

# L-708 / L-708LD Stern-Tube Bore Alignment System

Aligning Bores is  
Now Faster and  
Easier Than Ever





# Why Lasers?

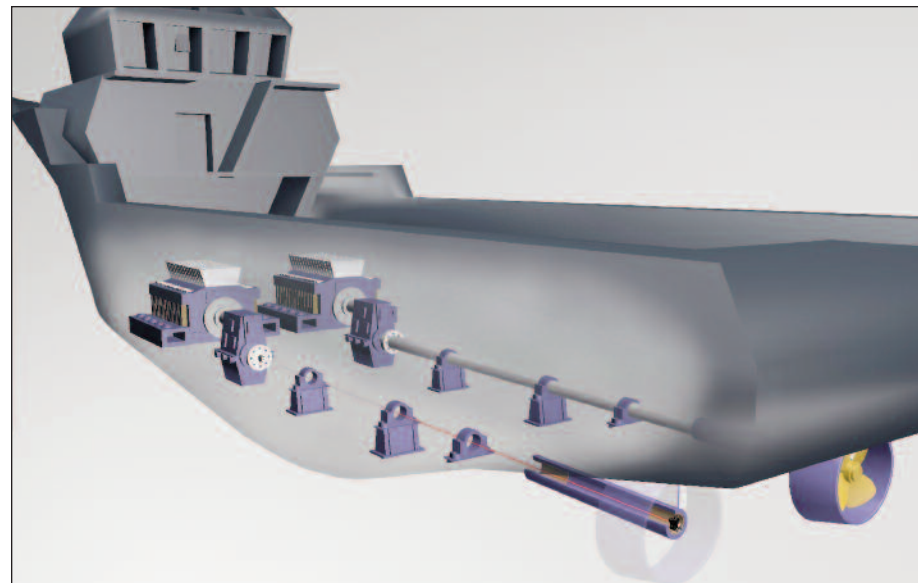
From the beginning, mechanical and optical methods of alignment in stern tube applications have been the tried and true methods for aligning stern tube bearings to drive-shaft gearbox rotation axes. However, there is a MUCH better way: lasers. It is an established fact that lasers offer faster and much more accurate alignments than optical or mechanical methods, and in most cases, are easier to learn and to use! Here are just a few of the many advantages of lasers over traditional methods::

## 10x Higher Resolution

Sophisticated electronics are used to detect the position of the laser beam, offering extremely high resolution measurements, down to .00002" (0.5 microns)! Higher resolution means higher accuracy and the confidence that what you see is what you get.

## Higher Accuracy

Lasers don't have sag like tight wire, nor are they subject to interpretation of an operator's eye like using optics. This



L-708 & A-514 Bore Adapter in Aft Strut Bore

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

Setup takes 15 to 20 minutes and taking bore measurements is extremely fast. But the real time-savings is the live alignment data feature that allows the user to see the bore moving as its being adjusted. This feature means that overall alignments with lasers can be done up to 3x faster than with optical bore scopes or tight wire!

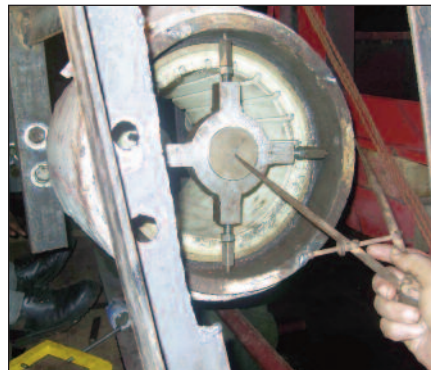
## More Accurate and Repeatable Measurements Than Optics

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. Conversely, laser systems use sophisticated electronic sensors to detect the laser, eliminating operator visual variability, and therefore offer greater accuracy and repeatability.

means laser are much more accurate. Higher accuracy means longer bearing life and fewer breakdowns.



Bore8 Setup Screen & R-1307 2-Axis Readout



Old mandrel method of alignment

## Less Manpower, Higher Profits

In addition to 2-3 times faster alignments, lasers require fewer technicians, which lower labor costs. Lower labor costs and faster alignments lead to higher shipyard profits. This also means happier customers who can put their ships back into service sooner, making them more money, too!

## Easy to Learn

Since lasers are similar to existing alignment methods, they are easy to learn and require much less training than optical or mechanical methods.

