Application Notes

Roll Alignment

System Recommendations

Printing Presses/Paper Machines
L-742W Ultra-Precision Roll Alignment System
Rubber Mills/Textiles
L-732W Precision Roll Alignment System

Whether you have a paper mill, printing press or textile mill, your business can benefit from laser alignment. Most roll-type machines that are poorly aligned will produce a product that has wrinkles and other quality problems. The material will also wander or "walk" to one side of the roll or the other. This means a lot of down time and scrapped product.

Our patented, state-of-the-art laser alignment systems are up to six times more accurate than and twice as fast as a theodolite. The system can align one roll of a mill to another that is 200 feet away to within .004". And that's an honest .004", not what some technician thinks he sees in his theodolite. Furthermore, unlike theodolites, only one technician is needed to run the laser system, freeing up critical maintenance staff during shutdowns.

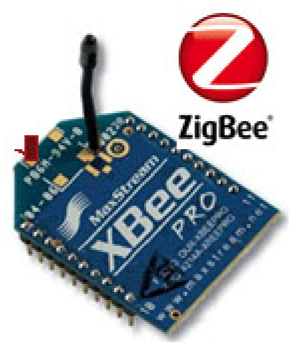
L-742W Ultra-Precision Roll Alignment System for Printing Presses/Paper Machines

The L-742W Ultra-Precision Roll Alignment system has been designed specifically for roll alignment applications. It is a very affordable yet powerful tool to not only measure but also *fix* roll misalignment on almost any kind of paper mill or process mill, all in a fraction of the time needed with conventional methods. The system is so accurate and easy to use that you can get the alignment right the first time, saving enormous costs in reduced downtime, scrapped product and quality problems. In fact, most machines that can handle it can run at faster speeds after laser alignment. This increased productivity can pay for the laser in a matter months.

Laser Planes Have 200-Foot Range Vertically and Horizontally

The L-742W Ultra-Precision Dual Scan® Laser offers two automatically rotating laser planes with 100-foot (30.5 meters) range in radius. That means rolls, at almost any elevation, can be measured simultaneously without having to move the laser vertically. This also allows the laser to be moved to more sections without having to change the location of the reference targets. In addition, the laser can be configured at the factory to have either two vertical planes, or one horizontal and one vertical plane.

Wireless Targets and Readout Speeds Setup



With Hamar's new line of wireless targets there is no need to string long extension cords to reference targets. The targets have up to a 3" (76 mm) measuring range and can be used up to 100 feet (30.5 meters) from the laser.

The A-1519-2.4ZB targets use the R-1355-2.4 ZB Readout, providing .001" (.03 mm), .0001" (.003 mm), .00001" (.001 mm in metric mode) resolution, color software and a wireless PDA data receiver to display up to eight targets. The R-1308, a single-axis readout that connects directly to the wireless targets may also be used for roll measuring. Other features like electronic zeroing and target averaging help to speed setup.

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Less Manpower Needed for Alignments

The L-742W Roll Alignment System reduces the alignment-team manpower. Wireless targets and automatically rotating laser planes make setting up the laser at each machine section easier and reduce the alignment team manpower. Our laser systems usually require only one operator. The wireless readout displays both targets simultaneously, allowing the user to quickly reference the benchmarks. Traditional optics usually requires at least one man holding a reference target in both reference locations.

Recommended System Configuration

- L-742W Ultra-Precision Dual Scan® Laser
- A-1519-2.4ZB Single-Axis Wireless Target w/1" range and .0005" resolution (qty 3)
- T-1500 Floor Fixture for reference targets (qty 2)
- R-1355-2.4ZB Readout w/Read 9 software
- R-1308 Single-Axis Readout for A-1519
- L-106 Instrument Stand
- L-106XY Translation Stage for L-106
- A-809XL Shipping Case

