Application Note 1

Bore Alignment with the L-706 Laser

L-706 Applications

- **Boring Bar Bearings**
- **Engine Crankcase Bores**
- **Post-Machining Bore Straightness**
- **Compressor Bores**

Designed for high-accuracy bore alignments, the L-706 offers the most accurate, yet easy to use laser alignment system. With high resolution, capability to measure a wide range of bore diameters, and our patented A-514 self-centering bore adapters, the L-706 is the best bore alignment system on the market.

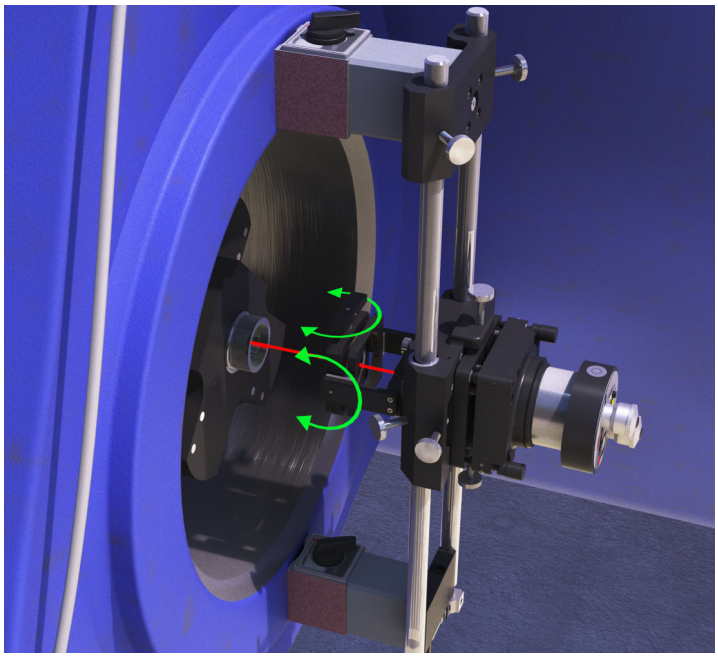
The L-706 also offers a variety of target options, including self-centering, see-through, 2-axis and 4-axis targets, hand-held readouts, and Windows®-based software to display and analyze alignment data. The system aids in boring-bar bearing alignment during setup and post-machining quality-control alignment checks for a wide variety of in-situ bore machining applications, including: construction equipment bearings, engine-block crankshaft bores, stern tube alignment, and many more.

PDF Adobe Brochure

The L-706 Bore Laser System

L-706 Bore Laser

The L-706 Bore Laser is a battery-operated, visible light laser that mounts magnetically in a bore fixture or mounting fixture. It is suitable for almost all bore applications. The laser has two mounting surfaces: 0.7498" (19.04 mm) and 2.2498" (57.14 mm). The laser beam is centered to both mounting ODs to within .0003" (0.08 mm). The L-706 Laser is equipped with fine angular adjustments necessary to set the laser beam to the center of the far reference target. It is used for applications up to 110 feet (33 meters).



Fast Setup and Even Faster Measurements

With simplified fixturing and self-centering targets, the system can be set up in as little as 15 minutes. Since it literally takes less than a minute to insert the target/adapter into a bore and take a measurement, bore straightness data can be taken and analyzed in 30 minutes or less in most cases. This means even the longest bore application can be measured in just minutes versus hours for optics, tight wire or other laser systems. *Nothing* is faster than the L-706 Bore Alignment System!

