SERVICE BULLETIN

Original Issue Date: **11/96**
Model: **2000–2800 kW**
Market: **Industrial**
Subject: **Dual Bearing Alternator Installation and Alignment**

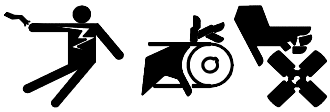
Introduction

Perform the following procedure before operating the generator set to 1) prevent alternator failure and 2) affect the warranty coverage.

Align the alternator to the engine to ensure proper alternator bearing operation and long life. Excessive misalignment causes vibration, noisy operation, coupling wear, and premature bearing failure.

Check and adjust, if necessary, the angular, axial, and parallel alignment of the coupling any time the generator set is moved. Insert dowels into the generator set frame through the mounting base to ensure that no movement in the alignment occurs during operation after generator set installation and coupling alignment. Follow the general recommendations provided to ensure correct alignment of the alternator to the engine.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery.

High voltage test. Hazardous voltage can cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

NOTICE

Hardware damage. The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

Required Tools

- Assorted combination wrenches
- Assorted socket wrenches and ratchet
- Torque wrench and/or torque multiplier capable of 1060 Nm (782 ft. lb.)
- Straight edge (to measure axial gap)
- 12 in. ruler graduated in 1/32 in. (to measure axial gap)
- Two dial indicators (measure parallel and angular alignment)
- Magnetic bases, posts, and clamps for indicators (to measure parallel and angular alignment)
- Feeler gauges
- Mirror with extended handle to read indicator in tight spots (to measure parallel and angular alignment)
- Engine barring tool (F6 555 766 DDC/MTU Series 4000, J22582 DDC Series 4000)
- Drill
- Reamer
- Sledge hammer
- Brass drift

Routing	Service Manager	Sales Manager	Parts Manager	Technician No. 1	Technician No. 2	Technician No. 3	Return This to
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Installation Procedure

1. Disconnection

1.1 Place the generator set master switch in the OFF/RESET position.

1.2 Disconnect the power to the battery charger, if equipped.

1.3 Disconnect the generator set engine starting battery(ies), negative (–) lead first.

2. Alignment preparation

2.1 Locate and level the alternator and engine on the mounting pad. Install spring isolators using the location shown in the dimension drawing. See the generator set installation manual for more information on mounting and vibration isolation.

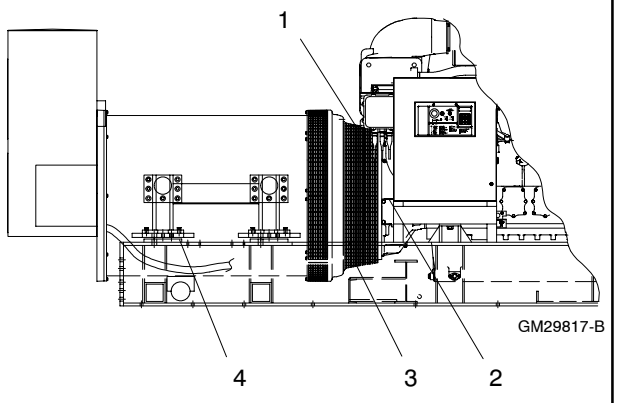
2.2 Remove both the top and bottom coupling guards. See Figure 1.

2.3 Remove right side flywheel cover plate from the engine. See Figure 1.

2.4 Mount the engine barring tool where the cover plate was removed.

2.5 Remove or reposition the following items (as necessary) on the generator set to provide better access to the coupling:

- Air cleaner and supports (D2000 engine)
- Battery charger (DDC/MTU Series 4000 engine)
- Fuel filter mounting (DDC Series 4000 engine)
- Fuel line mounting (DDC Series 4000 engine)



1. Top half coupling guard
2. Right side flywheel cover plate
3. Bottom half coupling guard
4. Screw jack

Figure 1 2000–2800 kW Assembly Drawing, Typical

3. Dial attachment and setup

3.1 Attach the dial indicator bases to one of the coupling halves and locate the dial indicators for measurements as shown in Figure 2 for RB couplings and Figure 3 for HTB couplings.

