Tech talks

FASEP GUIDES FOR EXPERTS

WHEEL ALIGNMENT

Theory of Heavy Duty Alignment.

For true experts.

you ask, we answer

ENGLISH EDITION **2017**

FASEP MADE IN ITALY

Qualcuno di cui ti puoi fidare.

SOMEONE YOU CAN TRUST.

6 good reasons
to check (and sell) wheel alignment

To focus selling services rather than just tires, we publish a small handbook on the reasons for carrying out professional wheel alignment. We recommend to print and attach visibly in the store.

1 LENGHTEN THE LIFE OF THE TIRE

It has happened to almost everyone to install a new set of tires at the same time and be with one or two worn tires before the others. In today's vehicles, this happens either on the front and rear tires. **The main reason for this tire wear is just a bad wheel alignment adjustment.**

Adjusting wheel alignment extends the life of the tire.

2 DETERMINE PROBLEMS IN TIME

The inspection of the suspension is a critical part of the operation of Wheel Alignment. This gives the mechanic a good opportunity to identify worn parts that could alter the structure but also an **opportunity to identify, even with a simple glance, small problems before they become "big" and "expensive."**

Checking wheel alignment: saving before it's too late.

3 ENSURE SAFE DRIVING

A periodic check of wheel alignment guarantees a car in perfect running condition, with excellent road holding, **giving also the opportunity to identify in time worn or defective parts that may affect the safety of driving.**

Inspection done: safe driving.

4 IMPROVE FUEL ECONOMY AND VEHICLE PERFORMANCE

Gasoline consumption decreases when the running resistance decreases. A proper alignment ensures a correct parallelism of the wheels, which helps to minimize tire wear and rolling resistance. **This, together with a properly inflated tire ensures maximum efficiency and lower fuel consumption.**

More power to the ground and lower fuel consumption.

5 IMPROVE DRIVING COMFORT

Your vehicle "pulls" to one side, the steering wheel vibrates, you have to constantly act on the steering to maintain the correct upright direction? **These and other problems are generally solved by proper wheel alignment.**

Wheel alignment set: comfortable ride, less stress.

6 TRAVELLING BEST

A proper alignment allows the suspension to do its job as intended by the designers. When all components of the suspension system are in the right position, **the bumps in the road are absorbed efficiently, so the car is more stable road holding and trip more comfortable.**

Adjust wheel alignment: travel well.

Page available as poster cm70x100 on www.fasep.it

CONTENTS

With the development of microprocessor controlled alignment equipment, important and often misinterpreted aspects of vehicle suspension geometry are now clearly defined.

Item A address not only the common alignment angles of camber, caster an d toe; but, due to their influence in the overall geometry of a heavy duty vehicle suspension system, also addresses alignment angles of geometric centerline, thrust line, tandem thrust and scrub angles.

Item B presents to practical the effects and results of misalignment on vehicle performance as relates to the areas of stability, totr wear and fuel consumption. All vehicle owners/drivers will recognize these facts and the affect they have on comfort, safety and revenue.

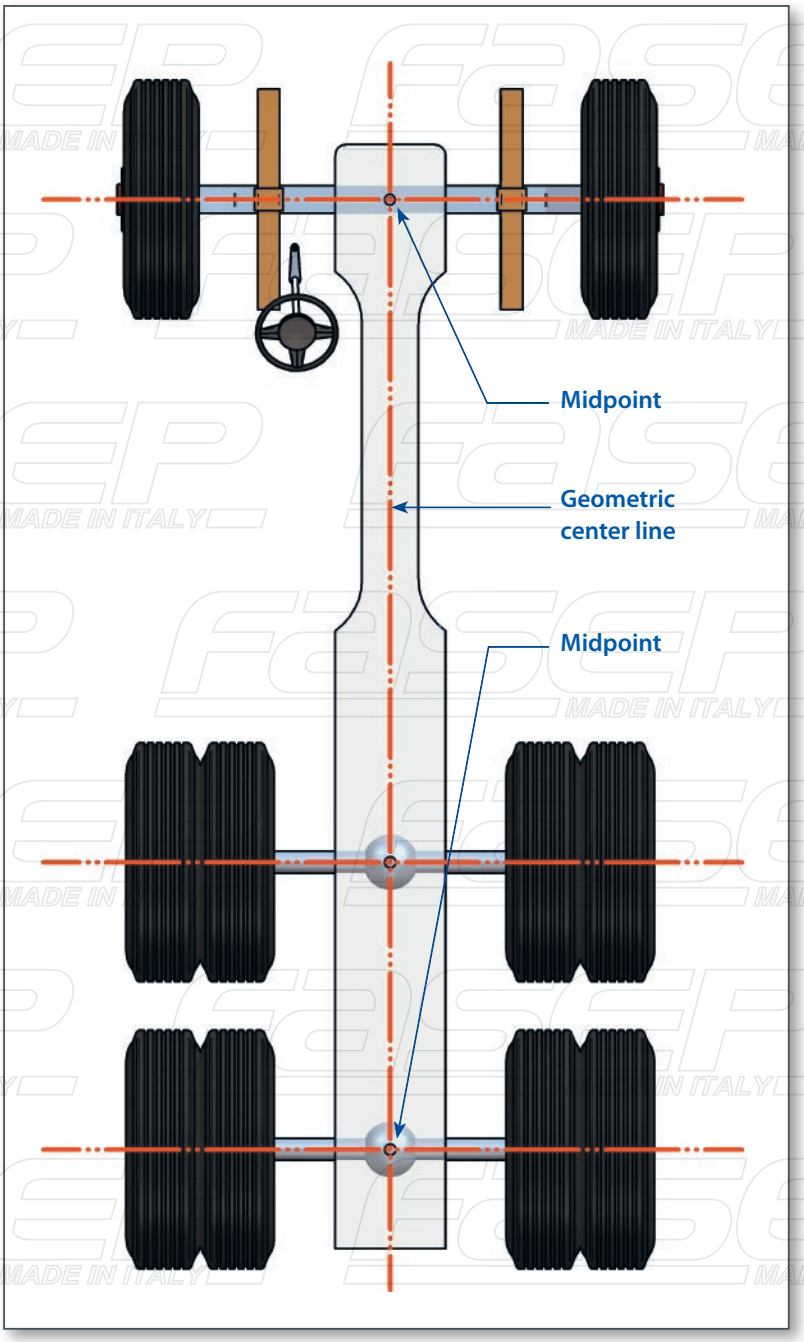
Item C relates to practical applications in correction of camber and caster on front axles of heavy duty vehicles and, also, corrections of toe o n all axles is shown by diagrams to illustrate the ease of application. This ease has been made possible by the microprocessor function of the new generation FASEP alignment equipment.