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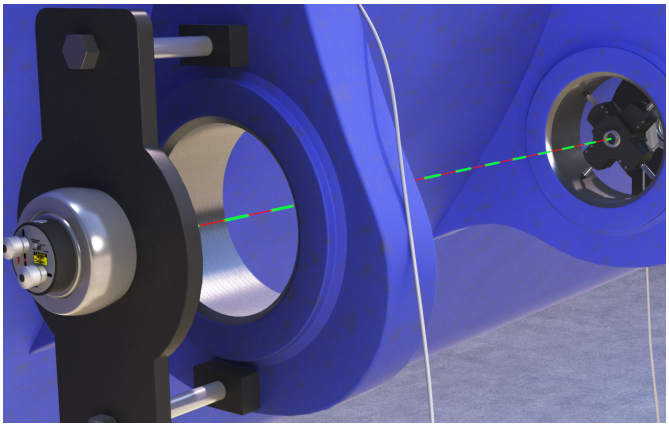
2.2495" Mounting Diameter Fits into Boring Bar Bearings for Quick QC

The L-706 Laser has been designed with a standard boring-bar diameter of 2.2495" (57.137 mm). This means the laser can be inserted directly into bearings after machining for a quick quality control bore straightness check when using our A-512/A-514 Self-Centering Bore Target and Adapters.



High Resolution Angular Adjustments

Micrometers provide high-resolution angular adjustment of laser beam to steer the laser to zero out the reference target (detector) during setup. The L-706 has an angular adjustment resolution of .001" 100 feet (0.025 mm in 30 meters). Each laser has a NOMINAL setting for both the Vertical and Horizontal micrometers that sets the laser square to the mounting faces and in the center of the adjustment range.

4-Axis Vertical or Horizontal Surface Mounting Fixture

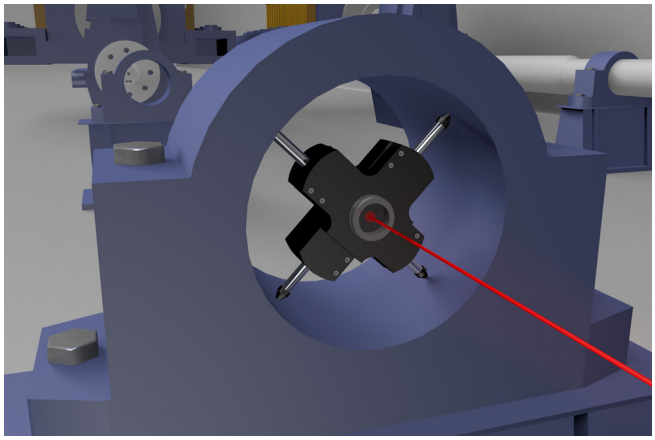
The L-111 Laser Stand and L-102 Beam Translator provide 4-axis adjustment capability to quickly align the laser beam to any two bores for alignment checks and for installing boring-bar bearings. The fixture can be mounted either on the face of a bore or on an instrument stand.

System Handles Large Range of Bores

Any bore, from 3.75" (92.25 mm) up to 50" (1,270 mm) or more, can easily be measured with our L-706 Bore Laser System. The system offers three bore adapters and a leg-setting gage to set the adapters to the nominal bore ID. We even offer bore targets that can measure bore alignment down to .70" (18 mm).

Patented Self-Centering Target & Adapters – The Key to the System

The A-512 2-Axis Bore Target has a 10x10 mm PSD and is designed specifically for our A-514 line of self-centering bore adapters. This unique feature allows our target to be inserted into a bore without any mechanical setup, such as bore sweeping or the need to rotate the target to determine mounting errors (a common problem with most other systems). The target is concentric to its housing to within .0003" (0.0075 mm). When used with the A-514 adapters, the sensor is centered to the bore within .0006" (0.015mm). Another unique feature of our A-514 adapters is they can handle a fairly large range of bore diameter changes of up to .040" (1 mm), so bore diameter changes do not affect the accuracy of bore alignment measurements.



A-512 Target and A-514 Self-Centering Bore Adapter mounted in a shaft bearing

High Resolution and Accuracy

When used with our R-1307 Readouts and Bore9 Software, the L-706 system provides a resolution of .00002" (0.0005 mm). Under good environmental conditions, the L-706 Laser is accurate to .040" (0.1 mm) over the whole 100' (30 M) range. By carefully following the NORMIN procedure, accuracies of .0003" (0.0075 mm) in 10 feet (3.1 meters) can be achieved.

