

SKF Shaft Alignment Tool Machine train app

Short flex couplings



Table of contents

- 1. Using the Machine train shaft alignment app..... 2
 - 1.1 How to change the app language2
 - 1.2 Main menu3
 - 1.3 Setting4
 - 1.4 Select units.....5
 - 1.5 Machine information.....5
 - 1.6 Sensor status10
 - 1.7 Measuring procedure.....11
 - 1.8 Manual measuring with fixed angles14
 - 1.9 Coupling A “As Found” measuring results.....15
 - 1.9.1 Measuring Unit Distances15
 - 1.9.2 Repeat measurement procedure 1.7 at coupling B.15
 - 1.9.3 The final coupling “As Found” measuring results16
 - 1.9.4 Machine Train “As Found” measuring results16
 - 1.10 Analyzing the Machine Train results.....17
 - 1.11 Vertical correction18
 - 1.12 Horizontal correction19
 - 1.13 Verify the alignment20
 - 1.14 “As Corrected” measuring results20
 - 1.15 Report21
 - 1.16 Machine library.....22

1. Using the Machine train shaft alignment app

“SKF Shaft alignment”



SKF Shaft Alignment Tool

Machine train app

Short flex couplings

1.1 How to change the app language

The app will adapt to the language and date format currently used by the operating device.

- To change the language of an iOS device, tap: *Settings --> General --> Language & Region*
- To change the language of an Android device:
 1. Open the **Settings** app.
 2. Under **Controls** tab, select **Language and input**.
 3. Tap on **Language English**.
 4. Select your preferred language.
 5. The tablet switches immediately to the new language.

NOTE: The alignment apps are available in 8 languages. The app uses the same language that is used as the system language of the TKSA DISPLAY.

If the app does not support the selected language, English is used as the default alternative.

1.2 Main menu

Start the app by tapping on the *Machine train shaft alignment app icon*, found on the home screen of the device. This will take you to the main menu.

IMPORTANT: Make sure you have read the instructions for use for your TKSA hardware.

a. Resume

If you have an ongoing alignment you will find it to the left in the main menu, with the possibility to resume it.

b. New alignment

Tap on the *plus sign* (“+”) to start a new alignment. If an alignment is in progress you will be asked if you want to start a new alignment or resume the current one.

c. Settings

Access the editable settings.

d. Machine Library

Access the library for machines and reports.

e. Help

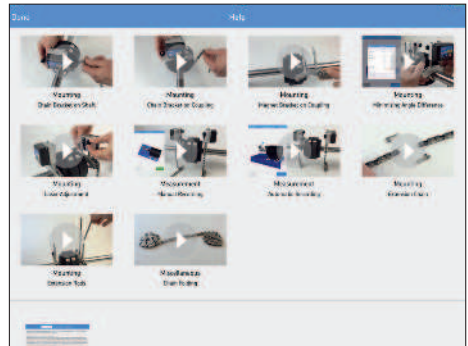
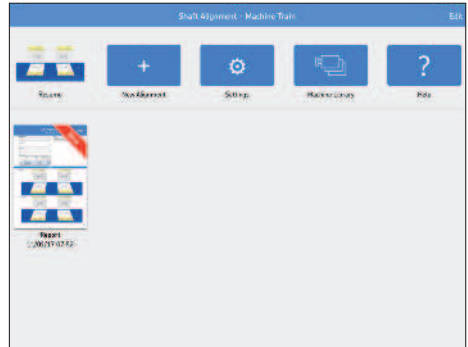
Access help videos and the Instructions for use documents.

f. Edit

The reports can be deleted via Edit, which is located in the upper right corner of the view. Delete reports by tapping on *Edit*, then tap the *reports* to be deleted and finish by tapping the *trash can* symbol in the upper left corner of the view.

g. Reports

Previously created reports are shown as miniatures below the main menu buttons. Tapping a *report* will open it for viewing, editing, printing and e-mailing.



