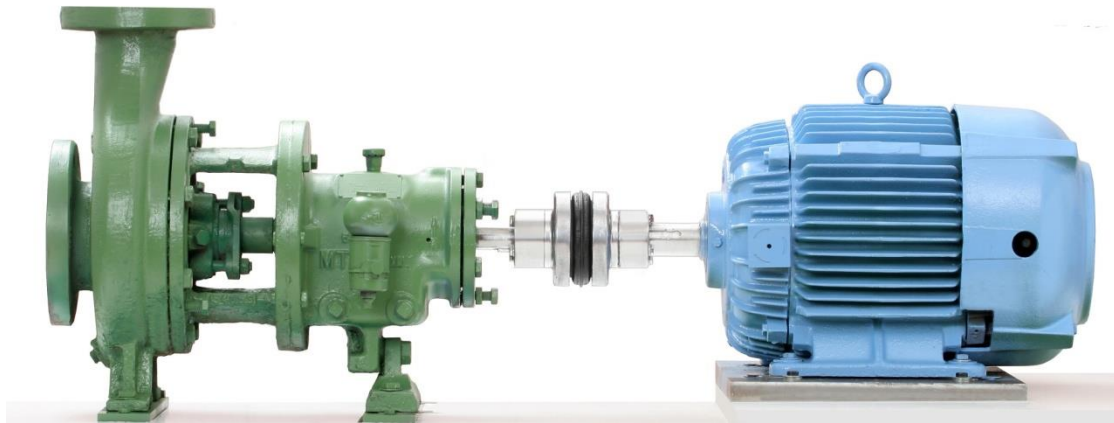
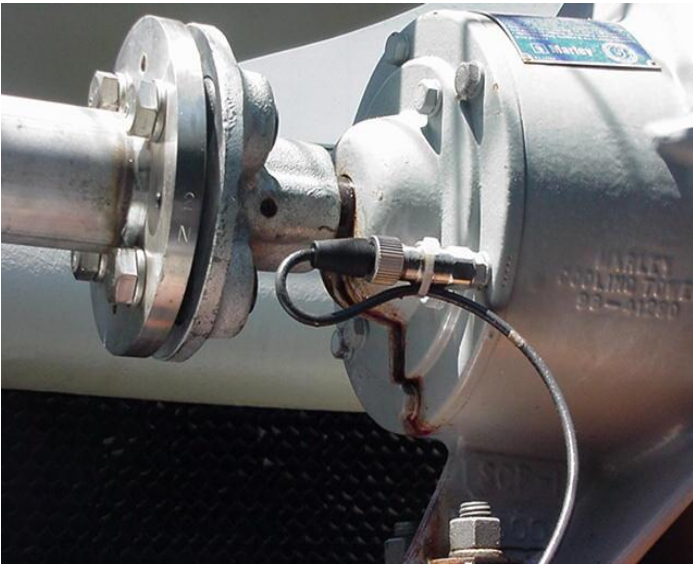


Pre-alignment: How 15 Minutes Can Save You



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What is coupling alignment?



Coupling alignment is shaft alignment. If the shafts are aligned, the couplings will normally go along for the ride.

Types of Couplings

Rigid – usually must be aligned to very close tolerances. Think of it as solidly bolting one shaft to another

Flexible – uses one or more elements to connect the shafts.

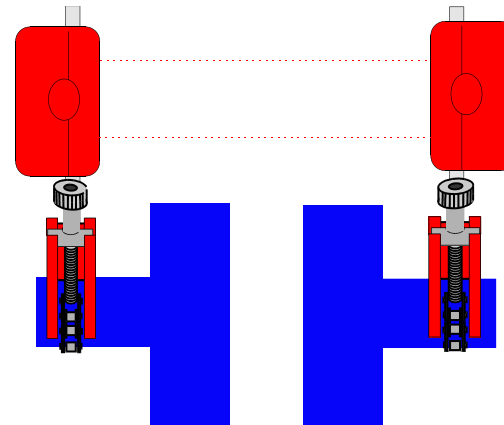
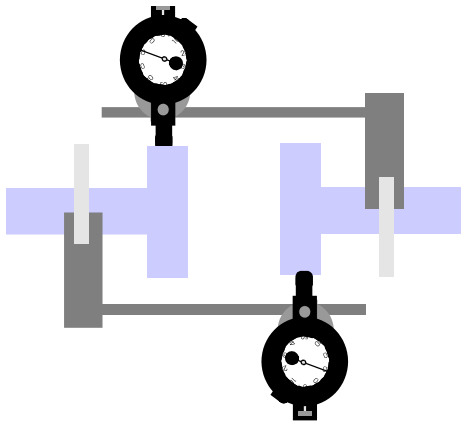
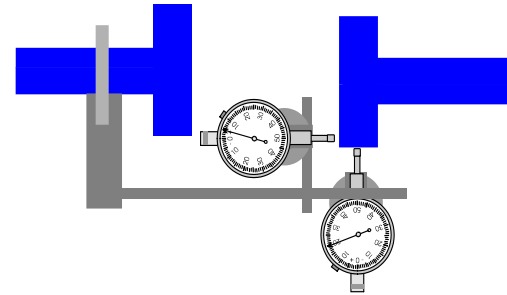
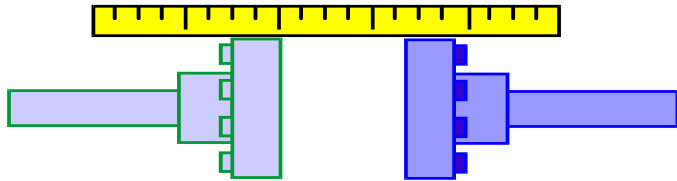
Mechanical

Elastomeric

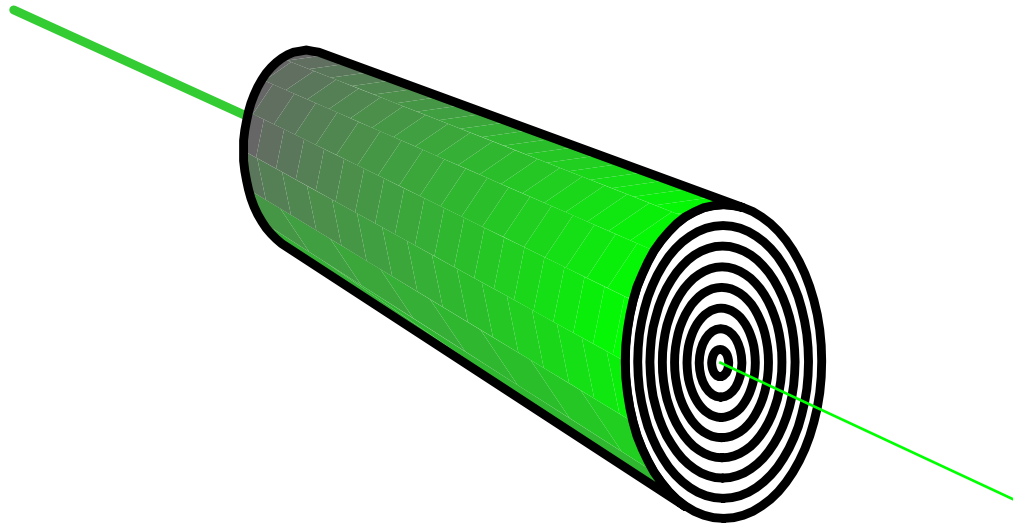
Metallic

These can tolerate slightly more misalignment, thermal changes, and shock.

Shaft Alignment

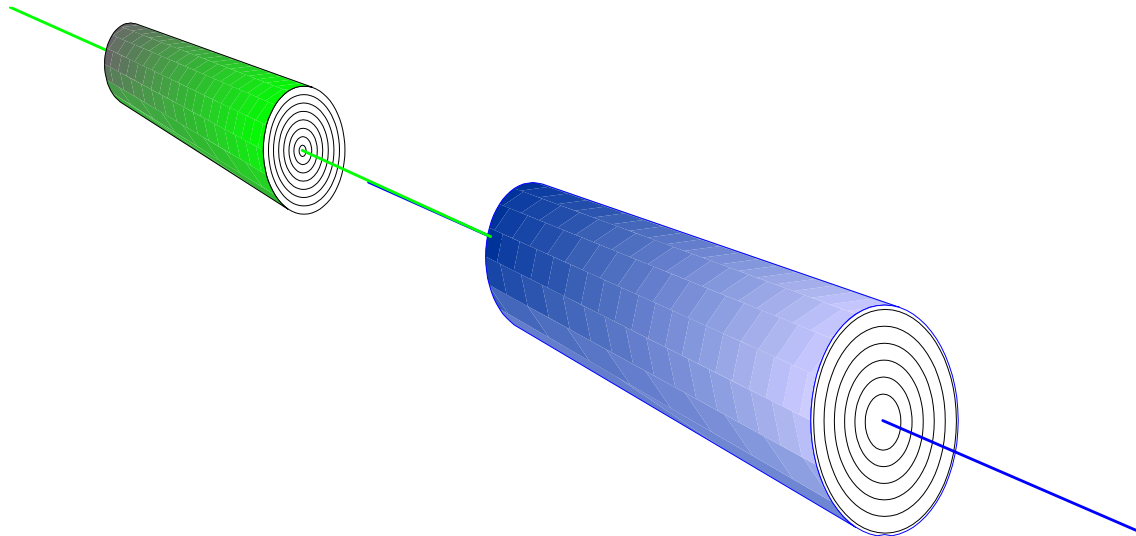


Every shaft, bent or straight, rotates about an axis that forms a straight line.



Co-linearity

Shafts in this same straight line are considered co-linear, or in the same straight line.



Types of Misalignment



Offset, or Parallel – the shafts are parallel to each other, but are not co-planar, or in the same plane. This can be both vertical and horizontal.



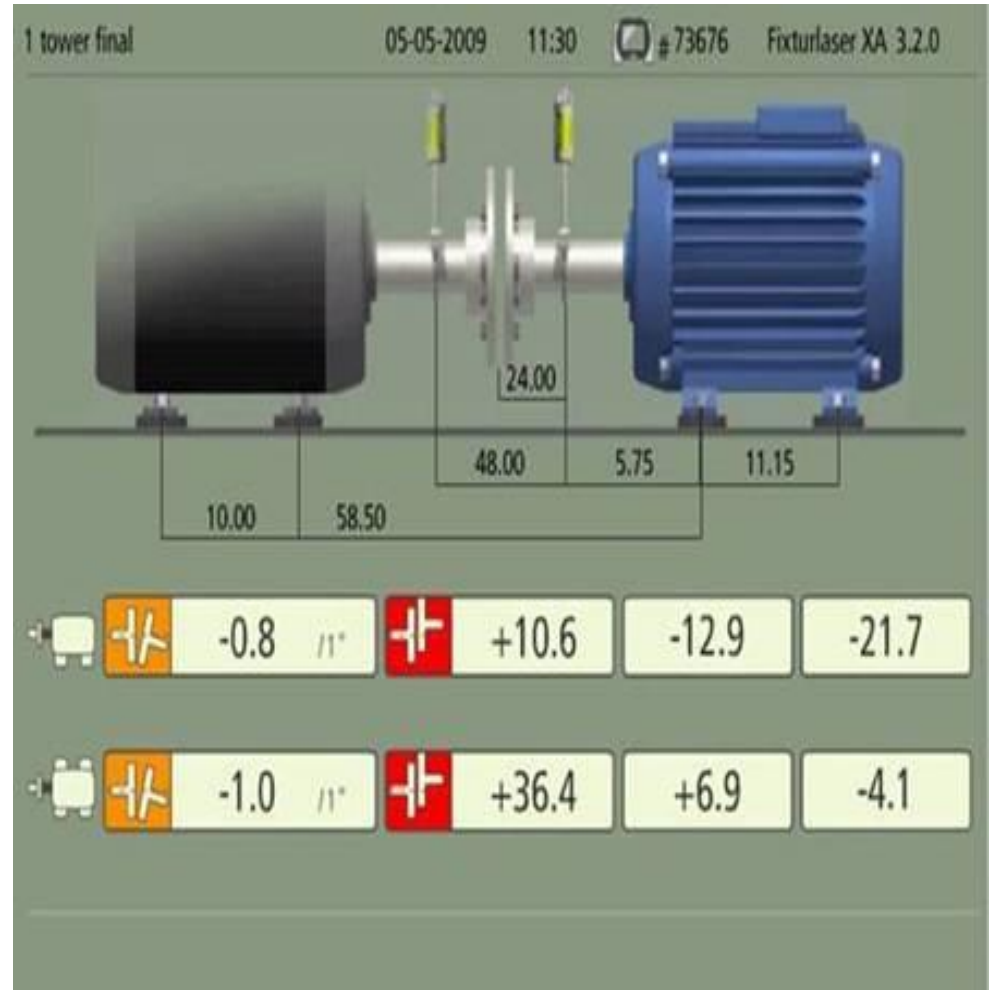
Angular – the shafts are not in the same plane, which causes a difference in measurement between measurements made 180 degrees opposite on the coupling faces.

