



TURBOMACHINERY TRAINING SEMINAR



“COMPRESSORS AND THEIR DRIVERS”

Performance of Centrifugal Compressors, Gas Turbines and Steam Turbines, Hardware & Systems.

Flexware® www.flexwareinc.com

Remote via. Zoom

2023



Field & Shop Performance Analysis, Case Studies, Troubleshooting & Problem Resolution

- Optimize Your Condition Based Equipment Reliability Program
- Maximize Plant Production & Reliability
- Confirm OEM Performance Guarantee
- Optimize Equipment Utilization

TAKE ADVANTAGE OF THIS EXCELLENT OPPORTUNITY TO LEARN COMPRESSOR & TURBINE THEORY AND EASY, PRACTICAL METHODS TO TROUBLESHOOT TURBOMACHINERY.

“Good Seminar. Improves my analytical knowledge. Will save the company money & time.” Sheridan Suleiman, Sarawak Shell

People Who Should Attend This Seminar

The people attending the course should be technical personnel interested in better understanding turbomachinery (operators, engineers & technicians, reliability specialists, project engineers, equipment specialists and planning engineers).

*“Difficult subject made easy to understand – Excellent work!”
Showkath Ali K. C., Qatar Petrochemical Co.*

FOR THE SEASONED ENGINEER AS WELL AS THOSE NEW TO THE SUBJECT OF TURBOMACHINERY.

Course Objective

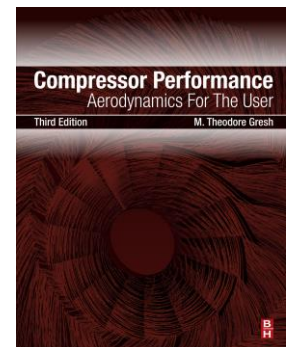
Basic turbomachinery operation and maintenance and easy, practical methods to troubleshoot turbomachinery problems. Improving plant production and reducing maintenance costs.

Course Materials: Flex Live software, access to training slides and other material.

Time Schedule

Seminar duration: 5 days for 4 hours each day. The seminar will be presented by invitation using Zoom.

“Notes, book & software are excellent. I still use the notes and text from your course regularly in my work.” Hosam Hassan, Praxair, Toronto



Program

Following subject areas are covered over a five-day program. A tentative schedule is shown below.

*“...All in all the course is excellent with a lot of valuable information being transmitted.”
Scott Schultz, Chart Energy & Chemicals, The Woodlands, Texas*

1) - Compressor Aerodynamics

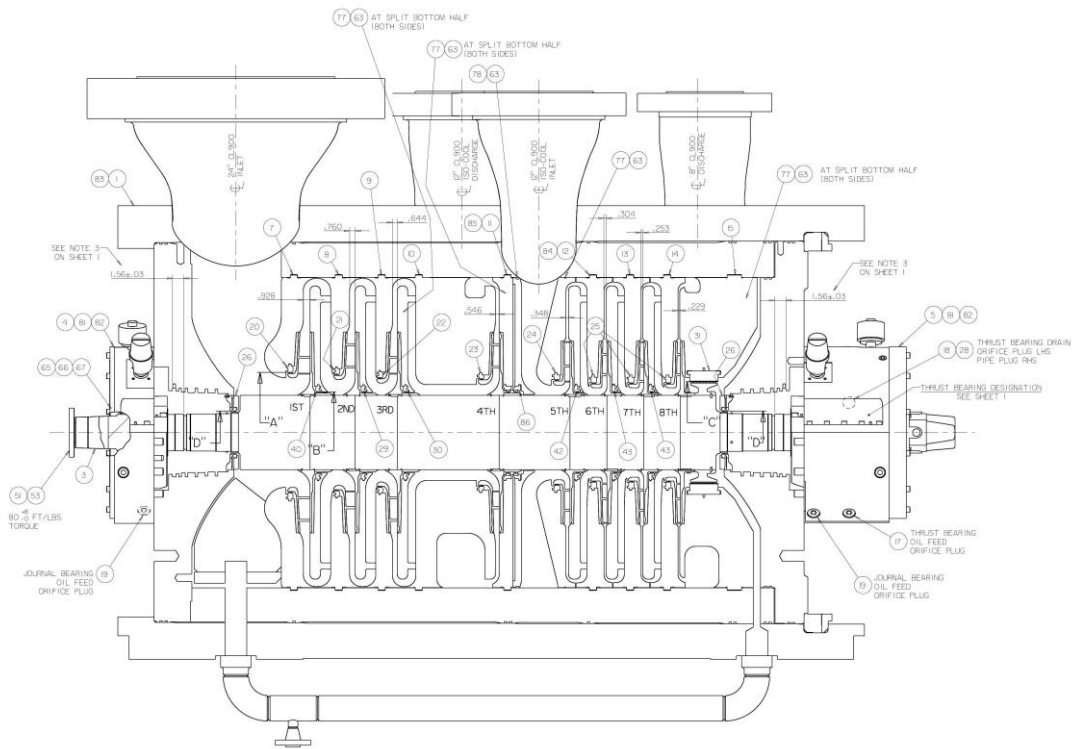
Introduction to Turbocompressors: Definition of compressor. Types of compressors. Relative comparisons of various compressor types.

