Fixturlaser XA

version 1.6

TRAINING MANUAL

VIBRALIGN

Unit 1

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

Module 1-1

The VibrAlign Story

[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.

Module 1-1

The VibrAlign Story

[Lesson] The instructor will discuss the following:

- VibrAlign Story
- Realigning America

VIDEO

The VibrAlign Story

VIDEO

Realigning America

Module 1-2

How We Train

[Objective]

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

- Understand the systematic approach to training.
- Understand why we train.

Module 1-2

How We Train

[Lesson] The instructor will discuss the following:

- How we train
- If shaft alignment is necessary

VIDEO

How We Train

VIDEO

Shaft Alignment Training, is it 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.

Module 1-3

The Machines We Align

[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.

Module 1-4

Basic Shaft Alignment Concepts

[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?

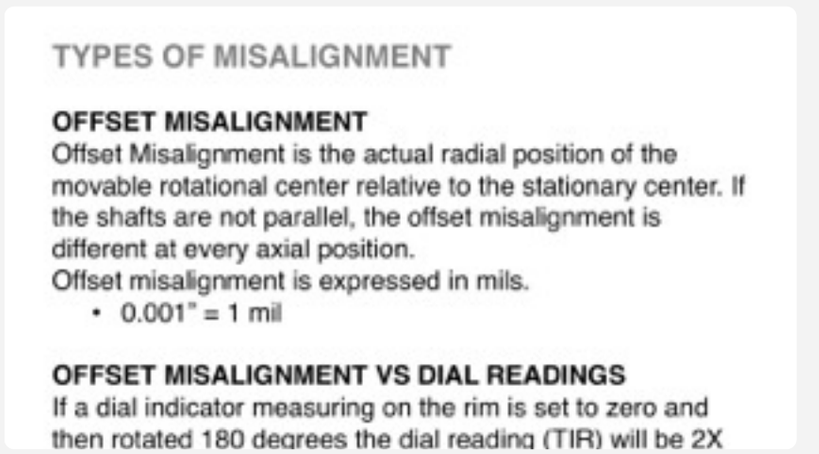
VIDEO

Concepts of Shaft Alignment 1, the Basics

VIDEO

Concepts of Shaft Alignment 2, Offset and Angularity

Lesson Gallery 1.4.1
Basic Shaft Alignment Concepts



Module 1-5

Misalignment Forces

[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.

Lesson Gallery 1.5.1
Misalignment Forces

MISALIGNMENT FORCES

Misalignment creates forces at the coupling which are exerted on the shafts. This results in reduced bearing and seal life.

The force effects of misalignment can be simplified by considering the misalignment as a simple lever. Misalignment at the coupling creates a moment of force acting on an effort arm. This will create a first class or second class lever with either the inboard or outboard bearing acting as a fulcrum. The length of the motor shaft between its bearings is the resistance arm. The objective of

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

  Activity 2-1: Performing rough alignment

- Module 2-2: Correcting Soft Foot

  Activity 2-2: Correcting 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.

Module 2-1

Rough Alignment

[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

Activity 2-1

Rough Alignment

1. Measure the vertical gap between the stationary and movable hubs using a straight edge and shims (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.

Discussion 2-1

Rough Alignment

1. Why do you perform rough alignment before attempting to precisely align machines?

Module 2-2

Correcting Obvious Soft Foot

[Objective]

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

- Correct gross soft foot.
- Correct final soft foot.
- Control and minimize the effects of any remaining residual 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.

VIDEO

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 the possible causes of soft foot?
2. Why do you check soft foot before attempting to precisely align machines?
3. Why do you think you were asked to make a rough alignment before checking soft foot on the moveable element?

Module 2-3

Tightening Sequence

[Objective]

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

- Understand the need to maintain a specific bolt tightening sequence.

Module 2-3

Tightening Sequence

[Lesson] The instructor will demonstrate the following:

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

VIDEO

Bolt Tightening

PHOTO

Bolt Tightening Order

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.

Discussion 2-3

Tightening Sequence

1. Why should you follow a specific sequence when tightening bolts?
2. You are doing precise alignment later in the process. Only front foot adjustments are required. What would you do?
3. Later, when you are making vertical alignment corrections, you may choose to loosen only two bolts at a time. If you follow this practice, what should you do after you finish the vertical corrections?

Module 2-4

Final Soft Foot

[Objective]

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

- Detect and correct final soft foot requirements.
- Identify whether an “angular” correction is required.
- Explain how to correct angled foot.

Module 2-4

Final Soft Foot

[Lesson] The instructor will demonstrate the following:

- Using a .002” (2 mils) shim to detect and correct any final soft foot.

VIDEO

Final Soft Foot Checks

Activity 2-4

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

1. Why do we check for obvious Final Soft Foot by loosening only one bolt at a time?
2. Why are two soft foot checks needed?
3. What benefits are gained by tightening the bolts down in a controlled, repeatable pattern?

Module 2-5

Other Pre-Alignment Checks

[Objective]

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

- Check run out.
- Coupling hub separation.
- Pipe stress.

Module 2-5

Other Pre-Alignment Checks

[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

Unit 3

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.

Module 3-1

Demonstration of Precision Alignment #1

[Lesson] The instructor will demonstrate the following:

- Setting up the XA.
- Starting the horizontal alignment program.
- Aiming the lasers.
- Entering machine dimensions.

VIDEO

Touch-Tip: Entering Dimensions

VIDEO

Touch-Tip: The Verti-Zontal Compound Move Alignment

VIDEO

Measurement Methods

BLOG POST

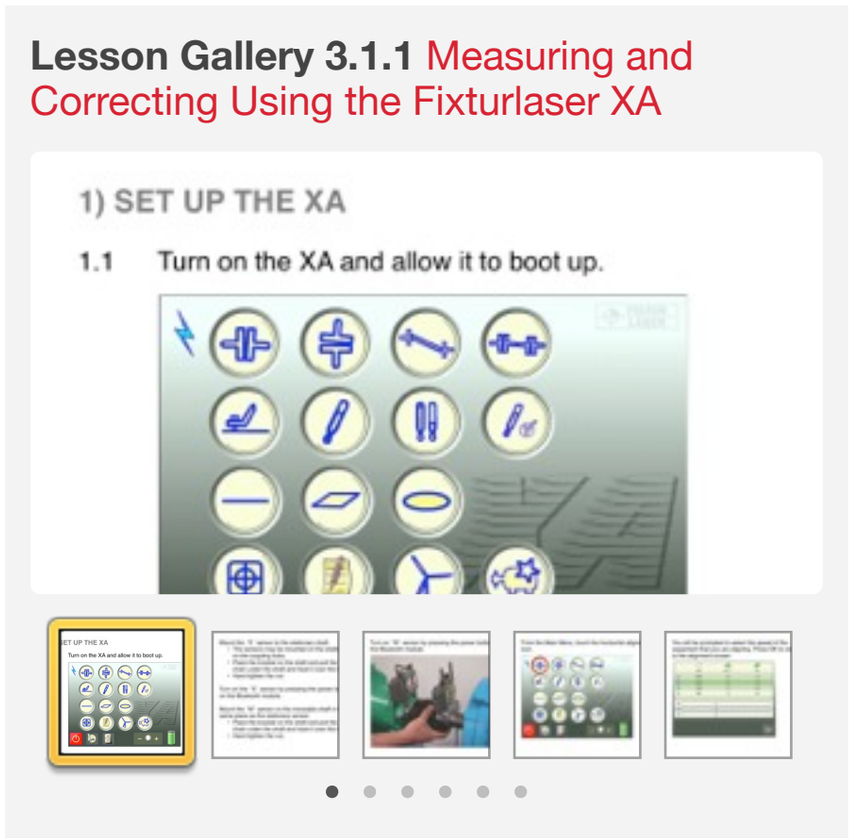
The Importance of Proper Alignment Technique and Being Aware of movement

Module 3-1

Demonstration of Precision Alignment #1

[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

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 XA.
- Starting the horizontal alignment program.
- Aiming the lasers.
- Entering machine dimensions.
- Measuring misalignment.