## No cheating

Unlike optics that require interpretation of the operator, the data from laser alignment systems can be seen by all, so this gives you the confidence that if the laser says it's aligned, it's aligned!



# Why Hamar?

## Over 47 Years of Laser Alignment Innovation

Hamar Laser has been providing highly accurate alignment systems to many different industries and applications. We started in the machine tool industry where tolerances are high and applications are difficult, and then 35 years ago we developed the world's first steam turbine bore alignment system. We never looked back and since then have developed systems for engine-block bores, stern tube, heat exchangers, spherical bearings, extruders and many other bore applications!

All of that experience and knowledge has gone into the design of the L-708/L-708LD Stern Tube Bore Alignment system, resulting in the most accurate, fastest and yet easy-to-use tool in the industry.



L-708 and A-514A Bore Adapter

## High Resolution and Accuracy

With a resolution of .00002" (0.0005 mm), bores can be aligned to .0012" (0.03 mm) and the results are repeatable to

.0002" (0.005 mm). For the highest-accuracy bore applications (under .001"), the laser can be mounted externally, using the L-111 Laser Stand with the L-102 Beam translator, which can produce accuracies down to .0002" (0.005 mm).

## Self-Centering Target Adapters Reduces Alignment Time by 50%

With conventional bore alignment methods, the bore fixture typically requires at least 2 measurements (one at 0° and another at 180°) to remove mounting errors and account for diameter changes. The bore fixtures also need to be square to the centerline. With Hamar's patented, self-centering target adapter technology, diameter changes do not affect the accuracy, so only 1 measurement is needed and squareness of the adapter is not important (see sidebar). This means it literally takes about 10 seconds to insert the target/adapter into a bore to take a measurement. This saves a lot of time and also means lesser skilled techs can achieve excellent results.

## Laser Industry's Biggest Range of Bore ID's

We offer targets and adapters that can measure from 0.25" to 40" (6.6-1,000 mm) and all in between! No other system on the market can match our breadth of target options and bore ID's.

## Reference Target Monitoring

In long-distance stern tube and other bore applications (over 7 m), the use of a reference target to monitor and adjust out laser drift is a very important feature. Our Bore9 software can display the data of 2 targets at a time, so you can watch

the Reference Target to make sure the laser does not drift.

## No Proprietary Data Display

The standard L-708 Bore Alignment system uses simple X-Y readouts that don't require any computer knowledge to use or high-powered computer formulas just to do bore alignment. Of course, for those who do want software, we offer our Windows®-based Bore9 software and the data is delivered via a wireless Zigbee® data link.



## Minimal Training

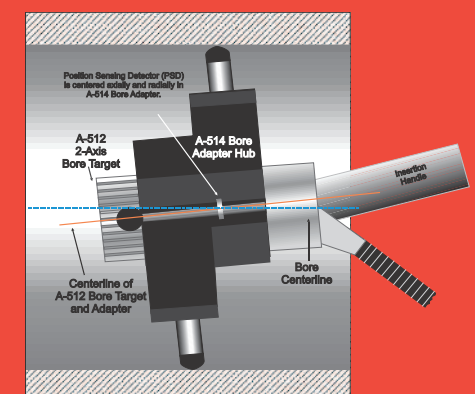
Easy to use means easy to train. Our laser setup is very similar to using tight wires. This means less training for your techs. Our systems only require 1 day of training or 2 if you purchase software. Training is held either at your plant or in our training facility in sunny Sarasota, FL.

## Adaptability

Our lasers can easily be adapted to many different bore application from stern tube bore alignment to engine blocks and even large-bore gun barrels. Usually all that is needed is a few extra fixtures and maybe a specialized target.

## Self-Centering Adapters — The Key to Speed

The A-512 Target and A-514 Adapter Hubs are designed so that the PSD (position sensing detector) is centered axially between the adapter's four feet, two of which are offset axially from the other two feet. This puts the PSD on the pivot point of the adapter and allows the target's angle of incidence to the laser to vary by up to 45° without changing the adapter's centering. This means the A-514 adapters can easily handle bore diameter changes up to 0.20" (0.5 mm) and still self-center! To insert the target/adapter into the bore, a weighted handle is attached to the target/adapter and the adapter is tipped forward, which allows it to be inserted into the bore. The weight of the handle forces the target to tip backward and seat the target to the bore, centering the adapter/target.