Aerodynamic Components: Axial compressors. Centrifugal compressors. Impellers, diaphragms, guide vanes. Interstage seals. Balance piston seal. Impeller thrust. Internal compressor configuration: Straight thru, double flow, back to back, multi-stage iso-cool, side-load.

Compressor Characteristics: Centrifugal compressors. Slope. Stonewall. Surge. Off-design operation. Influence of the different operating variables: suction pressure, suction temperature, molecular weight changes, rotational speed, etc.

Compressor Design & Construction: Casing, impellers, diaphragms & rotors.

Equipment Selection: Considerations for selecting new equipment and rerating existing.



2) - Steam Turbines & Auxilliary Systems

Introduction to Steam Turbines: Blade designs, trip & throttle valves, integral rotor forgings, electronic speed control & trip, Rankine cycle, reaction & impulse turbines, back pressure and condensing turbines.

Casing & Rotors: Casing, steam chest, inlet valves, diaphragms, extraction valves, nozzle ring solid rotors, built-up rotors.

Auxiliary Systems: Speed control, overspeed trip, gland seal systems, condensers

Lube & Seal Oil Systems: Design philosophy, basic components: reservoir, pumps, relief valves, back-pressure regulator, transfer valve, coolers, filters, instrumentation, temperature control valve, pressure reducing valves, differential pressure reducing valves, contaminated oil drainers, lube rundown tanks, seal rundown tanks, accumulators, degassing tanks, overhead seal tanks, purifiers & piping.

3) - Turbomachinery Hardware, Bearings, Seals, Rotor Dynamics and Vibration

Shaft Ends Seals: Different type of seals: Labyrinth, restrictive (carbon), mechanical contact, sleeve (restrictive bushing) and dry gas seals and buffer systems.

Journal and Thrust Bearings: Different type of journal bearings: plain, pressure dam and tilting pad. Tilting pad thrust bearings. Bearing installation. Bearing instrumentation. Bearing damage.

Vibration: Vibration limits for turbomachinery & case studies.

Balance: Low speed balance, High speed balance.



4) - Flex Live Software & AWM

Compressor Performance: Head & efficiency evaluation

Performance Monitoring: Using of Flexware for performance evaluation and monitoring

Performance Monitoring: Using of Flex Live and AWM for performance evaluation and monitoring. Examples of Flexware performance monitoring and AWM for selected equipment.

5) – Field Performance Analysis

Compressor & Turbine Performance – Evaluation & Troubleshooting: Performance analysis techniques, Head & efficiency evaluation, performance problems, solutions and troubleshooting techniques. Motors, backpressure turbine analysis, condensing turbine analysis, gas turbine analysis.

Troubleshooting & Case Studies: Aerodynamic problems, iso-cooled compressors, refrigeration compressors, shop & field problems.