1.3 Settings

a. Report Template

Company, Operator and Logo is additional information that is included in generated reports.

b. Angular error

Angular error expressed as /100 mm (mils/inch) or as coupling gap. For gap, specify the Coupling Diameter when entering the distances in the machine Information view.

c. Sensor values

Sensor values is an option to display the detector readings and rotational angles during the measurement.

d. Extended filter length

Measurement values are filtered over time, allowing accurate measurements in the presence of external disturbances, for instance vibration. The extended filter length option enables the sample time to be increased up to 20 seconds.

e. Hardware

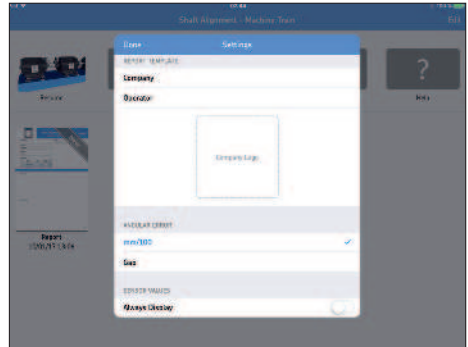
The connected measuring units. Tap *Select Hardware* if you want to select other units.

f. Unit

For the ability to change between metric and imperial measuring units. The displayed unit is normally based on the system unit, but you can override this and change between metric and imperial units.

g. Done

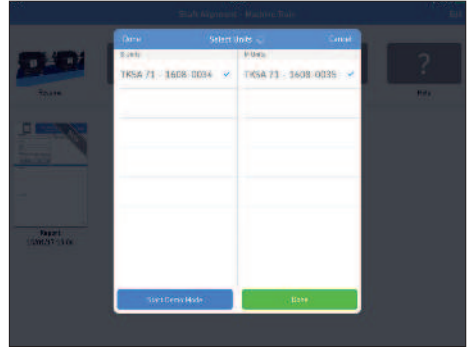
Complete any changes in settings by tapping *Done*.



1.4 Select units

The Bluetooth wireless communication will establish a connection between the device and the two measuring units. You will be informed if there is a need to turn on Bluetooth on the device.

NOTE: That the first time, you have to select the measuring units that you want to use in the system. Connect to the measuring units by tapping one *S* (*stationary*) unit and one *M* (*movable*) unit in the lists. The app will remember your chosen measuring units and will attempt to connect to these units at your next alignment.



The app features a Demo Mode which allows most functionalities to be tested without having physical measuring units available. The Demo Mode option is found at the bottom of the Select Units view.

1.5 Machine information

The Machine Information view is displayed when a new measurement has been initiated. The view is also reachable from the upper right corner of the screen while recording data in the three measurement positions.

a. Search

Tap the *magnifying glass* to search for machines in the library.

b. QR code scan

Tap the *QR code icon* to scan for codes that are associated with machines in the library. If found, the machine info will be filled out for that machine.

c. Machine ID

Enter a machine name that will be the identification of the machine.

The Machine ID can be associated to a QR code.

Tap *Add QR code* and scan the label with the camera. For a machine ID that is associated with a QR code you have the possibility to remove the QR code.



d. Number of Machine elements (2-6)

Select the number of elements in the train.

Enter a name for each Machine element (optional).

e. Static distances

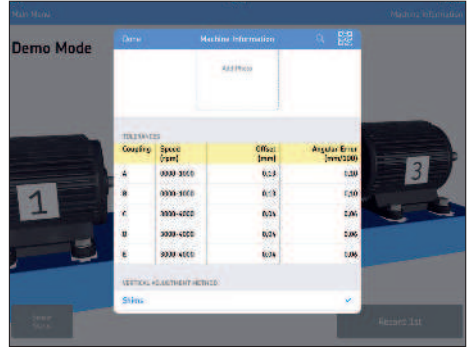
Enter the seven distances for the machine to be aligned, center of coupling is where the offset will be measured. If you want the error angles expressed as coupling gaps, you also need to specify the diameter of the couplings (see the Settings section). Tap on the *measurement* to select and specify new distance measurements using the appearing keypad. The distances entered from the previous alignment will be the default values.