A. The most important heavy vehicles alignment angles

1. GEOMETRIC CENTRE LINE (GCL)

Definition:

a line drawn between the midpoint ofr the front axle and the midpoint of the rear most axle, is used as a reference line from which other alignment angles may be measured.



2. THRUST LINE (TL)

Definition:

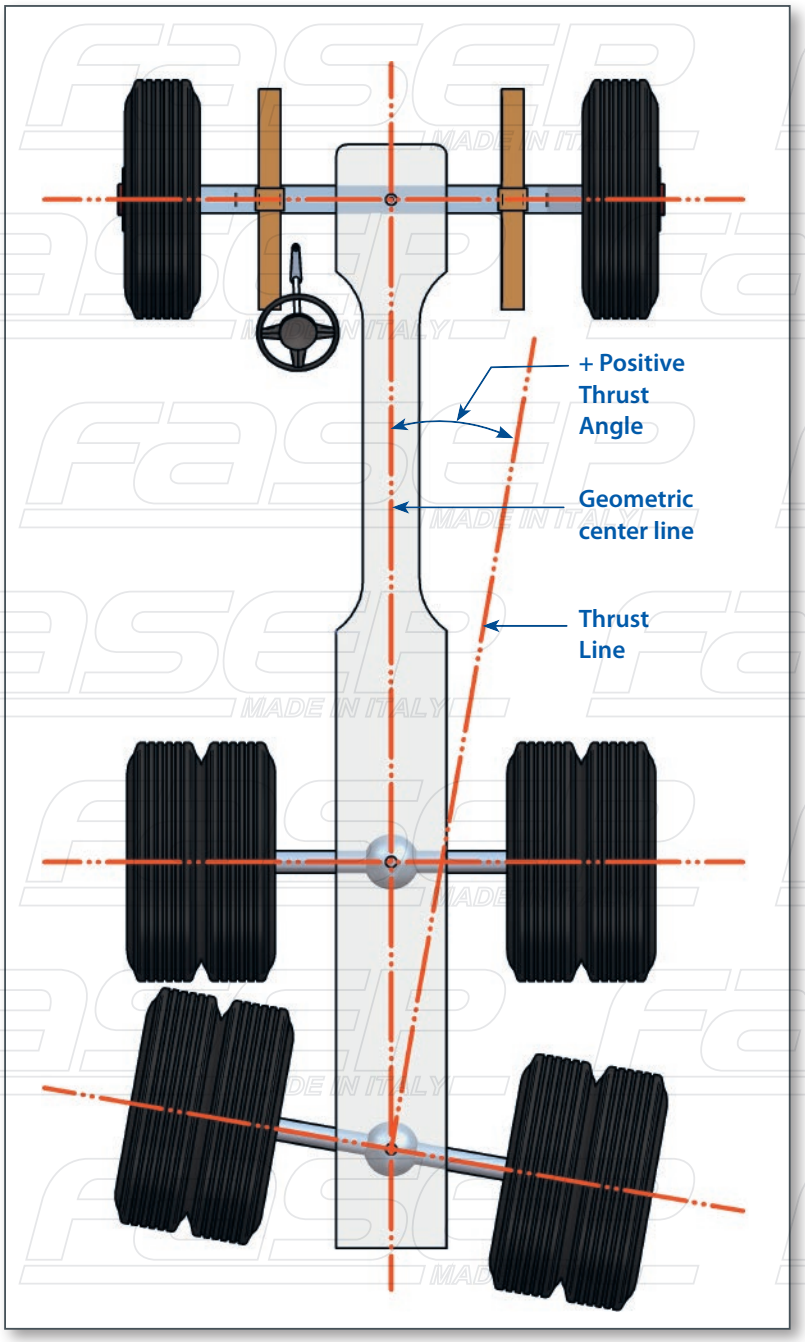
The bisector of total toe of the rear wheels.

On a tandem axle vehicle, thrust line will be present at each rear axle. The most accurate reference line from which t o compute other alignment angles on a two axle vehicle.

3. THRUST ANGLE (TA)

Definition:

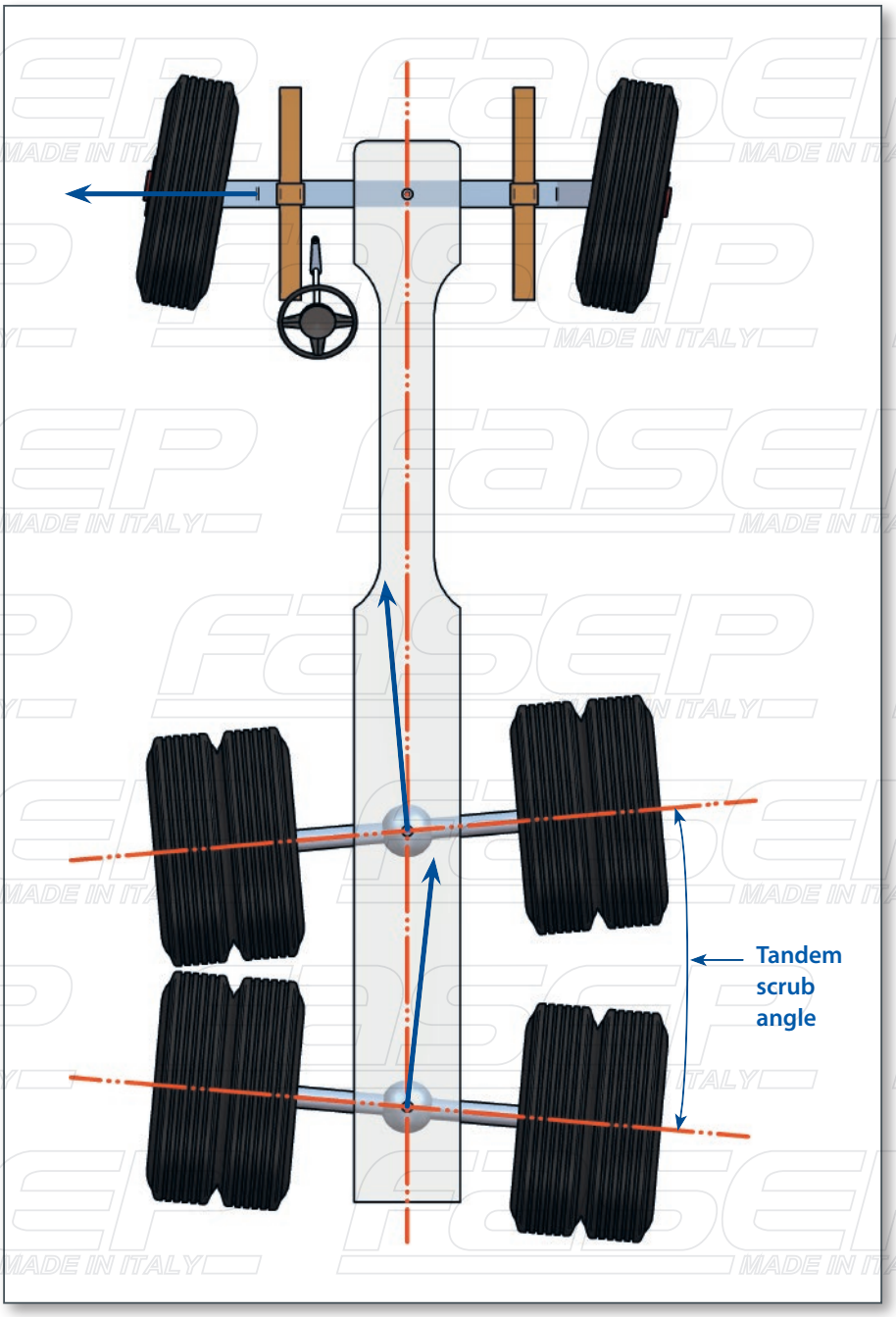
Thrust angle is the angle formed by the intersection ofr the geometric center line and the thrust line.



