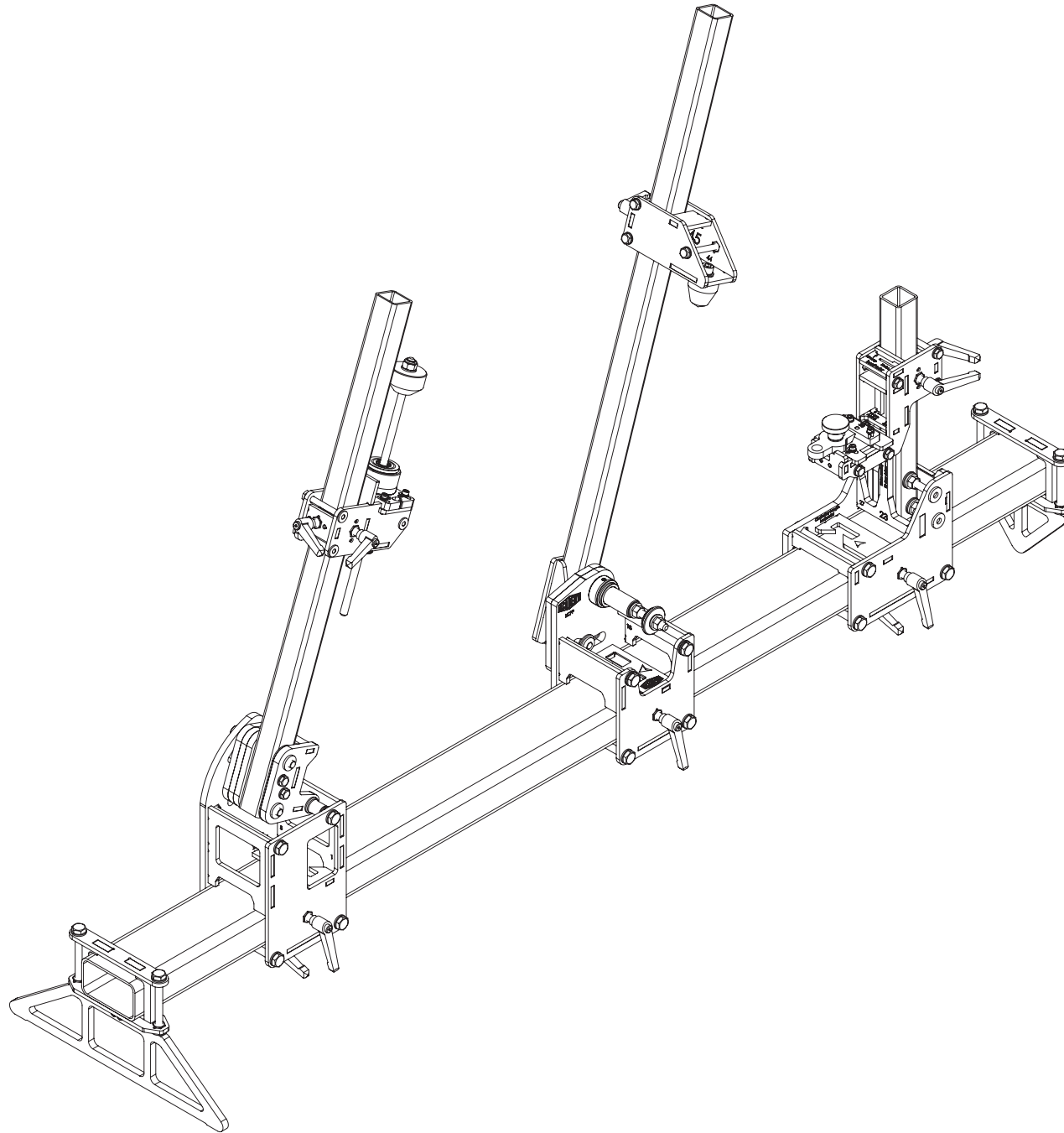




LCFF Setup & Calibration
Workshop Manual

LCFF 1.2



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Introduction

The Academy Tools Low Cost Frame Fixture (LCFF) provides affordability, accuracy and ease of use thanks to clever design.

Our proprietary User Calibratable Fixture Alignment System gives you the functionality you need to check and control the alignment of your frame fixture, independently at every interface, every time.

This has opened up some really exciting possibilities such as reduced manufacturing and production cost, flat-pack design, reduced shipping footprint and cost, user assembly & calibration and a huge and expandable build range. As a result the LCFF is the only fully functional low cost frame building fixture in existence.

Hollow Section Beams

The LCFF is designed to use globally available mild steel hollow section beams, of a range of sizes, manufactured to BS EN 10219 or ASTM A500.

These beams are commonly referred to as Rectangular Hollow Section (RHS) and Square Hollow Section (SHS).

Square - **38.1 mm (1.5") to 40 mm**
Rectangular - **100 mm to 101.6 (4") x 50.8 (2") to 60 mm**

Wall Thickness - **3 mm (0.125") (reccomended)**

See the assembly manual for full details, including section dimensions and lengths.

Mild steel hollow section beams are inherently not straight. Each length of beam will have a degree of bend and twist, within defined limits, this is a natural variation resulting from the beam manufacturing process. The Fixture Alignment System has been designed to accommodate these variations for the typical range of bicycle frame sizes.

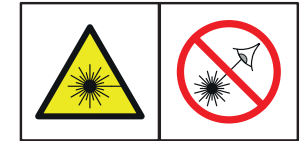
Important Calibration Note

Due to the variations in the beams it is necessary to calibrate the fixture for each frame geometry setup and every time a carriage is repositioned.

Calibration of the laser pointer in the laser holder is an essential first step before calibrating the fixture.

Laser Hazard

USE APPROPRIATE EYE PROTECTION.
DO NOT LOOK INTO THE DIRECT OR REFLECTED BEAM.
NEVER POINT ANY LASER TOWARDS AIRCRAFT OR VEHICLES; IT IS UNSAFE AND ILLEGAL.



THIS IS NOT A TOY.

Setup & calibration process summary

1. Set up the fixture to the desired bike geometry (p 3-9)
2. Take care to correctly tighten the carriages (p 5)
3. Calibrate the laser pointer in the laser holder (p 11)
4. Calibrate the Seat Tube, Head Tube and Rear Axle features (p 12-17)
5. Install the correct bb spacer, head tube adaptor and dummy axle (p 18-19)

Technical Documentation

1. Setup & Calibration Workshop Manual (included with your fixture)
2. Assembly Instructions (download)

PDF versions of both documents can be downloaded here:

<https://thebicycleacademy.org/pages/lcff-owners-manual>

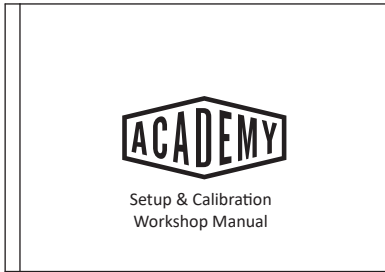


LCFF 1.2 Setup & Calibration
workshop manual v2

Page 1

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LCFF 1.2 - Crate Contents



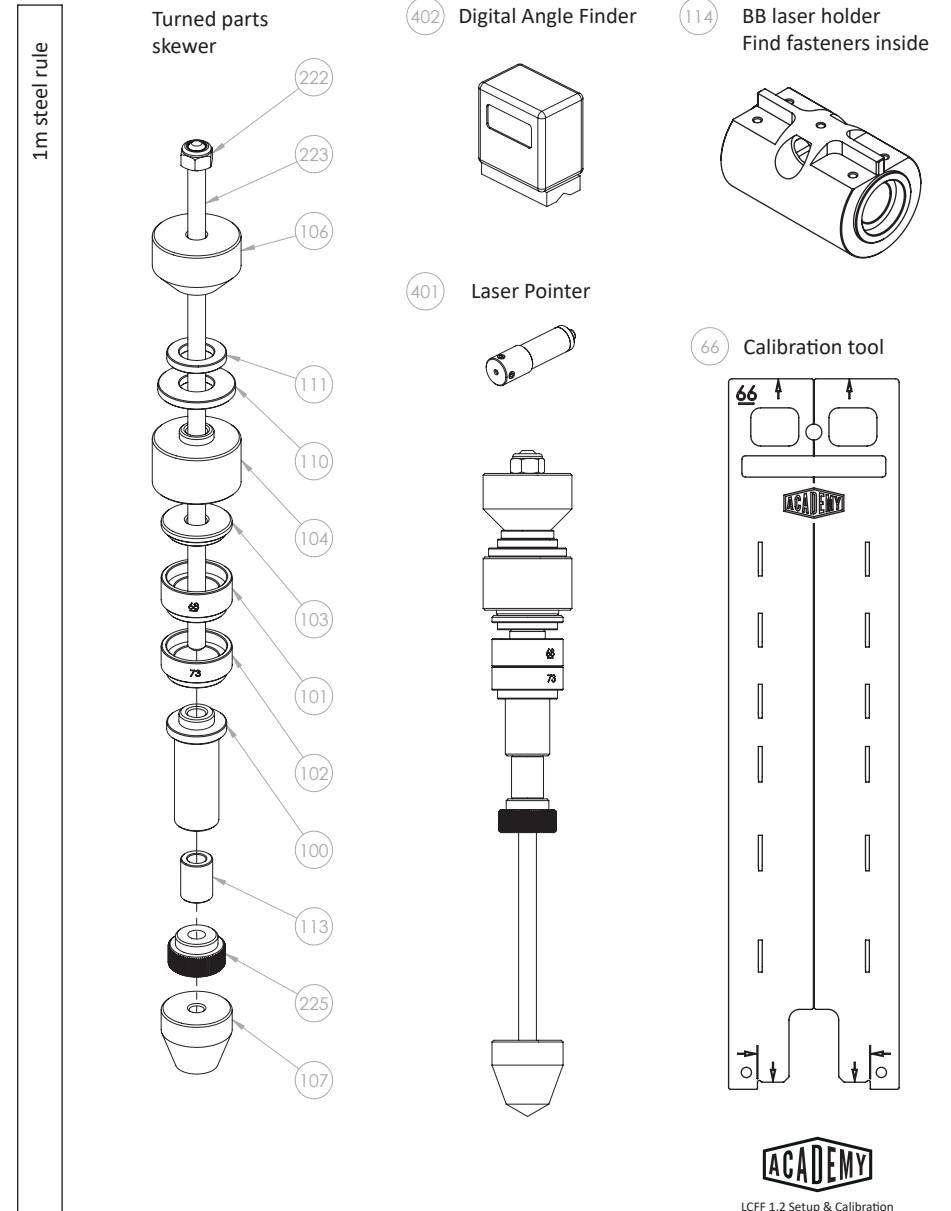
Laser cut part packs

Pack A Laser cut parts Main Beam Assembly	Pack B Laser cut parts Front Axle Carriage Assembly	Pack C Laser cut parts Bottom Bracket Carriage Assembly	Pack D Laser cut parts Rear Axle Carriage Assembly
Pack E Laser cut parts Head tube carriage Assembly	Pack F Laser cut parts Seat tube carriage Assembly	Pack G Laser cut parts Rear Axle Vertical Carriage assembly	

