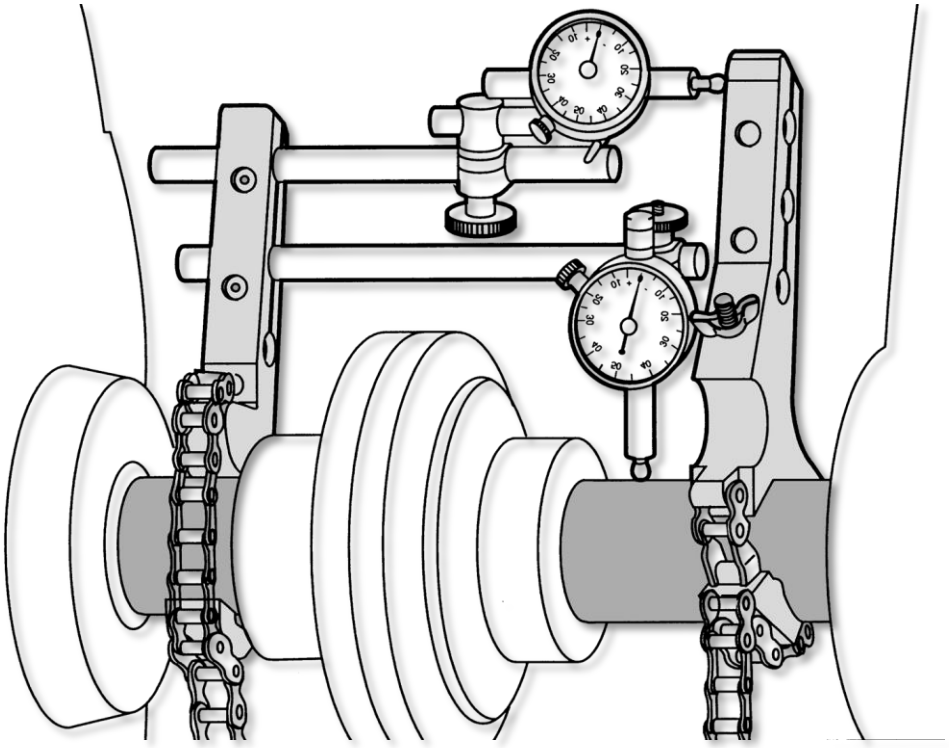
Instruction Manual

Peterson Alignment Tools Company

Software Manual and Alignment Hardware Guidebook



#30RA Shaft Alignment Kit shown

Manual for use with
the FastMath™ Worksheets or
the Alignment Manager™ v2.1
(XP / VISTA / WIN7)

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Read this manual completely and thoroughly before attempting to align your machinery using a Peterson Shaft Alignment System. Software images may differ slightly in manual from retail version you are using.

Read

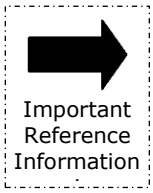
➢ The Importance of Proper Shaft Alignment

Power transmission equipment is usually linked by a coupling system. Proper shaft alignment will dramatically increase the life of the various components that collectively comprise the motor and pump assembly — things like the bearings, the coupling and the gearbox. Conversely, misaligned shafts will inevitably lead to vibration, high bearing loads, seal failure, and, eventually, failure of the coupling, motor or pump. The end results are all the same: down-time, repair and replacement expenses and lots of headaches.

A comprehensive preventive maintenance program will go a long way towards eliminating these problems and keep your machinery — and, therefore, your business — running smoothly. Maintaining proper alignment of your rotating equipment through the periodic use of a Peterson alignment tool will save you money in repairs, replacements and down time — more than paying for itself in as little as one month.

For purposes of continuity and consistency throughout this instruction manual, it will use the following guidelines:

1. Peterson brand Alignment Tools are designed to operate with the couplings intact, so separation of the coupling assembly is not necessary or advised.



2. Whenever possible, mount the alignment tool frame that will hold the mounting tubes on the stationary equipment side (left side of the coupling) and span the dial indicators across the coupling to the moveable equipment (right side of coupling). This configuration results in measurements being taken on the equipment to be adjusted, and is important in establishing consistency between the measurements and the mathematical formulae they will be used in. Refer to Figure 3 on Page 9.

➢ I. Determining and Correcting "Soft-Foot"

"Soft-Foot" is the term commonly applied to that condition which exists when all four (4) of the machine feet are not supporting the weight of the machine. This condition, when not corrected before starting the alignment procedure, is one of the major causes of frustration and lost productivity because it prevents you from properly aligning your equipment.

Your machinery may display this fault known as soft-foot, which will cause the machine to assume a different height dependent on the following factors:

- The amount of torque on the base fastenings -
- If the mounting base is not true and level -
- If existing shims are rusty, bent or broken -
- Equipment was mounted on an unclean surface -

Consider a chair with one of its legs shorter than the rest. The chair will never be stable unless the other three of its legs are shortened or the short leg is shimmed up. When a machine is in this condition, the dial indicator readings can be different each time the cycle of tightening, loosening and re-tightening is completed. Frustration and lost productivity occurs because attempted corrections do not produce the desired results.

The basis for understanding and correcting soft-foot is the knowledge that a plane is determined by three (3) points. In the case of the chair, the floor is the "plane" that we speak of, and the bottom tips of the legs are the "points". Three tips will always rest on the floor,

even if a person is sitting with his weight positioned above the short leg (the short leg will then be on the floor and the normal leg which is diagonally opposite the short leg will be off the floor). By using this example, it can easily be seen that when a machine is initially placed on its base it will be resting on three (3) of its support feet unless the base and the bottom of the feet are perfectly machined. Also, because the feet of the machine are actually square pads – not true points – it is possible that the machine will be resting on only two (2) support feet which are diagonally opposite each other. In this case, the machine will have two (2) soft feet.

Soft-foot should always be checked and corrected before beginning the alignment procedure. The following should be done as an initial check for soft-foot:

1. Remove all dirt, rust, and burrs from the bottom of the machine's feet, the shims to be used, and the base (at the areas where the machine's feet will rest).

2. Set the machine in place, but do NOT tighten the hold-down nuts.

3. Attempt to pass a thin feeler gage (or piece of shim stock) underneath each of the four (4) feet. Any foot which is not solidly resting on the base is a "soft-foot." (Bear in mind that a foot may be considered "soft" if the feeler gage passes beneath most of it and only contacts a small point or one edge.) If the feeler gage passes beneath a foot, determine the exact amount of gap beneath the foot with the feeler gages and place this amount of shims beneath that foot. This will be considered as being the "initial" soft-foot correction.

Final correction of soft-foot should be done as follows:

1. Tighten all hold-down nuts on the machine to be aligned ("MTBM" – Motor-To-Be-Moved reference).

2. Secure a dial indicator holder (such as one with a magnetic base) to the base of the MTBM in such a manner that the stem of the dial indicator is placed vertically above the foot which is to be checked for soft-foot. Set the dial indicator to zero (0). Completely loosen the hold-down nut(s) on that foot only. Watch the dial indicator for foot movement during the loosening process.

3. If the foot rises from the base when the hold-down nut(s) is loosened, place beneath the foot an amount of shims stock equal to the amount of deflection shown on the dial indicator.

4. Retighten the hold-down nut(s) and repeat the entire process once more to be certain there is no more movement present at the foot.

5. Move the dial indicator and holder to the next foot and repeat steps (1) through (4) for the remaining three (3) feet.

Remember, while a selected foot is being checked for soft-foot, the remaining (3) must remain securely tightened.

➢ II. Sag Calculation and Measurement

Read

"Sag," within the context of this alignment manual, is the deflection of a dial indicator due to gravity alone. If the distance from the mounting frame to the tip of the perpendicularly-

mounted dial indicator plunger is less than three inches, sag will be negligible. For distances greater than three inches, sag can have a significant impact on the accuracy of the alignment calculation and must be corrected for. You will be setting up a simulation of the alignment kit on a piece of pipe or tubing. Use the following simple procedure to determine the extent of any sag:

1. On the equipment to be aligned, measure (or estimate) the distance (horizontally) from the edge where the mounting frame will be, to the point of the perpendicular (also referred to as rim or radial) dial indicator plunger. Write this number down.

2. Mount the alignment kit on a temporary arbor (such as a scrap piece of pipe, between 1" and 2" in diameter, etc.) at the horizontal distance you wrote down in #1. IF YOU ARE USING THE MODEL #20RA, BOTH DIAL INDICATORS MOUNTED ON ONE PIECE OF TUBING MUST BE USED FOR THE SAG TEST. READ "PROCEDURE A - MOUNTING AND OPERATING MODEL #20RA," BELOW, FOR MORE INFORMATION ON THIS PROCEDURE.