1. Measure and enter the distance between the first and the second pairs of feet (machine 1).
2. Measure and enter the distance between the second pair of feet (machine 1) and the center of the coupling (A).
3. Measure and enter the distance between the center of the coupling (A) and the first pair of feet (machine 2).
4. Measure and enter the distance between the first and the second pairs of feet (machine 2).
5. Measure and enter the distance between the second pair of feet (machine 2) and the center of the coupling (B).
6. Measure and enter the distance between the center of the coupling (B) and the first pair of feet (machine 3).
7. Measure and enter the distance between the first and the second pairs of feet (machine 3).

f. Measurement specific distances

When mounted the measurement units at coupling A, enter the two distances.

1. Measure and enter the distance between the center of the rods on the S unit and the center of the coupling.
2. Measure and enter the distance between the center of the coupling and the center of the rods on the M unit.



g. Machine ID and photo

Enter a machine ID and select/take a photo of the machine. This information will be shown in the report when these options are enabled.

h. Tolerances

Specify tolerances for the two couplings. The built-in tolerance values can be used based on the RPM speed of the machine you are aligning. Select the appropriate tolerances by tapping the *row in the table* or choose custom tolerance values by tapping *Edit Custom Tolerances*.



i. Vertical Adjustment Method

– Shims

If the vertical results are out of tolerance, there is a need to make adjustments by adding or removing shims. The system calculates the correction values at the feet and shows if shims should be added or removed. Shims values are fixed, not live.

– Adjustable Chocks / Vibracons (Live)

If the vertical results are out of tolerance, there is a need to make adjustments by screwing the chocks up or down. The system shows how much the chocks need to be corrected and in which directions to make the adjustments. Choose this mode if you prefer live values.

j. Target Values

Enter the target values that the machine should have in off-line condition (shown by blue image) to be aligned in running condition (shown by red image). The measurement results will be compensated so when you adjust an off-line machine, having zeroed any misalignments, then the machine will be aligned when in running condition.



The target values can alternatively be calculated in one of three different methods.

1. Thermal growth
2. Entering target values at feet.
3. Selecting a hot and a cold measurement.



k. Report Information

Enter a report name that will be the identification of the report.

Soft Foot Check Performed: Tap this *box* if a Soft Foot check was performed. A check mark indicating “Soft Foot Check Performed” will appear in the report. The Soft Foot app is found on the App Store under the name: “SKF Soft foot”.

Add up to four Report Photos that will be added to the last page of the report.

There are three methods to calculate the target values. At each of the methods tapping the *button Calculate Target Values* will override and set the values for offset and angles in Target Values.

l. Thermal growth

Change in temperature in the machines will make them shrink or expand. The calculation for target values is based on thermal expansion coefficients for respectively selected material.

1. At each feet pair, tap and specify *temperature* for the off-line temperatures and the running temperatures.
2. Tap and select *material for the machine elements*.
3. Enter the distance between the centre line of the shafts and the base plane of the machine elements.

Complete any changes by tapping *Calculate Target Values*.

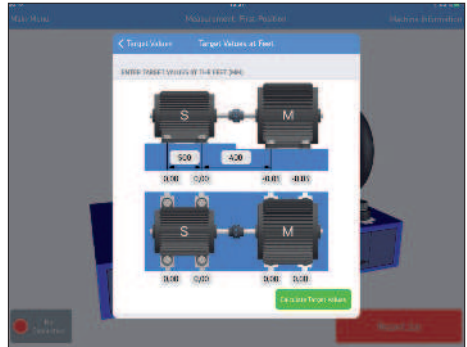


m. Target values at Feet

If information of thermal growth at the feet pairs are known you can enter those values here.

1. Enter target values at the feet for the vertical plane.
2. Enter target values at the feet for the horizontal plane.

Complete any changes by tapping *Calculate Target Values*.



