

# L-705 & L-706 Bore Alignment Systems

Aligning Bores is  
Now Faster and  
Easier Than Ever



# L-705 & L-706 Laser Bore Alignment Systems

## The Leader in Laser Bore Alignment Technology

Hamar Laser manufactures the most accurate, versatile and portable bore alignment laser systems available: The L-705 and L-706.

Both systems feature a multitude of 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 in real time.

L-705 and L-706 Bore Alignment Lasers can be used for a variety of bore alignment and measurement applications: extruder barrels, engine blocks, stern tubes, turbines, and many more.

## Results 3x Faster Than Optical Bore Scopes or Tight Wire

With Hamar, alignment of bores and extruder barrels is fast and easy: Setup takes 10 to 15 minutes, and overall alignments are done up to 3x faster than with optical bore scopes or tight wire. Because alignment data is real time, misaligned bores can be brought into tolerance very quickly. A 10' (3 m) bore can be measured for straightness every foot (300 mm) in under 10 minutes!

## Self-Centering Target Adapters Reduces Setup time by 90%

With conventional bore alignment methods, the measuring device is typically mounted outside the bores, and targets are used in reference

bores to align the measurement system — a very cumbersome process that can easily take an hour, or more. With Hamar's patented, self-centering target adapter technology, the setup process is simple: laser and target are mounted directly into the reference bores, reducing setup time to just minutes rather than hours.

## More Accurate and Repeatable Measurements Than Optics

With optics, the measurement process can be more of an "art" than a science, since one operator will "see" a different set of values than another. The L-705 uses sophisticated electronic sensors to detect the laser and thus offers greater accuracy and repeatability.

## Extend Component Life, Reduce Downtime

Misaligned extruder bores, for example, cause screws and barrels to wear out faster requiring frequent replacement, more downtime, and higher maintenance costs. Regular measurement of barrel-to-gearbox parallelism, straightness and barrel wear allows users to monitor alignment conditions and prevent big problems — before they occur. After laser alignment, customers tell us barrels and screws last up to 3x longer!

## Key Features:

- Adaptable to all bore applications
- Fast, easy setup using simple fixturing devices
- Setup and start capturing alignment data in under 15 minutes
- Measure diameters from 1.5" (38.1 mm) to 40"+ (1 m)
- Self-centering laser & target accurate to .0002" (0.005 mm)
- Live "real-time" data display with large color graphics
- Choice of hand-held LCD or large-display LED readouts
- Operational range up to 110' (33 m)\*
- Durable and rugged design
- Briefcase portable. System weighs < 20 lbs. (9.1 kg.)
- Windows-based software

\* The L-705 laser is designed for operational ranges of up to 45' (14 m). The L-706 laser is geared for longer distance applications — e.g. large steam turbines and compressors — ranging from 45' (14 m) to 110' (33 m)



*Hamar's patented, self-centering A-510 Target Adapters speed the alignment process, and use interchangeable legs for different sized bores.*



# Features Designed With Versatility in Mind

## Micrometer-Controlled Angular Adjustment

Micrometers provide precise angular pointing control over the visible laser beam as it projects through the reference bores during alignment. By adjusting them, the user can steer the beam concentric to the second reference bore.

## Self-Centering Laser and Target Bore Adapter Hubs

Our patented self-centering laser and target bore adapters accurately and quickly position the laser and target on the bore centerline. Small Bore Adapter Hubs are used for bores from 2" (50 mm) to 5" (125 mm). Large Bore Adapter Hubs are used for bores from 5" (125 mm) to 40"+ (1 m).

## Customized Target Adapter Legs

Self-centering laser and target adapter hubs have replaceable "legs" that allow hubs to be used for diameters ranging from 2" (37 mm) to 40" (1 m). Tell us the diameter you need, and we'll supply a set of custom "legs" to match.

## Visible Beam Light

A low power, visible-light laser beam makes coarse alignment easy. No viewing devices are required for operation.

## Compact, Rugged, Portable Design

Lasers are built of durable materials which are hardened to withstand a factory floor environment. Both the L-705 and L-706 lasers are light-weight (1.2 lbs.) and portable. They can even be stored as carry-on luggage in an airplane!

## T-218 Two-Axis Universal Target for Very Large, Half or Rough Bores

For bores over 1 meter, half-bores, or where bore surfaces are worn or rough, the T-218 Two-Axis Universal Target and T-225L Large Bore Flange are used. The T-218 has a prism



System includes laser, target, pole, chuck, readout and case.

that flips out of the way, allowing the laser beam to pass unobstructed through the target without removing it — a useful feature when aligning multiple bores over long distances. For half-bores, the T-218 is used with our A-502A Half-Bore and A-501A Bore Sweep Fixtures to center it in the bore.

