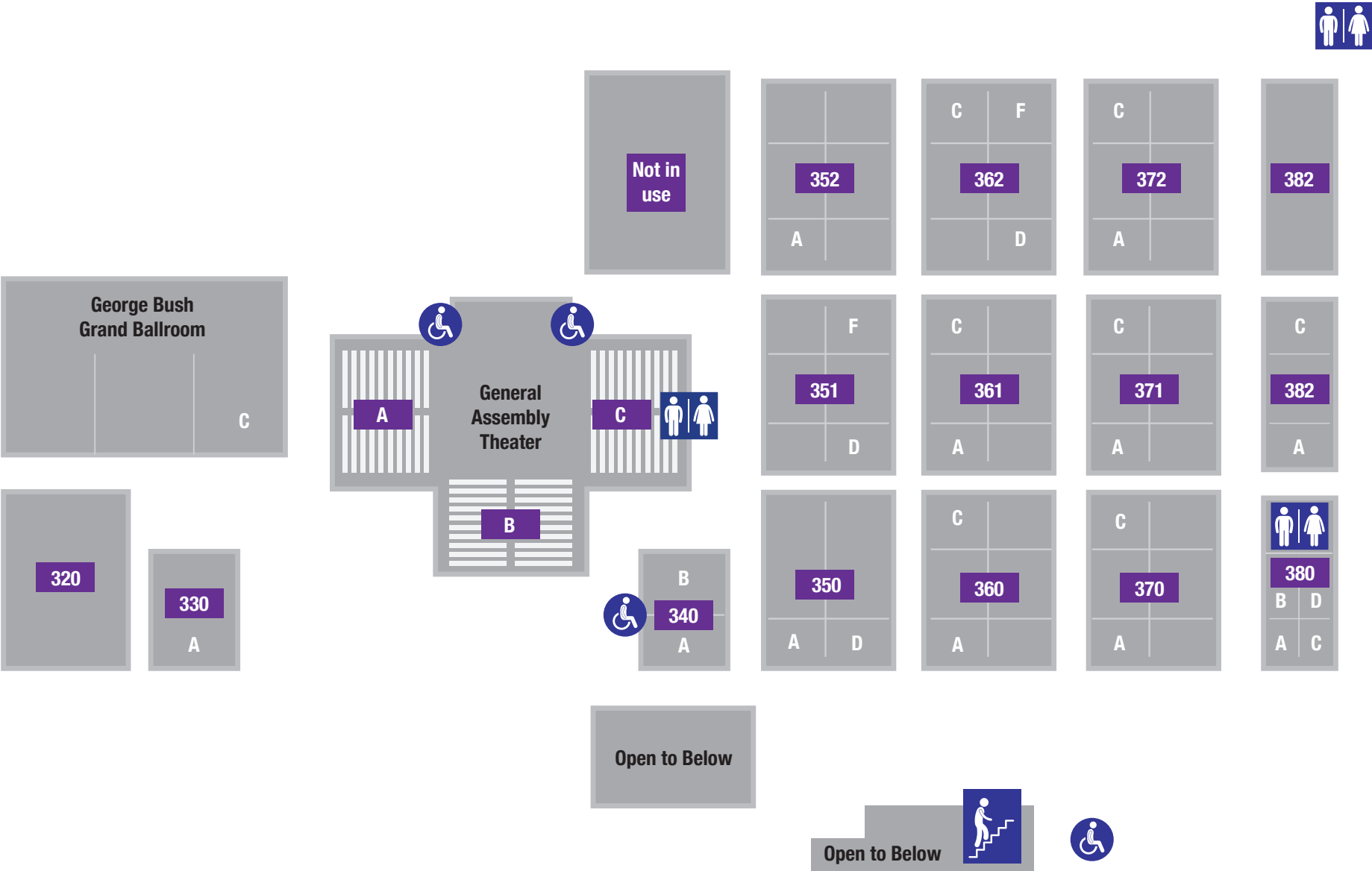
WEDNESDAY

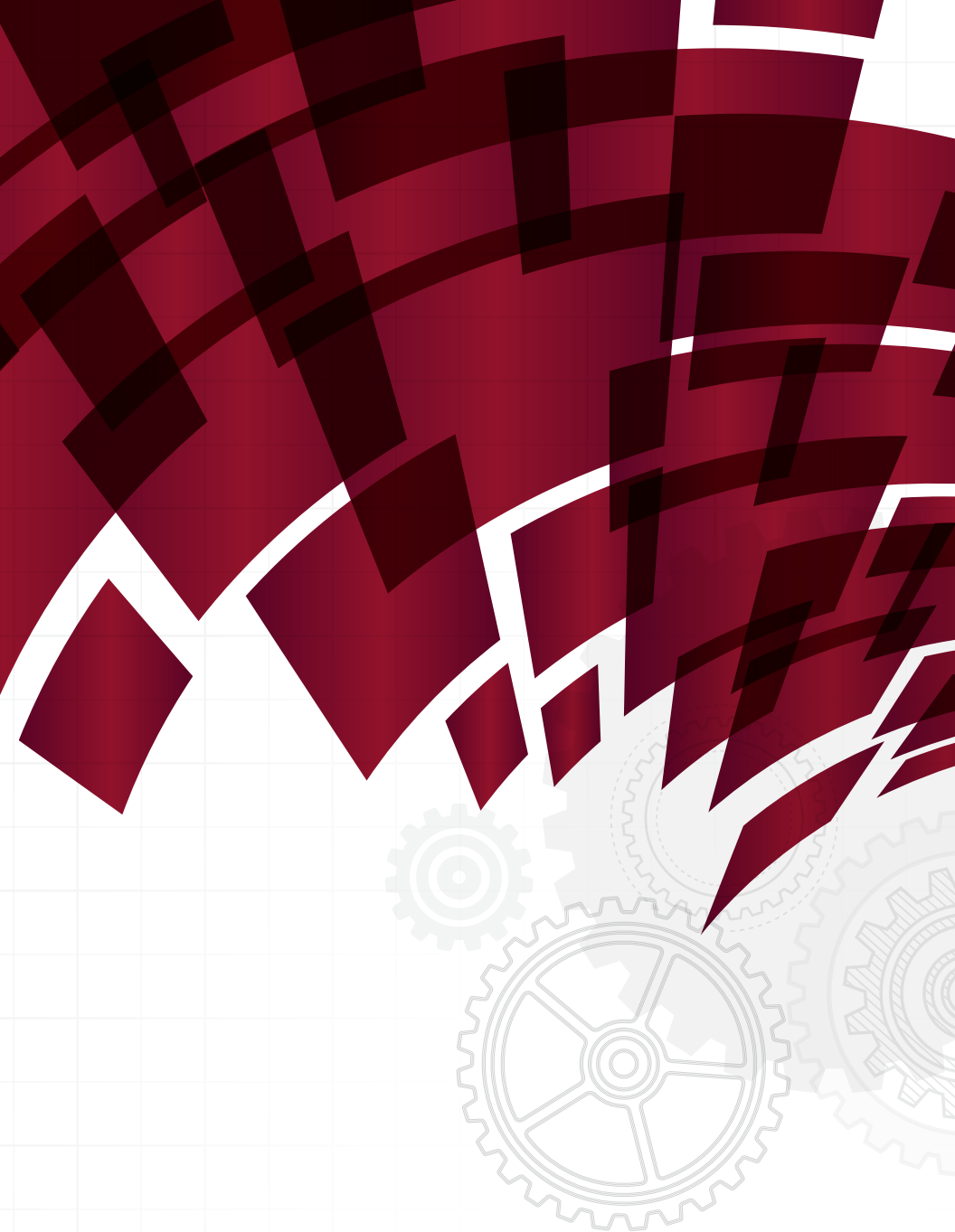
THURSDAY

REGISTRATION	7:30 A.M. – 5:00 P.M.	8:00 A.M. – 5:00 P.M.	8:00 A.M. – 12:00 P.M.
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 <i>featuring</i> Dr. Eric Petersen, Turbomachinery Laboratory Director		9:30 A.M. – 12:00 P.M. Exhibits Open
10:00 A.M. – 10:30 A.M.	Refreshment Break	Refreshment Break	Refreshment Break
12:00 P.M. – 2:00 P.M.	Lunch & Exhibits Open to Paid Delegates	Lunch & Exhibits Open to Paid Delegates	Symposia Ends at Noon
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	Exhibits Open	
7:30 P.M.	Tex-Mex Buffet at Hilton	Banquet at Hilton <i>featuring</i> The Crescent Circus	

CONVENTION CENTER

MAP LEVEL 3





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TURBO

DAILY SCHEDULE

Sunday, September 16, 2018

4:30 P.M. – 6:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
Leader Registration	Level 3, 340A

Monday, September 17, 2018

7:00 A.M. – 12:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
Leader Registration	Level 3, 340A

8:30 A.M. – 5:00 P.M. | SHORT COURSES

Short Course PT01 Vibration Problems and Solutions in Pumps and Turbomachinery	Level 3, 330A
---	---------------

Short Course T02 Torsional Rotordynamics of Machinery Equipment Strings	Level 3, 350D
--	---------------

Short Course T03 Centrifugal Compressors 101	Level 3, 360A
---	---------------

Short Course T04 Centrifugal Compressors 201	Level 3, 360C
---	---------------

Short Course T05 An Introduction to Hydrodynamic Bearings as Used in Industrial Turbomachinery	Level 3, 351D
---	---------------

Short Course T06 API 692 Dry Gas Seals	Level 3, 351F
---	---------------

Short Course T07 Introduction to sCO ₂ Power Cycles, Applications, Turbomachinery, Heat Exchangers, and Research Programs	Level 3, 361A
---	---------------

Short Course T08 Industrial Gas Turbines	Level 3, 361C
---	---------------

Short Course T09 Steam Turbine 101/201 Combined, Basic Knowledge of Steam Turbine	Level 3, 342D
--	---------------

Short Course T10 High Performance Coupling and Rotating Machines	Level 3, 352D
---	---------------

Short Course T11 Bearings for Oil-Free Rotating Machinery	Level 3, 362A
--	---------------

Short Course T12 Field Performance Testing of Centrifugal and Reciprocating Compressors	Level 3, 362C
--	---------------

10:00 A.M. – 10:30 A.M. | BREAK

Refreshment Break

Level 3, Lounge Area

12:00 P.M. – 1:15 P.M. | LUNCH

Short Course Luncheon

Level 3, George Bush
Grand Ballroom C

1:30 P.M. – 5:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration

Level 1, Exhibit Hall D

Leader Registration

Level 3, 340A

3:00 P.M. – 3:30 P.M. | BREAK

Refreshment Break

Level 3, Lounge Area

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

Turbomachinery Advisory Committee Meeting

Level 3, 320A

6:00 P.M. – 6:30 P.M. | PUMP COMMITTEE MEETING

Pump Advisory Committee Meeting

Level 3, 320A

TUESDAY, SEPTEMBER 18, 2018

7:00 A.M. – 7:45 A.M. | BREAKFAST

Leader Breakfast

Level 3, 330A

7:30 A.M. – 5:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration

Level 1, Exhibit Hall D

Leader Registration

Level 3, 340A

8:00 A.M. – 8:35 A.M. | WELCOME

Welcome Address - Dr. Eric Petersen, Turbo Lab Director

Level 3, General Assembly
Theatre C

8:45 A.M. – 10:15 A.M. TECHNICAL SESSIONS	
Lecture 1 Development Of New On-Line Wash Oil Injection System For Centrifugal Compressor	Level 3, 360A
Lecture 2 Development of New Heat Treatment Method to Impart High Creep Strength and High Toughness to Rotor Material for Condensing Steam Turbine	
Tutorial 1 Tutorial on Centrifugal Compressor Surge Control	Level 3, 351D
Tutorial 2 Determination of Operating Conditions and the Impact on Centrifugal Air Compressor Selection and Performance	Level 3, 351F
Discussion Group T06 Reciprocating Compressors	Level 3, 370A
Discussion Group T11 Turbomachinery Bearings and Annular Seals	Level 3, 371C
Discussion Group T12 Protection Systems Integrity	Level 3, 370C
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 Predicting, Understanding and Avoiding the Ekofisk Rotor Instability Forty Years Later	Level 3, 360A
Tutorial 3 A Review of Aerodynamically Induced Forces Acting on Centrifugal Compressors, and Resulting Vibration Characteristics Of Rotors	Level 3, 351D
Tutorial 4 Mechanical, Stress and Flow Considerations for Piping Design of Centrifugal Compressors	Level 3, 351F
Discussion Group PT01 Monitoring Vibration and Other Critical Machine Conditions	Level 3, 371C
Discussion Group PT02 Couplings and Alignment	Level 3, 371A
Discussion Group T08 Turbo Expanders & PRTs	Level 3, 372A
Discussion Group T09 Dry Gas Seals for Compressors	Level 3, 370A
12:00 P.M. – 2:00 P.M. LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall D
2:00 P.M. – 3:30 P.M. TECHNICAL SESSIONS	
Lecture 4 Testing of a 10 MWE Supercritical CO ₂ Turbine	Level 3, 360A
Lecture 5 A New Methodology For Verifying Pressurized Start-Up of Centrifugal Compressors Driven By Direct-On-Line Electric Motor by Leveraging String Test Results And Dynamic Simulation Analysis	

Tutorial 5 Centrifugal Compressor Evolution	Level 3, 351D
Tutorial 6 Multidisciplinary Approach to Failure Analysis of Turbomachinery Components	Level 3, 351F
Discussion Group PT04 Lubrication	Level 3, 371A
Discussion Group T13 Screw Compressors	Level 3, 370C
Discussion Group T15 Steam Turbine Design, Operation, and Maintenance	Level 3, 371C
2:30 P.M. – 7:00 P.M. EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall D
6:30 P.M. HOSPITALITY SUITES	
Hospitality Suites	See Hospitality Suite Schedule on Page 22
7:30 P.M. – 9:00 P.M. DINNER	
Tex-Mex Buffet (Badge required, not open to Free Pass)	Level 2, Hilton Ballroom A



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this valuable resource!

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SYMPOSIA
ARE AVAILABLE
**FREE
ONLINE**

WEDNESDAY, SEPTEMBER 19, 2018

7:30 A.M. – 8:15 A.M. | BREAKFAST

Leader Breakfast

Level 3, 330A

8:00 A.M. – 5:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration

Level 1, Exhibit Hall D

Leader Registration

Level 3, 340A

Booth Selection

Level 1, Exhibit Hall D,
Exhibitor Registration Counter

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

Lecture 6 Successful Application Of Nitrogen Turboexpanders - Compressors To Floating and Land-Based Liquefied Natural Gas (LNG) Facilities

Level 3, 360A

Lecture 7 Surge Exploration Tests and Second Quadrant Characteristic Dynamic Modeling On Full-Scale Centrifugal Compressor

Tutorial 7 Lifetime of Gas Turbines Hot Section Parts in an O&G Environment

Level 3, 351D

Tutorial 8 Gas Turbines and Associated Auxiliary Systems In Oil and Gas Applications

Level 3, 351F

Discussion Group T07 Advanced Topics In Centrifugal Compressor Design

Level 3, 371C

Discussion Group T14 Gas Turbine Operation and Maintenance

Level 3, 370C

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 8 New Challenges and Design For High Mach High Flow Coefficient Impeller For Large Size LNG Plant

Level 3, 360A

Lecture 9 Additive Manufacturing and Topology Optimization Applied to Impeller to Enhance Mechanical Performance

Tutorial 9 Gas Turbine Emissions Improvements by Advances in Design, Analysis, Materials, Manufacturing, And Control Technology

Level 3, 351D

Tutorial 10 Know Your Turbomachinery's Operating Environment

Level 3, 351F

Discussion Group PT04 Lubrication

Level 3, 371A

Discussion Group T05 Overspeed Trip Systems

Level 3, 370C

Discussion Group T10 Integrally Geared Compressors

Level 3, 371C

12:00 P.M. – 2:00 P.M. LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall C
2:00 P.M. – 3:30 P.M. TECHNICAL SESSIONS	
Lecture 10 API High Speed Balancing Acceptance Criteria and Pedestal Dynamics	Level 3, 360A
Lecture 11 High Reliability Pistons for Reciprocating Compressors With Validated Performance Modelling	
Tutorial 11 The Synchronous Rotor Instability Phenomenon - Morton Effect	Level 3, 351D
Tutorial 12 Worldwide Deployment of Predictive Asset Management in an Industrial Gases Company	Level 3, 351F
Discussion Group PT01 Monitoring Vibration and Other Critical Machine Conditions	Level 3, 371A
Discussion Group PT03 Gears	Level 3, 371C
Discussion Group T16 Compressor Controls	Level 3, 370C
2:30 P.M. – 7:00 P.M. EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall D
6:30 P.M. HOSPITALITY SUITES	
Hospitality Suites	See Hospitality Suite Schedule on Page 22
7:30 P.M. – 9:00 P.M. BANQUET (No entry after 7:45 P.M.)	
Banquet - The Crescent Circus (Badge required, not open to Free Pass)	Level 2, Hilton Ballroom A

THURSDAY, SEPTEMBER 20, 2018	
7:30 A.M. – 8:15 A.M. BREAKFAST	
Leader Breakfast	Level 3, 330A
Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
Leader Registration	Level 3, 340A
Booth Selection	Level 1, Exhibit Hall D, Exhibitor Registration Counter

8:30 A.M. – 10:00 A.M. TURBO CASE STUDY SESSION 1A	
Case Study T01 Investigation and Resolution of Governing Valve Linkage Failure for Compressor Drive Steam Turbine	Level 3, 360A
Case Study T02 Steam Turbine Reoccurring Rubs, Troubleshooting and Corrective Action	
Case Study T03 High Vibration Due to Steam Turbine Deposits	
Case Study T04 Steam Turbine with 0.9X Vibrations	
8:30 A.M. – 10:00 A.M. TURBO CASE STUDY SESSION 1B	
Case Study T05 Gas Seal Failures Caused by Axial Vibrations	Level 3, 361A
Case Study T06 A Review of the Critical Design Parameters for Labyrinth Type Separation Seals on Dry-Gas-Seals	
Case Study T07 Preventing a Major Wreck on a New Reciprocating Compressor: The Importance of Commissioning Testing	
8:30 A.M. – 10:00 A.M. TURBO CASE STUDY SESSION 1C	
Case Study T08 Understanding Design Parameters That Affect Thermal Stability Of High-Speed Turbo Machinery (Also Known As The Morton Effect)	Level 3, 362A
Case Study T09 Analysis and Countermeasures for Sideband of Gear Mesh Frequency (GMF) Induced by Shaft Fretting Corrosion in a Gearbox	
Case Study T10 Compressor Startup Flaring Avoidance Design Methodology	
Case Study T11 Impeller High Cycle Fatigue Failure on a Natural Gas Pipeline Compressor Following Choked Flow Operation	
9:30 A.M. – 12:00 P.M. EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall D
10:00 A.M. – 10:30 A.M. BREAK	
Refreshment Break	Level 3, Lounge Area
10:30 A.M. – 12:00 P.M. TURBO CASE STUDY SESSION 2A	
Case Study T12 Dry Gas Seal Failure Due to Axial Sub-synchronous Vibration on a Hydrogen Recycle Gas Compressor	Level 3, 360A
Case Study T13 Compressor Dry Gas Seal Failure Due To Oil Ingress	
Case Study T14 Investigation and Resolution of Dry Gas Secondary Seal Failure	

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

Case Study T15 Resolution of High Vibration on a Generator

Case Study T16 Mechanical Improvement of Electrical Interharmonics Damping

Case Study T17 Troubleshooting of Sub-synchronous Torsional Interaction Phenomena on an Electric Motor-Driven Centrifugal Compressor

Case Study T18 Stray Currents and their Damaging Effects on Rotating Machinery

Level 3, 361A

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

Advisory Committee Luncheon

Level 3, 330A

SYMPOSIA AND EXHIBITS END AT NOON

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TURBO

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The 47th 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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TURBO

SHORT COURSES

SHORT COURSE PTO1

Vibration Problems and Solutions
in Pumps and Turbomachinery

Monday, September 17, 2018
8:30 AM – 5:00 PM | Room 330A

Instructors

William Marscher, Eric Olson, Maki 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 TO2

Torsional Rotordynamics of
Machinery Equipment Strings

Monday, September 17, 2018
8:30 AM – 5:00 PM | Room 350D

Instructors

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

Description

One of the foremost concerns facing rotating equipment users today is that of torsional vibration. In contrast to lateral vibration, torsional vibration is rarely monitored. As a result, torsional failures can be especially heinous since the first symptom of a problem is often a broken shaft, gear tooth, or coupling. In the past, torsional vibration problems were considered to be rare; however the number

of torsional field problems has markedly increased recently with the advent of higher power, higher complexity variable frequency drives (VFD's). The increased risk plus the difficulty of detecting incipient failures in the field makes the performance of a thorough torsional vibration analysis an essential component of the turbomachinery design process.

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

SHORT COURSE TO3

Centrifugal Compressors 101

Monday, September 17, 2018
8:30 AM – 5:00 PM | Room 360A

Instructors

Mark Kuzdzal, Jay Koch (Siemens)

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;

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

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.

SHORT COURSE T04

Centrifugal Compressors 201

Monday, September 17, 2018

8:30 AM – 5:00 PM | Room 360C

Instructors

Instructors: Jeffrey Moore (Southwest Research Institute), James Sorokes, Nate Kiem (Siemens), James Hardin (Elliott Group), Rainer Kurz (Solar Turbines)

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.

SHORT COURSE T05

An Introduction to Hydrodynamic Bearings as used in Industrial Turbomachinery

Monday, September 17, 2018

8:30 AM – 5:00 PM | Room 351D

Instructors

Instructors: John Whalen (Consultant), Barry Blair (Waukesha Bearings), Scan DeCamillo (Kingsbury 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 T06

API 692 Dry Gas Seals

Monday, September 17, 2018

8:30 AM – 5:00 PM | Room 351F

Instructors

Robert Eisenmann, Jr. (BP), Jim Demetriou (Chevron), Chuck Parker (G.J. Oliver)

Description

Dry Gas Sealing Systems for Axial, Centrifugal, Rotary Screw Compressors and Expanders. API 692 1st edition defines design, application, testing, installation, commissioning and start-up requirements for compressor dry gas seals and the sealing system. This course will outline the document structure, nomenclature, seal arrangement, and support system design including default requirements and optional selections. Topics of seal testing and commissioning will also be covered. This 1st edition document replaces API 614 5th edition part 4. A copy of the standard will be provided as part of this course.

SHORT COURSE T07

Introduction to sCO₂ Power Cycles, Applications, Turbomachinery, Heat Exchangers, and Research Programs

Monday, September 17, 2018

08:30 AM - 05:00 PM | Room 361A

Instructors

Jason Wilkes, Tim Allison, Jeffrey Moore, Grant Musgrove, Aaron McClung (Southwest Research Institute)

Description

The recent interest to use supercritical CO₂ (sCO₂) in power cycle applications over the past decade has resulted in a large amount of literature that focuses on specific areas related to sCO₂ power cycles in great detail. Such focus areas are demonstration test facilities, heat exchangers, turbomachinery, materials, and fluid properties of CO₂ and CO₂ mixtures, to name a few. As work related to sCO₂ power cycles continues, more technical depth will be emphasized in each focus area, whereas those unfamiliar with the topic are left to undertake the large task of understanding fundamentals on their own. This short course aims to remedy this problem by providing an introduction to the following aspects of this new and exciting field.

1. sCO₂ Power Cycle Basics and Proposed sCO₂ Cycles
2. CO₂ Power Cycle Applications
3. sCO₂ Turbomachinery
4. sCO₂ Materials
5. sCO₂ Heat Exchangers
6. sCO₂ Research

SHORT COURSE T08

Industrial Gas Turbines

Monday, September 17, 2018

08:30 AM - 05:00 PM | Room 361C

Instructors

Francisco Gonzalez (Cheniere), Rainer Kurz (Solar Turbines), Klaus Brun (Southwest Research Institute), Cyrus B. Meher-Homji (Bechtel Corporation)

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 NO_x combustors. The components of a gas turbine will be addressed from a design, operation, and maintenance point of view as well as their effect on plant operation, plant availability, and reliability. Also covered will be the best practices in operating the new advanced technology gas turbines at variable loads obtaining best efficiencies with minimal down time.

SHORT COURSE T09

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

Monday, September 17, 2018

08:30 AM - 05:00 PM | Room 342D

Instructors

Matt Walton, Mayank Jain, Daisuke Takemura, Fabiola Alvarado, Akinori Tasaki (Mitsubishi Heavy Industries Compressor Corporation)

Description

This short course 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.

SHORT COURSE T10

High Performance Couplings
and Rotating Machines

Monday, September 17, 2018

08:30 AM - 05:00 PM | Room 352D

Instructors

Steven Pennington (John Crane),
Mark Oneil (Altra Couplings), Chuck
Sakers (Kop-Flex - Regal Power
Transmission Solutions), Ray Vollmer
(UTC Aerospace Systems)

Description

This course covers the design and application of high performance couplings and rotating machines. Initially the Turbomachinery driver and driven machines are analyzed together with their characteristics and how they affect the coupling. The various types of coupling in the market are covered next, including metal membranes and diaphragms and how these characteristics are utilized. Selection is reviewed next and how this affects the coupling design, including shaft end, balancing and materials. The oil and gas requirement to API671 are investigated and which coupling attributes are important. The course concludes with Installation and failure analysis and reviews the main factors affecting failures from misalignment through to torsional vibrations.

SHORT COURSE T11

Bearings for Oil-Free Rotating Machinery

Monday, September 17, 2018

08:30 AM - 05:00 PM | Room 362A

Instructors

Luis San Andres (Turbomachinery Laboratory),
Daniel Lubell (Oil-Free Machinery, LLC)

Description

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

The course also includes an introduction to magnetic bearings and their applications.

SHORT COURSE T12

Field Performance Testing of Centrifugal
and Reciprocating Compressors

Monday, September 17, 2018

08:30 AM - 05:00 PM | Room 362C

Instructors

Tim Allison, Klaus Brun, Hector Delgado,
Nathan Poerner (Southwest Research Institute)

Description

Field performance testing is often necessary to verify guaranteed as-installed aerodynamic and mechanical performance of new machinery. It can also be used to monitor long-term machinery performance, track degradation patterns, and determine appropriate maintenance practices. In order to obtain useful performance data, it is necessary to use appropriate instrumentation, follow adequate installation practices, use accurate performance calculation methods (including equations of state), and include uncertainty analysis. This short course provides a detailed overview of performance testing and provides guidelines from published documents such as ASME PTC-10, API 618, ISO 1217, and GMRC guidelines, including basic theory and calculations, instrumentation selection and location, installation and measurement accuracy, test methodology, and sources of uncertainty.

TURBO LECTURES

LECTURE 01

Development of New On-Line Wash Oil Injection System for Centrifugal Compressor

Tuesday, September 18, 2018

08:45 AM – 10:15 AM | Room 360A

Instructors

Ajay Matthew (ExxonMobil Manufacturing), Shinichiro Tokuyama, Shakuda Masaki (Mitsubishi Heavy Industries Compressor Corporation), Elumalai Subramani (ExxonMobil)

Description

The process gas compressor is the most critical unit in ethylene plants and several types of contamination can often foul the compressor flow path and plant production is significantly lost. In order to prevent this fouling, as common practice, washing oil is injected through the nozzles installed on the suction piping and return bend of each stage. However, fouling material was reported during turnaround with few years operation even though wash oil injection was carried out at required intervals. Hence, OEM found the effective approach to develop the new concept improving on-line wash oil injection system. Optimized oil injection system were evaluated to avoid any risk by means of CFD and FEM analysis. This evaluation was verified through subsequent verification test. OEM finally manufactured and delivered new oil injection system and after a few years commercial operation, the effectiveness of newly developed system was confirmed by trend data.

LECTURE 02

Development of New Heat Treatment Method to Impart High Creep Strength and High Toughness to Rotor Material for Condensing Steam Turbine

Tuesday, September 18, 2018

08:45 AM – 10:15 AM | Room 360A

Instructors

Kyoichi Ikeno, Mayank Jain, Katsumi Terada, Yuzo Tsurusaki, Shinya Morioka (Mitsubishi Heavy Industries Compressor Corporation)

Description

Higher temperatures in the HP section of the condensing Turbine requires rotor with high creep strength while low temperatures in the LP section require the rotor to have high toughness. The design basis for current rotor material, Ni-1.25Cr-Mo-V forged steel was high toughness at low temperatures. This led to rotor having insufficient creep strength in very high temperature region around control stage which limited the maximum allowable temperature of inlet steam thereby limiting the efficiency of the Turbine. This paper highlights the development of new heat treatment method to improve Ni-2.25Cr-Mo-V forged steel (10325MTE) as rotor material. To improve the mechanical properties of the material, heat treatment simulations were performed. A series of tests were done on the rotor. These tests evaluated the creep strength at high temperatures and toughness low temperatures. SCC (Stress Corrosion Cracking) susceptibility was evaluated in an accumulated corrosive environment using SSRT (Slow Strain Rate Test).

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 03

Predicting, Understanding and Avoiding the Ekofisk Rotor Instability Forty Years Later

Tuesday, September 18, 2018

10:30 AM - 12:00 PM | Room 360A

Instructors

John Kocur (ExxonMobil Research & Engineering), C. Hunter Cloud (BRG Machinery Consulting LLC), Brian Pettinato (Elliott Group)

Description

This famous machine is re-examined to assess how well (or not) current design and analytical methods have evolved to avoid shaft whip instability. In addition to reviewing the compressor's history and design evolution, the rotordynamic performance of a newly configured machine, based on today's technology, is compared against the original design.

LECTURE 04

Testing of a 10 MWE Supercritical CO₂ Turbine

Tuesday, September 18, 2018

02:00 PM - 03:30 PM | Room 360A

Instructor

Jeff Moore, Meera Day, Stefan Cich (Southwest Research Institute), Doug Hofer, Jason Mortzheim (GE Global Research)

Description

A new high temperature turbine was developed for use a sCO₂ closed-loop recompression Brayton cycle. This turbine was developed for Concentrating Solar Power (CSP) applications (700+°C), but its application includes traditional heat sources such as natural gas, coal, and nuclear power. The SCO₂ cycle can approach

50% thermal efficiency using externally fired heat sources. Furthermore, this cycle is also well suited for bottoming cycle waste heat recovery applications. This paper describes the design, commissioning, and initial testing of the 10 MWe turbine in a 1 MWe test facility.

LECTURE 05

A New Methodology for Verifying Pressurized Start-Up of Centrifugal Compressors Driven by Direct-On-Line Electric Motor by Leveraging String Test Results and Dynamic Simulation Analysis

Tuesday, September 18, 2018

02:00 PM - 03:30 PM | Room 360A

Instructors

Mirco Calosi, Marco Pelella, Riccardo Lorenzini, Riccardo Ranieri (Baker Hughes, a GE Company), Ibrahim Ahmed Kobbia (ADMA-OPCO), Luca Magnante (TechnipFMC)

Description

Fixed-Speed Electric Motors driving Centrifugal Compressors are designed considering the pressurized start-up as the most critical condition in terms of the torque requirement. Their capability is checked during the design phase by means of dynamic simulation, which may suffer from uncertainties, especially in the low speed range.

When a Complete Unit Test is requested by purchaser, on top of the defined scope, it can be exploited to validate and refine the dynamic simulation so to predict more accurately the behavior of the compressor train at site conditions and confirm the capability of the driver to start-up the compressor from Settled-Out condition. The present paper describes a new methodology to leverage Direct-On-Line Centrifugal Compressor

Complete Unit Test results to improve predictability of on-site pressurized start-up thanks to an enhanced dynamic simulation model.

A case study is also presented showing how the methodology has been successfully applied to a re-injection compressor string.

LECTURE 06

Successful Application of Nitrogen Turboexpanders-Compressors to Floating and Land-Based Liquefied Natural Gas (LNG) Facilities

Wednesday, September 19, 2018

08:30 AM - 10:00 AM | Room 360A

Instructors

Robert Benton, Ethan Eisweth (Air Products)

Description

LNG production in the form of large land-based Mega-trains and floating production, storage and offloading facilities (FPSO's) have been of particular interest in recent years. The task of designing and building these facilities and the successful integration of equipment into them can be challenging. Considerations in the scope of the equipment, design features and goals as well as the applications specific needs and end user desires must be considered to end up with a successful design.