3. Zero the dial indicator at twelve o'clock (0° - straight up) and rotate the arbor to 6 o'clock (180° - straight down).

4. Since gravity will pull the indicator away (pulling the plunger away from the surface of the pipe), the resulting reading on the dial indicator will always be a negative number. Write this negative number down for use later on with the FastMath Worksheets or with the Alignment Manager™ software. Remember, sag only applies to the dial indicator mounted perpendicular to the shaft.

Sag is discussed within the HELP system in the Alignment Manager™ software.

➢ III. Alignment Procedures - Peterson Alignment Systems

You are now ready to begin the actual alignment process for parallel and angular offset misalignment in both the vertical and horizontal planes. Keep in mind that Peterson Alignment Tools are Rim-and-Face-Based alignment kits, and are designed to operate with the coupling intact, so separation of the coupling should not be done. All alignment data is obtained in one 270° rotation of the equipment with a Peterson Alignment Tool in place.

DANGER!

BEFORE BEGINNING ANY ALIGNMENT JOB, BE SURE ALL POWER IS DISCONNECTED AND/OR SHUT OFF TO THE MACHINERY YOU WILL BE WORKING ON.

Use one of the two following procedures (IIIA. or IIIB., depending on which model you have purchased) as a guide in setting up and configuring your alignment tool. These procedures should work for most Rim-and-Face-Based alignment kits. Actual configurations can vary from user to user and/or from job to job. The following is simply a guideline, and you should not be alarmed if your configuration varies slightly due to the wide variety of machinery limitations, space restrictions, etc., that exists.

➢ IIIA. Mounting and Operating Model #20RA (9 Steps)

1. For proper orientation, mount the first alignment tool frame on the shaft (or coupling) of the stationary (fixed reference) equipment, and have this equipment to your left, if possible. Wrap the roller chain around the shaft or coupling and clip it to the footing of the frame (the "hook" that is connected to

the frame with a connecting link). Make certain the frame is firm and secure by tightening the wing nut on the frame. It does not matter whether or not the wing nut is towards you or away from you - you can switch it later if setup requires you to do so.

2. Insert the appropriate length of steel tubing into the ½" diameter hole in the alignment tool frame. Close the frame by tightening the socket-head cap screw with the Allen key. This screw will only close the jaws of the alignment tool. If you need to widen the jaws of the alignment tool to insert the ½" tubing, first make sure the socket-head cap screw is loose, then insert a screwdriver or any appropriate tool in the saw-cut at the top of the alignment tool to gently increase the gap width. You may need to adjust the tubing one or more times before your setup is complete.

3. Slide one swivel joint (with the dial indicator and mounting rod attached) onto the open end of the tubing and slide it toward the frame. Position it in such a manner that there is sufficient room to accommodate a second swivel joint on the same piece of tubing. Then slide the second swivel joint onto that same piece of tubing.

See Sag Reference Pgs. 4-5

4. Mount the second alignment tool frame across the coupling on the shaft of the moveable equipment side of the motor/pump assembly. This frame does not have to be directly across from the first, but should be as close as physically possible. This frame will act as a vertical "target" for your parallel-mounted (also referred to as the *angular* or *face*) dial indicator.

5. Manipulate and maneuver the first dial indicator assembly (the one you slid on first) so that the indicator plunger is perpendicular to the shaft on the moveable equipment side of the motor/pump assembly. The plunger should be touching the shaft and depressed approximately halfway.

6. Manipulate and maneuver the second dial indicator assembly so that the indicator plunger is parallel to the shaft on the moveable equipment side of the motor/pump assembly and striking the vertical "target" alignment frame anywhere on its flat surface, preferably towards the outer portion of it. The plunger should be depressed approximately halfway.

7. The dial indicator positioned perpendicular to the shaft will now be referred to as -R-, for rim indicator, and the dial indicator positioned parallel to the shaft will now be referred to as -F-, for face indicator.

When the alignment tool is setup according to steps 1-6, three constants must be recorded, which are: the diameter of the circle of revolution made by the -F- dial indicator's plunger about the centerline of the shaft ("H"); the horizontal distance from the -F- dial indicator plunger to the front set of motor feet on the Moveable Side ("D"); the horizontal distance from the -F- dial indicator plunger to the back set of motor feet on the Moveable Side ("E").

Optionally, you may record the following dimensions: the horizontal distance from the -F- dial indicator plunger to the front feet of the Stationary Machine ("F") and the horizontal distance from the -F- dial indicator plunger to the back set of motor feet on the Stationary Side ("G"). **See Section IV, Figure 3 on page 9 for all reference dimensions.**

Don't get -F-, the face dial indicator reading, confused with "F," the distance to the front feet on the stationary side.

Distances "F" and "G" may be entered into the Alignment Manager program if a situation arises where you are unable to add or remove shims to the moveable

equipment. By supplying these optional distances, the Alignment Manager will calculate and display alternate shim and adjustment amounts for each alignment you perform. *This option is not available for use with the FastMath Worksheets.*

Aligning the stationary side is not an option when using the FastMath Worksheet.

8. Zero both indicators at 12 o'clock (0°) and rotate the shaft and coupling assembly towards you, stopping at 90° intervals (90°, 180°, and 270°) to take the dial indicator readings (see Figure 1, below). Each individual dial indicator should stop at each interval. For an example at 90°, if the -R- indicator is 10° behind the -F- indicator, take the -F- reading first, rotate the assembly 10° more, then take your reading off of the -R- indicator.

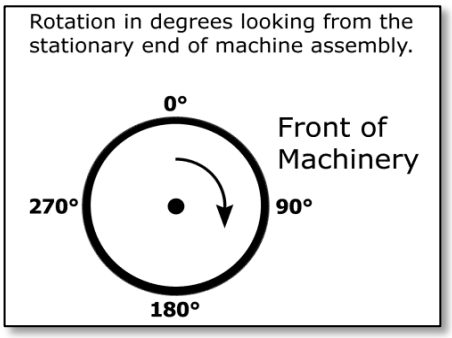


Figure 1: Proper rotation of alignment tool on equipment. Rotation of the shaft-coupling assembly is towards you with the stationary machine to your left and the moveable machine to your right.

9. You now have the data necessary to determine any misalignment present in your equipment. If you haven't already done so in step #IIIA-7 above, use Figure 3 in Section IV (page 9) to determine dimensional constants for use in the alignment calculation.

Turn to Page 11 to use the Alignment Manager™ Software
-or-
Turn to Page 19 to use the FastMath Worksheet

➢ IIIB. Mounting and Operating Model #30RA (9 Steps)

1. For proper orientation, mount the first alignment tool frame on the shaft (or coupling) of the stationary (fixed reference) equipment, and have this equipment to your left, if possible. Wrap the roller chain around the shaft or coupling and clip it to the footing of the frame (the "hook" that is connected to the frame with a connecting link). Make certain the frame is firm and secure by turning the wing nut on the frame. It does not matter whether or not the wing nut is towards you or away from you - you can switch it later if setup proves easier.

2. Insert appropriate lengths of steel tubing into the outermost and center ½" holes in the frame. Close the frame by turning both of the socket-head cap screws on the alignment frame with the Allen key. These screws will only close the jaws of the alignment tool. If you need to widen the jaws of the alignment tool, insert a screwdriver or any appropriate tool in the saw-cut to gently increase the gap width. You may need to adjust the tubing one or more times before your setup is complete.

See Sag Reference Pg. 4-5

3. Slide one swivel joint (with the dial indicator and mounting rod already attached) onto the outer piece of tubing; slide the second swivel joint onto the inner piece of tubing.

4. Mount the second alignment tool frame across the coupling on the shaft of the moveable equipment side of the motor/pump assembly. This frame does not have to be directly across from the first, but should be as close as possible. This frame will act as a vertical "target" for your parallel-mounted (also referred to as the angular or face) dial indicator.

5. Manipulate and maneuver the innermost dial indicator assembly so that the indicator plunger is perpendicular to the shaft on the moveable equipment side of the motor/pump assembly. The plunger should be touching the shaft and pushed in approximately halfway.

6. Manipulate and maneuver the outermost dial indicator assembly (farthest from the first mounting frame) so that the indicator plunger is parallel to the shaft on the moveable equipment side of the motor/pump assembly, striking the "target" alignment frame anywhere on its flat surface, preferably towards the outer portion of it. The plunger should be depressed approximately halfway.