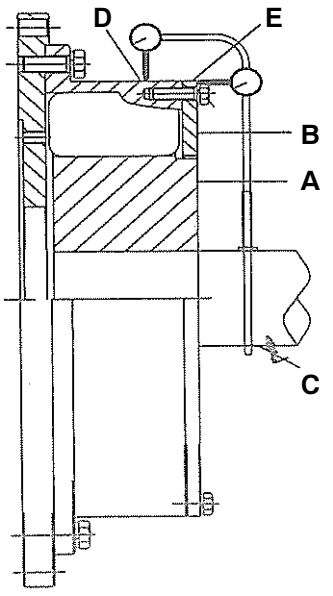
3.2 Place one dial indicator with the tip on the outside diameter and perpendicular to the shaft (parallel alignment).

3.3 Place the other dial indicator with the tip located on the coupling face as close to the outside diameter as possible (angular alignment).

3.4 Set each plunger at the midpoint of travel. Rotate the indicators so that they are at the top location and *zero* the indicator.

3.5 Mark the coupling hub at 0°, 90°, 180°, and 270° and make a reference mark on the stationary portion of the unit.

Note: If flexible coupling requires replacement, mark the engine-mounted coupling and the alternator-mounted coupling so that the set is recoupled exactly as it was uncoupled.



A. Face A
B. Face B minus Face A = average axial gap
C. Mount dial indicator on shaft at C
D. Locate dial indicator pointer at D for radial alignment
E. Locate dial indicator pointer at E for angular alignment

Figure 2 Dial Indicator Setup (RB Coupling)

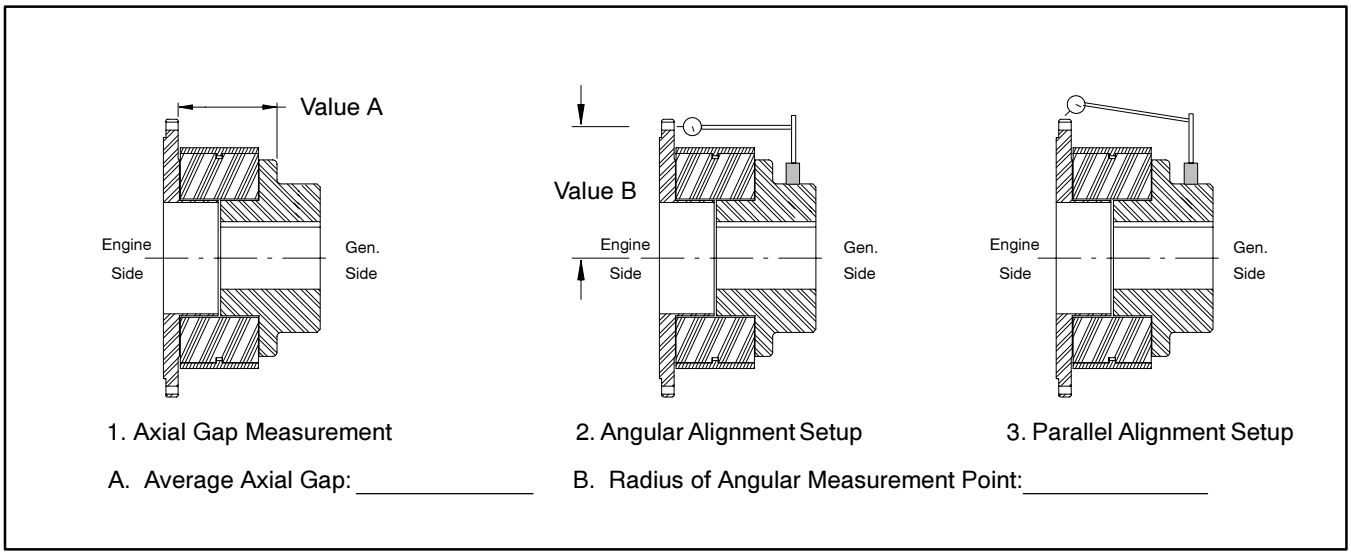


Figure 3 Dial Indicator Setup (HTB Coupling)

4. Coupling alignment types

The coupling has three basic dimensions of alignment—axial, angular, and parallel alignment. Misalignment of any one or more of the above can cause coupling misalignment. See Figure 4.

