Section 1
Preparing to go to the job site

Before you go to the job site, you must:

- Make sure you have all of the equipment you need
- Know the alignment tolerances for the machine to be aligned
- Know the thermal / dynamic movement

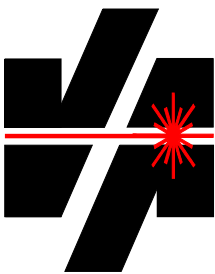
Equipment list

Shaft Alignment Tools

- Dial indicator with magnetic base
- Shaft alignment indicator or laser set
- Lifting tools
- Pre-cut shims
- Standard tools

- **Other equipment**
- *Shaft Alignment Reference Guide*
- Alignment report forms

The Alignment Reference Guide



VIBRALIGN

Section 2
Pre-Alignment Procedures

Section 2: Prealignment Procedures

You perform pre-alignment procedures to insure proper machinery performance and to expedite the precision alignment process.

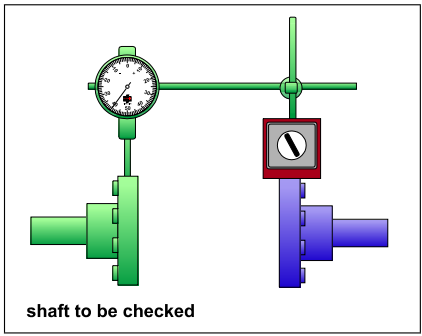
Before you attempt to perform precision alignment, you must:

- **Check run out**
- Check pipe strain
- Correct gross soft foot
- Set the coupling gap
- Perform rough alignment
- Correct final soft foot

Checking run out

To check run out, follow these steps:

1. With the coupling broken, mount the magnetic base to the coupling adjacent to the shaft to be checked.
2. Span to the coupling you want to check and center the dial indicator plunger.
3. Rotate the shaft to be checked until the dial indicator reaches a maximum travel (positive or negative). Zero the dial indicator.
4. Rotate the shaft to be checked until the dial indicator reaches a maximum value. This is the amount of run out.

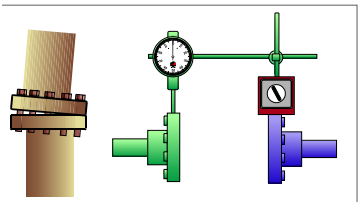


Checking Run Out	If	Then
Driven Side		
coupling run out	.002” or less	Driven side OK, go to driver side coupling
	greater than .002”	Check shaft run out
shaft run out	.001” or less	Shaft OK, coupling is eccentric
	greater than .001”	Shaft is bent
Driver Side		
coupling run out	.002” or less	Run out check completed.
	greater than .002”	Check shaft run out
shaft run out	.001” or less	Shaft OK, coupling is eccentric
	greater than .001”	Shaft is bent

Checking Pipe Strain

To check for pipe strain, follow these steps:

1. With the coupling broken, mount the magnetic base to the driver coupling.
2. Span to the driven coupling and center the dial indicator plunger.
3. With the dial at 12:00, zero the dial indicator.
4. Rotate the driver shaft to 3:00 and record the value.
5. Loosen the suction flange bolts and record the dial indicator values at 12:00 and 3:00. Re-tighten the suction flange bolts.
6. Re-zero the dial indicator at 12:00.
7. Rotate the driver shaft to 3:00 and record the value.
8. Loosen the discharge flange bolts and record the dial indicator values at 12:00 and 3:00. Re-tighten the discharge flange bolts.
9. The effect that pipe strain has on the driven shaft is reflected in change in dial indicator values from loosening the flanges.



Checking Pipe Strain	If	Then
Suction Flange	Dial indicator changes at 12:00 or 3:00 are:	
	.002” or less	Check discharge flange
	greater than .002”	Excessive pipe strain
Discharge Flange	Dial indicator changes at 12:00 or 3:00 are:	
	.002” or less	Pipe strain check completed.
	greater than .002”	Excessive pipe strain

Correcting Gross Soft Foot

You correct gross soft foot to expedite the rough alignment process.

To correct gross soft foot, follow these steps:

1. All mounting bolts should be loose.

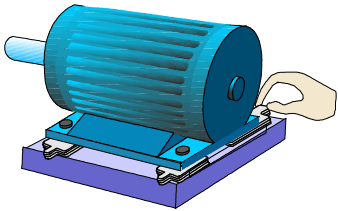
♦ If no shims are under the feet.