Module 3-2

Demonstration of Precision Alignment #2

[Lesson] The instructor will demonstrate the following:

- Making a Verti-Zontal Compound Move.
- Remeasuring alignment.
- Saving results.

VIDEO

Touch-Tip: Entering Dimensions

VIDEO

Touch-Tip: The Verti-Zontal Compound Move Alignment

VIDEO

Measurement Methods

BLOG POST

The Importance of Proper Alignment Technique and Being Aware of movement

Discussion 3-2

Demonstration of Precision Alignment #2

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 process with a tolerance of 1800 rpm.

Module 3-3

Practice #1: Using the Express Method

[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.

Discussion 3-3

Practice #1: Using the Express Method

1. What do the colors of the coupling icons represent?
2. What is a primary benefit of using the Verti-Zontal process?

Module 3-4

Changing Measurement Methods

[Objective]

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

- Understand the three measurement methods of the Fixturlaser XA and their uses.

Module 3-4

Changing Measurement Methods

[Lesson] The instructor will demonstrate the following:

- How to change the XA from Express Method to Tri-Point, and discuss when it should be used.

Measurement Methods

Lesson Gallery 3.4.1 Changing Measurement Methods

Activity 3-4

Changing Measurement Methods

1. Remove the shims from the moveable element.
2. Perform your pre-alignment checks and correction.
3. Start up the XA, 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.

Discussion 3-4

Changing Measurement Methods

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.

Module 3-5

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.

BLOG POST

How to Minimize the Effects of Backlash When Measuring Misalignment

BLOG POST

Aligning Uncoupled Machines

BLOG POST

Shaft Alignment With A Fluid Coupling

BLOG POST

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

BLOG POST

From the Mailbag: Mounting to Coupling Hubs

BLOG POST

Flexible Couplings and Flexible Shafts

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.
4. Re-measure and document the results.

Discussion 3-5

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.

BLOG POST

Who Decides Shaft Alignment Tolerances?

BLOG POST

Tolerances vs. Coupling Tolerances

ARTICLE

Don’t Look at Your Feet

PHOTO

The Zone of Good Alignment

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 XA to select 3600 rpm tolerance and enter the machine dimensions.
4. Leave the XA 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

Practice #3: 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

Practice #3: 3600 RPM Tolerances

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

BLOG POST

Who Decides Shaft Alignment Tolerances?

BLOG POST

Tolerances vs. Coupling Tolerances

ARTICLE

Don’t Look at Your Feet

PHOTO

The Zone of Good Alignment

Activity 3-7

Practice #3: 3600 RPM Tolerances

1. Complete the alignment, using a tolerance of 3600 rpm.
2. Re-measure and document the “as left” data.

Discussion 3-7

Practice #3: 3600 RPM Tolerances

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?

Module 3-8

Sampling Time and Repeatability Test

[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 XA.

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.

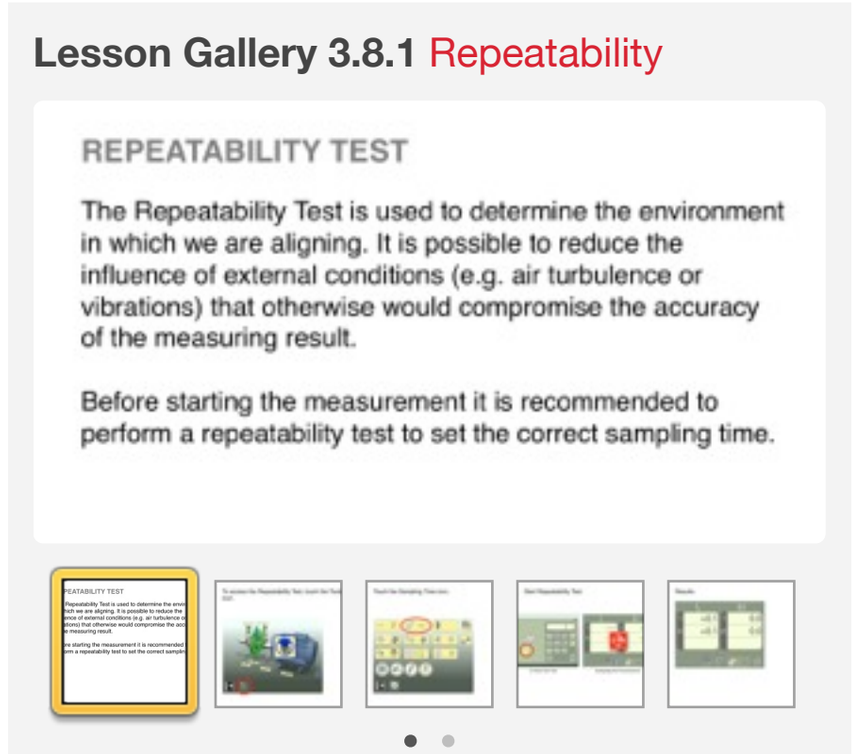
BLOG POST

Is Vibration Interfering With Your Precision Shaft Alignment?

BLOG POST

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

Lesson Gallery 3.8.1 Repeatability



Activity 3-8

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.

Discussion 3-8

Sampling Time and Repeatability Test

1. Should a Repeatability Test be performed before each alignment?
2. How can increasing the sampling time improve repeatability?

Module 3-9

Vibration Filtering

[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.

Discussion 3-9 Vibration Filtering

1. What is the best method of determining the influences of external vibration on alignment data?
2. Should the Screen Filter be used for every alignment? Why or why not?

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 XA, and how they can be utilized.

Module 3-10

Practice #4: Uncoupled Alignment

[Lesson] The instructor will demonstrate the following:

- Performing an uncoupled precision alignment.

BLOG POST

Aligning Uncoupled Machines

Activity 3-10

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.

Discussion 3-10

Practice #4: Uncoupled Alignment

1. When would it be preferable to perform an uncoupled alignment?
2. Should the alignment values change once the coupling is assembled?

Module 3-11

Practice #5: Spacer Shaft

[Objective]

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

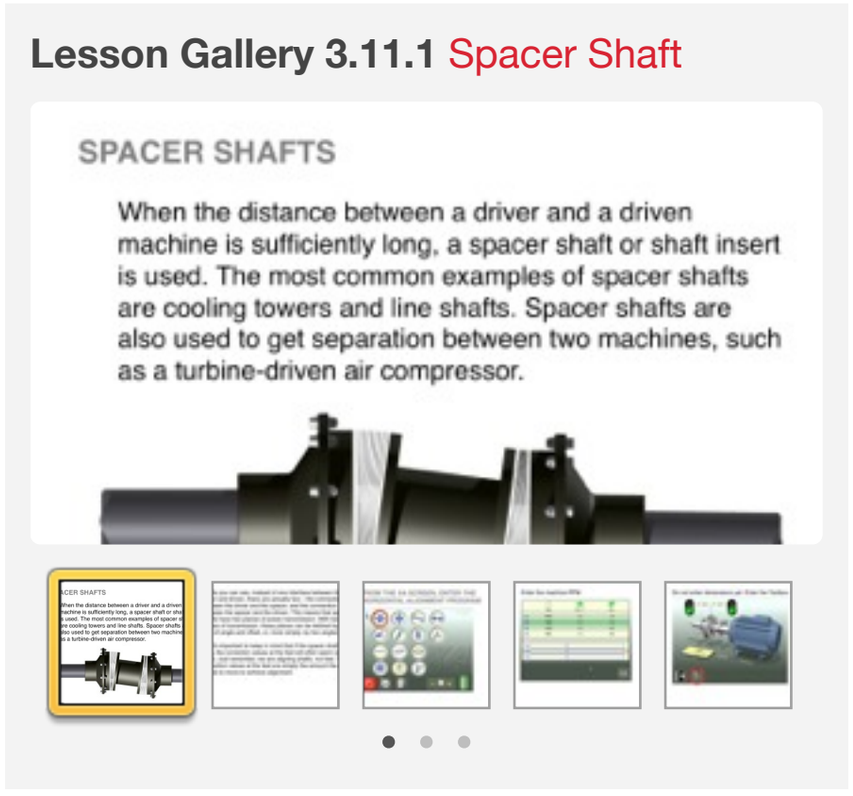
- Understand what is classified as a spacer shaft.
- Align a machine using the Spacer Shaft function.

