# Introduction to Alignment

- Module 1-1: The VibrAlign Story
- Module 1-2: How We Train
- Module 1-3: The Machines We Align
- Module 1-4: Basic Shaft Alignment Concepts
- Module 1-5: Misalignment Forces
- Module 1-6: Media Resources
[Objective]

At the end of this module, the student will be able to:

- Understand the VibrAlign mission, values, and why we exist.
- Know his/her instructor’s background.
[Lesson] The instructor will discuss the following:

- VibrAlign Story
- Realigning America
[Objective]

At the end of this module, the student will be able to:

- Understand the systematic approach to training.
- Understand why we train.
[Lesson] The instructor will discuss the following:

- How we train
- If shaft alignment is necessary
Module 1-3

The Machines We Align

[Objective]

At the end of this module, the student will be able to:

- Understand the types of machinery that is typically aligned.
[Lesson] The instructor will demonstrate the following:

- Basics in alignment
- The machines that get aligned
Module 1-4

Basic Shaft Alignment Concepts

[Objective]

At the end of this module, the student will be able to:

- Understand the rotational axis.
- Define shaft alignment.
- Be able to explain angular misalignment, gap difference, and offset misalignment.
[Lesson] The lesson gallery & videos will be used to demonstrate:

- What is Offset Misalignment and what does it look like?
- What is Angular Misalignment and what does it look like?
Module 1-5

[Objective]

At the end of this module, the student will be able to:

- Understand the importance of precise alignment.
- Understand the effects of Misalignment on couplings, bearings, seals, and machines.
Module 1-5

Misalignment Forces

[Lesson] The instructor will demonstrate the following:

- How misalignment forces cause coupling wear.
- How misalignment forces can cause bearing and seal failure.
Module 1-6

Introduction to Alignment Resources

The VibrAlign Story
Realigning America
How We Train
Shaft Alignment Training, is it Necessary?
Concepts of Shaft Alignment 1, the Basics
Concepts of Shaft Alignment 2, Offset and Angularity
Unit 2

Pre-Alignment

- Module 2-1: Rough Alignment
- Module 2-2: Obvious Soft Foot
- Module 2-3: Tightening Sequence
- Module 2-4: Final Soft Foot Checks
- Module 2-5: Other Pre-alignment Checks Listing
- Module 2-6: Media Resources
Module 2-1  Rough Alignment

[Objective]

At the end of this module, the student will be able to:

- Perform rough alignment of the shafts.
[Lesson] The instructor will demonstrate the following:

- Using straight edge or scale to measure the vertical and horizontal offset misalignment.
- Using the above information to correct the rough misalignment.

Rough Alignment

Roughing In
1. Measure the vertical gap between the stationary and movable hubs using a straight edge and shims as a feeler gauge.

2. Correct the vertical misalignment by adding or removing shims to all four feet of the moveable machine.

3. Using the straight edge, measure and correct the horizontal alignment.
1. Why do you perform rough alignment before attempting to precisely align machines?

2. Which direction should you typically rough align first - vertical or horizontal?

3. Should all machines be uncoupled before roughing in?
Module 2-2  Correcting Obvious Soft Foot

[Objective]

At the end of this module, the student will be able to:

- Correct obvious soft foot.
- Understand the different types of soft foot.
Module 2-2  Correcting Obvious Soft Foot

[Lesson] The instructor will demonstrate the following:

- How to identify and measure Obvious Soft Foot using shims or feeler gauges.
- How to properly correct Obvious Soft Foot using shims.

Elimination of Obvious Soft Foot
Activity 2-2  CORRECTING OBVIOUS SOFT FOOT

1. With the bolts loose, use a pry bar, screwdriver, or pliers to look for shim piles that have less resistance than others. This indicates that the weight is not being distributed equally over all four feet.

2. Add shims as needed to make the resistance at each foot feel the same.

3. You may need to pry up on a foot to insert the corrective shim.
Discussion 2-2  

**CORRECTING OBVIOUS SOFT FOOT**

1. What are some possible causes of soft foot?

2. Why should you correct soft foot before attempting precision alignment?

3. Why should you rough align before checking for soft foot?
[Objective]

At the end of this module, the student will be able to:

- Understand the need to maintain a specific bolt tightening sequence.
[Lesson] The instructor will demonstrate the following:

- Establishing a bolt tightening sequence.
- Taking three passes to achieve full torque.
Fixturlaser NXA

Activity 2-3

Tightening Sequence

In three steps:

1. Tighten bolts, in order, hand tight.
2. Snug bolts, in order, to about 50% of final torque.
3. Tighten bolts, in order, to final torque.
1. Why should you follow a specific sequence when tightening bolts?