4. TANDEM SCRUB ANGLE

Definition:

Tandem scrub angle is the angle formed between both rear axles when their thrust lines are different.

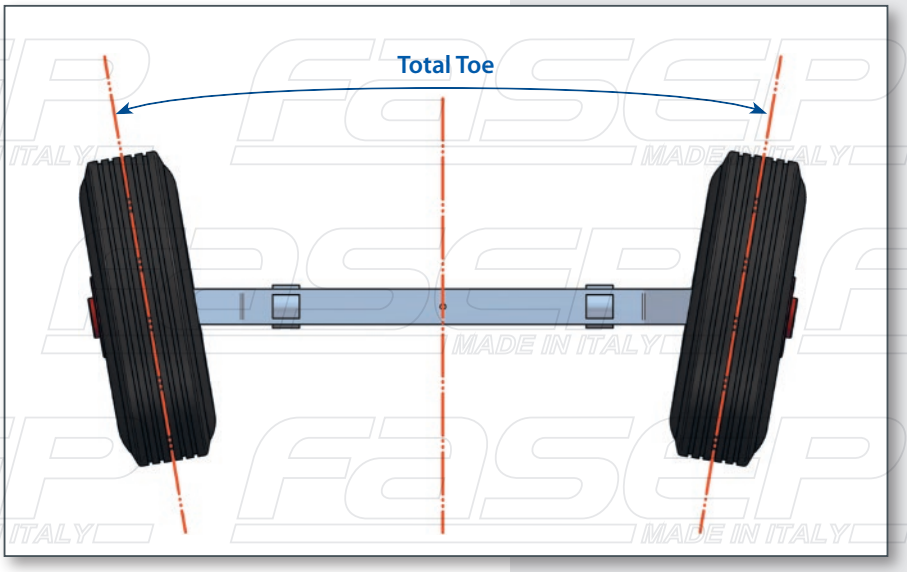


5. TOE

Definitions:

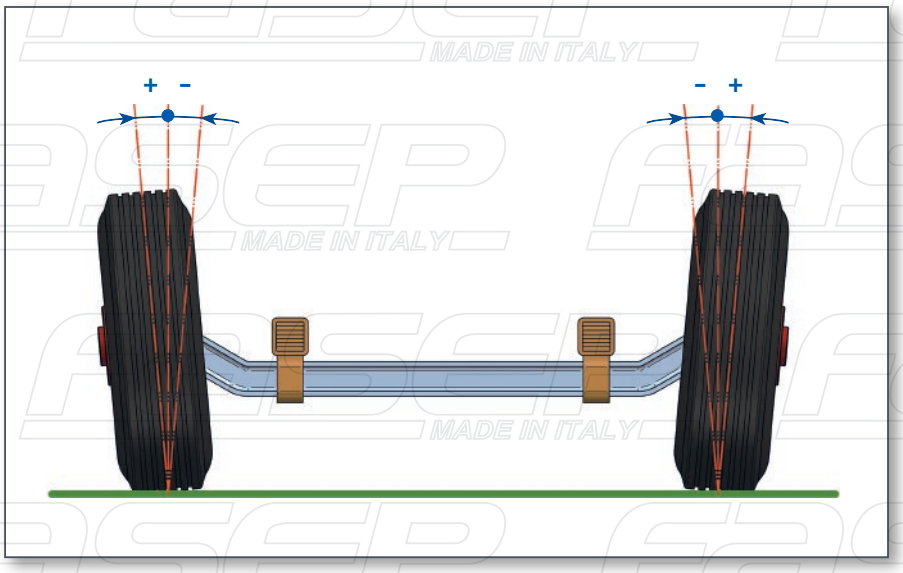
- **INDIVIDUAL FRONT TOE** is the angle formed by a horizontal line through the plane of one wheel and the thrust line.
- **INDIVIDUAL REAR TOE** is the angle formed by a horizontal line through the plane of one wheel and geometric center line.

• **TOTAL TOE** is the sum of the individual toe angles of wheels on the same axle.
Positive sign is ascribed to toe-in or wheels closing at front.
Negative sign is ascribed to toe-out or wheel opening at front.



6. CAMBER

Definition:
The inward or outward tilt of the wheel.
Positive: The wheel titled outward at the top.
Negative: The wheel titled inward at the top.