2. Try to slip a .005” shim under each foot. If the shim will fit under a foot, make up the gap by gradually increasing the shim thickness until a tight fit is achieved.

♦ If shims are already under the feet:

3. Check if existing shim piles have more than 4 shims. If so, consolidate the shims by using thicker shims.

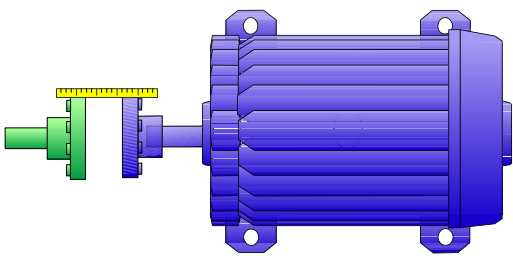
4. Check at each foot for loose shims. Make up the gap by gradually increasing the shim thickness until a tight fit is achieved.



Setting the Coupling Gap

To set the coupling gap, follow these steps:

1. **Horizontal Reference:** Use a scale to quickly correct rough horizontal position. This gives you a reference position to set the proper coupling gap.

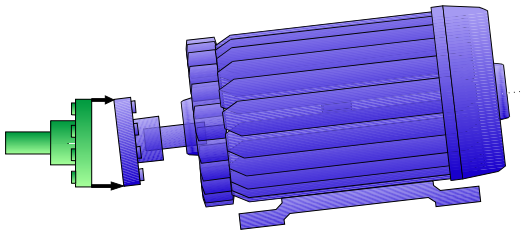


2. Use a taper or feeler gauge to find the coupling gap.
3. Set to the coupling manufacturer's recommendation.

- If the motor has plain bearings with endplay, be sure to position the motor shaft axially at magnetic center before setting the coupling gap.

Performing Rough Alignment

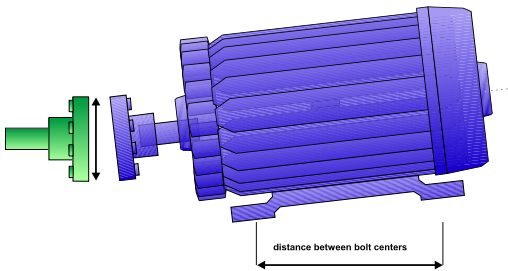
1. **Vertical Angular:** Use a taper or feeler gauge to find the top and bottom gap difference.



Gap difference = widest gap - narrowest gap

- If the gap is <u>wider at the top</u>, correct angular misalignment by removing shims from front feet **<u>or</u>** by adding to the rear feet

- If the gap is <u>wider at the bottom</u>, correct angular misalignment by removing shims from the rear feet **<u>or</u>** by adding to the front feet.



Angular correction:

$$\frac{\text{gap difference}}{\text{coupling diameter}} \times \text{distance between bolt centers}$$

2. **Vertical Offset:** Use a scale to correct rough vertical offset position.

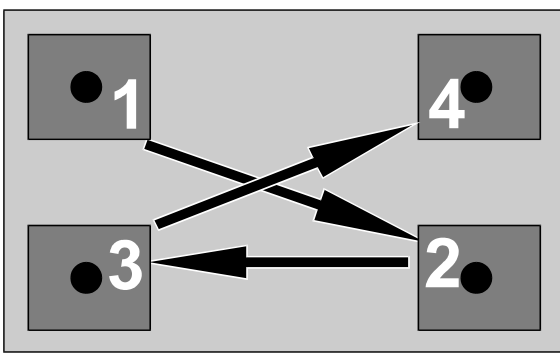
3. **Horizontal Angular:** Follow the same procedure you used to correct vertical angular to correct the horizontal angular misalignment.

4. **Horizontal Offset:** Use a scale to correct rough horizontal offset position.

Tightening Hold Down Bolts

To tighten the hold down bolts follow these steps:

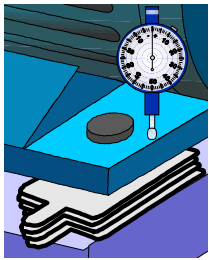
1. Number the bolts in a diagonal pattern.
2. Tighten the bolts in this sequence.
3. If more than one bolt is loosened at one time in the precision alignment process, be sure to loosen all of the hold down bolts and re-tighten in this sequence.