This paper will explore the differences and similarities in the successful development and application of nitrogen turboexpander-compressors (combanders) for both land based and floating LNG (FLNG) applications. The intent is to share general learnings from specific projects and present a roadmap to assist in the successful development and execution of such a product effort. In addition, specific takeaways on the application of machinery to both land-based and shipboard applications will also be presented.

LECTURE 07

Surge Exploration Tests and Second Quadrant Characteristic Dynamic Modeling on Full-Scale Centrifugal Compressor

Wednesday, September 19, 2018

08:30 AM - 10:00 AM | Room 360A

Instructor

Mirco Calosi, Marco Pelella, Fabio Baldanzini (Baker Hughes, a GE Company)

Description

Surge exploration tests on a full-scale centrifugal compressor have been performed allowing an evaluation of the transient behavior and the mechanical robustness of the compressor even during a critical event such as Surge.

The result of this work is a breakthrough for the tuning of a centrifugal compressor model to be used for dynamic simulations and prediction of compressor dynamics during Surge events in a more reliable and robust way.

Surge exploration tests results analysis, in terms of vibrations, axial displacements and thrust loads, together with development of a compressor enhanced dynamic model, allowed a change from a Surge acceptance criterion, based on the time spent on the left of the Surge Limit Line, to a more physics related criterion, based on the acceptable number of Surge cycles, thus optimizing the selection of additional protections, such as hot/cold gas bypass valves.

LECTURE 08

New Challenges and Design for High Mach High Flow Coefficient Impeller for Large Size LNG Plant

Wednesday, September 19, 2018

10:30 AM - 12:00 PM | Room 360A

Instructors

Alberto Guglielmo, Simone Corbò,
Roberto Valente, Giuseppe Iurisci
(Baker Hughes, a GE Company)

Description

The new generation of LNG plant are moving toward a larger size, that mean larger compression stations, driven by higher power gas turbine that can arrive and exceed 100 MW. This increase of specific power means also increase in compression gas flow and so the need to have compressors that are able to handle it in efficient way.

This is true in particular for impeller stages equipping the Propane Compressors that will be selected at higher specific flow coefficient and Mach number. The present paper illustrates an improved impeller stage designed in particular to fit this duty, the need of a multidisciplinary optimization, from aerodynamic, structural mechanic, aeromechanic and rotordynamic. The paper illustrates the main design challenges for this type of impeller design, the validation done by the OEM and the benefits of their usage by mean of dedicated Case studied.

LECTURE 09

Additive Manufacturing and Topology Optimization Applied to Impeller to Enhance Mechanical Performance

Wednesday, September 19, 2018

10:30 AM - 12:00 PM | Room 360A

Instructors

Simone Corbò, Giuseppe Iurisci, Francesco Cangioli (Baker Hughes, a GE Company), Enrico Boccini, Enrico Meli, Andrea Rindi (MDM Laboratory, Department of Industrial Engineering, University of Florence)

Description

The paper describes the link between additive manufacturing techniques and topological optimization design process. An overview of Inconel718 printed material characteristics and as printed quality is given. Finally expander and compressor topological optimization results are shown highlighting the improvement in stress level and dynamic behavior.

LECTURE 10

API High Speed Balancing Acceptance Criteria and Pedestal Dynamics

Wednesday, September 19, 2018

2:00 PM – 3:30 PM | Room 360A

Instructors

Brian Pettinato, Brian Hantz, Qingyu Wang
(Elliott Group)

Description

Acceptance criteria for high-speed balancing of turbomachinery are specified in API standards based on either pedestal velocity or shaft displacement. In addition to performing balancing, the measured displacements can also be used for verification of the unbalance response analysis. Since the pedestals are relatively soft, their dynamics need to be considered in the analysis. In this paper, multiple modal tests were conducted on 3 different pedestals. Different torques on the pedestal bolts were used to study the effect on the measured FRFs. The added-mass method was applied to DH7 pedestals.

The calculated modal mass and stiffness were compared to values identified from the measured FRFs. Unbalance verification of some shop orders is compared to the predictions with different ways of characterizing the pedestal dynamics: rigid, mass and stiffness, and the FRFs.

LECTURE 11

High Reliability Pistons for Reciprocating Compressors with Validated Performance Modelling

Wednesday, September 19, 2018

02:00 PM – 03:30 PM | Room 360A

Instructors

John Ladd, Bruce Hermonat, Andreas Brandl
(Hoerbiger Service Inc.)

Description

Piston ring leakage on reciprocating compressors is predictable due to defined leakage paths at the end gaps of piston rings. A new engineering approach quantifies the slippage and determines the dynamic pressure difference on each ring. With this approach the expected discharge gas temperature increase, expected capacity losses and the risks of rider bands activation due to piston ring slippage can be quantified. The piston design and ring styles can be iterated to find an optimized piston layout for a given application. 30% of the reciprocating compressors in the process gas industry show high sensitivity to piston ring leakage and subsequent performance related issues. This paper suggests quantifying piston performance as a standard when evaluating compressor reliability and efficiency. The industry managed to reduce compressor valve related problems due to more sophisticated modelling tools and smart design changes on valves. It is time to go that next step on pistons.

EXTENDED SHORT COURSES

The Turbo Lab offers extended short courses throughout the year led by industry experts and academics. Courses range from three to five days and offer working professionals valuable education opportunities in an interactive environment.

JANUARY 2019 **Machinery Vibration & Rotordynamics**

The course is designed to benefit both young engineers and veterans. The course will cover basic vibration theory and how to use it to solve mechanical vibration problems experienced in the field. Rotordynamics terminology in common use will be defined and explained, including critical speeds, critical speed inversion, unbalance response and rotordynamic instability.

MARCH 2019 **Centrifugal Compressor Operations**

Centrifugal Compressor Operations for 21st Century Users (CCOPS) is intended for beginning- and intermediate-level professionals to accelerate their understanding of centrifugal compressors and how they are used in oil & gas applications. The course covers design aspects, aerodynamics, rotordynamics, the practical applications of installation, testing, commissioning and procurement.

ROTORDYNAMICS

The Rotordynamics short course is for beginning- and intermediate-level engineers in the petroleum, chemical, power and gas industries. It provides a basis for understanding the rotordynamics—the behavior and diagnosis—of turbines, compressors, expanders, motors, pumps and generators and their subcomponents to help select, analyze, troubleshoot and repair them for maximum reliability. The course is packed with case studies and workshops for hands-on evaluation of actual machines.

LEARN MORE AT TURBOLAB.TAMU.EDU

TURBO TUTORIALS

TUTORIAL 01

Tutorial on Centrifugal Compressor Surge Control

Tuesday, September 18, 2018
08:45 AM – 10:15 AM | Room 351D

Instructors

Jeff Moore, Klaus Brun (Southwest Research Institute), Rainer Kurz (Solar Turbines)

Description

For every centrifugal compressor installation, the design of the surge control system is vitally important to prevent damage of the compressor internal components, seals, and bearings.

While most surge control systems are capable of preventing surge for steady-state operation, emergency shutdowns (ESDs) are particularly challenging, since the surge control system must respond faster than the deceleration rate of the train. This tutorial explores various aspects of compressor surge including steady state and transient operation.

TUTORIAL 02

Determination of Operating Conditions and the Impact on Integrally Geared Centrifugal Air Compressor Selection and Performance

Tuesday, September 18, 2018
08:45 AM – 10:15 AM | Room 351F

Instructors

Alex Curtin, Eric Huss (FS-Elliott), Thomas Bergman, Andrea Belair (Praxair Inc.)

Description

This tutorial will provide several examples of how a user's specified conditions impact the selection of the compressor along with discussions of how providing well-realized

conditions can help reduce the compressor's power consumption. The tutorial will also discuss the flexibility and limitations centrifugal compressor manufacturers have in meeting various operating conditions through the selection of aerodynamic hardware and the inlet control valve including variable inlet guide vanes. Finally, the paper will provide input from an end user of centrifugal air compressors offering their point of view of the conditions provided and the compressed air solutions they need. The overarching goal is to better educate end users and purchasers of centrifugal air compressors so they can make more informed requests and obtain machinery that more efficiently meets their year-round needs.

TUTORIAL 03

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

Tuesday, September 18, 2018
10:30 AM – 12:00 PM | Room 351D

Instructors

James M. Sorokes, Mark Kuzdzal,
D. Fred Marshall (Siemens)

Description

This tutorial reviews the various types of forces that can cause non-synchronous vibrations in centrifugal compressors. Many of these forces are aerodynamically-induced, such as impeller or diffuser stall or impeller/diffuser misalignment. The presentation includes a description of the phenomena, their most common root causes, the resulting impact on the rotor vibration characteristics, and ways to distinguish between the various phenomena. Attendees will see examples of "real time" wave forms (oscilloscope output) and frequency

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

spectra (FFT output) captured from compressors that experienced the various phenomena. This tutorial should be of interest to compressor operators, field service personnel, rotating equipment specialists and/or anyone who works with turbomachinery.

TUTORIAL 04

Mechanical, Stress and Flow Considerations for Piping Design of Centrifugal Compressors

Tuesday, September 18, 2018

10:30 AM – 12:00 PM | Room 351F

Instructors

Ben White, Pablo Bueno, Frank Fierro, Trenton Cook (Southwest Research Institute)

Description

This tutorial covers a range of factors that must be considered in the piping design associated with the installation of any new centrifugal compressor system. Multiple factors must be balanced in the piping design to have an overall successful final installation. The compressor piping must be configured and supported in a manner to safely contain the mechanical forces from the internal fluid pressure as well as the weight of the piping, fittings and valves. Additionally, the piping must not place any unusually high loads on the compressor itself or any piping supports due to thermal expansion, pressure elongation or weight loads. Finally, the piping layout should result in an even flow velocity profile that does not result in any detrimental impact to the aerodynamic performance of the centrifugal compressor.

TUTORIAL 05

Centrifugal Compressor Evolution

Tuesday, September 18, 2018

2:00 PM – 3:30 PM | Room 351D

Instructors

James M. Sorokes, Mark J. Kuzdza (Siemens)

Description

This tutorial addresses the advancements that have been made during the past 50 years in the design, analysis, and manufacturing methods for centrifugal compressors. The paper provides a historical perspective on these disciplines, citing how they and other technological innovations have contributed to significant improvements in the aerodynamic and mechanical performance of modern turbomachines.

TUTORIAL 06

Multidisciplinary Approach to Failure Analysis of Turbomachinery Components

Tuesday, September 18, 2018

2:00 PM – 3:30 PM | Room 351F

Instructors

Ricardo Guerrero, Kirill Grebinnyk, Vamadevan Gowreesan (Sulzer)

Description

This tutorial session is intended to provide insights into the failure analysis approach taken by authors for various components across different types of turbomachinery, such as steam turbines, axial and centrifugal compressors and hot gas expanders.

Successful failure analysis is crucial for making the right decisions to mitigate similar types of failure in the future. Whether a failure was caused by an inherent design flaw, improper operating practices or any other combination of factors, it is important to have a comprehensive understanding of mechanisms that led to failure in order to be able to correctly address them.

TUTORIAL 07

Lifetime of Gas Turbines Hot Section Parts in an O&G Environment

Wednesday, September 19, 2018

8:30 AM – 10:00 AM | Room 351D

Instructors

Bernard Quoix, Pablo Bellocq,
Amelie Pesquet (Total E&P)

Description

The main driver to define the time between overhauls of a gas turbine is the life of the hot components. For an Oil&Gas operator, a turbine overhaul represents a major cost and therefore is a key point for performance improvement. This paper reviews the main damaging mechanisms of the hot sections of gas turbines, the available models, and provides orders of magnitudes of the impact of the different factors in the life of components. It also presents the operational experience of Total through cases for which the time between overhauls was successfully extended.

TUTORIAL 08

Gas Turbines and Associated Auxiliary Systems in Oil and Gas Applications

Wednesday, September 19, 2018

8:30 AM – 10:00 AM | Room 351F

Instructors

Mounir Mossolly, Emmanuel Bustos, Alfredo Mastropasqua, Michael Hotho (TechnipFMC)

Description

This tutorial elaborates on the various gas turbine auxiliary systems; for mechanical drive applications in oil and gas projects, from an EPC contractor perspective. The tutorial briefly introduces the basics of gas turbines including thermodynamics, types, arrangements, components and combustion technologies. However, the focus of this tutorial remains on the gas turbine auxiliaries where the functions and technology selection options are explained; furthermore, the relevance on the gas turbine performance and availability and the technical constraints for implementation are described. This tutorial contributes; in addition to what have been previously published, by being focused on the engineering of interfaces between the gas

turbine, it's auxiliary systems, and the plant in oil and gas onshore and offshore projects.

TUTORIAL 09

Gas Turbine Emissions Improvements by Advances in Design, Analysis, Materials, Manufacturing, and Control Technology

Wednesday, September 19, 2018

10:30 AM – 12:00 PM | Room 351D

Instructors

David Stansel (Solar Turbines)

Description

This tutorial provides a general overview of the state of gas turbine combustion technology. Fundamental considerations for key pollutants are discussed along with techniques to control them. Since the commercial introduction of lean combustion in the early 1990s, it has become the preferred technology to minimize NOx emissions from a gas turbine, while Selective Catalytic Reduction (SCR) has remained a necessary technique to further reduce NOx emissions in some regulated areas with poor air quality. Improved designs have been enabled by more capable analysis, manufacturing techniques, and materials. All of this is leading to lower emissions engines with greater fuel flexibility and durability. Traditional diffusion flame combustion systems generate NOx between 100 and 400 ppm on natural gas, while early DLE systems started at 42 ppm and are now capable of single digit NOx.

TUTORIAL 10

Know Your Turbomachinery's Operating Environment

Wednesday, September 19, 2018

10:30 AM – 12:00 PM | Room 351F

Instructors

David Linden (D.H.Linden Associates, Inc.)

Description

Not accounting for detrimental environment factors in the design and environment degradation are two of the most common causes of Turbomachinery component failures.

This paper discusses the importance of knowing the operating environment that the Turbomachinery will be operating in. The lack of proper definition in the design phase can result in the manufacture of machinery that cannot perform or survive in the actual operating environment.

While the effects of the Turbomachinery environment are quite broad and reaching, this paper is intended to highlight the importance of knowing and controlling the environment in and around the machinery to assure maximum reliability. Several examples of environment degradation failures are discussed to highlight the complexity of the problem and how it reaches across all types of Turbomachinery. Suggestions are made as to what the Turbomachinery operators and manufacturers can do to minimize the potential for Turbomachinery environmental degradation and failures.

TUTORIAL 11

The Synchronous Rotor Instability Phenomenon - Morton Effect

Wednesday, September 19, 2018

2:00 PM – 3:30 PM | Room 351D

Instructors

Frits de Jongh (EthosEnergy)

Description

This paper gives an overview on the “Morton Effect” and explains how synchronous rotor instability, due to nonuniform heating of bearing journals, can occur in high-speed turbomachinery. The paper was presented before as a tutorial paper (de Jongh, 2008). Now, 10 years later, the paper has been updated with the latest published information on this subject. Theoretical investigations by Keogh and Morton (1993, 1994) indicate that rotors supported by fluid-film bearings inherently exhibit a nonuniform temperature distribution along the bearing journal circumference. This thermal effect results in rotor bending, which can, in combination with an overhung mass such as couplings and overhung impellers, significantly increase rotor unbalance and thus synchronous rotor vibration.

Under certain conditions, it can lead to synchronous rotor instability. Experimental studies have subsequently been performed verifying the existence of this rotordynamic phenomenon (de Jongh and Morton, 1994) that is more commonly known as the Morton Effect. In this paper, the phenomenon is explained and an overview is given of the existing literature on this subject. Since 2008, a significant amount of research has been carried out on this subject and new papers have been published especially on various methods to predict the Morton Effect from a theoretical point of view. A number of other papers show case studies with pragmatic solutions for unstable synchronous rotor behavior. These are discussed in more detail.

TUTORIAL 12

Worldwide Deployment of Predictive Asset Management in an Industrial Gases Company

Wednesday, September 19, 2018

2:00 PM – 3:30 PM | Room 351F

Instructors

Cyril Defaye, Paul Gerke, James Huber, Ann Attaway (Air Liquide), Frederic Verpillat (Air Liquide France)

Description

Air Liquide launched an international program to monitor and assess equipment asset health, resulting in a positive step-change in availability and reliability worldwide. Using predictive analytics, potential asset failures may be identified and appropriate intervention planned. Intervention prior to failure averts a possible reliability incident, adverse customer impact, and costly “emergency” maintenance activities.

TURBO

DISCUSSION GROUPS

DISCUSSION GROUP PTO1

Monitoring Vibration and Other Critical Machine Conditions

Tuesday, September 18, 2018

10:30 AM - 12:00 PM | Room 371C

Wednesday, September 19, 2018

02:00 PM - 03:30 PM | 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)

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 PTO2

Couplings and Alignment

Tuesday, September 19, 2018

10:30 AM - 12:00 PM | Room 371A

Instructors:

Jeff Haight (Anadarko Petroleum Company), Mark O'Neil (Altra Couplings), Thomas Davidson (Consultant), Michael Johnson (NRG Energy), Michael LeBlanc (John Crane)

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

A Discussion Group is a forum in which leaders and delegates 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 sessions' delegates. Each Discussion Group is 90 minutes long.

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

DISCUSSION GROUP PT03

Gears

Wednesday, September 19, 2018

02:00 PM - 03:30 PM | Room 371C

Instructors:

Joseph Silvaggio, Jr. (Siemens),
Robert 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 PT04

Lubrication

Tuesday, September 18, 2018

02:00 PM – 03:30 PM | Room 371A

Wednesday, September 19, 2018

10:30 AM – 12:00 PM | Room 371A

Instructors:

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

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 T05

Overspeed Trip Systems

Wednesday, September 19, 2018

10:30 AM – 12:00 PM | Room 370C

Instructors:

Bruce Bayless (Valero), Kevin Yates,
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 T06

Reciprocating Compressors

Tuesday, September 18, 2018

08:45 AM – 10:15 AM | Room 370A

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 T07

Advanced Topics in Centrifugal Compressor Design

Wednesday, September 19, 2018

08:30 AM – 10:00 PM | Room 371C

Instructors:

Mark Sandberg (Sandberg Turbomachinery Consulting, LLC), Leonardo Baldassarre (GE Oil & Gas), Urs Baumann (MAN Energy Solutions), Mark Kuzdzal, Jim Sorokes (Siemens), Jeffrey Moore (Southwest Research Institute), Brian Pettinato (Elliott Group)

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 T08

Turbo Expanders & PRTs

Tuesday, September 18, 2018

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

Instructors:

Lil Kassie (BP), Bob Kranz (Valero), Justin Kassie (Tesoro), Don Shafer (Rotating Machinery Services), Dave Linden (D.H. Linden Associates, Inc.), Nick Vachon (Siemens), George Seamon (Consultant), Jim Goode (Sulzer Turbo Services), Charles Rewoldt (McDermott)

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 T09

Dry Gas Seals for Compressors

Tuesday, September 18, 2018

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

Instructors:

Hans Weyermann (ConocoPhillips), Bernard Quoix (Total E&P), Leonardo Baldassarre (Baker Hughes, a GE Company), Joe Delrahim (John Crane), Emery Johnson (EagleBurgmann), Chris Auzenne (Flowserve)

Suggested Topics:

- DGS operating characteristics
- Unidirectional versus bidirectional
- Seals faces and seats, O rings materials
- Explosive decompression
- Primary seal gas supply control system
- 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 T10

Integrally Geared Compressors

Wednesday, September 19, 2018

10:30 AM -12:00 PM | Room 371C

Instructors:

Bradley Addison (DuPont), Kevin Kisor (MAN Energy Solutions), Terry 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 T11

Turbomachinery Bearings and Annular Seals

Tuesday, September 18, 2018

08:45 AM - 10:15 AM | Room 371C

Instructors:

John Whalen (Consultant), Malcolm Leader (Applied Machinery Dynamics), Michelle Guedry, Alan Mathis (Dow), Thomas Davidson (Consultant)

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 T12

Protection Systems Integrity

Tuesday, September 18, 2018

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

Instructors:

Lil Kassie (BP), Steve Locke, Ed Watson (DuPont), Robert Kranz (Valero), George Seamon (Consultant), Justin Kassie (Tesoro), Curtis Miller (SIS SILverstone LLC), Charles Rewoldt (McDermott)

Suggested Topics:

- Attendees Topics of Interests
- 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 T13

Screw Compressors

Tuesday, September 18, 2018

02:00 PM - 03:30 PM | Room 370C

Instructors:

Terryl Matthews (Shell), Kenneth Atkins (Engineering Dynamics Incorporated), Kevin Kisor (MAN Energy Solutions), Bruce McCain (Oxy Oil & Gas), Jigger Jumonville (Jumonville Engineering), Jim Goode (Sulzer Turbo Services)

Suggested Topics:

- API Standard 619 for screw compressors
- Oil-flooded vs. oil-free
- 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 T14

Gas Turbine Operation and Maintenance

Wednesday, September 19, 2018

08:30 AM - 10:00 AM | Room 370C

Instructors

Rainer Kurz (Solar Turbines, Inc.), Francisco Gonzalez (Cheniere), Jeff Haught (Anadarko Petroleum Company)

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 T15

Steam Turbine Design, Operation,
and Maintenance

Tuesday, September 18, 2018

2:00 PM - 03:30 PM | Room 371C

Instructors:

Vinod Patel (KBR), Gerry DiOrio (Siemens),
Gampa Bhat (Gampa Bhat & Associates, LLC),
LLC, 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 T16

Compressor Controls

Wednesday, September 19, 2018

2:00 PM - 03:30 PM | Room 370C

Instructors:

Mark Sandberg (Sandberg Turbomachinery
Consulting), Rainer Kurz (Solar Turbines),
Jeff McWhirter (Siemens), Meera Day-Towler
(Southwest Research Institute), David Downing
(Elliott Group), Mark Weatherwax (Chevron ETC)

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, September 20, 2018

08:30 AM - 10:00 AM | Room 360A

CASE STUDY 01

Investigation and Resolution of Governing Valve Linkage Failure for Compressor Drive Steam Turbine

Instructors

Nishiyama Kenichi, Mayank Jain (Mitsubishi Heavy Industries Compressor Corporation), Elumalai Subramani (ExxonMobil Research Engineering)

Description

Fatigue failure of Governing Valve Linkage Rod end bearing and wear marks on several parts was observed on a extraction steam turbine (driving a centrifugal compressor) after it was in service for more than 9 year. The top surface of rod-end bearing was completely worn out.

A detailed motion analysis was carried out to estimate the vibratory force and slip velocity of the Bearing ball and body. This paper presents the details of observations, inspections carried out and root cause analysis of the valve linkage failure along with the future recommendations.

CASE STUDY 02

Steam Turbine Reoccurring Rubs, Troubleshooting and Corrective Action

Instructors

Patrick Smith, Brent Ziegler
(Air Products & Chemicals)

Description

Rubs in steam turbines can be especially difficult to diagnose because the vibration signature can manifest differently depending on the location, severity, rotordynamics, machine design and bear similarities to other common causes of

elevated vibration. This case study presents the information gathering, engineering analyses and site testing performed to diagnose a 22 stage condensing steam turbine with an intermittent rub. On-stream troubleshooting allowed the vibration to be largely mitigated until the next maintenance opportunity and proper scope development to address stuck pedestal sliding surfaces distorting the casing and causing the rub.

CASE STUDY 03

High Vibration Due to Steam Turbine Deposits

Instructors:

John Yu, Haibo Lin, Nicolas Peton (Baker Hughes, a GE Company), Carl Feng Wang, Tony Wei Zhou (Shanghai SECCO Petrochemical Co.)

Description

This presentation provides a case study how to correctly deal with increased vibration on a steam turbine that drives a compressor. After the machine had not operated for a week, vibration level increased 5 times during its re-startup. The vibration was dominantly composed of 1X component. An in-depth review of vibration data as well as possible root-causes is demonstrated, to rule out some possible malfunctions. Balancing would be a quick fix to let this machine back in service, based on vibration data. What actions should we take, and is balancing would work in this case?

CASE STUDY 04

Steam Turbine with 0.9X Vibrations

Instructors

Piotr Mialkowski (Baker Hughes, a GE Company)

Description

This 15 MW steam turbine/gearbox/4-pole generator train, following a recent overhaul,

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.

as power limits due to vibration level increase. The case describes a single day* field investigation program, that lead to identification of the root cause of the problem and pin pointed other problems with the quality of the overhaul. Vibration data are reviewed showing solution through application of standard** methodology.

TURBO CASE STUDY SESSION 1B

Thursday, September 20, 2018

08:30 AM - 10:00 AM | Room 361A

CASE STUDY 05

Gas Seal Failures Caused by Axial Vibrations

Instructors:

James Byrne, Jose Vazquez (BRG Machinery Consulting LLC), Patrick Potter (Cincinnati Gearing Systems)

Description

This case study describes the root cause investigation of 12 dry gas seal failures in three integrally geared centrifugal compressors over a period of 12 years. These compressors are in fuel gas booster service, supplying a 500 MW gas turbine combined cycle power plant.

The root cause investigation determined that the dry gas seal failures were the result of a design integration problem in which the rotor-bearing system exposed the dry gas seals to both excessive axial displacement and excessive axial vibrations.

These problems were resolved by redesigning the rotor-bearing system to incorporate thrust bearings on the pinion.

CASE STUDY 06

A Review of the Critical Design Parameters for Labyrinth Type Separation Seals on Dry-Gas-Seals

Instructors

Dian Hanekom (Tasnee)

Description

An ethylene compressor experienced a dry-gas-seal (DGS) hang-up condition and a RCA concluded that a possible root- or contributing cause is lube oil passing the labyrinth type separation seal into the secondary DGS cavity, causing the dynamic O-ring to malfunction. Detailed modeling and design review of the separation seal system enabled the investigators to postulate several scenarios to explain how lube oil could migrate into the DGS. The presentation presents a procedure how to calculate the exit velocities of labyrinth type separation seals and the effects of changes in various design parameters.

CASE STUDY 07

Preventing a Major Wreck on a New Reciprocating Compressor: The Importance of Commissioning Testing

Instructors

Robert C. Eisenmann, Jr. (BP),
Luis Santos (BP Whiting)

Description

During commissioning testing of three new reciprocating compressors a fault was detected requiring the testing to be stopped. Debris was found in the bearing resulting in minor damage due to the early indication from the monitoring system.

This case study highlights the failure data, the monitored parameters, damage found and corrective action taken. However, the key learnings for the site was the justification of the commissioning process, the utilization of the monitoring system, and paying close attention to the available data from the monitoring system.

TURBO CASE STUDY SESSION 1C

Thursday, September 20, 2018
08:30 AM - 10:00 AM | Room 362A

CASE STUDY 08

Understanding Design Parameters that Affect Thermal Stability of High-Speed Turbo Machinery (also known as the Morton Effect)

Instructors

Robert Benton, Ethan Eiswerth (Air Products)

Description

At present, there are no commercially available codes in industry that have proven to reliably predict a rotor's sensitivity to the Morton Effect. The Morton Effect refers to synchronous rotor instability due to non-uniform heating of shaft journals. The industry's inability to reliably predict this phenomenon has caused both plant start-up delays and shutdowns due to machinery vibration. The multiple case studies that will be presented assess this problem and summarize the solutions that were developed, tested and ultimately implemented to address the Morton Effect.

CASE STUDY 09

Analysis and Countermeasures for Sideband of Gear Mesh Frequency (GMF) Induced by Shaft Fretting Corrosion in a Gearbox

Instructors

Seungil Bae, Bumsu Kim, Jongoh Jang, Sangjoo Lee (SK Energy)

Description

CS deals with trouble shooting and solving a chronic fretting corrosion damage b/w a gear

and shaft (shrink fit). The damage on the geared shaft always accompanied by an increase in the amplitude and frequency side bands at the gear mesh frequency (GMF).

The troubleshooting process and analysis revealed that the distance between the two gears is a critical design parameter for preventing fretting corrosion.

CASE STUDY 10

Compressor Startup Flaring Avoidance Design Methodology

Instructors

James Amodeo (S&B Engineers and Constructors), Krishnan Narayanan (ECT)

Description

This case study outlines the methodology used to avoid the flaring of refrigerant inventory during the startup of a 3-section refrigeration compressor used in LPG chilling service. S&B Engineers and Constructors (S&B) and Energy Control Technologies (ECT) conducted a joint analysis of potential problems in the field caused by high settle out pressure in the compressor casing following shutdown. This analysis involved dynamic simulation of the refrigeration system to develop and test various system improvements for preventing refrigerant loss.

CASE STUDY 11

Impeller High Cycle Fatigue Failure on a Natural Gas Pipeline Compressor Following Choked Flow Operation

Instructors

François Moyroud (GE Oil & Gas), Pascal Alas, François Libeyre (GRTgaz)

Description

The impeller of a natural gas pipeline compressor failed at the junction between the blade trailing edge and the hub.

A root cause analysis showed the machine had been operated beyond the compressor map right limit during short periods, in recent unit history (after 60000 hours of operation).

The impeller interference diagram analysis revealed the presence of a potentially critical interference at 100% speed, between an impeller trailing edge mode and an impeller/vaned diffuser aerodynamic synchronous excitation.

The metallurgical analysis and crack investigations confirmed the High Cycle Fatigue failure mode.

A reduced choke flow operational limitation was implemented based on unsteady aerodynamic simulation results.

TURBO CASE STUDY SESSION 2A

Thursday, September 20, 2018

10:30 AM - 12:00 PM | Room 360A

CASE STUDY 12

Dry Gas Seal Failure Due to Axial Sub-synchronous Vibration on a Hydrogen Recycle Gas Compressor

Instructors

Robert Eisenmann, Jr. (BP Machinery),
Luis Santos-Gutierrez (Rotating Equipment Engineering)

Description

Approximately 6 months after commissioning a new hydrotreater hydrogen recycle gas compressor the site experienced a dry gas seal failure. The investigation revealed wear of the primary seal dynamic sealing element due to movement thought to be caused by design and installation issues. The onset of a second failure indicated the root cause had not been identified. Further investigation discovered the compressor was experiencing high axial vibration during operation ultimately causing the seal failures.

This case study will present the data from each failure, monitoring methods used, analysis conducted, options evaluated and the corrective action taken to resolve the problem.

CASE STUDY 13

Compressor Dry Gas Seal Failure Due To Oil Ingress

Instructor

Arun Kumar (HPCL - Mittal Energy Limited, Bathinda Refinery, India), Navneet Singh Brar (Guru Gobind Singh Refinery, HMEL)

Description

This case study of a typical tandem arrangement dry gas seal failure during compressor start-up elaborates importance of start-up environment consideration during design for a compressor dry gas seal system. The seal failed due to oil ingress during compressor start-up.

The case study presentation details out following major contents:

- * Chronological events leading to dry gas seal failure, relevant data
- * Findings/observations during subsequent maintenance
- * Root cause analysis and outcomes
- * Corrective actions & subsequent performance
- * Key learning

CASE STUDY 14

Investigation and Resolution of Dry Gas Secondary Seal Failure

Instructors

Girish Chander Kamal, Fairul Azam Bin Salehan (Petronas Carigali Sdn Bhd)

Description

Dry Gas (DGS) Secondary Seal installed on one of the Flash gas compressor unit at an onshore gas treatment facility failed resulting in equipment downtime and process gas flaring. During detailed tear down inspection, primary seal was found heavily contaminated with sticky oily substance that reached into the secondary seal leading to contact between the seal faces causing thermal cracks. Failure analysis was performed and root causes were identified. Various solutions were implemented in the DGS operation and maintenance strategy. This case study will present the problem encountered, root causes analyzed, solutions implemented, results achieved and lessons learnt.



TURBO CASE STUDY SESSION 2B

Thursday, September 20, 2018

10:30 AM - 12:00 PM | Room 361A

CASE STUDY 15

Resolution of High Vibration Issue on a Generator

Instructors

Sankar Ganesh (GE Bently Nevada), Mustafa Shalabi (Baker Hughes, a GE Company)

Description

This is a synchronous generator driven by a GT through a speed reduction gearbox with a rated power of 25 MW(3600 rpm).