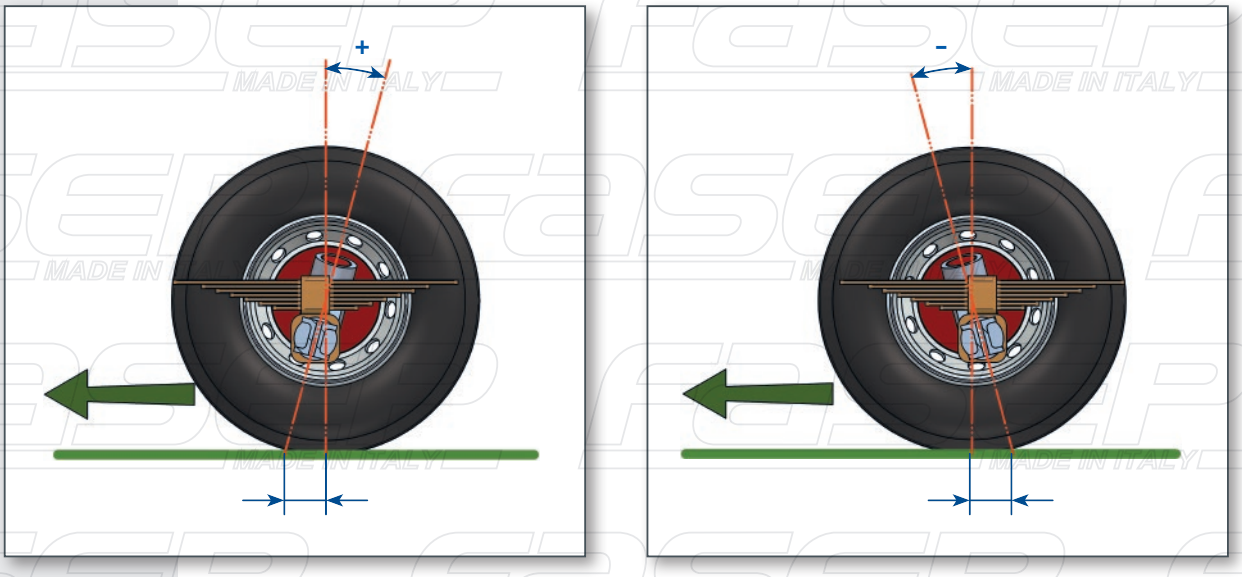
6. CASTER

Definition:

The forward or rearward tilt of the steering axis (the steering axis is an imaginary line drawn through the center of the kingpin).

Positive caster: Positive caster is when the steering axis is titled rearward.

Negative caster: Negative caster is when the steering axis is titled forward.



B. Effects of misalignment

1. TRUCK / BUS

1a. Effects of misalignment truck/bus, 2 axles

FRONT WHEELS

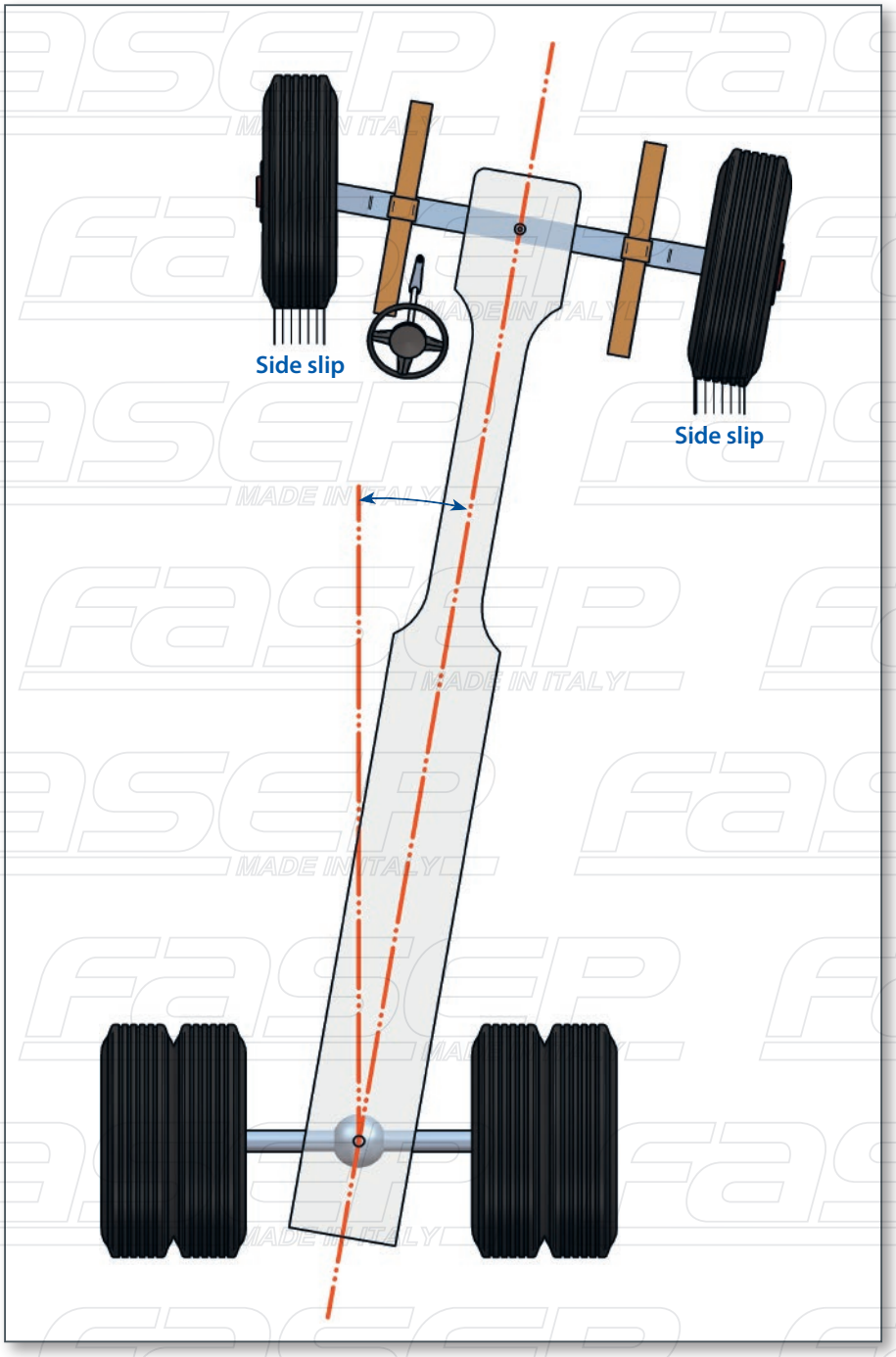
- **Toe:**
  - loss of stability
  - increase in tire wear
  - increase in fuel consumption
- **Camber:**
  - loss of stability
  - increase in tire wear
- **Caster:**
  - loss of stability