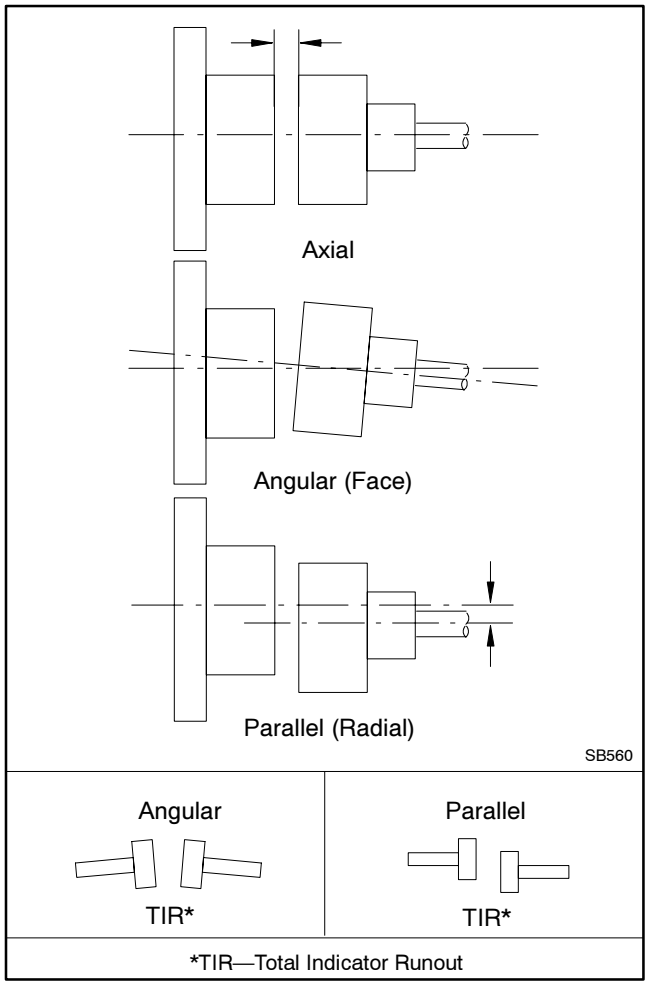


Figure 4 Alignment Types

Figure 5 shows a typical set of measurements and their corresponding Total Indicator Readings (TIR).