Generator bearing high vibration levels resulted in several machine trips during the startup attempt followed by a unit shutdown caused by high lube oil temperature. Generator bearings were replaced, exciter misalignment was rectified and insitu balancing of generator rotor was attempted by plant maintenance personnel but did not yield desirable results preventing machine from attaining FSNL speed with acceptable vibration levels. Data indicated dominant 1X amplitudes up to 90 mm/sec Pk at generator inboard bearing confirming generator

rotor unbalance coupled with high degree of anisotropic stiffness between horizontal and vertical planes. This case intends to detail how the high vibration issue was successfully diagnosed using various plots from different machine states and resolved by correct insitu balancing approach coupled with bump test technique to identify and eliminate structural resonance.

CASE STUDY 16

Mechanical Improvement of Electrical Interharmonics Damping

Instructors

Volker Huetten, Vijay Anantham Ganesan (Siemens AG)

Description

During operation of compressor trains by a variable speed drive system (VSDS) integer and non-integer harmonics are generated in the inverter. Via the electrical system of inverter and motor a torsional excitation is transferred across the air gap torque into the main mass of the motor. This excitation may cause torsional resonances. However, the main focus of this case study will be on the new electrical damping method to attenuate the torsional excitations



induced by an LCI Variable Frequency Drive (VFD). The effectiveness of the proposed electrical damping method will be demonstrated in 2 case studies:

Case Study 1

- Blocked speed ranges eliminated

Case Study 2

- High gear vibrations avoided

CASE STUDY 17

Troubleshooting of Sub-synchronous Torsional Interaction Phenomena on an Electric Motor-Driven Centrifugal Compressor

Instructors

Natalie Smith, Jason Wilkes, Jeffrey More, Chris Kulhanek, Tim Allison (Southwest Research Institute)

Description

This case study discusses the identification, troubleshooting, and correction of a torsional instability in an electric motor-driven driveline with variable frequency drive (VFD) for a high-pressure gas compressor test facility permanently installed at SwRI. A torsional instability was identified on the gearbox

high-speed shaft at speeds when the VFD output (line) frequency met or exceeded the torsional natural frequency of the train. The issue was resolved by changing to sensorless vector control in the VFD instead of voltage/frequency control. In the literature, this change was not observed.

CASE STUDY 18

Stray Currents and Their Damaging Effects on Rotating Machinery

Instructors

Dian Hanekom (Tasnee)

Description

Stray currents manifest in rotating machinery as a result of specific abnormalities in machines related to flux imbalance, residual magnetism, electrostatic build-up and induced voltages. Discharges of these voltages in components can be very harmful and sometimes catastrophic. Typical damage include pit marks, spark tracks, frosting and electric erosion in components such as bearings, seals and gear teeth. The presentation summarize, typical damage caused by stray currents, diagnostic techniques to identify the problem, remedies to resolve the problem and highlights several case studies.

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10:40 A.M.
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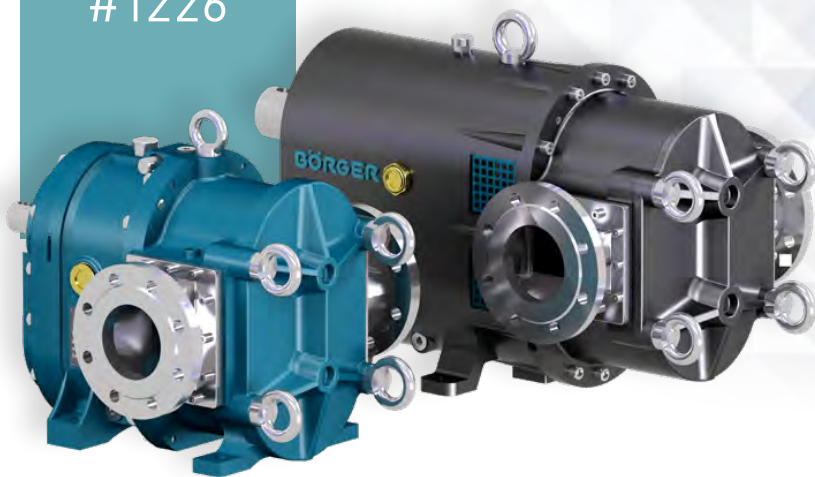
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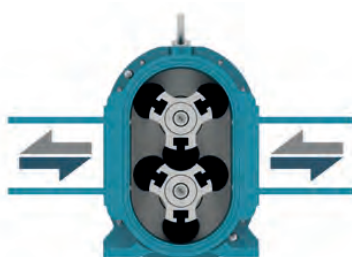
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DAILY SCHEDULE

SUNDAY, SEPTEMBER 16, 2018

4:30 P.M. – 6:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
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Leader Registration	Level 3, Room 340A
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MONDAY, SEPTEMBER 17, 2018

7:00 A.M. – 12:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
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Leader Registration	Level 3, Room 340A
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8:30 A.M. – 5:00 P.M. | SHORT COURSES

Short Course PT01 Vibration Problems and Solutions in Pumps and Turbomachinery	Level 3, Room 330A
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Short Course P02 Fundamentals of Mechanical Seals	Level 3, Room 370A
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Short Course P03 Pumps 101	Level 3, Room 370C
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Short Course P04 Fundamentals of Centrifugal Pump and System Interaction	Level 3, Room 371A
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Short Course P05 Pump Cavitation – Physics, Prediction, Control, Troubleshooting	Level 3, Room 371C
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Short Course P06 Differences In Piping System Design for Reciprocating and Centrifugal Pumps	Level 3, Room 372A
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Short Course P07 Optimizing Pumping Systems with Proven Engineering Assessment Processes and Methodologies	Level 3, Room 372C
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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
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1:30 P.M. – 5:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration	Level 1, Exhibit Hall D
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Leader Registration	Level 3, Room 340A
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3:00 P.M. – 3:30 P.M. BREAK	
Refreshment Break	Level 3, Lounge Area
5:30 P.M. – 6:00 P.M. TURBO COMMITTEE MEETING	
Turbomachinery Advisory Committee Meeting	Level 3, Room 320A
6:00 P.M. – 6:30 P.M. PUMP COMMITTEE MEETING	
Pump Advisory Committee Meeting	Level 3, Room 320A



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Please go to page 99 in the Exhibitors
Section for more information

FP

TUESDAY, SEPTEMBER 18, 2018

7:00 A.M. – 7:45 A.M. | BREAKFAST

Leader Breakfast

Level 3, Room 330A

7:30 A.M. – 5:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration

Level 1, Exhibit Hall D

Leader Registration

Level 3, Room 340A

8:00 A.M. – 8:35 A.M. | WELCOME

Welcome Address - Dr. Eric Petersen

Level 3, General Assembly Theater C

8:45 A.M. – 10:15 A.M. | TECHNICAL SESSIONS

Lecture 1 Crude Oil Non-Pusher Secondary Seal

Lecture 2 A Robust Algorithm to Detect Multiple Centrifugal Pump Faults with Corrupted Vibration and Current Signatures Using Continuous Wavelet Transform

Level 3, Room 350D

Tutorial 1 Fundamentals of MV Motor

Level 3, Room 361A

Tutorial 2 Protective Wisdom: HF Releases and Associated Pumps

Level 3, Room 361C

Discussion Group P07 Improving Mean Time Between Pump Failures

Level 3, Room 372A

Discussion Group P08 Vertical Pump Problems and Solutions

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 Leakage and Force Coefficients for Pump Annular Seals Operating with Air/Oil Mixtures: Measurements Vs Predictions and Air Injection to Increase Seal Dynamic Stiffness

Level 3, Room 350D

Tutorial 3 Fundamentals of MV Drives

Level 3, Room 361A

Tutorial 4 Water Hammer and Piping Stresses

Level 3, Room 361C

Discussion Group PT01 Monitoring Vibration and Other Critical Machine Conditions

Level 3, Room 371C

Discussion Group PT02 Couplings and Alignment

Level 3, Room 371A

Discussion Group P06 Mechanical Seals

Level 3, Room 370C

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

Exhibitor & Delegate Lunch

Level 1, Exhibit Hall D

2:00 P.M. – 3:30 P.M. | TECHNICAL SESSIONS

Lecture 4 Design and Verification Testing of Balance Piston for High-Viscosity Multiphase Pumps

Level 3, Room 350D

Lecture 5 Cooling Water Pump Station Optimization - Using CFD and Physical Model Testing**Tutorial 5** Midstream Pipeline Applications - Design Aspects and Considerations for Mechanical Seals

Level 3, Room 361A

Tutorial 6 The Theory and Application of True Weighted Efficiency – A New Metric to Evaluate Pump Energy Efficiency Considering Multiple Operating Conditions

Level 3, Room 361C

Discussion Group PT04 Lubrication

Level 3, Room 371A

Discussion Group P09 Sealless Pumps

Level 3, Room 370A

2:30 P.M. – 7:00 P.M. | EXHIBITS OPEN

Exhibits Open Free to Public

Level 1, Exhibit Hall D

6:30 P.M. | HOSPITALITY SUITES

Hospitality Suites

See Hospitality Suite Schedule on Page 22

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, SEPTEMBER 19, 2018

7:30 A.M. – 8:15 A.M. | BREAKFAST

Leader Breakfast

Level 3, Room 330A

8:00 A.M. – 5:00 P.M. | REGISTRATION

Delegate and Exhibitor Registration

Level 1, Exhibit Hall D

Leader Registration

Level 3, Room 340A

Booth Selection

Level 1, Exhibit Hall D,
Exhibitor Registration Counter

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

Lecture 6 Further Evaluation of the Modified Affinity Laws for the Prediction of Viscosity Effect on the Pump Head Performance

Level 3, Room 350D

Lecture 7 Maximum Efficiency for High Head Process Pumps – Optimizing Side Channel Pumps

Tutorial 7 ANSI/ASA S2.75-2017/Part 1 Shaft Alignment Methodology, Part 1: General Principles, Methods, Practices, and Tolerances

Level 3, Room 361A

Tutorial 8 An End-Users Guide to Centrifugal Pump Rotordynamics

Level 3, Room 361C

Discussion Group P10 Pipeline Applications

Level 3, Room 370A

Discussion Group P12 Cavitation/NPSH (Field Problems)

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

Tutorial 9 Precision Grouting of Critical Rotating Equipment

Level 3, Room 361A

Discussion Group PT04 Lubrication

Level 3, Room 371A

Discussion Group P05 Centrifugal Pump Operation, Maintenance, and Reliability

Level 3, Room 372A

Discussion Group P11 Cryogenic Fluid Pumping Applications

Level 3, Room 370A

12:00 P.M. – 2:00 P.M. LUNCH	
Exhibitor & Delegate Lunch	Level 1, Exhibit Hall D
2:00 P.M. – 3:30 P.M. TECHNICAL SESSIONS	
Tutorial 10 Best Practices for Cartridge Mechanical Seal Installations	Level 3, Room 361A
Tutorial 11 Navigating the US DOE Energy Conservation Standard and Test Procedure for Pumps	Level 3, Room 361C
Discussion Group PT01 Monitoring Vibration and Other Critical Machine Conditions	Level 3, Room 371A
Discussion Group PT03 Gears	Level 3, Room 371C
2:30 P.M. – 7:00 P.M. EXHIBITS OPEN	
Exhibits Open Free to Public	Level 1, Exhibit Hall D
6:30 P.M. HOSPITALITY SUITES	
Hospitality Suites	See Hospitality Suite Schedule on Page 22
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



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THURSDAY, SEPTEMBER 20, 2018

7:30 A.M. – 8:15 A.M. | BREAKFAST

Leader Breakfast

Level 3, Room 330A

8:00 A.M. – 11:00 A.M. | REGISTRATION

Delegate and Exhibitor Registration

Level 1, Exhibit Hall D

Leader Registration

Level 3, Room 340A

Booth Selection

Level 1, Exhibit Hall D,
Exhibitor Registration Counter

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

Case Study P01 NPSHR (NPSH3) Improvement of a Low Pressure Safety Injection Pump

Level 3, Room 350D

Case Study P02 Improvement of Rotating Equipment Reliability Using Optical Metrology

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

Case Study P03 Investigating and Improving the Drooping Curve of a Two-Stage Feed Pump

Level 3, Room 351D

Case Study P04 Fugitive Emissions Containment Using a Dual Pressurized Seal and API Plan 53B

Case Study P05 Improved Reliability of Industrial Waste Water Pumps

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

Case Study P06 Correction of High Vibration on a Vertical Turbine Deep Well Pump with a Dynamic Vibration Absorber

Level 3, 352D

Case Study P07 A Case Study of Vibration in Positive Displacement Pump Systems

Case Study P08 BB1 Lateral Dynamic Analysis

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

Exhibits Open Free to Public

Level 1, Exhibit Hall D

10:00 A.M. – 10:30 A.M. | BREAK

Refreshment Break

Level 3, Lounge Area

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

Case Study P09 Structural Natural Frequency Tuning on a Vertical Pump

Case Study P10 Motion Amplification: A New Way to Visualize Vibrations

Case Study P11 Use of Motion Amplified Video to Diagnose Pump Vibration

Level 3, Room 350D

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

Case Study P12 Up-Thrust and Seal Failures on a Vertical Can Pump

Level 3, 351D

Case Study P13 Vertical Turbine Pump Reliability Improvement

Level 3, 351D

Case Study P14 Resolving High Vibration Issue on a Vertical Pump/Motor

Level 3, 351D

12:00 P.M. – 2:00 P.M. | COMMITTEE LUNCHEON

Advisory Committee Luncheon

Level 3, Room 330A



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PUMP

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The 34th 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.

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PUMP

SHORT COURSES

SHORT COURSE PT01

Vibration Problems and Solutions in Pumps and Turbomachinery

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M. | Room 330A

Instructors

William Marscher, Eric Olson, Maki 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 PO2

Fundamentals of Mechanical Seals

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M. | Room 370A

Instructors

Henri Azibert (Fluid Sealing Association), Brian Kalfrin (John Crane), Steven Bullen (Chesterton), Michael Huebner (Flowserve)

Description

This short course is designed for all personnel that interacts with mechanical seals such as engineers, users, installers, purchasers, reliability engineers, and other industrial plant functions. It starts with basic operating and then goes into greater details of all aspects relating to the use and obtaining maximum operating life for dynamic shaft sealing.

The topics covered are as follows:

1. Operating principles
2. Classification of mechanical seals
3. Arrangements of mechanical Seals
4. Dual gas seals
5. Containment seals
6. Materials of construction
 - Seal faces
 - Metal parts
 - Secondary seals
7. 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
8. Seal chamber
9. Seal installation
10. Energy consumption of sealing systems
11. Life cycle costs

SHORT COURSE PO3

Pumps 101

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M. | Room 370C

Instructors

Daniel Wood (Chemours), Judy Hodgson (Hodgson Consulting)

Description

This course is aimed at engineers and this course is aimed at 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; 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, the attendees will hold a strong understanding of basic concepts. This knowledge will act as a springboard to further growth understanding of more complex pump concepts. An emphasis is placed on providing useful information with minimal theory and thus, comprehension of the information presented requires little to no mathematical skills in hydraulic or mechanical design.

SHORT COURSE P04

Fundamentals of Centrifugal Pump and System Interaction

Monday, September 17, 2018

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 P05

Pump Cavitation - Physics, Prediction, Control, Troubleshooting

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M. | Room 371C

Instructors

Bruno Schiavello, Frank C. Visser (Flowserve)

Description

This short course gives insight into roto-dynamic pump cavitation and provides deeper understanding of particulars like cavitation inception, three-percent head drop, 40,000 hours life criterion, cavitation damage potential, NPSHR scaling laws, the effect of dissolved gas, and thermodynamic effect for hot water and hydrocarbons.

Empirical correlations for predicting various types of NPSHR and the use of CFD will be discussed, and suction specific speed will be critically reviewed, along with criteria for NPSHA margin. Furthermore, the effect of fluid transients and viscosity will be addressed. Cavitation damage potential will be fully explained by the “Cavitation Modes Map”, which reflects fundamental insight gained since the 1940’s; here in particular the striking departure in shape from the NPSH3 curve for part flows is highlighted, being a key reason of many cavitation pump problems. Attention is further devoted to Impeller Life Expectancy and Cavitation Control with modern designs tools. In conclusion, four field case studies will demonstrate the use of cavitation failure analysis and solution strategy.

SHORT COURSE P06

Differences in Piping System Design for Reciprocating and Centrifugal Pumps

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M. | Room 372A

Instructors

Kelly Eberle, Michelle Witkowski (Wood),
Tom Newman (SPX Flow Power & Energy)

Description

Reciprocating pump installations require particular design considerations which are much different from centrifugal pump systems. 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.

The goal of this course is to provide insight into the design considerations and industry best practices for centrifugal and reciprocating pump installations. The focus of the course will be on reciprocating pumps due to their higher risk of fatigue failures.

SHORT COURSE P07

Optimizing Pumping Systems with Proven Engineering Assessment Processes and Methodologies

Monday, September 17, 2018

8:30 A.M. – 5:00 P.M. | Room 372C

Instructors

Peter Gaydon (Hydraulic Institute), Trey Walters
(Applied Flow Technologies)

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.

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PUMP LECTURES

LECTURE 01

Crude Oil Non-Pusher Secondary Seal

Tuesday, September 18, 2018

8:45 A.M. – 10:15 A.M. | Room 350D

Instructors

Darin Rasmussen, Jim Wasser, John Morton
(John Crane)

Description

Crude oil pipeline pumps traditionally suffer from seal leakage due to the fretting or wearing of the dynamic O-ring. A new concept secondary seal has been developed to eliminate this fretting occurrence. All major seal suppliers have products designed specifically for the operational challenges of crude oil pipeline services, some more than others recognize the application difficulties and have design characteristics that belie these. However none are designs based on non-pusher secondary seal concepts.

This paper will look at the design theory of a non-collapsible flexible sealing membrane, the subsequent successful development and testing of a non-pusher elastomer seal, and field deployment.

LECTURE 02

A Robust Algorithm to Detect Multiple Centrifugal Pump Faults with Corrupted Vibration and Current Signatures Using Continuous Wavelet Transform

Tuesday, September 18, 2018

8:45 A.M. – 10:15 A.M. | Room 350D

Instructors

Janani Shruti Rapur, Rajiv Tiwari (IIT
GUWAHATI)

Description

Centrifugal pumps are susceptible to seizures owing to reasons such as, fluid flow

abnormalities and/or mechanical component failures. Consequently, it is crucial to recognize these faults and estimate their severity. The present work shows the development of a robust algorithm based on support vector machines (SVM) to classify multiple CP faults, such as suction and discharge blockages (with varying severities), impeller defects, pitted cover plate faults and dry runs using continuous wavelet transform (CWT) analysis. For the sake of classification, the CP vibration data and motor line-current data are generated for each of these faults experimentally. Furthermore, in an industrial setting, CP signatures are susceptible to noise corruption due to other operating equipment in the premises. Hence, to assess the versatility of the developed methodology, the generated experimental data is further corrupted with 5%, 10% and 25% additive white Gaussian noise and used to test the algorithm.

LECTURE 03

Leakage and Force Coefficients for Pump Annular Seals Operating With Air/Oil Mixtures: Measurements VS Predictions and Air Injection to Increase Seal Dynamic Stiffness

Tuesday, September 18, 2018

10:30 A.M. – 12:00 P.M. | Room 350D

Instructors

Luis San Andres (Turbomachinery Laboratory),
Xueliang Lu (Texas A&M University), Zhu Jie
(Hunan Sund Industrial and Technological Co.,
Ltd. (China))

Description

The lecture presents measurements of leakage and dynamic force coefficients for six annular seals operating with an air in oil mixture ranging from pure liquid to just air. Each seal has a distinct clearance configuration: one is a plain seal with a small clearance, and another has a larger (worn) clearance ; a third seal introduces a wavy clearance that produces a significant

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.

centering stiffness; a fourth seal has a shallow groove pattern ; and the fifth and sixth seals have a stepped clearance (narrow to wide and wide to narrow). The tests in a plain seal supplied with gas injection (GVF-0 --> 0.6) in the oil stream demonstrate the seal recovers its dynamic stiffness, hence its usage to recover rotor stability. Air injection into a liquid stream drops the mixture sound speed to make it highly compressible; hence the hardening of the seal direct stiffness.

LECTURE 04

Design and Verification Testing of Balance Pistons for High-Viscosity Multiphase Pumps

Tuesday, September 18, 2018

10:30 A.M. – 12:00 P.M. | Room 350D

Instructors

Pierre-Jean Bibet (Total E&P), Ina Ekeberg, Halfdan Knudsen, Erik Torbergsen, Hans Fredrik Kjellnes, Rune Angeltveit, Knut Klepsvik, Erik Torbergsen (OneSubsea, a Schlumberger Company)

Description

OneSubsea was awarded a project involving the development and testing of a HighBoost multiphase pump for boosting unprocessed multiphase well streams with liquid viscosities up to 800 centipoise (cP). The viscosity requirement surpasses the existing viscosity range of dynamic multiphase pumps and the difference in viscosity for the liquid and gaseous phases is larger than in any other comparable test programs. Results from the full-scale testing have shown remarkable balance piston flow mechanisms affecting both rotordynamic behavior and step-changes in volumetric efficiency for the pump assembly. These phenomena have been studied in detail during the extensive testing, and further investigated with corresponding analysis. The work described in this paper has resulted in a design

improvement and a solution for this demanding subsea boosting application. Furthermore, the analysis also shows that more research is needed to fully understand high viscosity multiphase flow in seals and balance pistons. The comprehensive technology development work was conducted within the EPC project timeframe and has realized the operator's requirements of boosting the subsea production of a demanding oil-field.

LECTURE 05

Cooling Water Pump Station Optimization Using CFD and Physical Model Test

Tuesday, September 18, 2018

2:00 P.M. – 3:30 P.M. | Room 350D

Instructors

Francesco Annese, Letizia Ficele, Emanuele Lisanti (Baker Hughes, a GE Company)

Description

In this paper, a combined study between Computational Fluid Dynamics (CFD) and a model test has been carried on a Cooling Water Pumping Station as part of a new power plant. The aim of this work was to validate a water pit layout, more compact than required by ASME ANSI HI 9.8 2012 design guidelines.

LECTURE 06

Further Evaluation of the Modified Affinity Laws for the Prediction of Viscosity Effect on the Pump Head Performance

Tuesday, September 18, 2018

8:30 A.M. - 10:00 A.M. | Room 350D

Instructors

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

Description

The aforementioned abstract was accepted in the ASME Journal of Fluid Engineering and may cause copyright issues. The author wishes to submit this abstract and will get us a manuscript by May 1st if approved by the committee.

LECTURE 07

Maximum Efficiency for High Head Process Pumps – Optimizing Side Channel Pumps

Wednesday, September 19, 2018

8:30 A.M. – 10:00 A.M. | Room 350D

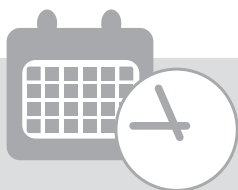
Instructors

Markus Mosshammer, Helmut Benigni, Helmut Jaberg (Institute of Hydraulic Fluid Machinery at the Technical University of Graz – Austria), Juergen Konrad (Dickow Pumpen GmbH & Co. KG)

Description

Side channel pumps provide high pressure at relatively low flow rates. This comes along with a quite low specific speed and thus with the known disadvantage of a quite poor maximum efficiency.

This paper describes the detailed analysis and optimization of a typical 1-stage side channel pump with an additional radial suction impeller by means of computational fluid dynamics (CFD) simulations.



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Keynote Speaker

Krutibas Panda is currently a Technical Advisor with Halliburton –Sperry Drilling Services located in Houston. He has been serving his current job for the past 9 years and in the present capacity he oversees Sperry Drilling's Materials needs. Prior to joining Halliburton, he spent about 5 years with Sandvik Mining and Construction (USA) and a brief stint with Tata Motors (India) as a Materials Engineer. He is an executive member of ASM International and a member of NACE International.

Krutibas Panda is the author and contributing author of more than 20 technical papers, research publications, and patents. His publications have appeared in leading materials journals like *Acta Materialia*, *Computational Materials Science*, *Metallurgical and Materials Transactions & Journal of Materials*. He received his Master of Science degree as well as his Ph.D. degree in Metallurgical Engineering from the University of Utah.

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PUMP TUTORIALS



TUTORIAL 01

Fundamentals of MV Motor

Tuesday, September 18, 2018

8:45 A.M. – 10:15 A.M. | Room 361A

Instructors

Brandon Kim, Manish Verma (TMEIC)

Description

Medium voltage ASDs (MV Adjustable Speed Drives) and motors are widely applied to plant rotating machinery like compressors, pumps, fans, extruders, mills, kilns, etc., ranging from a few horsepower (HP) to tens of thousands of horsepower. Safe, reliable and successful application of these ASDs and motors require a system level approach. The Short Course is an information-packed one-day series of practical sessions covering the selection, specification, and application of industrial MV equipment. The focus for the course will be application topics that can be used right away to specify, evaluate, procure and install a successful MV motor and drive system. The dimensions of the course will be medium voltage (>2.3kV) and motor power ranging from 500 HP thru 100,000 HP. In addition to classroom presentations, attendees are encouraged to bring their own real-world application issues for group discussion.

TUTORIAL 02

Protective Wisdom: HF Releases and Associated Pumps

Tuesday, September 18, 2018

8:45 A.M. – 10:15 P.M. | Room 361C

Instructor

Heinz Bloch (Process Machinery Consulting)

Description

Catastrophic releases of hydrofluoric acid from pumps in Alkylolation Units are a matter of public record. Exposure to HF can be fatal and specific safety measures are needed to enter the unit. Therefore, the reliability of these units is of utmost importance to reliability engineers. This tutorial teaches why and how we must:

- View the entire system. It includes pumps and their characteristics, seals and their geometries, also unique Plan 99 seal support systems.
- Look for experience. Never allow experimentation; it is unnecessary and costly in view of existing experience elsewhere.
- Teach what the support system does and how it must be part of operator surveillance.

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



In this tutorial, the author-presenter examines pumps that are presently in service and are thought to have only recently developed troublesome failure histories. The impressive pros and relatively few cons of properly engineered canned motor pumps are briefly highlighted.

TUTORIAL 03

Fundamentals of MV Drives

Tuesday, September 18, 2018

10:30 A.M. – 12:00 P.M. | Room 361A

Instructors

Brandon Kim, Manish Verma (TMEIC)

Description

The focus for the course will be application topics that can be used right away to specify, evaluate, procure and install a successful MV motor and drive system. The dimensions of the course will be medium voltage (>2.3kV) and motor power ranging from 500 HP thru 100,000 HP. In addition to classroom presentations, attendees are encouraged to bring their own real-world application issues for group discussion.

TUTORIAL 04

Water Hammer and Piping Stresses

Tuesday, September 18, 2018

10:30 A.M. – 12:00 P.M. | Room 361C

Instructor

Robert Leishear (Leishear Engineering, LLC)

Description

This tutorial provides guidance to help understand the causes, and to prevent or mitigate the effects of water hammer, or fluid transients, in piping and pipeline systems. The text of this paper is based on early drafts of ASME B31D, which is still under consideration (The American Society of Mechanical Engineers, ASME Code for Pressure Piping, "ASME B31D, Design of Piping Systems for Dynamic Loads from Fluid Transients"). Drafts of B31D were, in turn, based on an ASME Press text book, titled "Fluid Mechanics, Water Hammer, Dynamic Stresses, and Piping Design" which was written by this author. The information presented here is not necessarily new, but it is provided in a format to provide an overview of fluid transient topics that are important to practicing engineers who work with piping systems.

TUTORIAL 05

Midstream Pipeline Applications - Design Aspects and Considerations for Mechanical Seals

Tuesday, September 18, 2018

2:00 P.M. – 3:30 P.M. | Room 361A

Instructors

Brian Kalfrin, Raul Escontrais, Jack Bagain
(John Crane)

Description

There are few applications that place a significant demand on mechanical seals such as those associated with the handling of various fluids through pipelines. Pipeline applications are unique in that they typically encompass variable fluid properties, along with fluctuations in pressure, temperature, and speed, sometimes through the same pumping equipment. There are additional challenges in the midstream pipeline sector associated with the remote nature of the installations and limited accessibility. Equipment monitoring and logistics of preventative maintenance support place an increased emphasis on the criticality of selecting a robust mechanical seal design and associated support equipment. The purpose of this tutorial is to serve as a guideline for the equipment user and define effective and efficient sealing strategies in midstream pipeline applications, integrating relevant industry best practices and lessons learned from field installations. The tutorial will draw upon the combined previous experience of the authors in addressing these applications.

TUTORIAL 06

The Theory and Application of True Weighted Efficiency -- A New Metric To Evaluate Pump Energy Efficiency Considering Multiple Operating Conditions

Tuesday, September 18, 2018

2:00 P.M. – 3:30 P.M. | Room 361C

Instructor

Trygve Dahl (Intelliquip Inc.)

Description

Energy efficiency is being emphasized more prominently in the pump industry. A consistent method for evaluating pump energy efficiency with multiple operating conditions is needed. New energy efficiency indices have been introduced through legislation in the EU and the US, and some engineers have promoted time weighted efficiency metrics. These methods are helpful, but lack the simplicity, accuracy, or applicability needed when making multi-condition pump system efficiency comparisons. This need is the inspiration behind a new efficiency metric called True Weighted Efficiency (TWE), which is derived from basic engineering principles, using generalized load profiles for one or more system curves, multiple discrete condition points, and varying time of operation at each point. Three numerical Case Studies are presented and three different examples of TWE weighting factors are presented. The ease in which TWE is applied is an opportunity for broad use and adoption in the industry.

TUTORIAL 07

ANSI/ASA S2.75-2017/Part 1 Shaft Alignment Methodology, Part 1: General Principles, Methods, Practices, and Tolerances

Wednesday, September 19, 2018

8:30 A.M. – 10:00 A.M. | Room 361A

Instructor

Eugene Vogel (EASA, Inc.)

Description

In 2010, the Vibration Institute sought to establish a certification for shaft alignment technicians, similar to their certification for vibration technicians and analysts. Various alignment tool vendors and industry consultants had published tolerances for acceptable alignment of flexible couplings, but these varied among sources. Machinery manufacturers published various shaft alignment guides for their specific machines, but these varied widely in methodology and acceptable tolerances. Some industry specific standards did exist such as the API standard for machine installation, but these were not easily applied outside of those specific industries.

The Vibration Institute then launched an effort in conjunction with the Acoustic Society of America, (ASA), to produce a shaft alignment standard that could be applied broadly across industries, and that would form a basis for the development of a certification for shaft alignment technicians. The standard presented here is the culmination of that effort.

TUTORIAL 08

An End-User's Guide To Centrifugal Pump Rotordynamics

Wednesday, September 19, 2018

8:30 A.M. – 10:00 A.M. | Room 361C

Instructor

William D. Marscher (Mechanical Solutions, Inc.)

Description

This tutorial discusses concepts and methods involved in performing and evaluating rotor-dynamic 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.

TUTORIAL 09

Precision Grouting of Critical Rotating Equipment

Wednesday, September 19, 2018

10:30 A.M. - 12:00 P.M. | Room 361A

Instructors

Rick First, Fred Goodwin, Christopher Adams, Daniel Termunde (BASF Construction Chemicals)

Description

Recently, there has been a trend in the way new equipment is being mounted that affects precision grouting during installation. Improper grouting not only wastes material, but can result in misalignment, unnecessary vibration, and premature equipment failure. Traditionally, new equipment was mounted on a continuous steel base plate, but skid mounted equipment has a deep central cavity that must be filled

to act as an inertia block requiring very deep grout placement. Techniques to utilize both cementitious and deep – pour epoxy grouts will be described to provide adequate equipment support and prevent overflow of the shoulders. A focus on high speed turbomachinery will be made to tie reliability to proper installation of precision grout.

TUTORIAL 10

Best Practices For Cartridge Mechanical Seal Installations

Wednesday, September 19, 2018

2:00 P.M. – 3:30 P.M. | Room 361A

Instructor

Michael Huebner (Flowserve)

Description

The reliability of a mechanical seal depends on more than the design of the seal itself. It also depends heavily on the practices used to install the mechanical seal into the centrifugal pump or other equipment. The actual installation may occur in a controlled environment such as a factory or repair shop or it may occur out in the field in an installed pump. The people performing the installation range from skilled workers with significant experience with seals to general mechanics who have had little exposure to seals. Regardless of the situation, the steps taken during the installation process set the foundation for the ultimate success of the seal in operation. Different pump and seal designs may require different installation procedures but there are several key elements that are common across all installations. These include inspection of the equipment, general requirements for equipment condition, preparation for installation, installing the seal, setting the seal drive, removal of setting/shipping fixtures, and connecting the piping plan. While each of the steps is deceptively simple, the ability to identify and correct problems during the installation is critical.