7. The dial indicator positioned perpendicular to the shaft will now be referred to as -R-, for rim indicator, and the dial indicator positioned parallel to the shaft will now be referred to as -F-, for face indicator.

When the alignment tool is setup according to steps 1-6, three constants must be recorded, which are: the diameter of the circle of revolution made by the -F- dial indicator's plunger about the centerline of the shaft ("H"); the horizontal distance from the -F- dial indicator plunger to the front set of motor feet on the Moveable Side ("D"); the horizontal distance from the -F- dial indicator plunger to the back set of motor feet on the Moveable Side ("E").

Optionally, you may record the following dimensions: the horizontal distance from the -F- dial indicator plunger to the front feet of the Stationary Machine ("F") and the horizontal distance from the -F- dial indicator plunger to the back set of motor feet on the Stationary Side ("G"). **See Section IV, Figure 3 on page 9 for all reference dimensions.**

Don't get -F-, the face dial indicator reading, confused with "F," the distance to the front feet on the stationary side.

Distances "F" and "G" may be entered into the Alignment Manager program if a situation arises where you are unable to add or remove shims to the moveable equipment. By supplying these optional distances, the Alignment Manager will calculate and display alternate shim and adjustment amounts for each alignment you perform. *This option is not available for use with the FastMath Worksheets.*

Aligning the stationary side is not an option when using the FastMath Worksheet.

8. Zero both indicators at 12 o'clock (0°) and rotate the shaft and coupling assembly, stopping at 90° intervals (90°, 180°, and 270°) to take the dial indicator readings (see Figure 2, above). Each individual dial indicator should

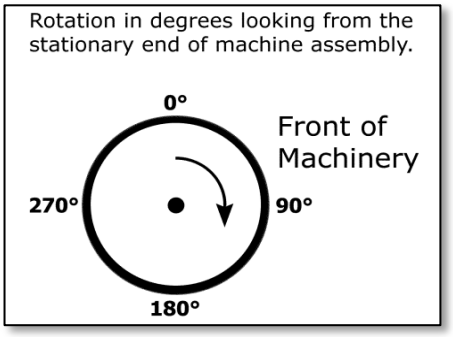


Figure 2: Proper rotation of alignment tool on equipment. Rotation of the shaft-coupling assembly is towards you with the stationary machine to your left and the moveable machine to your right.

stop at each interval. As an example at 90°, if the -R- indicator is 10° behind the -F- indicator, take the -F- reading first, rotate the assembly 10° more, then take your reading off of the -R- indicator.

9. You now have the data necessary to determine any misalignment present in your equipment. If you haven't already done so in step #IIIB-7 above, use Figure 3 in Section IV to determine dimensional constants for use in the alignment calculation.

Turn to Page 13 to use the Alignment Manager™ Software
-or-
Turn to Page 19 to use the FastMath™ Worksheet

➢ IV. Key to Variables

You should now be finished with mounting either the model #20RA or #30RA alignment system (or any 3rd party system), and you should have your Rim and Face dial indicator readings taken from 90º, 180º and 270º. If you will be using the Alignment Manager™ software for determining alignment correction amounts, you may enter the dial indicator readings directly and follow along as you go. Turn to page 11 now and start your software to begin entering those readings now.

The following figure shows the variables that are to be used in the alignment procedure, as well as the reference points they should be measured from. Study this diagram carefully.

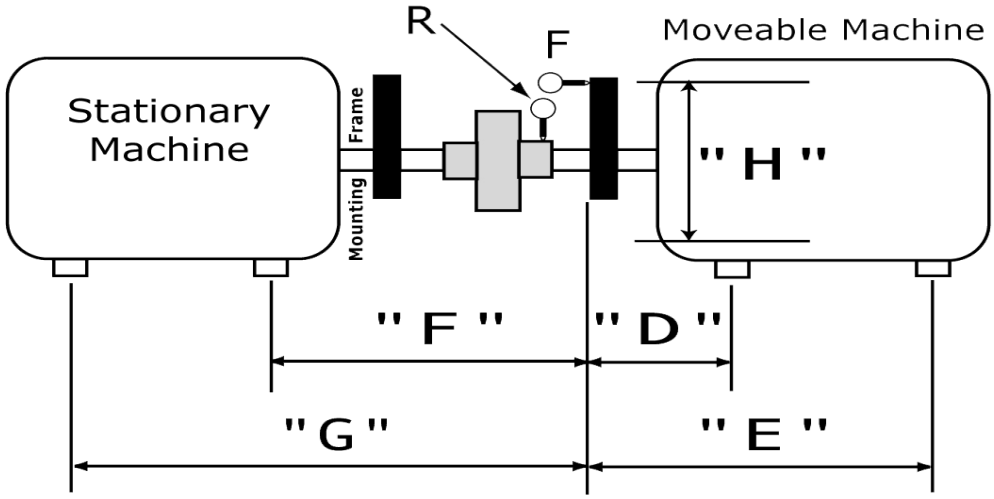


FIGURE 3: Diagram showing orientation and reference-point distances for Rim and Face method of shaft alignment. You will need these measurements for use with the Alignment Manager and the FastMath Worksheet.

Key To Variables:

H = Swing diameter (circle of revolution)
F = Face dial indicator orientation (plunger parallel to shaft)
R = Rim dial indicator orientation (plunger perpendicular to shaft)
D = Horizontal distance from parallel dial plunger to near feet of Motor-To-Be-Moved
E = Horizontal distance from parallel dial plunger to far feet of Motor-To-Be-Moved

Optional for Alignment Manager software Use Only:

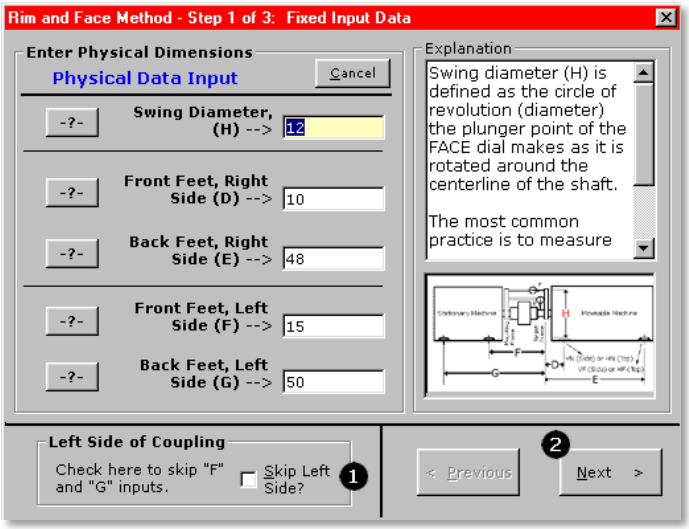
F = Horizontal distance: parallel dial plunger to near feet of Stationary Machine
G = Horizontal distance: parallel dial plunger to far feet of Stationary Machine

➢ V. Choose Alignment Calculation Method

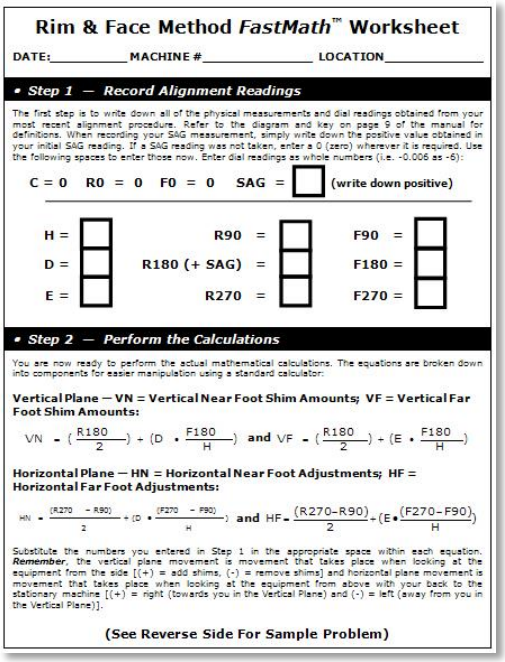
The alignment process should now be complete after using either method IIIA and the model #20RA alignment system, or method IIIB and the #30RA alignment system. You may also be using 3rd party alignment hardware, which you should have assembled and installed per the manufacturer's instructions. It is now time to choose which calculation method you will be using.

If you purchased the Alignment Manager software with either of the kits, please refer to Section VI immediately following this section for the proper instruction on using it. Additionally, you may find it helpful to refer to the enclosed flowchart titled "Alignment Manager™ software v2.X - Program Flowchart."