## Long Range, High Accuracy

The L-705 has built-in micrometers which are used to adjust the laser beam to .001" in 50 feet (0.025 mm in 15 m), although it can be used out to 110' (33 m). The beam is straight to .00001"/ft or 0.0008 mm/m — is 110' (33 m).

## The L-706 — For Long-Distance Measuring

With finer angular adjustment, the L-706 is designed for use in long-distance applications, i.e. from 45 feet (14 m) to 110 feet (33 m). The laser beam can be adjusted to .001" in 100' (0.025 mm in 30 m).

## Laser Beam Concentric to Mounting OD

The L-705 laser beam is concentric to its mounting surfaces (ODs) to 0.0005" (0.013 mm), and has two mounting OD options: .750" (19.05 mm) and 2.25" (57.15 mm). Powerful magnets hold the laser flush to the mounting surface.

## Optional Computer Upgrade

Data can be collected and displayed in real time with optional laptop upgrade.

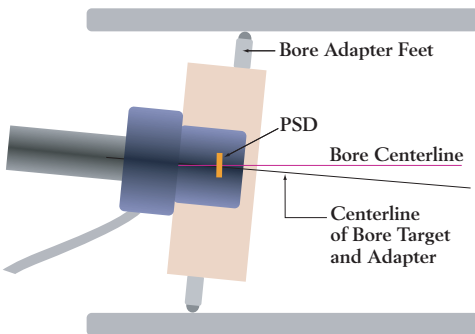


Bore8 Software showing plot of bore straightness.

# How Hamar Laser Bore Alignment Systems Work

## Simple to Set Up, Simple to Use

The L-705 laser is put into a Laser Bore Adapter Hub, then the entire assembly is placed into one reference bore. Next, an A-510 Target and Target Adapter Hub are inserted into the second reference bore. Once the target is placed, the laser adapter's tilt plate is adjusted until the reference target reads less than .010" (0.25 mm) in 10' (3 m). This ensures that the laser is centered in the adapter. Then, the angular micrometers on the laser are adjusted until the reference target reading is zero. The laser is now parallel to the end bores and the target can be moved — or a second target added — to inner bores for alignment checks. Since alignment data in the target updates automatically, any errors can be adjusted using the target as an indicator.



*Self-centering target reduces setup time by 90%!*

## Self-Centering Adapter Hubs — The Key to Speed

The A-510 Target and adapter hub are designed so that the PSD (position sensing laser detector) is centered axially between the four feet of the 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 45°. The A-510 takes advantage of this property by making the adapter slightly larger than the bore. A spring-loaded pole or weighted handle is attached to the target and bore adapter and together they are tipped forward and inserted into the bore. The weight of the pole forces the target to tip backward, which "jams" the target into the bore where it centers itself, displaying the alignment.

## Measuring Bore Alignment

After initial setup, the A-510 Target is then placed in the desired bore for measurement, which takes about 10 seconds. The R-307 2-Axis Readout then displays the bore misalignment. To truly align a bore to a centerline, two sets of readings are needed: one set in the section of the bore closest to the laser and one set in the section farthest away from the laser. The average of these two sets of reading indicates how far off center the bore is relative to the reference bores. The difference between the readings is how much angle the bore has to the reference bore centerline. To align a bore, both bore sections must be adjusted to zero, an easy task given that the readings from the target update in real time.

## Checking Straightness

Checking the straightness of a bore is a simple procedure. After setting up the laser, the target is inserted into the bore in predetermined increments and the readings are recorded. Bore8 records the data and also removes any remaining laser scope error. For long bores, the A-510 target uses a pole to push and



*The T-218 Target is a 2-axis target designed for measuring large diameter bores.*

position the target into each measuring point, and allows measurements to be taken up to 25' (7.6 m) into a bore.

## High-Tolerance Bore Alignment

For high-tolerance bore alignment applications, the Target Sensor Concentricity Error (TSCE) must be calculated using a simple procedure called the NORMIN method. Hamar's Read8 makes the process very simple. The TSCE is calculated by taking two readings, one with the target at the normal (12:00) position and a second with the target inverted (6:00). Horizontal and vertical calculations are done separately. The second reading is added to the first and the result is divided by two. This is the TSCE and shows how far off the center of the target is from the center of the bore. This calculation creates an offset that can then be subtracted from all subsequent bore measurements to get the true misalignment number. Our Bore8 software can easily calculate TSCE and even automatically remove it from the displayed reading.

# Alignment Solutions for Even the Most Difficult Bore Applications

## Applications Overview

Hamar Laser bore systems can handle a wide range of bore alignment, straightness determination and measurement tasks. Even extremely difficult bore alignment challenges, like spherical bearings, can be done easily. If you do not see your application listed, please contact us to discuss your requirements. We will be more than happy to provide a solution that's right for your unique alignment problem.