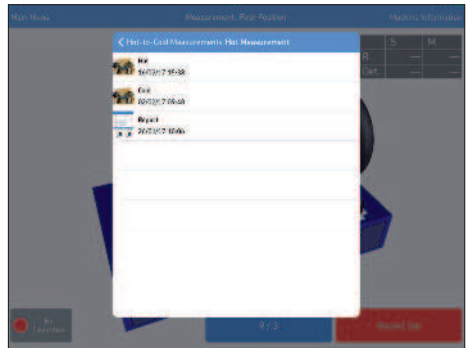
n. Hot-to-Cold Measurements

Procedure:

For a machine that have reached running condition temperature. Shut down and lock out the machine. As soon as possible setup the measurement system, measure and create a report containing as found measurement result.

Name the report "Hot" for easy identification later on. Let the machine cool down to off-line temperature. Measure and create a report containing as found measurement result. Name this report "Cold".

In Hot-to-Cold Measurements, select the two reports and complete the procedure by tapping *Calculate Target Values*. Any differences in coupling values from the two reports will then set the offsets and angles in Target Values.



o. Done

Complete any changes in Machine Information by tapping *Done*.

1.6 Sensor status

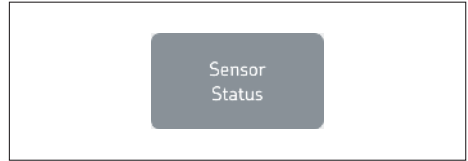
The Sensor Status appears if you have a warning or stop issue during the setup. It also appears if you tap the *warning / stop sign* or the Sensor Status button in the lower left corner of the screen during a measurement.

If a warning appears, Setup Assistance at the bottom of the view provides help to correct any issues. Warning signs can be ignored, but a stop sign is shown when it is not possible to read essential sensor values.



Warnings are shown when:

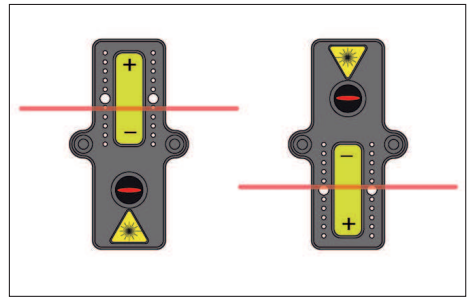
- Battery level is below 10% of full charge.
- Laser beam is more than 2 mm [80 mils] from the center target during the setup.
- Laser beam is too close to the edge of the detector.
- Rotational angle difference is more than 2° between measuring units.



Stops signs are shown when:

- There is no Bluetooth connection.
- No laser beam is detected.

TIP: The Sensor Status can be used to review temporary data, on the detector values and the rotation angles, during the measurement. When the results are shown, lasers are turned off and no detector values are available in this view.



a. Serial number and connected status

Serial number and connected status indicate if any measuring units are connected.

b. Battery level

Indicates the charge levels for the internal batteries.

c. Detector

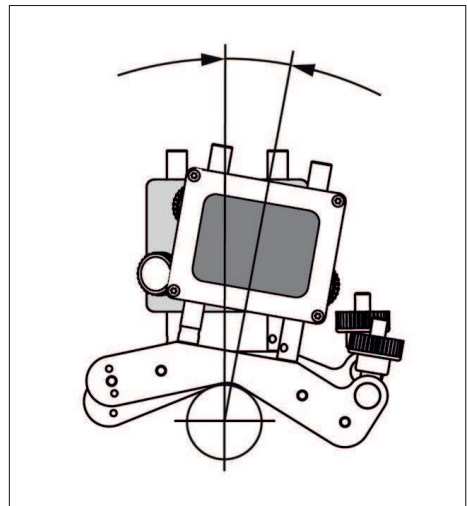
The detector values show the distances between the center of the detectors and where the laser beams hit the detectors.

d. Rotational angle and angle difference

The rotational angles and angle differences can be used for precise positioning of the two facing measuring units.

e. Select hardware

Lists the connected measuring units. Tap *Select Hardware* if you want to select other units.



f. Done

When no warnings are displayed tap *Done* to proceed to the measurement.