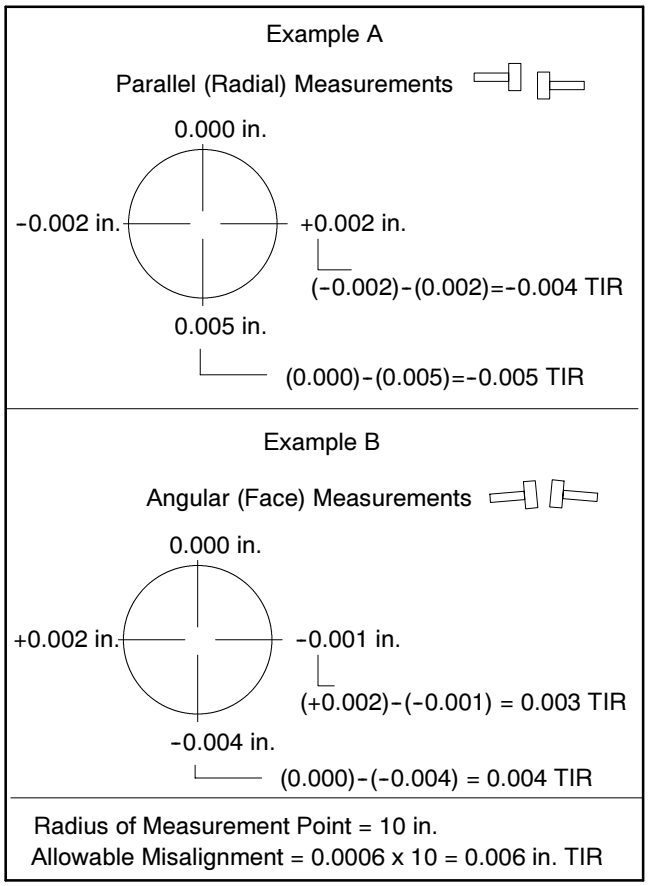


Figure 5 Sample Measurements

5. Alignment measurements

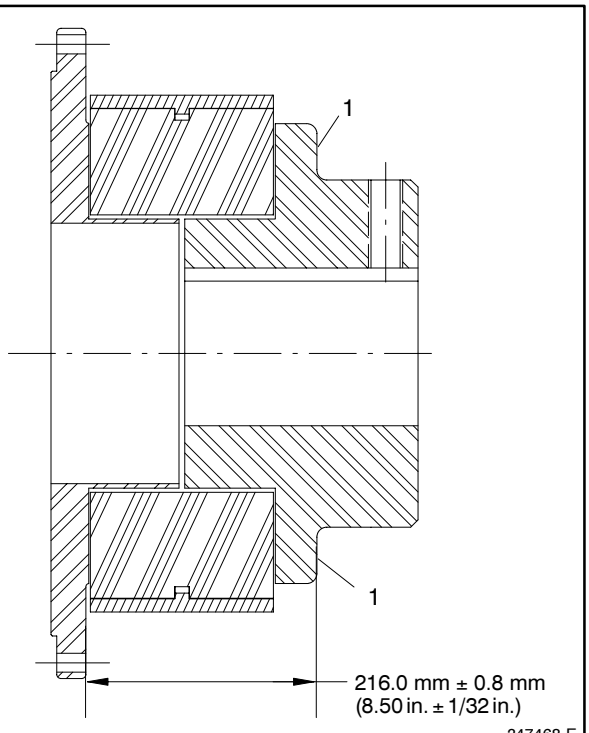
5.1 Inspect axial alignment. Use a graduated ruler or inside caliper and straight edge to measure axial alignment. See Figure 2, Figure 6, or Figure 7. Keep straight edge away from the inside radius.

5.2 Inspect angular and parallel alignment. See Figure 10 for documenting alignment data. Make copies of Alignment Worksheet, as necessary.

Rotate both shafts together when taking measurements. Take measurements at 90° increments and return coupling to initial position to check that indicators are at zero. If indicators are not at zero, reset indicators and repeat alignment measurement.

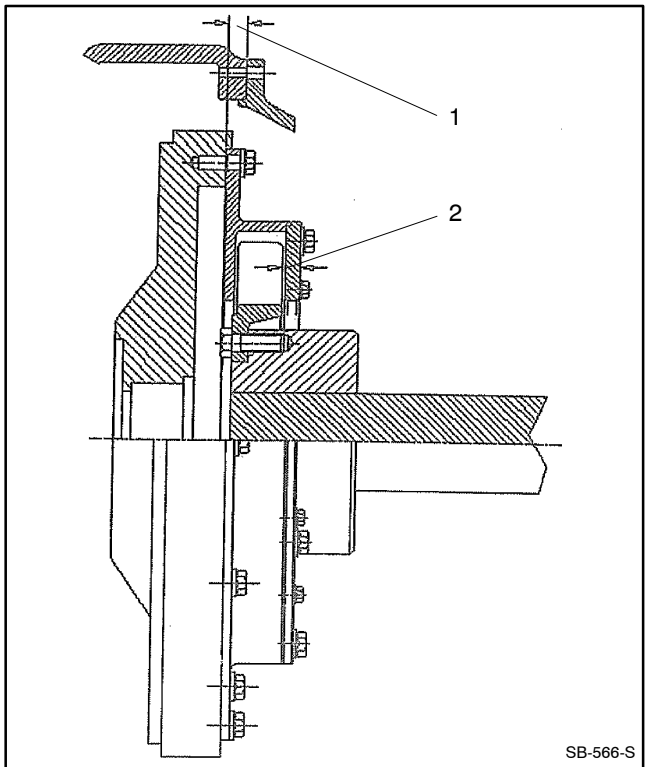
Make parallel and angular alignment measurements at the same time from the same position, if possible. If measurements are not made at the same time, mark the coupling and take measurements from the same position (degrees) for each measurement.