### Aircraft

- Hinge-line bearing alignment
- Tail rotor bearing alignment

### Automotive, Marine & Locomotive Engine Blocks

- Crankshaft and camshaft line bores
- Cylinder straightness

### Manufacturing & Metalworking

- Aluminum can-making machinery
- Bar turning machines
- Boring bar bearing alignment
- Deep bore straightness checks on parts
- Workpiece bore to spindle alignment

### Marine

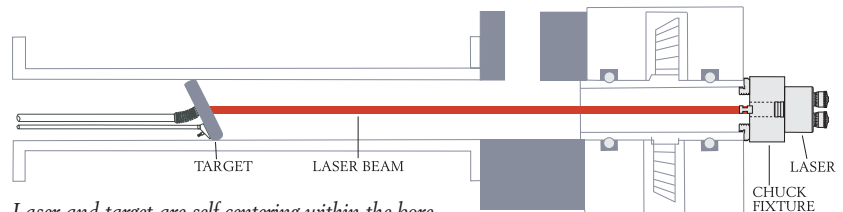
- Propeller shaft bearing bores
- Stern tube alignment

### Plastics

- Extruder barrel alignment

### Turbines and Compressors

- Bearing journals
- Diaphragms
- Oil line bores
- Seal housings



Laser and target are self-centering within the bore.

## Extruder Barrel Alignment

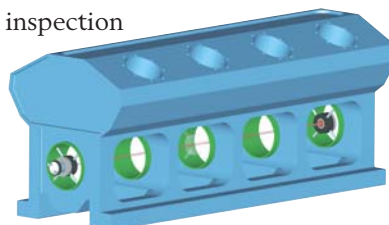
Using a self-centering fixture, the L-705 can be made concentric to the axis of rotation of the gearbox so the barrel can be checked for alignment. If it is out of tolerance, the barrel can be adjusted using the readout to show how far the barrel has moved and when it is back in alignment.

## Stern Tube & Propeller Shaft Bearings

The L-705 can quickly and easily check stern tube and propeller shaft bearing alignment. It can even check the gearbox shaft's axis of rotation alignment to its bearings, saving loads of time versus a tight wire. It can also be used to set up boring bar bearings for line boring equipment.

## Engine Block Bore Alignment

The L-705 gives automotive and diesel-engine manufacturers a fast, reliable way to measure crankshaft bores for straightness and size alignment. Our system decreases inspection



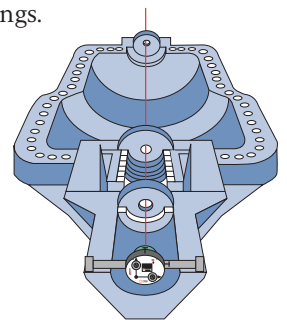
Engine block crankshaft bearing bore alignment.

times significantly and eliminates the need for expensive gauging. The L-705 is also used for measuring the straightness of engine block cylinder bores.

## Turbine Alignment

Since 1975, our Steam Turbine Alignment System has cut alignment times by 50% and increased accuracy vs. tight wires. With the introduction of the L-705, alignment times have been further reduced. We also offer lasers to check split joint flatness and motor couplings.

*The L-706 Laser is designed for use over long distances making it suitable for steam turbine alignment applications.*



## Hinge-Line Bearing Alignment

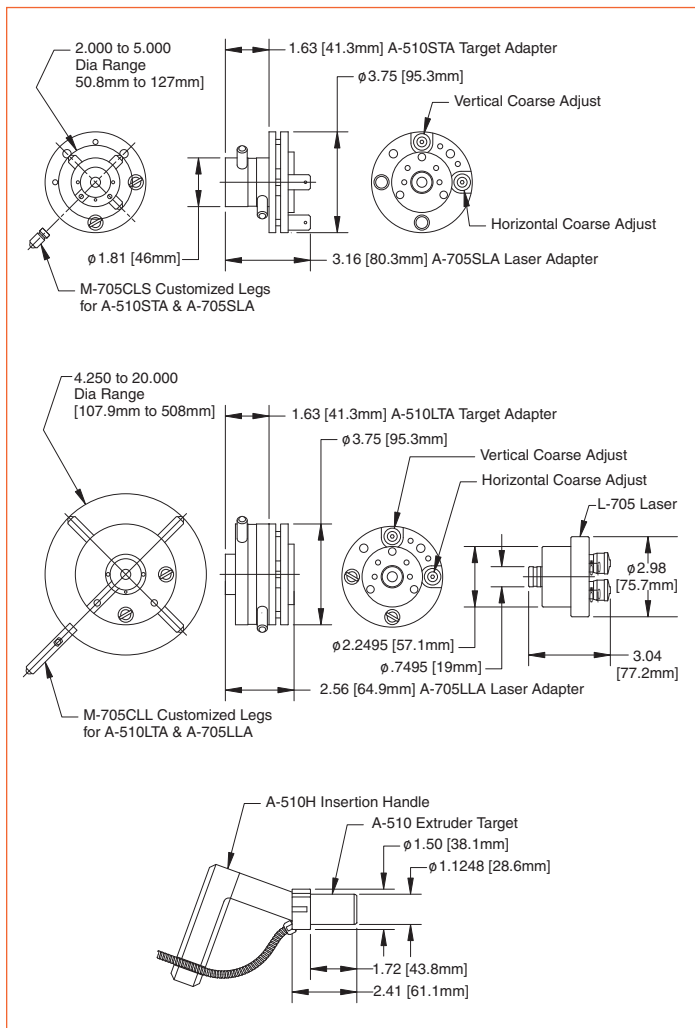
Smaller spherical bearings in commercial aircraft hinge-lines are aligned using the L-705 and T-271 2-Axis Virtual Center Target. For larger spherical bearings (2.25" and above) the T-218 Target and T-225X Flange are used. Now extremely difficult alignment tasks can be done in one-tenth the time!