1.7 Measuring procedure

The default measuring procedure is to make manual measurements in the three rotational positions, described in detail further down in this section. This means that the operator turns the shaft into each position and manually taps a *record button* to measure the shaft alignment data. There is also an automatic measuring option, while the operator can focus on rotating the shaft without the need to touch the record button for each position and at last, an option with measuring in three fixed positions (see the Settings section to read more about enabling these option).

Manual measuring

Record measurements in three different rotational positions. The system will begin with the measuring units in a horizontal position, though the 1st measurement position can be taken at any position around the shafts. The system will offer guidance on the direction to turn, but you can turn in the opposite direction if you prefer. It is best to continue in the same direction as the first rotation for the 2nd and 3rd measurements. When the record button turns green, the measuring unit and shaft have been rotated the ideal amount – at least 90°.

Tap record 1st.

A red arrow and red record button indicate that you still need to rotate the shafts before you can record the 2nd measurement position.

A blue arrow and blue record button indicate that the shafts have been sufficiently rotated (>20°), but less than the ideal amount (90°).

If possible, continue rotating the shafts until achieving 90° rotation for best results.

No arrow and a green record button indicates that the ideal amount of rotation has been performed (90°) for best results.



Tap record 2nd.

A red arrow and red record button indicate that you still need to rotate the shafts before you can record the 3rd measurement position.

A blue arrow and blue record button indicate that the shafts have been sufficiently rotated ($>20^\circ$), but less than the ideal amount (90°).

If possible, continue rotating the shafts until achieving 90° rotation for best results.

No arrow and a green record button indicates that the ideal amount of rotation has been performed (90°) for best results.

Tap record 3rd.

Automatic measuring

Record measurements in three different rotational positions. The system will begin with the measuring units in a horizontal position, though the 1st measurement position can be taken at any position around the shafts. The system will offer guidance on the direction to turn, but you can turn in the opposite direction if you prefer. It is best to continue in the same direction as the first rotation for the 2nd and 3rd measurements. When the record button turns green, the measuring unit and shaft have been rotated the ideal amount – at least 90° .

Tap start auto.

This records the 1st measurement position.

A red arrow and red Auto record button indicate that you still need to rotate the shafts before the system can record the 2nd measurement position.

A blue arrow and blue Auto record button indicate that the shafts have been sufficiently rotated ($>20^\circ$), but less than the ideal amount (90°).

If possible, continue rotating the shafts until achieving 90° rotation for best results.

No arrow and a green Auto record button indicates that the ideal amount of rotation has been performed (90°) for best results.



When the system senses that the shaft has been rotated sufficiently, and has been left untouched for a short while, it will automatically record the 2nd measurement position.

A red arrow and red Auto record button indicate that you still need to rotate the shafts before the system can record the 3rd measurement position.

A blue arrow and blue Auto record button indicate that the shafts have been sufficiently rotated ($>20^\circ$), but less than the ideal amount (90°). If possible, continue rotating the shafts until achieving 90° rotation for best results.

No arrow and a green Auto record button indicates that the ideal amount of rotation has been performed (90°) for best results.

When the system senses that the shaft has again been rotated sufficiently, and has been left untouched for a short while, it will automatically record the 3rd measurement position.



1.8 Manual measuring with fixed angles

Record measurements in three different rotational positions with 90° separation. An icon for fixed angles are shown during the measurement.

The screen shows where to position the measuring units. Pointed out with green arrows. The system will begin with the measuring units in a horizontal position.

Rotate the shafts to the first measurement position shown by the screen. You have the ability to toggle the starting position between the two horizontal positions by tapping the $\frac{2}{3}$ button.



Tap record 1st.



The display shows a simulation of the 90° rotation, of the Measurement units, to the second position. Now turn the units to this position.

Tap record 2nd.