TUTORIAL 11

Navigating the US DOE Energy Conservation Standard and Test Procedure for Pumps

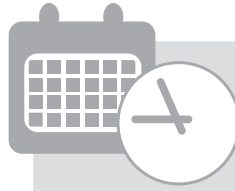
Wednesday, September 19, 2018
2:00 P.M. – 3:30 P.M. | Room 361C

Instructor

Peter Gaydon (Hydraulic Institute)

Description

As the compliance date of January 27, 2020 approaches, the complexity of the US DOE Energy Conservation Standard (ECS) and Test Procedure (TP) for Pumps leaves many pump manufacturers, distributors, engineering procurement contractors, consultants, and end users with uncertainty regarding the requirements and impact of the regulation. Since this is a first in the United States, this paper addresses the contents of this ECS and TP to provide an understanding of the scope; implications to the manufacturer, end users, and other interested parties; and the benefits of the rule and voluntary product energy labeling initiatives. As pump energy conservation standards progress, it will be more difficult to achieve the required energy savings through pump efficiency alone; therefore, an extended product approach will be required to achieve the energy savings. More and more, pumps will be sold with motors and controls. This paper aims to provide some additional information and training to the manufacturer, specifier, installer, and end user to ensure that published energy savings are achieved and that “intelligent” systems are not misapplied, resulting in reduced functionality, reliability, and potentially increased power consumption when misapplied.



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PUMP

DISCUSSION GROUPS

DISCUSSION GROUP PTO1

Monitoring Vibration and Other Critical Machine Conditions

Tuesday, September 18, 2018

10:30 A.M. – 12:00 P.M. | Room 371C

Wednesday, September 19, 2018

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 (CIRCOR), Jack Claxton (Patterson Pump Company), Juan Gamarra, Maki Onari (Mechanical Solutions, Ltd.), Monroe Voyles (ITT Goulds Pumps), Morg Bruck (HMIC), Ken Atkins (Engineering Dynamics Incorporated), Hemanth Satish (TransCanada)

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 PTO2

Couplings and Alignment

Tuesday, September 18, 2018

10:30 A.M. – 12:00 P.M. | Room 371A

Instructors

Jeff Haught (Anadarko Petroleum Company), Mark O'Neil (Altra Couplings), Thomas Davidson (Consultant), Michael Johnson (NRG Energy), Michael LeBlanc (John Crane)

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

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

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

DISCUSSION GROUP PT03

Gears

Wednesday, September 19, 2018
2:00 P.M. – 3:30 P.M. | Room 371C

Instructors

Joseph Silvaggio, Jr. (Siemens), Robert 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 PT04

Lubrication

Tuesday, September 18, 2018
2:00 P.M. – 3:30 P.M. | Room 371A
Wednesday, September 19, 2018
10:30 A.M. – 12:00 P.M. | Room 371A

Instructors

Leslie Thilagan (Independent Pump Consultant), Brian Pettinato (Elliott Group), Jeff Haught (Anadarko Petroleum Company), 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 P05

Centrifugal Pump Operation,
Maintenance, and Reliability

Wednesday, September 19, 2018

10:30 A.M. – 12:00 P.M. | Room 372A

Instructors

David DePaolis (Flowserve), Richard Donley (PBF Energy), Adam Gottlieb (Celanese Clear Lake Plant), Calvin Stevenson, Paul Pairmore (Flint Hills Resources), Arun Kumar (HPCL - Mittal Energy Ltd.), Katie Whaley (ARMS Reliability)

Top Voted for Discussion in 2017

- MI Inspections of pumps - (casing thickness) – UT, on-line, shops
- Methods for preventing reverse rotation, detecting reverse rotation
- Hot alignment – are there benefits, what temperature
- Predictive maintenance – how is info recorded, also condition based – how it is working
- What oil are we using for lubrication bearing housings (oil type, replacement frequencies)
- Motor greasing and use of UT
- Pump swapping program – frequency
- Pump monitoring – how are we doing this and how do we want to do this, wireless
- Craft training – precision maintenance

DISCUSSION GROUP P06

Mechanical Seals

Tuesday, September 18, 2018

10:30 A.M. - 12:00 P.M. | Room 370C

Instructors

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

Description

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

Typical topics covered in this discussion group include:

- Changes in upcoming API 682 5th 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 P07

Improving Mean Time Between Pump Failures

Tuesday, September 18, 2018

8:45 A.M. - 10:15 A.M. | Room 372A

Instructors

Bill Litton (Magellan Midstream Partners LP),
Dave DePaolis (Flowserve), Morg Bruck (HMIC),
Aaron Burton (Sulzer)

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



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Schedule Tab

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TPS

DISCUSSION GROUP P08

Vertical Pump Problems and Solutions

Tuesday, September 18, 2018

08:45 A.M. - 10:15 A.M. | Room 371A

Instructors

Howard Wright (Goulds Pumps), Jim Kilgore (Consultant), John Merrill (EagleBurgmann), Mike Smith (Flowserve), Clint Zentic (Sulzer), Justin Hollingsworth (Southwest Research Institute), Hemanth Satish (TransCanada)

Suggested Topics

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

DISCUSSION GROUP P09

Sealless Pumps

Tuesday, September 18, 2018

2:00 P.M. - 3:30 P.M. | Room 370A

Instructors

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

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 P10

Pipeline Applications

Wednesday, September 19, 2018

8:30 A.M. - 10:00 A.M. | Room 370A

Instructors

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

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 P11

Cryogenic Fluid Pumping Applications

Wednesday, September 19, 2018

10:30 A.M. - 12:00 P.M. | Room 370A

Instructors

Enver Karakas, Lonn Hall (Ebara Intl), Dag O. Calafell II (Technical Opus Solutions), Vinod Patel (KBR), Ron Adams (Sulzer), 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 vs. cryogenic submerged pump
- Pump columns / Column diameters determination and benefits

Suggested Topics

- Unexpected cavitation erosion
- Key parameters to consider for Root Cause Analysis when experiencing cavitation damage
- NPSHR, NPSHA, NPSH margin
- Performance loss due to insufficient NPSHA (margin)
- NPSH 40,000 hours
- Cavitation erosion rate and impeller life assessment
- Impact of dissolved and/or entrained gas
- Pumping hot water or hydrocarbons
- Reliability of operating with low NPSHA on hydrocarbons
- High cavitation-resistant materials
- Common types of pump cavitation, including: sheet cavitation, suction recirculation induced vortex cavitation, corner (vortex) cavitation, and tip vortex cavitation
- Suction specific speed
- Field cases (suggested by audience): Quick fix and ultimate solution

DISCUSSION GROUP P12

Cavitation/NPSH (Field Problems)

Wednesday, September 19, 2018

8:30 A.M. – 10:00 A.M. | Room 371A

Instructors

Bruno Schiavello, Frank C. Visser, Giancarlo Ciatelli (Flowserve), Patrick Green (LyondellBasell), David Henry (Marathon Petroleum), Ken Atkins (EDI), Francesco Annese, (Baker Hughes, a GE Company), Greg Curtin (Chevron), Ron Adams (Sulzer)

PUMP

CASE STUDIES

PUMP CASE STUDY SESSION 1A

Thursday, September 20, 2018

8:30 A.M. – 10:00 A.M. | Room 350D

CASE STUDY 01

NPSHR (NPSH3) Improvement of a Low Pressure Safety Injection Pump

Instructors

Frank C. Visser, Mark Ketelaar (Flowserve)

Description

This case study discusses the rerate of a set of vertically-mounted single-stage end-suction centrifugal pumps used for low pressure safety injection (LPSI) in a nuclear power plant. The original LPSI pumps were supplied early 1970's and for safety purposes it was decided to overhaul these pumps to improve NPSHR (i.e. NPSH3). The rerate consisted of replacing the existing impeller with a new design yielding close to identical head performance characteristic, yet lower NPSHR. Aim was to improve NPSHR by (minimally) 0.5 m (1.64 ft) at rated capacity of 682 m³/h (3003 USGPM) and 1470 r/min running speed, and demonstrate by test the actual improvement in NPSHR.

CASE STUDY 02

Improvement of Rotating Equipment Reliability Using Optical Metrology

Instructors

Dale Winterhoff, DJ Winterhoff
(Flowserve Corporation)

Description

Extreme thermal piping displacements were thought to be the root cause for the observed failures at a large refinery, namely 9 mechanical seal failures in 3 months. Optical Metrology methods were used to identify failure modes of critical service vacuum bottoms pumps. The testing involved the use of both

photogrammetry and digital image correlation to show how the large thermal displacements of the piping contributed to the mechanical seal failures. A high speed optical metrology rotodynamic study was also performed to observe the effects of the piping displacements on the operation of the pump.

PUMP CASE STUDY SESSION 1B

Thursday, September 20, 2018

8:30 A.M. – 10:00 A.M. | Room 351D

CASE STUDY 03

Investigating and Improving the Drooping Curve of a Two-Stage Feed Pump

Instructor

Tzuu Bin Ng (Flowserve)

Description

A two-stage feed pump exhibited a drooping head-flow characteristic during its shop test. Impeller reworks were done to improve the drooping curve. CFD study was performed to examine the pump flow behaviour and a more stringent test procedure was implemented. The key lesson learnt from this case is not to overly push the efficiency of the pump at a single best efficiency point, but to have a more balanced design between achieving good pump efficiency and attaining a stable curve.

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

CASE STUDY 04

Fugitive Emissions Containment Using a Dual Pressurized Seal and API Plan 53B

Instructors

Andrew Fillipowski (John Crane Inc.), Jacinda Valenci (Shell Oil Products)

Description

Fluids that require limited emissions are often sealed using dual pressurized mechanical seals and sealing systems. API Plan 53B systems use a bladder accumulator to provide the pressure for the barrier fluid to isolate the process from the atmosphere. Reliable performance of these systems requires an understanding of the effects of temperature, barrier fluid volume, and seal chamber pressure to maintain a positive pressure differential. This case study will cover design considerations to improve performance, analysis of problems with an existing application, and the changes that were implemented to correct these problems.

CASE STUDY 05

Improved Reliability of Industrial Waste Water Pumps

Instructor

Mohammad Ibrahim (SHARQ – SABI)

Description

This is a case study for a chronic waste water unit pumps failures. The impact of the failures were severe due to the significant cost of maintenance (130K USD on average) which was taking place twice a year. The pump design was re-evaluated, and after thorough market research, a cheap solution was found for a pump upgrade with a project cost that is less than 50% of the existing maintenance cost (Capital Project cost was 40K USD). After 15 months of operation, there has been zero breakdown/corrective maintenance cost. The yearly maintenance cost was eliminated down to zero (excluding the lubrication cost).

PUMP CASE STUDY SESSION 1C

Thursday, September 20, 2018

8:30 A.M. – 10:00 A.M. | Room 352D

CASE STUDY 06

Correction of High Vibration on a Vertical Turbine Deep Well Pump with a Dynamic Vibration Absorber

Instructors

Benjamin Bryant, Matthew Moll (Celanese)

Description

A 100 horsepower, 180 foot deep vertical turbine pump called “#12 Well Pump” had a history of reoccurring high vibration despite multiple pump rebuilds and motor replacements. The problem was identified as a structural resonance of the motor and discharge head assembly. It was determined that a dynamic vibration absorber (DVA) would be the most effective solution. This case study presents the technique of diagnosing the resonance and the methodology of designing and calibrating a dynamic vibration absorber. Installation of the DVA reduced the overall vibration velocity amplitude by a factor of 16.

CASE STUDY 07

A Case Study of Vibration in Positive Displacement Pump Systems

Instructors

Trenton Cook, Sarah Simons (Southwest Research Institute)

Description

Positive displacement pump systems can experience high piping vibrations. System vibration can have many root causes- including underdamped fluid pulsations, mechanical resonance, and poor skid design. This case study shows the mechanical and acoustic assessment of a reciprocating pumping system which had multiple vibration induced failures.

Poor support stiffness, coupled with inadequate pulsation dampener performance resulted in high amplitude piping vibration- requiring both mechanical and acoustic analyses. Collected field pulsation and vibration data are presented, along with follow-up acoustic and finite element modeling results to showcase a solution to pulsation induced vibration in this particular pump system.

CASE STUDY 08

BB1 Lateral Dynamic Analysis

Instructor

Landon Cooper (Sulzer)

Description

Customer has four 4x8x13 BB1 booster pumps for produced water injection. One pump was recently repaired and ran for only 4 months. Typically these pumps run about 16-18 months. Before shutting down the pump it had a high 1x vibration. It was discovered that the pump clearances had increased to 5x running clearances. The customer wanted to increase the mean time between repairs. A solution was derived doing a lateral dynamic analysis.

PUMP CASE STUDY SESSION 2A

Thursday, September 20, 2018

10:30 A.M. – 12:00 A.M. | Room 350D

CASE STUDY 09

Structural Natural Frequency Tuning on a Vertical Pump

Instructor

Donnie Patterson (Sulzer Pump Services)

Description

This case study demonstrates the steps taken to solve a structural resonance issue on a VFD driven vertical pump installed in the field. Topics discussed include problem validation, steps taken to solve the issue, the resulting reduction in vibration amplitude, and key takeaways.

CASE STUDY 10

Motion Amplification: A New Way to Visualize Vibrations

Instructor

Jeff Hay (RDI Technologies)

Description

Motion Amplification utilizes a camera to turn each pixel into a displacement sensor capable of measuring vibrations and amplifying them to a level visible to the eye. This capability lends itself to an advanced troubleshooting tool for routine inspection and root cause analysis.

A case study will highlight how the technology has been applied to solve a long standing critical motor stator pump issue at a power generation facility. Before and after video will demonstrate the results after corrective action.

CASE STUDY 11

Use of Motion Amplified Video to Diagnose Pump Vibration

Instructor

Maki Onari (Mechanical Solutions, Inc.)

Description

Use of Operating Deflection Shapes (ODS) has become an accepted method for understanding and diagnosing pump and other turbomachinery vibration problems. However, data acquisition can take a long period of time, and requires a large number of expensive probes, with associated FFT analyzer channels. New video magnification techniques can supplement or replace ODS.

PUMP CASE STUDY SESSION 2B

Thursday, September 20, 2018

10:30 AM - 12:00 PM | Room 351D

CASE STUDY 12

Up-thrust and Seal Failures on a Vertical Can Pump

Instructors

Bill Litton, Brian McBroom, Brett Smith
(Magellan Midstream Partners)

Description

Pine Bend, MN, 12x10, 9 stage vertical can pump, 600 hp, 1780 rpm. A new smaller, higher efficiency motor was installed to replace the old motor and shortly after numerous mechanical seal failures occurred. The motor is a solid shaft motor that is connected to the pump with a rigid coupling. The motor hub is connected to the motor shaft with a split ring. On startup it

was observed that the pump shaft would move about 3/8 inch upward and the mechanical seal would leak.

CASE STUDY 13

Vertical Turbine Pump Reliability Improvement

Instructor

Yve L. Zhao (BHP Billiton)

Description

The subject pump was designed and installed when pipeline pressure was estimated high based on a higher production volume. The selected multistage vertical turbine-pumps are generically prone to vibration issues due to its flexible shaft design.

Due to the deviation between the pump design condition and its actual operating condition, flow turbulence and recirculation in the pump impellers produced enough vibration excitation forces that caused the mechanical seals to fail prematurely and to leak.

Pump restaging was not implemented due to the relatively high cost and uncertainty of a future line pressure. Since the pump is used for batch services, not its entire operating flow/pressure range is necessary to meet production needs.

Performance and Reliability Mapping (PRM) were performed instead thus ensuring a higher MTBF on the pump and seal components.

CASE STUDY 14

Resolving High Vibration Issue on a Vertical Pump/Motor

Instructors

Sankar Ganesh (GE Bently Nevada), Sami Al Mubarak (Saudi International Petrochemical Company), Mustafa Shalabi (Baker Hughes, a GE Company)

Description

High vibration were observed on the motor, pump, structure for more than 2 years with 1X dominant motor vibration. Assuming that the issue is of complete structural issue even though this motor was running well in the past, some structural modifications have been carried out at site which includes a welding a mass of 100 Kg on the structure in addition to the installation of braces to the structure which did not yield any positive results. Structural measurement along with the ODS carried out at site did not reveal a significant issue with the structure itself except for the structural natural frequency slightly closer to the running frequency of the motor. The decision to carry out an onsite balancing on the motor which was intended to remove the excitation force yielded good results which exposed additionally a mistake in the balancing activities carried out by a local vendor at work shop.

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1012

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2901

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Mayfield, KY 42066 USA
PH: 270-247-1554 | FX: 270-247-1575
www.acecompressorservices.com



ACE Compressor Parts and Service is the leading OEM alternative centrifugal and oil free screw compressor company. Offering quality OEM alternative parts, engineering, repair work and field service. We offer TRUE multi-brand coverage with products and expertise that cover Ingersoll-Rand Centac, Cameron/Joy, Atlas Copco, Elliott and Clark Isopac. Our team of highly trained service technicians are ready to go at a moment's notice to cover everything from annual inspections to PM's to emergency outages anywhere in the continental US. Give us a call today to see how we can help lower your compressor maintenance costs and downtime.
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3100

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Cambridge, OH 43725
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www.aciservicesinc.com

ACI provides manufactured products, engineered solutions and performance software to a worldwide market. We have extensive experience with the custom design and manufacture of compressor cylinders, liners, pistons, rods, valves and unloading devices. ACI offers engineering services including thermodynamic performance reviews, acoustic studies and more.

ACUCUT, INC.

1836

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www.acucut.com

Acucut is a industry leader specializing in EDM and Laser services since 1978. Acucut provides all types of EDM (small hole, sinker and wire) Laser services include flat sheet & tube cutting & Laser drilling. In house conventional machining services (turning & milling) also available. Specializing in heavy industrial gas & steam turbine engine components and aero derivative industrial turbine components. NADCAP, ISO 9001:2000 , AS 9100:2004

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www.adhesiveservices.com

Adhesive Services Company specializes in foundation repair, grouting, and regrouting of heavy industrial machinery, the restoration of concrete foundations and structures, and the installation of high-performance secondary containment coatings and linings for concrete and steel. Services include anchor bolt repairs and/or replacement, pressure grouting of baseplates, new installation, diamond coring with air powered equipment, evaluations and technical reports, and turnkey capability. We provide a broad range of solutions and unique repair methods for foundation repairs. Our services include both contracting and consulting, with technology at the jobsite. An excellent safety record is highly maintained as we always provide quality and consistency.

ADVANCED COMPRESSOR TECHNOLOGY

2819

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PH: 630-482-9400
www.actcomp.com

Advanced Compressor Technology provides shop and field services on all brands of reciprocating and centrifugal compressors. Full machine shop services, compressor overhauls and re-rates. Complete line of new and refurbished compressor components.

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1539

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PH: 815-293-0900 | FX: 815-293-0909
www.thindiamond.com

Advanced Diamond Technologies (ADT) has helped organizations, from large mechanical seal manufactures to major pump OEMs, improve the performance of rotating equipment. The patented, award winning UNCD® (ultrananocrystalline diamond) family of materials has enabled customers to enhance the reliability of their equipment, leading to increased mean time between repairs (MTBR), while surviving combinations of intermittent dry running, poor lubricating conditions, exposure to corrosive media, and the abrasion presented in mining and mineral processing. Along the way UNCD has won numerous industry awards for innovation and technology leadership. ADT's UNCD Components bring the durability and low friction of diamond to mechanical seals, hydrodynamic thrust bearings and tilting-pad bearings.

ADVANCED ROBOTICS FOR MANUFACTURING INSTITUTE AT TEXAS A&M UNIVERSITY

2151

3123 TAMU
503 Mechanical Engineering Office Bldg
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www.arminstitute.org

Advanced Robotics at Texas A&M University is a collaborative robotic research organization that specializes in researching, developing, and integrating robotic technologies into manufacturing industries. As the South Central headquarters for the Advanced Robotics for Manufacturing Institute, Advanced Robotics at Texas A&M University utilizes the resources of the Texas A&M University System as well and the Manufacturing USA initiative. We aim to improve efficiency, safety, and technology of robotic integration into the manufacturing sector working directly with small, medium, and large manufacturers. We develop and research case study programs for education and technology integration directly with industry partners.

2741

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www.aerzenusa.com

AERZEN is a family-owned private company that was founded in 1864 in Aerzen, Germany. AERZEN manufactured the first European positive displacement blower in 1868 and has been manufacturing screw compressors since 1943. In 1978, we designed and manufactured the world's largest positive displacement blower and have since built over 150 of that type. In 1984, AERZEN built the world's largest screw compressor. AERZEN was one of the first ISO 9001 certified companies in the world and has maintained that certification since 1990.

1843

AESSEAL INC

355 Dunavant Drive
Rockford, TN 37853 USA
PH: 865-531-0192
www.aesseal.com

AESSEAL® is one of the world's leading specialists in the design and manufacture of mechanical seals, seal support systems and bearing protection. Our promise to customers is simple: we aim to give such exceptional service that they need never seek another source of supply. Established in 1983, it is our focus on customer service and quality that has seen us grow. Today, we have 230 locations worldwide, supplying customers in 104 countries, and employ a global network of sales engineers, technical support specialists and stocking distributors. By investing in pioneering technology, we respond quickly to customers' - whatever and wherever.

1300

AFTON PUMPS, INC.

7335 Avenue N.
Houston, TX 77011 USA
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www.aftonpumps.com

Afton Pumps, Inc. is a Houston, TX based manufacturer of vertical centrifugal pumps designed in accordance with Hydraulic Institute standards and API-610 when needed. Every pump is engineered for it's specific application. Both vertical turbine and vertical inline pumps offered. Repairs/modifications are made to all models of centrifugal pumps with the support of the factory engineering department.

AGILIS

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Palm Beach Gardens, FL 33410 USA
PH: 561-626-8900
www.agilis.com

2751

Agilis is a proven engineering team relentlessly dedicated to advancing gas turbine engine performance. From test rig to production floor, Agilis Engineering, Inc. helps leading manufacturers design, develop, and build next-generation engine technology for the most demanding applications. Agilis Measurement Systems, Inc. are industry-leading experts in blade vibration measurement and analysis. Our c360® Vibration Intelligence Software suite uses a non-intrusive approach to deliver detailed insight at every turn of every blade in prototype to production engines. We're scientists, engineers, software developers and technicians all dedicated to improving the performance of the engines that drive your business.

AIKOKU ALPHA CO.

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1737

AIKOKU use cutting-edge simultaneous 5-axis machining centers and unique single-clamp technique in machining process, which is a critical component of advanced processing technology and has made us one of the top machining specialists in the world. Our multifaceted simultaneous 5-axis machining center allow us to manufacture an extensive array of complex components. Our clients demand both small-batch and mass production depending on the specific part, and one of our key strengths is the ability to confidently meet those demands with our in-house technology.

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1727

Alfred Conhagen Inc specializes in Repairs, Re-Rates, and Redesign of Rotating Equipment. We offer turnkey services utilizing our Field Service crews. We have engineers on staff in all locations. With facilities in Texas, LA, and CA. Please stop and visit us at our booth.

1038

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2547

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2049

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Distributor of HVOF/Plasma Coating & Surface Prep Equipment, along with Superabrasives and Masking Products.

ALTA SOLUTIONS INC.

2807

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www.altasol.com

Alta Solutions is an innovative producer of Machinery Protection and Condition Monitoring, Combustion Dynamics, Transient Capture/Diagnostics, and Modal Analysis systems. Alta's products are optimized for monitoring and analyzing a variety of rotating machinery; steam and gas turbines, motors, generators, gearboxes, compressors, pumps, fans, blowers, and structures or piping vibration. With over 900 systems installed worldwide, Alta equipment has field proven reliability for Power Generation, Refining, Chemical Production, Steel and Aluminum Mills, Product Development, Research, and Production QC applications. Innovative features, accuracy, performance, and superior support allow customers to trust Alta Solutions for critical machinery health monitoring, protection, and analysis.

ALTRA INDUSTRIAL MOTION CORP.

2517

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Altra Couplings, a global manufacturer of engineered and standard flexible coupling products for driveline connections, is represented by the following well-known brands: Ameridrives International - Erie, Pa.; Bibby Transmissions – Dewsbury, England; Lamiflex Couplings – Sao Paulo, Brazil and TB Woods – San Marcos, Tx. Altra Couplings is a recognized as an industry leader for flexible couplings used on critical applications for turbomachinery and petrochemical applications. The Altra brands offer a complete line of diaphragm, disc, gear and elastomeric flexible couplings for general purpose, ANSI, API-610 and API-671 applications. Products include the Ameriflex® multi-convoluted diaphragm coupling, Ameridisc®, Turboflex®, Torsiflex®, Lamiflex® and Form-Flex® disc couplings; and Sure-Flex® and Dura-Flex® brand elastomeric couplings.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

2216

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Participating in an ASME organized conference or exposition is a crucial part of a career within the global turbomachinery community. Since 1956 ASME IGTI has been an important resource for the turbine community, hosting a prestigious annual conference and exposition, ASME Turbo Expo. With more than 60 years of experience, ASME offers the best conferences and expositions focused on turbines and turbine professionals.

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1335

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APPLIED SYSTEM TECHNOLOGIES

3013

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ARIEL CORPORATION

2511

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2327

ATLAS COPCO GAS AND PROCESS

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www.atlascopco-gap.com

Atlas Copco Gas and Process is a division within the Atlas Copco Group's Compressor Technique business area. It designs, develops, manufactures and maintains turbocompressors, positive displacement compressors, and expansion turbines. In addition, Gas and Process offers a matching range of aftermarket products. The Division's solutions are used in oil and gas and chemical/petrochemical processes, power generation, renewables, and the industrial-gases sector. The divisional headquarters is located in Cologne, Germany, and the production centers are in the United States, China, and India.

1747

AXIS MECHANICAL GROUP

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We are a millwright company providing turnkey solutions for installation, maintenance, repair, overhaul, or upgrade of industrial rotating and reciprocating equipment for the petrochemical industry.

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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.

BADGER METER**1114**

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PH: 414-217-7663
www.badgermeter.com

Flow Measurement Experts - An industry leader in flow measurement and control technologies, Badger Meter Flow Instrumentation manufactures products and solutions that measure whatever moves through a pipe. Customers rely on our wide range of solutions to deliver accurate and dependable flow data and control essential for their applications. We are committed to helping customers better manage and optimize their operations, and we continually apply our expertise and agility to better serve their needs.

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www.master-builders-solutions.basf.us

BASF is a leading supplier of innovative chemistry systems and formulations for the construction industry. BASF offers products and solutions for industrial construction in the way of concrete repair, grouts, sealants and containment coatings. Our unique solutions provide structural integrity, safety, and environmental protection allowing for uninterrupted production. Whether the need is support and alignment of critical rotating equipment, concrete deterioration prevention, or containment assurance, BASF's industry respected people and products provide unique solutions.

BAYTOWN ACE INDUSTRIAL SERVICES

2842

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www.aceindustrial.com

Baytown Ace Industrial Services, a family owned business founded in 1960, has become an industry leader in our efforts to support the refining and petro-chemical industries that encompass the Houston Ship Channel and surrounding counties. Thanks to our extremely experienced staff and our first in service mindset, coupled with our ever-changing state of the art equipment, we can better meet your desired turnaround and quality needs. Some of our capabilities include precision machine work, mechanical equipment repair, fabrication, welding (including R&U Stamp), and balancing...all within the most demanding industry tolerances.

BEARINGS PLUS

2227

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 PH: 713-948-6000
<http://www.bearingsplus.com>

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

BENTLY BEARINGS

1315

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www.bentlybearings.com

Bently Bearings™ is a line of externally-pressurized porous gas bearings for turbo equipment. Being externally pressurized, Bently Bearings™ have the load capacity of oil bearings, but without the oil. This enables high speed bearings operating at temperature extremes and on process gases. Zero contact starts and stops make reliability deterministic. Simplify and improve the design of your equipment by moving the bearings closer to the work being done. Bently Bearings™ is patented technology, owned by New Way Air Bearings®.

BENTLY NEVADA, LLC

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1347

Machinery Protection and Condition Monitoring hardware, software, and services.

BK VIBRO AMERICA

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www.bkvibro.com

1341

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 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 System for full-featured condition monitoring.

BO-GE ASSEMBLY, INC.

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Crosby, TX 77532 USA
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www.bo-ge.com

1720

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.

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BÖRGER

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1434

BOULDEN COMPANY

1013 Conshohocken Road, Suite 308
Conshohocken, PA 19428 USA
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www.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.

2611

BURCKHARDT COMPRESSION, INC.

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PH: 346-212-4465
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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.

CALNETIX TECHNOLOGIES**2514**

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www.calnetix.com

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

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Camfil Power Systems 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.

CANADA PIPELINE ACCESSORIES CO. LTD.**1004**

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Canada Pipeline Accessories is dedicated to the improvement of flow measurement accuracy and pump inlet fluid flow control through the provision of leading-edge equipment and engineering services. This includes the custom design and manufacture of flow conditioners, venturi nozzles, flow nozzles, mixers and custom items not otherwise available. Key Words: Pump fluid flow inlet control for proper pump performance

CASCADE ANALYTIC, LLC

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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.

CCC (COMPRESSOR CONTROLS CORPORATION)

4745 121st St
Des Moines, IA 50323 USA

CCC (Compressor Controls Corporation) is the leader in Turbomachinery Train Optimization Services for the upstream, midstream and downstream Oil & Gas industry. Process, controls, safety & technology engineers, and plant managers optimize plant efficiency every day utilizing CCC's expertise. Since 1974, more than 37,000 installations have benefited from more than two billion hours of CCC's operational experience. This expertise is executed in a comprehensive platform of hardware, software and consulting services that optimize turbomachinery to improve process performance, increase yield, save energy, reduce downtime and enhance plant safety & security. CCC's optimization services are technology-agnostic. No other controls or automation provider can serve your needs better with local support and a legacy of proven results.

CEC VIBRATION PRODUCTS

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Choose CEC for your critical machinery health monitoring, R&D and OEM applications.

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CEC has a field-proven reputation for product reliability and support. This strong reputation is the paramount reason our products can be found in aerospace, automotive, military, energy, industrial and medical applications worldwide.

2451
1835
3014

CEROBEAR GMBH

Kaiserstr. 100
Herzogenrath, NRW 52134 Germany
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www.cerobear.com

1112

CEROBEAR is a specialized manufacturer of high performance hybrid and all-ceramic bearings with highly customized solutions for the turbo machinery, fluid machinery, oil and gas, aerospace and race car market. 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

Unterer Kreuzweg 1
Dresden, Sachsen 1097 Germany
PH: (+)491722362235 | FX: (+)4935140790780
www.cfturbo.com

1638

CFTurbo GmbH offers design software, engineering services, and CAE-workflow development for Turbomachinery and related components. Our key product is the conceptual design platform CFTurbo® which is a modern, powerful, user-friendly design tool for various types of Turbomachinery. The software is made to design impellers, vaned and vaneless diffusers, volutes and other casings. Today it covers radial and mixed-flow pumps, blowers, compressors and turbines as well as axial fans, pumps, inducers and turbines. Interfaces to all major CAD- and CAE-systems are available. Its batch mode capability easily allows design exploration and optimization together with commercial or open source CFD/FEA-codes.