2. What benefits are gained by tightening the bolts down in a controlled, repeatable pattern?
Module 2-4

Final Soft Foot Corrections

[Objective]

At the end of this module, the student will be able to:

- Detect and correct final soft foot.
- Identify whether an “angular” correction is required.
- Explain how to correct angled foot.
- Control and minimize the effects of any remaining residual soft foot.
[Lesson] The instructor will demonstrate the following:

- Using a .002" (2 mils) shim to detect and correct any final soft foot.
In this procedure you will:

1. Loosen one foot.

2. Measure for any remaining soft foot by checking several places under the foot with a 2-mil shim.

3. Re-tighten hold-down bolt.

4. Repeat process for the remaining three feet, tightening each foot back down after completion.
Discussion 2-4

Final Soft Foot Corrections

1. Why do we check for Final Soft Foot by loosening only one bolt at a time?

2. Why are two soft foot checks needed?
Module 2-5

Other Pre-Alignment Checks Listing

[Objective]

At the end of this module, the student will have an understanding of additional pre-alignment checks.

- Check run out.
- Check for proper coupling hub separation.
- Measurement for pipe stress.
[Lesson] The instructor will discuss the following:

- Obvious safety inspections.
- Performing a visual inspection of the machine.
- Checking for run out on both coupling hubs and shafts.
- Measuring hub separation.
- Using dials to detect excessive pipe stress.
Module 2-6

Pre-Alignment Resources

- Rough Alignment
- Elimination of Obvious Soft Foot
- Bolt Tightening
- Final Soft Foot Checks
- Roughing In

- Bolt Tightening Order
Unit 3

Basic Shaft Alignment

• Module 3-1: Demonstration of precision alignment #1
• Module 3-2: Demonstration of precision alignment #2
• Module 3-3: Student Practice #1- Using the Express Method
• Module 3-4: Changing Measuring Methods
• Module 3-5: Student Practice #2- Using the Tri-Point Method
Basic Shaft Alignment

- Module 3-6: Introduction to Tolerances
- Module 3-7: Student Practice #3- Aligning Using 3600 RPM Tolerances
- Module 3-8: Sampling Time and Repeatability Test
- Module 3-9: Vibration Filtering
- Module 3-10: Student Practice #4- Uncoupled Alignment
- Module 3-11: Student Practice #5- Spacer Shaft
- Module 3-12: Media Resources
Module 3-1 Demonstration of Precision Alignment #1

[Objective]

At the end of this module, the student will be able to:

- Observe an entire precision alignment process
Demonstration of Precision Alignment #1

[Lesson] The instructor will demonstrate the following:

- Setting up the NXA.
- Starting the horizontal alignment program.
- Aiming the lasers.
- Entering machine dimensions.
[Lesson cont’d] The instructor will demonstrate the following:

- Measuring misalignment.
- Making a Verti-Zontal Compound Move.
- Remeasuring alignment.
- Saving results.
Discussion 3-1

Demonstration of Precision Alignment #1

1. Of the four dimensions which do you think are the most important to measure correctly?

2. True or false, the sensors should be mounted as closely together as possible.

3. At what point do the lasers become visible and begin measurement?
Module 3-2

Demonstration of Precision Alignment #2

[Objective]

At the end of this module, the student will be able to:

- Assist in an entire precision alignment process.
Module 3-2 Demonstration of Precision Alignment #2

[Lesson] The instructor will demonstrate the following:

- Setting up the NXA.
- Starting the horizontal alignment program.
- Aiming the lasers.
- Entering machine dimensions.
- Measuring misalignment.
Demonstration of Precision Alignment #2

[Lesson] The instructor will demonstrate the following:

- Making a Verti-Zontal Compound Move.
- Remeasuring alignment.
- Saving results.
1. How important is it to save the “as found” data?

2. Is it important to aim the lasers perfectly?

3. On the results screen, which group of numbers is most important, those at the coupling, or those at the feet?

4. How do you know if you’ve maintained proper backlash during the measurement process?
Module 3-3

Practice #1: Using the Express Method

[Objective]

At the end of this module, the student will be able to:

- Perform an entire precision alignment using the Verti-Zontal Compound Move® process with a tolerance of 1800 rpm.
[Lesson]

The instructor will observe and assist you in performing a complete alignment.
Activity 3-3

Practice #1: Using the Express Method

1. Remove the shims from the moveable element.
2. Perform your pre-alignment checks and correction.
3. Perform a precision alignment for an 1800 rpm machine.
4. Re-measure and document the results.
1. What do the colors of the coupling icons represent?