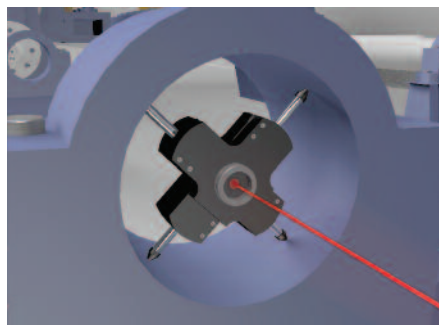
Self-centering target reduces setup time by 90%!



# Key Features – L-708/L-708LD

## Self-Centering Laser/Adapters

Our patented A-514 self-centering laser and target bore adapters accurately and quickly position the laser and target on the bore centerline. The adapters can be centered to the bore to within .0003" (0.008 mm).

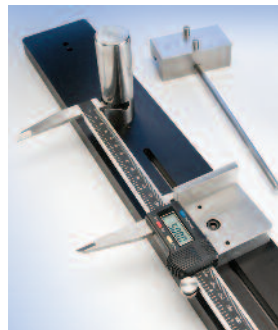


A-512 Bore Target with A-514B Self-Centering Bore Adapter in Shaft Bore

## Large Range of Bore Diameters

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

Choose from three bore adapters: 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) and A-514C for bores from 17" (432 mm) to 40" (1 M).



A-514GS Leg-Setting Gage

A leg-setting gage and caliper also come with the system to set the legs to the nominal bore ID.

## Long Range, High Accuracy

The L-708 can be used out to 100 feet (31 m) and the L-708LD out to 200' (61 m). The laser beam is straight to 0.0008 mm/M.

## 400' Wireless Data Transmission

With a Zigbee® wireless range of up to 400 feet (120 m), our R-1307-2.4ZB Readout can transmit its data to another readout or to a computer running our Bore9 software. This is especially helpful on long-distance stern-tube applications where constantly monitoring a reference target is a must.

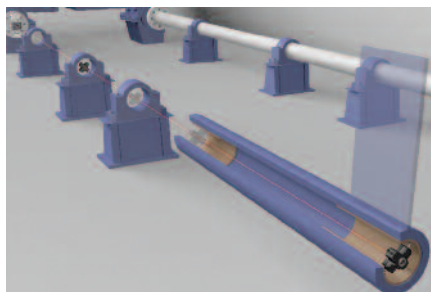


## Precise Laser Angular Adjustment

Precise angular adjustments provide angular pointing control of the laser beam, so it can be tilted with a resolution of .0007" in 100' (0.018 mm in 30.5 M). The L-708LD laser has an angular adjustment resolution of .0014" in 200' (0.036 mm in 61 M).

## Large-Range Targets for Large Bores

For 200-foot measuring range, the



L-708 & A-514A Bore Adapter in Aft Strut Bore

L-708LD Long Distance Bore laser requires a larger-diameter laser beam, which needs our large-range bore

target, the T-1218 2-Axis Bore Target or the T-1220 See-Through, 2-Axis Bore Target. Both targets have 20x20 mm measuring range and have hardened, stainless steel bodies. Use with the T-1225L or T-1255L Large-Bore Adapters to measure bores from 5.75" (146 mm) to 10"+ (3 m).

## Easy-to-Use 2-Axis Readout

The standard bore kit uses our simple R-1307 2-Axis Readout that doesn't require learning complicated software just to do an alignment. Simply plug the target into the R-1307, turn it on and you see the Vertical and Horizontal Axes displayed in real time. When it's zero, it's aligned!



R-1307 2-Axis Readout

## Win XP/7/8 Bore9 Software

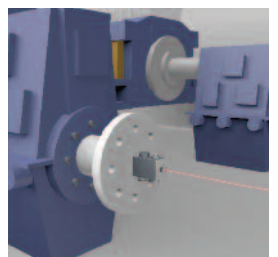
Designed to run on any standard Windows® laptop or tablet, our Bore9 software was designed to handle most bore alignment applications. It features a simple 5 step process with our Easy-Guide™ navigation that leads you through the alignment. Enter number of bores, dimensions, tolerances and select the number of targets. Hit Next and we take care of the rest!