Optional Accessories

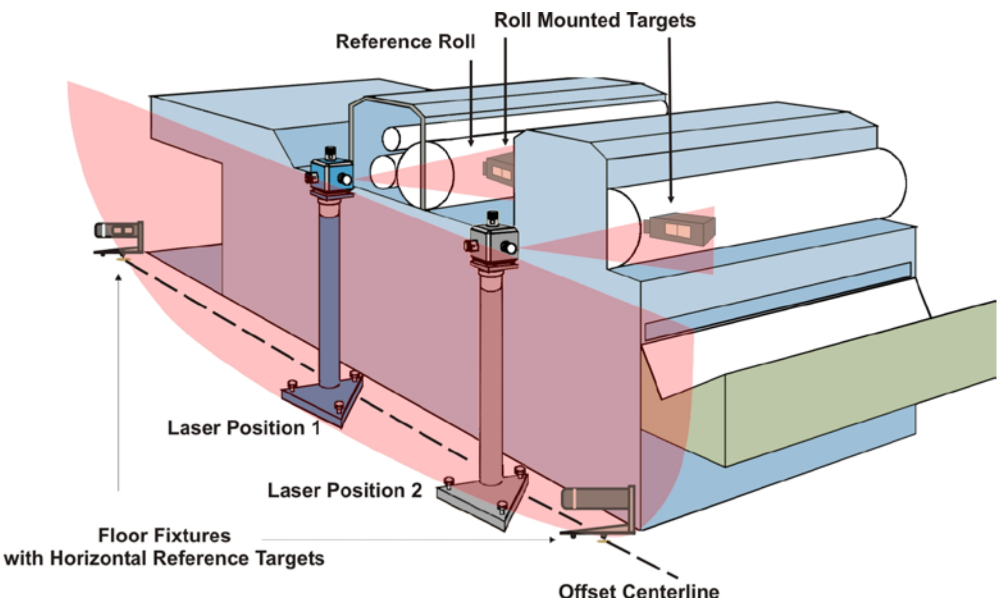
- A-1520-2.4 ZB Single-Axis Wireless Target w/.250" range and .0002" resolution for higher accuracy applications
- T-1600 Non-Magnetic Roll Fixture
- T-1601 Tight Space Tram Bar for T-1600

No Need for Optic's Time-Consuming Recalibration after Plumb Measurements

Unlike optics that usually require recalibration of the levels each time plumb is checked, the L-742W can simultaneously check level and plumb from a single setup. The levels usually only require calibration once a month or so and can easily be checked in the field with a simple 10-minute procedure.

L-742W Significantly Simplifies Roll Parallelism Checks

The setup process is easy and fast because we use timesaving and simplifying features like is our ALIGN mode in the R-1355-2.4ZB readout. The feature compares one targets reading versus another, calculating the difference between the two. This allows the user to adjust the roll until the "difference" reading is zero instead of having to calculate the difference in his head. It also is a great time saver for making the laser parallel to the reference targets.



Dimensional View of Roll Alignment

High Accuracy Reduces Optics' Guesswork

Hamar Laser's L-742W Roll Alignment System is accurate to +/-.002" (.06 mm) in 200' (61 meters) under good atmospheric conditions. This accuracy turns the alignment process from an art using optics to a science using lasers. The use of optics is considered an art because each operator "sees" the readings differently and essentially has to make an educated guess as to the correct number. In fact, it is rare that any two optics operators will get the same numbers. With the L-742W, this guesswork is essentially eliminated because the target electronics determine the alignment reading, which is very repeatable from one operator to the next.

Factory-Built Benchmark Fixturing

The L-742W Roll Alignment System comes with fixtures to pick up floor benchmarks for aligning the laser to the machine's centerline. The L-742W also has the flexibility to easily use the reference roll to set up temporary offset centerlines. In fact, this is our preferred method of referencing the machine's centerline, as benchmarks are frequently in not much better shape than the floor they sit in. Cracks in the floor can seriously affect the position of the benchmarks and often result in poor alignments.

L-742W System Features

- Two continuously rotating laser planes with operational range of 100' (30.5 meters) in radius.
- Completely self-contained
- Backlit levels accurate to 1 arc second (0.00006"/ft or 0.005mm/M)
- Laser planes flat to 1/2 arc second (0.00003"/ft or 0.0025 mm/M) in 180º sweep and 1/4 arc second (0.000015"/ft or 0.001 mm/M) in 90º sweep.
- Laser planes flat to 1/2 arc second (0.00003"/ft or 0.0025 mm/M) in 180º sweep and 1/4 arc second (0.000015"/ft or 0.001 mm/M) in 90º sweep.
- Planes are mutually square to 1 arc second (0.00006"/ft or 0.005 mm/M)
- Standard targets: A-1519-2.4ZB Single-Axis Wireless Target with 1" (24.5 mm) measuring range and .0005" (.01 mm) resolution
- A-1520-2.4ZB Single-Axis Wireless Targets w/1" (24.5mm) range and .0001" (0.0025mm) resolution for higher accuracy applications
- Factory-built benchmark fixtures and laser translation slide are included in system
- Includes Pitch/Roll/Yaw base with coarse and fine adjustments
- Instant on with virtually no warm-up
- Battery or AC powered
- Typical setup time 15 minutes or less
- Diode lasers 2 times more stable than HeNe-based laser systems