2. What is a primary benefit of using the Verti-Zontal process?

3. Did the training fixture move in the manner and direction you expected?
[Objective]

At the end of this module, the student will be able to:

- Understand the three measurement methods of the Fixturlaser NXA and their uses.
Module 3-4 Changing Measurement Methods

[Lesson] The instructor will demonstrate the following:

- How to change the NXA from Express Method to Tri-Point, and discuss when it should be used.
1. Remove the shims from the moveable element.
2. Perform your pre-alignment checks and correction.
3. Start up the NXA, and select horizontal alignment.
4. Select the Tools icon, then select the Measurement Methods icon.
5. Change the Measurement Method from Express to Tri-point.
1. When would it be beneficial to change the measuring method from Express to Tri-Point?
Module 3-5

Practice #2: Using the Tri-Point Method

[Objective]

At the end of this module, the student will be able to:

- Perform an entire precision alignment process with a tolerance of 1800 rpm using the Tri-Point Method.
Practice #2: Using the Tri-Point Method

[Lesson] The instructor will observe and assist you in the following:

- Perform a precision alignment for a 1800 rpm machine using the Tri-Point Method.
- Re-measure and document the results.
Activity 3-5

Practice #2: Using the Tri-Point Method

1. Remove the shims from the moveable element.
2. Perform your pre-alignment checks and correction.
3. Perform a precision alignment for an 1800 rpm machine using the Tri-Point method.
4. Re-measure and document the results.
Practice #2: Using the Tri-Point Method

1. What are the major benefits of using the Tri-Point Method?
2. Are there any disadvantages of using Tri-Point?
Module 3-6  

Introduction to Tolerances

[Objective]

At the end of this module, the student will be able to:

- Understand the reason for alignment tolerances.
Module 3-6  Introduction to Tolerances

[Lesson] The instructor will demonstrate the following:

- Changing the alignment tolerance from an 1800 rpm tolerance to a 3600 rpm tolerance.

Lesson Gallery 3.6.1 Tolerances

Who Decides Shaft Alignment Tolerances?
Tolerances vs. Coupling Tolerances
Don't Look at Your Feet
The Zone of Good Alignment
Touch-Tip: Entering Dimensions and Setting Tolerances
Fixturlaser NXA

Activity 3-6

Introduction to Tolerances

1. Remove the shims from the moveable element.
2. Perform your pre-alignment checks and correction.
3. Use the NXA to select 3600 rpm tolerance and enter the machine dimensions.
4. Leave the NXA on and in the shaft alignment application.
Discussion 3-6

Introduction to Tolerances

1. Why are alignment tolerances specified?
2. Do you know your company’s alignment tolerances?
3. Why is alignment to zero impractical?
Module 3-7  

Prac #3: Using 3600 RPM Tolerances

[Objective]

At the end of this module, the student will be able to:

- Measure the “as found” alignment data from the roughing in process and save the data.
- Perform an entire precision alignment process with a tolerance of 3600 rpm.
- Save the final “as left” alignment data.
Module 3-7  **Prac #3: Using 3600 RPM Tolerances**

[Lesson] The instructor will observe and assist in performing a 3600 rpm alignment.
Activity 3-7

Prac #3: Using 3600 RPM Tolerances

1. Complete the alignment, using a tolerance of 3600 rpm.

2. Re-measure and document the “as left” data.
1. What are some challenges of aligning to a 3600 rpm tolerance?

2. Are shim stack thicknesses more critical at 3600 rpm?

3. What would be the importance of saving both the “as found” and “as left” data?

4. How can the Zone of Good Alignment be used to determine acceptable foot values?
[Objective]

At the end of this module, the student will be able to:

- Understand and utilize the Sampling Time and Repeatability Test functions on the Fixturlaser NXA.
Module 3-8

Sampling Time and Repeatability Test

[Lesson] The instructor will demonstrate the following:

- A Repeatability Test with a sampling time of 3 seconds.
- Changing the Sampling Time to 5 seconds
- Repeating the Repeatability Test.