R-1342T Tablet with Bore9

## Specialized Target and Accessory Options for Bore Alignment

Hamar laser offers several target and accessory options for specialized applications from 2-axis bore targets for bore ID's down to .71" (18 mm) to a highly accurate 4-axis target. We also are happy to discuss customized targets if your application requires it. Here are a few examples:



### 4-Axis Target for Gearbox Shaft Alignment to Stern Tube Bores

Adding our T-261 4-Axis Spindle target to a fixture on the output flange of the gearbox and you can measure the center and angular alignment of the gearbox axis of rotation relative to the stern tube bores.

### Laser Drift Monitoring Targets

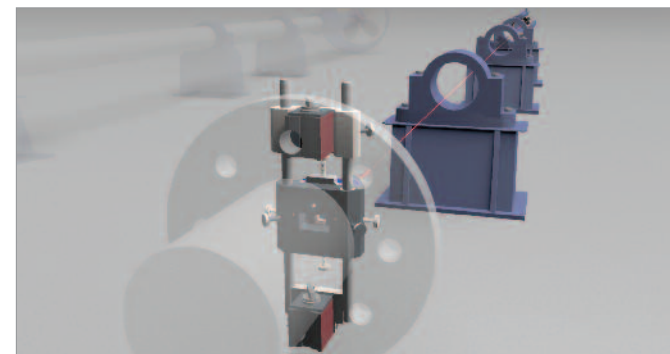
Our T-1218 2-Axis Bore Target and our T-1220 2-Axis See-Through Bore targets can be used to monitor laser drift on long distance applications. Both feature super-linear 20x20 mm PSDs for high accuracy and large measuring range.

### Deep-Bore Insertion Pole

The A-512 can be configured to add an insertion pole to insert the target up to 25 feet (8 meters) into a bore or stern tube. This is very helpful where getting to the inboard side of the stern tube is hard to do.

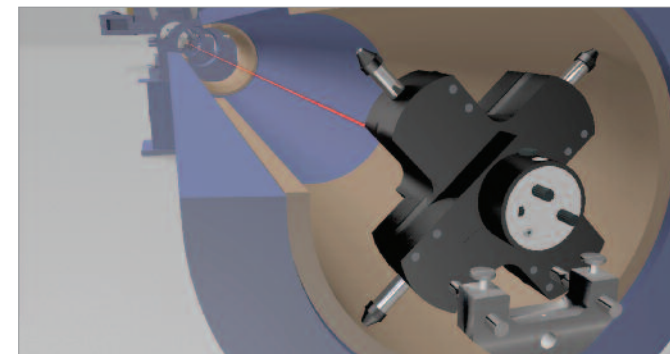


## Two Alignment Methods for Stern Tubes



### L-112 Gearbox-Coupling Flange Mount with L-700 Laser

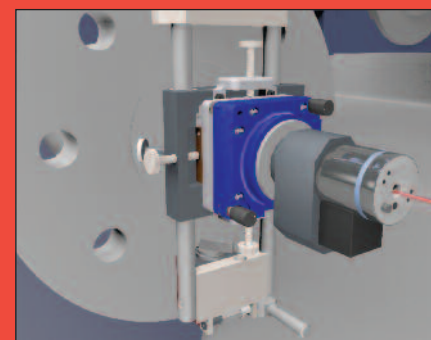
1. The L-700 Laser is mounted on the face of the gearbox shaft coupling flange using the L-112 Laser Stand and adjusted until the L-700 is near the center.
2. Next, the A-514 Adapter legs are set to the nominal bore ID using the A-514GS Leg-Setting Gage. The A-512 Target is inserted into the A-514 adapter and the R-1307B-2.4ZB Readout is connected. The A-512/A-514 are inserted into a shaft bore closest to the gearbox.
3. The L-112 V & H center adjustments are used to align the laser to the center of the A-512 target.
4. The shaft is rotated 180 degrees and the H & V values are divided by 2 to calculate the center Set Points. The L-112 V & H center adjustments are then used to align the laser to the Set Points.
5. Now the A-512/A-514 are moved to the stern-tube bore or other reference bore and the H & V values are recorded.
6. The shaft is again rotated 180 degrees. The H & V values are recorded and averaged with the first set of values to calculate the angular Set Points. This time the laser's angular adjustments are used to align the laser to the angular Set Points.
7. The laser is now aligned to the gearbox shaft axis and is projected down into the stern tube bores. The A-512/514 are then used to check the alignment of the all the bores relative to the shaft axis.
8. Alternatively, a second target/adpater can be mounted in the reference bore to monitor laser drift, usually caused by thermal growth of the ship.
9. Optional Bore9 Software can be used during the laser setup and to record the bore alignment data.