L-732W Precision Roll Alignment System for Lower Accuracy Applications

Primarily designed for roll alignment and other similar alignment applications that do not require the exacting tolerances of the L-742W Ultra-Precision Laser, the L-732W Precision Dual Scan Laser also offers two automatically rotating laser planes that can be configured at the factory as either two vertical planes, or one horizontal and one vertical laser plane.

The L-732W laser planes are flat and square to 2 arc seconds (0.00012"/ft or 0.01 mm/M). The laser comes with a pitch, roll and yaw adjustment base for setting the laser planes parallel to reference points, 2-arc-second level vials and a powerful magnet for maximum stability.

Recommended System Configuration

- L-732W Precision Dual Scan® Laser
- A-1519-2.4ZB Single-Axis Wireless Target w/1" range and .0005" resolution (qty 3)
- T-1500 Floor Fixture for reference targets (qty 2)
- R-1355-2.4ZB Readout w/Read 9 software
- R-1308 Single-Axis Readout for A-1519
- L-106 Instrument Stand
- L-106XY Translation Stage for L-106
- A-809XL Shipping Case

Optional Accessories

- A-1520-2.4 ZB Single-Axis Wireless Target w/.250" range and .0002" resolution for higher accuracy applications
- T-1600 Non-Magnetic Roll Fixture
- T-1601 Tight Space Tram Bar for T-1600

L-732W System Features

- Two automatically rotating laser planes, flat to 2 arc seconds (0.00012"/ft. or .01 mm/M in 180° sweep and 1 arc second in 90° sweep
- Completely self-contained
- Planes are mutually square to 2 arc seconds (0.00012"/ft. or .01 mm/M
- Includes Pitch/Roll/Yaw base with medium adjustments
- Backlit levels accurate to 2 arc seconds (0.00012"/ft. or .01 mm/M
- Factory-built benchmarking feature
- Standard targets: A-1519-2.4ZB Single-Axis Wireless Target with 1" (24.5 mm) measuring range and .0005" (.01 mm) resolution
- A-1520-2.4ZB Single-Axis Wireless Targets w/1" (24.5mm) range and .0001" (0.0025mm) resolution for higher accuracy applications
- Instant on with virtually no warm-up
- Battery or AC powered
- Typical setup time 20 minutes or less
- Multiple mounting orientations

How the Alignment Systems Work

Horizontal Roll Parallelism

When aligning rolls for paper mills, printing presses or film lines, the most difficult alignment is the horizontal parallelism (vertical parallelism or levelness can easily be checked using a machinist level. The following section provides suggestions for choosing a reference and step-by-step procedures for equipment setup and performing an alignment.