Lesson Gallery 3.8.1 Repeatability Test

REPEATABILITY TEST

The Repeatability Test is used to determine the environment in which we are aligning. It is possible to reduce the influence of external conditions (e.g. air turbulence or vibrations) that otherwise would compromise the accuracy of the measuring result.

Before starting the measurement it is recommended to perform a repeatability test to set the correct sampling time.

Is Vibration Interfering With Your Precision Shaft Alignment?

Non-repeatability, A Little movement Can Cause A Lot of Headaches
Sampling Time and Repeatability Test

1. Perform a Repeatability Test with the normal 3 sec duration.
2. Change the sampling time to 5 sec.
3. Perform a second Repeatability Test.
4. Change the sampling duration back to 3 sec.
1. What is the reason for the Repeatability Test?

2. Should a Repeatability Test be performed before each alignment? Explain.

3. How can increasing the sampling time improve repeatability?
[Objective]

At the end of this module, the student will be able to:

- Understand the use of the Screen Filter, and when to utilize it.
Module 3-9  VIBRATION FILTERING

[Lesson] The instructor will demonstrate the following:

- Use of the Screen Filter.
1. What is the purpose of the Screen Filter?

2. What is the best method of determining the influences of external vibration on alignment data?

3. Should the Screen Filter be used for every alignment? Why or why not?

4. Explain the difference in the Screen Filter and the Sampling Time.
Fixturlaser NXA

Module 3-10  Practice #4: Uncoupled Alignment

[Objective]

At the end of this module, the student will be able to:

- Complete a precision alignment of an uncoupled machine.
- Have a better understanding of the inclinometer values on the NXA, and how they can be utilized.
Practice #4: Uncoupled Alignment

[Lesson] The instructor will demonstrate the following:

- Performing an uncoupled precision alignment.
Practice #4: Uncoupled Alignment

1. Remove the shims from the moveable element.
2. Perform the pre-alignment steps.
3. Leave the coupling insert out.
4. Measure misalignment and save the “as found” data.
5. Complete the alignment, using a tolerance of 1800 rpm.
6. Re-measure and document the “as left” data.
1. When would it be preferable to perform an uncoupled alignment?

2. Should the alignment values change once the coupling is assembled?

3. How close should the inclinometer values be kept when performing an uncoupled alignment?
Fixturlaser NXA

Module 3-11

Practice #5: Spacer Shaft

[Objective]

At the end of this module, the student will be able to:

- Understand what is classified as a spacer shaft.
- Align a machine using the Spacer Shaft function.
Module 3-11

Practice #5: Spacer Shaft

[Lesson] The instructor will demonstrate the following:

- Use of the Spacer Shaft function of the NXA.
1. Remove the shims from the moveable element.

2. Perform the pre-alignment steps and re-assemble the coupling.

3. Input measurements, using the moveable element face as the first coupling, and the stationary element face as the second coupling.

4. Complete the alignment, using a tolerance of 1800 rpm.

5. Re-measure and document the “as left” data.
Discussion 3-11  Practice #5: Spacer Shaft

1. What is the definition of a spacer shaft?

2. Why are there no offset misalignment values displayed when using the Spacer Shaft function?

3. Suppose the machine you were aligning had a 6” shaft extension. Should it be treated as a spacer shaft alignment? Why or Why not?
The Importance of Proper Alignment Technique and Being Aware of movement

How to Minimize the Effects of Backlash When Measuring Misalignment

Aligning Uncoupled Machines

Shaft Alignment With A Fluid Coupling

Choosing the Best Way to Mount the Sensors of Your Laser Alignment Tool

From the Mailbag: Mounting to Coupling Hubs

Flexible Couplings and Flexible Shafts

Who Decides Shaft Alignment Tolerances?

Tolerances vs. Coupling Tolerances

Non-repeatability, A Little movement Can Cause A Lot of Headaches
Module 3-12

Basic Shaft Alignment Resources

- Is Vibration Interfering With Your Precision Shaft Alignment?
- Don’t Look at Your Feet
- The Zone of Good Alignment
Alignment Problems and Solutions

• Module 4-1: When Things Go Wrong- looseness, backlash
• Module 4-2: Soft Foot Revisited (including angled foot)
• Module 4-3: Student Practice #6: Solving Base Bound/Bolt Bound Issues
• Module 4-4: Media Resources
[Objective]

At the end of this module, the student will be able to:

- Identify issues associated with coupling backlash and system looseness.
[Lesson] The instructor will demonstrate the following:

- How backlash and looseness affect readings
- How to identify and control backlash and looseness
- Methods to control backlash
Activity 4-1 Backlash and Looseness