Measure Bore Angle in Seconds

To check for bore angle relative to the centerline, just take a measurement at the front or back of the bore and any difference shows the angle. Adjust the front and back of the bore to read zero and it's aligned! Also, with our unique design, our target only needs a few inches of bore width to take a measurement.

T-218 Target Measures Bore Diameter Change

The T-218 2-Axis Universal Target and T-225L Large Bore Flange are used to measure the bore diameter change from a nominal measurement. Simply measure one of the bores for a reference diameter and then insert the T-218/T-225L into the bore. Take two measurements, one in the normal orientation and one in the inverted. Bore9 does the math to determine the difference in bore diameter from the nominal measurement. This is very useful as a final check of newly machined bores.

Long Range and High-Resolution Angular Adjustments

The L-706 can be used for applications up to 110 feet (33 M). The fine-adjustment micrometers can steer the laser beam in the horizontal and vertical axes to .001" (0.03 mm) in 110 feet (33 M).

Simple Readouts, Optional Software

The L-706 Bore Alignment System comes with simple H & V axis readouts that are extremely easy to use. There is no complicated software to learn in order to use the system, which minimizes training requirements. For those who want to document the alignment and produce a report, there is no easier bore alignment program to use than our Bore9 software.

R-1307 Readout

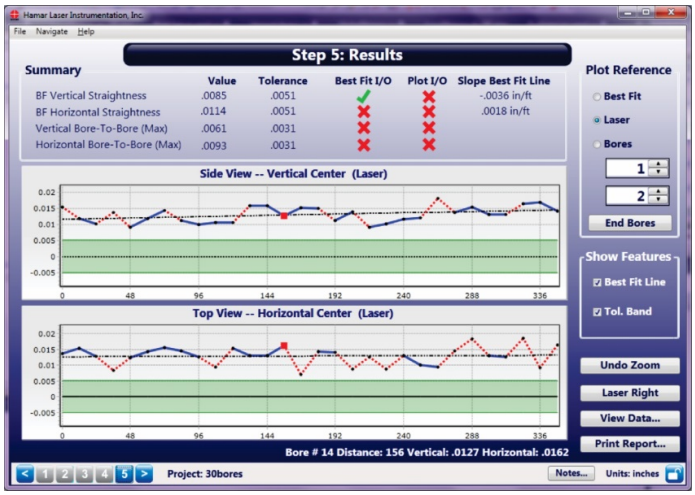
A-910-2.4ZB Computer Interface

Wireless Data Downloading and Transfer

For long-distance applications, the R-1307 Readout can be configured with a 2.4GHz Zigbee® radio and transmit its data up to 400 feet (120 M) to a second R-1307, which is very useful when bucking-in (setting up) the laser to reference targets that are at distances greater than 15 feet, or it can also be received by the A-910-2.4ZB Computer Interface for automatic downloading into our Bore9 Software.

Live Alignment Data Saves Even More Time

As with all of our laser alignment systems, the A-512 Bore Target provides live alignment data via our R-1307 readouts. This means once the target is installed in a bore and you are ready to align it, you just watch the readout continuously update as you adjust the bore, supporting pillow blocks or bearing sleeves. When the readings are zero, you're done!



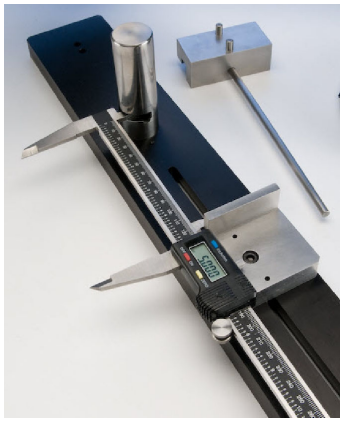
Bore9 Step 5: Results Screen

Model A-512 2-Axis Self-Centering Target

The A-512 Target *unit* is comprised of a stainless-steel housing, PSD sensor and insertion handle. The target is inserted into the A-514 Self-Centering Bore Adapters and together they are inserted into a bore to measure the straightness. The effective cell range is ± .100" (2.5 mm), and changes in the x and y axis positions of the target can be displayed on a digital readout with a resolution of .0001" or 0.001 mm.