Compressor and Turbine Operation: Commissioning. Start-up procedure of compressors for different types of drivers: steam turbines, gas turbines and electric motors. Operational cares. Avoiding liquid ingestion. Possible problems when operating outside the OEM performance curve.

Q & A: Review in detail questions about aerodynamic issues and go over specific questions and problems brought to the training seminar.

“Learned a lot!” Jasmin Tremblay, Ultramar (Valero), St. Romuald, Quebec

“..overall good job.” Damien Parson, Occidental Chemical, Geismar, Louisiana

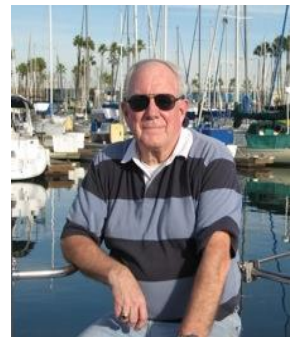
“Nice lecture & content. Helpful to my future work.” Frank Yuan, Chart Energy & Chemicals, The Woodlands, Texas

Instructor: Ron Stewart

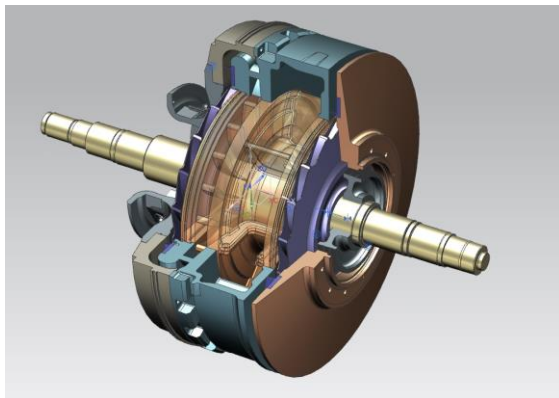
Ronald Stewart is currently Director, Technology Flexware, Inc., Grapeville, PA, USA where he assists with software development, does application engineering for rerates, and assists with sales, service calls & marketing. Mr. Stewart developed the original GasFlex® gas properties software which is the calculation engine for Flex Live® software.

Extensive worldwide sales and service career to global engineering firms and energy companies. Strong knowledge of complex turbomachinery systems (centrifugal gas compressors, axial air compressors, mechanical drive steam turbines, steam turbine generators & hot gas expanders) and how they integrate into end user’s systems.

Ronald Stewart received a Bachelor of Science - Marine Engineering at The University of Michigan - Ann Arbor, MI, USA in 1964.



“Thank you for the heat balance methodology for condensing turbines. I can save some money for Shell.” Clay Crook, Sarawak Shell Berhad



Client Listing: AdvanSix, Aramco, Astron Energy, British Petroleum, Chart Energy & Chemicals, ConocoPhillips, Consumer Coop Refineries, Canadian Natural Resources, Dakota Gasification, Dibran GmbH, ExxonMobil, Foster Wheeler, Full System Engineering, GE Oil & Gas, John Crane, Hess Oil, Kop-Flex, Linde Engineering, Meco, Motiva, Nalco, Occidental Chemical, Orinoco Iron, Petro-Canada, PDVSA, Praxair, Proman, PTT Exploration & Production Co., Qatar Petrochemical Co., RasGas, Sadara Chemical, Shell Chemical, Sherritt Metals, Sinclair Oil, Sincor, Sunoco, Syncrude Canada, Tata Chemicals, Turboaleaciones, Valero

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<u>#</u>	<u>Item & Description</u>	<u>Price Each</u>	<u>Quantity</u>	<u>Total Price</u>
1	1) - Compressor Aerodynamics			
2	2) - Steam Turbines & Auxilliary Systems			
3	3) - Turbomachinery Hardware, Brgs, Seals,.			
4	4) - Flex Live Software & AWM			
5	5) - Field Performance Analysis			
6	<u>“Compressors and Their Drivers” – 2023</u>	\$1,495 USD		
7	Flex Live XK, one year License	No Charge*		
	subtotal			
	6% Sales Tax (Pennsylvania Locations only)			
	Total Amount Due			

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