Fasteners & Fixings packs

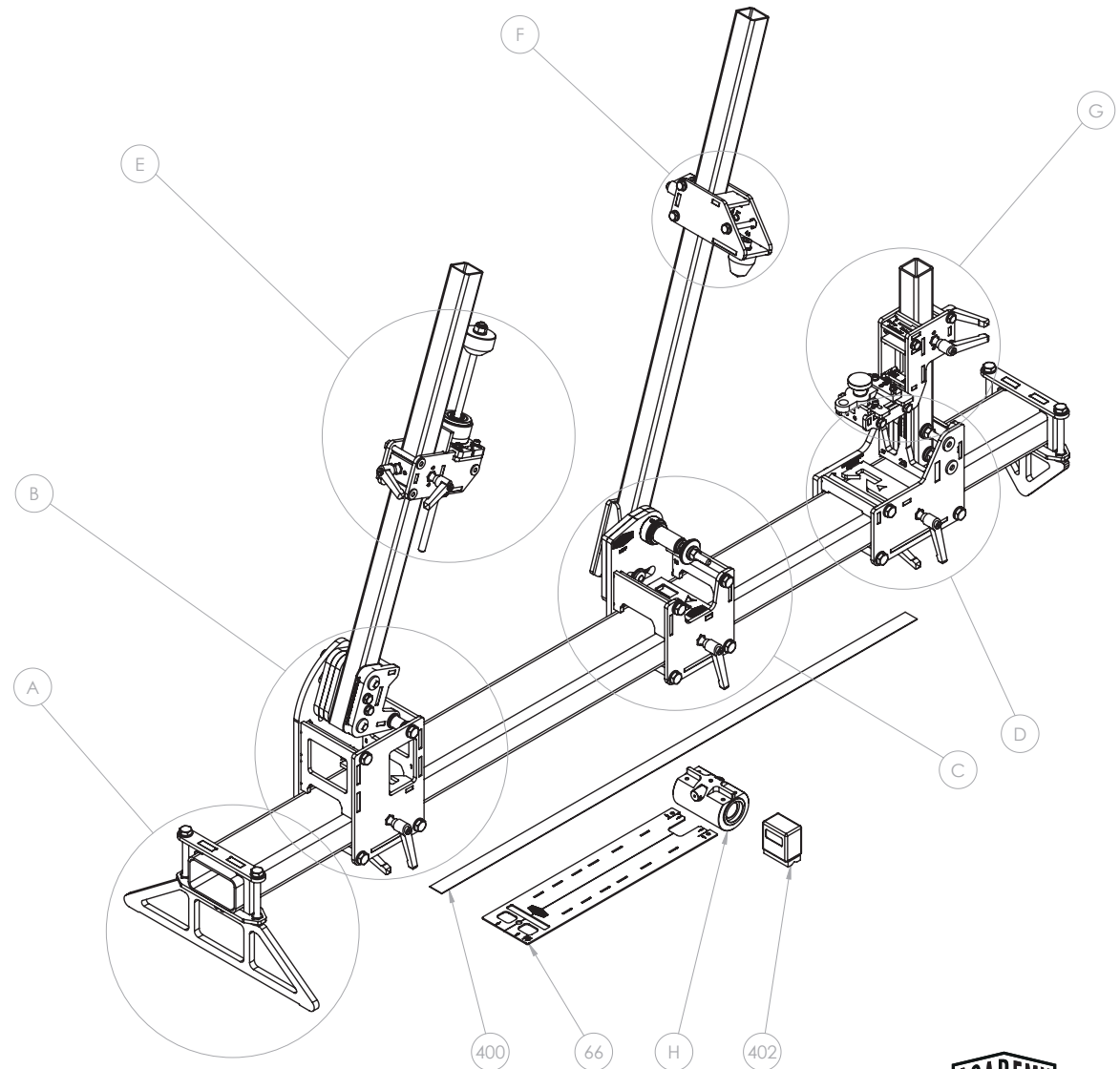
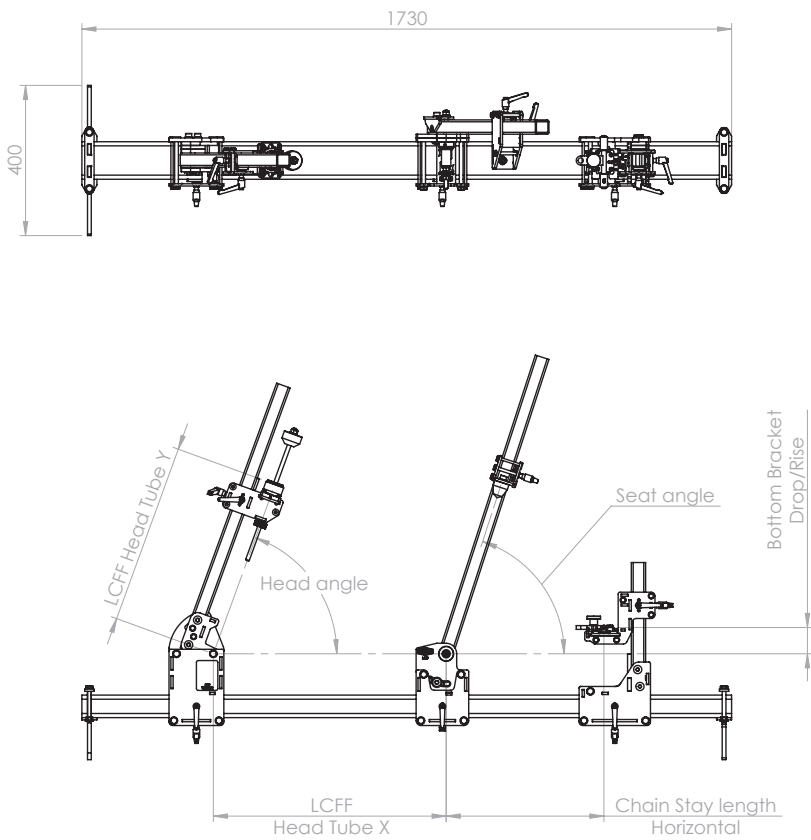
Pack A Fasteners & Fixings Main Beam Assembly	Pack B Fasteners & Fixings Front Axle Carriage Assembly	Pack C Fasteners & Fixings Bottom Bracket Carriage Assembly	Pack D Fasteners & Fixings Rear Axle Carriage Assembly
Pack E Fasteners & Fixings Head tube carriage Assembly	Pack F Fasteners & Fixings Seat tube carriage Assembly	Pack G Fasteners & Fixings Rear Axle Vertical Carriage assembly	Pack H Fasteners & Fixings Laser Calibration Assembly
Levers			

Loose Items

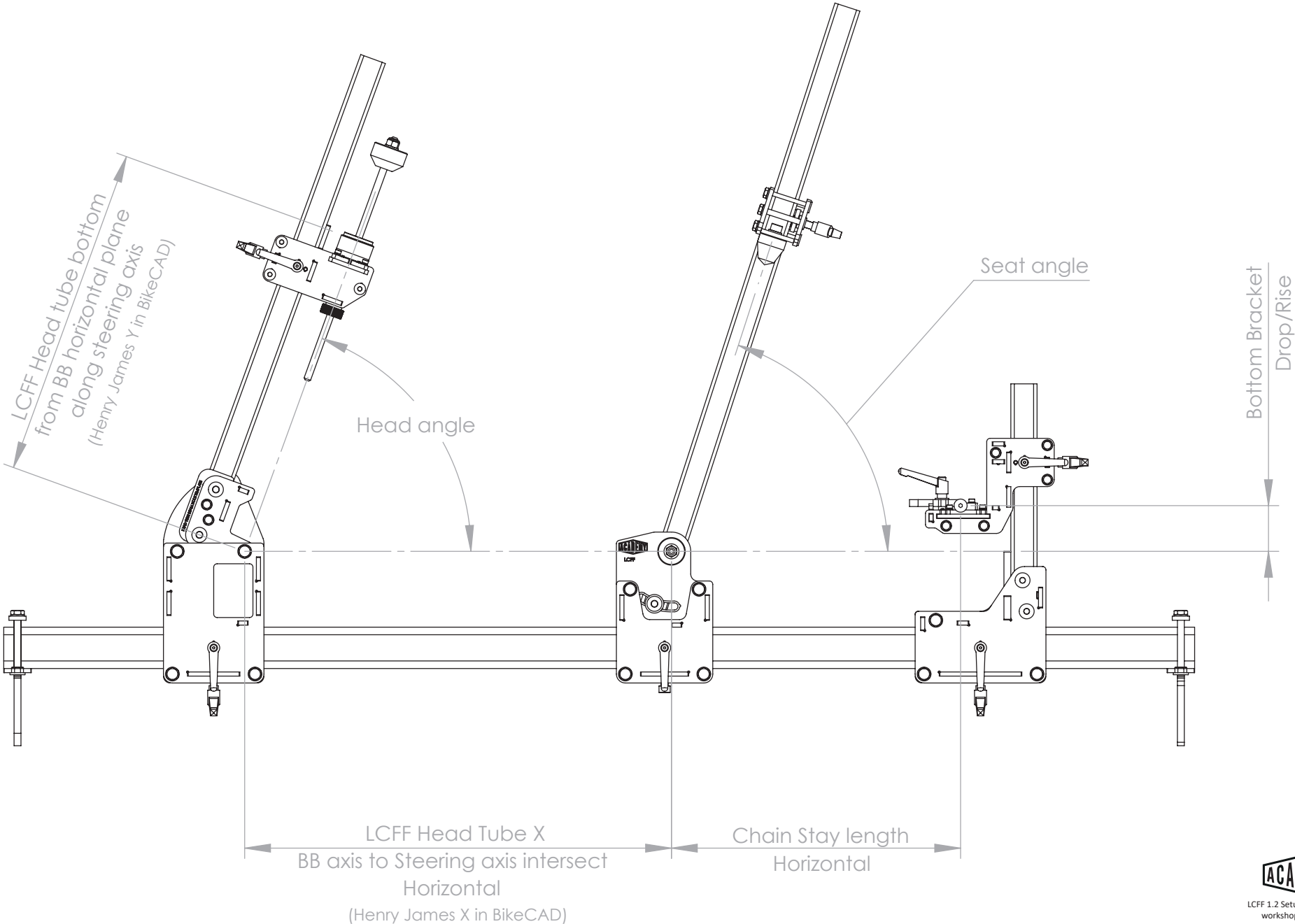


LCFF 1.2 - General Assembly

LCFF No.	Description	QTY.	Pack
A	Main Beam Assembly	1	A
B	Front Axle Carriage Assembly	1	B
C	Bottom Bracket Carriage Assembly	1	C
D	Rear Axle Carriage Assembly	1	D
E	Head Tube Carriage Assembly	1	E
F	Seat Tube Carriage Assembly	1	F
G	Rear Axle Vertical Carriage Assembly	1	G
H	Laser Calibration Assembly	3	H
66	Calibration tool	1	
400	Steel ruler 25 mm wide	1	
402	Digital angle finder	4	



Measurement System

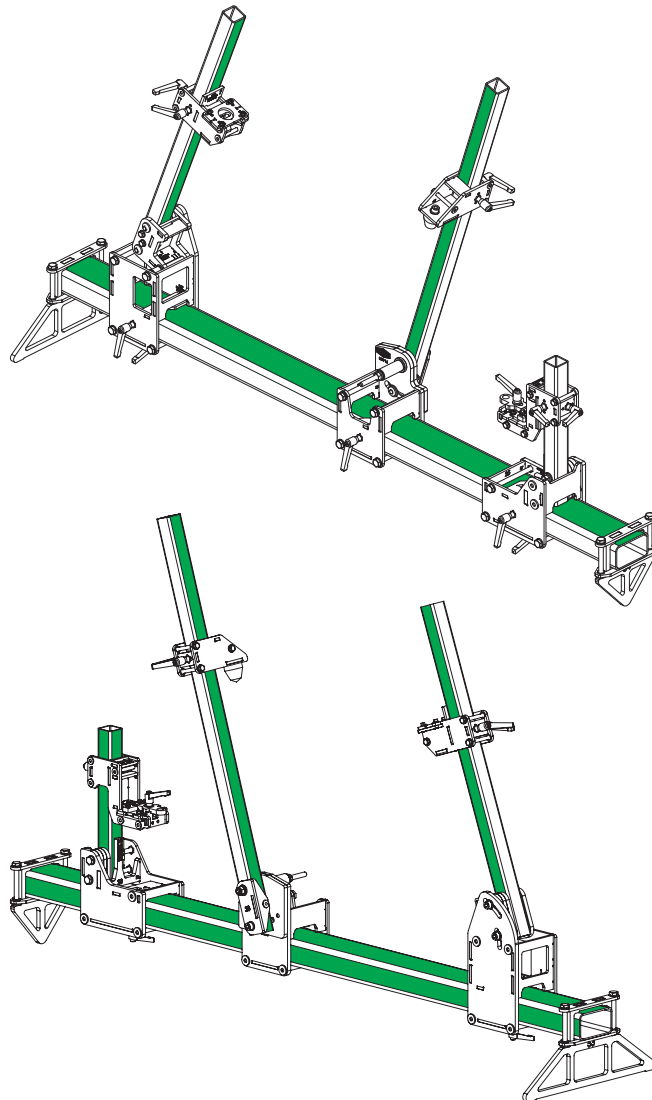


Carriage Datums & Clamping

Carriage Datums

Each carriage references two datum faces as highlighted in green.