It's almost always a combination of both!

Measurement Conventions

Offset or Parallel Misalignment is measured in thousandths of an inch (0.000"), also called mils.

Angular Misalignment is measured in thousandths of an inch (0.000"), or mils, per inch of coupling diameter.



Pre-alignment Steps

15 minutes or so of preparation time can save you hours, and dollars, in alignment costs.

It can also save you a lot of unnecessary work

The following slides list some of the most common errors made both before, and during, shaft alignment.

Error 1

ASSUMPTIONS AND THE LACK OF OBSERVATION

Example



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Assumptions

NEVER ASSUME IT'S LOCKED AND TAGGED!

Don't assume it's aligned correctly, even if you did it the last time.

Can the shafts be rotated together? Can they be rotated individually?

You may have to modify your alignment technique.

Is there a soft foot issue? Check and minimize before alignment.

Is there going to be thermal growth? How much? Which direction? Is it going to get hotter, or colder?

Is the coupling insert worn? Does it need replacement?

Is there adequate spacing between the shafts? Between couplings?

Has pipe strain been minimized?

Is the pump assembly sitting on isolators? Are they functioning properly?

Is the pump assembly sitting on an inertia block? Is it properly affixed to the floor?

Assumptions

Do you notice any cracks in the floor around the base? Can you feel vibration in the floor?

Does the coupling insert have excessive backlash?

Are the coupling flanges tight to the shaft?

Are set screws and bolts tight?

Are keys in place?

Are the hubs concentric? You may be able to align an eccentric hub, but may cause vibration, and make you look bad, if you miss it.

Does the coupling guard clear the coupling?

How clean is the area?

Soft foot is not limited to just under the motor feet. It can happen between a riser and frame, and between a frame and a floor.

Are there jackbolts? Are they screwed tight to the motor?

Error #2

You do not know what your alignment target, or tolerance, is.

Alignment Targets

DOES YOUR COMPANY HAVE AN ALIGNMENT
CRITERIA, OR TOLERANCE?

DON'T GO BY THE COUPLING MANUFACTURER'S
TOLERANCE!

THE COUPLING MANUFACTURER'S
TOLERANCE IS BASED UPON THE AMOUNT OF
MISALIGNMENT THE COUPLING WILL
TOLERATE,
NOT WHAT THE BEARINGS AND SEALS WILL
TOLERATE!

THINK OF IT LIKE A RUBBER BAND...

Alignment Tolerances

	 Rpm	 mils / 1"	 mils
▶	3600	0.5	2.0
▶	1800	0.7	4.0
▶	1200	1.0	6.0
▶	900	1.5	8.0
▶			
▶			
▶			

OK

VibrAlign's tolerance table

Alignment tolerances are based on many things, including:

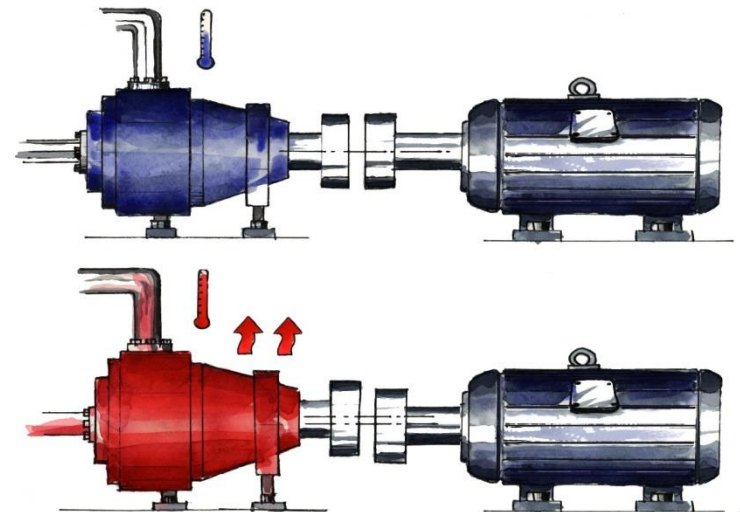
- Coupling type
- Running speed
- Company guidelines

Most alignment tool manufacturer's also have tolerances. Consult your Engineering department, or your alignment tool representative, for more information.

Thermal Growth Targets

Machines that operate at a considerably hotter or colder condition than the ambient room temperature should be thermally compensated.

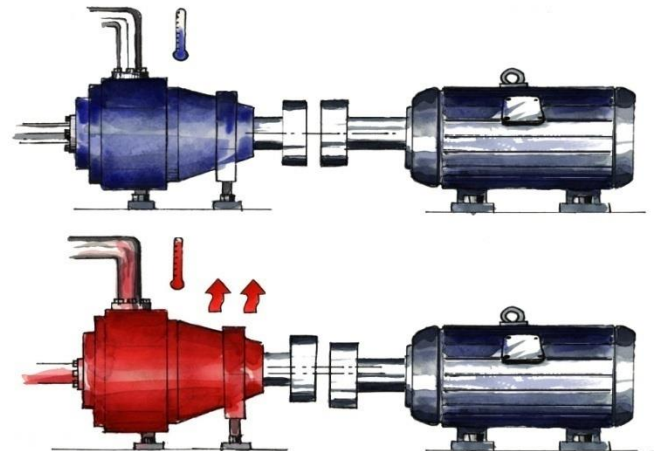
They will “grow” or “shrink” as they heat up, or cool off



The machine manufacturer's specs are a good place to startsss

But, the machine manufacturer probably
does not know:

- The exact temperature of the driver and driven machines
- Ventilation quality or cooling effects
- Piping strain influences
- Piping thermal changes



Coefficient of Thermal Expansion

**Coefficient of expansion:
carbon steel**

**.0063 x length x
temperature change
= Thermal Growth (mils)**

**If you can't remember this
chart, remember this:**

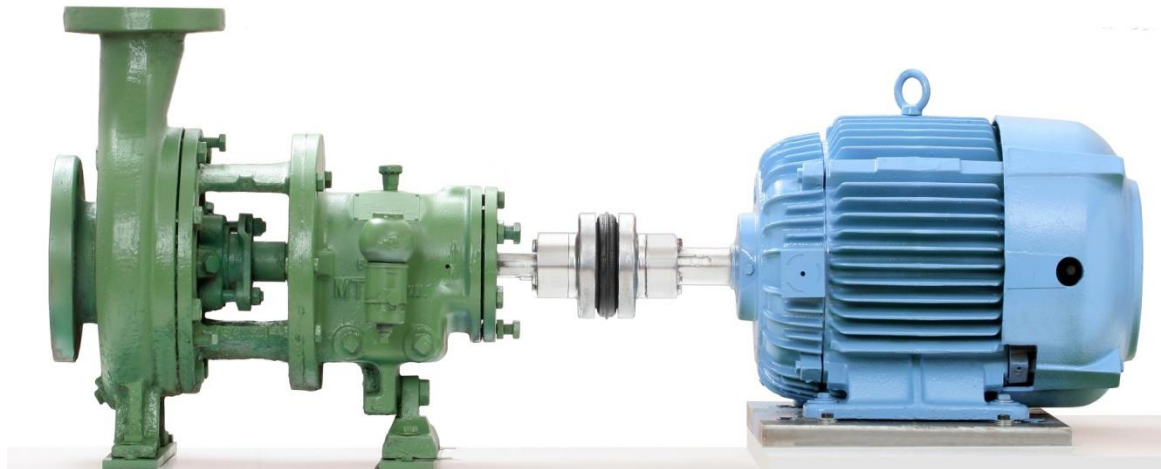
length (inches)	temp change	growth (mils)
15.0	100	9.5
15.0	125	11.8
15.0	150	14.2
15.0	175	16.5
15.0	200	21.3

**1foot of steel get 100
degrees hotter, it grows
about 8 mils (0.008")**

However, this is not a magic formula!

Machines do not usually heat or cool at the exact same temperature top to bottom.

You need to find a mean, or average temperature of the machine – from the centerline of the shaft, to the bottom of the foot.



The Best Way to Know Thermal Growth Changes...

is to measure them yourself.

Measure the machine in the cold condition, and pre-set it to the manufacturer's recommendations.

Re-measure in the hot condition, if possible.

Some lasers can do this calculation for you, or you can simply plot it on paper.

In addition, some laser alignment tool manufacturers sell equipment that allow you to measure the thermal changes.

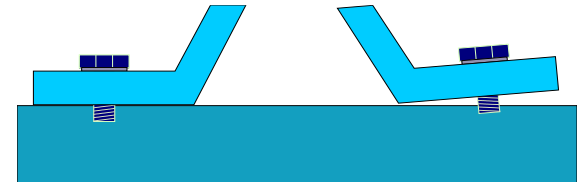
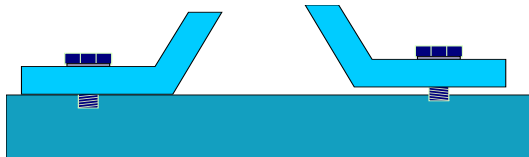
Error 3

Not correcting for soft foot

Soft foot...

Soft foot occurs when machine feet do not rest flatly on the machine base.

Soft foot is caused by deformed machine base plates or by deformed machine feet



Soft foot can be offset, angular, or both.

Error #4 — Not knowing when to say when

When the machine is aligned to within your alignment tolerance, you are done. Don't try to get it all the way to zero. You may cause more problems than you correct. AND, you will certainly waste time.

Error #5 — Not roughing in

Straightedge, flashlight, feeler gauges, taper gauge, outside caliper, etc...



A Quick Comment on Shims...

Try to use a maximum of 4 or less shims under each foot. It's not always possible, but try to minimize the number of shims per foot.

Use pre-cut stainless steel shims.

You can't cut them for less than you can buy them.

When you insert shims under the foot, slide them all the way in, then back them out $\frac{1}{4}$ ", so the bolt threads don't bend them.

Don't reuse painted, or badly bent shims.

Be careful. A 0.003" shim can cut you like a knife. Trust me on this one!

Keep them neat.

Error #6 Not controlling backlash or unwanted movement

Some alignment systems are sensitive to backlash or “play” in the coupling. Not only lasers, but indicators can be misread due to backlash, especially if there is any eccentricity in the coupling.

Beware of bumping your indicators or laser detectors. Beware of any binding or tightness in the machines as they are rotated.

Error #7 – Incorrect sequence of moves

Always correct vertical misalignment first.
Once the vertical (top to bottom, up and down) is corrected, you can theoretically move the machine side to side as far as it will go, without changing the vertical alignment.
Then, correct misalignment in the horizontal plane (side to side).

Now we're ready to align!

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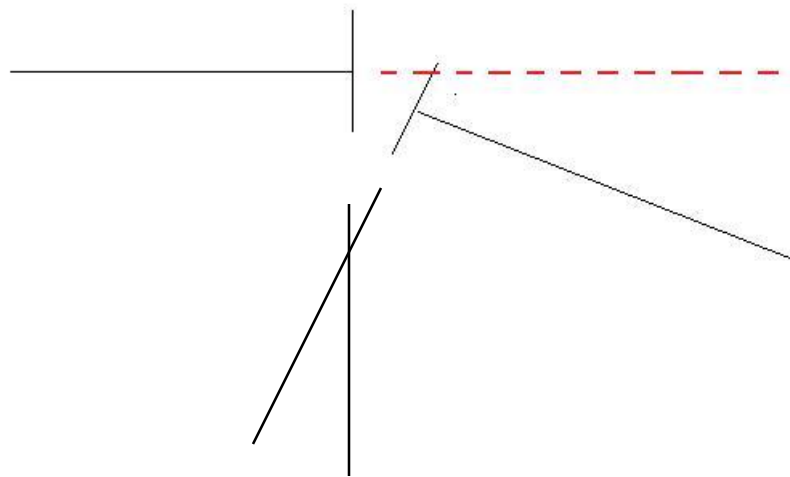
You got to make the right moves!