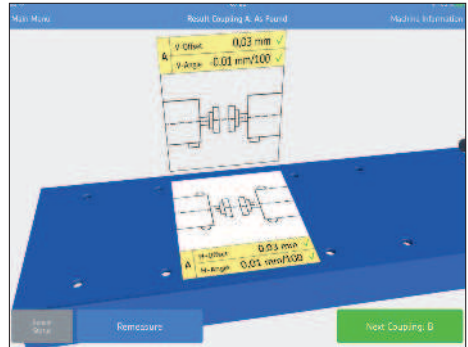
The display shows a simulation of the 90° rotation, of the Measurement units, to the third position. Now turn the units to this position.

Tap record 3rd.

1.9 Coupling A “As Found” measuring results

The offset and angular misalignment results for the vertical and horizontal axes, or planes, are shown in a combined view. Graphics show the position of the machine from a side and a top view. If a Target value is active, an image of that machine in running position is shown in red color.

The values are compared with the selected tolerances and the symbols to the right, of the offset and angular misalignment values, indicate if the values are within tolerance.



Within tolerance: ✓

Out of tolerance: ✗

a. Remeasure

If required, select Remeasure to cancel the results and make a new set of measurements.

b. Next coupling

Saves the result and continuing with measurement at the next coupling.

1.9.1 Measuring Unit Distances

When the measuring units are moved to a coupling, enter the two measurement specific distances. The previously entered distances will be the default values.

a. Measurement specific distances

1. Measure and enter the distance between the center of the rods on the S unit and the center of the coupling.
2. Measure and enter the distance between the center of the coupling and the center of the rods on the M unit.



b. Done

Complete any changes in Settings by tapping Done.

1.9.2 Repeat measurement procedure 1.7 at coupling B.

1.9.3 The final coupling “As Found” measuring results

The offset and angular misalignment results for the vertical and horizontal axes, or planes, are shown in a combined view.

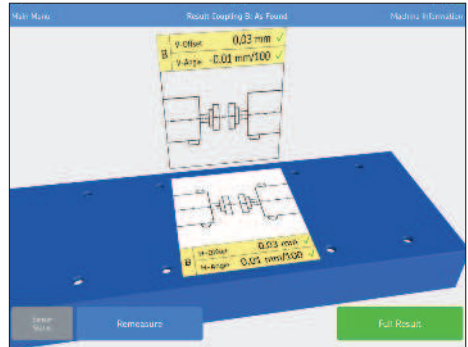
Graphics show the position of the machine from a side and a top view.

a. Remeasure

If required, select Remeasure to cancel the results and make a new set of measurements on this coupling.

b. Full Result

Shows the total result for the train.



1.9.4 Machine Train “As Found” measuring results

The offset and angular misalignment results are shown for all couplings in the train.

a. Remeasure

If required, select Remeasure to cancel the results and make a new set of measurements on all couplings.

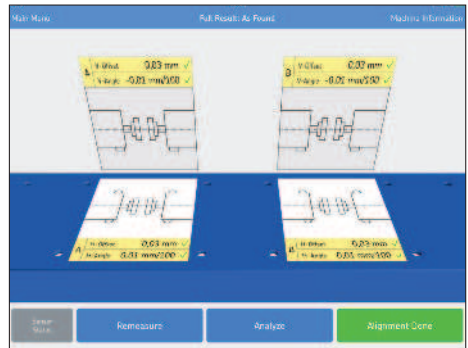
b. Analyze

Tap the button to *analyze the machine train* and change which feet should not be moved.

The misalignment results are calculated as deviation from the reference line formed by the locked feet.

c. Alignment Done

Accept the results by tapping *Alignment Done*. This creates a report which is placed below the main menu. The report contains “As Found” measuring results for the train.



NOTE: That it is possible to resume the alignment after Alignment Done has been selected.

1.10 Analyzing the Machine Train results

The length of the machine elements are scaled to reflect the correct position of the elements and the results can be analyzed by selecting various combinations of feet pairs, locking them down to mark them as references.