When repositioning and securing the carriages it is important to ensure that they are referencing the datum faces correctly.



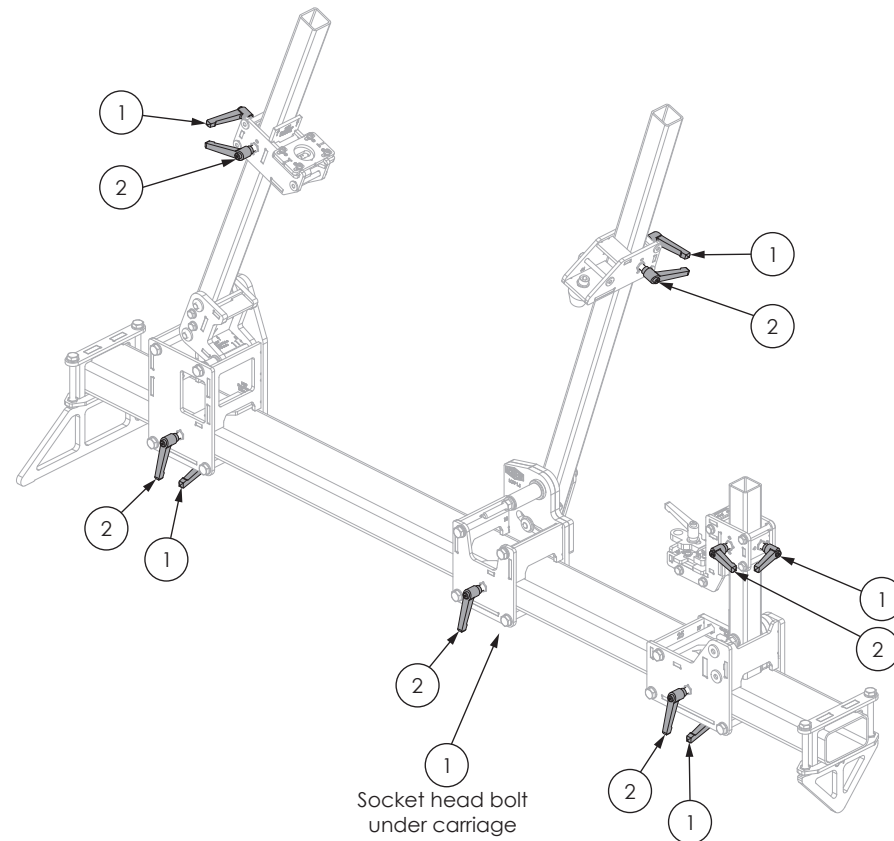
Clamping Order

When securing the carriages, the order and torque applied to the lever or bolt can have a significant impact on whether the carriage correctly references the datum faces of the beam.

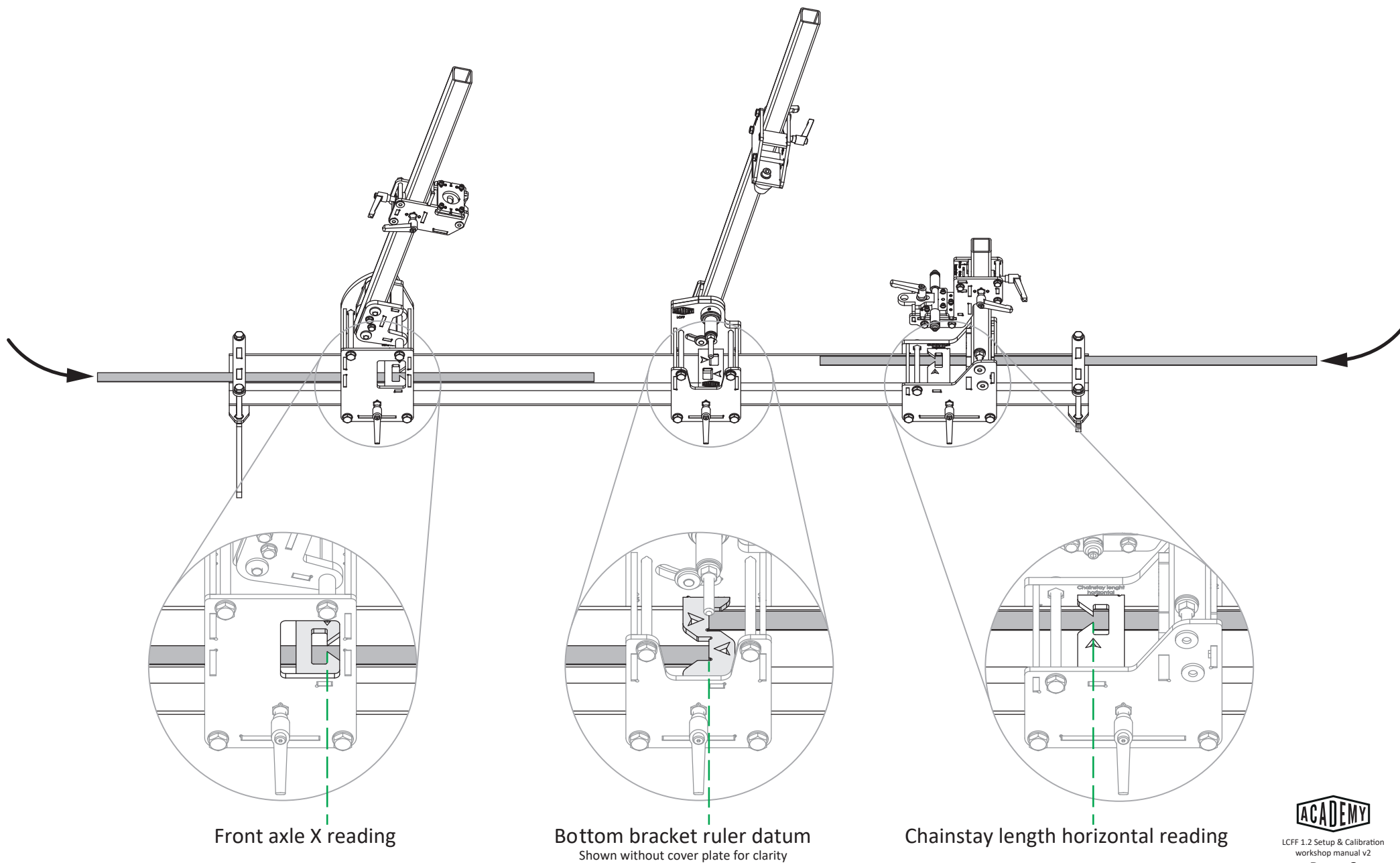
For each carriage, the first clamping lever (or bolt) should be tightened just enough so that the carriage is pulled up against the corresponding datum face.

The second lever should then be tightened so that the carriage pulls up against the second datum face and also locks the carriage in place.

If the first lever (or bolt) is overtightened, the carriage will not be able to move to reference the second datum face.

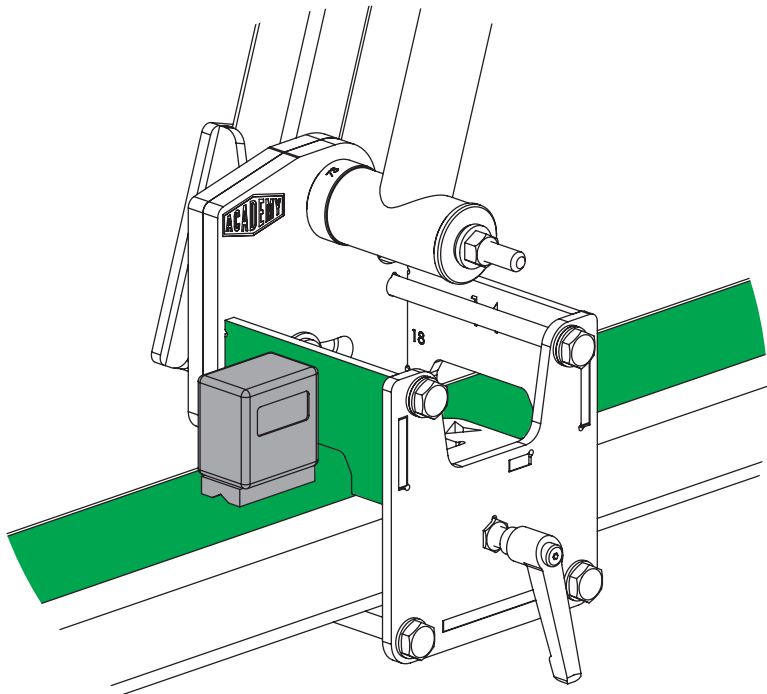


Head Tube & Rear Axle X Setting

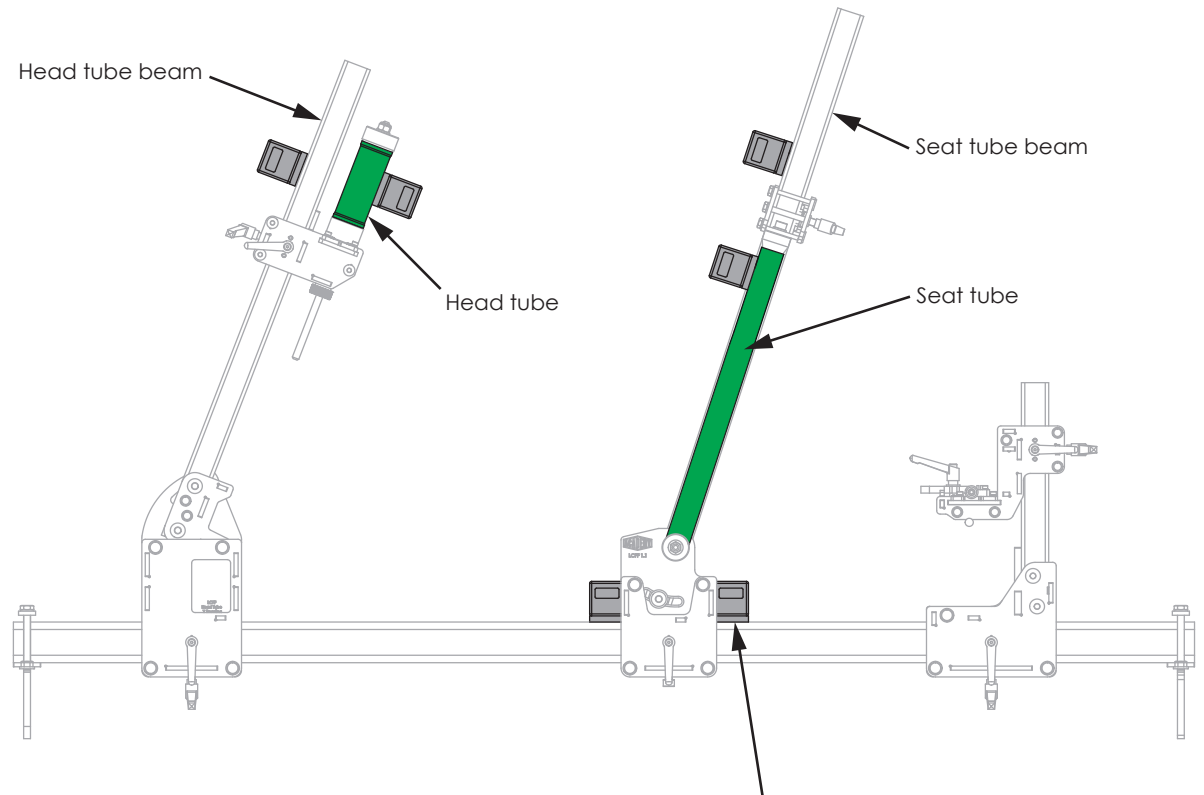


Angle Measurement Using Digital Angle Gauge

1. Position the angle finder as shown, so that it references the main beam and BB carriage datum faces highlighted in green.
2. Ensure there is no debris on the beam and on the magnetic v-base of the angle finder.
3. Zero the readout.