REAR WHEELS

- **Thrust angle:**
  - loss o f stability
  - improper tracking
- **Toe:**

loss of stability
increase in fuel consumption
increase in tire wear

- **Camber:**
  - loss of stability
  - increase in tire wear



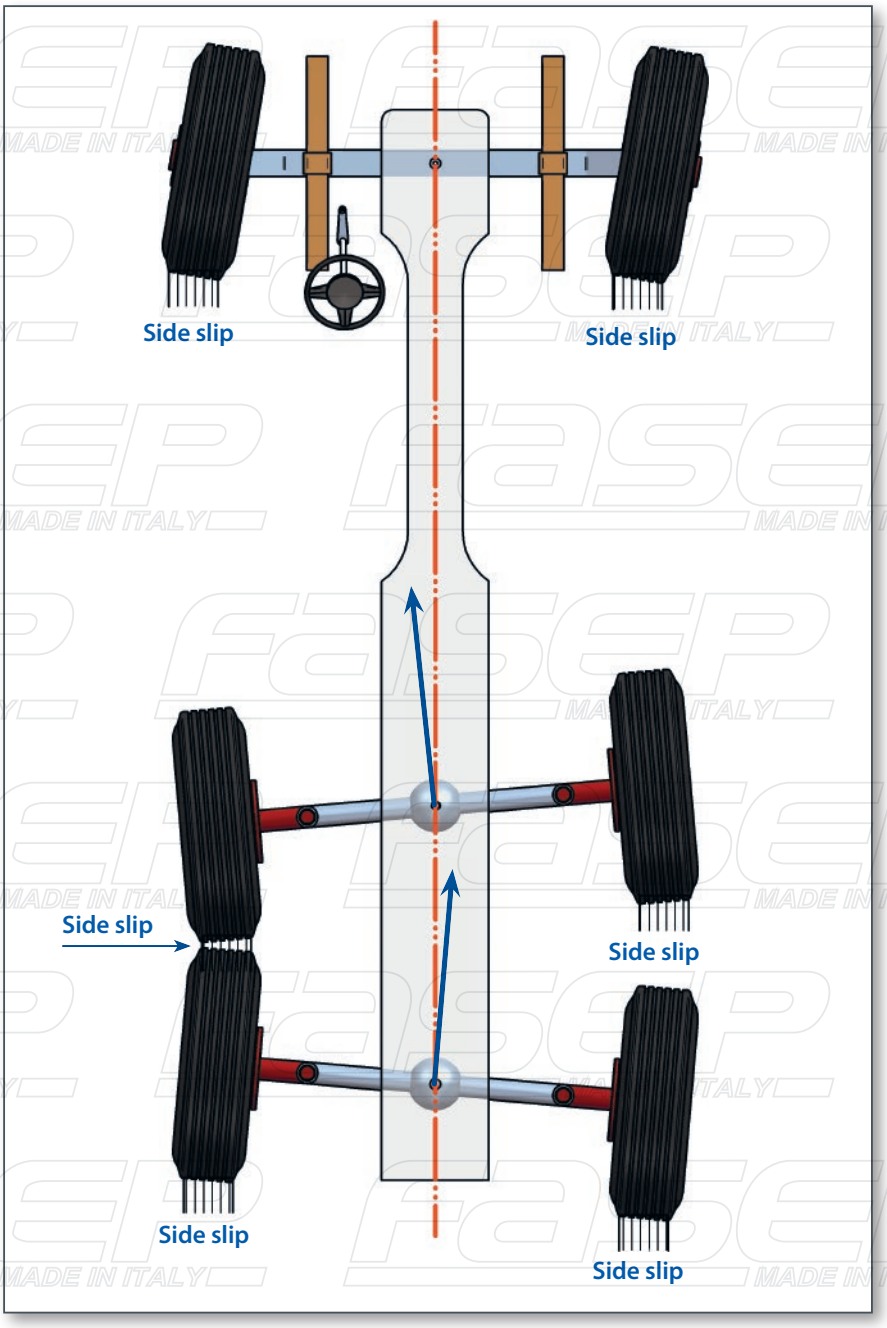
1b. Effects of misalignment truck/bus, 3 axles

FRONT WHEELS

- **Toe:**
  - loss of stability
  - increase in tire wear
  - increase in fuel consumption
- **Camber:**
  - loss of stability
  - increase in tire wear
- **Caster:**
  - loss of stability

REAR WHEELS

- **Tandem scrub angle:**
- loss of stability
- increase in tire wear on front and rear axle tires
- increase in fuel consumption
- improper tracking



1c. Effects of misalignment twin steer vehicles

FRONT WHEELS

- **Toe:**
- loss of stability
- increase in tire wear
- increase in fuel consumption
- **Camber:**
- loss of stability
- increase in tire wear