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1753

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1636

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2541

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2251

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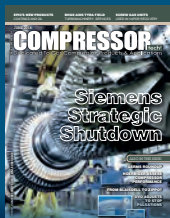


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2705

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**LOOKING FOR A PLACE
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PAGE 295

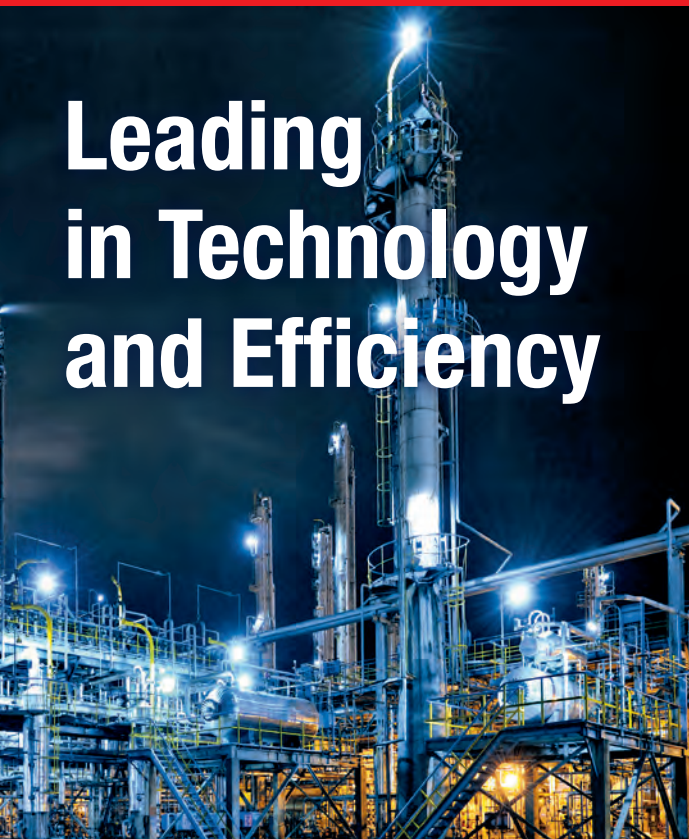
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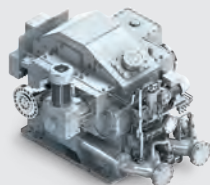
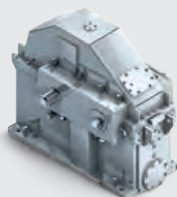
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FW Gartner (a business unit of Curtiss Wright Surface Technologies) is an ISO 9001 (2008) qualified provider of a broad range of surface technologies utilized for the protection and reclamation of critical components, and a fixture in the Houston area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

FARMER'S COPPER LTD.**1034**

9900 Emmett F. Lowry Expwy
Texas City, TX 77591 USA
PH: 800-231-9450 | FX: 409-765-7115
farmerscopper.com

Farmer's Copper has been serving the metals industry since 1920. We maintain a diverse inventory of Copper, Brass, Bronze, and Copper-Nickel alloys to meet the demands of the Oil & Gas, Turbine & Pump, Power Generation & Control, and Aerospace & Defense Industries. Our services include precision plate and bar sawing, water-jet cutting, CNC routing, shearing, and bus bar punching and bending. Our responsive sales team is ready to provide solutions for your toughest material requirements.

FARO TECHNOLOGIES INC.**2804**

250 Technology Park
Lake Mary, FL 32746 USA
PH: 407-333-9911 | FX: 407-562-5189
www.faro.com

FARO develops and markets portable CMMs (coordinate measuring machines) and 3D imaging devices to solve dimensional metrology problems. Technology from FARO permits high-precision 3D measurement, imaging and comparison of parts and compound structures within production and quality assurance processes. The devices are used for inspecting components and assemblies, production planning, documenting large volume spaces or structures in 3D, and more. FARO's 3D measurement technology allows companies to maximize efficiencies and improve processes.

FENGHUA ZHONGLI SEALS CO., LTD.**3239**

No 123 Yuanzhong Road, Tengtou Industrial Zone
Fenghua, Ningbo 315500 China
PH: (+)8657488911322 | FX: (+)8657488952096
www.zlseals.com

Zhongli Seals Company is a manufacturer specialized in design, producing and sale mechanical seals and sealing materials. Company was established in 1993 and covering 19500 square meters. Developed many series mechanical pump seals and cartridge seals, applied in petrochemical, food, automobile and mechanical industry etc.

FIELD INDUSTRIES**1942**

4906 Weeping Willow Rd.
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PH: 832-736-1839 | FX: 888-505-1775
www.fieldindustries.com

Field Industries is a distributor and supply house offering steel & alloy flanges, fittings, fasteners, pipe, centrifugal castings, plate, heads, rolled shells, and structural steel. Our materials conform to various domestic and international standards, including ASME, ANSI, NACE, API, AWWA, DIN, JIS, and customer-driven specs.

FISHER PRODUCTS LLC**1101**

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FiveStarProducts.com

A worldwide provider of high performance, versatile, specified non shrink cement and epoxy based construction solutions for use in the industrial, infrastructure and marine markets. Five Star's products include versatile precision, non-shrink grouts and structural repair products; highly chemical resistant coatings, patches and grouts; pile and column repair systems; concrete restoration and advanced vibration dampening products, waterproof coatings, adhesives and machinery foundation systems for rapid turnaround.

FLENDER-GRAFFENSTADEN

2826

115 Technology Drive A201
Trumbull, CT 06611 USA
PH: 203-268-5961
www.fggscorp.com

Flender-Graffenstaden has acquired the know-how and the experience to be a leader in the field of high speed gears. FG Gears are used in all processes in power plants, refineries, offshore and onshore oil and gas installations, petrochemical and industrial process plants. FG provides turbo parallel shafts and integral gear units with centerline distances ranging from 150 to 1500 mm. Designed to meet specific customer needs, our products can reach powers up to 110 MW. With Local support for Application Engineering and Field service support for startup and commissioning through FGGS Corp.

FLEXELEMENT TEXAS INC.

1912

8889 West Monroe Road
Houston, TX 77061 USA
PH: 713-910-3839 | FX: 713-910-0223
www.flexelement.com

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

FLOWSERVE CORPORATION

1635

2100 Factory St
Kalamazoo, MI 49001 USA
PH: 269-226-3499
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.

FLUID ENERGY CONTROLS, INC.

1419

6431 Flotilla Street
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OEM of Custom Lube Oil System Accumulators (LOSA). Stainless Steel and Carbon Steel construction with option of Buna-n, Viton, Butyl, EPR and Hydrin bladders. ASME Sec VIII, Div I, with options of CRN, NR-13, SELO/SQL/ML, AS-1210, DOSH, and CE/PED. Emergency supply of Lube Oil for high speed bearings in Turbo-Expanders, Turbo-Compressors, Gas and Steam Turbines during a lube pump switch-over or lube supply failure. Other applications include Surge Suppressors to minimize pressure spikes in Pipelines; Pulsation Dampeners to alleviate pressure pulses from Positive Displacement Pumps, and Suction Stabilizers to prevent Pump Cavitation.

FLUID SEALING ASSOCIATION

1018

994 Old Eagle School Road, Suite 1019
Wayne, PA 19087 USA
PH: 610-971-4850 | FX: 610-971-4859
www.fluidsealing.com

Founded in 1933, the FLUID SEALING ASSOCIATION® (FSA) is an international trade association. Member companies are involved in the production and marketing of a wide range of fluid sealing and containment devices primarily targeted to the industrial market. FSA membership includes a number of companies in Europe and Central and South America, but is most heavily concentrated in North America. FSA members account for a majority of the manufacturing capacity for fluid sealing and containment devices in the Americas market.

FONDA PUMPS

3147

No. 171-5 Honghui Road, Yuhong district
Shenyang, Liaoning 110141 China
PH: (+)008689362243 | FX: (+)008689362260
www.fondapumps.com

Fonda Pump is a professional centrifugal pump manufacturer, which specializes in designing, manufacturing and servicing of API 610 pumps and components for oil and gas, heavy chemical industries. We are devoting ourselves in the most qualified API 610 pump and non-API pump fabrication and best solutions to our clients all over the world.

FRAMO AS

1106

P.O. Box 23
Florvagvegen, NO-5329 FLORVAG Norway
PH: (+)4748040040 | FX: (+)47999380
www.framo.com

Framo AS is a pump manufacturer based in Bergen. The company was founded in 1938 and is now a worldwide organisation 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

5710 Mellon Road
Export, PA 15632 USA
PH: 724-387-3253
www.fs-elliott.com



1741

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.

FUSION INC.

2040

6911 Fulton
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PH: 713-691-6547 | FX: 713-699-1003
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.

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G.J. OLIVER, INC.**3119**

50 Industrial Road
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 PH: 908-454-9743 | FX: 908-454-0927
www.gjoliver.com

G.J. Oliver is a supplier for engineered rotating machinery packaging and auxiliary support systems including lube, seal, dry gas seal, steam conditioning, water cooling and injection wash systems, ASME/PED Code vessels and piping. Also we provide custom steel fabrications and machining for baseplates, machinery components including casings, columns, heads, impellers, shrouds, inlet guides, diaphragms, bearing housings & related.

GAS & AIR SYSTEMS, INC.**1735**

1304 Whitaker Street
 Hellertown, PA 18055 USA
 PH: 610-838-9625 | FX: 610-838-9650
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**1602**

15814 Champion Forest Drive, Ste 409
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www.gascompressionmagazine.com

Gas Compression Magazine provides in-depth coverage of the products, systems, technologies, and news that affect the global gas compression industry. Upstream, midstream, and downstream, Gas Compression Magazine is your source for gas compression news and information. Published monthly, Gas Compression Magazine is delivered to the people who manufacture, maintain, purchase, package, and teach gas compression products and systems. Offered in print and digital formats, readers can choose their preferred delivery method (or both!). Free to subscribe and free to renew, sign up today at www.gascompressionmagazine.com.

GBS CASTING

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GBS casting is THE choice for all of your OEM technical cast and ductile iron parts. We manufacture the highest quality cast and ductile iron parts up to 2.5 tons and in varying quantities. We take complete control of pattern and fixture design and manufacture so we control lead times. We serve the engine, pump, valve, alternator, and printing press industries and will add to that list. ISO 9001, TS 16949.

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2217

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GEA's proven, world-class process refrigeration and gas compression solutions include screw compressor packages, chiller systems, condensing units, shell & tube heat exchangers, pressure vessels, and controls. Our expertise also extends to disk-stack and decanter centrifuges, as well as gas jet compressor systems. GEA prioritizes value and functionality throughout the lifecycle of its products and service support includes parts as well as predictive & preventive maintenance. Talk with us to learn why industry-leading companies worldwide choose GEA, and how we can meet your process-critical requirements. Booth #2605, by the Attendee entrance. GEA - engineering for a better world.

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2925

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General Atomics Electromagnetic Systems compact, integrated direct drive permanent magnet generators and modular, adjustable speed drive systems offer greater energy efficiency, measurable energy savings, and lower maintenance requirements to ensure reliable performance and reduced operating costs. Our generators connect direct to gas turbines, pumps and compressors, eliminating the need for auxiliary gearboxes.

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2740

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PH: 210-262-2213
www.gpps.global

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2643

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www.gore.com/turbinefilters

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1640

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GRAHAM CORPORATION

1718

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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 (over 80 years) of top-quality, reliable products, and high standards of customer service. Sold either as components or complete systems, the principal 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.

GRAPHITE METALLIZING CORP.

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PH: 914-968-8400
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1216

GRAPHALLOY, a graphite/metal alloy from Graphite Metallizing Corporation, is a uniform, solid, self-lubricating bushing and bearing material for pumps that permits dry starts, survives frequent loss of suction, reduces vibration and extends pump life for continuous service. GRAPHALLOY's unique non-galling and self-lubricating properties enable a pump to handle fluids and survive upsets that would seize a metal fitted pump. Graphalloy is normally supplied in finished form and can be installed without additional machining. Graphite Metallizing has over 100 years of experience solving the toughest bearing problems. Most of our products are custom designed to unique requirements of the specific application.

GULF COAST BEARING & SEAL INC.

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Houston, TX 77075
PH: 281-822-0313 | FX: 281-481-4809
www.gcbsinc.com

3015

While Gulf Coast Bearing & Seal (GCBS) may be a new name to some, our team is not new to the rotating equipment industry. We have assembled an experienced management and engineering team with over 125 years of experience to support your babbitted bearing and labyrinth seal needs for your critical rotating equipment. We specialize in the design, manufacture and repair of all types of babbitted bearings and labyrinth seals including Thermoplastic seals to increase your machines efficiency.



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1944

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3040

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1505

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Hammelmann manufactures extremely compact 3, 5 and 7 cylinder pumps for injection service with input capabilities up to 1500HP. The latest variation of this pump series is the "Zero Emission Pump" where the pumped fluid is hermetically sealed within the pump, preventing leakage to atmosphere during operation. Hammelmann pumps produce maximum performance from a minimal footprint which is the result of combining a compact integral speed reduction gear end with the concept of a vertical configuration. The vertical configuration channels oscillating forces directly downwards into the base structure. Unwanted lateral oscillations as produced by horizontal pumps do not occur.

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2919

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PH: (+)8618072820188 | FX: (+)8657185780250
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 POWER SYSTEMS

2946

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Changwon-si, Gyeongsangnam-do 51542 Korea
PH: (+)827071474085
www.hanwhapowersystems.com

Hanwha Power Systems (formerly Hanwha Techwin) is a one of the fastest growing companies in turbo machinery industry. As a total energy solution provider, Hanwha Power Systems is expanding the business globally pursuing its world-leading technology and commitment to quality. Based in South Korea, we have overseas offices in China, Italy, Russia, UAE, and the US. Hanwha Power Systems mainly produces turbo compressors and develops innovative power generation system such as sCO₂(Supercritical CO₂) Engine and Oxy-fuel Gas Turbine.

HAYWARD GORDON

2816

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PH: 1-905-693-8595
www.haywardgordon.com

Hayward Gordon is manufacturer of heavy duty pumps and mixers

HENKEL CORPORATION

2915

One Henkel Way
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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.

1947

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PH: 281-443-0905
www.hermeticpumps.com

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

100 W. Fourth Street
Elmira, NY 14901 USA
PH: 607-733-7121
hilliardcorp.com



1500

Hilco, a division of The Hilliard Corporation, has been engineering and manufacturing filtration systems for Turbo-Machinery Equipment since 1925. Hilco filtration cartridges have superior dirt holding capacity and have continually outperformed its competitor's cartridges. Some of the company's systems include Oil Mist Eliminators with an efficiency rating of 99.97% at .03 micron, Lube Oil Conditioners, Duplex/Simplex Filters, Transfer Valves with zero leak pads, Process Equipment, Patented Dry Resin Ion Exchange, Varnish Prevention/Removal equipment as well as Engine Starting systems. Hilco welcomes your most challenging filtration needs.

HITACHI / SULLAIR

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MI City, IN 46360 USA
PH: 800-785-5247
americas.sullair.com



2617

Hitachi and Sullair will both be featuring their respective centrifugal compressor product lines. The Hitachi product line includes vertically and horizontally split compressors; pipeline compressors; and overhang compressors. Hitachi compressor clients benefit from many technological features, including in-house design automation (CAD) system, high performance and high efficiency impellers and vaned diffusers, and sophisticated rotor dynamics analysis and high pressure compressor design. Sullair provides a broad range of centrifugal compressor options in both packaged and custom configurations. The Sullair lineup includes products up to 118,000 scfm with discharge pressures up to 725 psig – all providing oil free air.

HOERBIGER COMPRESSION TECHNOLOGY

2211

1358 West Newport Center Drive
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PH: 954-422-9850
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 our two locations in the Houston area La Porte, and Sam Houston Beltway North west: rebuilds, rerates, overhauls, reciprocating and centrifugal compressors. Offering to our clients the latest technology developed for gas the gas compression market for reliability, safety, and performance in the equipment.

HOOSIER PATTERN

1123

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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

2035

8150 Lawndale
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PH: 713-928-6200 | FX: 713-928-2903
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, gear-boxes, 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

1527

900 West Mount Street
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PH: 800-557-6687 | FX: 765-827-9317
www.howdenroots.com

Howden is a global company that brings the innovators and developers of the world's most advanced compressor, fan, and heater 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.

HUANGSHAN RSP MANUFACTURING CO., LTD.

1103

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PH: (+)865592567755 | FX: (+)865592568248
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.

HY-LOK USA

2601

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PH: 832-634-2000
www.hylokusa.com

Hy-Lok USA, Inc. is the American master distributor of Hy-Lok Corporation, a global industry leading provider of valve and fitting solutions.

HY-PRO FILTRATION

3112

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PH: 317-849-3535
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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.

HYDRAULIC INSTITUTE

1213

6 Campus Drive, First Floor North
Parsippany, NJ 07054 USA
PH: 973-267-9700 | FX: 973-267-9055
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.

HYDROCARBON PROCESSING

3102

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Houston, TX 77046 USA
PH: 713-529-4301 | FX: 713-525-4655
www.hydrocarbonprocessing.com

Hydrocarbon Processing provides technical insight and market information for the global refining, petrochemical and gas processing industries. Since 1922, Hydrocarbon Processing's in-depth technical articles and data products have been a trusted resource for successive generations of engineers and management professionals. For more information, visit Hydrocarbonprocessing.com.

Gas Processing is the first publication devoted solely to the global natural gas processing industry. Gas Processing covers the latest process technologies, equipment, operations, maintenance, regulations, market and environmental trends related to midstream gas processing and distribution infrastructure, as well as LNG and GTL. For more information, visit Gasprocessingnews.com

HYDROTEX DYNAMICS

1227

6320 Cunningham Road
Houston, TX 77041 USA
PH: 713-937-9001
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

2641

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

IDEAL ELECTRIC (FORMERLY HYUNDAI IDEAL ELECTRIC CO.)**2512**

330 E First Street
Mansfield, OH 44902 USA
PH: 409-522-3611
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, TX, returning the company to private ownership and marking the next chapter in the more than 114-year history of the Company.

IMI SENSORS**2721**

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www.pcb.com/imi-sensors

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.

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1441

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We are your source for all things Engineering, whether your projects is a basic need, minor modification to an existing process or any scope in between, Impac System Engineering (ISE) is capable of providing the engineering, drafting and project services you need. Impact System Engineering stronger asset is our reputation for providing quality services, understanding client needs, our commitment to developing creative, innovate and responsible solutions to a wide variety of project challenges.

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1600

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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.

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1504

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PH: 904-655-1082 | FX: 386-267-3149
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.

1627

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PH: 704-655-4000
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.

2227

INPRO/SEAL

4221 81st Ave W
Rock Island, IL 61201 USA
PH: 309-787-4971 / FX: 309-787-6190
info@inpro-seal.com
<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.

INTEGRATED TURBOMACHINERY

2440

7411 Telegraph Road
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PH: 323-726-5200 | FX: 323-726-5206
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.

INTERTEK

3211

16441 Space Center Blvd., Suite D-100

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We use state of the art hardware and software to provide 3D measurement data allowing for comprehensive delineation of physical objects. With accuracies in the thousands of an inch we service companies involved in a variety of industries including aerospace, automotive, casting and forging as well as oil and gas, injection molding, medical, chemical and power generation.

ISOMAG CORPORATION

1634

11871 Dunlay Avenue

Baton Rouge, LA 70809 USA

PH: 225-752-0926

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.

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3111

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www.gouldspumps.com

ITT Industrial Process (IP) is a dynamic business expanding on a global scale. Headquartered in Seneca Falls, NY, 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.

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PH: 215-855-8450
itwperformancepolymers.com

ITW Performance 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.

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JIANGSU SMART SPECIAL VALVE CO., LTD.**1016**

No. 489, Xiangjiang Road

Haimen, Jiangsu 226114 China

PH: (+)8651382226887 | FX: (+)8651382226887

www.jssv.com.cn

Jiangsu Smart Special Valve Co., LTD. is a special valve solution provider in China, specialized in research and development, manufacturing, sales and service of process-specific valve, severe condition application valve. Possessing advanced casting production line, we provide various precision casting and processing services.

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Xinfeng Industry Park

Jiaxing City, Zhejiang 314005 China

PH: (+)86057383128822

www.cnyayida.com

Jiaxing Yayida Special Steel Casting Co., Ltd, adopts medium temperature wax, silica sol investment casting process.

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Compressor blade, diaphragm and other parts manufacturer for Gas & Steam Turbine, various compressors and turbo machinery.

1935

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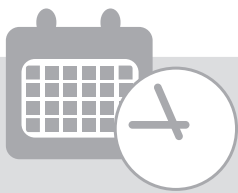
John Crane is a global leader in rotating equipment solutions, supplying engineered technologies and services to process industries. The company designs and manufactures a variety of products including mechanical seals and systems, couplings, filtration systems and predictive digital monitoring technologies.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

1848

JOY INDUSTRIES (DALIAN) CO., LTD.

156 Jinma Road DDA
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PH: (+)8641188173946
www.joydalian.com

From 2002, we established the machining factory and surface treatment factory in Dalian, and then we became the shareholder of the investment casting foundry. We have staff around 136, and we take the building area about 8000 square meters. We have the ISO9001 certificate since 2007, and ISO14001 certificate since 2013.



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PAGE 14

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Section for more information

TPS

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www.kaydonringandseal.com

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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.

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2047

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17625 El Camino Real, Suite 412
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www.knighthawk.com

KnightHawk Engineering (KHE) is a specialty engineering company that performs consulting, field services, expert witnessing, customized testing and product design and implementation services worldwide. KHE has been in business since 1991 and has been asked to solve some of the most challenging problems in many different industries.

2501

KOBELCO COMPRESSORS AMERICA, INC.

1415 Louisiana St, Suite 4111
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PH: 713-655-0015 | FX: 713-982-8450
www.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.

1234

KRAL-USA, INC.

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www.kral-usa.com

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.

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1406

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PH: 201-461-0900
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.A. TURBINE

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PH: 661-294-8290 | FX: 888-674-6503
www.LATurbine.com

L.A. Turbine (LAT) delivers custom turboexpander design, manufacturing and testing of application-specific, highly engineered turboexpanders used in hydrocarbon processing, geothermal power generation, industrial power recovery or refrigeration applications. A new offering is ARES, the industry's first standard turboexpander-compressor configuration with either oil or active magnetic bearings. LAT also provides aftermarket field service, equipment repair and redesign, and spare parts for all OEM turboexpander brands. A global field service team provides diagnostic, maintenance and consultative support 24/7/365 onsite and remotely via +1-855-FX-TURBO. LAT's world headquarters and manufacturing is in Valencia, CA. Service centers are in CA and Belgium, LAT's European headquarters.

1620

LANCER SYSTEMS

2800 Milford Square Pike
Quakertown, PA 18951 USA
PH: 610-973-2600 | FX: 610-973-2601
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.

3116

LEISTRITZ ADVANCED TECHNOLOGIES CORP.

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Allendale, NJ 07401 USA
PH: 201-934-8262 | FX: 201-934-8266
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.

1241

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1111

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

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PH: 912-466-0304 | FX: 912-466-0086
www.lobepro.com

1136

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.

LONE STAR BLOWER

1100 LA Street
South Houston, TX 77587 USA
PH: 832-532-3112 | FX: 832-532-3115
www.lonestarblower.com

3236

Lone Star Blower, Inc. is a manufacturer, packager, and service company for blower and blower control systems with representatives located throughout North and South America and beyond. Products offered include gear driven single-stage turbo blowers with variable inlet and discharge guide vanes, gearless (high speed) turbo blowers, and vertically split multistage turbo blower technologies.

Industries served include Water and Wastewater, Power, Petro-Chemical, Oil and Gas, Food and Beverage, Mining, and other industries using low pressure compressed air or gas in pressure or vacuum applications. Our aftermarket group provides repair services on most other major brand blowers in addition to our own.

LUBE-POWER, INC.

1304

50146 Utica Drive
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PH: 586-247-6500 | FX: 586-247-6510
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.

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1826

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2534

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LUFTEX GEARS MANUFACTURING AND SERVICES

1107

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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 on site inspections, trouble shooting and complete over haul of all Major Brands.

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1408

P.O. Box 2044

Deer Park, TX 77536 USA

PH: 281-482-0034 | FX: 281-482-0075

The Luneta Corporation is a manufacturer of new and innovative lubrication accessories for all types of rotating equipment. The Condition Monitoring Pod is only their first of many innovations to come. Over the last 27 years, RCM Sales & Services, Inc. has been a distributor of products to the process industries in Texas, LA, and OK 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

1235

9401-Q Southern Pine Blvd.

Charlotte, NC 28273 USA

PH: 704-716-9044

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.

MACEK POWER & TURBOMACHINERY ENGINEERING

1813

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Friendswood, TX 77546 USA

PH: 281-993-3737

www.macekpower.com

Formed in 2003 and launched in 2007, Macek Power is an engineering and consulting firm based in the Houston, TX, USA vicinity. Services include: Power generation engineering with emphasis on the Rankine cycle and associated equipment specification, Steam turbine design and engineering, Turbomachinery consulting, Commissioning and field support, and Root cause failure analysis. Additionally, through a jointly owned manufacturing subsidiary, RIMAC Precision Machining, Macek Power supplies steam turbine and axial compressor blades to various repair facilities.

2911

MACHINE SAVER INC.

9788 Clarewood Dr, Suite 302
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PH: 832-581-9908
www.machinesaver.com

Machine Savers IoT wireless and wired machine protection and condition monitoring solutions. We supply automated machine conditioning monitoring software. Our 3 axis and proximity probe 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 total 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.machinesaver.com

3237

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3218

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www.magseal.com

MagSeal has been producing sealing devices for over 60 years servicing the aerospace and industrial markets.

Our core competency is providing sealing solutions for bearing housings and pump systems. The recent THM acquisition allows us to leverage the application of precision, large diameter components that will significantly strengthen our offering to our traditional aerospace and industrial customers.

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1845

MAN Energy Solutions enables its customers to achieve sustainable value creation in the transition towards a carbon neutral future. Addressing tomorrow's challenges within the marine, energy and industrial sectors, we improve efficiency and performance at a systemic level. Leading the way in advanced engineering for more than 250 years, we provide a unique portfolio of technologies. Headquartered in Germany, MAN Energy Solutions employs some 14,000 people at over 120 sites globally. Our after-sales brand, MAN PrimeServ, offers a vast network of service centres to our customers all over the world.

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3225

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PH: 979-845-3489 | FX: 979-458-1493
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)

3223

005B Fermier Hall
3367 TAMU
College Station, TX 77843-3367 USA
PH: 979-458-5083
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.

1815

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2801

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19475 Gramercy Place
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www.mayekawausa.com

Mayekawa's gas compressors can handle a wide range of petrochemical industry gases including hydrogen, helium, carbon dioxide; raw material gases including vinyl chloride, methyl chloride; active gases including chlorine, hydrogen chloride, hydrogen sulfide; gas mixtures and VOC and associated gases from refinery processes. MYCOM gas compressors' performance and reliability have been proven over and over in petrochemical, oil and gas projects around the world. Our gas compressors are applied to various fuel gases for power generation and recovering oil, hydrocarbons and raw material gases contributing to energy-saving and environmental sustainability

2321

MECHANICAL REPAIR & ENGINEERING, LP

202 N 18th
PO Box 1542
La Porte, TX 77571 USA
PH: 281-471-1061
www.mreinc.com

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.

MECHANICAL SOLUTIONS, INC.

2341

11 Apollo Drive
Whippany, NJ 07981 USA
PH: 973-326-9920
www.mechsol.com

MSI's reputation is founded on its ability to solve difficult rotating machinery problems using specialized testing and analysis techniques such as vibration, strain, dynamic pressure, operating deflection shape (ODS), experimental modal analysis, and motion amplified video (VibVue™). MSI provides complete machinery and component development services, mechanical and fluid dynamic analysis services, and foil (gas) bearing designs and products. Computational tools regularly utilized by MSI include CFD, FEA, and rotordynamics analysis packages. MSI's years of machinery experience have been leveraged to develop and support its physics-based Sentry® Diagnostic Advisor system and Envision Motion's VibVue™ motion amplified video product.

MEGGITT (VIBRO-METER®)

136 Harvey Road, Suite A9
Londonderry, NH 03053 USA
PH: +1 603-657-2519
www.meggittsensing.com/energy

MEGGITT 2418

Meggitt, with the Vibro-Meter products and solutions, is a world leading provider of high performance sensing and condition monitoring solutions to the Oil & Gas and Power Generation industries. Our systems monitor rotating equipment from gas, steam, hydro turbines and generators to motors, compressors, and fans. Our solutions consist of our high-performance sensors, monitoring and protection systems such as the VM600 and VibroSmart®, all managed and operated using VibroSight® – fast and user-friendly software with exceptional data handling and visualization capabilities. Visit our booth to learn how our products and services can help you achieve better outcomes.

MERIDIAN EQUIPMENT, INC.

1810

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PH: 713-991-5100
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.

METRIX INSTRUMENT COMPANY**1835**

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PH: 281-940-1748 | FX:
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With more than 50 years of service, Metrix is the preferred supplier of industrial vibration monitoring systems and services to many of the world's leading manufacturers and users of cooling towers, gas turbines, generators, pumps, motors, fans, reciprocating compressors, and other rotating machinery. With headquarters in Houston, Texas, we operate in more than 50 countries via factory-direct sales and service professionals, along with a strategic network of instrumentation partners.

MIBA INDUSTRIAL BEARINGS/TCE**3053**

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Miba Industrial Bearings formerly Turbo Components and Engineering/John Crane Engineered Bearings. We specialize in the design, repair and replication of babbbitted bearings and labyrinth seals for critical rotating equipment.

MID-AMERICA MACHINE INC.

1814

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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

2525

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PH: 832-710-4700
www.mhicompressor.com/en



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

1222

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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.

1321

MOMENTUM ENGINEERED SYSTEMS, INC.

8305 Monroe Rd
Houston, TX 77061 USA
PH: 832-804-7424 | FX: 832-804-9891
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.

3220

MSC SOFTWARE CORPORATION

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Newport Beach, CA 92660 USA
PH: 714-540-8900
www.cradle-cfd.com

MSC Software develops simulation software technology that enables engineers to validate and optimize their designs using virtual prototypes. Our CFD solutions are characterized by their user-friendly interfaces, high accuracy, and high efficiency. Customers in almost every part of manufacturing use our software to complement, and in some cases even replace the physical prototype "build and test" process that has traditionally been used in product design.

NANOPRECISE SCI CORP

#211, Advanced Technology Centre
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PH: 780-680-2693
www.nanoprecisesc.com



3149

Nanoprecise is Canadian company with a patent-pending predictive analytics system that is based on the latest advancements in vibration analysis algorithms, and high precision sensors based on nanotechnology. VibrationLF uses low-cost wireless sensors that can be installed without interrupting plant operations. The sensors provide near real-time data to the Nanoprecise servers which analyze and interpret vibration signals to provide health information and a highly accurate time to failure for each piece of equipment. Nanoprecise can import vibration data from existing DCS systems limiting the need to install new sensors on equipment already being monitored.

NATIONAL COMPRESSOR SERVICES

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

1000

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

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1007

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 United States.

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www.pumps.netzsch.com

NETZSCH Pumps North America, LLC is the North American subsidiary of the operating group of NETZSCH companies. For over six decades NETZSCH has been manufacturing and supplying NEMO® Progressing Cavity Pumps and TORNADO® Rotary Lobe Pumps (Classic T1 version and T2, the most technologically advanced RLP market wide), NOTOS™ Multiple Screw pumps, macerators/grinders, metering systems, mobile pumps and accessory equipment for custom and challenging applications. NETZSCH's markets include Oil & Gas Upstream, Oil & Gas Downstream, Chemical, Pulp & Paper, Environmental & Energy, Metering Technology and Food & Pharmaceutical (FDA, 3A, EHEDG). Our innovative, quality products are valued globally.

**NEUMAN & ESSER USA, INC. / NEAC COMPRESSOR
 SERVICE USA, INC.**
2335

1502 East Summitry Circle
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 PH: 281-493-2357
www.neuman-esser.com



NEUMAN & ESSER is a leading provider of reciprocating compressor solutions for the energy industry. More than 180 years of manufacturing heritage has positioned the company as one of the premier manufacturers, packagers and service providers of gas-separable, reciprocating compressors. As the OEM, NEUMAN & ESSER is responsible for the manufacturing, packaging, service and spare parts inventory of every compressor it delivers, giving customers the most integrated and efficient compressor solutions available. This combination of quality, performance, integration and expertise results in improved reliability, reduced business risk and a lower total cost of ownership.

NEW RESOURCES INDUSTRIAL LTD. (XIAMEN)**3137**

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NIDEC INDUSTRIAL SOLUTIONS

1713

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PH: (+)390264451
www.nidec-industrial.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.

NIDEC-KATO ENGINEERING

1715

2075 Howard Drive West
North Mankato, MN 56003 USA
PH: 507-625-4011 | FX: 507-389-4146
www.katoengineering.com

Founded in 1926, Kato Engineering employs about 360 people in its 245,000 square-foot facility in North Mankato, Minnesota. KATO designs and manufactures ruggedly constructed generators that can survive in the harshest environments. The KATO name has become synonymous with dependable and high-quality power generation worldwide.