The A-514GS and A-514GL Leg-Setting Gage

The gages are used to set the A-514 Adapter legs to the correct bore diameter. The gages are available in two sizes, depending on the size of the bore being measured. The A-514GS is used with the small (A-514A) or medium (A-514B) bore adapters. The A-514GL can be used for all three adapters and must be purchased if using the large bore adapter.



A-514 Self-Centering Bore Adapters for the A-512 Target

The A-514 self-centering laser and bore adapters accurately and quickly position the laser and target on the bore centerline. The adapters have adjustable legs that allow them to be used for bore diameters ranging from 3.75" (95 mm) to 40" (1M).

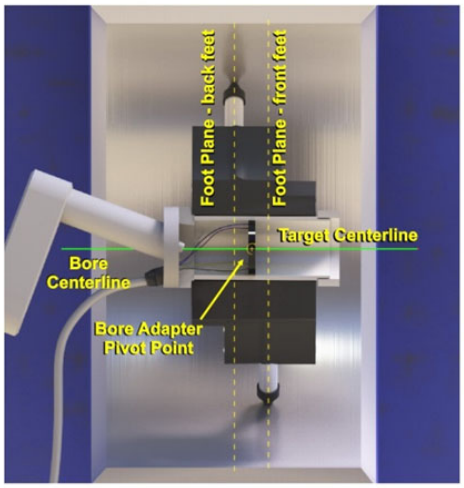
Three sizes are available, as follows:

- **A-514A** for bores from 3.75" (95 mm) to 6.75" (172 mm)
- **A-514B** for bores from 6.5" (165 mm) to 17.5" (445 mm)
- **A-514C** for bores from 17.0" (432 mm) to 40.0" (1 M)

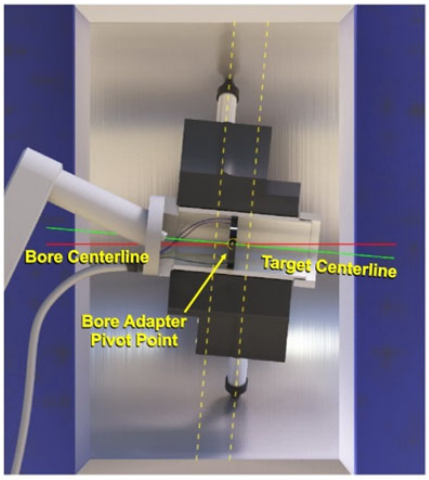
How the A-512 Target and A-514 Adapters Work

The A-512 Target is designed so that the PSD is centered axially between the four feet of the A-514 Adapter, two of which are offset axially from the other two. This, in effect, puts the PSD on the pivot point of the adapter and allows the angle of incidence to the laser beam to vary by up to 45º. This means even if the bore diameter changes, the A-514 will still self-center giving an accurate measurement of the bore's alignment. To insert the target into the bore, attach the handle to the target and tip the target forward, which allows it to easily slide into the bore. Release the handle/insertion pole and the target/adapter "jam" into the bore, finding the center automatically. The weight of the handle keeps the target centered in the bore.

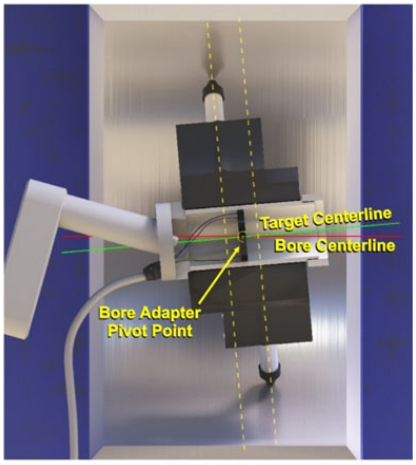
How the A-512 and A-514 Self-Centering Adapters Work