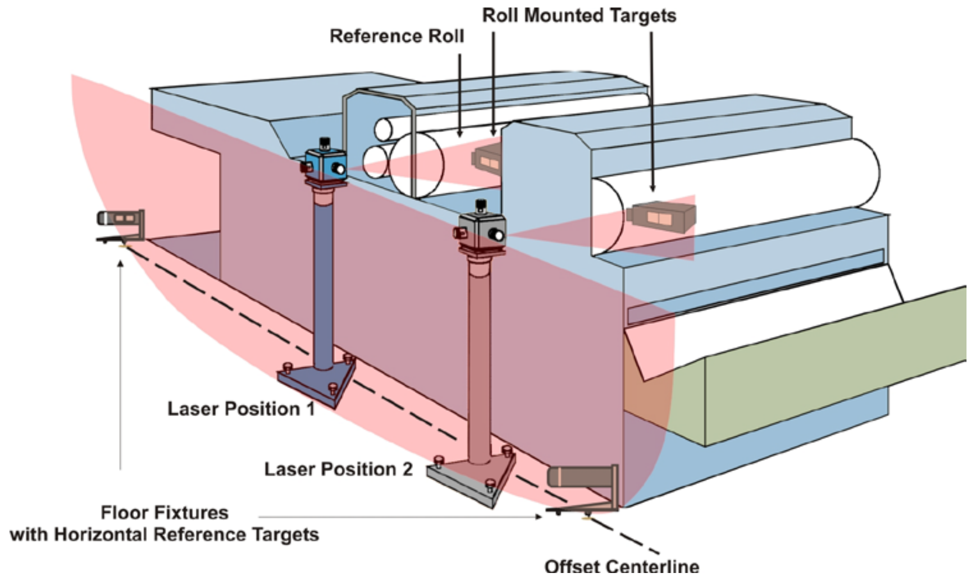


Figure 1 – *Dimensional view of roll alignment*

Choosing a Reference on Process Mills

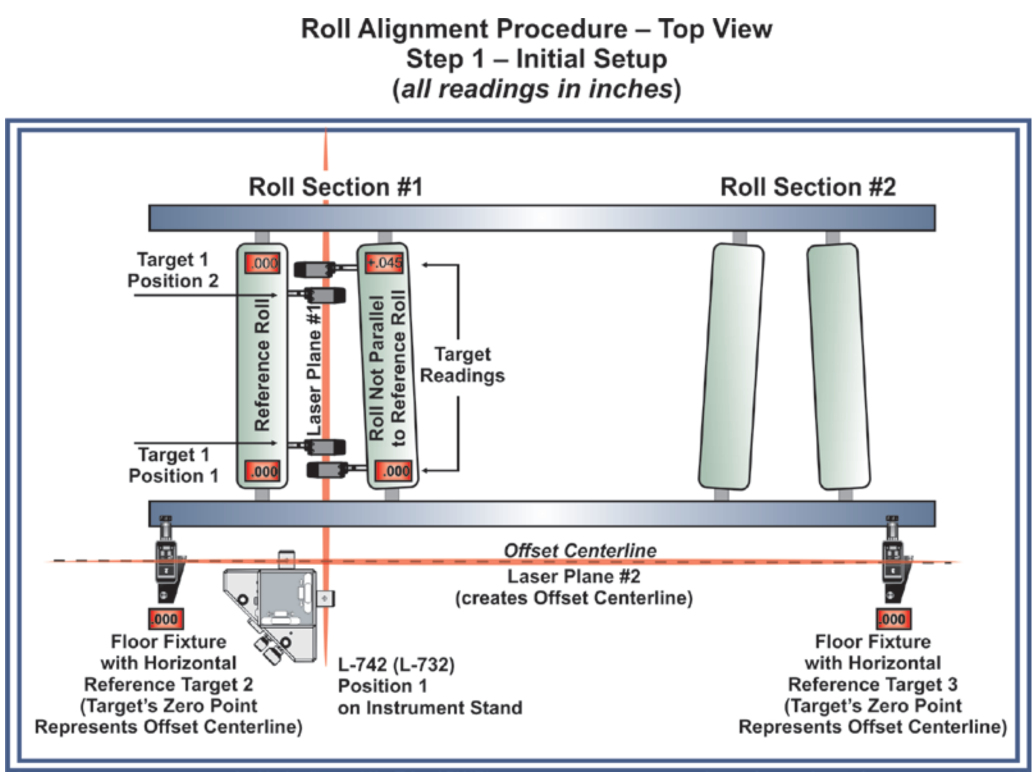
Conventional methods of roll alignment usually use floor benchmarks (monuments) at the side of the machine as references. The L-742W (or L-732W) offers the versatility of using these benchmarks or of picking up a reference roll, such as a cooch roll on paper mills. We strongly believe that using a reference roll provides the most accurate reference and results in better alignments.

Benchmarks are usually set in a thin concrete floor, are rarely covered, and are routinely run over and nicked. More importantly, they move with the slab of concrete and rarely hold their position relative to the mill itself. Most floors in a typical plant have multiple slabs and are usually cracked throughout, creating instability of the monuments. Unless checked every time they are used, the use of the benchmark probably will result in significant alignment errors.