Kato is a major supplier of high-wattage power generation to multiple global markets including hospitals, data centers, remote areas, the U.S. military, and oil and gas, to mention a few.

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1020

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Nidec Motor Corporation (NMC) is a leading manufacturer of commercial, industrial, and appliance motors and controls. The NMC product line features a full line of high efficiency motors, large and small, which serve industrial, residential, and commercial markets in applications ranging from agriculture, water treatment, mining, oil and gas, and power generation to pool and spa motors, air conditioning condensers, rooftop cooling towers, and commercial refrigeration. The company also manufactures motors, controls, and switches for automotive and commercial markets. For more information, visit our website.

NINGBO AUNCEN MACHINERY TECHNOLOGY CO.,LTD**2849**

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 Ningbo, Zhejiang 315195 China
 PH: (+)8657488464863
www.auteseal.com

Auteseal was founded in 1990. Since 1996, it has started to focus on high-quality metal parts of mechanical seals. Since 2006, we have developed new challenges. It manufactures mechanical constructions for chemical industry, petroleum and gas, electric power, food and sanitary, pharmaceuticals industry, Mining & Slurry, shipping industry, aircraft industry. Every day, Auteseal makes work-pieces according to customers' specific drawings not only large quantities, but also small quantities and single piece.

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www.nord-lock.com

The Nord-Lock Group is the world leader in bolt securing systems. Our products prevent loosening on critical bolted joints in the most extreme conditions. We safeguard human lives and customer investments with a combination of experience, expertise, and a wide range of products. Nord-Lock washers, Superbolt mechanical tensioners, and Boltight hydraulic tensioners are securing the world's most demanding applications today. Our products have documented success in every major industry and hold several certificates from independent institutes. Optimize your bolted connections. www.nord-lock.com

NRG ENERGY SERVICES**2252**

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2717

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3235

OILMAN MAGAZINE

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OILMAN Magazine - The Magazine for Leaders in American Energy. Honoring the proud history of the Oil & Gas industry and reporting the developing trends shaping the future of the industry.

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Omni Manufacturing is a heavy duty case company that creates custom foam inserts for equipment, parts, data communications networks and other sensitive tools.

OROS

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PH: 703-478-3204
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**

1420

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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.

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PERONI POMPE SPA

1134

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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.

PETASENSE

3117

2 N 1st St, 5th Floor
San Jose, CA 95113 USA
PH: 800-215-1485
www.petasense.com

Founded with a vision of making industrial machines smarter, Petasense is an Industrial IoT startup based in Silicon Valley. The company offers an end-to-end solution – comprised of a patent-pending wireless vibration sensor, cloud software and machine learning analytics – that helps with asset reliability and predictive maintenance.

Customers are able to monitor, assess and predict the health of their critical machines in real-time. This helps them reduce unplanned downtime and lower repair costs. Petasense's clients include industry leaders like JLL, C&W Services, Silicon Valley Power and Stanford University.

PETROPAGES

2825

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Webster, TX 77598 USA
PH: 281-316-0353
www.petropages.com

PetroPages is a full-service Industrial 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, and more. PetroPages maintains the most active industry-specific online directory.

PETROTECH, INC.**3001**

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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.

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PRIME PHOTONICS, LC

2818

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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.

PROFLOW PUMPING SOLUTIONS

1021

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www.proflow.co

ProFlow Pumping Solutions: The customer's pump company. A pump and seal distributor with a difference, ProFlow Pumping 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, we partner 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 Pumping Solutions also provides complete repairs, parts, support, and training programs on site or at one of their Texas locations in the Houston and Odessa areas.

PROGNOST SYSTEMS INC

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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.

PRUFTECHNIK

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www.pruftechnik.com

Pruftechnik, the makers of the ROTALIGN, OPTALIGN and PARALIGN systems, sets high standards in precision measurement to provide solutions for laser alignment, condition monitoring, ultrasound and non-destructive testing 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. Pruftechnik runs four offices in North America: Philadelphia, San Diego, Cleveland and Montreal (Canada).

PSC COUPLINGS

N56 W13855 Silver Spring Dr.
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PH: 262-290-1904
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.

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1013

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PUMPS & SYSTEMS MAGAZINE

1117

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www.pumpsandsystems.com

Celebrating its 25th anniversary in 2018, Pumps & Systems continues to provide the most comprehensive coverage of the pump industry worldwide. Our monthly magazine and digital edition connect 46,000 qualified, BPA-audited subscribers with technical solutions and informative case studies. The total monthly P&S audience has grown to more than 180,000, thanks to our active website and popular newsletters. Readers—regardless of the platform they choose—return to P&S again and again for the relevant news, market analysis, helpful how-tos and industry trends. Additionally, our effective webinar program provides an average of more than 500 high-quality leads for sponsors.

PUMPWORKS 610

1316

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PUMPWORKS INDUSTRIAL

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PVTVM, INC.

10200 West Airport Blvd.
Suite 170
Stafford, TX 77477 USA
PH: 713-830-7601
www.pvtvm.com

PVTVM Inc. was founded in 1996 in Houston Texas USA. PVTVM is a leading manufacturer of rotating and reciprocating machine condition monitoring and machine protection hardware, software and field services. Products manufactured include machine protection monitors, vibration switches, vibration transmitters (4-20mA or MODBUS). PVTVM also manufactures a complete line of proximity probes, accelerometers and piezo-velocity sensors. Software includes real time vibration and process information, trending, machine condition diagnostics, dynamic data, transient data capture. Services include vibration training, installation, start-up and commissioning assistance. PVTVM has complete machine monitoring solutions for critical steam/gas turbines, compressors as well as small pumps, motors and fans.

PYROMATION, INC.

5211 Industrial Road
Fort Wayne, IN 46825 USA
PH: 260-484-2580
www.pyromation.com



Pyromation is a top-tier manufacturer of temperature sensors in North America. The company began operations in 1962 and has become a world-class producer of thermocouples, RTDs, thermowells and sensor assemblies used in the power generation, oil & gas, chemical and other industries. A Lean enterprise, Pyromation specializes in developing and making custom sensor designs per customer specifications. Decades of sales and engineering experience allow Pyromation to provide solutions for any temperature sensor application. The company's design-patented general-purpose and XP-rated connection heads; variety of transmitters; FM, CSA and ATEX certifications; product quality and fast delivery ensure that Pyromation can meet any request.

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QUADRANT EPP

2243

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Reading, PA 19605 USA
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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 #2243 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.

QUEST ENERGY GROUP

3003

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12233 FM 529
Houston, TX 77041 USA
PH: 713-466-1890
www.ramalloys.com



2647

Ram Alloys is an ISO 9001:2015 certified stocking metals service center focusing on the rotating equipment and flow control markets (OEM and repair and maintenance). 100+ years of industry experience allows Ram Alloys to tactically build its stainless and nickel alloy round bar and PSQ inventory to effectively serve its target markets. Ram Alloys further leverages its expertise to offer customers several value-added services: (1) Centerless Grinding; (2) Boring, Honing, Trepanning; (3) Heat Treating – long lengths both horizontally and vertically; (4) Saw Cutting – custom lengths, production cuts, or blocks; (5) Inventory Management – JIT and Kanban; and (6) 24/7 Emergency Service.

RDI TECHNOLOGIES, INC.

10301 Technology Drive, Suite A
Knoxville, TN 37932 USA
PH: 865-256-0105
www.rdi technologies.com

1202

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.

REGAL

7120 New Buffington Road
Florence, KY 41042 USA
PH: 800-626-2120
www.regalbeloit.com

2135

Kop-Flex® couplings have been supplied to the global Oil and Gas Industry for over 30 years and have amassed billions of hours of reliable operation in API 671 and API 610 applications. The Kop-Flex brand's diverse product line, combined with unique Factory Recertification and Perceptive Technologies capabilities, can be leveraged to support increased uptime of customer and end user equipment. Milwaukee Gear manufactures custom steel gears, pinions and assemblies to Oil & Gas Industry leaders to exacting specifications. Be sure to visit Kop-Flex and Milwaukee Gear® at our booth. While there be sure to ask about how Regal® Power Transmission Solutions LifeCycle Services can support rotating equipment plant wide.

REINHART & ASSOCIATES, INC.

2417

13419A Immanuel Rd.
Pflugerville, TX 78660 USA
PH: 512-834-8911 | FX: 512-834-1266
www.reinhartassoc.com

Over the past 30 years Reinhart & Associates, Inc. (R&A) has provided independent inspections and remaining lifetime analysis services of gas and steam turbine units at power plants around the world. These inspections have used state-of-the-art nondestructive evaluation (NDE) techniques and equipment to obtain data to determine the integrity and remaining life of major turbine components including rotors, blading, retaining rings, etc. R&A has also provided the first NDE method or equipment available in the industry: first in-place remote video/eddy current NDE of L-1 turbine blades; and first independent NDE and life assessment of small bore generator rotors.

RELADYNE, LLC

1237

8280 Montgomery Road, Suite 101
Cincinnati, OH 45236 USA
PH: 513-489-6000
www.reladyne.com

RelaDyne, Inc., headquartered in Cincinnati, OH, is a leading supplier of comprehensive equipment reliability products and value added services. The company's long heritage in the Automotive, Commercial and Industrial markets brings more than 350 years of combined expertise to more than 10,000 clients, cementing its commitment to each and every customer to deliver value, dependable service and solutions based on a foundation of partnership as a true trusted advisor.

RELEVANT SOLUTIONS

2443

9900 Sam Houston Centre Drive, Suite 200
Houston, TX 77064 USA
PH: 888-858-3647
www.relevantsolutions.com

Businesses that rely on rotating equipment for the continued success of their operation are aware of the complexities associated with the selection of proper equipment and the ongoing challenges of sustaining a reliable, safe and efficient operation. Relevant Solutions is a comprehensive service and equipment provider that expertly supports compressors, dryers, blowers, vacuums and all associated products. Need a tailor-made solution? Our comprehensive engineering, design and project management team can provide custom configurations. We not only fabricate to meet your specifications, we create integrated solutions to meet the demands for any application. It doesn't end there, Relevant also provides rentals for you emergency, planned and long-term needs.

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EDM Service. We provide Wire, Ram, and Small hole EDM for production orders large and small. Large parts and High Quantities are our specialty. We have locations in Houston and Broussard, LA. We have over 80 EDM machines in operation. EDM questions?

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PH: (+)004982157000 | FX: (+)498215700460
www.renk.eu



RENK Drive Technology for the Power Generating Industry: - High speed gear units for generator drives up to 250 MW, for generators and blowers -Variable speed drives up to 20 MW - Windmill drives up to 10 MW - Planetary gears for cooling water pumps up to 30 MW - Epicyclic gears for water power turbines up to 20 MW - Epicyclic gears integrated in electric machines - Self synchronising clutches for marine applications and power generation up to 300 MW - Turn drives with self synchronizing clutches Gear, flexible disk and diaphragm couplings - Hydrodynamic and hydrostatic bearing solutions, especially for electric machines - Revamp of existing equipment

REVAK KEENE TURBOMACHINERY, LP

12204 W. Fairmont Parkway
LaPorte, TX 77571 USA
PH: 281-427-8800 | FX: 281-474-0561
www.revakkeene.com



Revak Keene Turbomachinery LP, a full-service sales and repair facility in LaPorte, TX, offers a large inventory of all brands of steam turbines and associated parts. Its machine shop, bearing shop, weld shop, mechanic shop, pump shop, field service, and balance departments are operated by some of the most experienced personnel in the industry. Surplus turbines, gearboxes, Woodward TG/PG style governors, and Revak Series II Lube Pumps are inventoried and repaired. Owners, Lynn Revak and Lendell Keene, have a worldwide reputation for knowledge in this field and for quality parts, repairs, and re-rates at reasonable prices and quick delivery times.

1722

1851

1518

REXA, INC.

2143

4 Manley St.
West Bridgewater, MA 02379 USA
PH: 508-584-1199
www.rexa.com

REXA Electraulic™ Actuation offers unmatched accuracy, repeatability, and speed of response, allowing plants to optimize control of their rotating equipment while maximizing uptime and throughput. REXA technology is self-contained eliminating the requirement for a hydraulic power unit and problematic servo/proportional valves. REXA Applications on Rotating Equipment include: - Steam Turbine Governor Control - Extraction Valve Control - Compressor Inlet Guide Vane - Antisurge Valve - Hot Bypass Valve - GT Fuel Control Valve - Water/Steam Injection Valve.

REXNORD INDUSTRIES, LLC

3021

4701 W. Greenfield
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PH: 414-935-9700
www.rexnord.com

Rexnord Power Transmission (PT) keeps industry moving with a broad portfolio of products including gear drives, bearings, couplings, industrial chain, and a wide range of conveyor components. Rexnord products and services enhance the reliability of equipment used worldwide, supporting industries such as transportation, mining, energy, food & beverage. Our expertise and focus on customer service ensures that you have the right solution when you need it.

RF SYSTEM LAB

1307

13919 S. West Bay Shore Drive, Suite 207
Traverse City, MI 49684 USA
PH: 231-943-1171 | FX: 989-688-5966
www.rfssystemlab.us

RF System Lab is a worldwide leader in remote visual inspection and video borescope technology. Makers of leading edge, fully (360°) articulating, video borescopes like the innovative VJ-Advance; available in 2.8mm, 3.9mm, or 6.9mm insertion tube diameters. The VJ-Advance delivers the ideal features sought after by industry professionals. RF System Lab offers an industry-first no obligation demo program to allow companies to test the VJ-Advance on an inspection at their facility, for free.

RILEY GEAR CORPORATION

3046

One Precision Dr.
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PH: 904-829-5652
www.rileygear.com

Manufacturer of gears, precision gears, splines and gear boxes.

RIVERHAWK COMPANY

2119

215 Clinton Road
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PH: 315-768-4855
www.riverhawk.com

Riverhawk Company is a custom design engineering and manufacturing firm with over 400 years of engineering experience. Riverhawk core products originate from designs developed to solve specific customer issues when standard products could not meet the demand. Riverhawk engineered solutions have focused on fastening systems, rotational power transmission issues and shaft solutions across several industries. Riverhawk provides solutions to daily problems that most of the competition wouldn't even consider.

ROC CARBON COMPANY

2115

1605 Brittmoore Road
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PH: 713-468-7743 | FX: 713-465-2158
www.roccarbon.com

ROC manufactures carbon/graphite, metal, PTFE, PEEK, custom-seals (segmented, labyrinth etc), bearings, and high-compression wear parts for compressors, turbines, centrifugal pumps, industrial fans, blowers. ROC supplies parts to OEMs, industrial repair companies, end-users (refineries, petrochemical, power plants). ROC's engineering support includes capability to design/modify seals, meeting individual customers sealing application. ISO 9001:2008.

ROCHEM TECHNICAL SERVICES, USA, LIMITED

1312

4711 SW Huber Street, Suite 7E
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Rochem designs, manufactures, installs compressor cleaning systems for all gas turbine/process compressors. Includes nozzle/manifold assemblies, pneumatic/automatic delivery skids, chemicals, performance enhancing systems.

RODYN VIBRATION ANALYSIS

2250

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PH: 434-326-6797
dyrobes.com

Rodyn Vibration Analysis sells and supports Dyrobes rotordynamics software.

ROOTS SYSTEMS, INC

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2111 Welch St. A315
Houston, TX 77019 USA
PH: 832-833-5813
www.roots-blowers.com

Manufacturer of Rotary Compressor, Vacuum Booster and Process Blower packages

ROPER TECHNOLOGIES, INC.

1835

4725 121st Street
Des Moines, IA 50323 USA
PH: 515-270-0857
www.cccglobal.com

Roper is a diversified technology company that provides engineered products and solutions for global niche markets. Compressor Controls Corporation (CCC) and Metrix are part of Roper's Energy Systems and Controls group. CCC is a leading supplier of turbomachinery control solutions. Visit our webpage at www.cccglobal.com to learn about the solutions we offer that service your total train. Metrix Instrument Co. has been providing machinery condition monitoring solutions for more than 50 years. Learn more about our vibration monitoring products at www.metrixvibration.com. Please join us at booth #2111.

ROTATING EQUIPMENT REPAIR

2146

7721 Thomson Street
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PH: 281-485-2400 | FX: 281-485-2406
www.specialtyrer.com

Specialty Rotating Equipment Repair, Inc., DBA Rotating Equipment Repair provides comprehensive repair, refurbishment, and maintenance on rotating equipment to the petrochemical and refining industry of the Houston and entire Gulf Coast area, as well as OK, New Mexico and Kansas. RER has become one of the primary non-OEM providers of turbine and pump repair, while offering trustworthy, reliable and efficient solutions to problems on all types of rotating equipment.

ROTATING MACHINERY SERVICES, INC.**2427**

2760 Baglyos Circle
 Bethlehem, PA 18020 USA
 PH: 484-821-0702 | FX: 484-821-0710
www.RotatingMachinery.com

Rotating Machinery Services (RMS) was established in 1998 with the vision to reinvent the concept of an aftermarket turbomachinery business. The goal was to provide Turbomachinery operators with unparalleled service based on established relationships, solid engineering and technical expertise—all backed by responsiveness in competitive prices and lead times.

RMS Specializes in:

- Axial & Centrifugal compressors
- Gas, Steam, & Power turbines
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RMS is your OEM provider for AC Compressor axial, centrifugal, and oil free screw compressors as well as CONMEC axial and centrifugal compressors. Visit rotatingmachinery.com to learn more.

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Roth Pump is the leading developer and manufacturer of LOW NPSH regenerative turbine pumps. For over 85 years Roth has been handling high head (up to 3200 feet/975 M TDH), low flow (up to 150 GPM/34 M3/H) boiling point liquids. Use of Roth ONE FOOT /0.30 METER LOW NPSH pumps, significantly reduces required tank height which lowers design and construction costs. Roth Pump boiler feed, deaerator, condensate return systems handle water at 212°F/100°C, 250°F/121°C, 350°F/177°C and 400°F/204°C, which result in substantial energy savings.

ROYAL PURPLE SYNTHETIC OIL**1538**

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 PH: 281-354-8600
www.royalpurple.com

Royal Purple manufactures high performance lubricants for most automotive, industrial, marine, motorcycle and racing applications. It is considered the best synthetic oil by many end users. Royal Purple synthetic oil and synthetic lubricants are formulated to maximize performance in real world applications.

RPM SERVICES, INC.**2746**

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 PH: 281-595-3165 | FX: 713-513-5410
www.rpm-services.com

Shop and Field Rotating Equipment Installation and Repair

S&R CONTROLS**3100**

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www.PanelsbySR.com

S&R Control's designs, manufacturers, and commission's custom control panels for industrial machine builders. We provide reliable products for solving our client's specific automation challenges. S&R Control's products are designed for reliability, simplicity, and efficiency. With over 20 years of experience, our basis of doing business has never changed – build long-term relationships based on trust and respect while making sure the quality and reliability of our products exceeds our clients' requirements. Our business philosophy has resulted in many long-term relationships with satisfied clients. S&R Controls – Making automation easy.

S2W CONTRACTING LLC**2943**

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 Clarks Summit, PA 18411 USA
 PH: 570-836-8362
www.s2wcontracting.com



We provide alignment, leveling, commissioning, installation, overhaul and maintenance of all kinds of turbomachinery. Foundation repairs, grouting and construction services.

SAMCO ENTERPRISES, INC.**2812**

16115 Aldine-Westfield
 Houston, TX 77032 USA
 PH: 281-443-6505
www.samcoenterprises.com

SAMCO specializes in the repair, sale and manufacture of reciprocating compressor valves and parts. We also have an extensive inventory of compressor parts, cylinders, frames and much more. We are an American-owned company based in Houston with branch operations nationwide. This year, SAMCO celebrates 45 Years of Supporting American Energy

SCHENCK TREBEL CORPORATION

1834

535 Acorn Street
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PH: 631-242-4010
www.schenck-usa.com

Schenck Trebel has been making balancing machines for just about every industry since 1908! Anything that rotates, or is supported in bearings that allow it to rotate, needs balancing to ensure quality performance. Our products include horizontal and vertical machines with the sensitivity to meet the strictest API requirements, high-speed machines, spin-test systems and portable vibration analyzers and monitors. Our services include in-house balancing services, as well as on-site field balancing, and consulting services.

SCHNEIDER ELECTRIC

3006

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Webster, TX 77598 USA
PH: 281-709-1200
www.schneider-electric.us

Schneider Electric is the global EcoStruxure specialist in energy management and automation. EcoStruxure is Schneider Electric's IoT-enabled, plug-and-play, open, interoperable architecture and platform, in Homes, Buildings, Data Centers, Infrastructure and Industries. With revenues of ~€27 billion in FY2015, our 160,000+ employees serve customers in over 100 countries, helping them to manage their energy and process in ways that are safe, reliable, efficient and sustainable. From the simplest of switches to complex operational systems, our technology, software and services improve the way our customers manage and automate their operations. Our connected EcoStruxure technologies reshape industries, transform cities and enrich lives.

SCHUNK CARBON TECHNOLOGY

1037

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Zona Industrial Ocoyoacac.
Ocoyoacac, Mexico 52740 Mexico
PH: (+)527282847769
www.schunk-carbontechnology.com/en/

Schunk Carbon Technology leverages its international market-leading expertise in the development, manufacture and application of advanced materials and products of mechanical carbon, electrical carbon, technical ceramics, thermal carbon, composite materials and coatings. For the sealing, pump and compressor industry Schunk Carbon Technology produces highly specialized carbon, silicon carbides, composite materials and fiber-reinforced materials for seal rings, bearings, vanes, sleeves and other components. The high reliability of our materials combined with the inhouse application engineering help customers to increase the lifetime of their products for pharmaceutical, chemical, oil and gas industry as well as power plants, aircraft and marine markets.

SCOTT ROTARY SEALS

2851

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www.scottrotaryseals.com

With over 5 decades of experience in specialized fluid sealing applications and complete in-house production capabilities, SRS provides flexible and innovative solutions for a wide range of industries. With a narrow focus on rotary union, rotary timing valve, and Babbitt bearing technology, SRS delivers products with performance and precision that exceed industry standards. SRS also Specializes in design (including reverse engineering), production, and repair of precision tilting pad and fixed geometry Babbitt Bearings. Babbitt precision OEM bearings for high speed rotating equipment: compressors, turbines, gearboxes, electrical motors, and pumps.

SEAL & DESIGN INC.

1337

4015 Casilio Parkway
Clarence, NY 14031 USA
PH: 716-759-3355 | FX: 716-759-2222
www.sealanddesign.com

Seal & Design Inc. is a world-class manufacturing and distribution company registered to IATF 16949. We specialize in all types of sealing products include die-cut, digital and rotary cut gaskets, o-rings, spring energized rotary seals, molded rubber and many other engineered products for any sealing application. Our sales and design team will offer outstanding service to ensure complete satisfaction from design to production parts.

SES GLOBAL

2439

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Summit Staffing boasts over 30 years of experience filling positions for special projects and contracts, or as temp to perm. Because of a large pool of skilled labor and millwrights, Summit will supply the customer with quality personnel that will help the customer get the job completed efficiently. Tradesmen provided by Summit Staffing are of the highest quality, pre-screened, background checked, drug tested and safety course certified. Best of all, they are experts in their fields such as: Centrifugal and Reciprocating Compression Turbines 100Mw Steam & Gas Engines Electric Utilities Hydrocarbon Processors Co-Generation Facilities Wind Turbine/Energy

SETTIMA USA INC.

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PH: 630-812-1433
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Settima Meccanica designs and manufactures no noise hydraulic pumps from 40 years

SHACKELFORD-WATTNER

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www.swtcb.com

Shackelford-Wattner along with our sister company, Kile Industries, Inc., is conveniently located in the shadow of Houston's Hobby Airport and has been servicing the needs of the rotating equipment industry for over 50 years. Shackelford-Wattner and Kile Industries have earned a reputation for producing the highest quality products and services which include manufacturing, balance, inspection, repair, replacement, special fasteners, lapping tools, and plug/ring gages for all types of gear, disc, and diaphragm couplings. We take great pride in being able to provide quick, accurate, and complete support of couplings and coupling related products.

SHANLEY PUMP & EQUIPMENT

2525 S. Clearbrook Drive
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www.shanleypump.com

Shanley Pump is in suburban Chicago. We are a 40 year stocking supplier of positive displacement pumps for lube oil, fuel oil and hydraulic oil pumping applications and specialty centrifugal pumps. Our factory trained sales engineers offer immediate response to pump inquiries.

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Shell Lubricants offers an industry-leading package of premium products, engineering expertise and support services.

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1035

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Foshan City, Guangdong 528300 China
PH: (+)008675727881769 | FX: (+)008675727837097
www.shengye.com

Sheng Ye Electrical Co.,Ltd was founded in 1996, is a national high-tech enterprises, is a collection research and development, production, sales and after-sales service in one of the large-scale professional film capacitors and related electronics parts manufacturing enterprise. Covers an area of 30000 square meters, have more than 600 employees, possesses more than 40 national patents. Company products are widely used in household appliances, power factor correction system, industrial power electronics, new energy...etc industry. Sheng Ye capacitors have passed the united state UL, China CQC, Germany VDE, TUV and Canada CSA...etc quality certificates and ISO9001 quality system certificate.

SHIJIAZHUANG JINJIEBER LTD.

1503

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Shijiazhuang, China 50000 China
PH: (+)031187817196 | FX: (+)031187817196
jinjieber.com

Jinjieber supplies 3 to 30 inch Plug Valves, Butterfly Valves, Air Valves, Check Valves and fittings, all of which have been widely used in irrigation, fire protection, waterworks, infrastructures, oil fields, mining, and other industries. Through the combined efforts of our independently owned foundries, Jinjieber has the full capability of producing 50,000 tons of high quality metal products. In conjunction to our foundries, we also have manufacturing facilities that are in exclusive partnerships with our corporation; helping in our ability to provide the following manufacturing services independently: Prototyping Casting (Investment casting; Die casting, Sand casting) Forging Fabrication Finishing (anodizing, dyeing, etching, teflon coating, powder coating, precision grinding, plating, heat treating, annealing).

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1422

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Shijiazhuang Qinye Casting Co.,Ltd. specialized in casting and machining of OEM parts for pump, valve, electric motor manufacturers and other mechanical parts for various industries.

SHIN NIPPON MACHINERY CO., LTD.

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SIEMENS

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Siemens is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for more than 165 years. The company is active in more than 200 countries, focusing on the areas of electrification, automation and digitalization. One of the world's largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of efficient power generation and power transmission solutions and a pioneer in infrastructure solutions as well as automation, drive and software solutions for industry. In fiscal 2017, which ended on September 30, 2017, Siemens generated revenue of €83.0 billion and net income of €6.2 billion.

SIFCO ASC

5708 E. Schaaf Road
Independence, OH 44131 USA
PH: 800-765-4131
www.sifcoasc.com

SIFCO Applied Surface Concepts provide practical, cost-effective selective brush plating solutions to improve part performance and reduce manufacturing costs through corrosion protection, increased wear resistance, increased hardness, improved conductivity, anti-galling or slip. SIFCO ASC surface enhancement technologies and brush plating services have been utilised for over 50 years on both OEM components and on parts requiring refurbishment in the aerospace, oil and gas, general industry and power generation sectors.

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SIMERICS, INC.

1127

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PH: 425-502-9978
www.simerics.com

Simerics-MP+ CFD software (formerly PumpLinX) from Simerics, Inc. is an efficient and accurate tool that can be used to simulate and analyze a wide range of positive displacement machines (pumps and compressors), valves, motors, turbomachines and hydraulic systems. The complete time dependent three-dimensional CFD transport equations are solved and the predictions have been extensively validated with measurements.

Examples of Pumps include Gerotor, Crescent, Variable Vane, External Gear, Radial Piston, Bent Axis Piston, Progressive Cavity, Swash Plate Piston, Rolling Piston, Variable Flow Gear, Axial-Centrifugal etc. Compressors include Scroll, Lobe, Single Screw, Twin Screw, Rolling Piston, Reciprocating, Vacuum, Axial-Centrifugal etc. Valves include Spool, Control, Release, Ball, Poppet, Flip, Axial, Circumferential etc.

SKF MAGNETIC MECHATRONICS

2218

2 rue des Champs
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PH: 023-264-3323
www.skf.com

The SKF S2M Magnetic Bearing is a standard for Oil & Gas turbomachinery, with more than 1200 references in operation, and now having successfully pioneered the application to subsea natural gas compressors.

It allows oil free design of centrifugal compressors, high speed electric motors, turboexpanders and turbines. A highest reliability is achieved, powerful monitoring at user's disposal, and the concept avoids oil lubrication issues like acid gas dilution, clogging in heat exchangers, energy consumption, fire risk.

Turbomachinery with SKF S2M Magnetic Bearings is used in onshore and offshore, upstream to downstream, for natural gas treatment, transportation, storage, petrochemical production or power generation.

SKINNER POWER SYSTEMS

1522

8214 Edinboro Road
Erie, PA 16509 USA
PH: 814-868-8500 | FX: 814-868-5299
www.skinnerpowersystems.net

Skinner Power Systems, A Division of Time Machine Inc., and a manufacturer of single-stage steam turbines up to 3,000 HP and turbine generator packages up to 2 megawatts. Over 10,000 Skinner turbines have been built to drive pumps, fans, generators, compressors, sugar-mill shredders--to name just a few applications. The Skinner turbine's simplicity and dependability make it one of the most popular machines of its kind in the world. We also service all kinds of turbines, especially Skinner, Dean Hill, Wing and Manubat steam turbines since we built them over the past century. A Skinner Vertical Single-Stage Steam Turbine is displayed in the booth.

SOFTINWAY INC.

1500 District Avenue
Burlington, MA 01803 USA
PH: 781-685-4942
www.softinway.com

SoftInWay Inc. is a global engineering company specializing in the development of efficient turbomachinery. We offer extensive expertise through our training and consulting services along with our flagship software, AxSTREAM - for flowpath design, redesign, analysis, and optimization and AxCYCLE - for design and simulation of full thermodynamic cycle. Founded in 1999, SoftInWay has offices in the US, Switzerland, India, and Ukraine and supports over 300 companies worldwide including OEMs, EPCs, and other service providers in power generation, oil and gas, aerospace, defense, automotive, and clean tech sectors. We also work closely with universities, research laboratories, and government and defense.

SOHRE TURBOMACHINERY INC.

128 Main Street
P.O. Box 1099
Monson, MA 01057 USA
PH: 413-267-0590 | FX: 413-567-0592
www.sohreturbo.com



Sohre makes shaft grounding brushes to control stray electrical currents in electrical and non-electrical turbomachinery (compressors, Sohre brushes are useful for electrostatic, electromagnetic, or other electrically induced stray currents. The current rating of Sohre brushes ranges from 1 to 100 DC amperes per year of bristle life. Brushes utilize special alloy bristles and are run directly on shaft, either dry or in oil. Cleaning or maintenance generally is not necessary.

SOLAR TURBINES

P.O. Box 85376
San Diego, CA 92186-5376 USA
PH: 619-544-5352 | FX: 619-544-2633
www.solarturbines.com

Headquartered in San Diego, CA, USA, Solar Turbines, a subsidiary of Caterpillar Inc., is one of the world's leading manufacturers of industrial gas turbines and compressors, with approximately 15,000 units with more than 2.3 billion operating hours in more than 100 countries. Products from Solar play an important role in the development of oil, natural gas and power generation projects around the world. Solar's products include gas turbine engines, gas compressors, and gas turbine-powered compressor sets, mechanical-drive packages and generator sets.

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SOLBERG OIL MIST ELIMINATORS

2906

1151 Ardmore Ave
Itasca, IL 60143 USA
PH: 630-616-4411 | FX: 630-776-0727
www.solbergmg.com

Solberg designs and manufactures vacuum assisted and static oil mist eliminator systems to capture the vented emissions from turbine and compressor lube oil systems, and engine crankcases. Our systems protect the rotating equipment by preventing seal leakage and protect the surrounding environment by eliminating the oily emissions.

SOURCE PUMPS & SYSTEMS CO.,LTD.

1001

No.20 Changda Road
Dalian, Liaoning 116036 China
PH: (+)8641139023835
www.sourcepump.com

Source Pumps & Systems is concentrating on pump design and manufacture. Product comply with latest edition of API610, DIN, ANSI, ISO, etc.

