MUE247
Alignment Methods and Application
Course Introduction:

One of the most common causes of vibration in rotating equipment is shaft misalignment. This comprehensive course trains the participants the needs for precision shaft alignment and instructs the popular methods to achieve it. This course will provide participants with the working knowledge to achieve alignment on two-shaft systems (e.g. motor and pump) and will emphasize on what is involved in the overall alignment process. This course helps to insure that the participants are aware of the various techniques to measure and correct misalignment. In addition, it will help participants to know the best method of alignment to suit their applications on the process plant.

Course Objectives:

Upon successful completion of this course, the delegates will be able to:

- Aware of the energy saving techniques
- Apply and gain a comprehensive understanding of alignment
- Identify the importance of proper shaft alignment and identify the symptoms of misalignment
- Understand and analyze the symptoms of misaligned rotating machinery
- Identify Problems caused by Misalignment
- Accomplish Pre-Alignment checks
- Discuss the foundations, baseplate and piping effects and enumerate various types of couplings
- Determine Bar Sag, measure and compensate for it
- Determine, measure, compensate and correct Soft Foot
- Learn what is the pipe strain and how to compensate for it
- Check shaft Run out
- Identify alignment and coupling tolerances and perform the preliminary alignment checks
- Enumerate the different alignment methods (dial indicator and laser) and state the advantages of each alignment method
- Apply alignment procedures, analyze mathematical relationships and perform alignment calculations and graphic
- Evaluate alignment considerations for specific equipment such as; electric motors, pumps, gear boxes, compressors, cooling towers, blowers & fans & internal combustion engines
- Prevent misalignment severity and vibrations caused by misalignment
- Learn about various coupling types and applications
- Identify specific vibration characteristics associated with alignment related malfunctions
- Calculate and incorporate the thermal growth, then extract target dial indicator readings that will result in optimum hot alignment
- Know the advanced engineering tools, equipment and software that can be used to make difficult and complicated analysis of equipment condition easier and accurate
Learn about case studies and industrial standards for vibration correction and alignment of rotating machines

Who Should Attend?

This course is intended for maintenance engineers, plant and design engineers, technical support engineers, maintenance supervisors and technician millwright.

Course Outline:

Day 1:
Introduction
- What's Alignment?
- Causes of Misalignment
- Types of Misalignment
- Effects of Misalignment on the followings components:
  - Couplings
  - Gears
  - Seals
  - Bearings

Effect of Misalignment
- Vibration
- Overload
- Economics of Alignment (Costs Savings)
- Downtime

Day 2:
Alignment Preparation and Measurement
- Base preparation
- Coupling Run out
- Soft Foot
- Piping Strain
- Motor Magnetic Centre
- Bar Sag (Fixture Assembly, Measuring Bar Sag, Compensation for Bar Sag)
- Thermal Growth (Effects on Alignment, Measuring the Growth, Calculating the Correct Alignment)
- Alignment Tolerances (Considerations, Limitations and Acceptable Limits)
- Various types of alignment tools, methods and stages of shaft alignment techniques & methods
• Alignment methods
  • Visual
  • Straight Edge
  • Dial Indicators
  • Laser
  • Alignment Accuracies

Rim and Face Shaft Alignment
  • Balance Dial Indicator
  • Converting sweep readings
  • Formulas for determining Horizontal and Vertical Moves
  • Precision Alignment
  • Horizontal Alignment
  • Precise Horizontal Alignment
  • Precise Horizontal Alignment
  • Final Readings

Day 3:
Reverse/Cross Dial Alignment Method
  • Cross dial method
  • Rim Dial reading
  • Cross Dialing Alignment Graphical Method
  • How to construct the cross dial Graph
  • Steps in Drawing the Graph
  • Horizontal Cross Dial Graph Example
  • Graph Method of Cross Dialing in the Horizontal Plane
  • Cross Dial Measurement Method
  • Corrective Moves on MTBM
  • Angular Error Check
  • Offset Error Check
  • Alignment Error Limitations
  • Cross Dialing Horizontal Plane Alignment Using Formulae
  • Comparing Cross Dialing to Reverse Dialing

Laser Shaft Alignment
  • Laser Safety
  • Rim and Face Alignment
  • How accurate is the dial indicator readings
  • Laser Alignment
  • Key Laser Components
• Laser Emitter
• Receiver
• Safety and Operating Guide lines for Laser Units.
• Laser Bore Alignment

Day 4:
Advanced Alignment
• Safety
• Drive Shaft Coupling Alignment.
• Thermal Growth
• Practical Example
• Example of thermal Growth problem
• Electric Motor Thermal Growth
• Combination Misalignment and thermal Growth Correction.
• Hot Alignment Methods.
• Characteristics of Online Monitoring,
• Multi-Machine Shaft Alignment.

Aligning V-Belt Drives
• Belt Drive Systems—Advantages and Disadvantages
• V-Belt Standards Information
• Sheave Information
• V-Belt Recommendations and Rules of Thumb
• Sheave and Belt Wear
• Adjusting Belt Tension
• Preliminary Alignment Checks for V-Belts and Sheaves
• Types of Sheave Misalignment Conditions
• Using a Straightedge to Measure Misalignment
• Measuring the Misalignment at the Sheaves
• V-Belt Machine Measurements
• Modeling V-Belt Alignment Problems
• V-Belt Alignment Modeling Sample Problem

Day 5:
Flexible and Rigid Couplings
• Coupling and Shaft Misalignment Tolerances
• What is the Difference?
• The Role of Flexible Coupling
• What to Consider when Specifying a Flexible Coupling
• Types of Flexible Couplings
Course Requirement:

“Hand’s on practical sessions, equipment and software will be applied during the course if required and as per the client’s request”.

Course Certificate:

International Center for Training & Development (ICTD) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionaires
- Group Work
- Discussion
- Presentation

Course Fees:

To be advised as per the course location. This rate includes participant’s manual, and-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Course Timings:

Daily Course Timings:

08:00 - 08:20    Morning Coffee / Tea
08:20 - 10:00    First Session
10:00 - 10:20    Coffee / Tea / Snacks
10:20 - 12:20    Second Session
12:20 - 13:30    Lunch Break & Prayer Break
13:30 - 15:00    Last Session