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Regardless of the method you use, alignment needs to be done in four steps

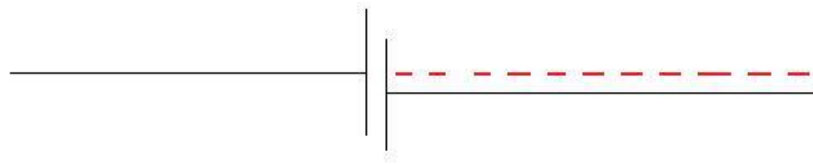
Angular misalignment in the Vertical Plane

Side View



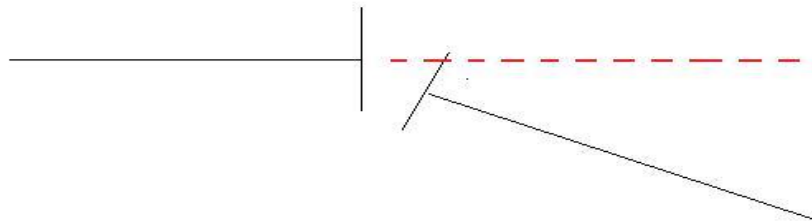
Parallel Offset in the Vertical Plane

Side View



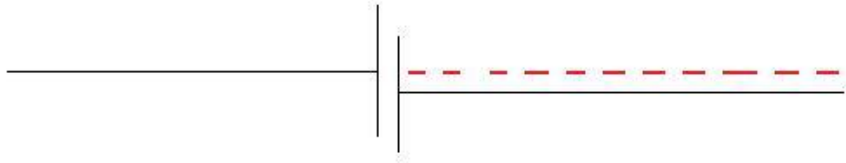
Angular misalignment in the Vertical Plane

Top View



Parallel Offset in the Horizontal Plane

Top View



**THAT'S THE WAY IT'S SUPPOSED TO
HAPPEN!**

So what do we do if it doesn't?

- Check for soft foot.
- Check for bolt or base bound condition.
- Check to make sure you haven't bumped or moved your alignment tools
- Check for coupling backlash.
- Check for excessive vibration in the area
- Re-measure, and see if your results are repeatable.

Stan's Tricks of the Trade

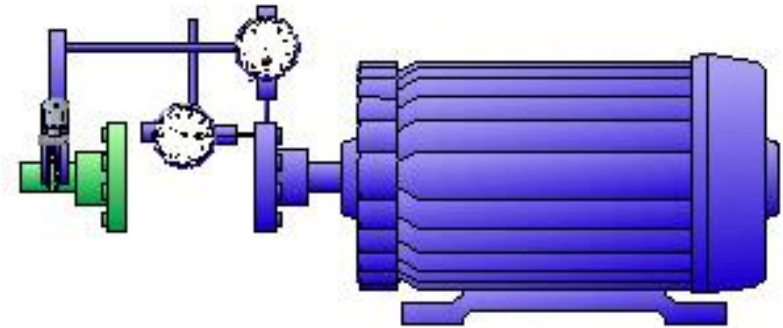
- **A straightedge, an outside caliper, a Starrett taper gauge, and a flashlight are good roughing-in tools.**
- **A can of compressed air, like those used for cleaning electronics, is good to clean dirt out from under motor feet.**
- **A 0-1" micrometer is great for measuring the thickness of shim stacks.**
- **When aligning, excessive backlash can be compensated with a few rounds of duct tape.**
- **Two dial indicator magnetic bases make great stops to rest the laser tool or indicator brackets at the 3 and 9 o'clock positions. It gives you an extra set of hands.**

Rim and Face method overview

Rim and Face method overview

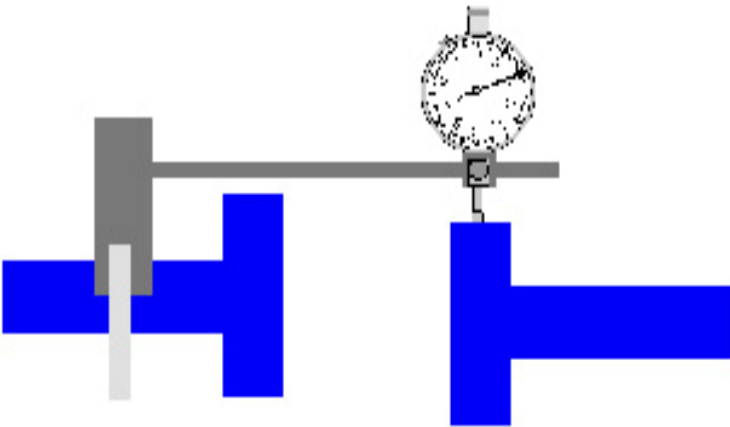
The Rim-Face method is recognized as the oldest method of shaft alignment. Many different variations of the rim-face method are used, including straight edge and feeler gauge methods, single dial rim-face, two dial rim-face, trial and error

rim-face, etc. In this training, we will focus on two dial rim-face alignment and how to accurately determine shaft positions using calculation and graphing procedures.

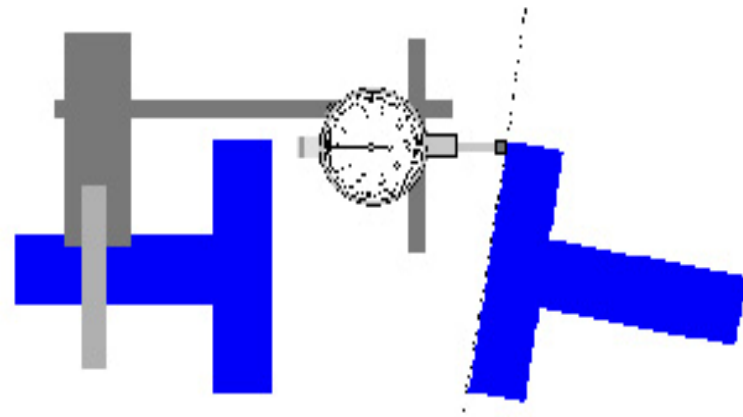


Two dial indicators are used to determine the relative position of the movable shaft with respect to the stationary shaft.

Rim and Face method overview



The rim dial is used to measure offset in one plane along the shaft lengths.



The face dial measures angularity or slope between the shafts.



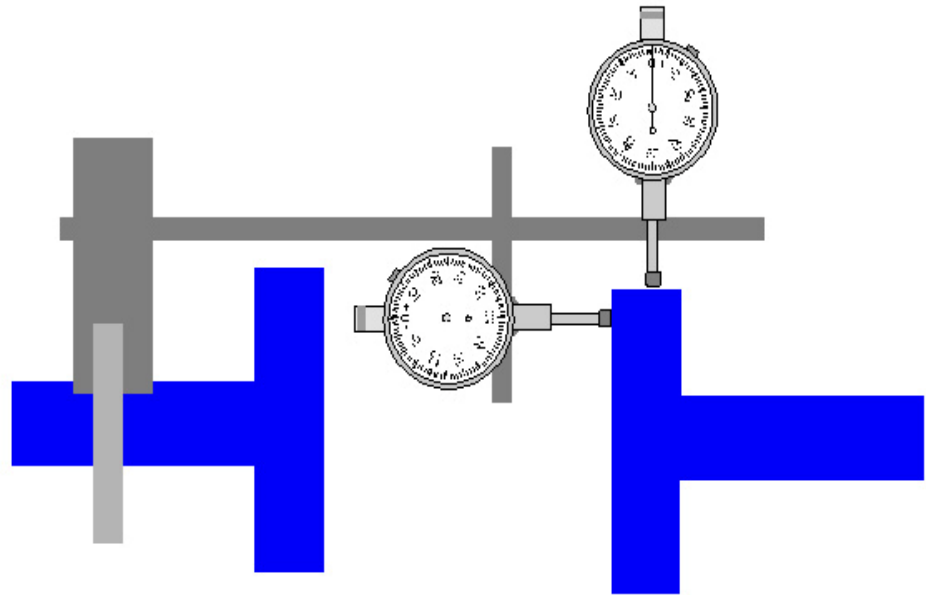
Rim and Face method overview

Using the offset and angularity measurements along with fixture setup and machine dimensions, the relative position of the movable shaft is determined by performing calculations or by graphing/plotting.

Rim and Face method overview

Fixturing Overview

A variety of shaft alignment fixtures are available for performing Rim-Face alignment. Selection and use of a commercial package designed to accommodate a variety of shaft diameters is recommended. 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.



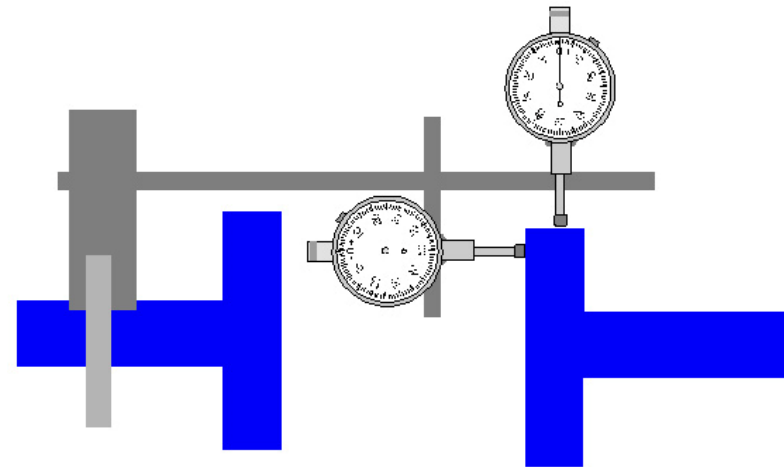
Uncoupled shafts.

Rim and Face method overview

Fixturing Overview

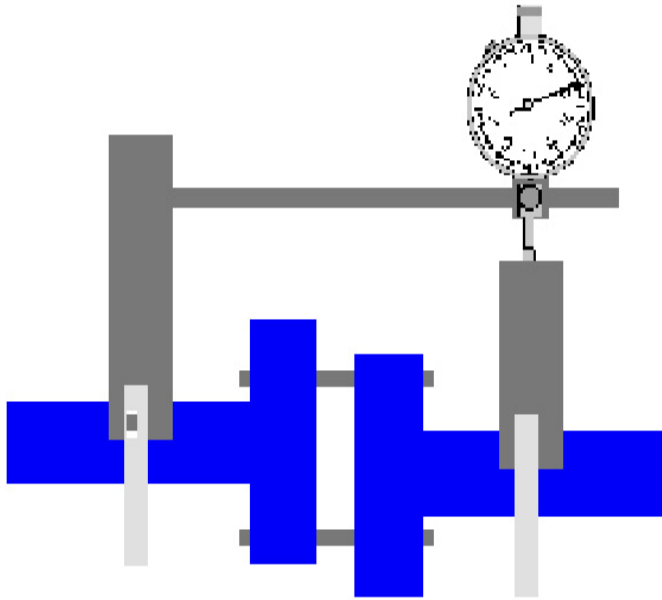
For machines with sufficient space between coupling halves, fixtures can be mounted such that the dial indicators are in direct contact with the coupling or the shaft. In this case, the alignment can be performed with the shafts un-coupled.

When machines are close-coupled, there is generally NOT sufficient room to mount indicators to contact the coupling hub. In these cases, rim-face alignment can be performed with the shafts coupled. Indicators are often mounted to contact a bracket, similar to the illustration below.

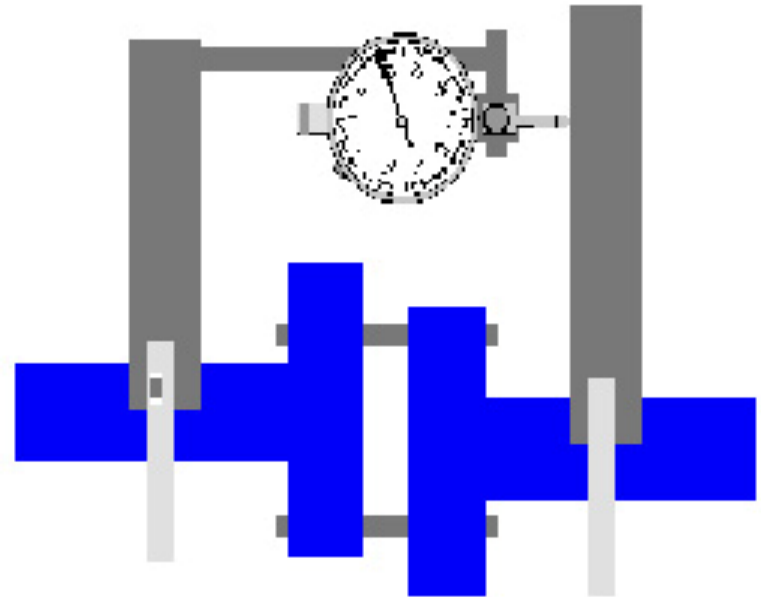


Uncoupled shafts.

Rim and Face method overview



Coupled shafts, rim dial.



Coupled shafts, face dial

Rim and Face method overview

Rim-Face Alignment Procedure

Measurement Process Overview

The Rim-Face dial measurement process consists of the following procedures:

- Measuring and documenting as-found misalignment conditions.
- Measuring vertical misalignment conditions.
- Measuring horizontal misalignment conditions.

Obtaining a set of as-found readings is considered optional in some facilities, but is highly recommended here. For most alignment tasks, it is desirable to obtain and document a complete set of as-found readings along with the A, B, and C dimensions.