SOUTHWEST IMPREGILON

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Applicators of High Performance Coatings for Industry to help solve the problems of Friction, Corrosion, Galling, and Non-Stick/Release, with capacity to handle the smallest of parts such as fasteners to the largest of parts, up to 90' risers supported by crane capacity of up to 50 tons. Located on the NE side of Houston we offer easy access to the airport as well as the freeway system.

SOUTHWEST RESEARCH INSTITUTE

2735

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San Antonio, TX 78238-5166 USA
PH: 210-522-5449
www.swri.org

Southwest Research Institute® (SwRI®) is an independent, nonprofit, applied research and development organization headquartered in San Antonio, TX, with nearly 2,600 employees and an annual research volume of more than \$528 million. For almost 70 years, SwRI has provided quick-response field consultation and design services to solve vibration, pulsation, and performance problems associated with plant machinery and piping systems. SwRI also provides turbomachinery services from concept design to full-scale testing.

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3005

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www.spxflow.com

2605

About SPX FLOW, Inc.: Based in Charlotte, North Carolina, SPX FLOW is a leading global supplier of highly engineered flow components, process equipment and turn-key systems, along with the related aftermarket parts and services, into the food and beverage, power and energy and industrial end markets. SPX FLOW has more than \$2 billion in annual revenues and approximately 8,000 employees with operations in over 35 countries and sales in over 150 countries around the world. To learn more about SPX FLOW, please visit our website at www.spxflow.com

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3142

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1027

Standard Alloys Inc., a KSB Company, is a full service solution provider offering replacement parts, repair and complete pump assemblies. Our factory and three repair centers are certified ISO-9001:2015 by DNV. Our services include custom engineered solutions designed by our engineering staff. These designs are supported with our in-house pattern shop, foundry and machine shop. We have the ability to pour over 300 alloys as well as develop custom alloys to fit your application. Parts manufactured at our Port Arthur, TX foundry are supported by our extensive machine shop, which allows us to offer quick deliveries.

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2435

Stein Seal Industrial Division is a world-class manufacturer of mechanical sealing systems. With over sixty years of mechanical seal Development, Engineering, Manufacturing, and repair service history. With strategic repair and development centers, Stein is uniquely positioned to service the needs of the turbine, compressor, petrochemical and heavy industries market segments.

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1203

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Stronghold Coating Systems is a Polymer coating manufacture that develops special coating for industrial and military applications. We have two coatings that are military approved and a third on test at NAVSEA. These coating vary from sprayed thermoplastic, sealer for pump castings and special interior coatings for pumps.

STRUCTURAL

2800

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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.

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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.

2947

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PH: (+)81676353662
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.

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2442

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Manufacturer of synthetic lubricants, greases, descalers, degreasers, and oil/water separators. Major Markets: Air Compressors, Pumps, Food Grade, Refrigeration, Refining and Petrochemicals.

1601

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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.

1205

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SPOUSE PROGRAM

TPS

PAGE 9

Please go to page 9 in
the Introduction Section
for more information.

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Tacmina manufactures Smoothflow diaphragm pumps with a unique set of features to support difficult pumping applications such as abrasive slurry, shear sensitive material, solvent-based and aggressive chemicals and for applications where the smooth, pulse-free transfer of fluids is required. Tacmina Smoothflow pumps feature a seal-less design to eliminate air or contaminants from entering the system, are extremely accurate and are easy to clean and maintain. Tacmina Smoothflow pumps are widely used in slot die coating, chemical production and food and pharmaceutical manufacturing applications.

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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 provide machining and repair services for Power Generation, Aero Space, Oil & Gas, and many other industries. We are ISO 9001:2015 CERTIFIED

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TECO-Westinghouse manufactures electric motors from 1/4 to 100,000 hp, and supplies inverters, gear reducers, and renewal parts. TWMC offers engineering services and large motor repairs.

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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

3227

3372 TAMU

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PH: 979-458-0276

energy.tamu.edu

The Texas A&M Energy Institute pursues and supports new approaches for multi-disciplinary energy research, education, and external partnerships. These approaches cross departmental and college boundaries and address all facets of the energy landscape that naturally connect engineering, sciences, technologies, economics, law, and policy decisions. The institute offers a Master of Science in Energy degree and a Certificate in Energy. Designed to create the next generation of leaders in energy, this program will target both students and professionals who want to be educated on the high-impact and interdisciplinary facets of the energy research landscape through quantitative analytical methods and multi-scale systems based approaches.

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Texas Business Radio is a syndicated radio show that covers news, events, and business happenings all over the great state of Texas.

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3121

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2700

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TPS SOCIAL MEDIA HUB

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College Station, TX 77843-3254 USA
PH: 979-845-7417 | FX: 979-845-1835
tps.tamu.edu



2022

EXHIBITOR
DESCRIPTIONS

The TPS Social Media Hub is a place where delegates come to connect online and face-to-face. Stop by for information and tips on the TPS 2018 #GetSocialTPS social media scavenger hunt. Four \$1,000 prizes are up for grabs. On Thursday, Sept. 20, 9-11:30 a.m., the inaugural Marketers Meetup will be hosted in the booth. Anyone involved or interested in marketing communications for the industry is invited to attend. Network with colleagues and engage in presentations from two marketing gurus.

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Turbomachinery International covers industries engaged in all forms of energy, including power generation, electric utilities and cogeneration. It also covers oil & gas refining, gas processing, compression, drilling and exploration. The emphasis is on application where gas and steam turbines and related turbomachinery are used worldwide. Coverage includes maintenance, overhaul and repair of all turbines and rotating equipment, including pumps and compressors. Turbomachinery News/Blog is an interactive hub, featuring a daily newsletter loaded with the latest news, blogs, commentary from top experts around the world, engineering data and graphics, and cutting-edge stories that you won't find in print.

TURBOMACHINERY LABORATORY

Texas A&M University, Texas A&M
Engineering Experiment Station
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College Station, TX 77843-3254 USA
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turbolab.tamu.edu



2125

The Turbomachinery Laboratory, part of The Texas A&M System, conducts theoretical and applied research into 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 Southeast Asia.

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

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PH: (+)8328656718
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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.

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WAUKESHA MAGNETIC BEARINGS

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PH: +44 1903 275500
www.waukeshabearings.com

Waukesha Magnetic Bearings® leads the industry in custom-engineered magnetic bearing systems for large turbomachinery and high-performing rotating equipment in oil & gas, power generation and marine markets. Field-proven hardware designs allow direct immersion in process fluids, often eliminating the need for shaft seals. Third-generation controller technology offers remote commissioning, monitoring, diagnostics and adjustments to reduce operating costs while maintaining near perfect availability.

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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 waste-water, 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.

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2538

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X

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2240

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- 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

ACE Compressor Parts & Services	2901
Advanced Compressor Technology	2819
Aerzen USA Corporation	2741
Ariel Corporation	2511
Armadillo Energy Services	3126
Atlantic Plant Maintenance, Inc.	1006
Atlas Copco Gas & Process	2327
Axis Mechanical Group	1747
BO-GE Assembly, Inc.	1720
Burckhardt Compression (US) Inc.	2611
Compressor & Turbine Services, LLC	2913
CoorsTek, Inc.	2348
CPI (Compressor Products International)	3104
CTS, Inc.	1125
EGC Critical Components	2705
Elliott Group	2235
Epic Industrial Solutions	2843
F.W. Gartner Thermal Spraying	3008
Farmer's Copper	1034
Fisher Products LLC	1101
Fluid Energy Controls, Inc.	1419
FS-Elliott	1741
Gas & Air Systems, Inc.	1735
GEA Systems North America LLC	2217
Gulf Coast Bearing & Seal, Inc.	3015

After-Market Services and Products (Continued)

HOERBIGER Compression Technology	2211
Houston Dynamic Service, Inc.	2035
Ingersoll Rand	1627
Integrated TurboMachinery	2440
John Crane	1935
Kaydon Ring & Seal, Inc.	2220
Kobelco Compressors America, Inc.	2501
L.A. Turbine Corporation	1620
Lone Star Blower	3236
MAN Energy Solutions SE	1645
Mayekawa USA, Inc.	2801
Mechanical Repair & Engineering, LP	2321
Meridian Equipment, Inc.	1810
Mid-America Machine Inc.	1814
Mitsubishi Heavy Industries Compressor Int'l.	2525
National Compressor Services	1000
Neuman & Esser	2335
Nord-Lock Group	3106
Relevant Solutions	2443
Riverhawk Company	2119
ROC Carbon Company	2115
Rotating Machinery Services, Inc.	2427
RPM Services, Inc.	2746
SAMCO Enterprises, Inc.	2812
Scott Rotary Seals	2851
Seal & Design, Inc.	1337
Siemens	2724
Stork H&E Turbo Blading	2117
Sulzer	1719

After-Market Services and Products (Continued)

Summit Staffing	2439
SuperLok USA	2439
Texas Compression LLC	2703
TMS Machine	2824
TOPS Field Services	3150
Turbine, Pump and Compressor	1403
Universal Plant Services	1611
Waukesha Bearings	2227
Zenith Equipment Repair	1439

COUPLING REPAIRS

Altra Industrial Motion Corporation	2517
Artec Machine Systems	3017
Compressor & Turbine Services, LLC	2913
Coupling Corporation of America	2928
EthosEnergy	2421
F. W. Gartner Thermal Spraying	3008
FlexElement Texas Inc.	1912
MagSeal	3218
NRG Energy Services	2252
PSC Couplings	1215
RENK AG	1851
Riverhawk Company	2119
Shackelford-Wattner	1926
United Technologies	3035
Universal Plant Services	1611

EXPANDER PARTS, REPAIR, OVERHAUL

Armadillo Energy Services	3126
Atlantic Plant Maintenance, Inc.	1006
Atlas Copco Gas & Process	2327
BO-GE Assembly, Inc.	1720
EthosEnergy	2421
L.A. Turbine Corporation	1620
MagSeal	3218

Neuman & Esser	2335
Rotating Machinery Services, Inc.	2427
Stork H&E Turbo Blading	2117
Sulzer	1719
Universal Plant Services	1611
Zenith Equipment Repair	1439
FIELD SERVICE	
ACE Compressor Services	2901
Adhesive Services Company	2214
Advanced Compressor Technology	2819
Aerzen USA Corporation	2741
Atlantic Group, Inc.	1328
Atlantic Plant Maintenance	1006
Burckhardt Compression (US) Inc	2611
Cascade Analytic, LLC	2451
CPI (Compressor Products International)	3104
Drake Controls	2935
Elliott Group	2235
Energy Control Technologies, Inc.	3027
EthosEnergy	2421
FARO Technologies	2804
Flender-Graffenstaden	2826
Gas & Air Systems, Inc.	1735
Graham Corporation	1718
Hahn & Clay	2829
HOERBIGER Compression Technology	2211
Ideal Electric Company	2512
Integrated TurboMachinery	2440
Knighthawk Engineering, Inc.	2047
Lone Star Blower	3236
Luftex Gears	1107
MAAG Pump Systems	1235

After-Market Services and Products (Continued)

Magnetic Products & Services, Inc.	3237
MAN Energy Solutions SE	1645
Mayekawa USA, Inc.	2801
Meridian Equipment, Inc.	1810
Mitsubishi Heavy Industries Compressor Int'l.	2525
National Compressor Services	1000
Neuman & Esser	2335
Nidec-Kato Engineering	1715
Prognost Systems, Inc.	1309
Pulsafeeder, Inc.	1013
PumpWorks 610	1316
Quest Energy Group	3003
Relevant Solutions	2443
Roper Technologies, Inc.	1835
Rotating Machinery Services, Inc.	2427
RPM Services	2746
S2W Contracting LLC	2943
SIFCO ASC	3042
Sulzer	1719
Summit Staffing	2439
Texas Compression LLC	2703
The Nut Place, Inc.	3229
The Progress Group, Inc.	3141
TOPS Field Services	3150
Turbine, Pump and Compressor	1403
Universal Plant Services	1611
Voith Turbo, Inc.	2835
FUEL CONTROL	
Drake Controls	2935
Energy Control Technologies, Inc.	3027
EthosEnergy	2421
Petrotech, Inc.	3001

GAS TURBINE PARTS, REPAIR, OVERHAUL

AAF International	3048
Alloy Coating Supply	2049
Armadillo Energy Services	3126
Atlantic Plant Maintenance, Inc.	1006
B-W Grinding Services, Inc.	1827
CEROBEAR GmbH	1112
CoorsTek, Inc.	2348
CTS, Inc.	1125
EthosEnergy	2421
ExOne	1129
F. W. Gartner Thermal Spraying	3008
Farmer's Copper	1034
Flender-Graffenstaden	2826
Fluid Energy Controls, Inc.	1419
Gulf Coast Bearing & Seal Inc.	3015
Intertek	3211
JinYoung TBX	3216
Kulite Semiconductor Products, Inc.	1406
Meridian Equipment, Inc.	1810
Nord-Lock Group	3106
NRG Energy Services	2252
Riverhawk Company	2119
Rotating Machinery Services, Inc.	2427
RPM Services, Inc.	2746
Seal & Design, Inc.	1337
Siemens	2724
Stork H&E Turbo Blading	2117
Sulzer	1719
Summit Staffing	2439
Texas Bearing Services	2701
Texas Compression LLC	2703
TOPS Field Services	3150
Universal Plant Services	1611

Vericor Power Systems	2550
Zenith Equipment Repair	1439
GEAR BOX REPAIRS	
Armadillo Energy Services	3126
Artec Machine Systems	3017
Baytown Ace Industrial Services	2842
Cincinnati Gearing Systems	2541
Compressor & Turbine Services, LLC	2913
CTS, Inc.	1125
Epic Industrial Solutions	2843
F. W. Gartner Thermal Spraying	3008
Flender-Graffenstaden	2826
Houston Dynamic Service, Inc.	2035
Integrated TurboMachinery	2440
Luftex Gears	1107
MagSeal	3218
Mechanical Repair & Engineering, LP	2321
Meridian Equipment, Inc.	1810
Philadelphia Gear	2221
RENK AG	1851
Revak Keene Turbomachinery, LP	1518
Rexnord Industries, LLC	3021
Rotating Equipment Repair	2146
RPM Services, Inc.	2746
Sumitomo Heavy Industries Gearbox Co., Ltd.	2947
TMS Machine	2824
Turbine, Pump and Compressor	1403
Zenith Equipment Repair	1439
PUMP PARTS AND REPAIR	
Afton Pumps, Inc.	1300
Alloy Coating Supply	2049
Baytown Ace Industrial Services	2842
BO-GE Assembly, Inc.	1720

B-W Grinding Services, Inc.	1827
Compressor & Turbine Services, LLC	2913
CoorsTek, Inc.	2348
Corporación POK S.A. de C.V.	3043
CPC Pumps International	1210
CTS, Inc.	1125
EGC Critical Components	2705
Epic Industrial Solutions	2843
ExOne	1129
Fisher Products LLC	1101
Flowserve Corporation	1635
Framo AS	1106
Hahn & Clay	2829
Houston Dynamic Service, Inc.	2035
HydroTex Dynamics, Inc.	1227
Integrated TurboMachinery	2440
Intertek	3211
ITT, Inc.	3111
Jiaxing Yayida Special Steel Casting Co., Ltd.	1336
KRAL-USA, Inc.	1234
LEWA-Nikkiso America, Inc.	1111
Lone Star Blower	3236
MAAG Pump Systems	1235
MagSeal	3218
Mechanical Repair & Engineering, LP	2321
Meridian Equipment, Inc.	1810
Netsch Pumps North America, LLC	2742
NRG Energy Services	2252
Peroni Pumps America	1134
Power Zone Equipment, Inc.	1334
ProFlow Pumping Solutions	1021
Pulsafeeder, Inc.	1013
PumpWorks 610	1316
PumpWorks Industrial	1314

After-Market Services and Products (Continued)

Ram Alloys	2647
ROC Carbon Company	2115
Rotating Equipment Repair	2146
RPM Services, Inc.	2746
Seal & Design, Inc.	2746
Shanley Pump & Equipment	1100
Shenyang Fonda Pump Co., Ltd.	3147
Source Pumps & Systems Co., Ltd.	1001
Standard Alloys & Manufacturing Company	1027
Sichuan Sunny Seal Co., Ltd.	1718
SKF	1419
Source Pumps & Systems Co.,Ltd.	1115
Standard Alloys Incorporated	1322
The Progress Group, Inc.	3141
TMS Machine	2824
TOPS Field Services	3150
Turbine, Pump and Compressor	1403
Watson Grinding & Manufacturing	1207
Weir Specialty Pumps	1221
Zenith Equipment Repair	1439
REAPPLICATION SERVICES	
Macek Power & Turbomachinery Engineering	1813
MagSeal	3218
Turbine, Pump and Compressor	1403
SPIN TESTING	
Houston Dynamic Service, Inc.	2035
STEAM TURBINE PARTS, REPAIR, OVERHAUL	
Allied Reliability	2547
Alloy Coating Supply	2049
Atlantic Plant Maintenance, Inc.	1006
BO-GE Assembly, Inc.	1720
B-W Grinding Services, Inc.	1827
Compressor & Turbine Services, Inc.	2913
F. W. Gartner Thermal Spraying	3008

Fluid Energy Controls, Inc.	1419
Gulf Coast Bearing & Seal, Inc.	3015
HOERBIGER Compression Technology	2211
Houston Dynamic Service, Inc.	2035
Integrated TurboMachinery	2440
JinYoung TBX	3216
Macek Power & Turbomachinery Engineering	1813
Maudlin Products	1815
Mechanical Repair & Engineering, LP	2321
Mitsubishi Heavy Industries Compressor Int'l.	2525
Nord-Lock Group	3106
NRG Energy Services	2252
Revak Keene Turbomachinery, LP	1518
ROC Carbon Company	2115
Rotating Equipment Repair	2146
Rotating Machinery Services, Inc.	2427
Scott Rotary Seals	2851
Skinner Power Systems	1522
Stork H&E Turbo Blading	2117
Sulzer	1719
Summit Staffing	2439
SuperLok USA	1205
Texas Compression LLC	2703
The Progress Group, Inc.	3141
TMS Machine	2824
TOPS Field Services	3150
United Technologies	3035
Woodward	1427
SURFACE FINISHING/BLASTING & EQUIPMENT	
Alloy Coating Supply	2049
CTS, Inc.	1125
HM Plating & Thermal Spray	1944
Praxair Surface Technologies	2920

SIFCO ASC	3042
Texas Compression LLC	2703
TURBOCHARGER REPAIR	
JinYoung TBX	3216
OTHER	
Applied System Technologies	3013
CEC Vibration Products	3014
DDI Inc.	3152
Epic Industrial Solutions	2843
ExOne	1129
Howden Roots	1527
HydroThrift Corporation	2641
Krytox™ Lubricants from The Chemours Co.	1501
Lancer Systems	3116
Nidec-Kato Engineering	1715
Rochem Technical Services, USA, Ltd	1312
Rotating Equipment Repair	2146
Sohre Turbomachinery, Inc.	2634
Southwest Impreglon	1619
Summit	2442
The Nut Place, Inc.	3229

AUXILIARY EQUIPMENT

ACCUMULATORS (PULSATION DAMPENERS)

Fluid Energy Controls, Inc.	1419
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Momentum Engineered Systems, Inc.	1321
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ACOUSTIC EQUIPMENT (SILENCERS)

Camfil Power Systems	2413
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ACTUATORS

Drake Controls	2935
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Governor Control Systems, Inc.	1640
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Pulsafeeder, Inc.	1013
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REXA, Inc.	2143
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Southwestern Controls	3005
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Woodward	1427
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ALIGNMENT TOOLS AND EQUIPMENT

Cascade Analytic, LLC	2451
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FARO Technologies	2804
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SKF	1419
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Hamar Laser Instruments	3040
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Intertek	3211
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Maudlin Products	1815
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Nord-Lock Group	3106
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Pruftechnik	1421
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RDI Technologies, Inc.	1202
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S2W Contracting LLC	2943
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BALANCING MACHINES

NRG Energy Services	2252
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Pruftechnik	1421
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BASE PLATES

G.J. Oliver, Inc.	3119
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BEARINGS – FLUID FILM	
Advanced Diamond Technologies, Inc.	1539
BO-GE Assembly, Inc.	1720
Daedong Metal Industry Co., Ltd.	2814
Graphite Metallizing Corporation	1216
Gulf Coast Bearing & Seal Inc.	3015
Kingsbury, Inc.	2635
Luftex Gears	1107
Miba Industrial Bearings	3053
Renk AG	1851
Schunk Carbon Technology	1037
Scott Rotary Seals	2851
Texas Bearing Services	2701
Waukesha Bearings	2227
BEARINGS – ISOLATORS	
Cascade Analytic, LLC	2451
Isomag Corporation	1634
Texas Bearing Services	2701
Waukesha Bearings	2227
BEARINGS – MAGNETIC	
CEROBEAR GmbH	1112
Texas Bearing Services	2701
SKF S2M Magnetic Bearings	2218
Waukesha Bearings	2227
BEARINGS – PRESSURIZED	
Bently Bearings (by New Way Air Bearings)	1315
BEARINGS – ROLLING-ELEMENT	
CEROBEAR GmbH	1211
Kingsbury, Inc.	2635
Krytox™ Lubricants from The Chemours Co.	1501
Luftex Gears	1107
Quadrant Engineering Plastic Products	2243
Rexnord Industries, LLC	3021

Miba Industrial Bearings	2701
Zollern North America LP	2240
BEARINGS – ROLLING-ELEMENT-PROTECTION	
Zollern North America LP	2240
BEARINGS – TEMPERATURE SENSORS	
Kingsbury, Inc.	2635
Miba Industrial Bearings	3053
Pyromation, Inc.	1535
Zollern North America LP	2240
BEARINGS – THRUST	
Bently Bearings (by New Way Air Bearings)	1315
Graphite Metallizing Corporation	1216
Gulf Coast Bearing & Seal, Inc.	3015
Kingsbury, Inc.	2635
Lancer Systems	3116
Miba Industrial Bearings	3053
Revak Keene Turbomachinery, LP	1518
ROC Carbon Company	2115
Schunk Carbon Technology	1037
Scott Rotary Seals	2851
Texas Bearing Services	2701
Zollern North America LP	2240
BLOWERS	
Aerzen USA Corporation	2741
Lone Star Blower	3236
ROC Carbon Company	2115
Zollern North America LP	2240
BORESCOPIES	
RF System Lab	1307
USA Borescopes	2840
CENTRIFUGES	
Mid-America Machine, Inc.	1814

Auxiliary Equipment (Continued)

Power Zone Equipment, Inc.	1334
Quadrant Engineering Plastic Products	2243
Source Pumps & Systems Co., Ltd.	1001
CLUTCHES	
HILCO	1500
RENK AG	1851
SSS Clutch Company, Inc.	2316
COMPRESSED AIR DRYERS	
Applied System Technologies	3013
Hitachi/Sullair	2617
COMPRESSORS, AIR	
Aerzen USA Corporation	2741
FS-Elliott	1741
Hitachi/Sullair	2617
Ingersoll Rand	1627
Kobelco Compressors America, Inc.	2501
SPX Flow, Inc.	2605
CONDITION MONITORING	
Bently Nevada, LLC	1347
Cascade Analytic, LLC	2451
CEC Vibration Products	3014
Emerson	1301
ITT, Inc.	3111
LUDECA, Inc.	2534
Luneta/RCM Sales & Services, Inc.	1408
Mechanical Solutions, Inc.	2341
Meggitt	2418
Nidec-Motor	1020
Petasense	3117
Prognost Systems, Inc.	1309
PVTVM, Inc.	1410

Schenck Trebel Corporation	1834
The Vibration Guys LLC	3121
CONTROL & CONTROL SYSTEMS	
Drake Controls	2935
Farmer's Copper	1034
GEA Systems North America LLC	2217
Governor Control Systems, Inc.	1640
HIMA Americas, Inc	2704
HOERBIGER Compression Technology	2211
L.A. Turbine Corporation	1620
Lone Star Blower	3236
National Compressor Services	1000
Petrotech, Inc.	3001
Power Zone Equipment, Inc.	1334
Roper Technologies Inc.	1835
S&R Controls	3100
Schneider Electric	3006
TMEIC Corporation	2700
Torquemeters Limited	2535
Woodward	1427

CONTROLS

Drake Controls	2935
Governor Control Systems, Inc.	1640
Ingersoll Rand	1627
Petrotech, Inc.	3001
Pulsafeeder, Inc.	1013
S&R Controls	3100
Schneider Electric	3006
Southwestern Controls	3005

CONTROLS, ELECTRIC MOTORS

e + a	3135
Ideal Electric Company	2512
Nidec-Motor	1020
Petrotech, Inc.	3001
TECO-Westinghouse Motor Company	1521
TMEIC Corporation	2700

COOLERS – AFTER

Diversified Manufacturing, Inc.	2445
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COOLERS – INTER

Diversified Manufacturing, Inc.	3234
Mid-America Machine, Inc.	1814

COUPLINGS – MAGNETIC

KRAL-USA, Inc.	1234
Rexnord Industries, LLC	3021

COUPLINGS, MECHANICAL

Altra Industrial Motion Corporation	2517
Artec Machine Systems	3017
Coupling Corporation of America	2928
John Crane	1935
KTR Corporation	1618
Nord-Lock Group	3106
PSC Couplings	1215

Regal	2135
Rexnord Industries, LLC	3021
Shackelford-Wattner	1926
SSS Clutch Company, Inc.	2316
SuperLok USA	1205
WEH Technologies Inc.	3051

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Sohre Turbomachinery, Inc.	2634
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DIAPHRAGMS

Hy-Lok USA	2601
JinYoung TBX	3216
Torquemeters Limited	2535
United Technologies	3035

DRIVERS – ELECTRIC MOTORS

e+a	3135
Ideal Electric Company	2512
Krytox™ Lubricants from The Chemours Co.	1501
Nidec Industrial Solutions	1713
Nidec-Motor	1020
ProFlow Pumping Solutions	1021
SKF S2M Magnetic Bearings	2218
TECO-Westinghouse Motor Company	1521
TMEIC Corporation	2700

DRIVERS – STEAM TURBINES

Elliott Group	2235
Revak Keene Turbomachinery, LP	1518
Skinner Power Systems	1522

EFFICIENCY IMPROVEMENT FOR GAS TURBINES

Camfil Power Systems	2413
Luneta/RCM Sales & Services, Inc.	1408
Rochem Technical Services, USA, Ltd	1312

ENERGY RECOVERY DEVICES

Calnetix Technologies	2514
HydroThrift Corporation	2641

EXPANSION JOINTS

Armadillo Energy Services	3126
Peerless PROCORE	2141

FASTENERS

BASF Corporation	2320
Field Industries	1942
The Nut Place	3229
WEH Technologies, Inc.	3051

FILTERS & FILTRATION SYSTEMS

AAF International	3048
Boll Filter Corporation	1435
Camfil Power Systems	2413
HILCO	1500
Hy-Pro Filtration	3112
John Crane	1935
MAAG Pump Systems	1235
Momentum Engineered Systems, Inc.	1321
Solberg Oil Mist Eliminators	2906
W.L. Gore Turbine Filters	2643

FLOW CONTROL DEVICES

Applied System Technologies	3013
Atlantic Group, Inc.	1228
Badger Meter	1114
Hy-Lok USA	2601
Peerless PROCORE	2141

FLOW METERS

Allied Reliability	2547
Badger Meter	1114

Auxiliary Equipment (Continued)

KRAL-USA, Inc.	1234
Settima USA, Inc.	1105
FLUID DRIVES	
Voith Turbo, Inc.	2835
GAS TURBINE WASHING	
Rochem Technical Services, USA, Ltd.	1312
GASKETS	
Champion Hi-Tech Manufacturing Co., Inc.	1753
Industrial Info Resources, Inc.	1600
GEARS AND GEAR BOXES	
Artec Machine Systems	3017
Hayward Gordon	2816
Luftex Gears	1107
Mid-America Machine Inc.	1814
Nidec-Motor	1020
Philadelphia Gear	2221
Riley Gear Corporation	3046
TECO-Westinghouse Motor Company	1521
Voith Turbo, Inc.	2835
GOVERNORS	
Governor Control Systems, Inc.	1640
Petrotech, Inc.	3001
Revak Keene Turbomachinery, LP	1518
Schneider Electric	3006
Woodward	1427
HEAT EXCHANGERS	
Diversified Manufacturing, Inc.	3234
Farmer's Copper	1034
Graham Corporation	1718
Hahn & Clay	2829
HydroThrift Corporation	2641

Auxiliary Equipment (Continued)

Momentum Engineered Systems, Inc.	1321
National Compressor Services	1000
SPX Flow, Inc.	2605
HEAT TRANSFER PRODUCTS & SERVICES	
Diversified Manufacturing, Inc.	3234
Graham Corporation	1718
HydroThrift Corporation	2641
HYDRAULIC FITTING	
WEH Technologies, Inc.	3051
INLET COOLING FOR GAS TURBINES	
AAF International	3048
Camfil Power Systems	2413
GEA Systems North America LLC	2217
INSTALLATION EQUIPMENT	
Applied System Technologies	3013
LUBRICATION SYSTEMS	
COBEY, Inc.	2420
Elliott Group	2235
G.J. Oliver, Inc.	3119
Lube-Power, Inc.	1304
LUDECA, Inc.	2534
Momentum Engineered Systems, Inc.	1321
Shell Lubricants	2907
MIXERS	
Hayward Gordon	2816
SPX Flow, Inc.	2605
PACKING	
AESSEAL, Inc.	1843
Hoerbiger Compression Technology	2211
Luneta/RCM Sales & Services, Inc.	1408
Xtend Packaging, Inc.	2924

POLYMER PARTS & PRODUCTS

Boulden Company, Inc.	1434
Lancer Systems	3116

PRESSURE VESSELS

COBEY, Inc.	2420
Fluid Energy Controls, Inc.	1419
G.J. Oliver, Inc.	3119
Hahn & Clay	2829
Lube-Power, Inc.	1304
Momentum Engineered Systems, Inc.	1321

REFRIGERATION

GEA Systems North America LLC	2217
HydroThrift Corporation	2641
Mayekawa U.S.A., Inc.	2801
York Process Services	2041

SEALS – ANNULAR (LABYRINTH, CARBON)

AESSEAL, Inc.	1843
Luneta/RCM Sales & Services, Inc.	1408
Miba Industrial Bearings	3053
New Resources Industrial Ltd.	3137
Stein Seal Industrial Division	2435
SwRI – Southwest Research Institute	2735
Waukesha Bearings	2227

SEALS – DRY GAS

AESSEAL, Inc.	1843
Champion Hi-Tech Manufacturing Co., Inc.	1753
COBEY, Inc.	2420
CoorsTek, Inc.	2348
Flowserve Corporation	1635
John Crane	1935
Kaydon Ring & Seal, Inc.	2220
New-Seal (by New Way Air Bearings)	1414

Auxiliary Equipment (Continued)

Stein Seal Industrial Division	2435
SwRI – Southwest Research Institute	2735
SEALS – MECHANICAL	
Advanced Diamond Technologies, Inc.	1539
AESSEAL, Inc.	1843
Champion Hi-Tech Manufacturing Co., Inc.	1753
CoorsTek, Inc.	2348
John Crane	1935
Kaydon Ring & Seal, Inc.	2220
New-Seal (by New Way Air Bearings)	1414
Ningbo Auncen Machinery Technology Co., Ltd.	2849
ProFlow Pumping Solutions	1021
Schunk Carbon Technology	1037
Stein Seal Industrial Division	2435
WEH Technologies, Inc.	3051
SEALS – NON-MECHANICAL	
Stein Seal Industrial Division	2435
SEALS – RESILIENT METAL	
AESSEAL, Inc.	1843
Miba Industrial Bearings	3053
New Resources Industrial Ltd.	3137
Stein Seal Industrial Division	2435
SwRI – Southwest Research Institute	2735
SHAFT-CURRENT CONTROL EQUIPMENT	
Magnetic Products & Services, Inc.	3237
Sohre Turbomachinery, Inc.	2634
SHIMS	
Cascade Analytic, LLC	2451
LUDECA, Inc.	2534
Maudlin Products	1815