5.3 Compare the measurement values to the maximum allowable shaft misalignment values shown in Figure 8.



1. Straight edge location

Figure 6 Axial Alignment Measurement with Atraflex Coupling (2000 kW)



1. Angular (face)
2. Axial

Figure 7 Axial Alignment Measurement with HTB Coupling (2500/2800 kW)

Model	Axial Measurement, mm (in.)	Angular (Face), mm (in.)	Parallel (Radial), mm (in.)
2000 kW (Atraflex Coupling)	216.0 ±0.8 (8.5 ±1/32)	0.015 (0.0006)	0.13 (0.005)
2000 kW (RB Coupling)	0.61 (0.024)	0.30 (0.012)	2.54 (0.10)
2500 kW/ 2800 kW new (HTB Coupling)	23.11 ±1.0 (0.91 ±0.04)	0 (0)	0.41 (0.016)
2500 kW/ 2800 kW used * (HTB Coupling)	23.11 ±1.0 (0.91 ±0.10)	0 (0)	1.5 (0.060)
* Inspect after approximately 10000 hours.			

Figure 8 Maximum Allowable Shaft Misalignment

6. Alignment corrections

6.1 Go to step 7.1 if measurements meet the specifications. Go to the next step if the measurements do not meet the specifications.

It is good practice to first correct the parallel and angular misalignment in the horizontal plane. Jack screws attached to the skid can be used to adjust the location in the horizontal plane. After following the alignment corrections, a new set of alignment measurements should be made. If the alignment in the horizontal plane are within limits, proceed with correction in the vertical plane.

Evaluate the measurements and determine the correction process. Corrections for parallel and angular misalignment can be made at the same time. Take new measurements after corrections are made.

Note: The factory ships the adjustment block bolts, shims, and dowel pins loose with the generator set.

6.2 Install the eight adjustment bolts into the four adjustment blocks on the generator set skid. See Figure 9. Keep the eight adjustment screws loose so they do not affect *soft foot* measurements. *Soft foot* exists when the alternator does not rest flat on its base and only three of the four mounting points support the alternator.

6.3 Check the alternator for *soft foot* condition.

If no *soft foot* exists, go to step 6.4. If *soft foot* needs correction, perform the following steps.

6.3.1 Tighten the eight alignment bolts to 136 Nm (100 ft. lb.) against the alternator to prevent it from moving.

6.3.2 Loosen the four alternator mounting bolts one at a time and measure the relative movement with a dial indicator.

6.3.3 Shim the alternator for *soft foot* using jack screws and supplied shims to eliminate that relative movement. The relative movement should not exceed 0.13 mm (0.005 in.). Shims with burrs on the edges can contribute to the *soft foot* condition.

6.3.4 Tighten the alternator mounting bolts.

6.4 Check the angular, axial, and parallel alignments. See Figure 9. Use the jack screws and shims to adjust the height of the alternator. Use the adjustment bolts to adjust the horizontal position of the alternator. Loosen the opposing adjustment bolt prior to tightening an adjustment bolt.

Note: Replace all damaged hardware. Do not reuse crushed, cupped, or otherwise distorted washers or shims.