The Procedure

Here's how the process works for picking up a reference roll: (keep in mind that using the L-742W or L-732W is like having 2 walls, both perpendicular to each other, 100 feet (30.5 M) in radius and very flat).

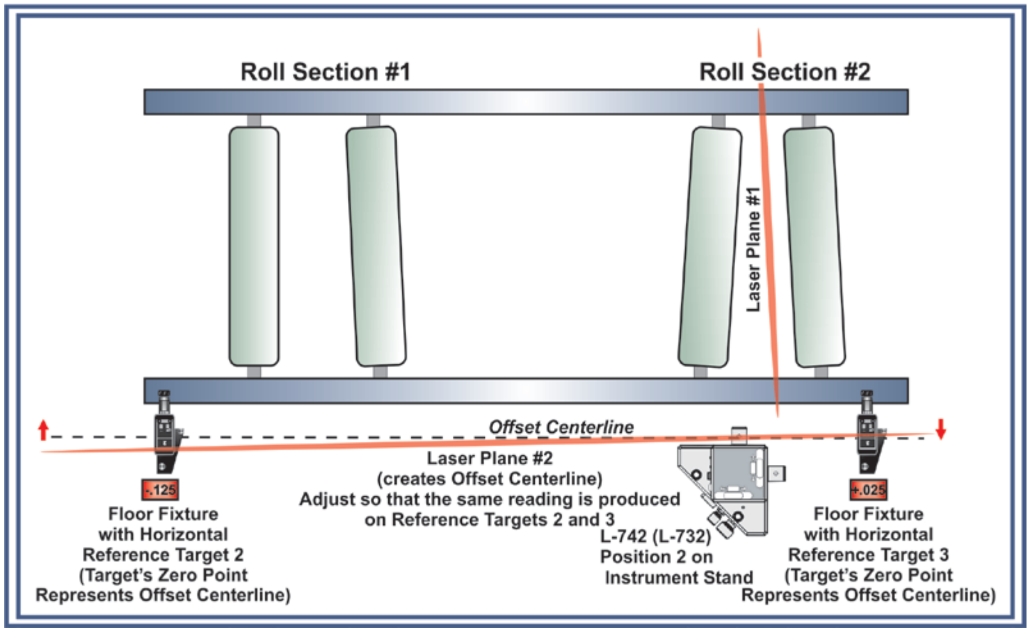
1. Place the laser on an instrument stand near the reference roll at the side of the machine and level it using the laser's level vials. Make the vertical laser plane approximately parallel to the reference roll using visual aids (see Figure 1 for a dimensional view and Step1 for a top view of the setup).



Step 1

2. Place one target horizontally on the reference roll at the closest point to laser. Mark the location on the roll. Adjust the height of the target on the magnetic base until the target detects the laser and zero the target. Move the target to the far end of the roll. Place a second target on the same point on the rolls that is closest to the laser and zero. Since both targets were zeroed at the same point on the roll, they become the reference points for the roll.
3. "Buck-in" or adjust the vertical laser until the same reading appears on the two reference targets. The laser plane is now parallel to the reference roll (see Step 1).
4. Since the laser is placed outside the machine and the second vertical laser plane is perpendicular to the first, the second laser plane, in effect, becomes the offset centerline of the mill. This offset centerline has a range of 100 feet (30.5 meters) on either side of the laser. To measure other rolls for parallelism, the offset centerline must be temporarily established by placing two reference targets, horizontally, either on floor fixtures (see Figure 2) or on the side frame of the mill (see Figure 1). The reference targets are zeroed, thus becoming the offset reference line and are not touched during the remainder of the alignment.
5. To check the parallelism of an individual roll, move the laser and stand along the offset centerline until the desired roll or section of rolls is reached. Position the laser to allow about 4-5" of horizontal space between the laser plane and the roll to be measured. The instrument is then leveled (see Step 2).