SHIPPING CONTAINERS	
Eastern Alloy	2834
Omni Manufacturing Services	1009
SKIDS	
Boll Filter Corporation	1435
Eastern Alloy	2834
Xtend Packaging, Inc.	2924
STARTERS AND STARTING MOTORS	
e+a	3135
HILCO	1500
THERMOCOUPLES	
Peerless PROCORE	2141
Pyromation, Inc.	1535
TOOLS	
Alloy Coating Supply	2049
LUDECA, Inc.	2534
USA Borescopes	2840
WEH Technologies, Inc.	3051
TORQUE METERS	
Regal	2135
Riverhawk Company	2119
Torquemeters Limited	2535
TRANSMISSIONS	
Voith Turbo, Inc.	2835
USED EQUIPMENT, GENERAL	
National Compressor Services	1000
VACUUM EQUIPMENT	
Dekker Vacuum Technologies	2802
Graham Corporation	1718
Solberg Oil Mist Eliminators	2544

VALVES	
Atlantic Group, Inc.	1228
Badger Meter	1114
Bently Bearings (by New Way Air Bearings)	1315
Corporación POK S.A. de C.V.	3043
EGC Critical Components	2705
Hy-Lok USA	2601
Jiangsu Smart Special Valve Co., Ltd.	1016
Jiaxing Yayida Special Steel Casting Co., Ltd.	1336
Joy Industries (Dalian) Company, Ltd.	1848
Ningbo Auncen Machinery Technology Co., Ltd.	2849
Peerless PROCORE	2141
Settima USA, Inc.	1105
Southwestern Controls	3005
SPX Flow, Inc.	2605
SuperLok USA	1205
Woodward	1427
VARIABLE FREQUENCY DRIVES	
General Atomics Electromagnetics	2925
Nidec-Motor	1020
TMEIC Corporation	2700
VIBRATION MEASURING, MONITORING, ANALYSIS	
Agilis	2751
Bently Nevada, LLC	1347
CEC Vibration Products	3014
Dynamics SPC USA	3215
Emerson	1301
Engineering Dynamics, Inc.	1537
LUDECA, Inc.	2534
Machine Saver, Inc.	2911
Meggitt	2418
Nanoprecise Sci Corporation	3149
Nidec-Kato Engineering	1715

OROS, Inc.	2136
Petasense	3117
Prime Photonics, LC	2818
Prognost Systems, Inc.	1309
Pruftechnik	1421
PVTVM, Inc.	1410
RDI Technologies, Inc.	1202
Schenck Trebel Corporation	1834
Torquemeters Limited	2535
Wilcoxon Sensing Technologies	2538
OTHER	
Impac Systems Engineering	1441
Schneider Electric	3006

DISTRIBUTORS

PUMP RELATED EQUIPMENT

Atlantic Group, Inc.	1228
Canada Pipeline Accessories Co., Ltd.	1004
Dekker Vacuum Technologies	2802
Framo AS	1106
Huangshan RSP Manufacturing Co., Ltd.	1103
Hy-Lok USA	2601
Peerless PROCORE	2141
Tacmina USA	1236
The Nut Place, Inc.	3229

PUMPS

Dekker Vacuum Technologies	2802
Framo AS	1106
Huangshan RSP Manufacturing Co., Ltd.	1103
Luneta/RCM Sales & Services, Inc.	1408
Power Zone Equipment, Inc.	1334
ProFlow Pumping Solutions	1021
PumpWorks Industrial	1314
Shanley Pump & Equipment	1100
Shijiazhuang Qinye Casting & Trading Co., Ltd.	1422
Southwestern Controls	3005
Tacmina USA	1236

CONSULTING – MAINTENANCE & RELIABILITY

All Cert Training, Inc.	1036
Chem Show, The	1026
Dynamics SPC USA	3215
Equity Engineering Group, The	2244
Magnetic Products & Services, Inc.	3237
Prognost Systems, Inc.	1309
Pruftechnik	1421
RDI Technologies, Inc.	1202
Regal	2135
Roper Technologies, Inc.	1835
Turbomachinery Laboratory	2125
Vibration Institute	2542

CONTINUING EDUCATION CREDIT COURSES

All Cert Training, Inc.	1036
Hydraulic Institute	1213
Mary Kay O'Connor Process Safety Center	3225
Texas A&M Engineering Experiment Station	3125
Turbomachinery Laboratory	2125
Vibration Institute	2542

EDUCATIONAL COURSES

All Cert Training, Inc.	1036
American Society of Mechanical Engineers (ASME)	2216
Camfil Power Systems	2413
Chem Show, The	1026
Hydraulic Institute	1213
Mary Kay O'Connor Process Safety Center	3225
Master of Engineering Technical Management (METM)	3223
Texas A&M Energy Institute	3227
Texas A&M Engineering Experiment Station	3125

Turbomachinery Laboratory	2125
RESEARCH – PUMPS/FLUID HANDLING	
Chem Show, The	1026
Settima USA, Inc.	1105
Turbomachinery Laboratory	2125
RESEARCH – TURBINES/ROTATING EQUIPMENT	
New Resources Industrial Ltd.	3137
Turbomachinery Laboratory	2125
TRAINING	
Advanced Robotics at TAMU	2151
All Cert Training, Inc.	1036
Chem Show, The	1026
Equity Engineering Group, The	2244
Framo AS	1106
Hydraulic Institute	1213
Mary Kay O'Connor Process Safety Center	3225
RDI Technologies, Inc.	1202
Roper Technologies, Inc.	1835
Schenck Trebel Corporation	1834
SoftInWay, Inc.	2249
TechStar	3219
Texas A&M Engineering Experiment Station	3125
The Vibration Guys LLC	3121
Vibration Institute	2542
TRAINING MATERIALS	
Mary Kay O'Connor Process Safety Center	3225
Schenck Trebel Corporation	1834
Vibration Institute	2542
OTHER	
All Cert Training, Inc.	1036
Texas A&M Energy Institute	3227

MACHINERY SERVICES

3D SCANNING AND INSPECTION

Craft Pattern & Mold, Inc.	1028
Exact Metrology, Inc.	1941
Intertek	3211
Stork H&E Turbo Blading	2117
Tern Technologies, Inc.	2134

ALIGNMENT

Axis Mechanical Group	1747
Hamar Laser Instruments	3040
Pruftechnik	1421
RDI Technologies, Inc.	1202
S2W Contracting LLC	2943
Tern Technologies, Inc.	2134

ANALYSIS

IMI Sensors	2721
Kelm Engineering, LLC	1519
Structural	2800
The Vibration Guys LLC	3121
Windrock, Inc.	2153
Wood	2322

BALANCING

ACE Compressor Services	2901
Baytown ACE Industrial Services	2842
Bently Bearings (by New Way Air Bearings)	1315
Kelm Engineering LLC	1519
Rotating Equipment Repair	2146
The Progress Group, Inc.	3141
The Vibration Guys LLC	3121

COMPONENT DEVELOPMENT & TESTING

EGC Critical Components 2705

FARO Technologies 2804

COMPRESSOR PACKAGING

Advanced Compressor Technology 2819

Burckhardt Compression (US), Inc. 2611

COBEY, Inc. 2420

Diversified Manufacturing, Inc. 3234

Mayekawa U.S.A., Inc. 2801

Neuman & Esser 2335

PDC Machines, Inc. 1420

Relevant Solutions 2443

Roots Systems, Inc. 2350

SAMCO Enterprises, Inc. 2812

York Process Services 2041

CONDITION MONITORING

Allied Reliability 2547

Alta Solutions, Inc. 2807

Bruel & Kjaer Vibro 1341

Envision Motion - Mechanical Solutions, Inc. 2343

IMI Sensors 2721

Machine Saver, Inc. 2911

Prime Photonics, LC 2818

Regal 2135

Tern Technologies, Inc. 2134

Wilcoxon Sensing Technologies 2538

Windrock, Inc. 2153

Wood 2322

CONTROL SYSTEMS

ACE Compressor Services 2901

Energy Control Technologies, Inc. 3027

Governor Control Systems, Inc. 1640

Hima Americas, Inc. 2704

Roper Technologies, Inc.	1835
S&R Controls	3100
York Process Services	2041

DESIGN

Agilis	2751
CFturbo GmbH	1638
Cincinnati Gearing Systems	2541
Impac Systems Engineering	1441
Macek Power & Turbomachinery Engineering	1813
SoftInWay, Inc.	2249
Structural	2800

DESIGN AUDITS

Macek Power & Turbomachinery Engineering	1813
Mechanical Solutions. Inc.	2341

EFFICIENCY IMPROVEMENT FOR GAS TURBINES

IMI Sensors	2721
Rochem Technical Services, USA, Ltd.	1312
Torquemeters Limited	2535

ELECTRICAL DISCHARGE MACHINING (EDM)

Acucut, Inc.	1836
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FAILURE ANALYSIS

Envision Motion - Mechanical Solutions, Inc.	2343
Henkel Loctite Corporation	2915
IMI Sensors	2721
Knighthawk Engineering, Inc.	2047
Magnetic Products & Services Inc.	3237
Mechanical Solutions. Inc.	2341
Prognost Systems, Inc.	1309
Regal	2135
The Vibration Guys LLC	3121

FOUNDATION REPAIR AND GROUTING

Adhesive Services Company	2214
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Five Star Products, Inc.	2719
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ITW	3217
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S2W Contracting LLC	2943
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GAS TURBINE WASHING

Rochem Technical Services, USA, Ltd	1312
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GROUTING

Adhesive Services Company	2214
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BASF Corporation	2320
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Five Star Products, Inc.	2719
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ITW	3217
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S2W Contracting LLC	2943
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Stronghold Coatings Systems	1203
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Structural	2800
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HIGH VELOCITY OIL FLUSHING

CIRCOR Reliability Services	1826
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HYDROSTATIC TESTING

Atlantic Group, Inc.	1228
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INDUSTRIAL CONTROLS

Energy Control Technologies, Inc.	3027
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WEG/Electric Machinery	2813
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INFRARED IMAGING

Industrial Reliability & Alignment, LLC	1504
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INSTALLATION

Adhesive Services Company	2214
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Advanced Compressor Technology	2819
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Applied System Technologies	3013
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Canada Pipeline Accessories Co., Ltd	1004
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Tern Technologies, Inc.	2134
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LUBRICATION SYSTEMS	
Allied Reliability	2547
CIRCOR Reliability Services	1826
Lube-Power, Inc.	1304
Royal Purple Synthetic Oil	1538
Settima USA, Inc.	1105
MACHINE CONDITION MONITORING	
Alta Solutions, Inc.	2807
Bently Nevada, LLC	1347
Bruel & Kjaer Vibro	1341
Dynamics SPC USA	3215
Emerson	1301
Industrial Reliability & Alignment LLC	1504
Machine Saver, Inc.	2911
Magnetic Products & Services, Inc.	3237
Meggitt	2418
PVTVM, Inc.	1410
Wilcoxon Sensing Technologies	2538
Windrock, Inc.	2153
Wood	2322
MACHINERY PROTECTION SYSTEMS	
Alta Solutions Inc.	2807
Bruel & Kjaer Vibro	1341
Emerson	1301
Machine Saver, Inc.	2911
Meggitt	2418
Sohre Turbomachinery, Inc.	2634
MAINTENANCE SYSTEMS	
Industrial Reliability & Alignment LLC	1504
Quest Energy Group	3003

METALLURGY

Equity Engineering Group, The	2244
Reinhart & Associates, Inc.	2417
Tycon Alloy Industries (Hong Kong) Co., Ltd.	1623

NON-DESTRUCTIVE EVALUATION

Envision Motion - Mechanical Solutions, Inc.	2343
Reinhart & Associates, Inc.	2417
RF System Lab	1307
USA Borescopes	2840

OIL PURIFICATION

CIRCOR Reliability Services	1826
HILCO	1500
RelaDyne, LLC	1237

PACKAGING

CIRCOR Reliability Services	1826
G.J. Oliver, Inc.	3119
Lube-Power, Inc.	1304
Omni Manufacturing Services	1009
Peroni Pumps America	1134
Xtend Packaging, Inc.	2924

PIPING PACKAGES

Canada Pipeline Accessories Co., Ltd	1004
COBEY, Inc.	2420
Field Industries	1942
Lube-Power, Inc.	1304
Omni Manufacturing Services	1009

PREDICTIVE MAINTENANCE

Adhesive Services Company	2214
Agilis	2751
Allied Reliability	2547
Axis Mechanical Group	1747
Machine Saver, Inc.	2911

Nanoprecise Sci Corporation	3149
Wilcoxon Sensing Technologies	2538
Windrock, Inc.	2153

PRESSURE TESTING

Equity Engineering Group, The	2244
Kulite Semiconductor Products, Inc.	1406

PULSATION ANALYSIS

Applied Flow Technology	1335
Kelm Engineering, LLC	1519
Wood	2322

RESEARCH AND DEVELOPMENT

Agilis	2751
Applied Flow Technology	1335
Canada Pipeline Accessories Co., Ltd	1004
CFturbo GmbH	1638
Dynamics SPC USA	3215
Fisher Products LLC	1101

ROTORDYNAMICS ANALYSIS

Alta Solutions Inc.	2807
Kelm Engineering, LLC	1519
Knighthawk Engineering, Inc.	2047
Prime Photonics, LC	2818
Rodyn Vibration Analysis	2250
Scott Rotary Seals	2851
SoftInWay, Inc.	2249

TURBINE PACKAGING

Skinner Power Systems	1522
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ULTRASOUND TESTING

Industrial Reliability & Alignments, LLC	1504
Reinhart & Associates, Inc.	2417

VIBRATION ANALYSIS	
Agilis	2751
Alta Solutions, Inc.	2807
Bently Nevada, LLC	1347
Bruel & Kjaer Vibro	1341
Dynamics SPC USA	3215
Equity Engineering Group, The	2244
Envision Motion - Mechanical Solutions, Inc.	2343
Industrial Reliability & Alignments, LLC	1504
Kelm Engineering, LLC	1519
Nanoprecise Sci Corporation	3149
Petasense	3117
Prime Photonics, LC	2818
PVTVM, Inc.	1410
Riverhawk Company	2119
Tern Technologies, Inc.	2134
Vibration Institute	2542
Wilcoxon Sensing Technologies	2538
Windrock, Inc.	2153
Wood	2322
WELDING	
Fisher Products LLC	1101
Quest Energy Group	3003
OTHER	
Krytox™ Lubricants from The Chemours Co.	1501
Southwest Impreglon	1619

MACHINERY ANALYSIS SOFTWARE

CAD

Applied Flow Technology	1335
CFturbo GmbH	1638
Impac Systems Engineering	1441

CFD

Applied Flow Technology	1335
CFturbo GmbH	1638
Impac Systems Engineering	1441
Numeca USA	2717
Simerics, Inc.	1127

DESIGN AND ANALYSIS

CFturbo GmbH	1638
Simerics, Inc.	1127
SoftInWay, Inc.	2249

FINITE ELEMENTS ANALYSIS

Rodyn Vibration Analysis	2250
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LIFE PREDICTION

General Atomics Electromagnetics	2925
Nanoprecise Sci Corporation	3149
Reinhart & Associates, Inc.	2417

MAINTENANCE AND RELIABILITY

General Atomics Electromagnetics	2925
HILCO	1500
Petasense	3117
RF System Lab	1307
SwRI – Southwest Research Institute	2735
WEG/Electric Machinery	2813

PIPE FLOW ANALYSIS

Simerics, Inc.	1127
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PUMP SELECTION

Simerics, Inc.	1127
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ROTORDYNAMICS

OROS, Inc.	2136
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Rodyn Vibration Analysis	2250
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STRESS ANALYSIS

Knighthawk Engineering, Inc.	2047
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Reinhart & Associates, Inc.	2417
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Rodyn Vibration Analysis	2250
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SwRI – Southwest Research Institute	2735
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VIBRATION ANALYSIS

Emerson	1301
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Envision Motion - Mechanical Solutions, Inc.	2343
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Meggitt	2418
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Nanoprecise Sci Corporation	3149
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OROS, Inc.	2136
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PVTVM, Inc.	1410
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Rodyn Vibration Analysis	2250
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SoftInWay, Inc.	2249
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OTHER

FARO Technologies	2804
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Simerics, Inc.	1127
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MANUFACTURERS

CATEGORICAL LISTINGS

BLOWER	
Roots Systems, Inc.	2919
COMPRESSOR – AXIAL	
Aikoku Alpha Company	1737
Calnetix Technologies	2514
MAN Energy Solutions SE	1645
COMPRESSOR – CENTRIFUGAL	
Aikoku Alpha Company	1737
Atlas Copco Gas & Process	2327
Cryostar USA LLC	1534
FS-Elliott	1741
Gas & Air Systems, Inc.	1735
Hitachi/Sullair	2617
Howden Roots	1527
Ingersoll Rand	1627
Kobelco Compressors America, Inc.	2501
MAN Energy Solutions SE	1645
Mitsubishi Heavy Industries Compressor Int'l.	2525
Relevant Solutions	2443
Siemens	2349
Solar Turbines, Inc.	2311
Sundyne	1601
York Process Services	2041

COMPRESSOR – DIAPHRAGM

Gas & Air Systems, Inc.	1735
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PDC Machines, Inc.	1420
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Sundyne	1601
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COMPRESSOR – INTEGRAL GEAR

Atlas Copco Gas & Process	2327
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Cincinnati Gearing Systems	2541
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Hanwha Power Systems	2946
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Ingersoll Rand	1627
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MAN Energy Solutions SE	1645
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COMPRESSOR – LIQUID RING

Dekker Vacuum Technologies	2802
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COMPRESSOR – RECIPROCATING

Ariel Corporation	2511
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Axis Mechanical Group	1747
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Burckhardt Compression (US), Inc.	2611
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CPI (Compressor Products International)	3104
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EGC Critical Components	2705
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Gas & Air Systems, Inc.	1735
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Kobelco Compressors America, Inc.	2501
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L.A. Turbine Corporation	1620
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Quadrant Engineering Plastic Products	2243
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Relevant Solutions	2443
Siemens	2724
COMPRESSOR – ROTARY	
Howden Roots	1527
Roots Systems, Inc.	2350
COMPRESSOR – SCREW	
Aerzen USA Corporation	2741
GEA Systems North America LLC	2217
Hitachi/Sullair	2617
Howden Roots	1527
Kobelco Compressors America, Inc.	2501
Mayekawa U.S.A., Inc.	2801
York Process Services	2041
COMPRESSOR – INTEGRAL GEAR	
Atlas Copco Gas & Process	2327
Cincinnati Gearing Systems	2541
Hanwha Power Systems	2946
Ingersoll Rand	1627
MAN Energy Solutions SE	1645
COMPRESSOR – LIQUID RING	
Dekker Vacuum Technologies	2802
COMPRESSOR – RECIPROCATING	
Ariel Corporation	2511
Axis Mechanical Group	1747
Burckhardt Compression (US), Inc.	2611
CPI (Compressor Products International)	3104
EGC Critical Components	2705
Gas & Air Systems, Inc.	1735
Kobelco Compressors America, Inc.	2501
L.A. Turbine Corporation	1620
Quadrant Engineering Plastic Products	2243
Relevant Solutions	2443
Siemens	2724

ELECTRIC MOTORS

Calnetix Technologies	2514
e + a	3135
General Atomics Electromagnetics	2925
Ideal Electric Company	2512
Nidec Industrial Solutions	1713
Nidec-Kato Engineering	1715
TECO-Westinghouse Motor Company	1521
TMEIC Corporation	2700
WEG/Electric Machinery	2813

EXPANDERS

Aikoku Alpha Company	1737
Atlas Copco Gas & Process	2327
Calnetix Technologies	2514
Cincinnati Gearing Systems	2541
Cryostar USA LLC	1534
Elliott Group	2235
L.A. Turbine Corporation	1620
TURBOCAM International	2820

GEARS AND GEARBOXES

Cincinnati Gearing Systems	2541
Flender-Graffenstaden	2826
Philadelphia Gear	2221
RENK AG	1851
Riley Gear Corporation	3046
Sumitomo Heavy Industries Gearbox Co., Ltd.	2947
TECO-Westinghouse Motor Company	1521
TMS Machine	2824
WEG/Electric Machinery	2813

GENERATORS

Calnetix Technologies	2514
Cryostar USA LLC	1534
e + a	3135

Manufacturers (Continued)

General Atomics Electromagnetics	2925
Ideal Electric Company	2512
Nidec Industrial Solutions	1713
Nidec-Kato Engineering	1715
Skinner Power Systems	1522
WEG/Electric Machinery	2813

IMPELLERS

Aikoku Alpha Company	1737
Alfred Conhagen Inc. of Texas	1727
Corporación POK S.A. de C.V.	3043
Craft Pattern & Mold Inc.	1028
SPX Flow, Inc.	2605
Standard Alloys & Manufacturing Company	1027
TURBOCAM International	2820

MECHANICAL SEAL

Champion Hi-Tech Manufacturing Co., Inc.	1753
Fenghua Zhongli Seals Co., Ltd.	3239
Flowserve Corporation	1635
Ningbo Auncen Machinery Technology Co., Ltd.	2849

PROCESS BLOWER

Roots Systems, Inc.	2350
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PUMP – CENTRIFUGAL

Comercializadora FEOC S.A. de C.V.	2941
CPC Pumps International CPC	1210
Cryostar USA LLC	1534
Dickow Pump Company, Inc.	1200
Flowserve Corporation	1635
Framo AS	1106
GBS Casting	1017
Hayward Gordon	2816
Hermetic Pumps Inc.	1947
Huangshan RSP Manufacturing Co., Ltd.	1103

Manufacturers (Continued)

ITT, Inc.	3111
LEWA-Nikkiso America, Inc.	1111
ProFlow Pumping Solutions	1021
PumpWorks 610	1316
PumpWorks Industrial	1314
Roth Pump Company	1201
Shanley Pump & Equipment	1100
Shenyang Fonda Pump Co., Ltd	3147
Shijiazhuang Jinjie Import & Export Corp., Ltd.	1503
Shijiazhuang Qinye Casting & Trading Co., Ltd.	1422
Shin Nippon Machinery	1327
Source Pumps & Systems Co., Ltd.	1001
SPX Flow, Inc.	2605
Standard Alloys & Manufacturing Company	1027
Sundyne	1601
Teikoku USA	1135
TURBOCAM International	2820
Weir Specialty Pumps	1221
PUMP – DISK FLOW	
Industrial Info Resources, Inc.	1600
PUMP – PITOT-TUBE	
Weir Specialty Pumps	1221
PUMP – POSITIVE DISPLACEMENT	
Boerger, LLC	1226
CIRCOR Reliability Services	1826
Comercializadora FEOC S.A. de C.V.	2941
Cryostar USA LLC	1534
Hammelmann Corporation	1505
Hayward Gordon	2816
Hermetic Pumps, Inc.	1947
Huangshan RSP Manufacturing Co., Ltd.	1103
ITT, Inc.	3111
KRAL-USA, Inc.	1234

Manufacturers (Continued)

Leistritz Advanced Technologies Corporation	1241
LEWA-Nikkiso America, Inc.	1111
LobePro Rotary Pumps	1136
MAAG Pump Systems	1235
Netzsch Pumps North America LLC	2742
Peroni Pumps America	1134
Roth Pump Company	1201
Settima USA Inc.	1105
Shanley Pump & Equipment	1100
Shijiazhuang Jinjie Import & Export Corp., Ltd.	1503
Tacmina USA	1236

PUMP – SEALLESS

Dickow Pump Company, Inc.	1200
Flowserve Corporation	1635
Hermetic Pumps, Inc.	1947
RSP Manufacturing Co., Ltd.	1103
LEWA-Nikkiso America, Inc.	1111
Pulsafeeder, Inc.	1013
Roth Pump Company	1201
Shanley Pump & Equipment	1100
Sundyne	1601
Tacmina USA	1236
Teikoku USA	1135

Pump – Vacuum

Dekker Vacuum Technologies	2802
Graham Corporation	1718
Hermetic Pumps, Inc.	1947
Shijiazhuang Qinye Casting & Trading Co., Ltd.	1422

PUMP – VERTICAL TURBINE

Alfred Conhagen Inc. of Texas	1727
ITT, Inc.	3111
National Pump Company	1007
Ningbo Auncen Machinery Technology Co., Ltd.	2849

Manufacturers (Continued)

PumpWorks 610	1316
Shin Nippon Machinery	1327
Sundyne	1601
Vericor Power Systems	2550
Weir Specialty Pumps	1221
ROTARY LOBE VACUUM BOOSTER	
Roots Systems, Inc.	2350
TURBINES – GAS	
AAF International	3048
Aikoku Alpha Company	1737
Flender-Graffenstaden	2826
JinYoung TBX	3216
Siemens	2724
Solar Turbines, Inc.	2311
TURBOCAM International	2820
Vericor Power Systems	2550
TURBINES – STEAM	
Hangzhou Steam Turbine Company, Ltd.	2919
Howden Roots	1527
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HM Plating & Thermal Spray	1944

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Mary Kay O'Connor Process Safety Center	3225
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American Society of Mechanical Engineers (ASME)	2216
CompressorTech2	2713
Empowering Pumps & Equipment	1204
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CompressorTech2	2713
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Oilman Magazine	3235
PetroPages.com	2825
Pumps & Systems Magazine	1117
Putman Media	1541
Turbomachinery International Publications	1914

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GENERAL

ABOUT THE TURBOMACHINERY LAB



The Turbomachinery Lab, a center of the Texas A&M Engineering Experiment Station (TEES), conducts basic and applied research into important problems of reliability and performance of turbomachinery — rotating machinery that extracts or adds energy to fluids. That's everything from the classic Dutch windmill to the space shuttle's main engine turbopumps and compressors that move natural gas through the distribution system.

VISIT turbolab.tamu.edu

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The Turbo Lab, established in 1982, continues to address the needs of users and manufacturers of turbomachinery and pumps. The Turbo Lab continues Texas A&M University's land-grant charter and tradition of attention to industry needs in three areas:

- Basic & Applied Research
- Undergraduate and Graduate Education
- Continuing Education & Professional Development

The Turbo Lab offers graduate engineering coursework through Texas A&M's Department of Mechanical Engineering, and provide continuing education opportunities to users of turbomachinery and pumps all over the world. Opportunities include short courses led by world-renowned researchers and original equipment manufacturers and users, as well as highly-regarded symposia in Houston, Texas, and Southeast Asia.

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).

TURBO LAB

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Join TRC today

The Turbomachinery Research Consortium (TRC) is an exclusive organization of major turbomachinery developers and users who have united with the Turbo Lab to find answers to important questions about turbomachinery performance and reliability through cutting-edge research.

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Visit us in Booth 2125



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 C, D, and E. The halls will be open during the following times:

- **Tuesday**
Noon – 2 P.M.
- **Wednesday**
Noon – 2 P.M.

FREE PASS HOURS - EXHIBITION

Free Pass registration required.

- **Tuesday**
2:30 P.M. – 7 P.M.
- **Wednesday**
2:30 P.M. – 6:30 P.M.
- **Thursday**
9:30 A.M. – Noon

WELCOME ADDRESS

The welcome address is scheduled for Tuesday, September 19, 2018 from 8 - 8:35 A.M. in the General Assembly Theatre C in the George R. Brown, Level 3. This year's speaker is Dr. Eric Petersen, director of the Turbomachinery Laboratory. Admission is free and open to the public.

LUNCHEONS

Badge required, not open to Free Pass

Lunch will be served on September 18th and 19th in Exhibit Hall D. 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, September 18, 2018, 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 feature The Crescent Circus, a husband-wife duo, Nathan Kepner and Morgan Tsu-Raun, who fuse their expertise in magic and circus arts respectively to deliver a one-of-a-kind experience on stage.

The Banquet is scheduled for Wednesday, September 19, 2018, 7:30 P.M. – 9 P.M. in the Hilton Ballroom of the Americas A. Admission is granted to paid attendees, exhibitors, and press.

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, September 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.

EXTENDED SHORT COURSES

The Turbo Lab offers extended short courses throughout the year led by industry experts and academics. Courses range from three to five days and offer working professionals valuable education opportunities in an interactive environment.

JANUARY 2019

Machinery Vibration & Rotordynamics

The course is designed to benefit both young engineers and veterans. The course will cover basic vibration theory and how to use it to solve mechanical vibration problems experienced in the field. Rotordynamics terminology in common use will be defined and explained, including critical speeds, critical speed inversion, unbalance response and rotordynamic instability.

MARCH 2019

Centrifugal Compressor Operations

Centrifugal Compressor Operations for 21st Century Users (CCOPS) is intended for beginning- and intermediate-level professionals to accelerate their understanding of centrifugal compressors and how they are used in oil & gas applications. The course covers design aspects, aerodynamics, rotordynamics, the practical applications of installation, testing, commissioning and procurement.

ROTORDYNAMICS

The Rotordynamics short course is for beginning- and intermediate-level engineers in the petroleum, chemical, power and gas industries. It provides a basis for understanding the rotordynamics—the behavior and diagnosis—of turbines, compressors, expanders, motors, pumps and generators and their subcomponents to help select, analyze, troubleshoot and repair them for maximum reliability. The course is packed with case studies and workshops for hands-on evaluation of actual machines.

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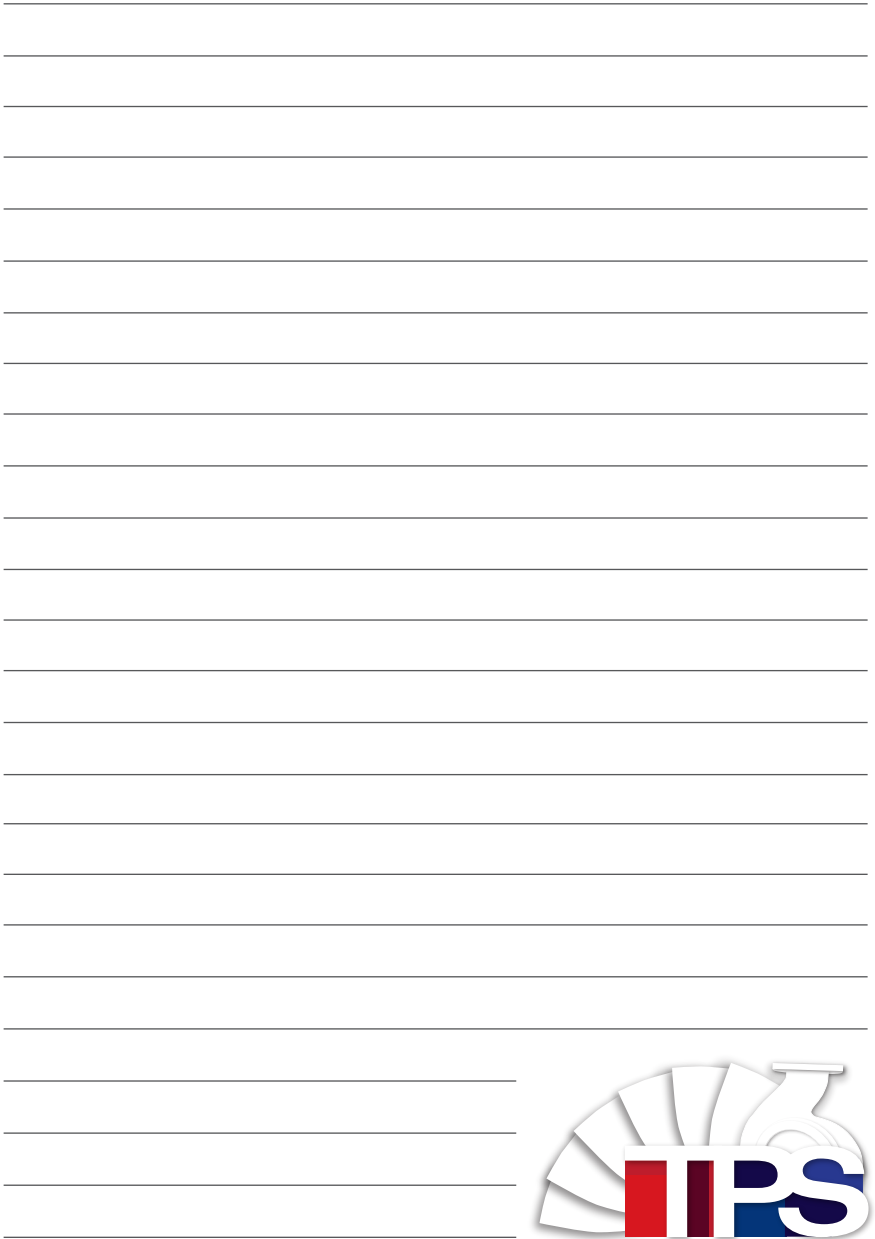
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