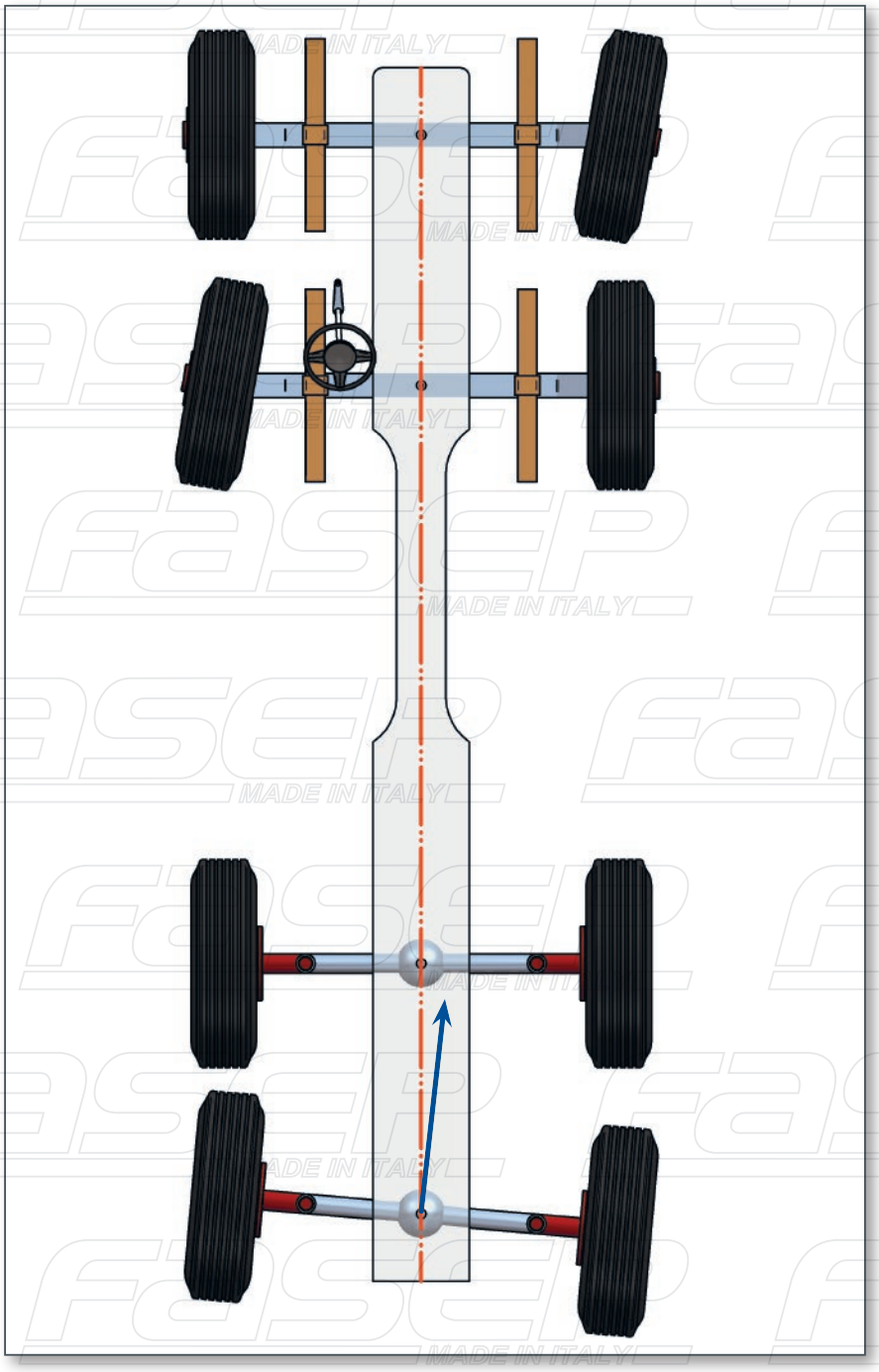
• **Caster:**
- loss of stability

REAR WHEELS

• **Thrust angles:**
- loss of stability
- increase in tire wear
- increase in fuel consumption
- improper tracking

• **Toe:**
- loss of stability
- increase in fuel consumption
- increase in tire wear

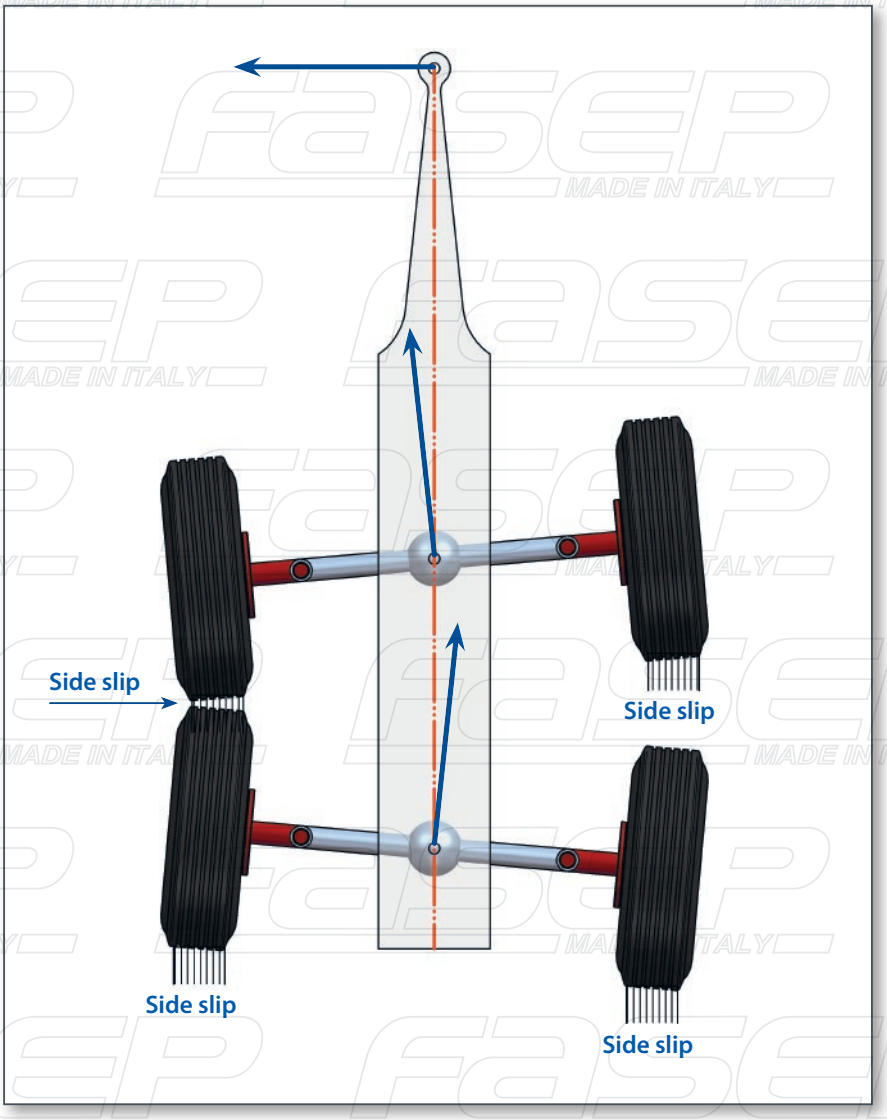
• **Camber:**
- loss of stability
- increase in tire wear



2. TRAILERS

2a. Effects of misalignment semi-trailer

• **Tandem scrub angle:**
- loss of stability
- increase in tire wear on tractor and trailer tires
- increase in fuel consumption
- improper tracking