If you did not purchase the Alignment Manager with either of the kits, please turn to page 19 for proper instruction on getting started with the FastMath Worksheet.



Turn to the following page to begin using the Alignment Manager software as your calculation method.



Rim & Face Method *FastMath*™ Worksheet

DATE:_____ MACHINE #_____ LOCATION_____

• Step 1 — Record Alignment Readings

The first step is to write down all of the physical measurements and dial readings obtained from your most recent alignment procedure. Refer to the diagram and key on page 9 of the manual for definitions. When recording your SAG measurement, simply write down the positive value obtained in your initial SAG reading. If a SAG reading was not taken, enter a 0 (zero) wherever it is required. Use the following spaces to enter those now. Enter dial readings as whole numbers (i.e. -0.006 as -6):

C = 0 R0 = 0 F0 = 0 SAG = ☐ (write down positive)

H = ☐ D = ☐ E = ☐

R90 = ☐ R180 (+ SAG) = ☐ R270 = ☐

F90 = ☐ F180 = ☐ F270 = ☐

• Step 2 — Perform the Calculations

You are now ready to perform the actual mathematical calculations. The equations are broken down into components for easier manipulation using a standard calculator:

Vertical Plane — VN = Vertical Near Foot Shim Amounts; VF = Vertical Far Foot Shim Amounts:

$$VN = \left(\frac{R180}{2}\right) + \left(D \bullet \frac{F180}{H}\right) \text{ and } VF = \left(\frac{R180}{2}\right) + \left(E \bullet \frac{F180}{H}\right)$$

Horizontal Plane — HN = Horizontal Near Foot Adjustments; HF = Horizontal Far Foot Adjustments:

$$HN = \frac{(R270 - R90)}{2} + \left(D \bullet \frac{(F270 - F90)}{H}\right) \text{ and } HF = \frac{(R270 - R90)}{2} + \left(E \bullet \frac{(F270 - F90)}{H}\right)$$

Substitute the numbers you entered in Step 1 in the appropriate space within each equation. ***Remember***, the vertical plane movement is movement that takes place when looking at the equipment from the side [(+) = add shims, (-) = remove shims] and horizontal plane movement is movement that takes place when looking at the equipment from above with your back to the stationary machine [(+) = right (towards you in the Vertical Plane) and (-) = left (away from you in the Vertical Plane)].

(See Reverse Side For Sample Problem)

Turn to page 19 for instructions on using the FastMath Worksheets as your calculation method.

➢ VI. Alignment Manager™ Software v2.1 Calculation Method

Use the following instructions as a guide when using the Alignment Manager™ v2.1 software as your calculation method. You may also use the help system within the program by clicking on "Help," and then "About Alignment Manager."

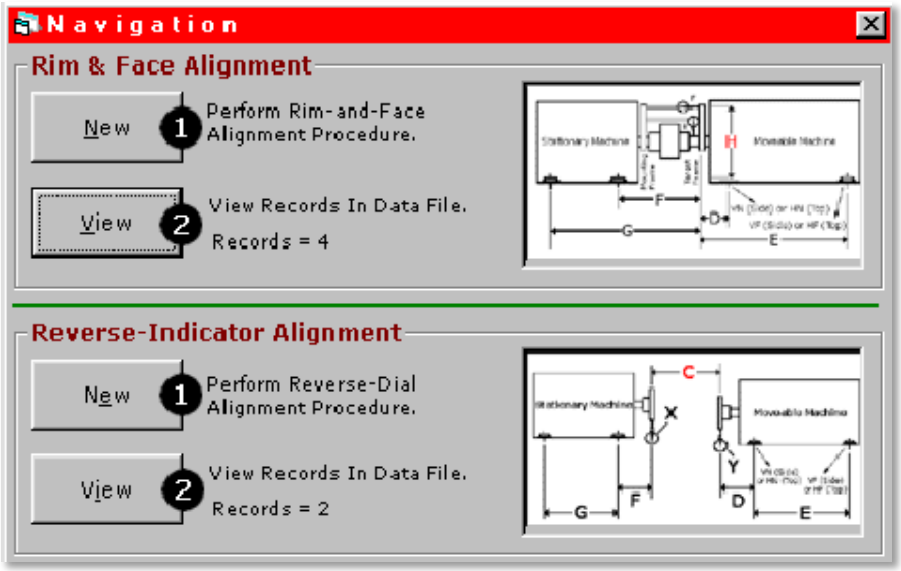
These instructions will assume you have some knowledge about the Windows operating system, and that you have started the Alignment Manager software and are ready to begin entering data. These instructions will also be primarily concerned with Rim-and-Face type alignment procedures, the same type used with either the #20RA or #30RA shaft alignment kit mentioned earlier in these instructions.

Alignments performed with Reverse-Indicator (or Double-Dial) type hardware follow a similar procedure, but are not outlined in detail here. To set up this type of alignment kit, follow the instructions that came with your alignment set.

OPENING SCREEN (FIG 4)

The opening screen is shown below. The Navigation Dialog Box is where program navigation begins every time you start the Alignment Manager program. From here, you are given the opportunity to start new alignment procedures for either the Rim-and-Face Method ❶ (top), or the Reverse-Indicator Method ❶ (bottom). Additionally, you may view previous procedures for either alignment method if any records exist in the data file. If records are available for viewing, the "View" command button will be enabled for clicking ❷, and a number will appear next to "Records =" indicating how many saved records there are in the data file for that type of alignment method.

Figure 4



New Alignment(s)

To perform a new alignment for either the Rim-and-Face or Reverse-Indicator Methods of shaft alignment, click on the appropriate command button labeled "New" under the desired type of alignment you wish to perform. A graphic of the typical setup is next to each type of alignment method.

View Saved Alignments

If you've previously used the Alignment Manager program and saved any data from subsequent alignment procedures, the number of records that are saved will be displayed next to "Records =" by each of the "View" command buttons. There are no practical limits to

the number of records you can save, but it's a good idea to save only those records that you will need to track for later analysis.

If you close the navigation dialog box, you will be left with a blank form. To bring back the navigation box again, click the "Navigation" menu at the top of the screen and select **"Show Nav Dialog"** (you can also hit the <Alt-A> shortcut key combination).

NEW RIM-AND-FACE ALIGNMENT (FIG 5)

Starting a new alignment procedure for the Rim-and-Face method or the Reverse-Indicator method are both similar. The Rim-and-Face method is outlined first.

This screen is where physical dimensions are entered of the equipment you will be calculating shims for. See the included diagram in the middle-right area that highlights each measurement as you tab to each of the fields.

Important: Data input should be entered as inches and any decimal fractions. For example, a measurement for the Swing Diameter (H) of 12-1/4" should be entered as 12.25.

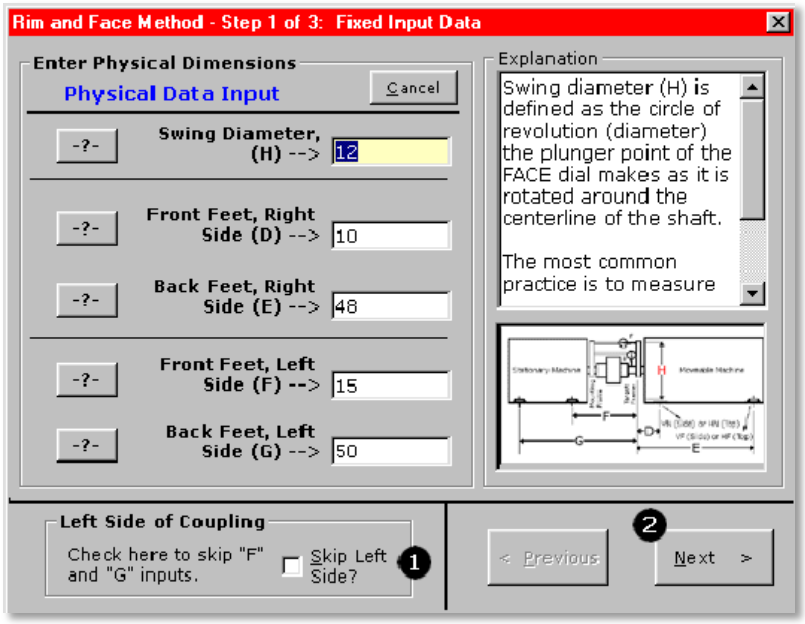


Figure 5

Swing Diameter

The swing diameter is defined as the diameter that the horizontally-mounted dial indicator scribes as it is rotated around the shaft centerline.