### L-708 Laser with A-514 Self-Centering, Stern-Tube Bearing Mount

1. The laser and target A-514 Self-Centering Bore Adapters legs are set to the nominal bore ID using the A-514GS Leg-Setting Gage.
2. Next the L-708 and A-512 Target are quickly inserted into their respective A-514 bore adapters. The L-708/A-514 is then inserted into the far stern-tube bearing bore or some other bearing reference bore near the aft end of the ship.
3. The A-512/A-514 is inserted into a second reference bore, either the forward stern tube bore or a shaft bearing bore.
4. The R-1307B-2.4ZB readout is connected to the A-512 target and the L-708 angular adjustments are then used to steer the laser to center (zero) of the A-512 target. The laser is now aligned to the bore center line.
4. Now, the A-512/A-514 are moved and inserted into the inner stern-tube bore or shaft-bearing bores to check the alignment, which takes less than a minute for each bore.
5. Alternatively, a second target/adpater can be mounted in the reference bore to monitor laser drift, usually caused by thermal growth of the ship.
6. Optional Bore9 Software can be used during the laser setup and to record the bore alignment data.

## External L-112 Laser Stand Fixture and L-700 Gearbox Flange Laser Options

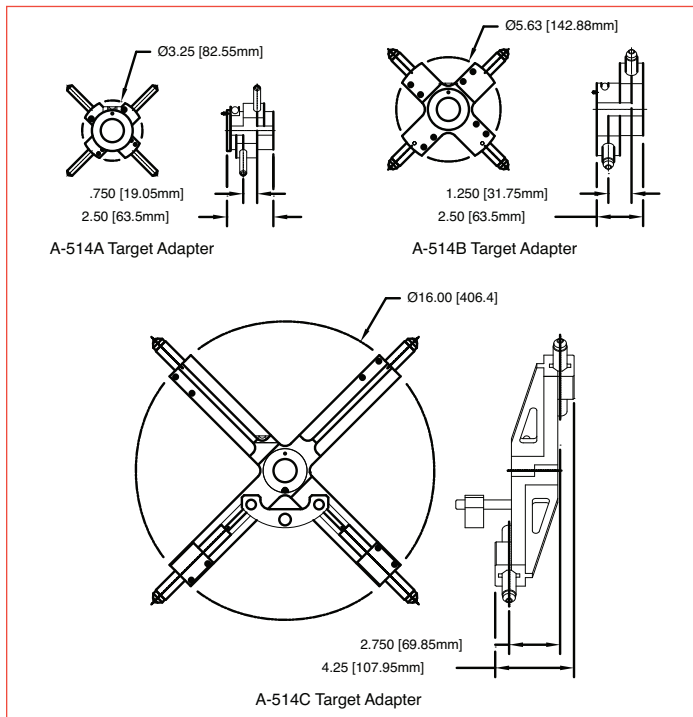


The Optional L-112 Laser Stand can be used to mount the L-708 Laser on: 1) an instrument stand or other horizontal surface outside the reference bore for cases where badly worn-out bores cause mounting problems for the L-708's A-514 bore adapters; 2) on the face of a bore where higher accuracy is needed or an instrument stand can't be used; or 3) on an instrument stand to align boring-bar bearings to the target reference bores, and then to verify the alignment after machining. Alternatively the L-700 Spindle Laser can be purchased and used with the L-112 to mount the laser on the gearbox shaft-coupling flange to align the laser to the shaft rotation axis for checking the alignment of the stern tube bores.