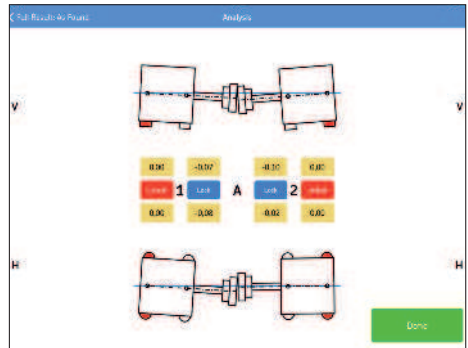
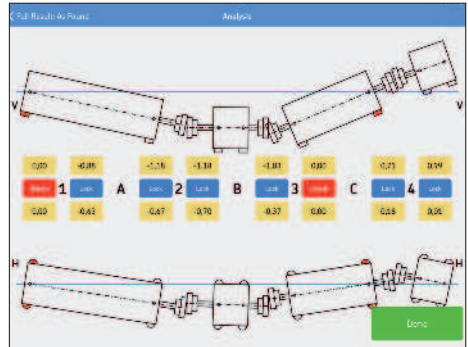
Each pair has a corresponding blue button that can be tapped to *lock* or *unlock* the pair. A blue reference line is drawn through the locked pairs, showing the target alignment of the full machine train.

a. Adjustment

As default the two feet pairs of element 1 are locked as references. Select feet pairs, watch the recalculated feet correction values and start the adjustment by tapping *Adjust*.

TIP: Very useful in a two machine element train where you can't move the movable machine in to tolerances because of base bound, bolt bound or pipe strain. In the Analysis view you can unlock the two feet pairs at machine element 1 and lock another set of feet pairs.

NOTE: Some machine elements have displaced shafts but because all measurements are performed at the couplings individually, all shafts do not have to form a common center line.



1.11 Vertical correction

If the vertical results are out of tolerance, you need to correct the shimming or the adjustable chocks. Based on the offset and angular misalignment values, the system calculates the correction values at the feet. An animation shows the bolts being loosened in order to make corrections. In the Machine Information view you can set the vertical adjustment method.

NOTE: That the correction is done towards the blue reference line corresponding to the full machine train as opposed to the coupling.

This means that when correcting e.g. machine 3, coupling B (between 2 and 3) can become more misaligned temporarily, before all machines have been corrected.

a. Vertical adjustment method – Shims

If the vertical adjustment method in the Machine Information is set to Shims, the system will show if shims should be added or removed.

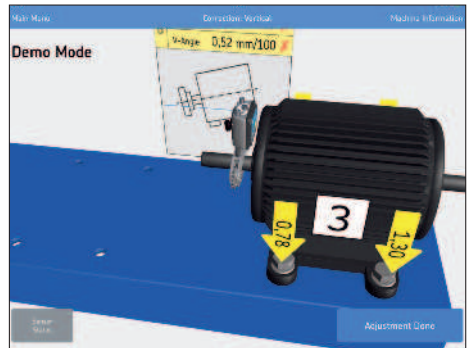
After the correction, or if no correction is needed, tap *Shimming Done*.



b. Vertical adjustment method – Adjustable Chocks (Live)

If the vertical adjustment method in the Machine Information is set to Adjustable Chocks, the screen will show vertical correction values. Set the measuring units in a vertical position for live adjustment.

After the correction, or if no correction is needed, tap *Adjustment Done*.



1.12 Horizontal correction

Based on the offset and angular misalignment values, the system calculates the correction values at the feet of the moveable machine. When the units are in a horizontal position then the horizontal values are live values.

Move the machine according to the arrows and observe the offset and angular misalignment values that are updated continuously.

NOTE: That the correction is done towards the blue reference line corresponding to the full machine train as opposed to the coupling. This means that when correcting e.g. machine 3, coupling B (between machines 2 and 3) can become more misaligned temporarily, before all machines have been corrected.