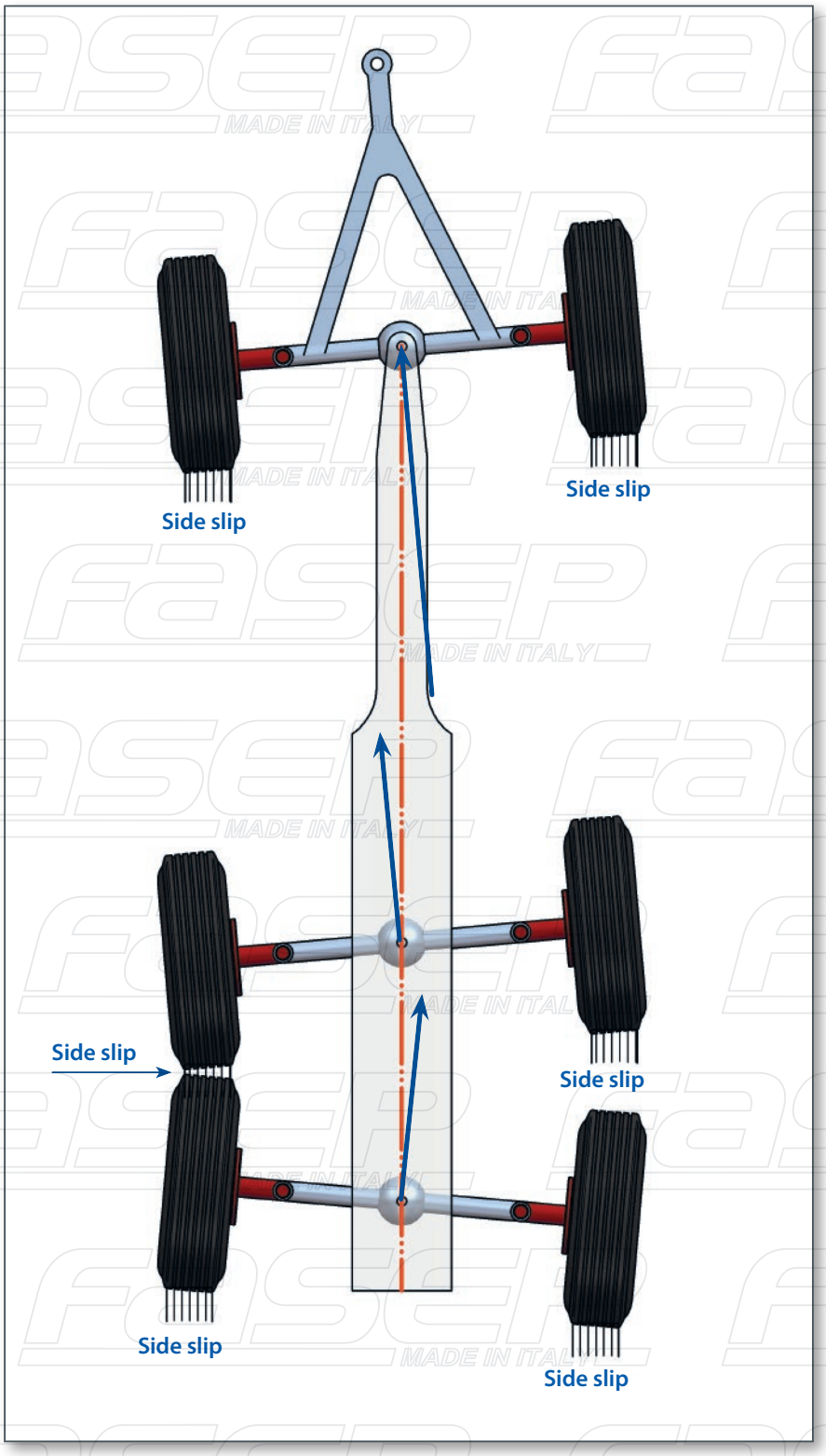
2b. Effects of misalignment full trailer

FRONT AXLE

• **Draw bar angle:**
- improper tracking

REAR AXLES

• **Tandem scrub angle:**
- loss of stability
- increase in tire wear on all axle tires, may have some effect on tractor tire wear
- increase in fuel consumption
- improper tracking


Side slip
Side slip
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Side slip