Front Feet, Right Side (D)

From the surface that the horizontally-mounted dial indicator plunger is touching, drop a line to the floor (mounting base of the motor/pump assembly) and measure over (to the RIGHT) to the centerline of the bolt(s) that secure the FRONT FEET of the equipment to the base.

Back Feet, Right Side (E)

Again, from the surface that the horizontally-mounted dial indicator plunger is touching, drop a line to the floor (mounting base of the motor/pump assembly) and measure over (to the RIGHT) to the centerline of the bolt(s) that secure the BACK FEET of the equipment to the base.

The configuration shown throughout the Alignment Manager program, depicting the

"Moveable Machine" to the right of the coupling (typically called the DRIVER UNIT), and the "Stationary Machine" to the left (typically called the DRIVEN UNIT), will be followed in all cases involving any given alignment procedures. When mounting alignment equipment and taking measurements, you must put yourself and the equipment to be aligned in this configuration or your answers will not be calculated correctly.

Front Feet, Left Side (F)
From the surface that the horizontally-mounted dial indicator plunger is touching, drop a line to the floor (mounting base of the motor/pump assembly) and measure over (to the LEFT) to the centerline of the bolt(s) that secure the FRONT FEET of the equipment to the base.

Back Feet, Left Side (G)
From the surface that the horizontally-mounted dial indicator plunger is touching, drop a line to the floor (mounting base of the motor/pump assembly) and measure over (to the LEFT) to the centerline of the bolt(s) that secure the BACK FEET of the equipment to the base.

Left Side of Coupling Measurement Option
Measurements (F) and (G) towards the LEFT of the coupling are optional. These measurements are used if you are unable to move the equipment to the RIGHT of the coupling due to various reasons, such as the possibility of your measurements requiring you to remove shims to bring your equipment into proper alignment, but there are none or to few present to perform the task.

By clicking the option "Skip Left Side?" ❶ your data input fields for (F) and (G) will be disabled and ignored for the rest of the alignment procedure. You can come back at any time and enable this feature and put in the numbers for re-calculation.

Once you have input the required data, the "Next" button ❷ will become available to click. Click this command button to proceed to the next screen for entering your dial indicator measurements.

VIEW SAVED ALIGNMENT RECORDS (FIG 6)
This screen (below) allows you to scroll through all available records for either the Rim-and-Face or Reverse-Indicator method, depending on which "View" button you clicked on the Navigation Dialog Box. This view is only available if there are records in the data file to view. You must have saved a previous alignment procedure to get to this screen.

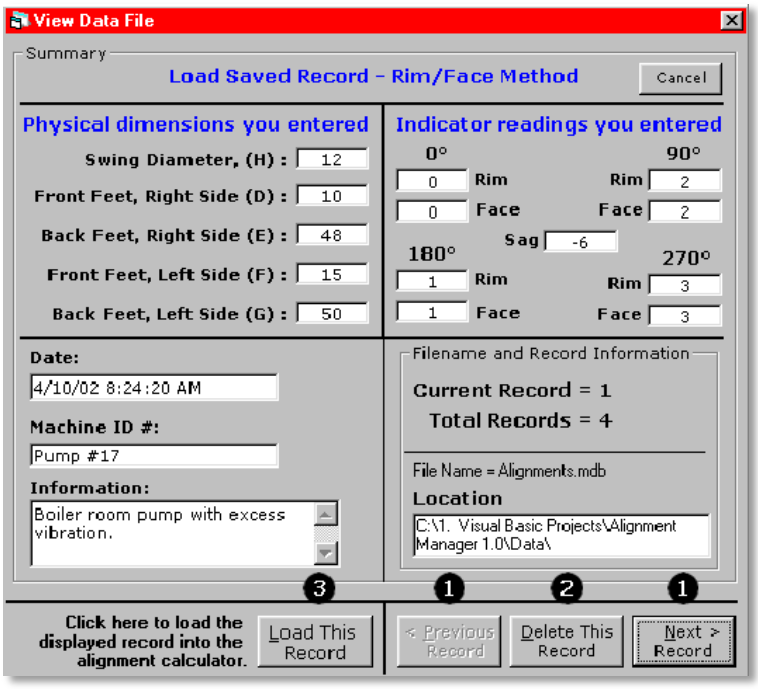


Figure 6

The upper-left-half of the data screen shows the physical dimensions you entered for that particular alignment procedure. To the right of that are the dial-indicator readings entered, along with any sag measurement reading you may have included.

The lower-right of the data screen displays the record being currently displayed and the total number of records in the data set. Click "**Next**" ❶ to scroll forward through the data or "**Previous**" ❶ to scroll backward through data. Once you reach the beginning or the end of the data set, the respective scroll button will be grayed-out and unavailable at that point.

Click on the "**Load This Record**" ❸ command button in the lower left of the screen to take the displayed information and load it into a new alignment procedure. The information then becomes editable by switching between "**Next**" and "**Previous**" screens you would have used when you initially input the data.

For each record in the data set that you view you have the option of permanently deleting it from the group. Click on the command button labeled "Delete This Record" ❷ to perform this action. ONCE IT IS DELETED, YOU CANNOT UNDO THIS ACTION - IT IS PERMANENT. Make sure this is the action you wish to take before using this feature.

DIAL GAGE INPUT DATA (FIG 7)

The DIAL GAGE DATA INPUT screen is where all of the dial indicator readings will be entered.

IMPORTANT NOTE: For this release of the Alignment Manager™ software, only dial readings in MILS are valid input quantities. For example, a dial reading of 0.011 should be entered as 11 (whole number). If dial indicator quantities are not entered in this manner, certain graphical displays throughout the program may not be displayed properly.

Record Dial Indicator Readings

Data input begins with your cursor at the RIM reading at 90 degrees ❶. By using the TAB button on your keyboard, you will then move to each successive field for inputting your dial indicator readings. REMEMBER, readings should be entered as whole numbers representing MILS.

Sag Measurement Input

See Part II on page 4, "Sag Calculation and Measurement" for details on how to determine SAG readings.

If you followed the above procedure and wish to input a SAG reading, click the check box ❷ (bottom) to activate the data field for SAG input ❷ (middle-left). You should only enter the magnitude of the measurement (without any sign of [+] or [-]). The program will take care of properly integrating it into final shim thickness calculation.

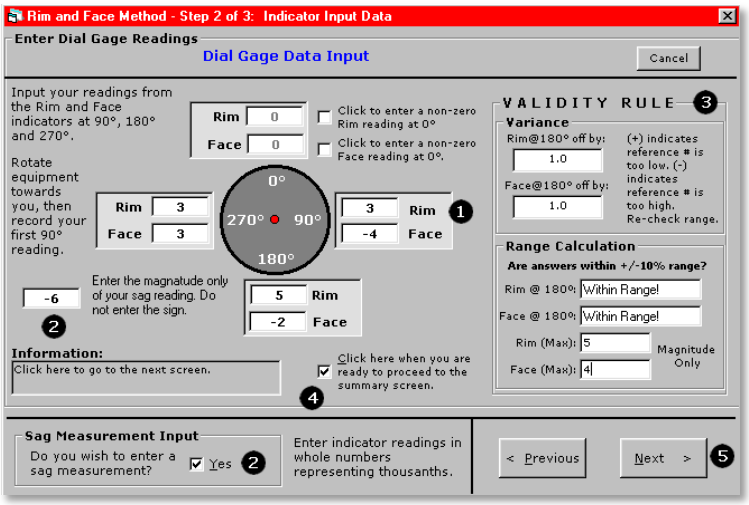


FIGURE 7

Validity Rule Calculations

The VALIDITY RULE ❸ states that the two RIM readings entered at 90- and 270-degrees will equal (when summed) the number entered for the RIM reading at 180-degrees within 10%. The same holds true for the FACE readings.

The top readings (labeled **"Variance"**) indicate how far off your reading at 180-degrees is, based upon adding your 90- and 270-degree readings that were input.

The Range Calculation is figured by taking the largest number input (RIM, then FACE) and then comparing whether your RIM and FACE readings at 180-degrees fall within 10% of where the number should be based on the sum of your readings at 90- and 270-degrees. The Validity Rule should only be used as a guide, and will not prevent you from proceeding further through the program if calculations fall outside of the upper- and lower-bound.

After Data Is Input

Once you have finished inputting all of your indicator readings, click the check box ❹ to activate the "Next" command button ❺. If you need to go back and make changes to any of your input values, the checkbox will automatically become unchecked and the "Next" command button will be disabled. Click the checkbox again to activate this button.