# Specs & Dimensions

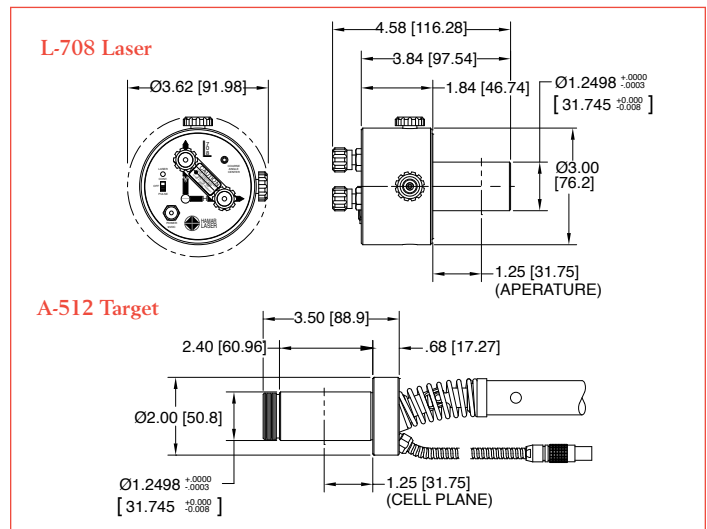
## Targets and Bore Adapters

<b>A-512 Target</b>	Mounting Surface OD: 1.2498" (31.745 mm). Target sensor concentric to OD to within .0003" (0.008 mm). Mounting surface 440 SS.
<b>Sensor: 2-Axis 10x10 mm PSD</b>	Measurement: R-1307: .0001 in. or 0.001 mm (display) Resolution: A-910: .00002 in. (0.0005 mm)
<b>A-514A Small Bore Target Adapter</b>	For bore diameters from 3.75" (95 mm) to 6.75" (172 mm).
<b>A-514B Medium Bore Target Adapter</b>	For bore diameters from 6.50" (165 mm) to 17.5" (445 mm).
<b>A-514C Large Bore Target Adapter</b>	For bore diameters from 17" (431.8 mm) to 40" (1 M)
<b>A-514G Bore Gage</b>	Sets A-514 Adapters legs to correct bore diameter to .0002" (.005 mm). Use A-514GS for A-514A & B Adapters. Use A-514GL for A-514A, B & C Adapters.



## L-708 / L-708LD Laser

<b>Size</b>	(See line drawings)
<b>Weight</b>	1.6 lbs. (0.7 kg.)
<b>Ambient Light Correction:</b>	Blinking laser provides ambient light protection by removing the effects of background light from the measurement improving accuracy
<b>Power</b>	9V external battery pack/AC adapter
<b>Center</b>	Laser concentric within .0003" (0.008 mm) No adjustment
<b>Angular Adj. Resolution</b>	Controlled by two high-pitch adjustment knobs. Coarse: .0006"/ft. (0.05 mm/M) Fine: .000007"/ft. (0.0006 mm/M)
<b>Angular Adj. Range</b>	Coarse: $\pm 1.0^\circ$ ( $\pm .21"/ft.$ or 17.5 mm/M) Fine: $\pm 0.03^\circ$ ( $\pm .007"/ft.$ or 0.6 mm/M)
<b>Operating Distance</b>	L-708: Up to 100' (30.5 M) L-708LD: Up to 200' (61 M)
<b>Laser Beam Diameter</b>	L-708: < 0.25 in. (6.4 mm) dia. L-708LD: < 0.38" (9.6 mm) dia.
<b>Beam Straightness</b>	.00001"/ft. (0.0008 mm/M)
<b>Beam Stability</b>	.0001"/hr./°F (0.004 mm/hr./°C) .0001"/ft./hr./°F (0.01 mm/M/hr./°C)
<b>Laser Type</b>	Diode Laser < 0.9 mW Cw, BRH Class II
<b>Laser Wavelength</b>	650 nanometers
<b>Materials</b>	Aluminum Flange. All mounting surfaces: 440 SS.



### Other Bore Targets and Adapters

<b>A-510</b>	2-Axis Bore Target
<b>A-510STA</b>	Self-Centering Bore Hub for ID's: 2" - 6" (51-152 mm)
<b>A-510LTA</b>	Self-Centering Bore Hub for ID's: 5" - 6" (127-305 mm)
<b>M-705CL</b>	Set of 4 Adapter legs customized to each bore diameter.
<b>A-510SM</b>	Small-Bore Self-Centering, 2-Axis Bore Target for ID's: 1.5" - 3.0" (38 - 76 mm)
<b>T-220</b>	Super-Small, Self-Centering, 2-Axis Bore Target for ID's: .70" - 2.0" (18-50 mm)
<b>T-218</b>	2-Axis Bore Target with See-Through Capability 10x10 mm PSD
<b>T-1220</b>	2-Axis Bore Target with See-Through Capability 20x20 mm PSD



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