1. Mount the sensors as you would in a normal alignment.
2. Start up the NXA, and select horizontal alignment.
3. Enter dimensions.
4. Select 1800 RPM and follow through to the alignment screen, stop.
5. At this point, take note of the inclinometer readings at the top of the NXA display screen.
Activity 4-1  

Backlash and Looseness

6. Rotate the movable shaft back and forth causing backlash in the coupling.

7. Take note of the inclinometer readings and how they change.

8. Take note of any warnings that may be displayed on the screen.
Discussion 4-1  BACKLASH AND LOoseness

1. When the shafts are rotated, how did the inclinometer readings change?

2. When backlash was introduced into the coupling, were there any warnings displayed on the screen?

3. How would you correct the warning situation?

4. What are some methods for preventing backlash?
Module 4-2  Soft Foot Revisited

[Objective]

At the end of this module, the student will be able to:

- Measure and correct soft foot using the Fixturlaser NXA.
[Lesson] The instructor will demonstrate using the NXA Soft Foot App.
Activity 4-2  Soft Foot Revisited

1. Using the process demonstrated, measure and correct soft foot on your demonstrator using the NXA Softfoot application.
Discussion 4-2  Soft Foot Revisited

1. What do the numbers represent?
2. How could all four feet be soft?
3. What would be the reason that adding a shim would cause little or no change when re-measured?
4. How could you resolve this problem?
5. What effect does “angled” softfoot have on the alignment?
Module 4-3  Base Bound/Bolt Bound Issues

[Objective]
At the end of this module, the student will be able to:

- Discuss alternative solutions to limited movement of machines in both vertical and horizontal planes.
- Determine solutions for dealing with Base Bound/Bolt Bound issues and correct.
Module 4-3  Base Bound/Bolt Bound Issues Lesson

[Lesson] The instructor will demonstrate the following:

- Solving base-bound bolt-bound conditions using the NXA Feet Lock program.

Lesson Gallery 4.3.1 Solving Bolt-Bound/Base-Bound Conditions

SOLVING FOR BASE-BOUND/BOLT-BOUND PROBLEMS WITH FEET-LOCK™

Sometimes the result displayed for the movable machine is not possible to accomplish. If the movable machine setting is too high and you have to remove more shims, the machine is said to be base-bound.

BLOG POST
Base-Bound/Bolt-Bound Math

BLOG POST
Is it okay to undercut bolts?

BLOG POST
Take a Step Back During Your Shaft Alignment

BLOG POST
What if You Had to Leave a Machine Slightly Misaligned?
Activity 4-3

Base Bound/Bolt Bound Issues

1. Student will perform procedure as outlined and demonstrated by instructor.
Discussion 4-3 Base Bound/Bolt Bound Issues

1. What does it mean to be bound in the vertical or horizontal planes?

2. What alternatives may be exercised to eliminate this condition?

3. If both base-bound and bolt-bound conditions are present can the selection of locked feet be changed during the alignment process?
Base Bound/Bolt Bound Issues

4. Once the base-bound or bolt-bound condition(s) are corrected, how do you switch back to the regular shaft alignment program?
Module 4-4

Alignment Problems and Solutions

Resources

- How To Minimize the Effects of Coupling Backlash When Measuring Misalignment
- Troubleshooting Looseness During Shaft Alignment
- Pre-alignment Steps for Shaft Alignment
- "Mic" Your Shims
- Small Details Make A Big Difference in Shaft Alignment
- Base-Bound/ Bolt-Bound Math
- Is it okay to undercut bolts?
- Take a Step Back During Your Shaft Alignment
- What if You Had to Leave a Machine Slightly Misaligned?
VibrAlign Resources

- Module 5-1: Mobile Applications
- Module 5-2: The Alignment Blog
- Module 5-3: VibrAlign YouTube Channel
- Module 5-4: Realigning America
- Module 5-5: The Alignment Resource Center
- Module 5-6: T-mail Training Newsletter
- Module 5-7: Training Website
Module 5-1

MOBILE APPS: iOS and Android

Gallery 5.1 Laser-Dials App

Gallery 5.2 Therm Align App

Gallery 5.3 Align Terms App
Module 5-1

MOBILE APPS: iOS and Android

Gallery 5.4 Align Hot Check

Gallery 5.5 Fixturlaser Dials
Our goal here is to provide informative, relevant articles on the challenges of aligning industrial equipment. We’ll talk about gathering meaningful alignment data, making the difficult moves, common pitfalls, etc. We’ll present real-world situations with data we’ve collected in the field and hopefully get some good discussions going. This will also be another place to keep up with innovations and product releases from Fixturlaser.
Module 5-3