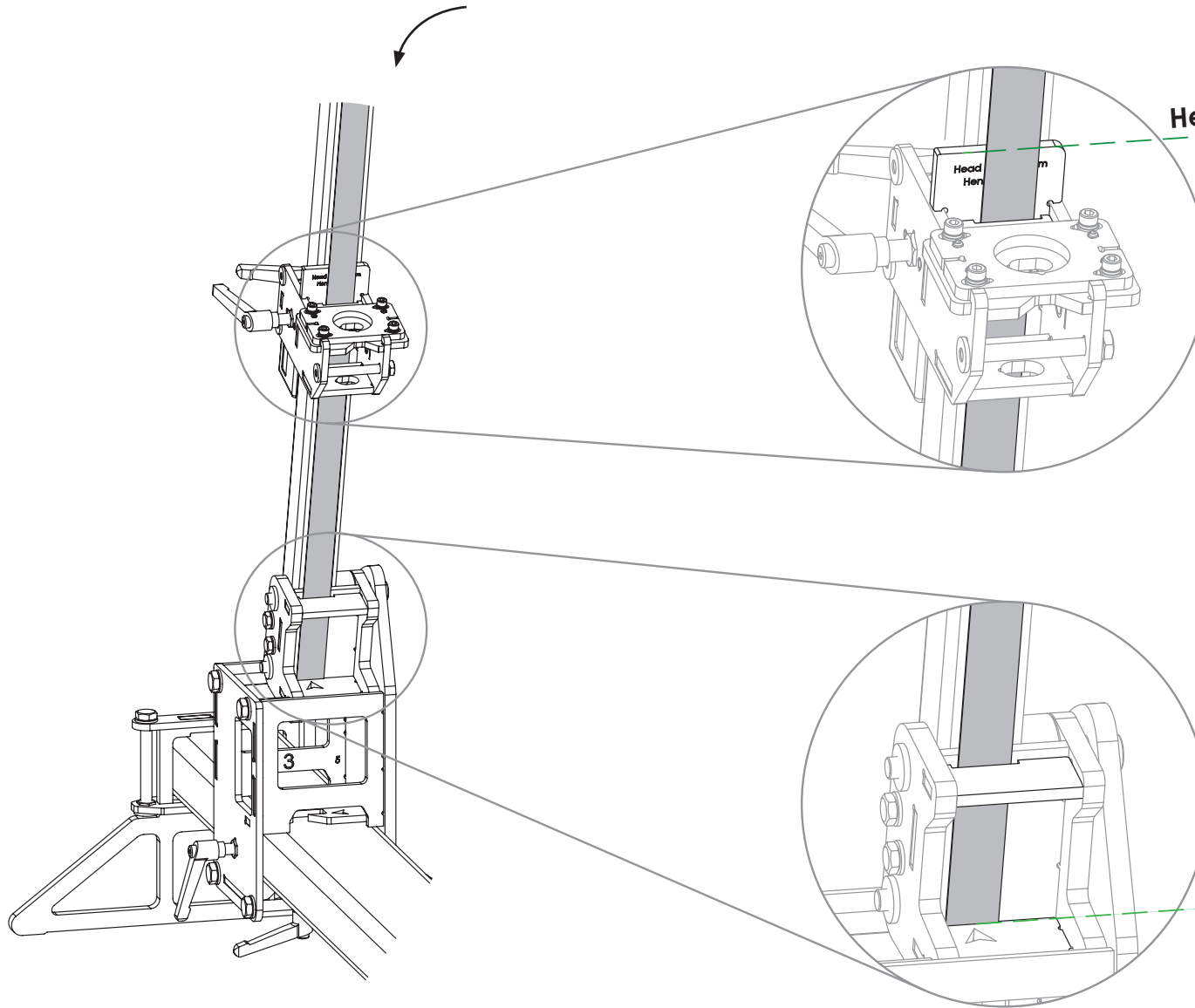
4. Transfer the angle finder to the head tube or seat tube beam as required.
5. Do not flip the device 180 degrees (note the readout window is facing the same way as when it was set to zero)
6. Ensure the front face of the angle finder is still parallel to the main beam side datum to take the reading.
7. To ensure the accuracy of the setup (and head tube roll calibration) load a head tube and seat tube into the fixture and check the angles again by positioning the angle finder on these tubes accordingly.



Alternative position for angle finder when fixture is mounted in LCFF stand



Head Tube Y Setting



Head tube Y reading

Insert the steel ruler as shown.

Push the ruler against the back plate if necessary to reduce parallax.

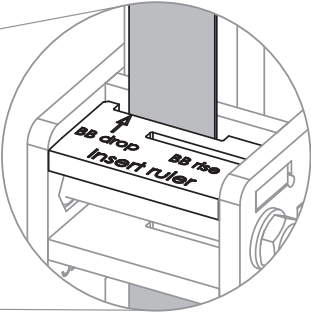
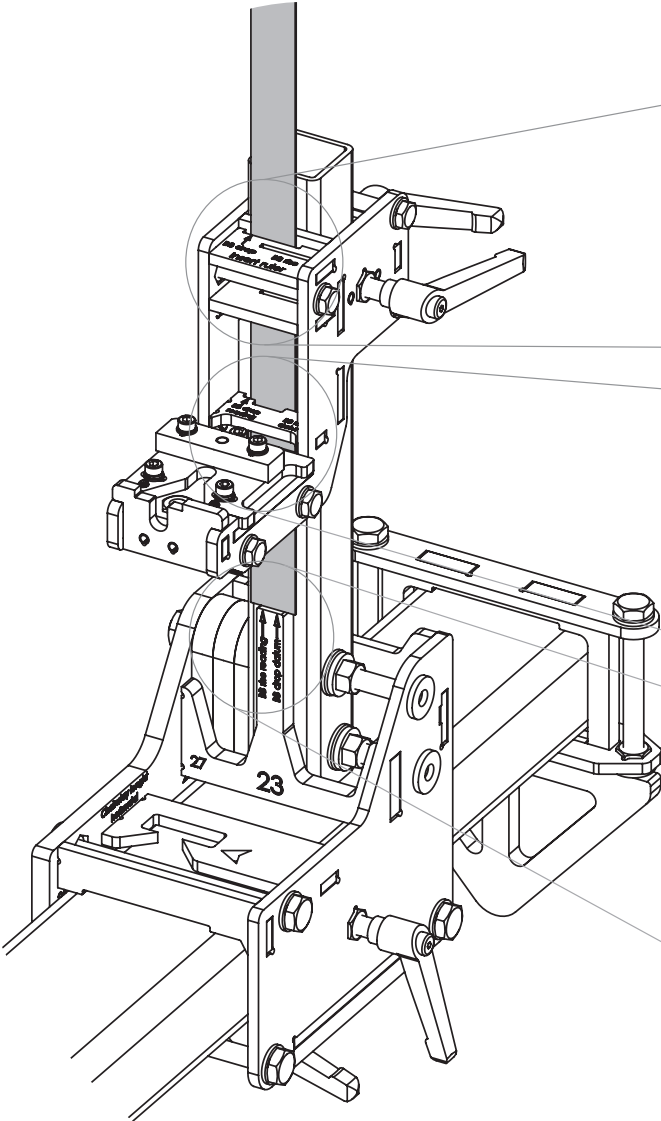
Ensure the steel ruler references the datum plate as shown.

If necessary push the ruler back against the back plate, in the direction of the laser cut arrow.

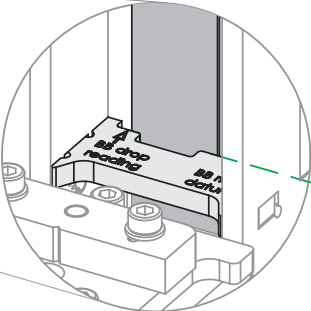
Head tube Y datum



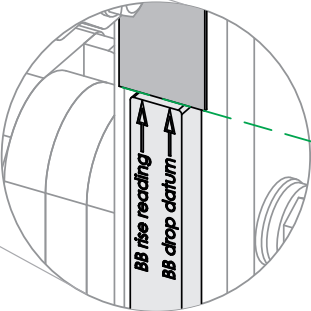
Rear Axle Height Setting - BB DROP



Insert the steel ruler through BB drop slot as shown.



BB drop reading

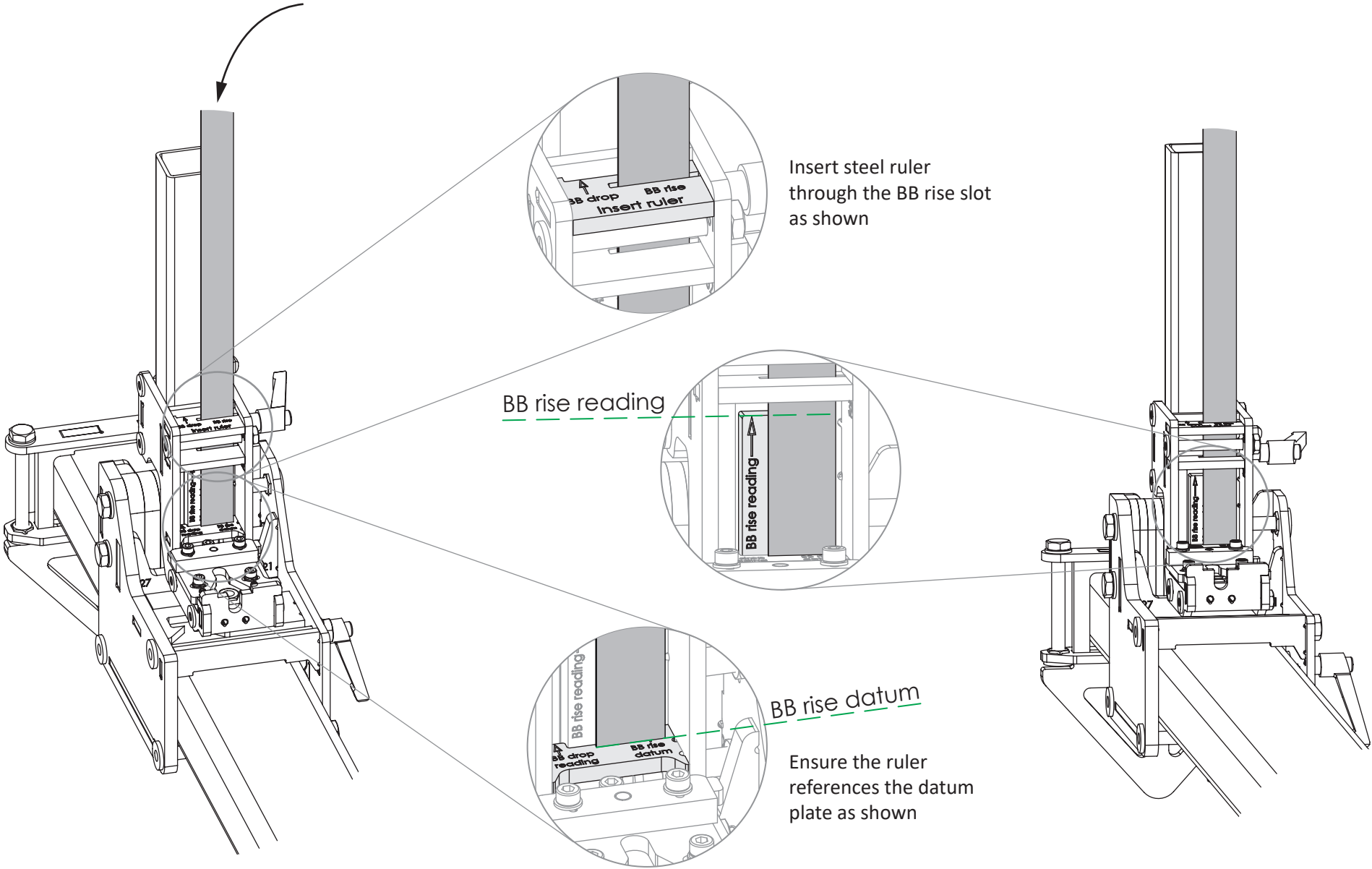


BB drop datum

Ensure the steel ruler references the datum plate as shown.