Rim and Face method overview

Rim-Face Alignment Procedure

Measurement Process Overview

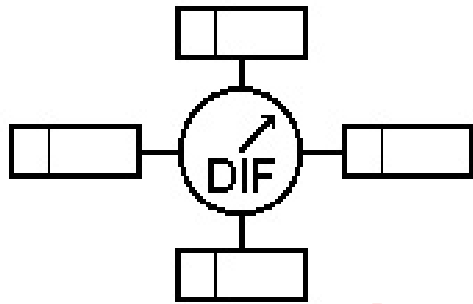
As-found readings are used for a variety of purposes:

- Documenting alignment conditions prior to removing equipment from service for repair.
- Determining whether or not suspected misalignment is realistic or not.
- Supporting and justifying actions taken to equipment suppliers, vendors, and manufacturers.
- Maintenance of equipment history files.
- Better communication between different personnel involved with the alignment task.

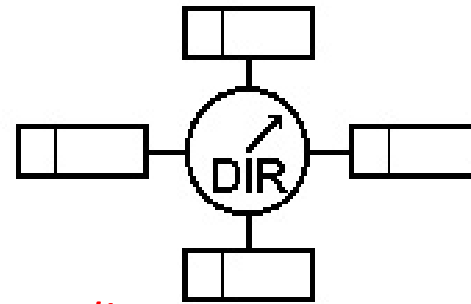
Rim and Face method overview

Rim-Face Alignment Procedure

Measurement Process Overview



Obtaining As-found Readings



Documenting as found readings.

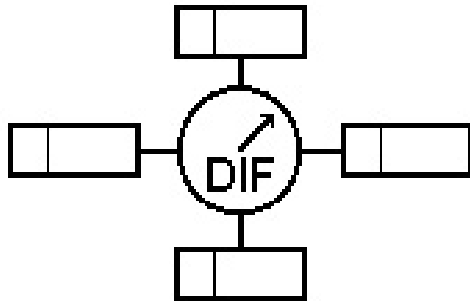
To obtain a complete set of as-found readings, perform the steps below:

- 1.Rotate the dial indicators to 12:00.
- 2.Set the rim dial indicator to the positive sag value.
- 3.Set the face dial indicator to zero.
- 4.Record the setting of both dials at 12:00.
- 5.Rotate the dial indicators to 3:00.
- 6.Determine and record the reading on both dials.

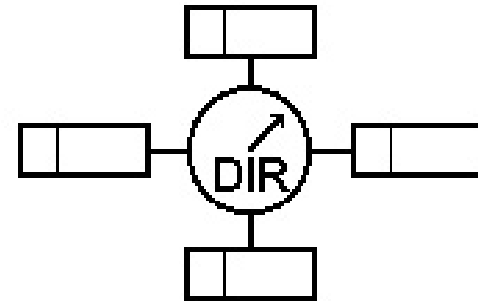
Rim and Face method overview

Rim-Face Alignment Procedure

Measurement Process Overview



Obtaining As-found Readings



Documenting as found readings.

- 7. Rotate the dial indicators to 6:00.
- 8. Determine and record the reading on both dials.
- 9. Rotate the dial indicators to 9:00.
- 10. Determine and record the reading on both dials.
- 11. Rotate the dials to 12:00 and ensure that both dials return to their original setting.

To document as-found results, use a format similar to that shown below. Note that “DIF” stands for Dial Indicator on the Face and “DIR” stands for Dial Indicator on the Rim.

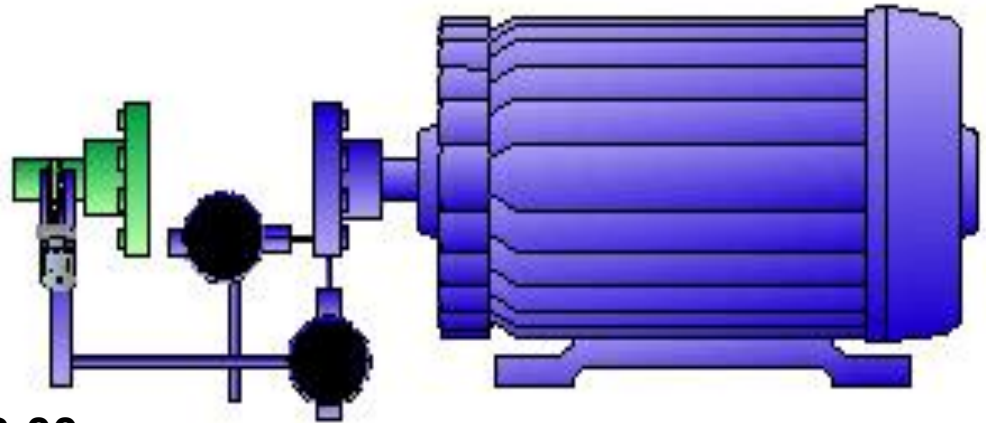
Rim and Face method overview

Rim-Face Alignment Procedure

Measuring Vertical Misalignment

To measure vertical misalignment, perform the following steps:

1. Rotate the dial indicators to 6:00.
2. Set the face dial indicator to read zero.
3. Set the rim dial indicator to the sag value.
4. Rotate both shafts (if possible) to 12:00.
5. Record the DIR and DIF dial indicator TIR values



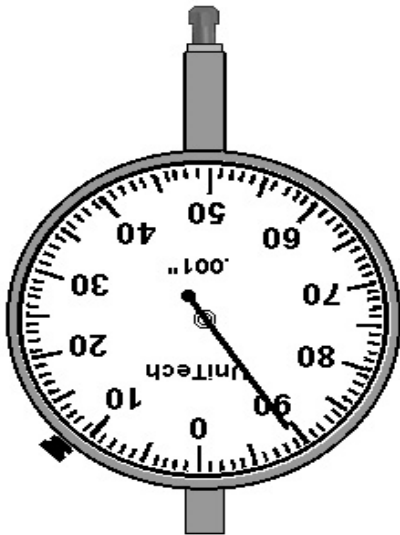
Measuring vertical misalignment, 6 o'clock.

NOTE: For example, if the amount of sag for the rim dial fixture is determined to be -9 mils, the dial would be set to read - 9 at the 6:00 position.

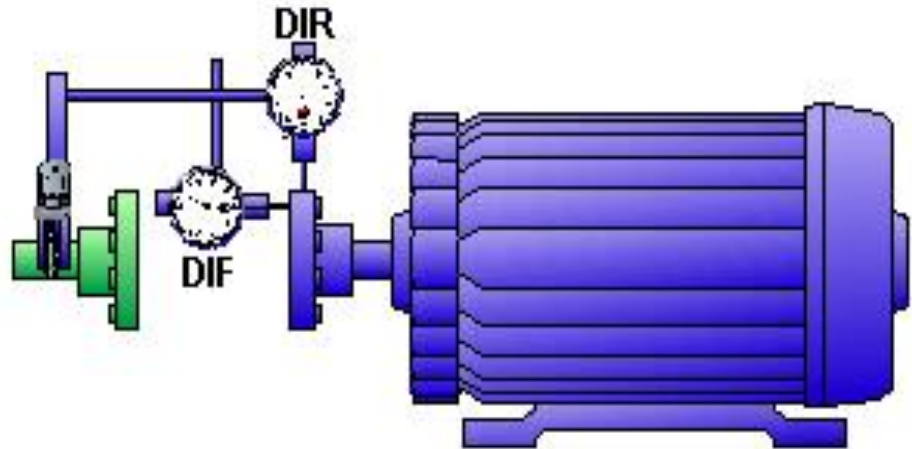
Rim and Face method overview

Rim-Face Alignment Procedure

Measuring Vertical Misalignment



Setting the sag value



Measuring vertical misalignment, 12 o'clock.

Rim and Face method overview

Rim-Face Alignment Procedure

Interpreting Vertical Misalignment Data

To determine offset and angularity from the 12:00 TIR's, use the following rules:

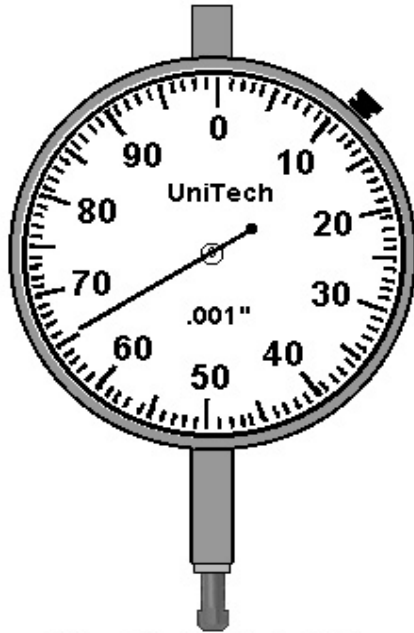
- Coupling Offset = $\frac{\text{Rim Dial (DIR) TIR}}{2}$
- Shaft Angularity = $\frac{\text{Face Dial (DIF) TIR}}{\text{A dimension}}$

Consider the following Rim-Face 12:00 total indicator readings (TIR's).

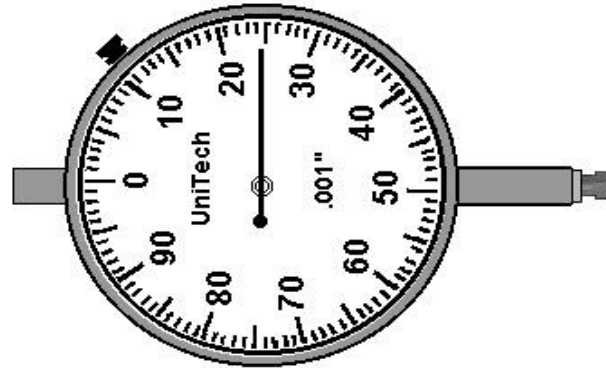
Rim and Face method overview

Rim-Face Alignment Procedure

Interpreting Vertical Misalignment Data



Rim Dial (DIR) TIR



Face Dial (DIF) TIR

Example, TIR readings.

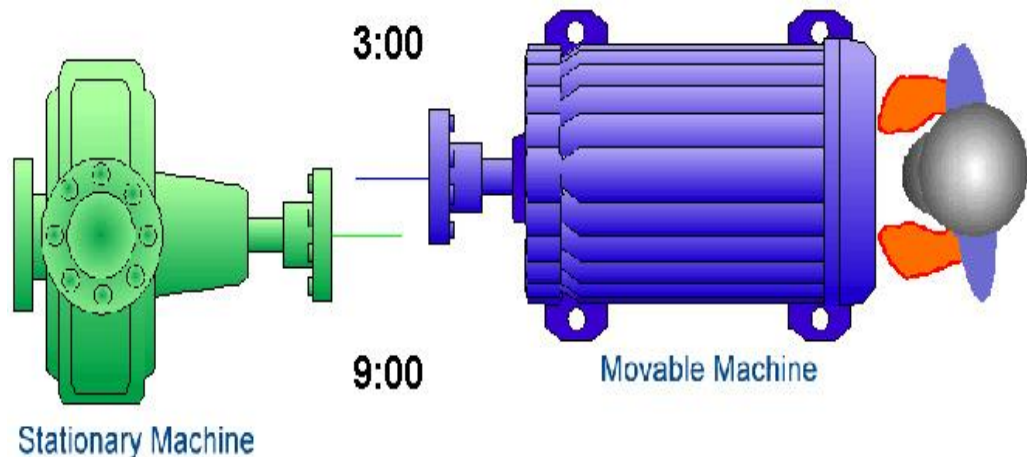
1. The Rim Dial TIR is -34 mils (-0.864 mm). The coupling offset is - 17 mils (-0.432 mm), or 17 mils low.
2. The Face Dial TIR is +24 mils (+0.610 mm). Given an A dimension of 4 inches (101.6 mm), the vertical angularity would be $+24 \text{ mils} / 4'' = 6.0 \text{ mils per inch}$ (0.6 mm / 100 mm).

Rim and Face method overview

Rim-Face Alignment Procedure

Measuring Horizontal Misalignment

A major precaution for measurement and interpretation of horizontal misalignment data is the establishment of the direction of view. For this training, all clock positions are referenced from the viewpoint shown below...standing behind the movable machine facing the stationary machine.