Module 3-11

Practice #5: Spacer Shaft

[Lesson] The instructor will demonstrate the following:

- Use of the Spacer Shaft function of the XA.



Activity 3-11

Practice #5: Spacer Shaft

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?

Module 3-12

Basic Shaft Alignment Resources

VIDEO

Touch-Tip: Entering Dimensions

VIDEO

Touch-Tip: The Verti-Zontal Compound Move Alignment

VIDEO

Measurement Methods

BLOG POST

The Importance of Proper Alignment Technique and Being Aware of movement

BLOG POST

How to Minimize the Effects of Backlash When Measuring Misalignment

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

Unit 4

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

Module 4-1

Backlash and Looseness

[Objective]

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

- Identify issues associated with coupling backlash and system looseness.

Module 4-1

Backlash and 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

BLOG POST

How To Minimize the Effects of Coupling Backlash When Measuring Misalignment

BLOG POST

Troubleshooting Looseness During Shaft Alignment.

Activity 4-1

Backlash and Looseness

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

Activity 4-1

Backlash and Looseness

5. Rotate the movable shaft back and fourth causing backlash in the coupling.

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

7. 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 XA.

Module 4-2

Soft Foot Revisited

[Lesson] The instructor will demonstrate using the XA Soft Foot App.

Lesson Gallery 4.2.1 Soft Foot Revisted

VIDEO

Pre-alignment Steps for Shaft Alignment

BLOG POST

“Mic” Your Shims

BLOG POST

Small Details Make A Big Difference in Shaft Alignment

BLOG POST

Defining Level vs. Flat

Activity 4-2

Soft Foot Revisited

1. Using the process demonstrated, measure and correct soft foot on your demonstrator using the XA 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.

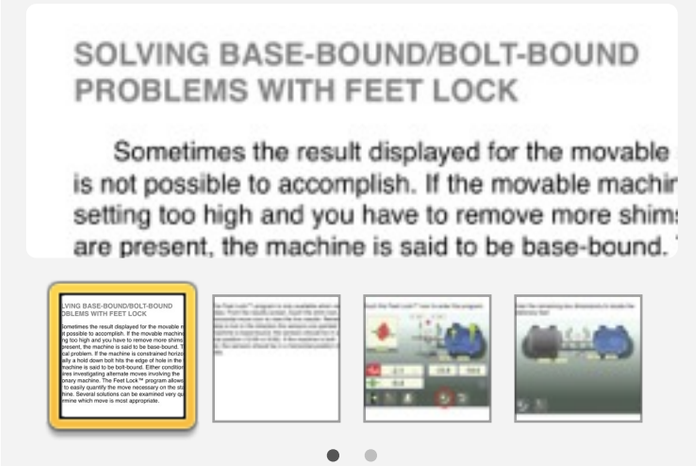
Module 4-3

Base Bound/Bolt Bound Issues Lesson

[Lesson] The instructor will demonstrate the following:

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

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



VIDEO

Touch-Tip: Solving For Base or Bolt Bound Conditions

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?

Discussion 4-3 Base Bound/Bolt Bound Issues

4. Once the base-bound or bolt-bound condition(s) are corrected, how do you switch back to the standard Live Mode?

Module 4-4

Alignment Problems and Solutions

Resources

BLOG POST

How To Minimize the Effects of Coupling Backlash When Measuring Misalignment

BLOG POST

Troubleshooting Looseness During Shaft Alignment.