REVIEW SCREEN/EQUIPMENT IDENTIFICATION (FIG 8)

The review screen (below) is where all of your input data comes together and can be viewed and checked for accuracy before you calculate shim correction amounts or save you data. If you need to make changes to any of the data, use the "Previous" command button ❼ to return to the previous screen to make changes to your dial indicator input measurements. You may also hit the same command button on that screen to modify any physical dimensions of the equipment. Once answers are entered in their fields, they are preserved as you jump between the various input forms.

The upper-left-half of the data screen shows the physical dimensions you entered for that particular alignment procedure ❶. To the right of that are the dial-indicator readings entered, along with any sag measurement reading you may have included ❷.

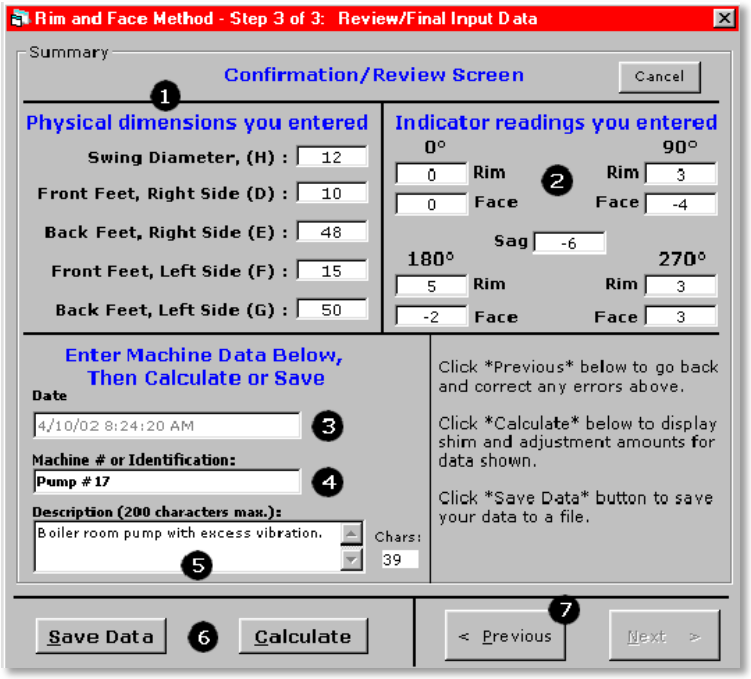


FIGURE 8

Details

The lower-left of the review screen displays the time ❸ that this particular screen was displayed for the first time. This value is not editable and always stays with the related record.

Below the time is a field for you to enter any identification for the particular machine you are performing the alignment for ❹. This field allows a maximum of 80 characters. Use an identification scheme that will be obvious every time you do an alignment for this equipment. This will make it easier to track details for this equipment over time.

The last field ❺ is for recording a description of the problem that initiated the need for this alignment, and any other comments you wish to include. The maximum number of characters allowed is 200.

Once you are satisfied with the data you've collected, you may choose to save the data to the data file, or calculate the shim requirements for this data.

Save Data

Click on the "Save Data" command button ❻ (left) to save all of your input data to the data file. It will be assigned a record number based on its position in the record set. You will then be able to access this data at any time from the Navigation Dialog Box that appears when you start the program, or when you choose to start a new alignment from any of the various menus.

Calculate

Click on the "Calculate" command button ❻ (right) to go to the Final Output Data screen. All vertical shim requirements and horizontal moves are displayed for both the DRIVER (left) and DRIVEN (right) units. Only the right or left side can be viewed at a time (not both at once). Your option is to align one side or the other, but not both of them at the same time.

FINAL OUTPUT DATA SCREEN (FIG 9)

All vertical shim requirements and horizontal moves are displayed for both the DRIVER (left) and DRIVEN (right) units. Only the right or left side can be viewed at a time (not both at once). Your option is to align one side or the other, but not both of them. The right- and left-side answers are mutually exclusive.

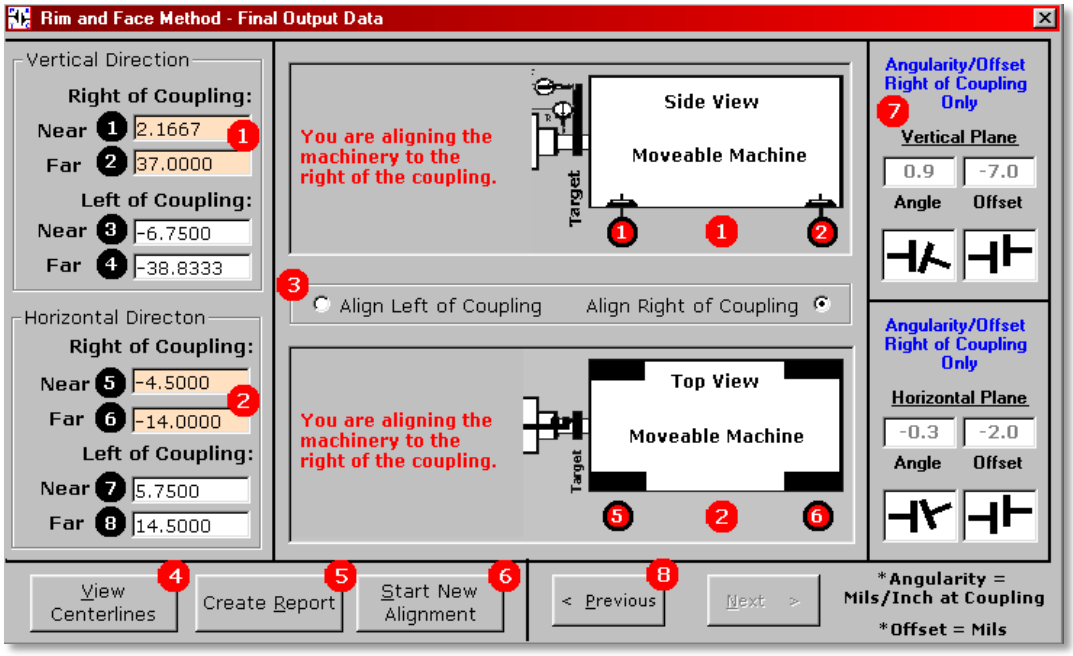


Figure 9

The answers along the left side of the form are arranged first by the vertical direction on top, and then the horizontal direction on the bottom. The vertical direction is the plane that extends from the floor to the ceiling. Similarly, the horizontal direction is the plane along the floor that extends from the front of the machinery to the back. Each plane is separated by 90 degrees. [|__]

Vertical Direction, Right of Coupling

The first set of answers at ❶ represent the shim amounts needed under the corresponding front and back feet of the moveable machine. Positive numbers indicate the addition of shims are needed in the amount shown at the respective foot location. Conversely, a negative number means shims need to be removed in the amount shown.

Horizontal Direction, Right of Coupling

Displayed In the lower portion next to ❷ are the near and far feet readings for the horizontal direction. These answers represent the amount that the front and rear feet must be "slid" across the floor - towards you if the number is positive, or away from you if the number is negative. These numbers are independent of each other, so care must be taken to move each location without disturbing the other foot locations' position.

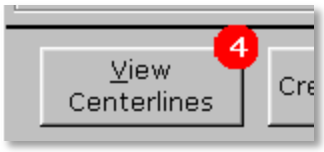
Left of the Coupling

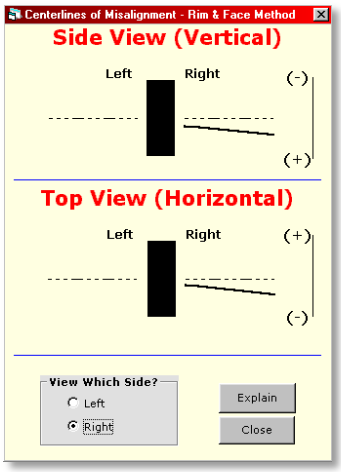
If you entered physical measurements to both the front and back feet of the DRIVEN UNIT (left of the coupling), you will see numbers for correcting the alignment for that equipment. The graphics for these numbers can be displayed by clicking on the radio button with the label "Align Left of Coupling." ❸ Clicking this radio button will hide graphics to the right of the coupling and display those to the left.

Shimming and sliding the equipment to the left of the coupling works according to the same conventions and rules as those to the right of the coupling.

View Centerlines

You can use the "View Centerlines" button ❹ to show a visual representation of where each centerline is in relation to the other. Click this command button and a form will pop up showing the graph.





