

# Balancing Rotating Machinery

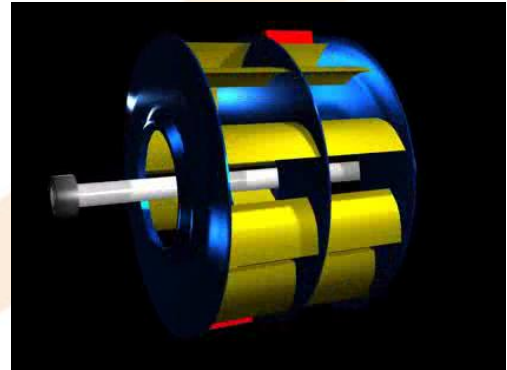
Machines that have been precision balanced run longer, use less energy and cost less to operate. Unbalance causes fatigue, reduces the life of bearings and can make looseness and resonance conditions far worse. This course will equip you with the knowledge and skills so that you can use a vibration analyzer/balancer, or a simple sheet of graph paper and protractor, and balance a machine - without having to remove it from the plant.

Learn how to recognize unbalance and set up the balance job for a successful balance. We start with the basics, provide an introduction to vibration, phase and vectors, and fully explain the balancing process. You will first learn how to perform a single plane balance with vectors. You will learn how to balance a machine using the single-plane and two-plane balance function of your analyzer. You will watch a complete demonstration of the balancing process, and you will be able to practice it yourself.

## The Mobius Way

Mobius makes vibration training unique. We use 3D animations, Flash simulations, and software simulators that completely explain and demonstrate the balancing process – you need to see them to believe them! You will understand vibration, phase, vectors and the calculations required. And you will understand the balancing process.

If you have to balance machines, then you need this course. If you have a modern analyzer/balancer you have two choices: take the readings, follow its instructions and hope for the best – or you can understand what you are doing, anticipate problems and complete any balancing job successfully. We will ensure you understand the entire process and give you the skills to perform precision balancing. We will not have time to explain the operation of every model of vibration analyzer, but we will provide you with the knowledge so that you will be successful with whatever model you own.



### Course Description:

Duration: 2 days. Topics include:

- What is unbalance:
  - Static and couple (with animations)
  - Dynamic

- o Why do machines become out of balance
- o Using vibration analysis to ensure it is out of balance and not misaligned
- o Dealing with runout and eccentricity, etc.
- o The balancing check-list:
  - o What you must have in place to do the balance job
- o Practical issues
  - o Stopping and starting the machine
  - o Knowing where to place the weights
  - o Where do you get the weights (what can be used as trial and final weights)
- o Quick review of amplitude and phase readings
  - o Relationship between vibration and unbalance and speed
  - o Relationship between balance weight/force and radius
  - o Phase conventions
- o Collecting vibration and phase readings
  - o What type of vibration and phase sensor to use
    - Accelerometers and proximity probes
    - Optical and laser tachometers
    - Keyphasors
    - Can you use a strobe to balance?
  - o Where to place the sensors
  - o Mounting the sensors
- o Understanding vectors
  - o What are they?
  - o Adding and subtracting vectors
  - o Polar plots
  - o Heavy spot and high spot
  - o Leading and lagging phase
- o Single plane balancing
  - o Review of the process
  - o When can you use the single-plane method
  - o Using vectors to perform single-plane balancing
  - o Using modern data collectors/analyzers to perform single-plane balancing
- o Estimating the size for the trial weight
- o Adding weights:
  - o Leaving the trial weights on between runs
  - o Removing the trial weights between runs

- o Splitting weights: when the solutions calls for a weight between two blades or holes
- o Combining weights: when balance weights are already on the machine and you wish to consolidate them
- o Two-plane balancing
  - o Review of the process
  - o When should you use the two-plane method
  - o Using modern data collectors/analyzers to perform two-plane balancing
- o The static-couple method
- o Balancing overhung machines
- o A quick review of balancing flexible rotors
- o Balancing standards
  - o ISO grades
  - o Using the charts
  - o Which grade to use
- o Why balancing may not be successful
  - o Machine is not out of balance
  - o Resonances
  - o Bad phase reference
- o The four-run method – balancing without phase
- o A quick introduction to shop balancing
- o We will demonstrate the entire process, and you will also be able to take readings and balance a machine