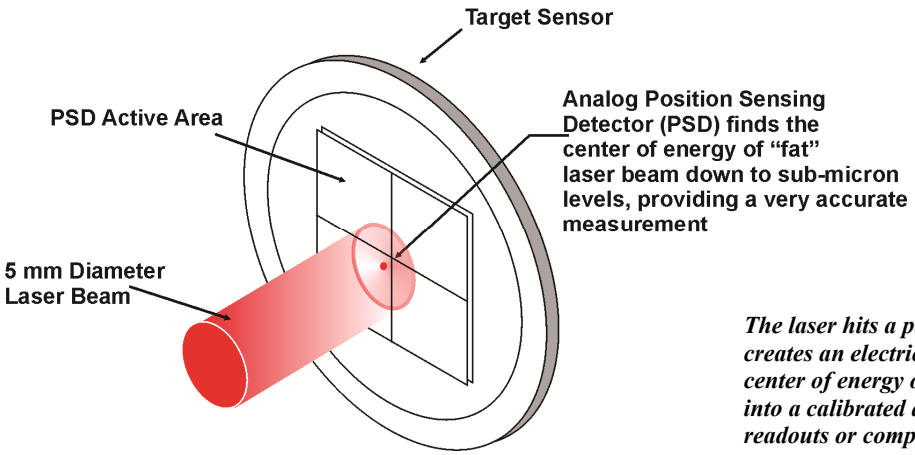
A-512/A-514 Target & Adapter
Adapter OD = Nominal Bore ID



Bore ID > Nominal ID
Target Tilts Forward
PSD Is Still Centered



Bore ID < Nominal ID
Target Tilts Back
PSD Is Still Centered



The laser hits a position-sensing detector (PSD), which creates an electrical signal representing the position of the center of energy of the laser beam. This signal is converted into a calibrated digital reading using a variety of hand-held readouts or computer interfaces for use with our software.

Recommended System Configuration

- L-706 Long Distance Bore Laser
- L-111 Laser Adjustment Stand
- L-102 2-Axis Laser Beam Translation Fixture
- A-512 2-Axis Bore Target
- A-514A Small-Bore, Self-Centering Adapter for 3.5" to 6.75" diameter bores
- A-514B Medium-Bore, Self-Centering Adapter for 6.5"- 17.5" diameter bores
- A-514GS Small Leg-Setting Gage for A-514 A and B Adapters
- R-1307B-2.4ZB 2-Axis Combination Readout
- A-814 Shipping Case

Optional Accessories

Bore-Diameter Measuring Accessories

- T-218 2-Axis Universal See-Through Target
- T-225L Large Bore Flange for T-218 Target

Bore Alignment Software Accessories

- A-910-2.4ZB Wireless Data Receiver
- S-1403 Bore9 Software for Windows
- T-231AL 25' Target Extension Cable

Laser Mounting Accessories

- L-106 Instrument Stand
- L-111FM Face Mount Accessory for L-111 to extend bore diameter to 32" (813 mm)

Large-Bore Targets and Adapter Accessories

- A-514C Large-Bore, Self-Centering Adapter for 17" to 40" diameter bores
- A-514GL Large Let-Setting Gage for A-514 A, B and C Adapters
- A-514CXL X-Large Bore Self-Centering Adapter for 17" to 50" diameter bores
- A-510 2-Axis Bore Target

Small-Bore Targets and Adapter Accessories

- A-510 2-Axis Bore Target
- A-510STA Self-Centering Adapter Hub
- A-510LTA Self-Centering Adapter Hub for Large Bores
- M-705CL Set of 4 Customized Legs for A-510STA
- A-510SM Customized, 2-Axis, Small-Bore Target and Adapter

A-514 A, B, C Bore Adapters

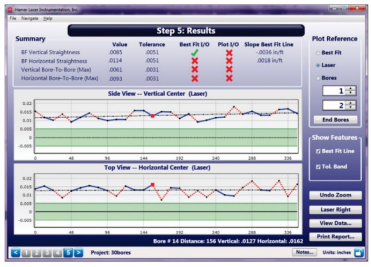
T-218 Target

T-1218 Target

T-1220 Target

L-106 Instrument Stand

R-1307 Readout



Bore9 Software