Roll Alignment Procedure – Top View
Step 2 – Laser Transfer
(*all readings in inches*)



Step 2

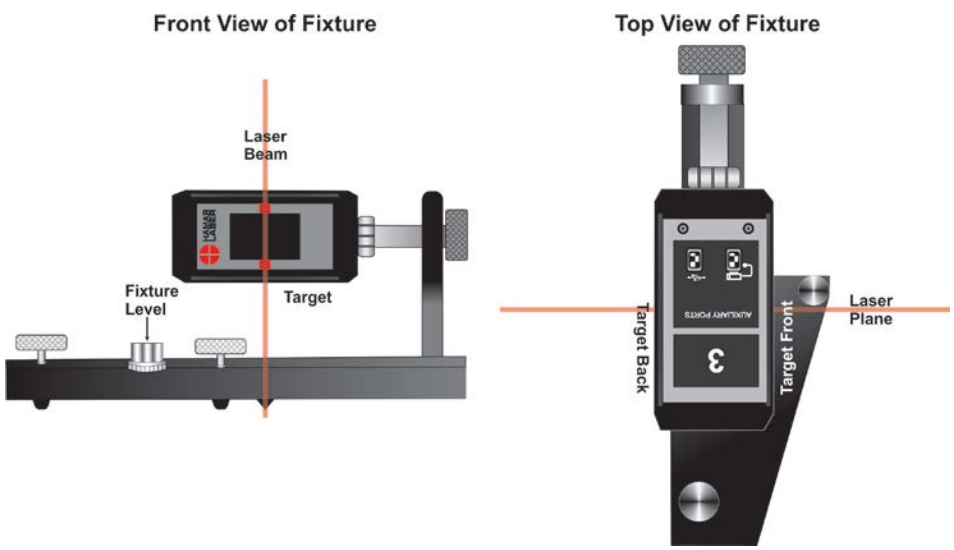
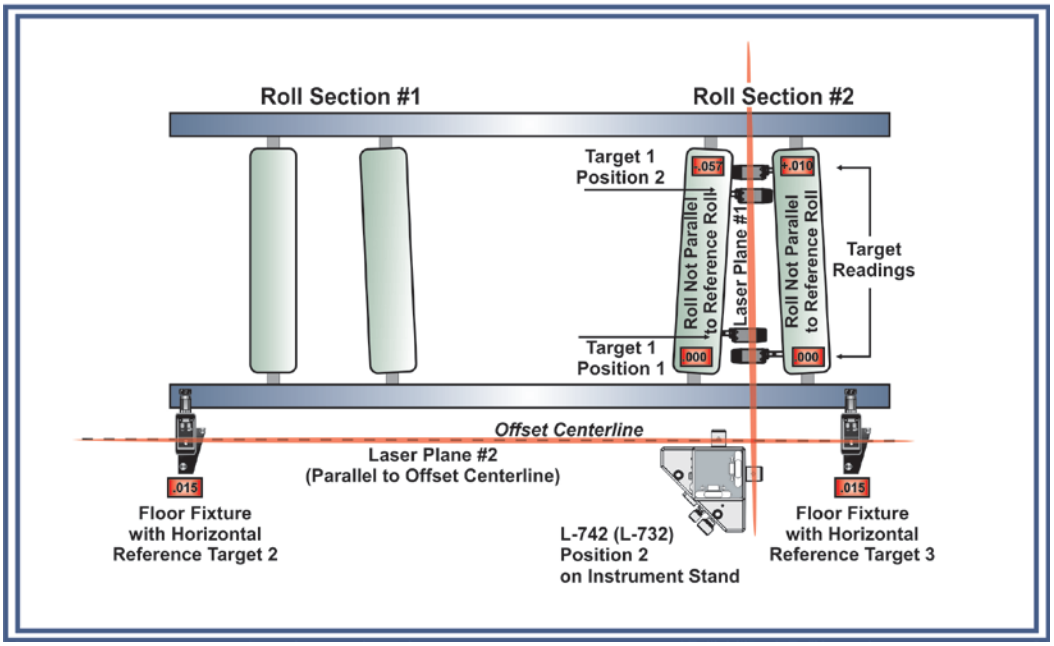


Figure 2 -- *Reference Targets Mounted on Floor Fixtures*

6. Use the yaw adjustment on the laser base to rotate Laser Plan #2 so that it is parallel to the offset centerline, using the temporary reference targets as guides. When the same reading appears on both reference targets, the laser is parallel to the centerline. This task has been greatly simplified by the R-1355-2.4ZB Readout (see Page 9) and the A-1519-2.4ZB Single-Axis Wireless Targets. The software subtracts one reference target reading from the other and displays the difference in a graphical format. Adjust the laser until the difference is zero and the laser is bucked in.
7. To measure a roll for alignment in the horizontal axis relative to the reference roll, place a target horizontally on the roll closest to the laser and zero. Move the target to the far end of the roll and measure the alignment (deviation from parallel shown in Step 3). Since the readings are live, the roll can then be adjusted until the target reads zero, which would mean the roll is aligned and parallel to the reference roll. Since the laser generates a plane, rolls at any elevation in that section that are within 2 feet (610 mm) horizontally of the laser plane can be measured for parallelism without changing the setup of the laser.