Measuring horizontal misalignment

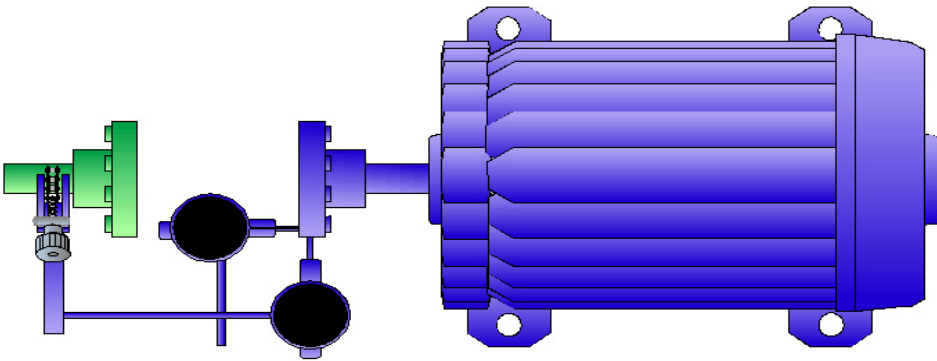
To measure horizontal misalignment, perform the following steps:

1. Rotate the dial indicators to 9:00.

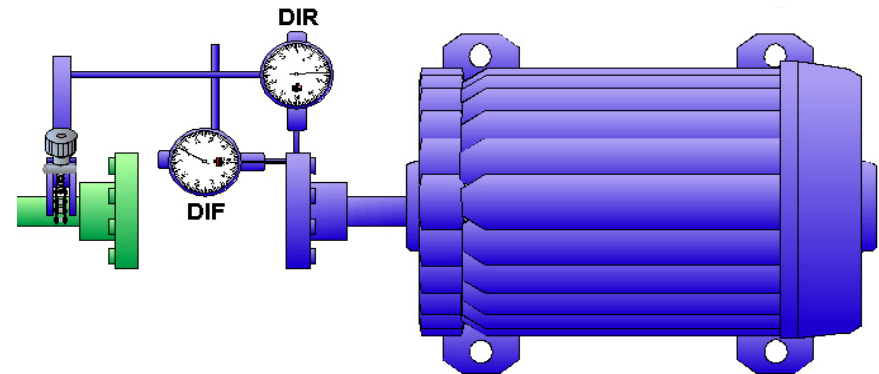
Rim and Face method overview

Rim-Face Alignment Procedure

Measuring Horizontal Misalignment



Measuring horizontal misalignment, 9 o'clock



Measuring horizontal misalignment, 3 o'clock

To measure horizontal misalignment, perform the following steps:

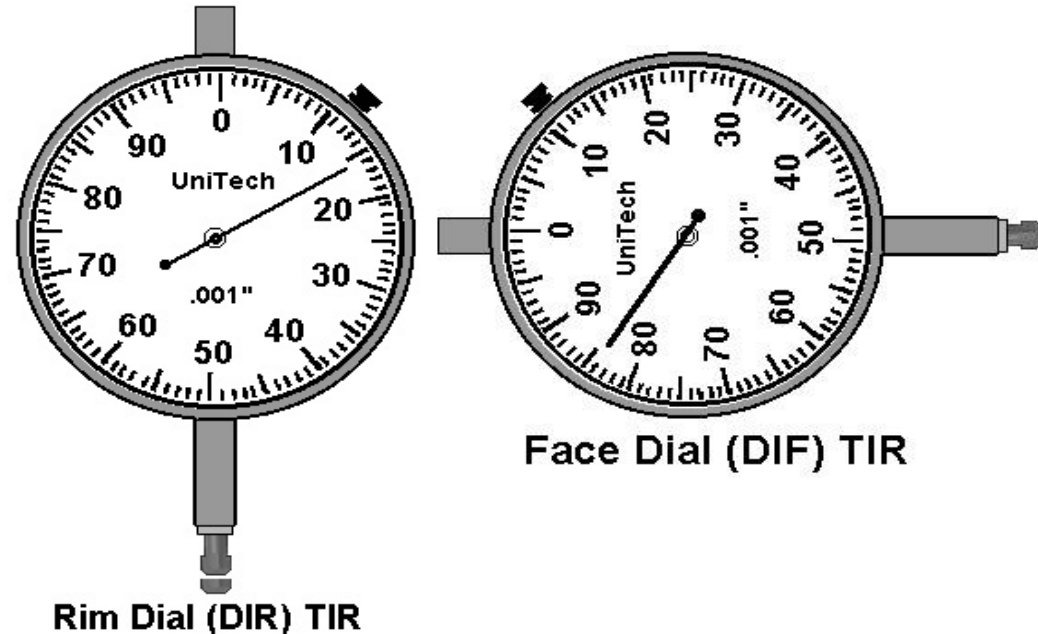
1. Rotate the dial indicators to 9:00.
2. Set both dial indicators to zero.
3. Rotate both shafts to 3:00.
4. Record the DIF and DIR dial indicator TIR values.

Rim and Face method overview

Rim-Face Alignment Procedure

Interpreting Horizontal Misalignment Data

1. The Rim Dial TIR is +16 mils (+0.406 mm). The coupling offset is +8 mils (+0.203 mm), or 8 mils to the right.



Example, horizontal TIR readings.

2. The Face Dial TIR is -16 mils (-0.406 mm). Given an A dimension of 4 inches (101.6 mm), the horizontal angularity would be $-16 \text{ mils}/4'' = -4.0 \text{ mils per inch}$ (-0.4 mm/100mm).

Rim and Face method overview

Rim-Face Alignment Procedure

Rim-Face Calculations

Many different equations may be used for various Rim-Face calculations. The information presented here applies to a Rim-Face dial setup presented earlier in the Unit. The equations presented are used to calculate the position of the movable machine's front and rear feet from DIR offset value and the shaft angularity as determined from the face dial indicator (DIF).

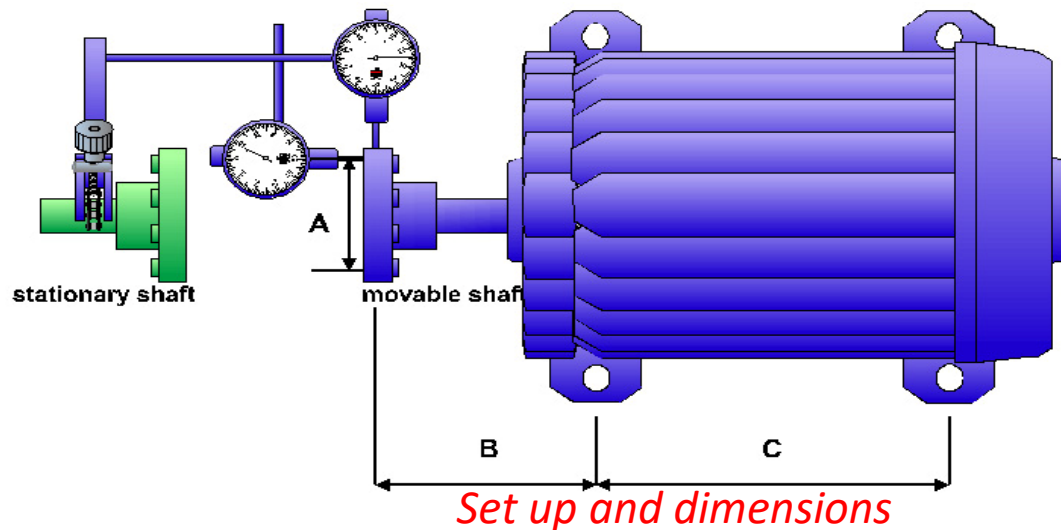
Calculations apply to both the vertical and horizontal planes of misalignment. However, they are typically applied primarily to the vertical plane. As presented in Section 3.2.7.3, correcting misalignment in the horizontal plane may be accomplished without calculating or graphing the exact front and rear feet positions.

Rim and Face method overview

Rim-Face Alignment Procedure

Calculating the Front Feet and Rear Feet Positions

As shown in earlier sections and illustrated below, the following setup, dimensions, and offset designations apply.



The position of the movable machine's front feet is determined using the following equation:

Equation, front feet calculation

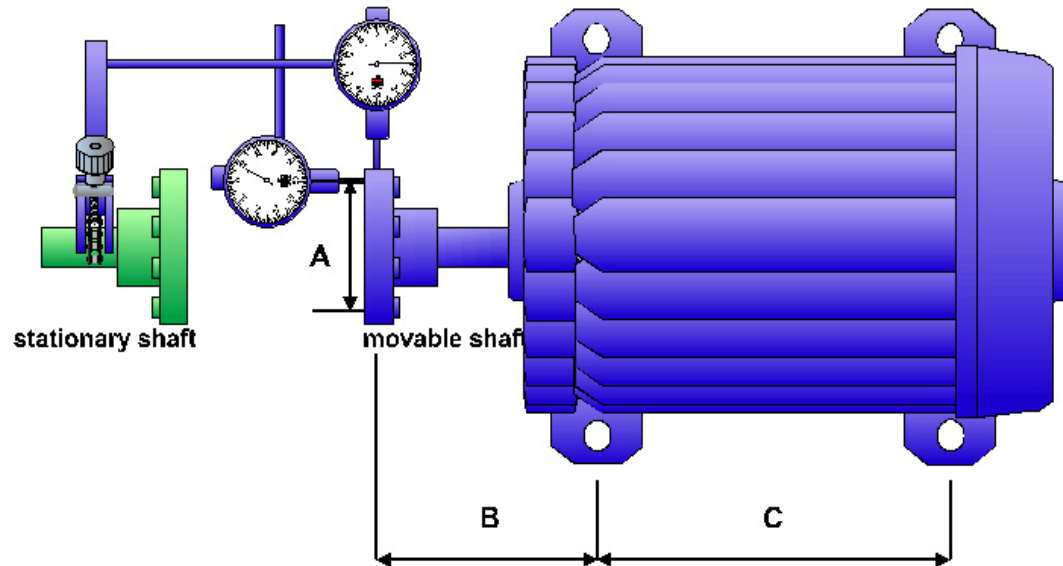


$$\left(\frac{\text{Face TIR}}{A} \times B \right) + 1/2 \text{ Rim TIR}$$

Rim and Face method overview

Rim-Face Alignment Procedure

Calculating the Front Feet and Rear Feet Positions



The position of the movable machine's rear feet is determined using the following equation

Equation, rear feet calculation



$$\left(\frac{\text{Face TIR}}{A} \times (B + C) \right) + 1/2 \text{ Rim TIR}$$

Rim and Face method overview

Rim-Face Alignment Procedure

Calculating the Front Feet and Rear Feet Positions

where:

- **Face TIR** = Total Indicator Reading from the Face Dial
- **Rim TIR** = Total Indicator Reading from the Rim Dial
- **A** = the diameter of the face dial indicator travel
- **B** = the distance from the Rim dial indicator plunger to the movable machine's front feet bolt center
- **C** = the distance between the movable machines' front and rear feet bolt centers
- Positive results mean the foot is high (vertical) or to the right (horizontal)
- Negative results mean the foot is low (vertical) or to the left (horizontal)

Rim and Face method overview

Rim-Face Alignment Procedure

Rim-Face Calculation Examples

Sample Data

Given the following vertical misalignment data:

- The rim dial (DIR) 12:00 TIR is +24 mils (+0.610 mm).
- The face dial (DIF) 12:00 TIR is +12 mils (+0.305 mm).
- A = 6 inches (152.4 mm)
- B = 7 inches (177.8 mm)
- C = 24 inches (609.6 mm)

Front Foot Position Calculation

$$\left(\frac{\text{Face TIR}}{A} \times B \right) + 1/2 \text{ Rim TIR}$$

Front feet calculation.

The front feet are 26 mils (0.66 mm) too high; shims need to be removed.

$$\left(\frac{+12 \text{ mils}}{6''} \times 7'' \right) + 1/2 (+24 \text{ mils}) = +26 \text{ mils}$$

$$\left(\frac{0.305 \text{ mm}}{152.4 \text{ mm}} \times 177.8 \text{ mm} \right) + 1/2 (+0.610 \text{ mm}) = 0.66 \text{ mm}$$

Rim and Face method overview

Rim-Face Alignment Procedure

Rim-Face Calculation Examples

Rear Foot Position Calculation

Rear feet calculation.

The rear feet are 74.0 mils (1.88 mm) too high; shims need to be removed.

$$\left(\frac{\text{Face TIR}}{A} \times (B + C) \right) + 1/2 \text{ Rim TIR}$$

$$\left(\frac{+12 \text{ mils}}{6''} \times (7'' + 24'') \right) + 1/2(+ 24 \text{ mils}) = + 74 \text{ mils}$$

$$\left(\frac{0.305 \text{ mm}}{152.4 \text{ mm}} \times (177.8 + 609.6) \text{ mm} \right) + \frac{1}{2} (+0.610 \text{ mm}) = 1.88 \text{ mm}$$

Rim and Face method overview

Rim-Face Alignment Procedure

Rim-Face Calculation Precautions

- **Ensure that the rim and face dial indicator TIR's are properly determined from the dials prior to performing calculations.**
- **Be careful NOT to make mathematical errors when subtracting signed numbers.**
- **Observe parentheses in the equations. Perform operations inside parenthesis first.**
- **Do NOT make human errors substituting real values into the equations.**
- **Ensure that the A, B, and C dimensions are accurate and are properly entered into the equations.**

Rim and Face method overview

Rim-Face Alignment Procedure

Rim-Face Graph

As discussed earlier, one way to determine the position of the movable machine's front and rear feet from DIR and DIF TIR values is to perform Rim-Face calculations. Another way is to construct a scaled graph. A main advantage of graphing methods is that the shaft centerlines and misalignment conditions are represented visually.