# Specifications

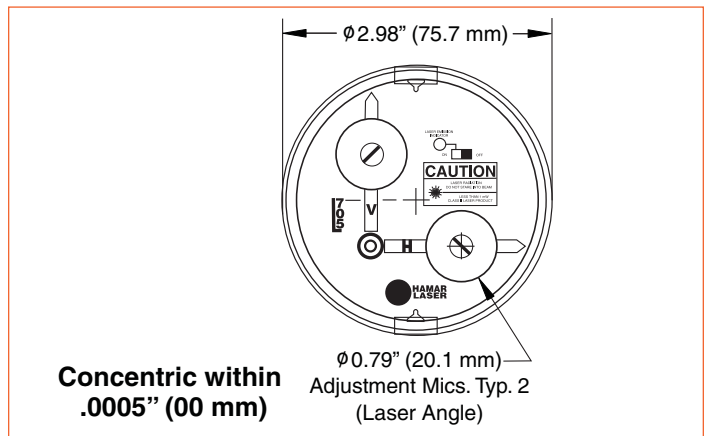
## Target and Bore Adapters

- A-510 Target** Mounting Surface OD: .7495" (19.05 mm). Target sensor concentric to OD to within .0005" (0.01 mm). Mounting surface 440 SS hardened.
- A-510STA Small Bore Target Adapter Hub** For bores from 2" (50.8 mm) to 5" (127 mm). Centering of adapter is controlled by the M-705CL measuring legs which contact A-510 housing.
- A-510LTA Large Bore Target Adapter Hub** For bores from 5" (127 mm) to 40+" (1 M). Centering of adapter is controlled by the M-705CL measuring legs which contact A-510 housing.
- A-705SLA Small Bore Laser Adapter Hub** For bores from 2" (50.8 mm) to 5" (127 mm). L-705 mounting stud centered within .0005" (0.01 mm)
- A-705LLA Large Bore Laser Adapter Hub** For bores from 5" (127 mm) to 40+" (1 M). L-705 mounting stud centered within .0005" (0.01 mm)
- M-705CL Adapter Legs** Customized to bore diameter. Leg length held to .0001" (0.0025 mm). Each set of legs can handle approximately +/- .040" (1 mm) of bore diameter change.



## L-705 and L-706 Lasers

- Size** (See line drawings)
- Weight** 1.2 lbs. (0.5 kilograms)
- Power** 9V external battery pack/AC adapter
- Center** Laser aperture ground concentric within .0003" (0.005 mm)  
No adjustment
- Angle** Controlled by two micrometers.  
L-705 (.001" on micrometer = .010" tilt @ 33 ft. or 0.25 mm in 10 M)  
L-706 (.001" on micrometer = .010" tilt @ 100 ft. or 0.25 mm in 30 M)
- Angular Adj. Range** L-705:  $\pm 0.18^\circ \pm .0375"/ft.$  ( $\pm 3.13$  mm/M)  
L-706:  $\pm 0.06^\circ \pm .0125"/ft.$  ( $\pm 1.04$  mm/M)
- Operating Distance** L-705: up to 45 ft. (14.0 M) Recommended  
L-706: up to 110 ft. (33.3 M) Recommended
- Laser Beam Diameter** Laser < 0.25 in./6.4 mm Dia. [Up to 30 ft./9 M]
- Beam Straightness** .00001"/ft. (.0008 mm/M)
- Beam Stability** .0001"/hr./°F (0.004 mm/hr./°C)  
.0001"/ft./hr./°F (0.01 mm/M/hr./°C)
- Laser Type** Laser < 1 mW Cw, BRH Class II
- Laser Wavelength** 670 nanometers
- Materials** Aluminum Flange. All mounting surfaces: 440 SS.  
Aperture: Hardened and ground in one setup (RC 54-60).



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