Roll Alignment Procedure – Top View
Step 3 – Roll Parallelism of Section 2
(*all readings in inches*)



Step 3

Leveling Rolls

For checking level on applications with multiple rolls in the same horizontal plane, the L-743 or L-733 must be used since they have a horizontal laser plane in addition to the two vertical planes of the L-742W or L-732W. The laser is leveled and a target is placed on one end of the roll and zeroed. The target is then moved to the other end of the roll and the deviation from level is measured. If both readings are zero, then the roll is level. If not, it can be adjusted using the target as an electronic indictor.

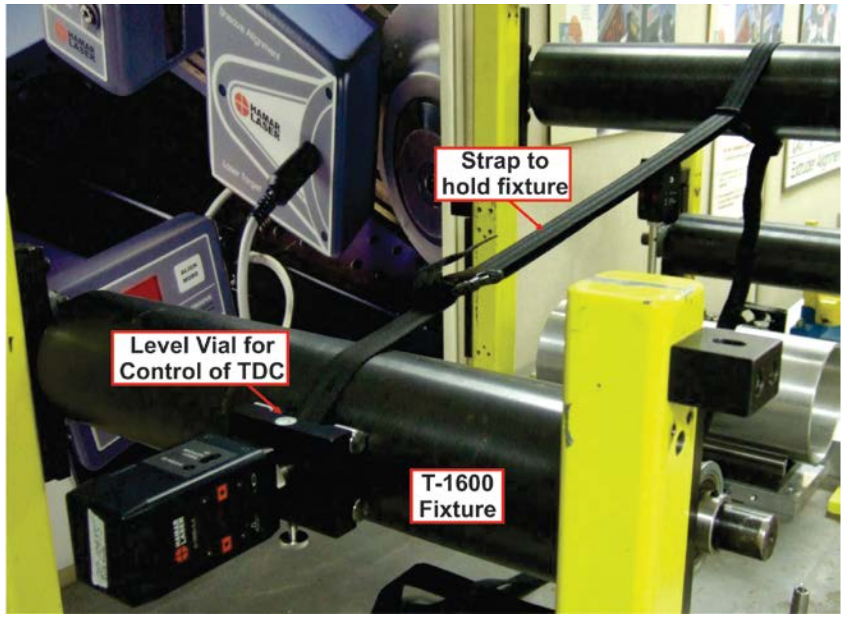
Checking Drive Shaft Alignment

To check the drive shaft alignment, the L-742W or L-732W is placed either at the end of the drive shaft or in the middle, depending on the how long it is. The horizontal plane is made parallel to the top of the closest drive shaft using vertically mounted targets and the vertical scan plane is made parallel to the side of the same shaft.

Each shaft is checked for parallelism to the reference shaft and aligned accordingly. To check a shaft for parallelism/colinearity, a target is moved from the reference shaft without re-zeroing, and two measurements are made, one at either end of the shaft. The difference between the two readings is the angle of the shaft relative to the reference shaft and the average is how far off center it is from the reference shaft. Up to 200 feet of drive shafts can be checked with one setup.

The T-1600 Non-Magnetic Roll Fixture for the A-1519-2.4ZB Targets

The T-1600 Non-Magnetic Roll Fixture is used for aluminum, rubber and stainless steel rolls. Also available is the T-1601 Tight Space Roll Fixture/Tram Bar, which uses two A-1519-2.4ZB Targets to measure alignment in tight spaces. The following procedure describes the setup and procedure for using the T-1600.