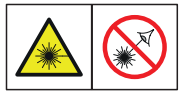


Rear Axle Height Setting - BB RISE

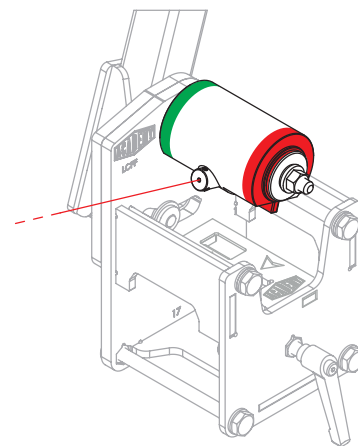
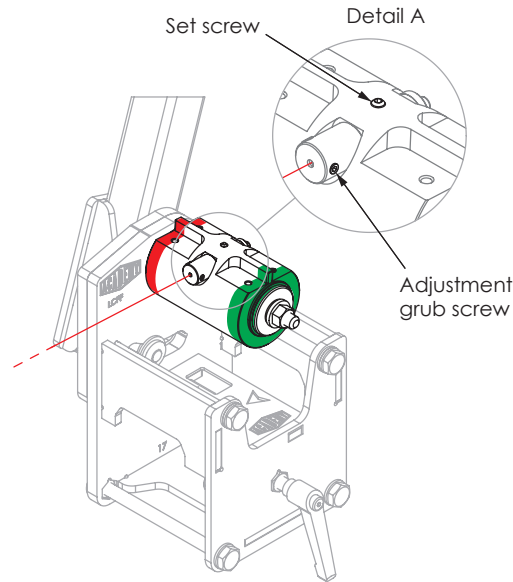
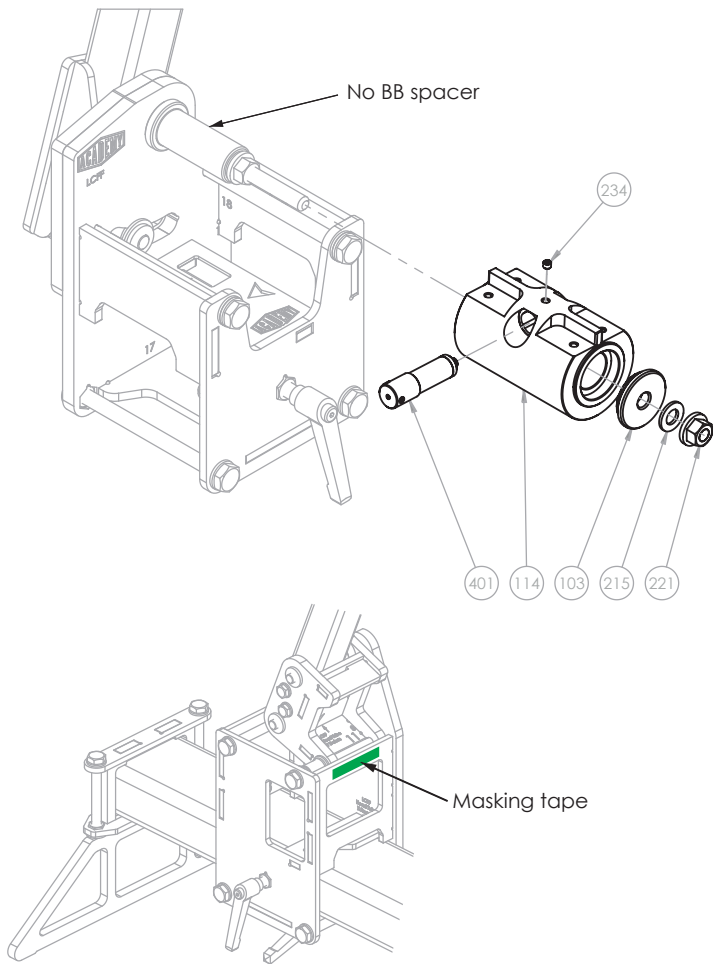


Laser Pointer Calibration -

This ***ESSENTIAL*** process validates that the laser is projecting perpendicular to the BB axis



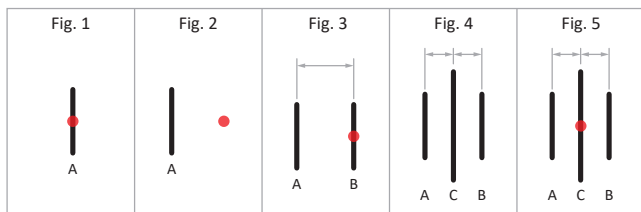
Ensure the laser holder is securely clamped with a consistent force each time a measurement is taken.



1. Install the laser pointer into the BB laser holder with one adjustment grub screw aligned horizontally as shown in detail A and secure in place with the top set screw.
2. Position and secure the head tube carriage as far away from the BB carriage as possible. Apply some masking tape to the head tube carriage as shown.
3. (Fig. 1) - Turn the laser on and position the laser holder so that the laser dot strikes the masking tape. Clamp the laser holder in place with the nut and mark a vertical line through the centre of the dot (A). Turn the laser off.
4. (Fig. 2) - Without removing the laser from the holder, or making any adjustment to the grub screws; re-orientate the BB laser holder as shown. Switch the laser on and adjust the rotation of the holder so that the laser strikes the masking tape at roughly the same elevation as the first mark.
5. (Fig. 3) - Mark another vertical line where the laser strikes the tape (B). It is important that the head tube carriage has not moved since making the first mark.
6. (Fig. 4) - Measure the distance between the marks and make another vertical mark half way between (C).
7. (Fig. 5) - Adjust the horizontal grub screw on the pointer so that the laser strikes the central mark.
8. Return the BB laser holder to its original orientation and repeat the process so that you are satisfied that the laser strikes in the same place with the holder in both orientations.

Laser pointer calibration schematics

Direction and extent of initial error will vary

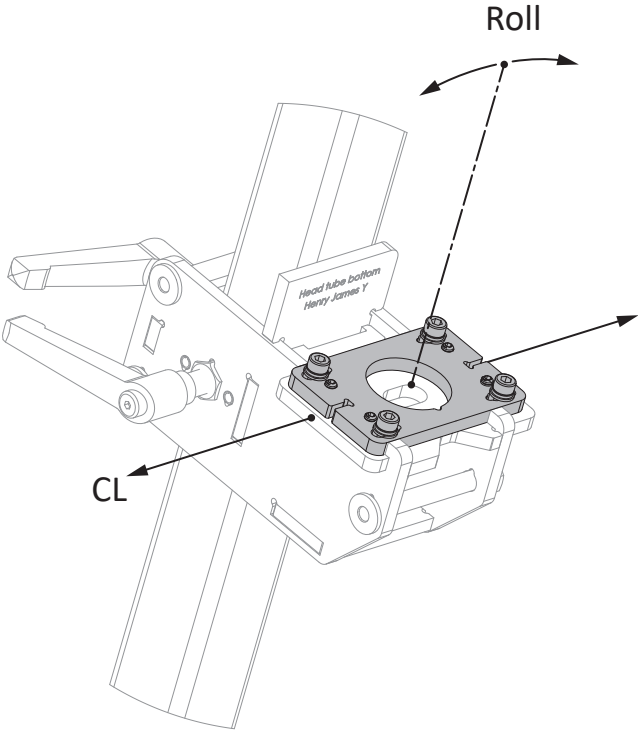


This ***ESSENTIAL*** process verifies that the laser is projecting perpendicular to the BB axis.