Performing Final Soft Foot

To perform the final soft foot correction, follow these steps:

1. All of the bolts should be tightened.
2. Starting at bolt #1 in your sequence, mount a dial indicator vertically at the foot.



3. Zero the dial indicator.
4. Loosen the bolt, record the dial indicator value, and re-tighten the bolt.
5. Repeat steps 2-4 at each bolt.
6. If you recorded a value greater than .002”, correct the soft foot starting at the foot with the largest value.
7. Place a shim the thickness of the lift under the foot with the largest value. Recheck.

8. After making a correction with a reduction in lift at the corrected foot, repeat the process until no foot has a value greater than .002”.

9. If the correction results in less change than you expected, you most likely have an angled foot. Angled foot correction requires “step shimming” to create a wedged shim pile.

Section 3
Rim & Face Alignment Method

Section 3: Rim & Face Alignment Method

You can use the Rim & Face Method to perform a calculated precision alignment process.

You may use a variety of shaft alignment fixtures. We recommend that you use a commercial package designed to accommodate a variety of shaft diameters. The fixtures should include an assortment of rods to span various coupling lengths. These packages expedite the precision alignment process. Also, sag values can be pre-determined for the standard rod assortment.

To perform the Rim & Face Method, you must:

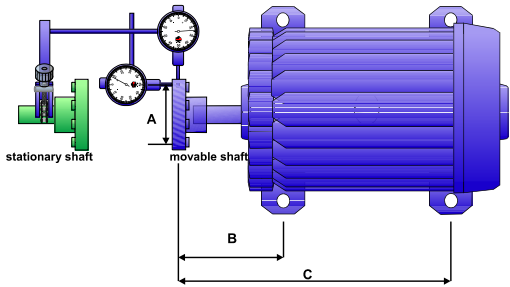
- Mount the dial indicators fixtures
- Measure the A, B, & C dimensions
- Perform an intitial horizontal adjustment
- Calculate the vertical foot positions
- Make vertical corrections
- Make horizontal corrections
- Re-measure and record final alignment values

Mounting the dial indicator fixtures

To mount the fixtures follow these steps:

1. With the coupling broken, mount the fixture to the stationary shaft or coupling hub.
2. Never attach the fixture to the flexible portion of the coupling.
3. Span the coupling with a rod. Rotate the fixture to 12:00.
4. Affix the face dial indicator. The dial indicator plunger must be centered for equal positive and negative travel.
5. Affix the rim dial indicator. The dial indicator plunger must be centered for equal positive and negative travel.

Measuring the A, B, & C dimensions



To measure the A, B, & C Dimensions, follow these steps.

1. **The “A” Dimension** is the diameter of face indicator travel. The”A” Dimension should be slightly less than the coupling diameter.

   This is the most critical dimension.

   Measure “A“ very carefully.

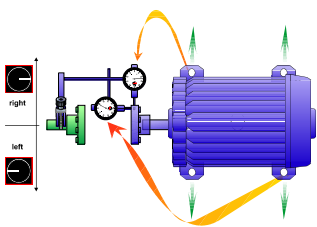
2. **The “B” Dimension** is the distance from the rim indicator to the front foot bolt center. This dimension is measured parallel to the shaft.

3. **The “C” Dimension** is the distance from the rim indicator to the back foot bolt center. This dimension is measured parallel to the shaft.

Making an initial horizontal adjustment

You will perform precision vertical alignment first. Lifting and lowering the machine in the vertical process will disturb the horizontal position. However, you will find that quickly aligning horizontally will assure that movable machine is not bolt bound and will speed up the precision vertical correction.

1. Rotate the dial indicators to 9:00 and zero them..
2. Rotate both shafts (if possible) to 3:00.
3. Adjust the dial indicators to one-half values.
4. Move the front feet of the movable machine as you watch the rim indicator move to zero.
5. Move the rear feet of the movable machine as you watch the face indicator move to zero.
6. Repeat steps 4 & 5 until both dial indicators read zero.



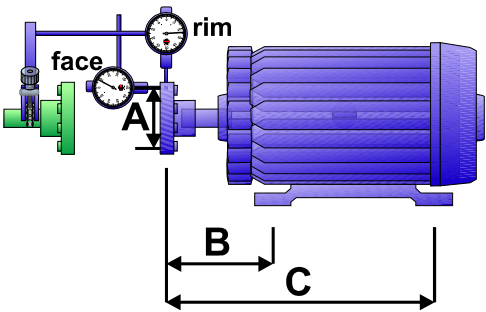
Making vertical corrections

To calculate vertical misalignment at the feet, follow these steps:

1. All mounting bolts should be tight.
2. Rotate the dial indicators to 6:00 and zero the face indicator.
3. Set the rim indicator to sag value.
4. Rotate both shafts (if posssible) to 12:00.
5. Record the rim and face values.
6. Calculate the front & rear foot positions.