After the correction, or if no correction is needed, tap *Adjustment Done*.

An animation shows the bolts being tightened down. Alignment is now complete and to confirm the result there is a need to re-do the measurement.

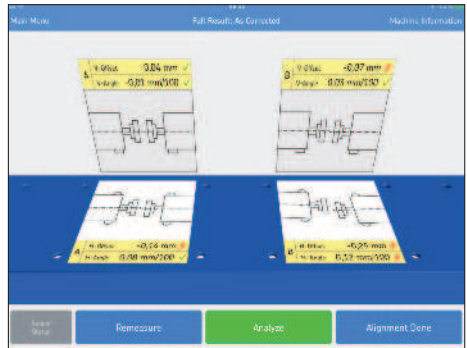


1.13 Verify the alignment

The system requires that a new measurement is made to verify the alignment. This step is mandatory.

1.14 “As Corrected” measuring results

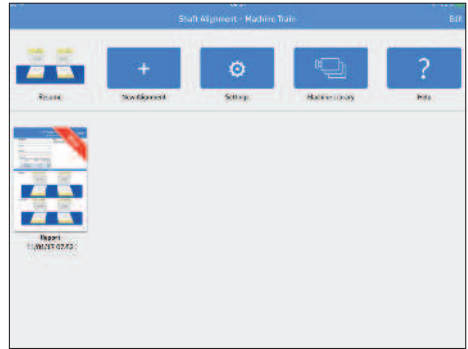
When the Alignment Done button is green, the machines are aligned within the chosen tolerances. If this is not the case, tap *Adjust* to correct the misalignment. Tap *Alignment Done* to exit to the main screen and to automatically create a report.



1.15 Report

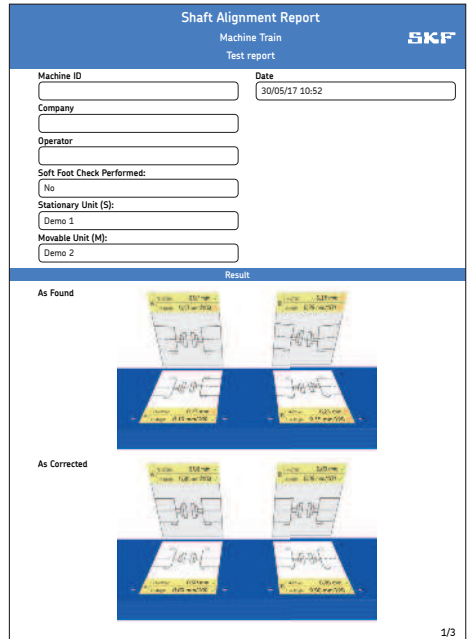
The reports are automatically generated as PDF files and they are displayed on the main menu, with the most recent alignment in the upper left corner.

A report automatically contains measuring data for both the “As Found” and “As Corrected” results when a complete alignment has been performed.



a. Edit report

The report contains information from the measurement and can be completed with additional information. Tap anywhere in the report to edit.



b. Signature

Tap the *Signature* field and write your signature in the opening Sign Report view. If a signed report is to be edited then the editor will be informed of a signature removal. The user will have to confirm this before editing is possible.

c. Share report

While viewing a report it is possible to share it through for instance email or by printing it. The sharing functionality is available in the upper right corner of the view.



1.16 Machine library

The Machine library is a convenient way to search and select previously measured machines and reports.

a. Machine library

Displays a list with Machine ID and the Reports from previously measured machines.

b. Search

Tap the *search field* to sort out the Machine ID's in the list.

c. Machine info

Select a Machine ID to view the corresponding machine info.

d. New alignment

Tap to use the shown machine info as a *template for a new measurement*.

e. List of reports

Tap the *number of reports* to display a list with corresponding reports with the date for each report.

f. Report

Select a report to view it.

g. Share report

While viewing a report it is possible to share it through for instance email or by printing it. The sharing functionality is available in the upper right corner of the view.



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