VIDEO

Pre-alignment Steps for Shaft Alignment

BLOG POST

“Mic” Your Shims

BLOG POST

Small Details Make A Big Difference in Shaft Alignment

BLOG POST

Defining Level vs. Flat

VIDEO

Touch-Tip: Solving For Base or Bolt Bound Conditions

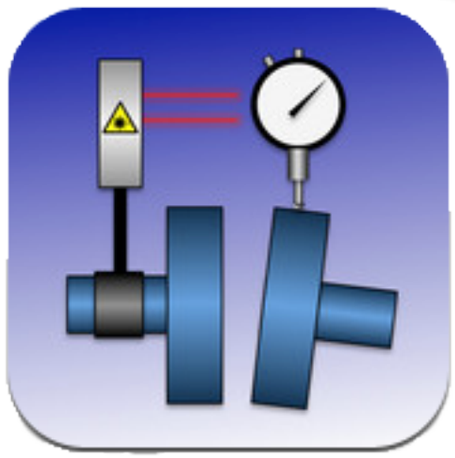
Unit 5

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



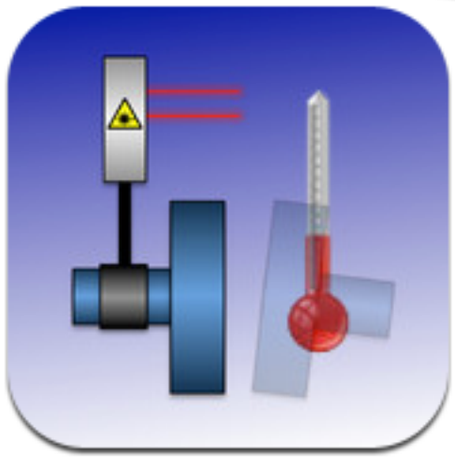
Gallery 5.1 Laser-Dials App

Gallery 5.2 Therm Align App

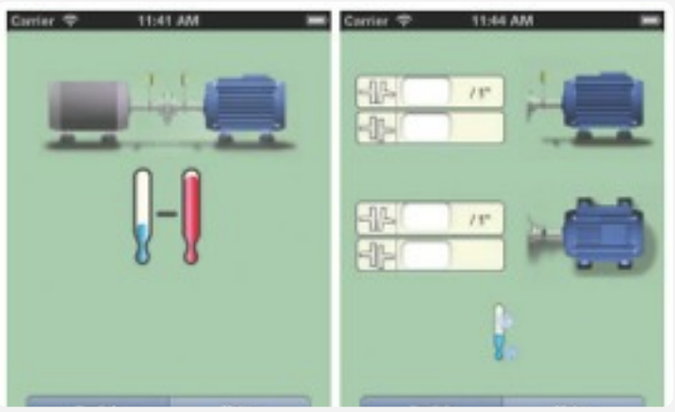
Gallery 5.3 Align Terms App

Module 5-1

Mobile Apps: iOS and Android



Gallery 5.4 Align Hot Check



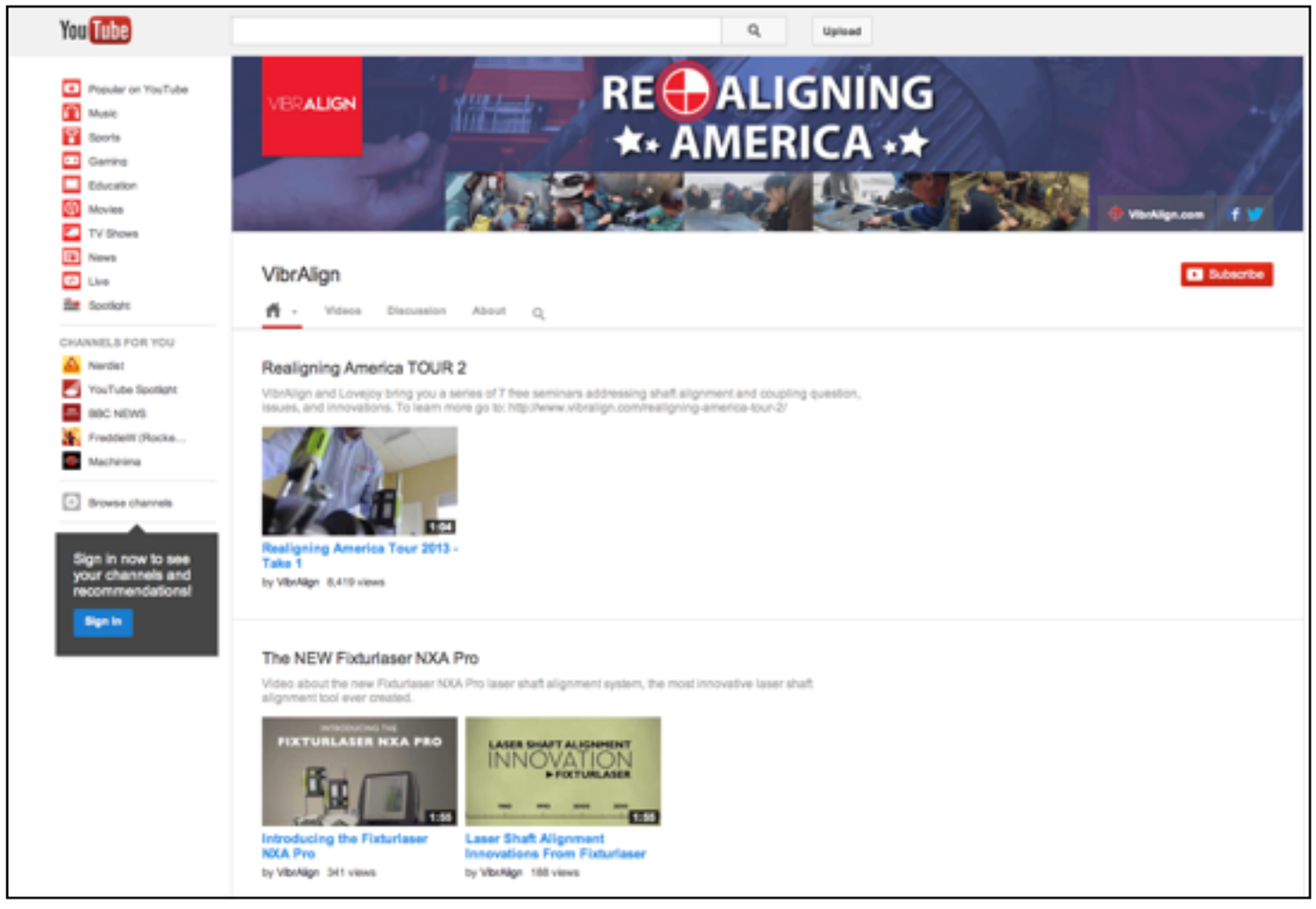
Module 5-2

The Alignment Blog

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

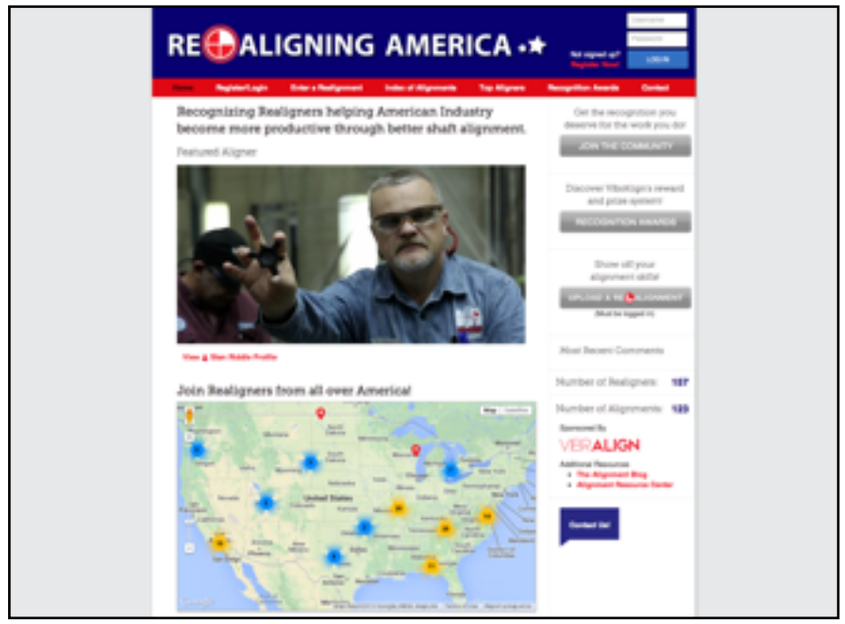
VibrAlign YouTube Channel



http://www.youtube.com/user/VibrAlign

Module 5-4

Realigning America



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.

Module 5-5

The Alignment Resource Center

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.