   (pages 3-7 & 3-8)
7. Reposition the machine by adding or removing shims to both front feet and both rear feet.
8. Repeat steps 2-7 until you meet tolerances.

Calculating the front foot position

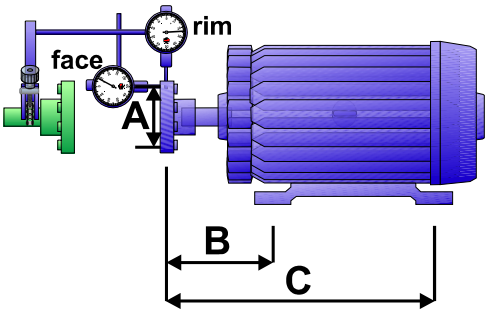


- **Front foot position calculation:**

$$\frac{face}{A}(B) + \frac{1}{2}rim$$

- positive values mean the foot is high, shims must be removed.
- negative values mean the foot is low, shims must be added.

Calculating the rear foot position



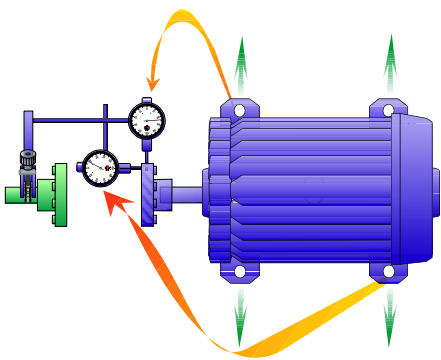
- **Rear foot position calculation:**

$$\frac{face}{A}(C) + \frac{1}{2}rim$$

- positive values mean the foot is high, shims must be removed.
- negative values mean the foot is low, shims must be added.

Making horizontal corrections

1. Rotate the dial indicators to 9:00 and zero them..
2. Rotate both shafts (if possible) to 3:00.
3. Adjust the dial indicators to one-half values.
4. Move the front feet of the movable machine as you watch the rim indicator move to zero.
5. Move the rear feet of the movable machine as you watch the face indicator move to zero.
6. Repeat steps 4 & 5 until both dial indicators read zero.



Section 4
Reverse Rim Alignment Method

Section 4: Reverse Rim Alignment Method

You can use the Reverse Rim Method to perform a calculated precision alignment process.

You may use a variety of shaft alignment fixtures. We recommend that you use a commercial package designed to accommodate a variety of shaft diameters. The fixtures should include an assortment of rods to span various coupling lengths. These packages expedite the precision alignment process. Also, sag values can be pre-determined for the standard rod assortment.

To perform the Rim & Face Method, you must:

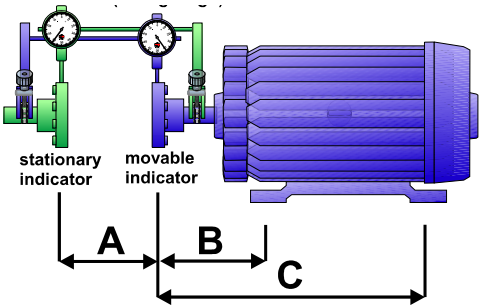
- Mount the dial indicators fixtures
- Measure the A, B, & C dimensions
- Perform an initial horizontal adjustment
- Calculate the vertical foot positions
- Make vertical corrections
- Make horizontal corrections
- Re-measure and record final alignment values

Mounting the dial indicator fixtures

To mount the fixtures follow these steps:

1. With the coupling assembled, mount the fixtures to the shafts or coupling hubs.
2. Never attach the fixture to the flexible portion of the coupling.
3. Span the coupling from each fixture with a rods. Rotate the fixtures to 12:00.
4. Affix the dial indicators. The dial indicator plungers must be centered for equal positive and negative travel.

Measuring the A, B, & C dimensions



To measure the A, B, & C Dimensions, follow these steps.

1. **The "A" Dimension** is the distance between indicator plungers. The "A" Dimension is measured parallel to the shafts.