6.4.1 Loosen the alternator mounting bolts.

6.4.2 Make adjustments to the horizontal plane.

6.4.3 Tighten alternator mounting bolts.

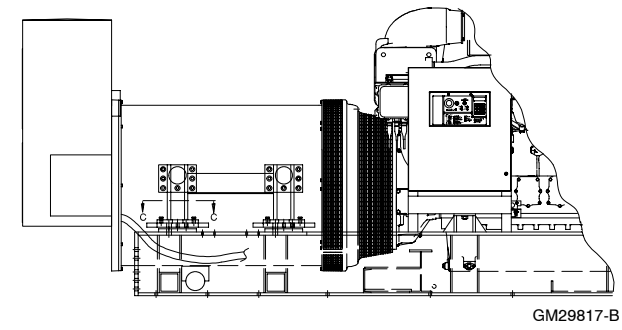
6.4.4 Reinspect alignment.

6.4.5 Loosen alternator mounting bolts.

6.4.6 Make adjustments to the vertical plane.

6.4.7 Tighten alternator mounting bolts.

6.4.8 Reinspect alignment.



1. Adjustment blocks (4)
2. Alternator mounting bolts (4)
3. Dowel location (4)
4. Jack screws (4)
5. Adjustment block bolts (8)

Figure 9 Alternator Adjustment Layout

6.5 Verify that alignment meets specifications.

6.6 Tighten all adjustment blocks to 136 Nm (100 ft. lb.) to prevent movement during torquing.

6.7 Torque mounting bolts to 407 Nm (300 ft. lb.) in a clockwise bolt pattern sequence. Then torque mounting bolts to 1060 Nm ±10% (782 ft. lb. ±10%) in a clockwise bolt pattern sequence.

6.8 Recheck all alignment measurements after torquing. Repeat alignment procedure if measurements do not meet specifications.

7. Component assembly

7.1 Record the final alignment measurements for reference purposes.

7.2 Remove engine barring tool from the starter mounting location.

7.3 Reinstall engine starter motor.

7.4 Reposition or reinstall any items moved during the alignment procedure.

7.5 Reinstall the top and bottom coupling guards. See Figure 1.

8. Dowel pin installation

8.1 Select opposite corner dowel pin mounting locations. See Figure 9.

8.2 Drill and ream the existing 22.22 mm (0.875 in.) hole in the skid to 25.30–25.32 mm (0.996–0.997 in.).

8.3 Drive in the supplied dowel pins using a brass drift and sledge hammer within 12.70–15.87 mm (0.50–0.63 in.) from the alternator base.

9. Reconnection

9.1 Place the generator set master switch in the OFF/RESET position.

9.2 Reconnect the generator set engine starting battery(ies), negative (–) lead last.

9.3 Reconnect the power to the battery charger, if equipped.

9.4 Move the generator set master switch to AUTO for startup by remote transfer switch or remote start/stop switch.

Electrical Test/Long Term Storage

If the generator set is exposed to extreme dampness during shipment or storage, an initial period of operation may be necessary to dry all windings. Determine the need for drying out by measuring the stator insulation resistance with a megohmmeter. Connect the megohmmeter between the stator terminal and generator set frame. The one-minute test of the stator resistance at an ambient temperature of 40°C (104°F) must be at least:

Rated voltage of unit/1000 +1 = Minimum resistance value (megohms)

If the stator insulation resistance measures less than specified for the generator set voltage rating, the unit must be dried out until at least the minimum recommended resistance value is obtained. Dry out the unit by applying an external heat to obtain an end-winding temperature of 75°C (167°F) using a thermometer. Apply heat evenly and slowly to avoid excessive vapor or gas pressure harmful to insulation. Do not exceed a temperature rise of 10°C (18°F) per hour.

The easiest and most convenient method of drying out the alternator is by placing the complete or partially disassembled alternator in an oven. Apply external heat using space heaters beneath the alternator to obtain an even distribution of heat along the length of the unit. Be sure to provide adequate air circulation to ensure a complete and thorough drying out process.

When the generator set is placed in storage or not in use, the alternator strip heaters should be energized unless the unit is in a humidity controlled environment. When in storage, the unit should have adequate air circulation for moisture removal and prevention of overheating.