The information presented here applies to a Rim-Face dial setup where both dial indicators are attached at the same location around the circumference.

Rim and Face method overview

Rim-Face Alignment Procedure

Rim-Face Graph

Graphing procedures may be applied to both the vertical and horizontal planes of misalignment. However, they are typically applied primarily to the vertical plane. As presented earlier, misalignment in the horizontal plane may be accomplished without calculating or graphing the exact front and rear feet positions.

Rim and Face method overview

Rim-Face Alignment Procedure

Setting Up the Graph

To construct a scaled Rim-Face graph, perform the following steps:

1. Obtain graph paper with 10 divisions between bold lines.
2. Turn the graph paper so that the long side is horizontal.
3. Draw a horizontal line at the center of the page.

1. This line represents the stationary shaft center and is drawn across the page midway down the graph dividing the page. It is helpful if this line is on top of one of the bold lines.

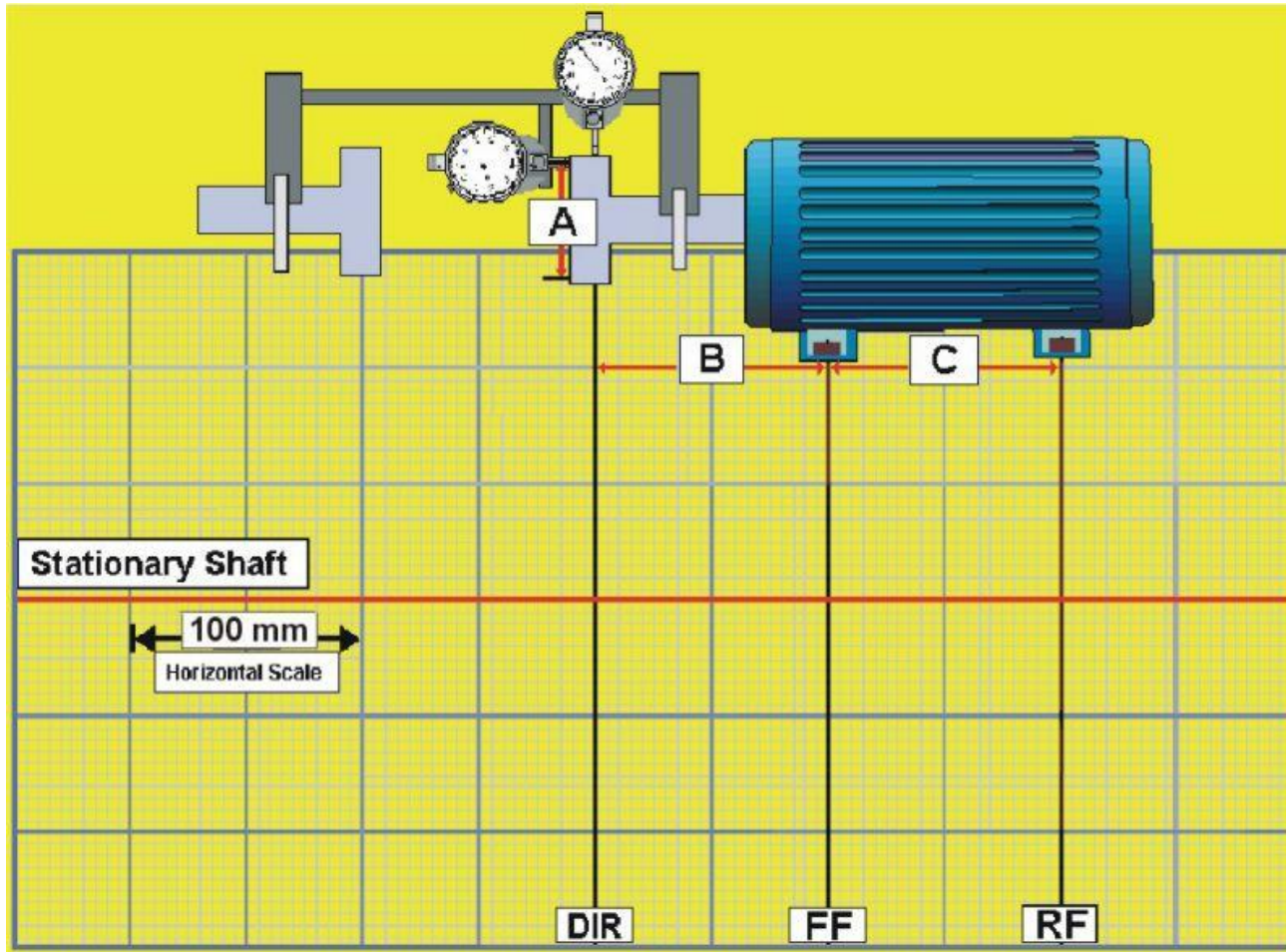
4. Determine the horizontal plotting scale.

1. Always use the largest scale possible. Measure the distance from the stationary indicator plunger to the centerline of the rear feet of the movable machine. Standard graph paper is about 260 mm across. The largest horizontal scale will be the machine distance divided by the page width. Note your horizontal scale.

Rim and Face method overview

- **5.** Make a vertical line on the extreme left of the horizontal line.
 - **1.** This mark represents the point where the rim dial indicator contacts the shaft or coupling hub and is labeled: DIR.
 - **6.** Make a second vertical line representing the point along the shaft length of the front feet of the movable machine (FF).
 - **7.** Make a third vertical line representing the point along the shaft length of the rear feet of the movable machine (RF).
- Upon completion of the steps above, the graph will look similar to the one shown below. For this example, the B and C dimensions both equal 10 inches.

Rim and Face method overview



Setting up the graph.

Rim and Face method overview

Plotting Offsets

After setting up the graph, the next step is to plot two offset points. One is the offset measured in the plane of the rim dial indicator (DIR). The other offset point is derived from the face dial indicator (DIF) reading and the “A” dimension. To plot the offsets, perform the following steps:

1. Determine the vertical scale.

- The vertical scale is typically 1 hundred of a mm (0.01) per division. In cases of gross misalignment where the offsets will not fit on the page, a larger scale, such as 2-3 hundreds per division, is sometimes required.

2. Plot the offset from the rim dial indicator on line DIR.

- Use the horizontal line representing the stationary shaft centerline as the reference. All points above this horizontal line are positive (+) and all points below the line are negative (-).

Rim and Face method overview

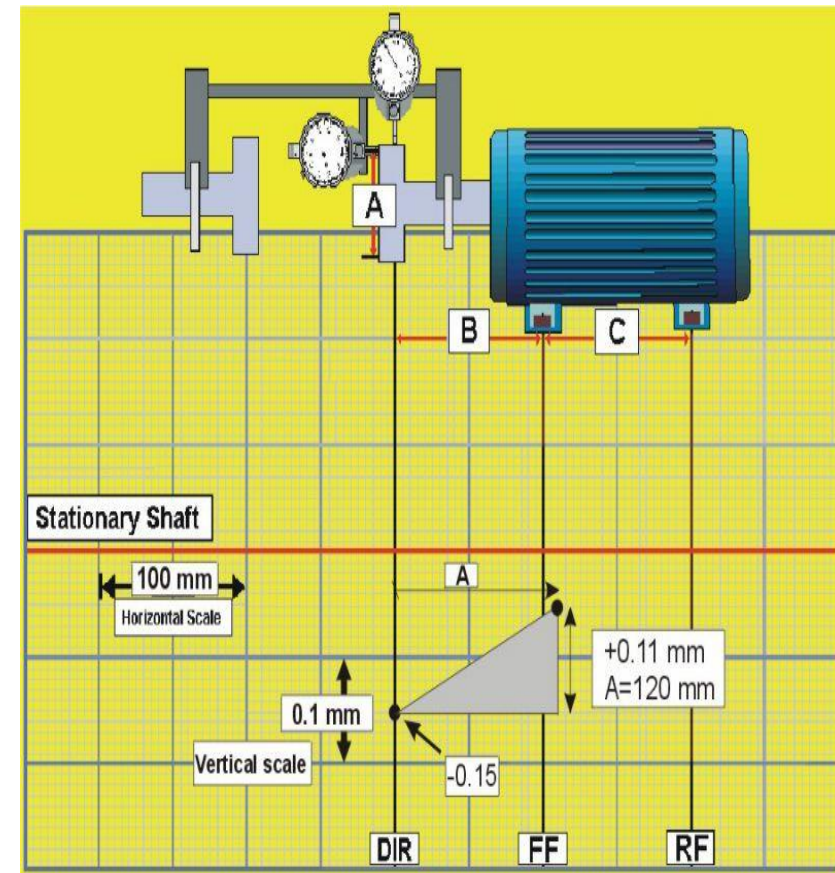
Plotting Offsets

- Ensure you divide the Rim Dial TIR by 2 to obtain an offset value.

3. Plot the second offset point using the shaft slope (Face TIR / “A” dimension).

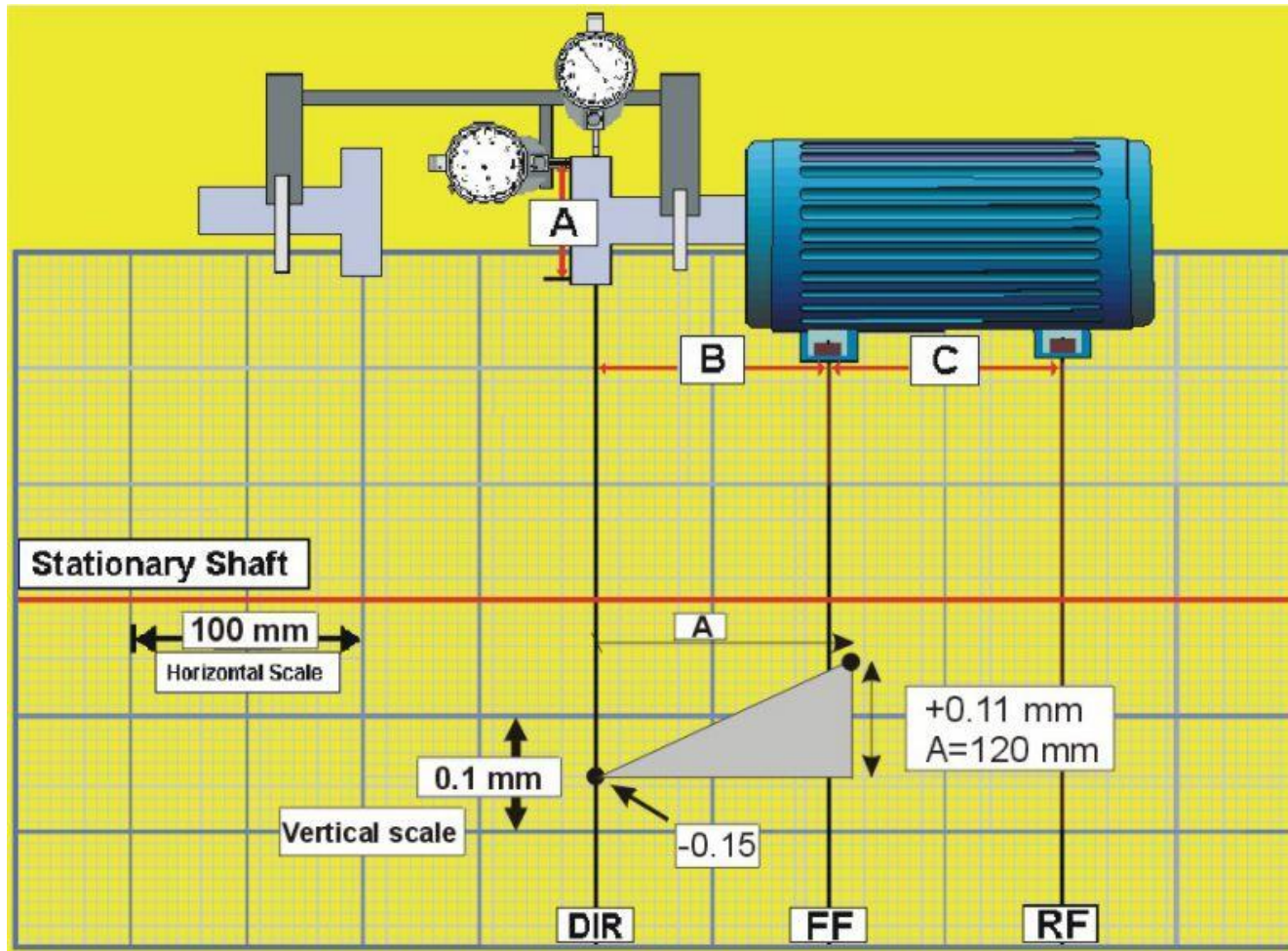
- Plot this point counting from the DIR offset point!