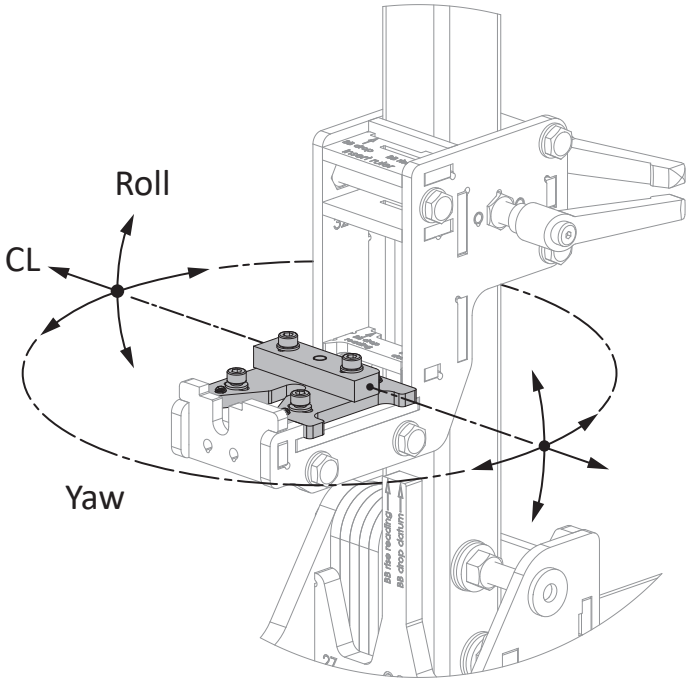


Degrees of freedom that enable fixture calibration

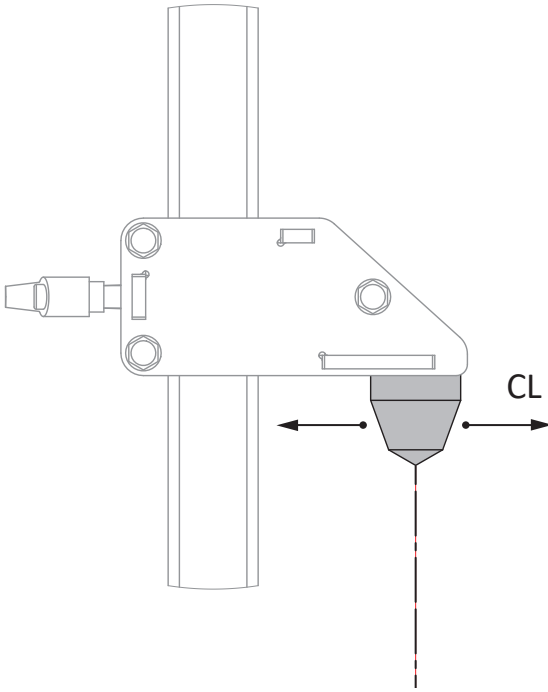
Head tube centre line & roll



Rear axle centre line, roll & yaw



Seat tube centre line



Correct Grub Screw Adjustment

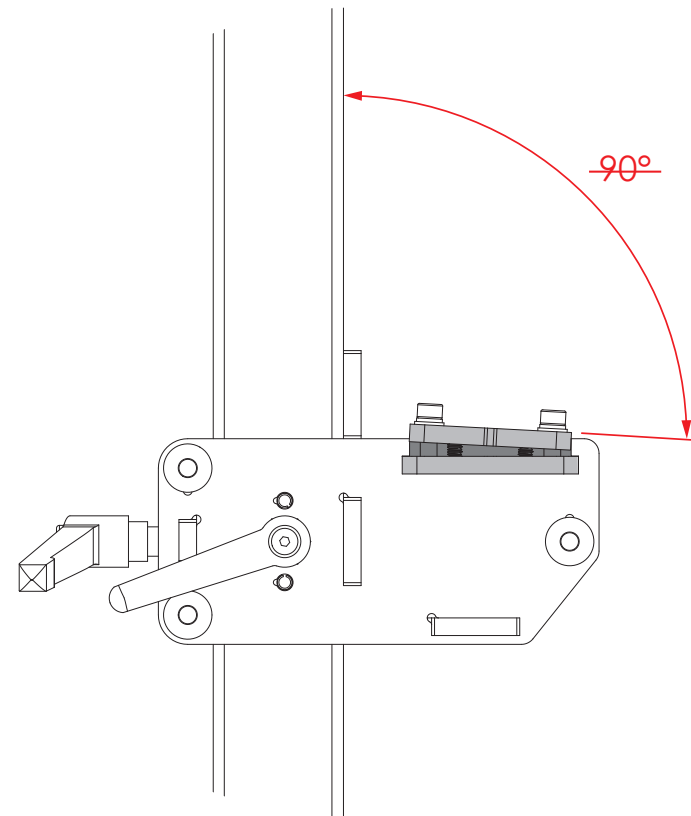
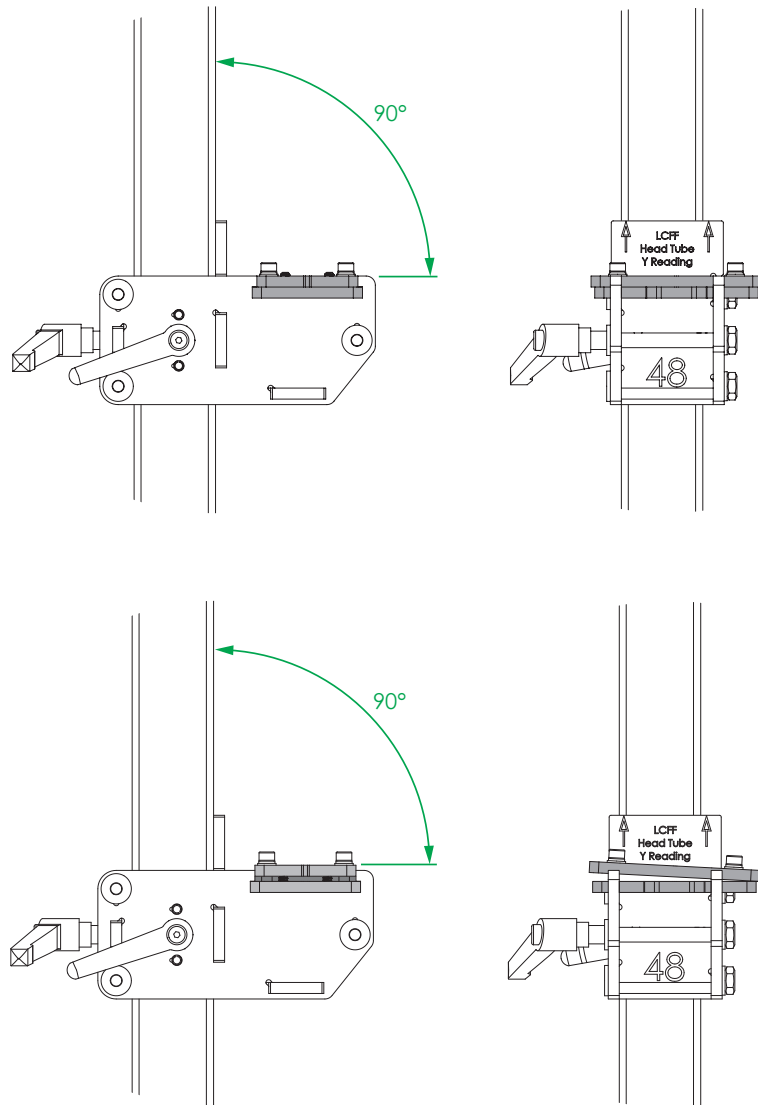
(applicable on head tube carriage & rear axle vertical carriage)

Correct adjustment - grub screws adjusted equally on each side

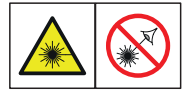
Incorrect adjustment - grub screws adjusted unequally

Ensure that any roll adjustment maintains the 90° relationship between the reference plate and the beam.

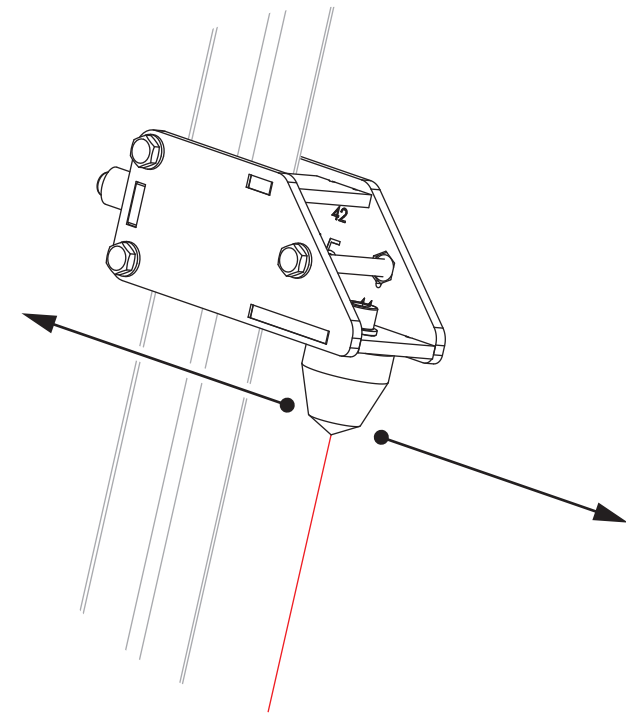
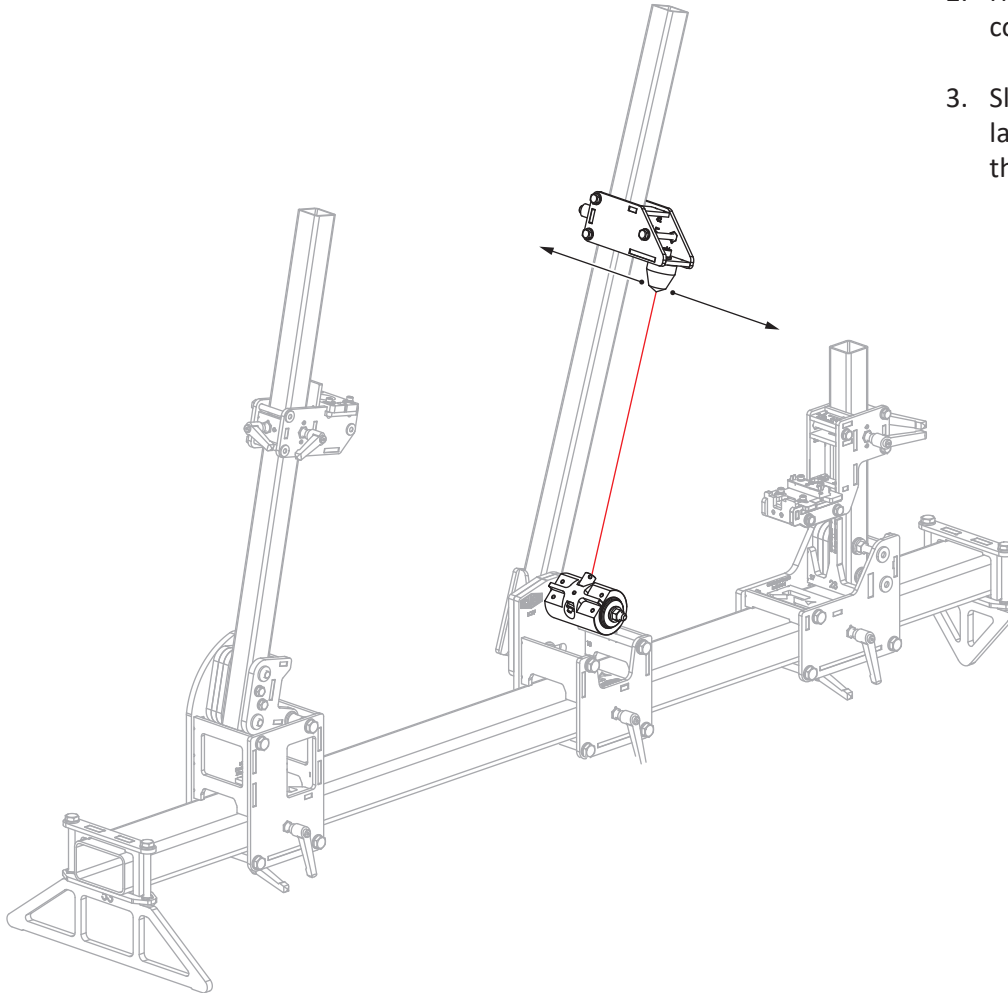
In the case shown below, there would be a discrepancy in Head tube X dimension and top tube length.



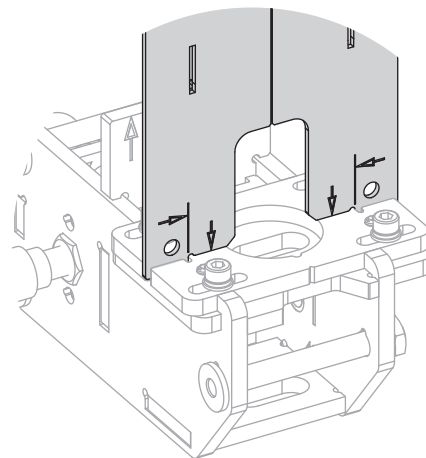
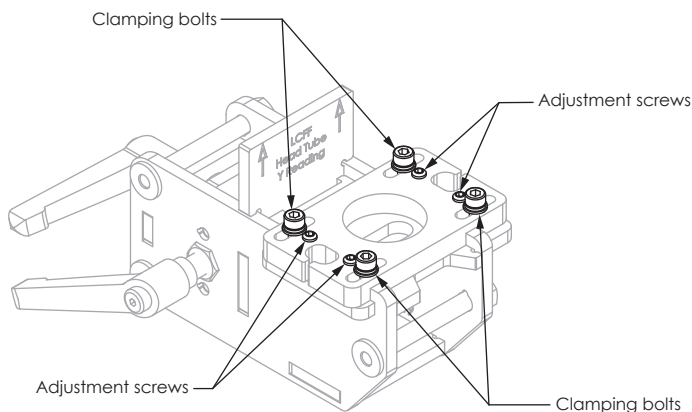
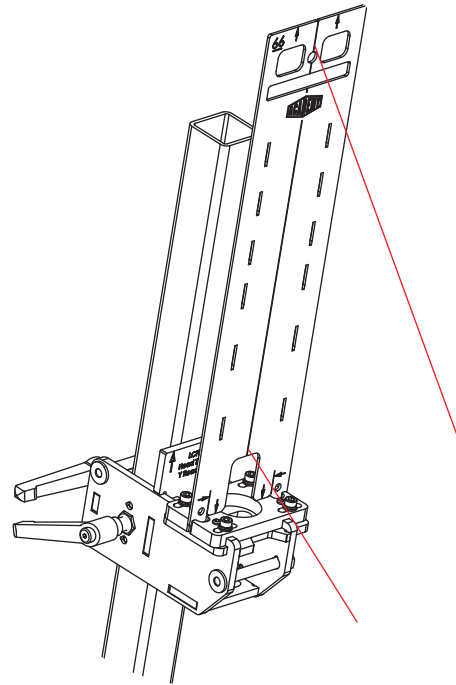
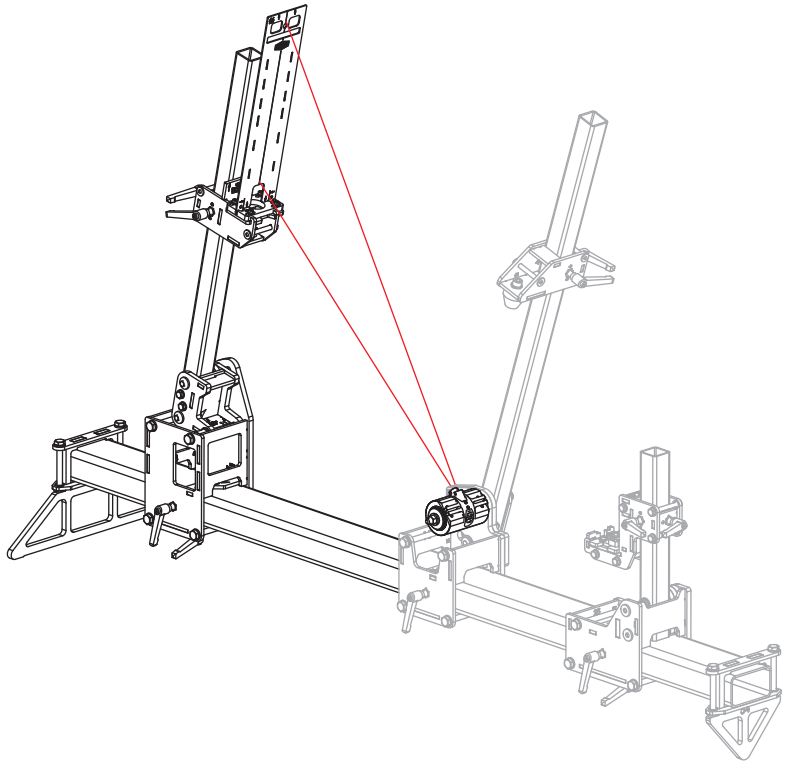
Calibration Step 1 - Seat Tube Centre Line