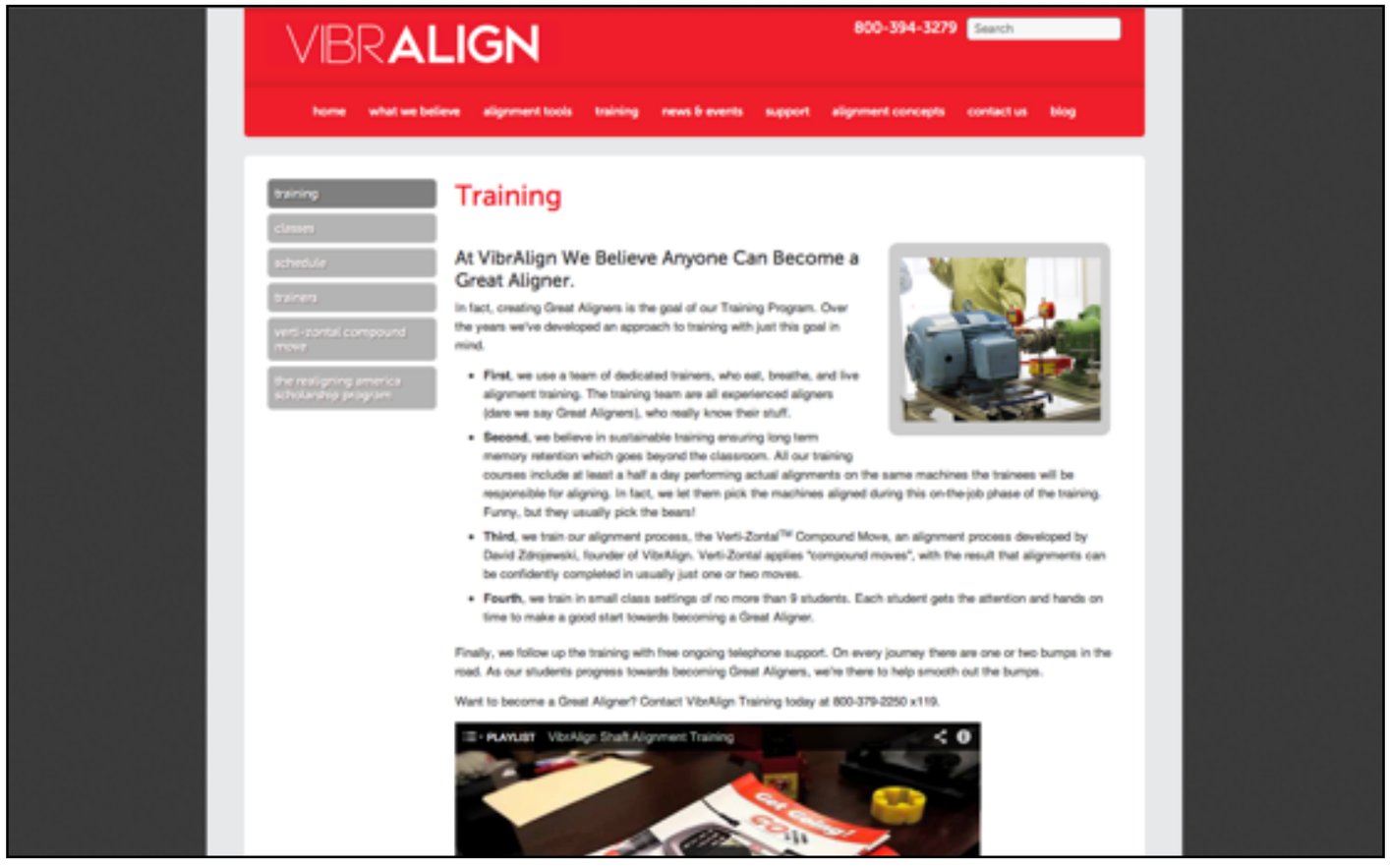
Module 5-6

T-mail Training Newsletter

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

Operating Modes, Global Settings, & File Management

- Module 6-1: Operating Modes
- Module 6-2: Power Supply
- Module 6-3: Global Settings
- Module 6-4: Bluetooth Pairing
- Module 6-5: File Management
- Module 6-6: XA Care and Handling
- Module 6-7: Media Resources

Module 6-1

XA Pro Operating Modes

[Objective]

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

- Understand using the various operating modes of the XA, including ON and Off, Sleep and Transport.

Module 6-1

XA Pro Operating Modes

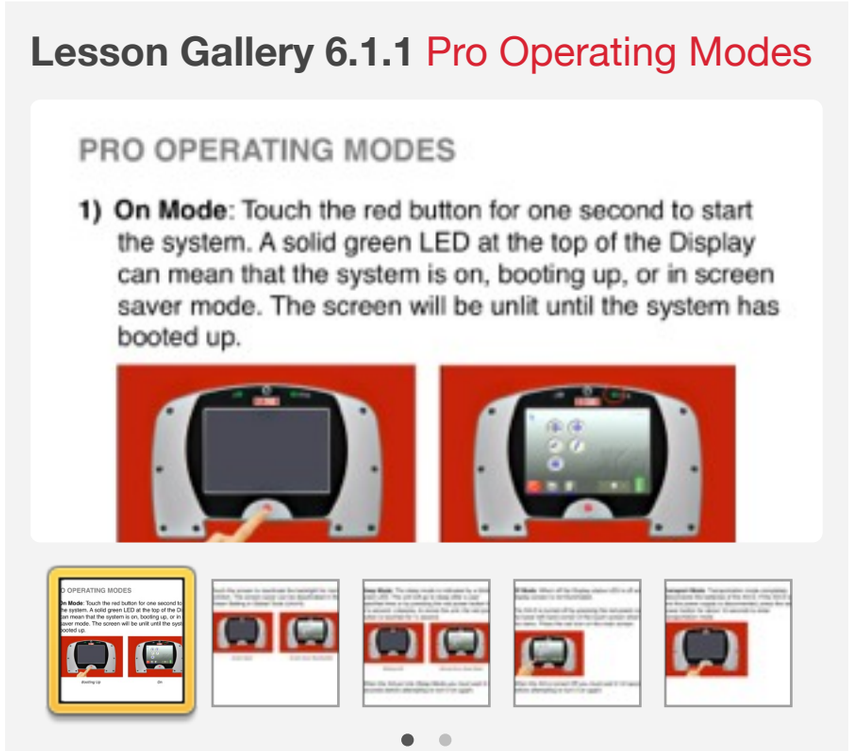
[Lesson] The instructor will demonstrate the following:

- The four operating modes of the Fixturlaser XA.

VIDEO

Touch-Tip: The XA Display Unit

Lesson Gallery 6.1.1 Pro Operating Modes



Activity 6-1

XA Pro Operating Modes

1. With the XA Power Supply/Charger unplugged turn off the XA display unit from the touch screen.
2. After waiting 10 seconds, hold down the Red button on the display unit for 5-6 seconds (until the battery LED on the top left flashes green) to put the XA DU into transport mode.
3. Attempt to turn on the DU.

Activity 6-1

XA Pro Operating Modes

4. Plug the XA Power Supply into the display unit, when the green status LED on the top right begins to flash press and release the Red button to turn on the display unit.
5. Once the XA Display boots up (about a minute) enter any alignment program.
6. Press and release the Red button on the display to put the XA into sleep mode. The green status LED on the top right should be flashing.

Activity 6-1

XA Pro Operating Modes

7. After waiting 5-6 seconds press and release the Red button on the display to revive the XA from Sleep Mode.

Discussion 6-1

XA Pro Operating Modes

1. Why do you NOT hold down the Red Button to turn on the XA Display Unit?
2. I press and release the Red Button to turn on the XA Display Unit and nothing happens. What do I do?
3. What does the flashing green LED on the top right of the XA Display Unit mean?
4. After putting the XA Display Unit into Sleep Mode why must you wait 5-10 seconds before attempting to turn in back on?

Module 6-2

XA Pro Power Supply and Charging

[Objective]

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

- Understand the charging functions of the XA.

Module 6-2

XA Pro Power Supply and Charging

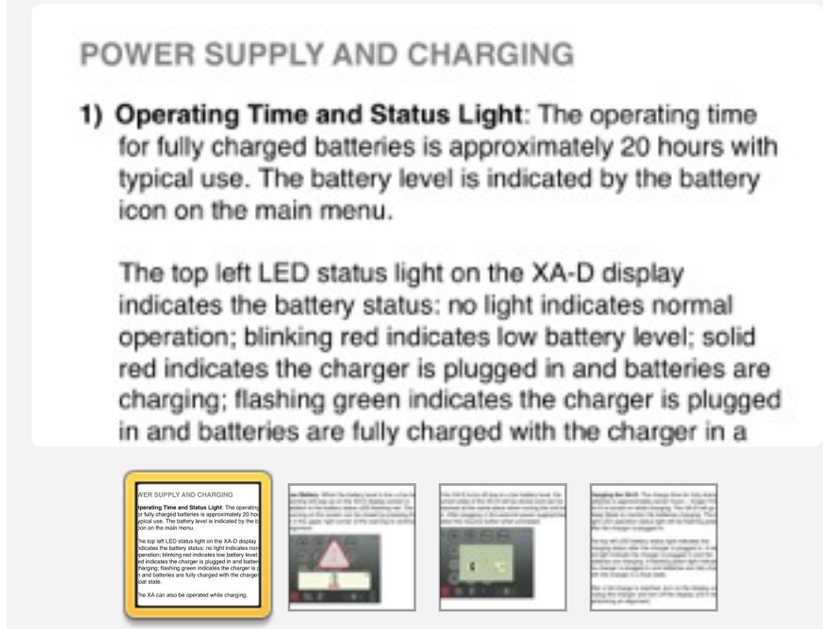
[Lesson] The instructor will demonstrate the following:

- Battery life and maintenance.
- Low battery indicator.
- Charging cycle and indicator.

VIDEO

Touch-Tip: The XA Display Unit

Lesson Gallery 6.2.1 Power Supply and Charging


POWER SUPPLY AND CHARGING

1) Operating Time and Status Light: The operating time for fully charged batteries is approximately 20 hours with typical use. The battery level is indicated by the battery icon on the main menu.