VIBRALIGN YouTube Channel

http://www.youtube.com/user/VibrAlign
Realigning America signifies a nationwide community of aligners that can provide a sense of support and camaraderie among colleagues. Through Realigning America, your work is made public to the world. This exposure offers a gateway for aligner prominence and notability within the community of Realigning America. Posted alignments instantly create a learning environment that fosters collaboration and education.
All of the VibrAlign collection of alignment materials is now being collected and made available on the Alignment Resource Center. The site not only provides access to articles and videos about alignment, it also provides access to all the posts from The Alignment Blog. All the content is organized and searchable.
The eNewsletter features advice from VibrAlign’s alignment experts, and articles on technical topics, as well as answers to questions from T-Mail subscribers and VibrAlign customers. T-Mail will also keep subscribers up to date on product updates, new software including apps, training classes, and relevant content available through other publications such as VibrAlign’s blog and website.
Module 5-7

Training Website

http://www.vibralign.com/Training
## Unit 6

### Omniview™, Operating Modes, Global Settings, & File Management

- Module 6-1: Screen Flip and Omniview™
- Module 6-2: Power Supply and Charging
- Module 6-3: Global Settings
- Module 6-4: Bluetooth Pairing
- Module 6-5: File Management
- Module 6-6: NXA Care and Handling
Module 6-1

Screen Flip and Omniview™

[Objective]

At the end of this module, the student will be able to:

- Understand the Screen Flip and Omniview™ functions and how to utilize them.
[Lesson] The instructor will demonstrate the following:

- Screen Flip function
- Activating Omniview™
- Synchronizing Omniview™
- Calibrating Omniview™
1. Student synchronizes Omniview™ function of NXA, and rotates NXA screen using Screen Flip function.
1. If the screen view on the NXA does not match the view the user sees of the machine, how can the NXA screen be changed?
[Objective]

At the end of this module, the student will be able to:

- Understand the charging functions of the NXA.
Module 6-2

Power Supply and Charging

[Lesson] The instructor will demonstrate the following:

- Battery life and maintenance.
- Low battery indicator.
- Charging cycle and indicator.
- How to charge the display unit and Bluetooth transmitters.
1. Should I ever remove the charging cables from the NXA case?

2. Can I check the charge level of the batteries while the NXA is turned off?
Module 6-3 Global Settings

[Objective]

At the end of this module, the student will be able to:

- Set up and modify the various global utility parameters in the NXA Display Unit.
[Lesson] The instructor will demonstrate the following:

- Setting the date and time
- Changing measurement units between inches and millimeters.
- Battery Status settings
- Wireless settings
- Auto-start settings
1. How can I easily tell if the NXA is set up to measure in inches or millimeters?

2. Why would you use cables instead of the Bluetooth Units.
Module 6-4  Bluetooth Pairing

[Objective]

At the end of this module, the student will be able to:

- Know how and when to re-pair the Bluetooth Transmitters
[Lesson] The instructor will demonstrate the following:

- Un-Pairing and re-pairing the Bluetooth transmitters
1. What image (icon) should you see in the middle lower portion of the main (opening) screen of the NXA display unit when using the Bluetooth Transmitters?
Module 6-5

File Management

[Objective]

At the end of this module, the student will be able to:

- Understand the difference between a file and a folder.
- Create a new folder.
- Sort, move and rename files.
- Copy alignment data from the NXA Display Unit to a PC.
Module 6-5

File Management

[Lesson] The instructor will demonstrate the following:

- Creating a new folder.
- Copying a file into a folder.
- Changing a file name.
- Save the file onto a flash drive and transfer to a PC.
[Lesson cont’d] The instructor will demonstrate the following:

- Open alignments on a PC and discuss jpeg vs. text files.
1. Students will rename their most recent saved alignment and copy it from the My Measurements folder onto a USB Flash drive.
1. What would be a good way to organize folders for your facility?