In the example below, the DIR offset is -0.15 mm and the shaft slope is $+0.11$ mm over an A dimension of 120 mm.



Plotting

Rim and Face method overview



Plotting

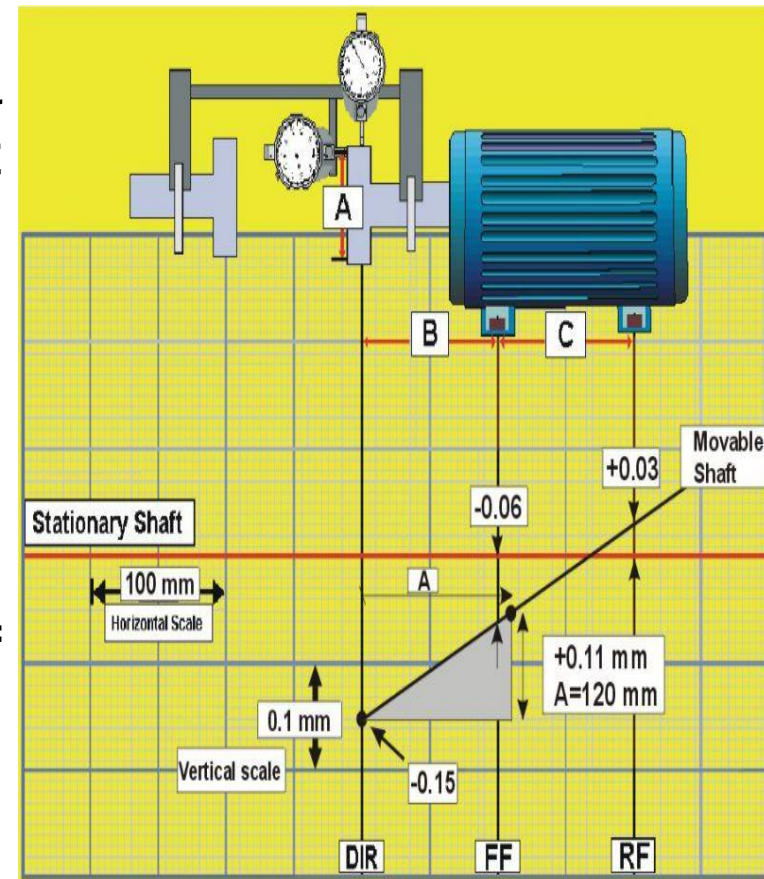
Rim and Face method overview

Determining Movable Shaft Position

After plotting the two points, to determine the movable shaft position perform the following steps:

1. Using a ruler or straightedge, draw a line through the two offset points that extends to the rear feet of the movable machine.
2. Count the number of squares in the plane of the front and rear feet to determine the position and corrections needed.

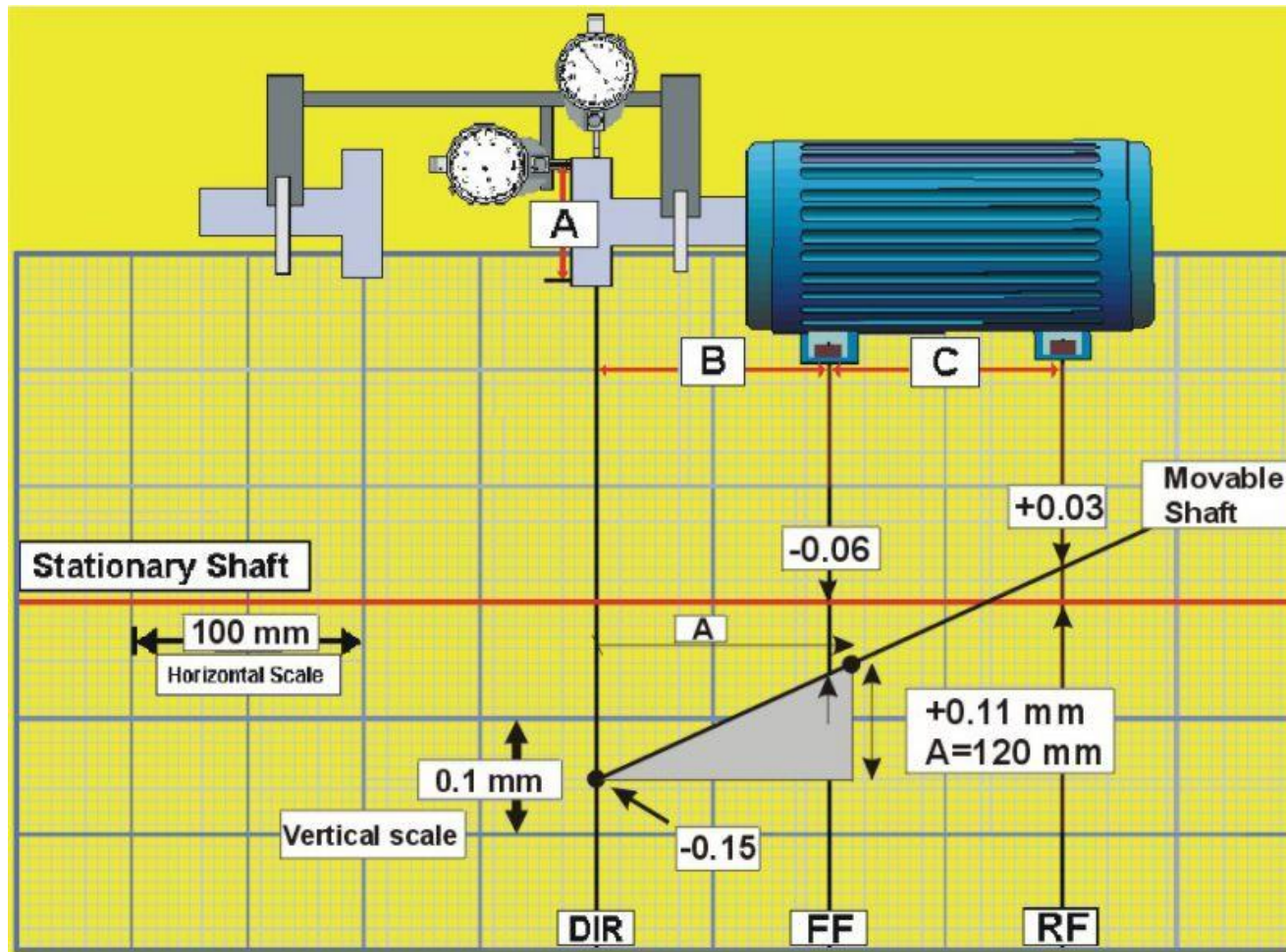
In the example below, the front feet of the machine are 0.06 mm low; shims need to be added. The rear feet are positioned 0.03 too high; shims need to be removed from both rear feet.



Graph, feet positions.

Rim and Face method overview

Determining Movable Shaft Position



Rim and Face method overview

Rim-Face Graphing Precautions

1. Ensure that proper horizontal and vertical scaling techniques are consistently used.
2. Always double check the position of vertical lines drawn to represent the DIR, FF, and RF.
3. Ensure that the two plot points are properly determined from TIR's.
4. Ensure that positive offsets are plotted above the horizontal reference line and negative offsets are plotted below the line.
5. When interpreting the graph to determine the movable shaft's front and rear feet positions in the vertical plane, observe the following rules:
 1. If the movable shaft is above the horizontal stationary shaft reference line, the shaft is too high.
 2. If the movable shaft is below the horizontal stationary shaft reference line, the shaft is too low.

Rim and Face method overview

Rim-Face Graphing Precautions

6. When interpreting the graph to determine the movable shaft's front and rear feet positions in the horizontal plane, view the graph the way you view the machine, that is, standing behind the movable machine facing the stationary machine. Also, observe the following rules:

- If the movable shaft is above the horizontal stationary shaft reference line, the shaft is positioned to the right.
- If the movable shaft is below the horizontal stationary shaft reference line, the shaft is positioned to the left.

Rim and Face method overview

Correction Process Overview

To correct misalignment involves a number of different procedures. The sequence of steps in a correction process varies slightly according to the specific alignment conditions of the machine.

Before Correcting Misalignment

Before correcting misalignment , the following procedures are to be performed:

- Perform pre-alignment checks and corrections.**
- Setup the Rim-Face fixtures.**
- Correct soft foot.**
- Measure misalignment.**
- Determine alignment tolerances.**
- Compare alignment conditions to specified tolerances.**

Rim and Face method overview

Correction Process Overview

After Correcting Misalignment

After correcting misalignment, the following procedures are to be performed.

- Re-measure alignment conditions.**
- Compare alignment conditions to specified tolerances.**
- Document final result.ss**

Rim and Face method overview

Correction Process Overview

Common Correction Questions

When it comes to actually moving the machine, that is, SOLVING the PROBLEM, several questions are often asked:

- Do I start with the vertical or horizontal?**
- What about use of precut shims?**
- Should I take a new set of readings after moving vertically or horizontally?**
- Do I need to use dial indicators to monitor the horizontal moves?**
- Is it necessary to use torquing procedures?**
- Do I move the front feet or the rear feet first?**

Each of these questions is valid and will be answered in this lesson.

Rim and Face method overview

Correction Process Overview

Determining the Sequence of Corrections

Correcting misalignment involves initial and final corrections. Initial corrections are made to minimize the amounts of misalignment and improve the accuracy of alignment measurements.

Prior to making any moves, look at the horizontal and vertical positions of the movable machine. In general, you will start the correction process by making initial corrections in the plane where the misalignment is worse and then make final corrections.

Rim and Face method overview

Correction Process Overview

Making Corrections	If	Then
Both Vertical and Horizontal Front and Rear Feet	Misalignment is 0.5 mm or less	• Make final vertical corrections. • Make final horizontal corrections.
Both Vertical and Horizontal Front and Rear Feet	Misalignment is greater than 0.5 mm	• Make initial vertical and horizontal corrections. • Make final vertical corrections. • Make final horizontal corrections.
Either Vertical or Horizontal Front and Rear Feet	Misalignment is greater than 0.5 mm	• Make initial vertical or horizontal corrections. • Make final vertical corrections. • Make final horizontal corrections.

Consider the following sets of data

Front Feet Vertical Position: +0.2 mm

Front Feet Horizontal Position: -0.4 mm

Rear Feet Vertical Position: +0.5 mm

Rear Feet Horizontal Position: -0.9 mm

Rim and Face method overview

Correction Process Overview

Consider the following sets of data

Front Feet Vertical

Position: +0.2 mm

Front Feet Horizontal

Position: -0.4 mm

Rear Feet Vertical

Position: +0.5 mm

Rear Feet Horizontal

Position: -0.9 mm

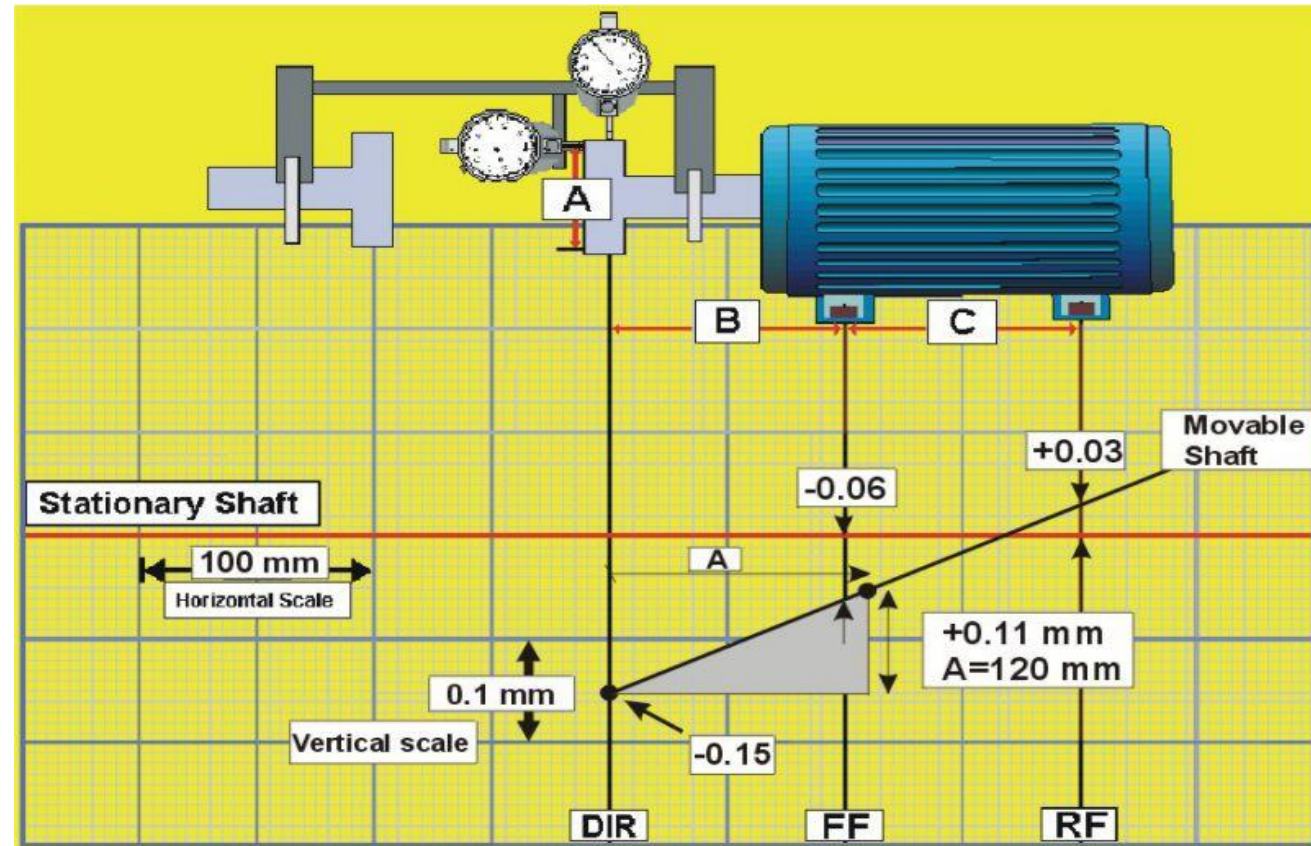
In this example, the horizontal misalignment is over twice the vertical misalignment. Therefore, an initial horizontal adjustment will be made; then, final vertical and horizontal corrections will be made.