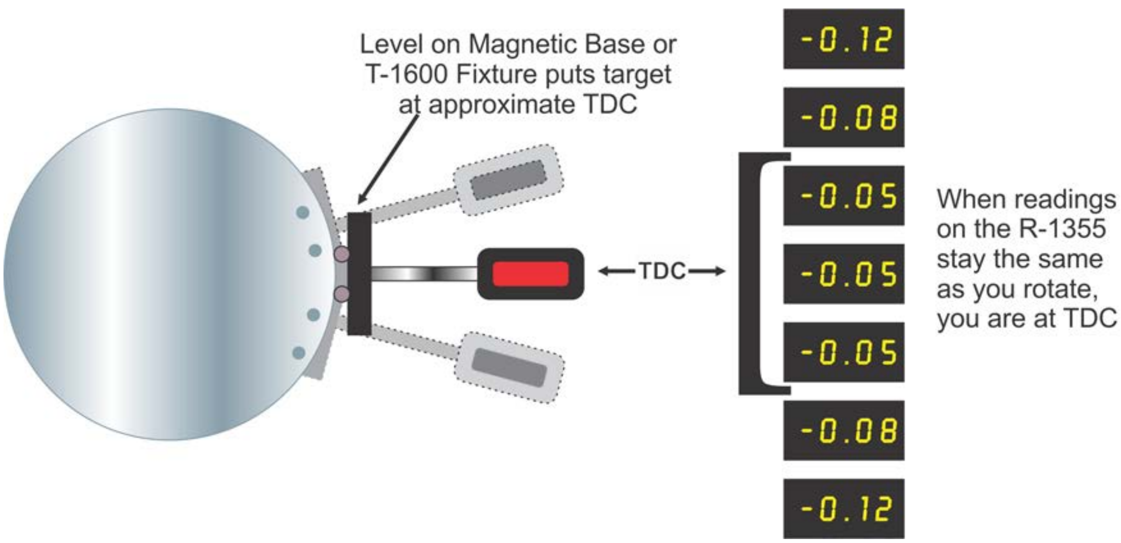


T-1600 Non-Magnetic Roll Fixture

Sweeping Through the Arc

Finding Top Dead Center (TDC) on rolls when using long target posts or when the roll diameter is greater than 2 feet (0.6 M).

Slowly rotate the roll (or slide the V-block mag base or T-1600 Fixture around the roll) and watch the display on the R-1355 Readout. The highest number (most +) will be at TDC and this is the measurement value to record.



TDC Procedure

Note that the level vials on the target mag base or the T-1600 Non-Magnetic Roll Fixture will find TDC for most applications where the roll diameter is less than 2 feet (0.6 M) and when the target post is also less than 2 feet (0.6 M). However, when performing roll alignments on large-diameter rolls or when using long target posts, use the Sweeping Through the Arc Method.

1. Set up the T-1600 and T-1601 as shown in the photograph (or set up the target magnetic base). Make sure that the level on the fixture is centered, indicating you are close to TDC.
2. If using the T-1600, slowly slide it around the roll while watching the R-1355 display. You will see the readings start to increase you get closer to true TDC. When you get to TDC, the readings will stay the same for a short time as you rotate the roll and then start to decrease as you pass TCD.
3. If using the mag base, slowly rotate the roll in the same manner. For large diameter rolls that do not rotate, you will need to slide the mag base in the same way as the T-1600 fixture.
4. The highest reading (most positive) will be at the TDC and this is the value to record.

The R-1355-2.4ZB Readout

The R-1355-2.4ZB Readout uses Hamar Laser's Read9 alignment software on a wireless, ruggedized PDA data receiver. The R-1355-2.4ZB can display data for up to eight A-1519-2.4ZB Single-Axis Wireless Targets, (four targets in two user-selectable screens) making multiple readouts unnecessary and allowing the user to perform many alignment functions with the convenience and portability of a handheld computer. The display screen shows a measurement value for each of the connected targets. Each value represents the position of the laser plane relative to the target centerline. A positive reading indicates that target is above the laser plane, while a negative reading indicates that the target is below the laser plane.

The Read9 software can toggle between **Absolute** (indicating exactly where the laser plane hits the target cell) and **Relative** modes. In Relative mode, the readout shows the measurement relative to the user-determined zero point. It also shows a display of the difference between two target measurements, a very useful feature for buck-in, roll alignment and angular measurements, and a graphical display of each target's position relative to the laser plane.

Read9 ALIGN Screen showing the difference between Target 1 and Target 2 relative to the laser plane.