2. Can a file or folder be moved back into the NXA from a PC.

3. Is a special program needed to transfer files and folders from the NXA onto a PC?
Objective

At the end of this module, the student will be able to:

- Understand the proper care, handling and cleaning of the Fixturlaser NXA Pro Alignment System.
Module 6-6  Care and Handling

[Lesson] The instructor will discuss the following:

- NXA Storage case.
- NXA DU, M & S Sensors IP65 rating.
- Touch screen durability.
- Temperature and Humidity working range.
- Proper cleaning of display unit screen, detector and laser “windows” using a soft cloth or Q-tip not paper products. Use Alcohol only.
1. Can I clean my NXA with an ammonia based cleaner?

2. Do I need to protect the NXA Display Unit and Sensors from rain?

3. What should I use to clean the laser and detector openings on the sensors, paper towels or a Q-tip?
Advanced Shaft Alignment

- Module 7-1: Thermal Growth & Dynamic Movement
- Module 7-2: Entering Thermal Targets at the Feet
- Module 7-3: Entering Thermal Targets at the Coupling
- Module 7-4: Student Practice #7 using Thermal Targets
Unit 7

Advanced Shaft Alignment

• Module 7-5: Hot Check Program
• Module 7-6: OL2R Program*
• Module 7-7: Machine Train*
• Module 7-8: Offset Alignment*
• Module 7-9: Media Resources*
Module 7-1  Thermal Growth & Dynamic Movement

[Objective]

At the end of this module, the student will be able to:

- Explain why some machines are intentionally misaligned.
- Discuss the difference between thermal growth and thermal targets.
- Define Dynamic Movement.
Module 7-1  Thermal Growth & Dynamic Movement

[Lesson] The instructor will demonstrate the following:

- Causes of thermal growth.
- How thermal growth affects
- Necessity of accurate thermal growth targets.
**Discussion 7-1**

**Thermal Growth & Dynamic Movement**

1. What are targets?
2. Can thermal changes affect both elements?
3. Can you have both vertical and horizontal changes?
4. What is the most common cause of dynamic movement?
Module 7-2  ENTERING THERMAL TARGETS AT THE FEET

[Objective]

At the end of this module, the student will be able to:

- Enter thermal targets at the feet of the moveable and/or stationary machine(s).
Module 7-2

Entering Thermal Targets at the Feet

[Lesson] The instructor will demonstrate the following:

- Select the Thermal Targets icon.
- Choose the foot icon.
Activity 7-2

Entering Thermal Targets at the Feet

1. Student enters thermal targets at the feet.
1. When would you enter the Thermal Growth Target Values at the feet?

2. Can Thermal Growth Targets be entered for both the moveable and stationary machines?

3. Where do your thermal growth targets come from?

4. Should thermal growth targets be used if the machine you are aligning is hot?
Module 7-3  Entering Thermal Targets at the Coupling

[Objective]

At the end of this module, the student will be able to:

- Enter thermal targets at the coupling for the movable machine.
Module 7-3  Entering Thermal Targets at the Coupling

[Lesson] The instructor will demonstrate the following:

- Select the Thermal Targets icon.
- Choose the coupling icon.
- Define and enter targets.
- Return to the shaft alignment.
Activity 7-3

**Entering Thermal Targets at the Coupling**

1. Students re-measure new alignment results, then input thermal offset targets at the coupling of +.5 mils per inch angularity, and an offset of +3 mils.
**Discussion 7-3**

**ENTERING THERMAL TARGETS AT THE COUPLING**

1. Where do I get these targets?
2. Why would you use foot targets vs. coupling targets?
3. How do I use the positive and negative values?
4. Can I store these targets?
[Objective]

At the end of this module, the student will be able to:

- Perform the entire precision alignment process with a tolerance of 1800 RPM and to Thermal Targets of -8 mils for the front and rear feet of the movable machine.
Practice #7: Using Thermal Targets

[Lesson] The instructor will observe & assist in the following:

- Remove the shims from the moveable element.
- Perform your pre-alignment checks and corrections.
- Enter Thermal Target Foot Values of -8.0 mils for the front and rear feet of the movable machine.
- Perform a precision alignment for an 1800 rpm machine.
- Re-measure and document the results.
Discussion 7-4

Practice #7: Using Thermal Targets

1. What icon should you see on the NXA DU screen when performing an alignment with Thermal Targets.

2. You have entered a Thermal Target of -8.0 mils for the front feet of the movable machine. The NXA Shim Screen shows to remove 28 mils from the front feet. How much shim do you remove?
Module 7-5

Hot Check Program

[Objective]

At the end of this module, the student will be able to:

- Utilize the Hot Check program of the NXA.
Module 7-5  Hot Check Program

[Lesson] The instructor will demonstrate the following:

- Hot check program.
**Activity 7-5**

**HOT CHECK PROGRAM**

1. Student uses cold and hot measurements stored in the NXA to simulate Hot Check.
1. What is the function of Hot Check?
2. Why take measurements hot and cold?
3. Why should the “Hot” Measurements be taken quickly?
[Objective]

At the end of this module, the student will be able to:

- Utilize the OL2R Program and special brackets.
[Lesson] The instructor will demonstrate the following:

- OL2R brackets and program on a training fixture.
OL2R Program Discussion 7-6

1. How does the OL2R Program differ from Hot Check.

2. Should the M & S sensors be removed while waiting for the machines to reach operational temperatures for the “Hot” OL2R Measurement?

3. What happens if the OL2R special brackets are moved during the OL2R measuring process?
[Objective]
At the end of this module, the student will be able to:

- Understand what a machine train is.
- Understand when to use Machine Train.
- Understand how to set up and measure a machine train.
Module 7-7  Machine Train

[Lesson] The instructor will demonstrate the following:

- What is a machine train.
- How to set up and measure a machine train.
Discussion 7-7  Machine Train

1. What constitutes a machine train?

2. Can the machine train function be used with a right-angle gearbox?

3. Is it possible to perform the moves of all machines using the Machine Train Function?

4. What are some benefits of using the Machine Train Function?
Module 7-8  Offset Alignment

[Objective]

At the end of this module, the student will be able to:

- Utilize the Offset Alignment Program and Brackets in the NXA.
[Lesson] The instructor will demonstrate the following:

- Offset Alignment Program and brackets.
1. Why is it important to minimize the vertical and horizontal angular misalignment on machines with offset drives.

2. When making the vertical angular correction, if the rear motor feet are sitting high and there are no shims under the rear feet, how would you correct the vertical alignment?
Module 7-9

Advanced Shaft Alignment Resources

- Shaft Alignment Thermal Growth Targets - When You Don't Know
- Checking Your Thermal Targets
- How Does Calculating Your Own Alignment Targets Work?
- Thermal Growth: What's So Hot About It?
- Thermal Growth Compensation - Growth Versus Targets
- Should Thermal Growth Affect Angular Misalignment?
- Calculating Foot Targets
- Measuring Thermal growth with XA Pro and OL2R
- Machine Train Shaft Alignment - To Move or Not to Move

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Appendix

• Module 8-1: Clock Mode
• Module 8-2: Vertical Alignment
• Module 8-3: Machine Defined Data
• Module 8-4: Media Resource
[Objective]

At the end of this module, the student will be able to:

- Determine when to use clock method.
- Select clock method.
- Understand the differences between Express Mode, Tripoint and Clock methods.
[Lesson] The instructor will demonstrate the following:

- How to change the NXA into clock method.
- Discuss when to perform measurements in clock method.
1. What are the major differences between Clock Method, and Express and Tri-Point Methods?

2. Explain True Position.

3. When would you use the clock method as opposed to the others?
Module 8-2  Vertical Alignment

[Objective]
At the end of this module, the student will be able to:

- Identify when to use the vertical alignment application.
- Understand the differences in vertical alignment of C-face motors, and vertically-oriented motors with four feet.
[Lesson] The instructor will demonstrate & discuss the following:

- The Vertical Alignment icon.
- Differences in C-face and four footed motors.
1. What are the major differences in the dimensions needed to perform a vertical alignment?

2. How could you perform a vertical alignment on a machine with four motor feet?

3. If you have a horizontally-mounted C-face motor, which measurement method should you use – horizontal or vertical?
Module 8-3  Machine Defined Data

[Objective]

At the end of this module, the student will be able to:

- Understand the Machine Defined Data function of the NXA.
- Discuss possible uses of the function
Module 8-3

Machine Defined Data

[Lesson] The instructor will demonstrate the following:

- How to save Machine Defined Data

Lesson Gallery 8.3.1 Machine Defined Data

SAVING MACHINE DEFINED DATA

To save Machine Defined Data, touch the Machine Defined Data icon in the settings menu.
[Lesson cont’d] The instructor will demonstrate the following:

- How to recall Machine Defined Data
1. You have 10 identical motor-pump configurations. Could a Machine Defined Data template be used?

2. If the 10 machines above were not identical, could a Machine Defined Data template be used? Why or why not?
Module 8-4

APPENDIX RESOURCES

Dial Indicator Alignment Concepts

A Vertical Shaft Alignment Process

VIDEO

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