Rim and Face method overview

Making Vertical Corrections

Determine the vertical position of the movable machine using calculation and/or graphing techniques.

- Positive values at the feet mean that the movable machine is high, therefore you will remove shims.
- Negative values mean that the movable machine is low, so you will add shims.



Making vertical corrections

Rim and Face method overview

Making Vertical Corrections

Vertical Correction Tips

- **Make shim changes to both front feet and both rear feet as needed.**
- **Always check shim thickness with an outside micrometer. Precut shims aren't always what they're marked; many shim manufacturers designate shims with the “nominal” thickness.**
- **Use consistent and correct torquing procedures.**
- **As shim changes are made, check for and take precautions to avoid creating soft foot conditions.**

Rim and Face method overview

Horizontal Corrections Process

When using the Rim-Face method, two different procedures are commonly used for horizontal corrections:

- .Determining the corrections using calculation or graphing techniques and monitoring movement using dial indicators positioned at the machine feet.**

- .sMonitoring movement using dial indicators mounted at the coupling.**

To correct horizontal misalignment by monitoring movement at the movable machine feet, perform the following steps:

- 1.Measure horizontal misalignment using procedures given in 3.2.4.**

- 2.Determine the horizontal position of the movable machine using calculation or graphing procedures given in 3.2.5 and 3.2.6.**

- Ensure that you are standing with the movable machine on your right and the stationary machine on your left.**

- Positive values at the feet mean that the movable machine is away from you; therefore it should be moved towards you.**

Rim and Face method overview

Horizontal Corrections Process

3. Negative values at the feet mean that the movable machine is towards you; therefore it should be moved away from you.
4. Position dial indicators at the front and rear feet.

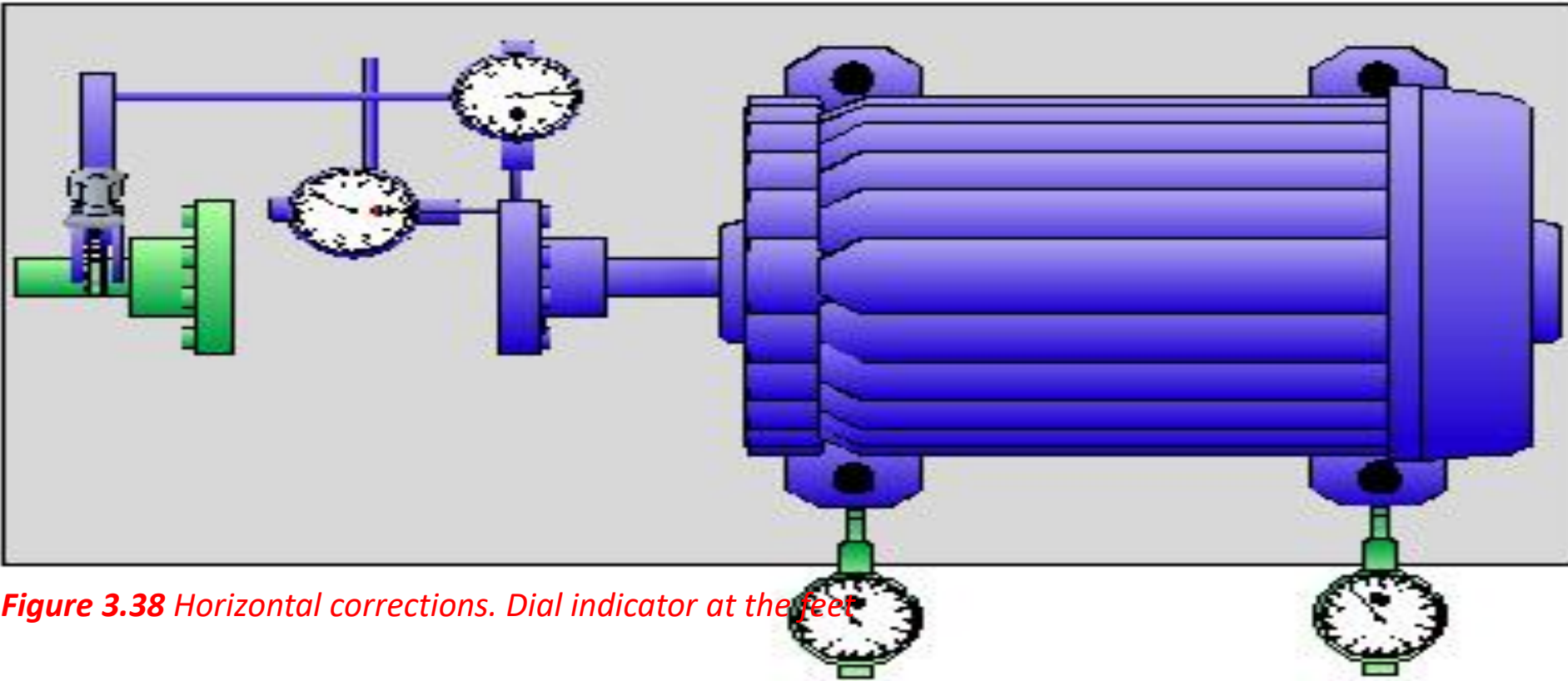


Figure 3.38 Horizontal corrections. Dial indicator at the feet

Move front and rear feet the amounts needed while watching the dial indicators.

Rim and Face method overview

Horizontal Corrections Process

To correct horizontal misalignment by monitoring using dial indicators mounted at the coupling, perform the following steps:

- 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 their values.**
- 4. Move the front feet of the movable machine as you watch the rim dial indicator move to zero.**
- 5. Move the rear feet of the movable machine as you watch the face dial indicator move to zero.**
- 6. Repeat steps 4 & 5 until both dial indicators read zero.**

Rim and Face method overview

Horizontal Corrections Process

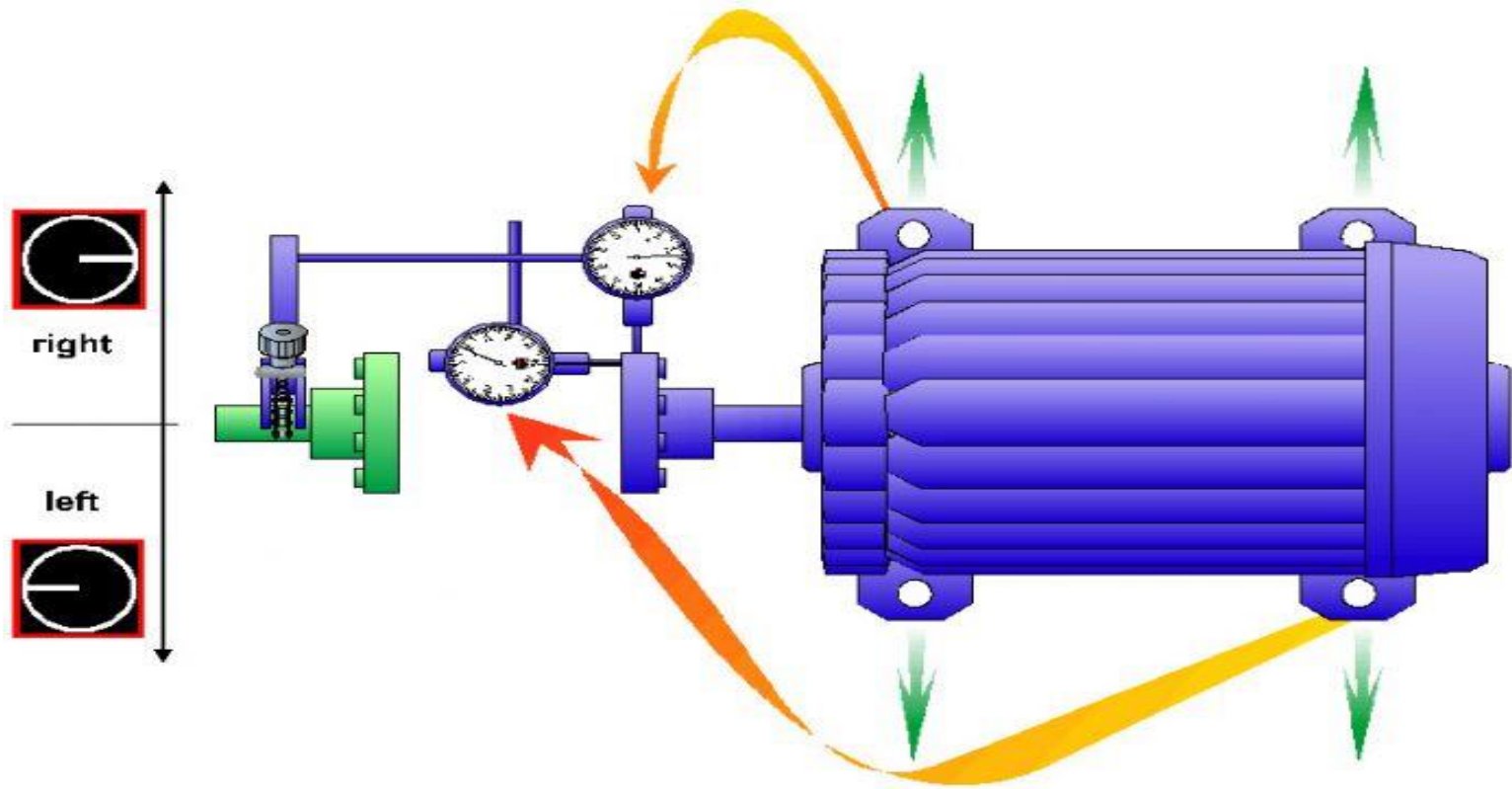


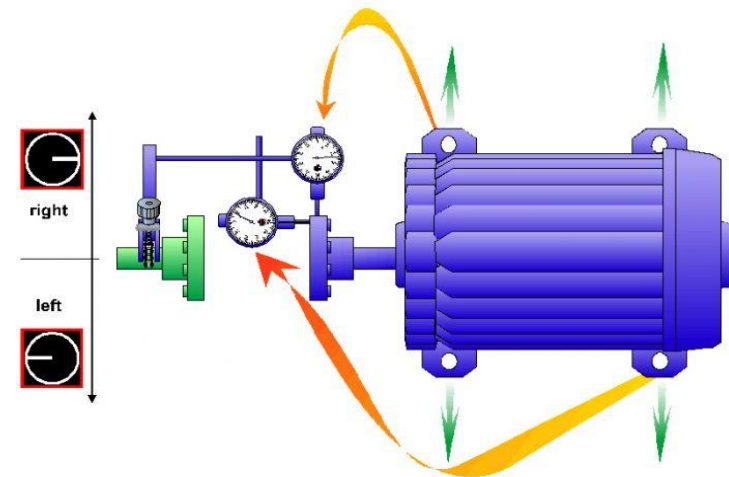
Figure 3.39 Horizontal corrections. Monitoring dial indicators mounted at the coupling.

Rim and Face method overview

Horizontal Corrections Process

Horizontal Correction Tips

1. Start making moves at the feet where the misalignment is greatest.
2. Bring tlf not already present, install jackbolts wherever possible.
3. he front and rear feet into alignment together; they're a team.
4. When the feet are within 0.05 mm or so, start torquing and watch the dial indicators. Use the proper criss-cross torquing sequence.



Rim and Face method overview

Horizontal Corrections Process