The top left LED status light on the XA-D display indicates the battery status: no light indicates normal operation; blinking red indicates low battery level; solid red indicates the charger is plugged in and batteries are charging; flashing green indicates the charger is plugged in and batteries are fully charged with the charger in a

Discussion 6-2 XA Pro Power Supply and Charging

1. Do I lose alignment information if the XA Display Unit shuts downs due to a low battery?
2. Can I use the XA Display Unit while it is plugged in?
3. What does the flashing red LED on the top left of the XA Display Unit mean?
4. I press and release the Red Button to turn on the XA Display Unit and nothing happens. What do I do?

Discussion 6-2 XA Pro Power Supply and Charging

5. What does the flashing green LED on the top left of the XA Display Unit mean?

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 XA Display Unit.

Module 6-3

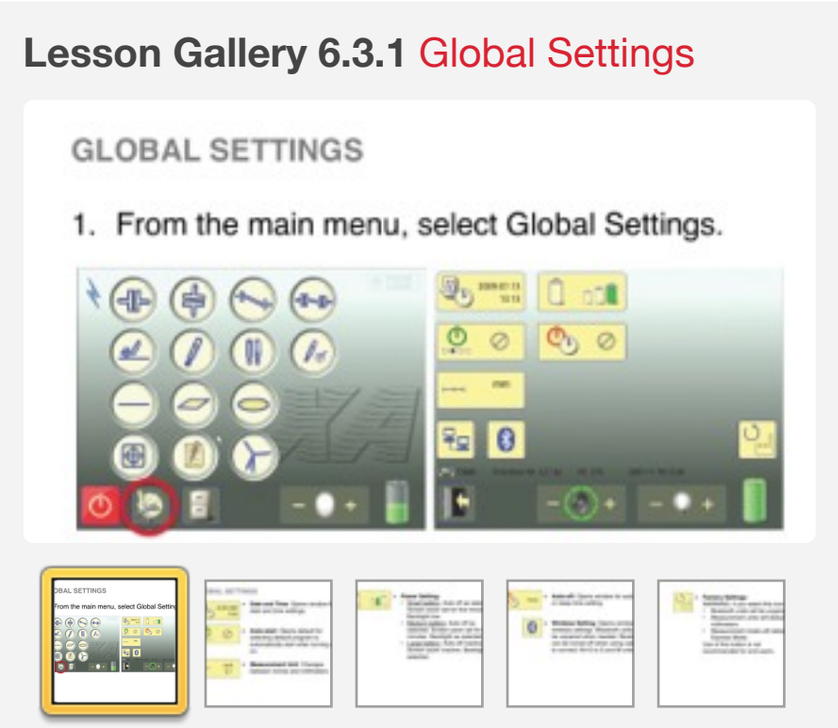
Global Settings

[Lesson] The instructor will demonstrate changing Global Settings.

VIDEO

Touch-Tip: XA Global Settings

Lesson Gallery 6.3.1 Global Settings



Discussion 6-3

Global Settings

1. When would you change from a higher power setting to a lower power setting.
2. What happens if the Factory Default (Settings) icon is selected. Is there ever a time to use this function in your facility?
3. Why would you use cables instead of the Bluetooth Units.
4. Does turning off the Bluetooth Wireless function un-pair 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.

Module 6-4

Bluetooth Pairing

[Lesson] The instructor will demonstrate the following:

- Un-Pairing and re-pairing the Bluetooth transmitters.

Lesson Gallery 6.4.1 Bluetooth Pairing

WIRELESS

The XA-D utilizes standard Bluetooth technology for wireless sensor operation.

In order for the wireless units to communicate with the DU, the wireless units need to be paired to the DU.

If the sensors lose their pairing you may have to re-pair them.

Discussion 6-4 Bluetooth Pairing

1. What happens if the Factory Defaults (Settings) icon is selected? Is there ever a time to use this function in your facility?
2. Why would you use cables instead of the Bluetooth Transmitters?
3. What image (icon) should you see in the upper left corner of the main (opening) screen of the XA 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 XA Display Unit to a PC.

Module 6-5

File Management

[Lesson] The instructor will demonstrate File Management.

Lesson Gallery 6.5.1 File Management

Activity 6-5

File Management

1. Students will rename their most recent saved alignment and copy it from the My Measurements folder onto a USB Flash drive.

Discussion 6-5

File Management

1. What would be a good way to organize folders for your facility?
2. Can a file or folder be moved back into the XA from a PC.
3. Is a special program needed to transfer files and folders from the XA onto a PC?

Module 6-6

Care and Handling

[Objective]

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

- Understand the proper care, handling and cleaning of the Fixturlaser XA Pro Alignment System.

Module 6-6

Care and Handling

[Lesson] The instructor will discuss the following:

- XA Storage case.
- XA 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.

Discussion 6-6

Care and Handling

1. Can I clean my XA with an ammonia based cleaner?
2. Do I need to protect the XA 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?

Module 6-7

Operating Modes, Global Settings, & File Management Resources

VIDEO

Touch-Tip: The XA Display Unit

VIDEO

Touch-Tip: XA Global Settings

Unit 7

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.

Module 7-1

Thermal Growth & Dynamic Movement

[Lesson] The instructor will demonstrate the following:

- Causes of thermal growth.
- How thermal growth affects alignment values.
- Necessity of accurate thermal growth targets.

BLOG POST

Shaft Alignment Thermal Growth Targets- When You Don't Know

BLOG POST

Checking Your Thermal Targets

BLOG POST

How Does Calculating Your Own Alignment Targets Work?

BLOG POST

Thermal Growth: What's So Hot About It?

BLOG POST

Thermal Growth Compensation- Growth Versus Targets

BLOG POST

Should Thermal Growth Affect Angular Misalignment?

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:

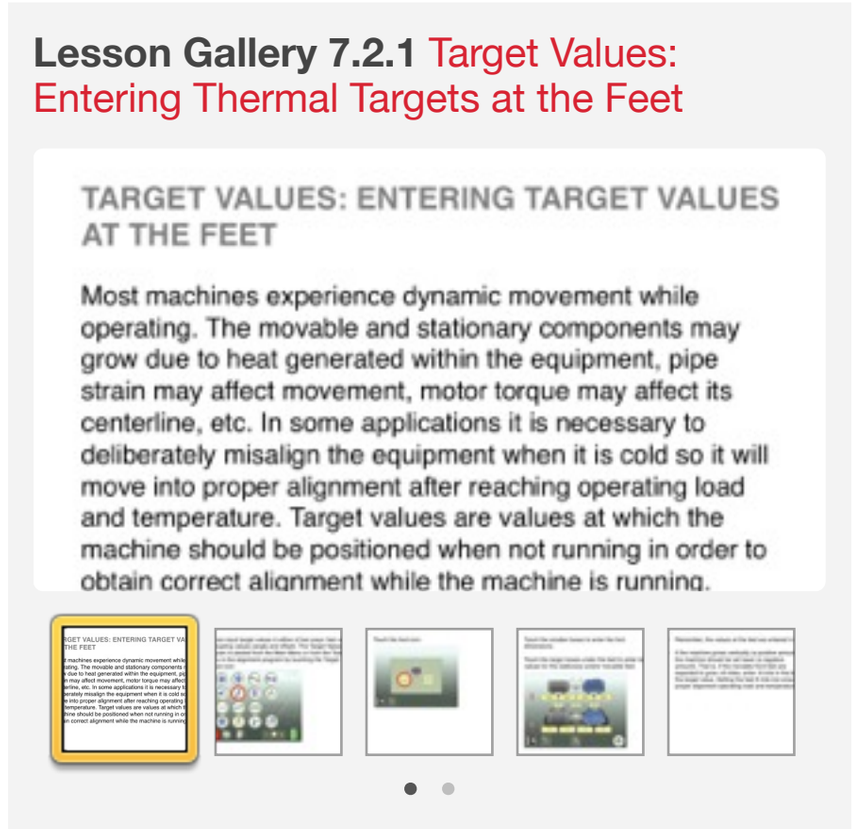
- Enter thermal targets at the feet of the moveable and/or stationary machine(s).