1. Set the fixture seat angle and cone height for the planned frame build.
2. Having calibrated the laser pointer (see page 11) aim the laser at the tip of the seat cone and secure the laser holder with a nut.
3. Slacken the seat cone using the hexagon socket head bolt and slide the cone until the laser strikes the very tip. This position will be highlighted by an even light scatter on the cone.

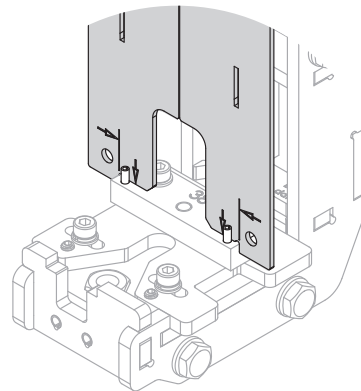
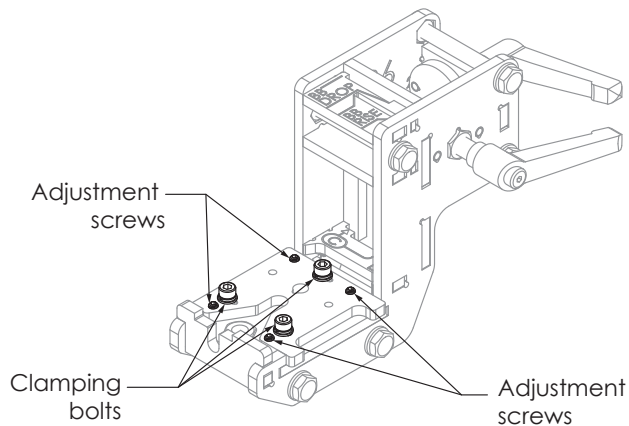
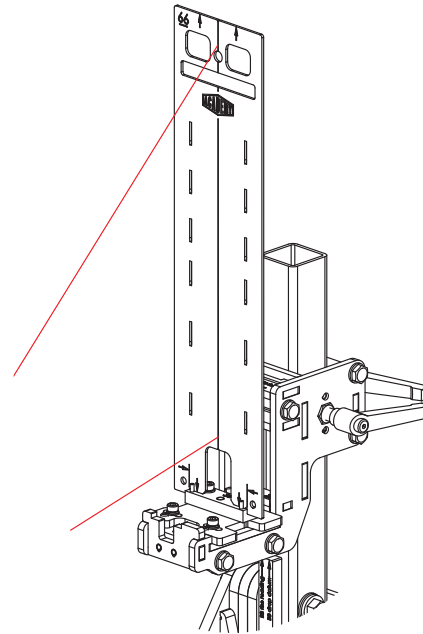
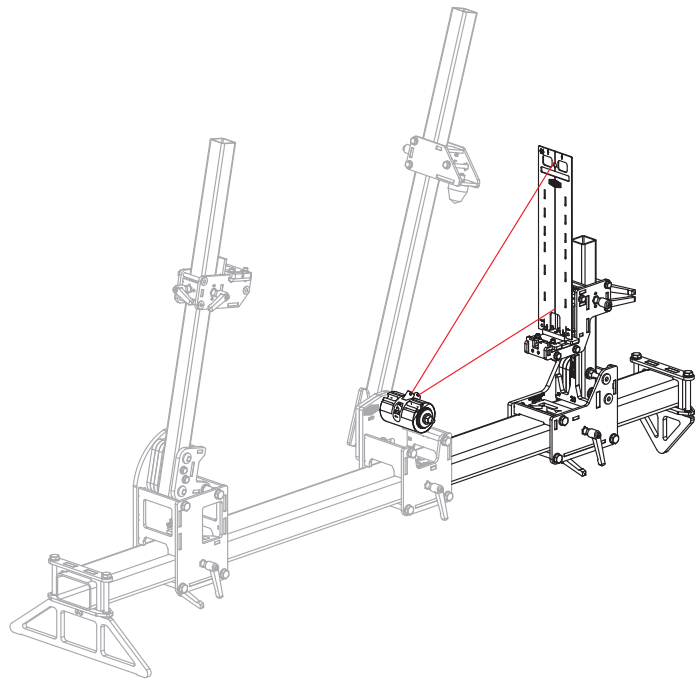
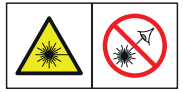


Calibration Step 2 - Head Tube Centre Line & Roll



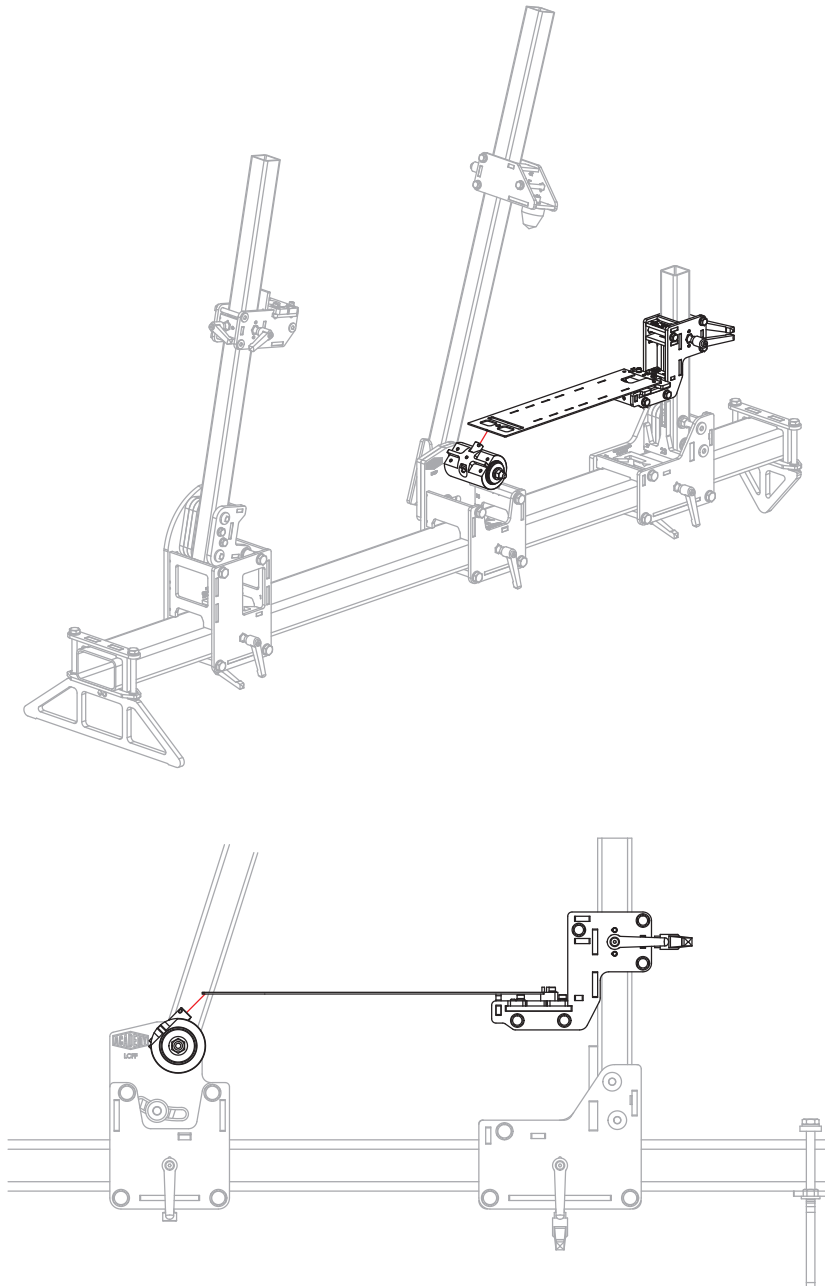
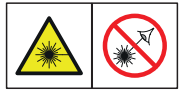
1. Set the fixture head tube X, Y and angle for the planned frame build.
2. Insert the laser calibration tool as shown and ensure it is referencing the head tube plate correctly.
3. Having calibrated the laser pointer (see page 11) aim the laser at the lowest point on the calibration tool and secure the laser holder with a nut.
4. Slacken the 4x M5 clamping bolts to allow the head tube plate to slide and align the centre line of the calibration tool with the laser dot.
5. Aim the laser at the top of the calibration tool and secure the laser holder with the nut again.
6. Evenly adjust the grub screws on one side to align the calibration tool centre line with the laser dot. Take care to adjust both grub screws (see page 13).
7. Aim the laser at the base of the tool again, secure and slide the head tube plate if required. Tighten the 4x clamping bolts evenly - **DO NOT OVER TIGHTEN.**
8. Repeat the process until you are satisfied that the laser strikes the calibration tool centre line in both positions shown with the 4x clamping bolts tightened - **DO NOT OVER TIGHTEN.**

Calibration Step 3 - Rear Axle Centre Line & Roll

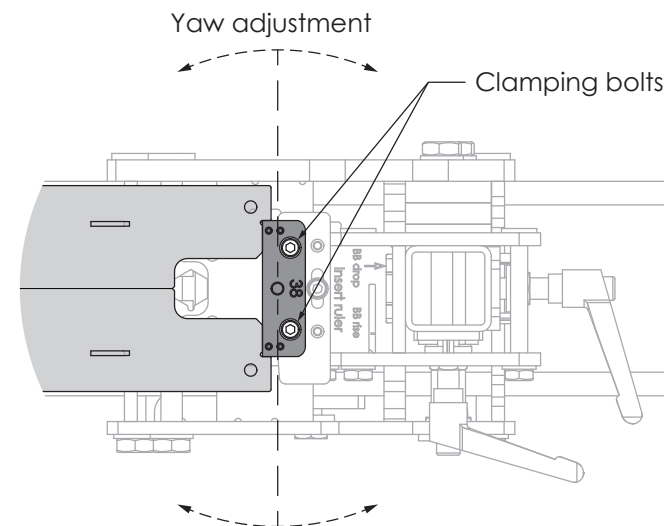


1. Set the fixture rear axle X and BB drop/rise for the planned frame build.
2. Insert the laser calibration tool as shown and ensure it is sitting squarely on the dummy axle reference block.
3. Having calibrated the laser pointer (see page 11) aim the laser at the lowest point on the calibration tool and secure the laser holder with a nut.
4. Slacken the 3x M5 clamping bolts to allow the rear axle slide plate to slide and align the centre line of the calibration tool with the laser dot.
5. Aim the laser at the top of the calibration tool and secure the laser holder with the nut again.
6. Evenly adjust the grub screws on one side to align the calibration tool centre line with the laser dot. Take care to adjust both grub screws (see page 11).
7. Aim the laser at the base of the tool again, secure and slide the rear axle slide plate if required. Tighten the 3x clamping bolts evenly - **DO NOT OVER TIGHTEN.**
8. Repeat the process until you are satisfied that the laser strikes the calibration tool centre line in both positions shown with the 3x clamping bolts tightened - **DO NOT OVER TIGHTEN.**