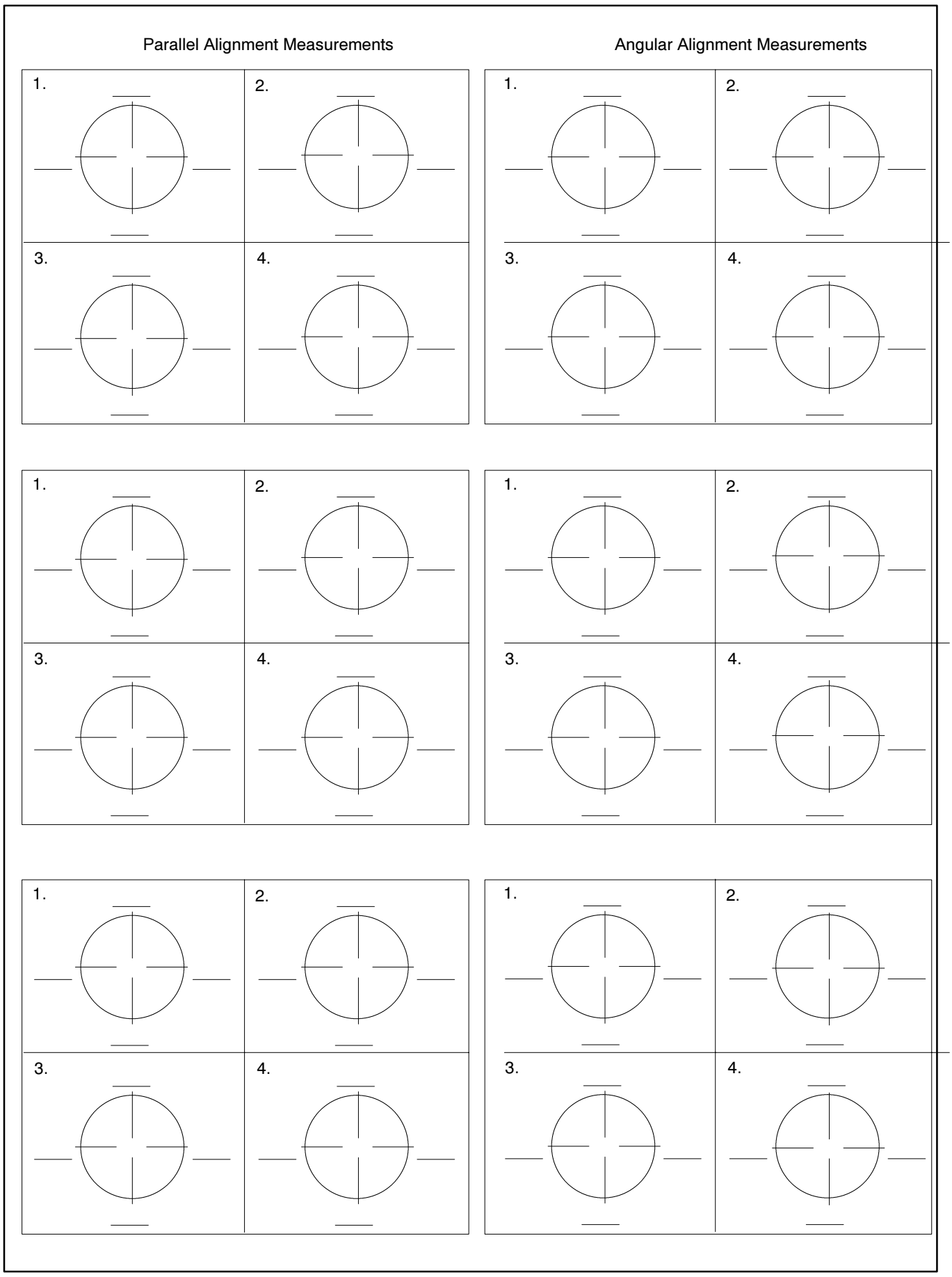


Figure 10 Alignment Worksheet (photocopy as necessary)