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.
- Define and enter targets.
- Return to shaft alignment.



VIDEO

Touch-Tip: Thermal Growth

BLOG POST

Calculating Foot Targets

Activity 7-2

Entering Thermal Targets at the Feet

1. Student enters thermal targets at the feet.

Discussion 7-2

Entering 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?

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

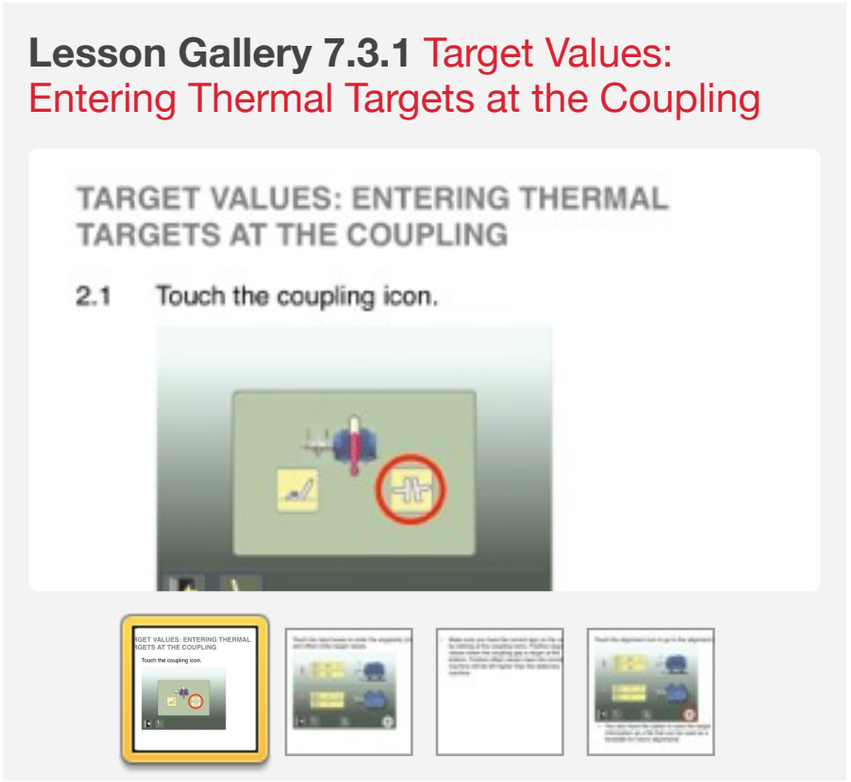
[Lesson] The instructor will demonstrate the following:

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

VIDEO

Touch-Tip: Thermal Growth

Lesson Gallery 7.3.1 Target Values: Entering Thermal Targets at the Coupling



Activity 7-3

Entering Thermal Targets at the Coupling

1. Students enters Thermal Target at the coupling.

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?

Module 7-4

Practice #7: Using Thermal 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 for the front and rear feet of the movable machine.

Module 7-4

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 XA 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 XA 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:

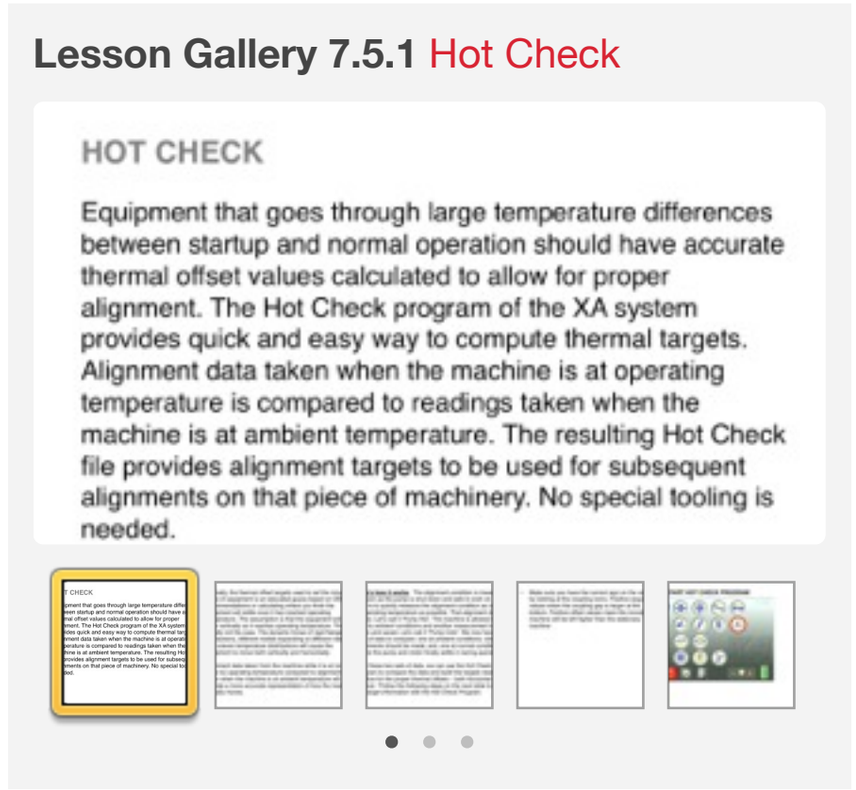
- Utilize the Hot Check program of the XA.

Module 7-5

Hot Check Program

[Lesson] The instructor will demonstrate the following:

- Hot check program.



VIDEO

Touch-Tip: Thermal Growth and Laser Shaft Alignment

Activity 7-5

Hot Check Program

1. Student uses cold and hot measurements stored in the XA to simulate Hot Check.

Discussion 7-5

Hot Check Program

1. What is the function of Hot Check?
2. Why take measurements hot and cold?
3. Why should the “Hot” Measurements be taken quickly?

Module 7-6

OL2R Program

[Objective]

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

- Utilize the OL2R Program and special brackets.

Module 7-6

OL2R Program

[Lesson] The instructor will demonstrate the following:

- OL2R brackets and program on a training fixture.

BLOG POST

Measuring Thermal growth with XA Pro and OL2R

Discussion 7-6 OL2R Program

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?

Module 7-7

Machine Train

[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.

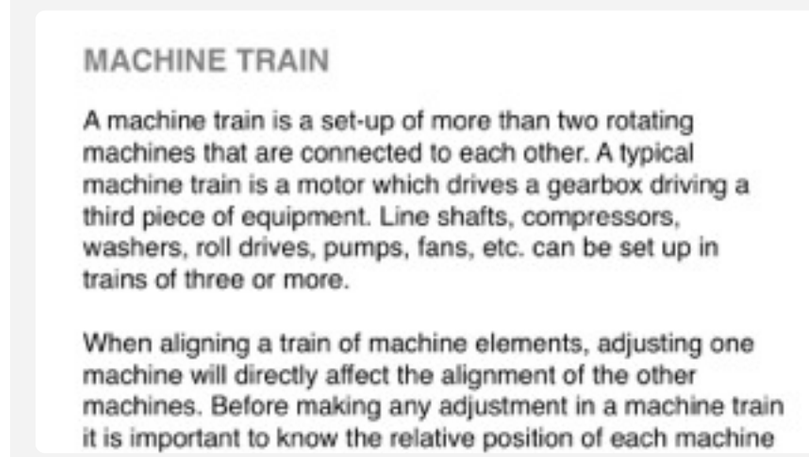
Module 7-7

Machine Train

[Lesson] The instructor will demonstrate the following:

- What is a machine train.