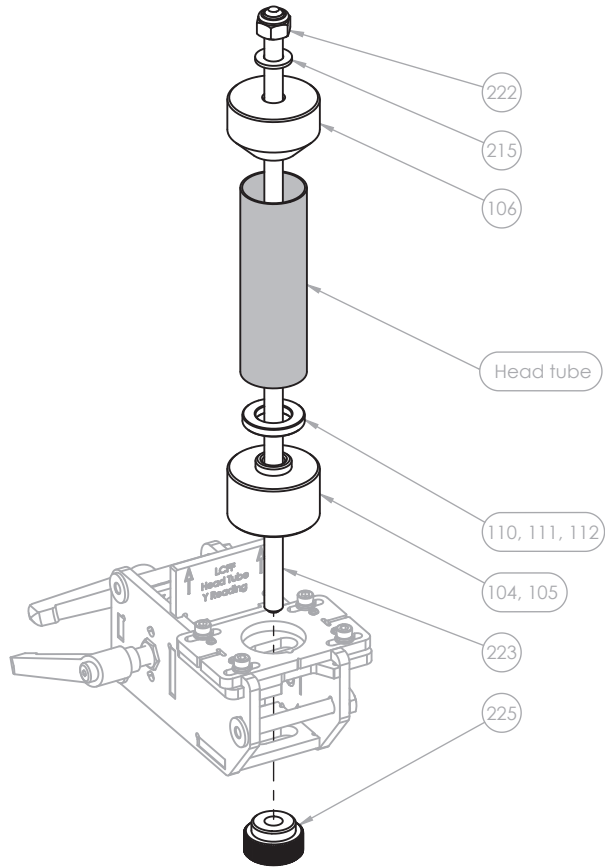
Calibration Step 4 - Rear Axle Yaw



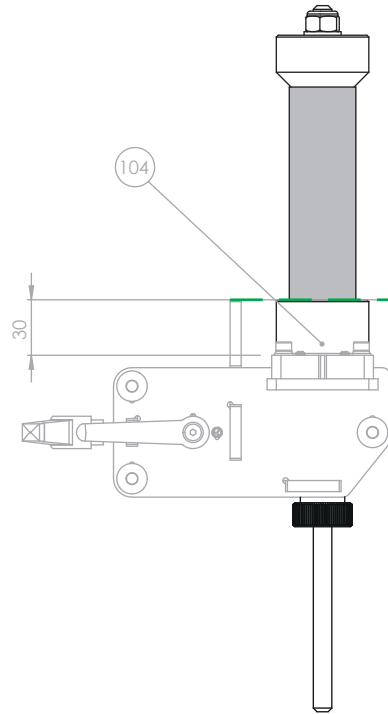
1. Having set the fixture rear axle X and BB drop/rise for the planned frame build and calibrated the rear axle centre line & roll (see page 14) hold the calibration tool so that it references the dummy axle reference block (part 38) as shown. Take care to hold the tool as close to horizontal as is practical.
2. Aim the laser pointer at the end of the calibration tool and secure with a nut.
3. Slacken the 2x clamping bolts on the dummy axle reference block (part 38) and rotate until the calibration tool centre line is aligned with the laser dot.
4. Tighten the 2x clamping bolts.
5. Reposition the calibration tool to the vertical position and repeat the rear axle centre line and roll checks.
6. Repeat the process until you are satisfied that the laser strikes the calibration tool centre line in all positions.



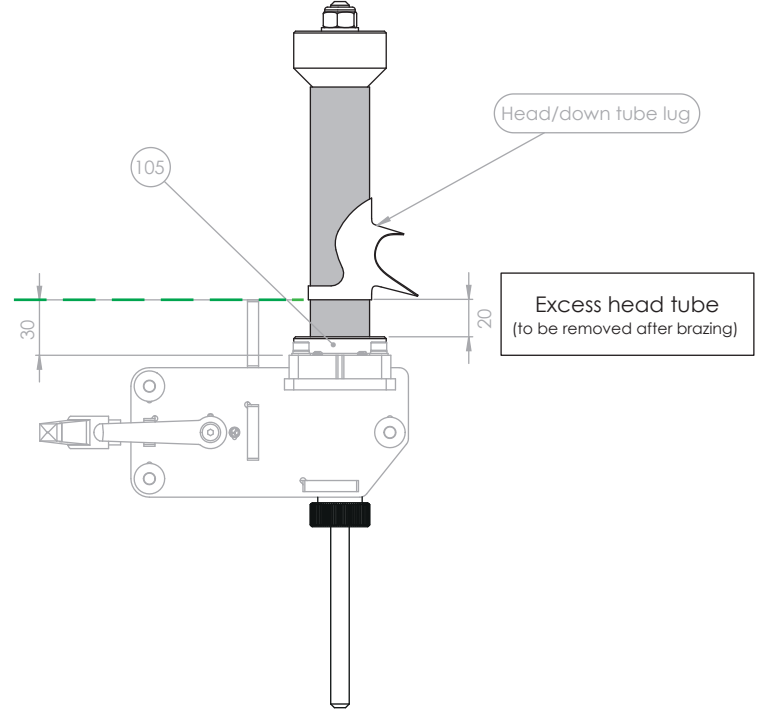
Head Tube Pucks & Adaptors



Lugless construction

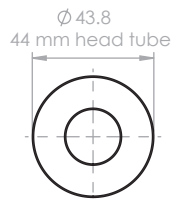


Lugged construction

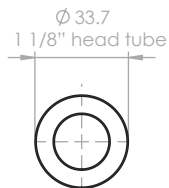


Brass adaptors for various head tube diameters

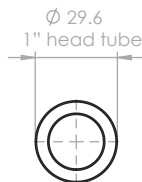
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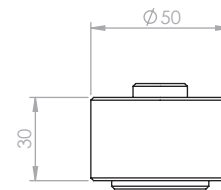


112 Optional extra



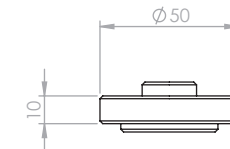
Lugless construction

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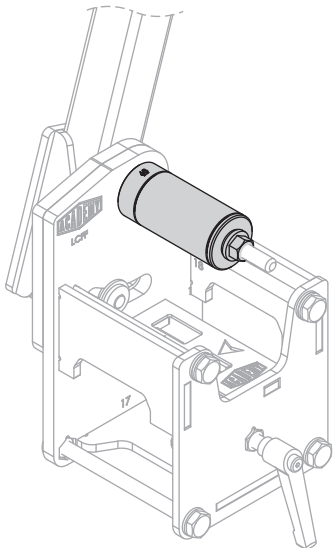
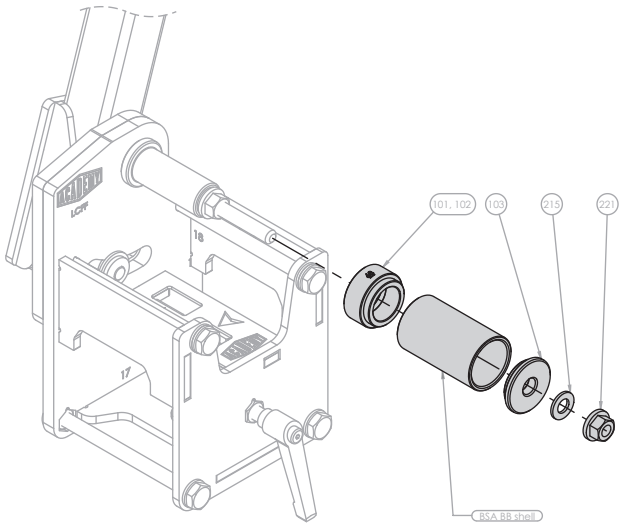
Lugged construction

105 Optional extra



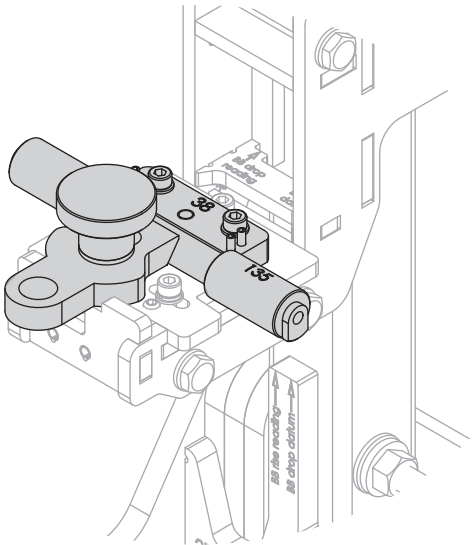
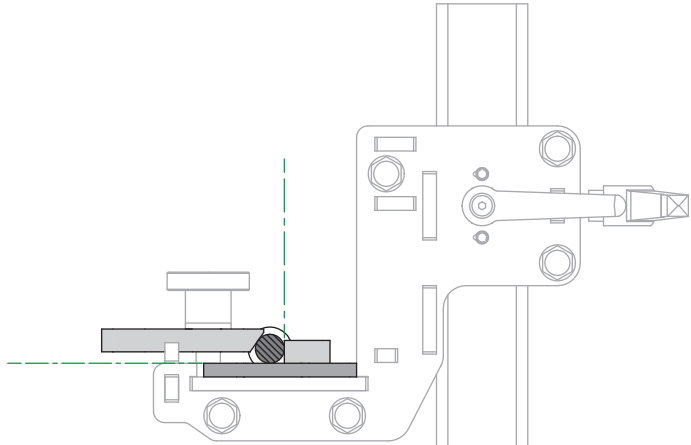
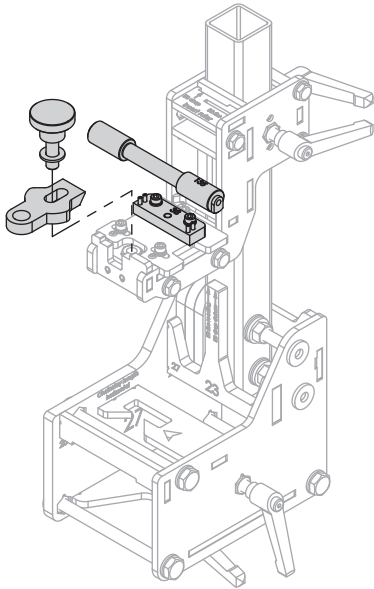
Bottom Bracket Adapters & Dummy Axle Setup

Select the appropriate BB shell adapter and assemble



101	Adapter for 68 mm BSA bottom bracket	
102	Adapter for 73 mm BSA bottom bracket	

Ensure the dummy axle references the datum faces as shown



Please see our website for the full range of available
head tube adaptors and dummy axles:

<https://thebicycleacademy.org/collections/academy-tools>

If you have any questions please get in touch via email or phone:

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The Bicycle Academy Limited is incorporated and registered
in England and Wales with company no. 07890658
whose registered office is at The Welsh Mill, Park Hill Drive,
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