Create Report

This feature is perhaps the most important from a maintenance personnel's standpoint. Once you've input all of your readings and calculated the shims and horizontal movements needed to bring your equipment into alignment, click this command button ❺ to show you a summary of your data. You can then print all alignment data on one page, providing you with a "hard copy" of the procedure performed.

See the sample printout included with your Alignment Manager CD and support documents. See also hyperlinks supplied in the HELP system regarding this feature.

Start New Alignment

Click on "Start New Alignment" ❻ to return to the opening Navigation Dialog Box to either start a new alignment procedure or view any existing data in the data file.

Angularity and Offset Readings

The information in the right-most portion of the Final Output Data form ❼ is reserved for Angularity and Offset data display. It should first be noted that (1) this information only pertains to the Rim-and-Face Method of shaft alignment, and (2) data is only displayed for the equipment to the right of the coupling.

Angularity

Angularity is described (within the scope of this computer program and/or Peterson-brand alignment hardware) as the number of MILS per inch that the moveable machine's centerline is out of alignment, running either above or below the "true" centerline in the vertical plane, and either to the left or right of the "true" centerline in the horizontal plane.

In the example shown on the graphic at the top of the page, positive angularity (displayed by the graphic ) indicates that the FACE indicator reading at the bottom of your rotation from 0 to 180 degrees is a positive number, and that your shaft centerline on your moveable machine (to the right) is pointing down away from the coupling. The number shown (0.9 MILS/Inch) is saying that for every inch that you travel to the right of the coupling, the centerline is dropping away from the "true" centerline by 0.9 MILS (0.0009 inches).

Offset

Offset can be described (again, within the scope of this computer program and/or Peterson-brand alignment hardware) as how high or how low the centerline of the moveable machine is (at the coupling) in relation to the stationary machine's centerline without any regard to angularity.

In the example shown on the graphic at the top of the page, negative offset (displayed by the graphic ) indicates that the RIM indicator reading at the bottom of your rotation from 0 to 180 degrees is a negative number, and that your shaft centerline on your moveable machine (to the right) is higher than the "true" centerline of the stationary equipment (the reference line). The number shown (-7 MILS) is saying that the shaft centerline on your moveable machine is high by 7 MILS (in this example, 1/2 of -14 MILS which is the RIM reading at 180 degrees) and needs to be lowered by that amount. If there were no angular misalignment present, you would simply have to remove shims from all four feet of your moveable equipment in the amount of 7 MILS.

A similar analysis can be made in the horizontal plane from 90 to 270 degrees. The vertical plane of reference is simply rotated by 90 degrees and is parallel to the floor (horizontal), instead of the wall (vertical).

Going Back

Clicking on the "Previous" command button ❽ takes you back to the Review Screen. You once again have the opportunity to modify the machine identification information or description that you input, plus previous input data by clicking on subsequent "Previous" command buttons. Note: Any changes you make to the data is not changed in the data file until you click "Save Data." A new record is created with the new changes you made (if any). If you find you have duplicates of data in the data file, view you data from the open Navigation Dialog Box and use the delete function to clear out any unwanted or unneeded records.

This concludes the Alignment Manager portion of the instruction manual. You should now have finished the alignment procedure – both the setting up of the alignment kits, and using the data to establish corrective shim thickness.

It may take *more* than one or two rotations and adjustments of the equipment if the motor/pump assembly is out of alignment by a considerable amount. Repeat the procedure until required shim amounts are within acceptable tolerances.

➢ VII. FastMath Worksheet Calculation Method

Performing alignment calculations with the supplied FastMath Worksheets is a simple matter. It is most convenient if you can use a standard calculator which is capable of addition, subtraction, multiplication and division.

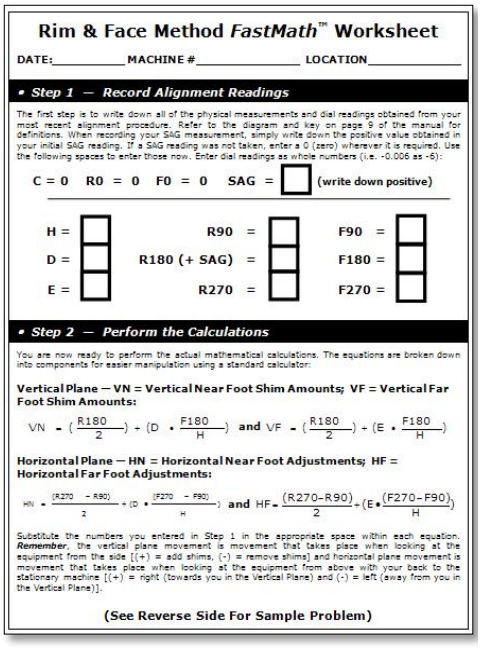
If you purchased the Alignment Manager™ software, the FastMath™ Worksheets are provided as a convenience, and you should never need to use them. All of the math is performed by the software.

Start by following the steps beginning on page 5 or page 7 for mounting and operating models #20RA or #30RA alignment system, respectively. Follow the instructions carefully to acquire both your Rim (-R-) and Face (-F-) dial indicator readings from 90º, 180º and 270º as the alignment equipment is rotated about the shaft of the equipment to be checked.

Once you have the necessary alignment information, turn to one of the FastMath Worksheets to begin filling in the information for calculation. Have the worksheet completely filled out before you begin calculating your answers with a standard calculator.

You may use one of the worksheets as a "master" – keep this sheet separate from the rest and use it to make copies for future alignment jobs.

You may find it helpful to practice with the FastMath Worksheets first by using the sample calculation found on the opposite side of the blank answer sheet. This example has been worked out for you and shows the correct answers for both the vertical and the horizontal planes.



Rim & Face Method *FastMath*™ Worksheet

DATE:_____ MACHINE #_____ LOCATION_____

• Step 1 — Record Alignment Readings

The first step is to write down all of the physical measurements and dial readings obtained from your most recent alignment procedure. Refer to the diagram and key on page 9 of the manual for definitions. When recording your SAG measurement, simply write down the positive value obtained in your initial SAG reading. If a SAG reading was not taken, enter a 0 (zero) wherever it is required. Use the following spaces to enter those now. Enter dial readings as whole numbers (i.e. -0.006 as -6):

C = 0 R0 = 0 F0 = 0 SAG = ☐ (write down positive)

H = ☐	R90 = ☐	F90 = ☐
D = ☐	R180 (+ SAG) = ☐	F180 = ☐
E = ☐	R270 = ☐	F270 = ☐

• Step 2 — Perform the Calculations

You are now ready to perform the actual mathematical calculations. The equations are broken down into components for easier manipulation using a standard calculator:

Vertical Plane — VN = Vertical Near Foot Shim Amounts; VF = Vertical Far Foot Shim Amounts:

$VN = \left(\frac{R180}{2}\right) + \left(D \cdot \frac{F180}{H}\right)$ **and** $VF = \left(\frac{R180}{2}\right) + \left(E \cdot \frac{F180}{H}\right)$

Horizontal Plane — HN = Horizontal Near Foot Adjustments; HF = Horizontal Far Foot Adjustments:

$HN = \frac{(R270 - R90)}{2} + \left(D \cdot \frac{(F270 - F90)}{H}\right)$ **and** $HF = \frac{(R270-R90)}{2} + \left(E \cdot \frac{(F270-F90)}{H}\right)$

Substitute the numbers you entered in Step 1 in the appropriate space within each equation. ***Remember***, the vertical plane movement is movement that takes place when looking at the equipment from the side [(+) = add shims, (-) = remove shims] and horizontal plane movement is movement that takes place when looking at the equipment from above with your back to the stationary machine [(+) = right (towards you in the Vertical Plane) and (-) = left (away from you in the Vertical Plane)].

(See Reverse Side For Sample Problem)

The FastMath Worksheets allow you to figure shim thickness/lateral movement for the Motor-To-Be-Moved only (to the right of the coupling), so your answers will match only those found under the "Motor-To-Be-Moved Alignment" heading.

The example on the following page is identical to the one found on the back of the FastMath Worksheet, with the exception that sag is not included.

➢ VIII. Reference Example Using a Sample Calculation

The following figure may be used as a reference when performing alignments with either of the Peterson brand shaft alignment systems. Follow the directions carefully from either the Alignment Manager or FastMath Worksheet procedures.