Lesson Gallery 7.7.1 What is a Machine Train



BLOG POST

Machine Train Shaft Alignment- To Move or Not to Move

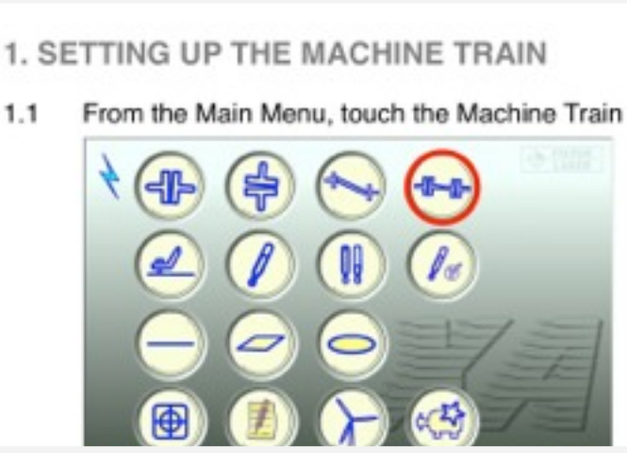
Module 7-7

Machine Train

[Lesson cont'd] The instructor will demonstrate the following:

- How to set up and measure a machine train.

Lesson Gallery 7.7.2 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 XA.

Module 7-8

Offset Alignment

[Lesson] The instructor will demonstrate the following:

- Offset Alignment Program and brackets.

Discussion 7-8 Offset Alignment

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

BLOG POST

Shaft Alignment Thermal Growth Targets- When You Don't Know

BLOG POST

Checking Your Thermal Targets

BLOG POST

How Does Calculating Your Own Alignment Targets Work?

BLOG POST

Thermal Growth: What's So Hot About It?

BLOG POST

Thermal Growth Compensation- Growth Versus Targets

BLOG POST

Should Thermal Growth Affect Angular Misalignment?

VIDEO

Touch-Tip: Thermal Growth

BLOG POST

Calculating Foot Targets

BLOG POST

Measuring Thermal growth with XA Pro and OL2R

BLOG POST

Machine Train Shaft Alignment- To Move or Not to Move

Unit 8

Appendix

- Module 8-1: Clock Mode
- Module 8-2: Vertical Alignment
- Module 8-3: Machine Defined Data
- Module 8-4: Media Resources

Module 8-1 Clock Method

[Objective]

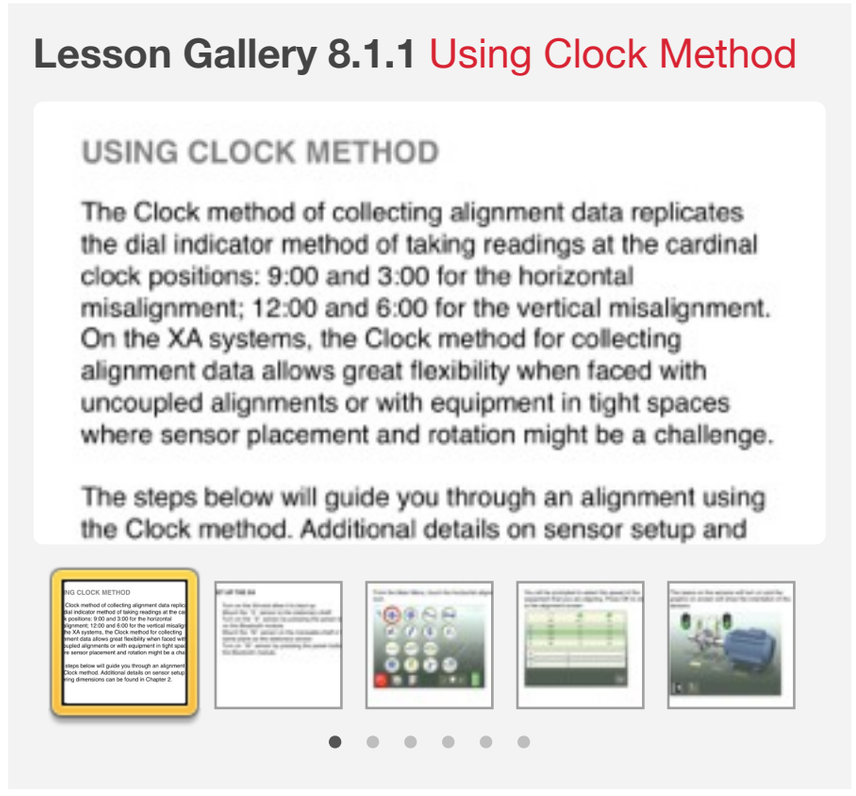
At the end of this module, the student will be able to:

- Determine when to use clock method.
- Select clock method.
- Understand the differences between Express Mode, Tripoint and Clock methods.

Module 8-1 Clock Method

[Lesson] The instructor will demonstrate the following:

- How to change the XA into clock method.
- Discuss when to perform measurements in clock method.



VIDEO

Dial Indicator Alignment Concepts

Discussion 8-1 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 fee.

Module 8-2

Vertical Alignment

[Lesson]

The instructor will demonstrate & discuss the following:

- The Vertical Alignment icon.
- Differences in C-face and four footed motors.

BLOG POST

A Vertical Shaft Alignment Process

Discussion 8-2 Vertical Alignment

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 XA.
- Discuss possible uses of the function

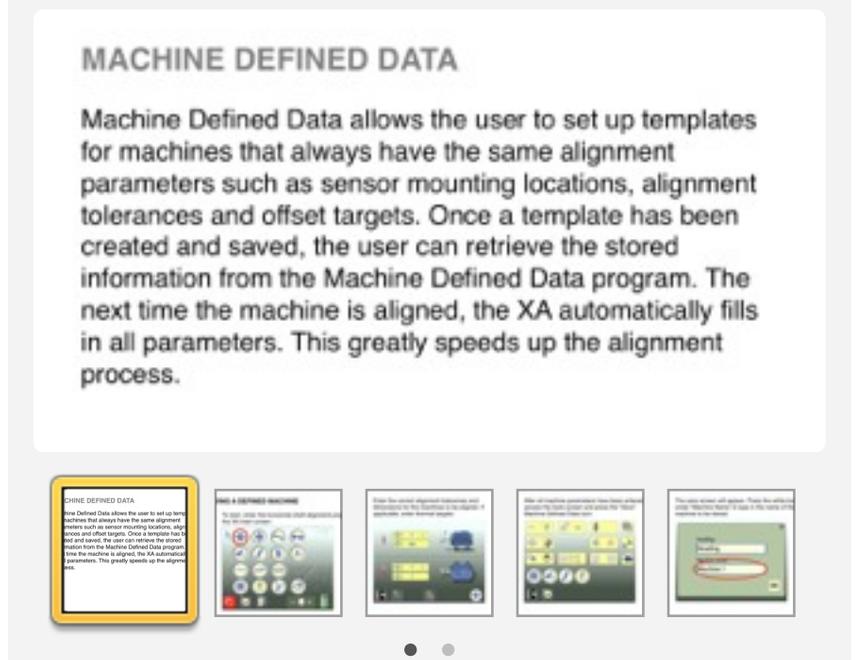
Module 8-3

Machine Defined Data

[Lesson] The instructor will demonstrate the following:

- How to save Machine Defined Data

Lesson Gallery 8.3.1 Machine Defined Data



Module 8-3

Machine Defined Data

[Lesson cont'd] The instructor will demonstrate the following:

- How to recall Machine Defined Data

Lesson Gallery 8.3.2 Recalling Saved Machined Defined Data

Discussion 8-3

Machine Defined Data

1. When would this function be most beneficial?

Module 8-4

Appendix Resources

VIDEO

Dial Indicator Alignment Concepts

BLOG POST

A Vertical Shaft Alignment Process

Fixturlaser XA Training Manual

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