   This is the most critical dimension.

   Measure "A" very carefully.

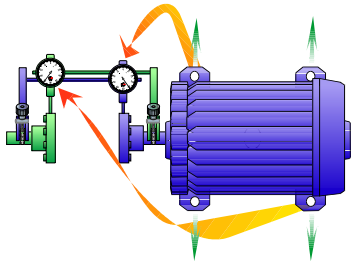
2. **The "B" Dimension** is the distance from the movable side indicator to the front foot bolt center. This dimension is measured parallel to the shafts.

3. **The "C" Dimension** is the distance between front and rear foot bolt centers. This dimension is measured parallel to the shaft.

Making an initial horizontal adjustment

You will perform precision vertical alignment first. Lifting and lowering the machine in the vertical process will disturb the horizontal position. However, you will find that quickly aligning horizontally will assure that movable machine is not bolt bound and will speed up the precision vertical correction.

1. Rotate the dial indicators to 9:00 and zero them..
2. Rotate the fixtures to 3:00.
3. Adjust the dial indicators to one-half values.
4. Move the front feet of the movable machine as you watch the movable side indicator move to zero.
5. Move the rear feet of the movable machine as you watch the stationary side indicator move to zero.
6. Repeat steps 4 & 5 until both dial indicators read zero.



Making vertical corrections

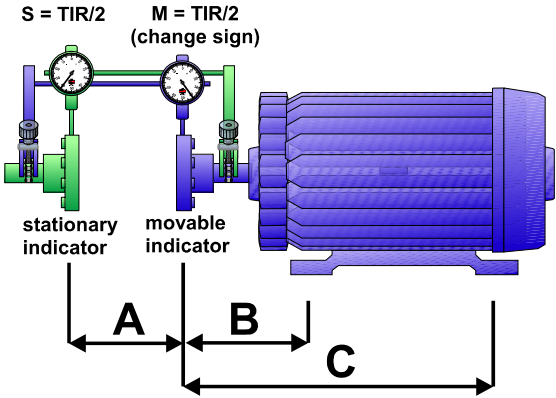
To calculate vertical misalignment at the feet, follow these steps:

1. All mounting bolts should be tight.
2. Rotate the dial indicators to 12:00 and zero the indicators.
3. Set the indicator to the positive sag value.
4. Rotate both shafts (if possible) to 6:00.
5. Record the dial indicator values.
6. Stationary Side Offset (S) = TIR / 2

7. Movable Side Offset (M) = TIR/2 & reverse the sign (+ to -) or (- to +)
8. Calculate the front & rear foot positions.

   (pages 3-7 & 3-8)
9. Reposition the machine by adding or removing shims to both front feet and both rear feet.
10. Repeat steps 2-7 until you meet tolerances.

Calculating the front foot position

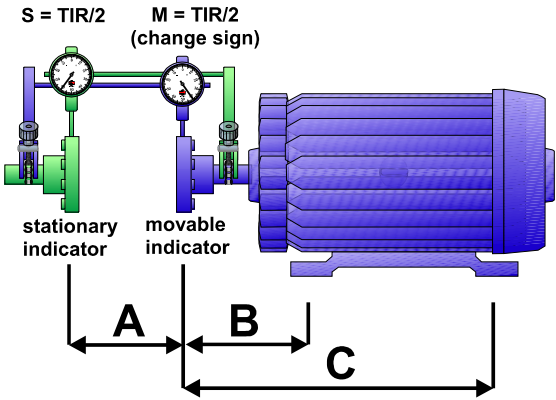


- **Front foot position calculation:**

$$\left(\frac{S+M}{A}\right)B+M$$

- positive values mean the foot is high, shims must be removed.
- negative values mean the foot is low, shims must be added.

Calculating the rear foot position



- **Front foot position calculation:**

$$\left(\frac{S+M}{A}\right)C+M$$

- positive values mean the foot is high, shims must be removed.
- negative values mean the foot is low, shims must be added.

Making horizontal corrections

1. Rotate the dial indicators to 9:00 and zero them.
2. Rotate shafts to 3:00.
3. Adjust the dial indicators to one-half values.
4. Move the front feet of the movable machine as you watch the movable indicator move to zero.
5. Move the rear feet of the movable machine as you watch the stationary indicator move to zero.
6. Repeat steps 4 & 5 until both dial indicators read zero.