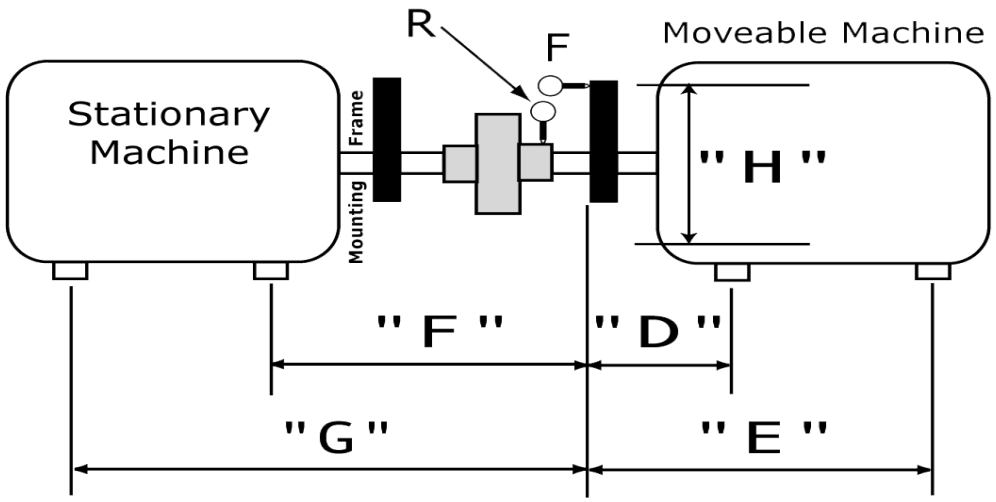


Figure 10: This figure is the same as Figure 3 found on page 9. Use this diagram to follow the sample calculations below. Refer to Figure 3 on page 9 for the "Key To Variables."

The following example may be used as a "calibration check" to ensure the Alignment Manager program is functioning properly.

(V = Vertical, H = Horizontal; N and F stand for Near and Far Feet, respectively). Both R0° and F0° are 0 (Zero):

Physical Measurements		**Rim Readings**	**Face Readings**
H = 12		R90° = 12	F90° = 11
F = 15	D = 10	R180° = 9	F180° = -6
G = 50	E = 48	R270° = -3	F270° = -17

Answers are as follows using the above sample:

Stationary Machine Alignment		**Motor-To-Be-Moved Alignment**	
Vertical Direction	**Horizontal Direction**	**Vertical Direction**	**Horizontal Direction**
VN = -12.00	HN = -27.50	VN = – 0.50	HN = – 30.83
VF = -29.50	HF = -109.17	VF = – 19.50	HF = – 119.50

➢ IX. Reference Graphic For Reverse-Dial Method Setup

The following figure may be used as a reference when taking measurements on equipment set up for the Reverse-Indicator method of shaft alignment.

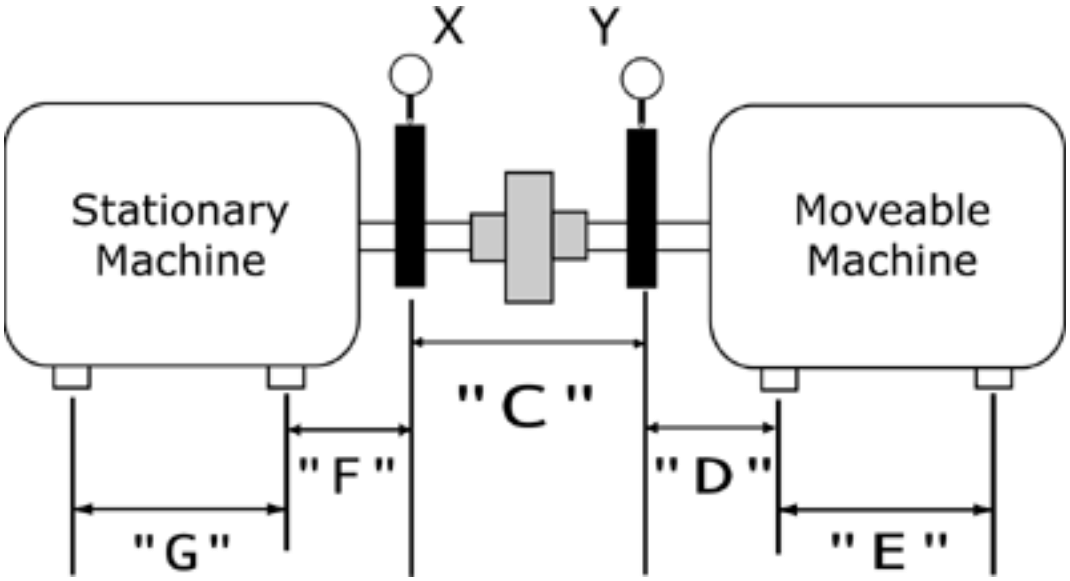


Figure 6: Use this figure for determining reference measurement points when performing the Reverse-Indictor method of shaft alignment. Alignment kit setup instructions are not available for this method of shaft alignment. Peterson brand kits are based on the Rim-and-Face method.

The following example may be used as a check to ensure the program "REVDIAL" is functioning properly. (V = Vertical, H = Horizontal; N and F stand for Near and Far Feet, respectively). Both X0 and Y0 are 0 (Zero):

Physical Measurements		**Left "X" Indicator**	**Right "Y" Indicator**
C = 10		X90 = 11	Y90 = 12
F = 6	D = 5	X180 = -6	Y180 = 9
G = 11	E = 10	X270 = -17	Y270 = -3

Answers are as follows using the above sample:

Stationary Machine Alignment		**Motor-To-Be-Moved Alignment**	
Vertical Direction	**Horizontal Direction**	**Vertical Direction**	**Horizontal Direction**
VN = – 2.10	HN = – 26.90	VN = 5.25	HN = – 18.25
VF = – 0.45	HF = – 50.55	VF = 6.75	HF = – 39.75

➢ X. Parts List

The following is a list of parts and components present in each of the alignment kits. Please report any missing items immediately to customer service at (815) 725-6600.

Model #20RA Parts List

- 2.....Alignment frames, each with 1 – ½" diameter mounting hole
  (Reorder item #20FRM)
- 20".....#41 roller chain (attached to each frame)
  (Reorder item #20CHN for each frame, above)
- 2.....dial indicator assemblies with swivel joints and mounting rods
  [Reorder #J1-B500-250 (dials); #S8SJ (swivel joint), #571 IMR (mounting rod)]
- 2.....each of ½" diameter tubing in 5", 7", and 9" lengths
  (Reorder #TUBE-X where X is the length you need)
- 1.....3/16" Allen key
  (Reorder #HXK316)
- 1.....Instruction manual
  (Reorder #MAN204)
- 1.....Impact-resistant carrying case
  (Reorder #CASE20 – comes with top and bottom foam)

Model #30RA Parts List

- 2.....Alignment frames, each with 3 – ½" diameter mounting holes
  (Reorder item #30FRM)
- 18".....#40 roller chain, 18" attached to each alignment frame. Expandable with extra chain (not included). (Reorder item #18CHN)
- 2.....Dial indicator assemblies with swivel joints and mounting rods
  [Reorder #J1-B500-250 (dials); #S8SJ (swivel joint), #571 IMR (mounting rod)]
- Assorted ½" diameter tubing, 2 x 5", 1 x 7", 1 x 9", 1 x 12", and 2 x 15" long
  (Reorder #TUBE-X or TUBE-XX, where X (XX) is the length you need)
- 1.....General inspection mirror
  (Reorder item #555 GIM)
- 1.....3/16" Allen key
  (Reorder #HXK316)
- 1.....Instruction manual
  (Reorder #MAN204)
- 1.....Impact-resistant carrying case
  (Reorder #CASE30 – comes with top and bottom foam)

Notes

➢ XI. How To Contact Us

You may contact us at the following addresses and telephone numbers:

Physical Address (Returns, Etc.) —

PETERSON ALIGNMENT TOOLS COMPANY
1601 JONES ST
JOLIET IL 60435-6713
ATTN: RETURNS DEPARTMENT

Payment / Correspondence Address —

PETERSON ALIGNMENT TOOLS COMPANY
1601 JONES ST
JOLIET IL 60435-6713
ATTN: CHRIS BOWEN

For All Technical Assistance —

Contact: Chris Bowen
Local: 815.725.6600
Fax: 815.741.5086

Website Support —

For product questions, direct your e-mails to:
> sales2@petersontools.com

For product information or to purchase on-line:
> http://www.petersontools.com
> http://store.alignmentsales.com

Current software upgrades and information:
> http://www.petersontools.com/software

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