C. Preactical applications

1. HEAVY VEHICLE FRONT CAMBER AND CASTER CORRECTIONS

1a. Camber increase correction

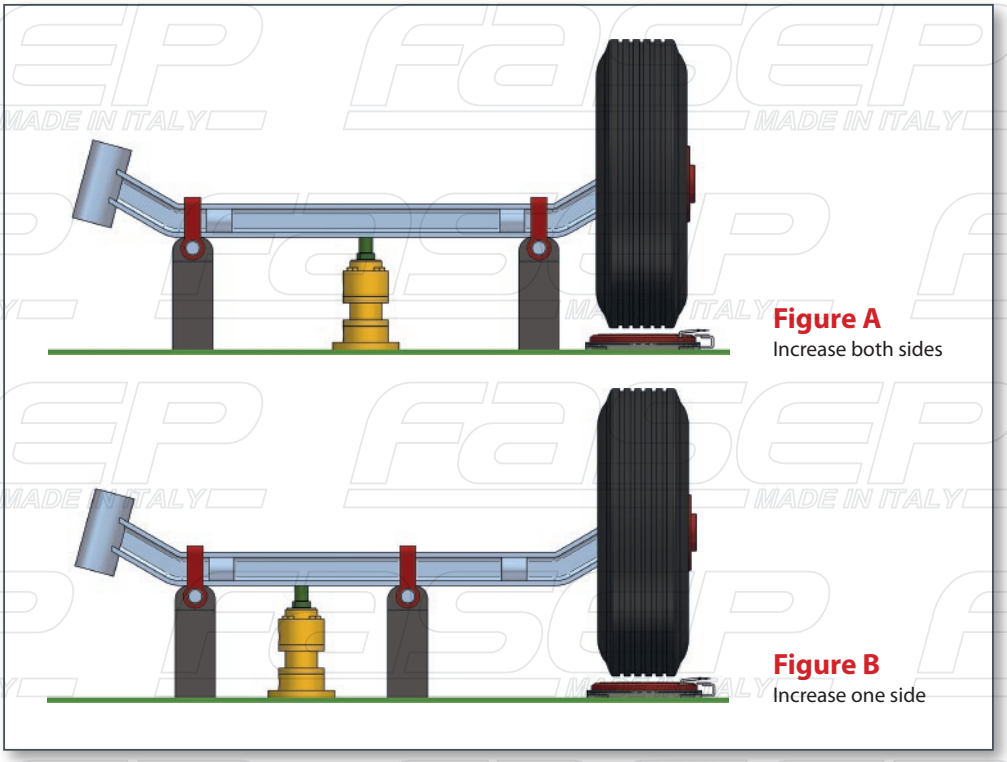


Figure A
Increase both sides

Figure B
Increase one side

1b. Camber decrease correction

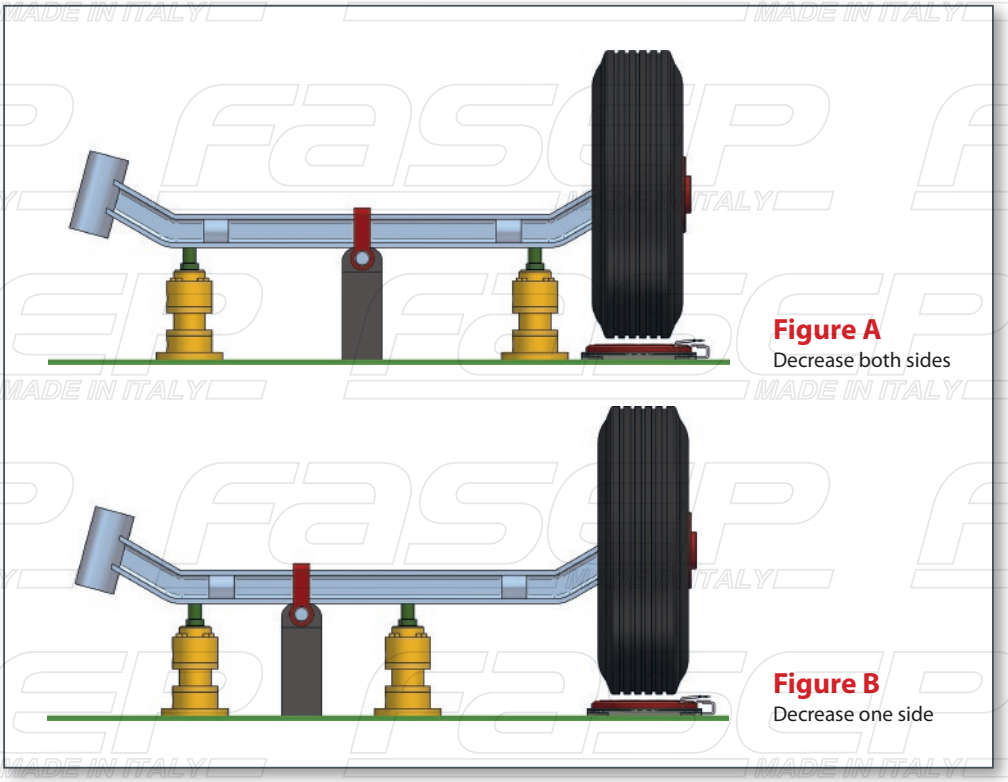
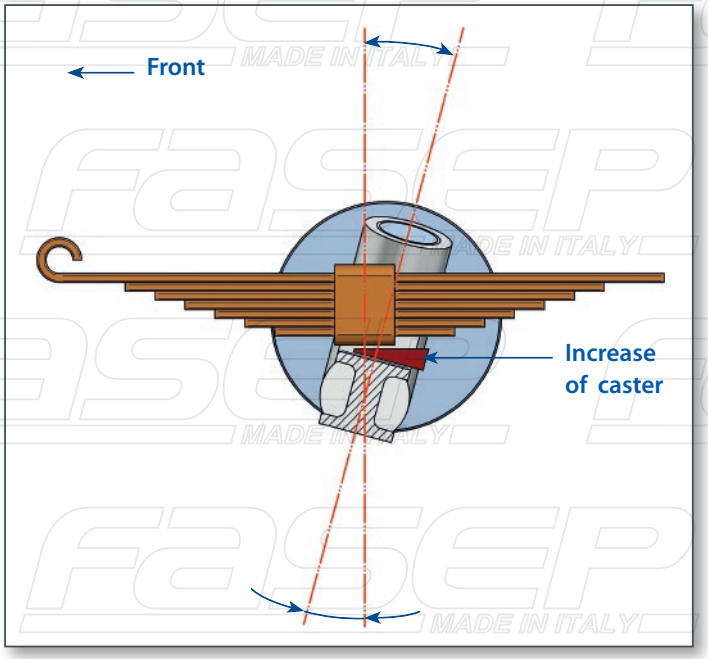
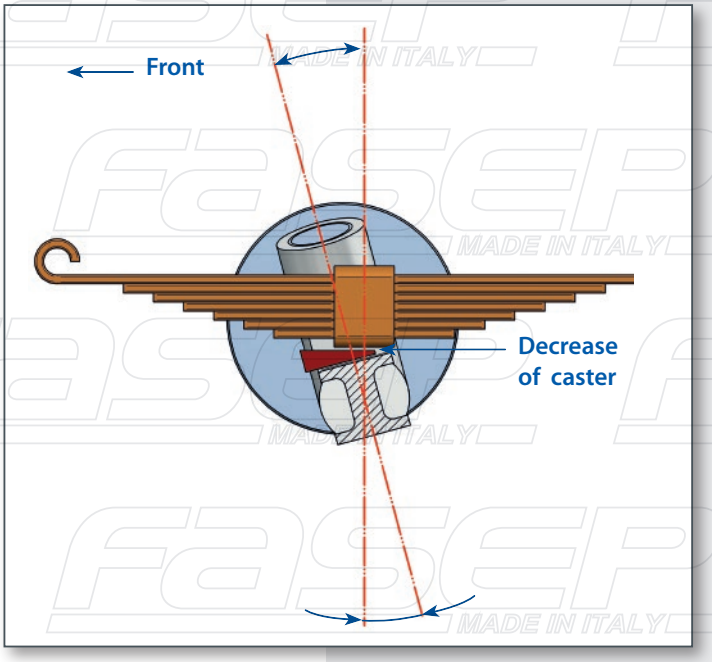


Figure A
Decrease both sides

Figure B
Decrease one side

1c. Caster correction shim procedure





1d. Caster correction axle twist procedure

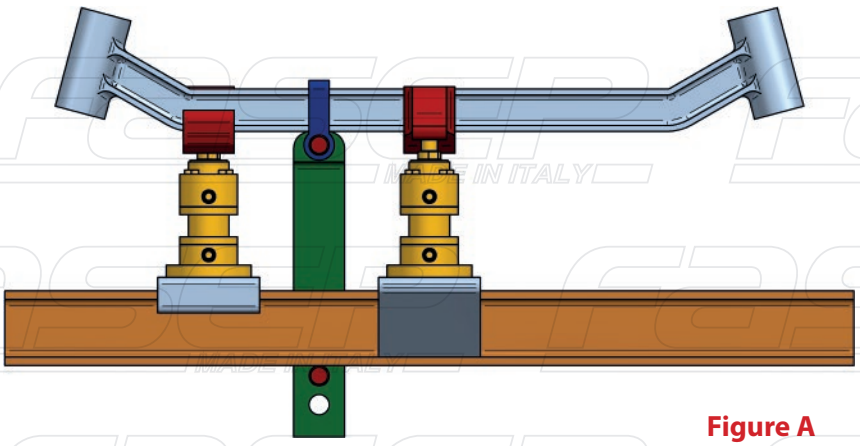


Figure A
Right side

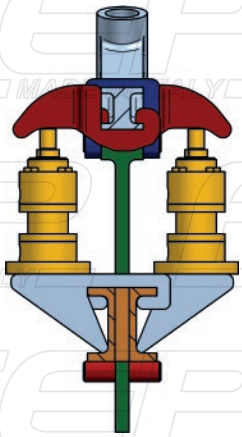
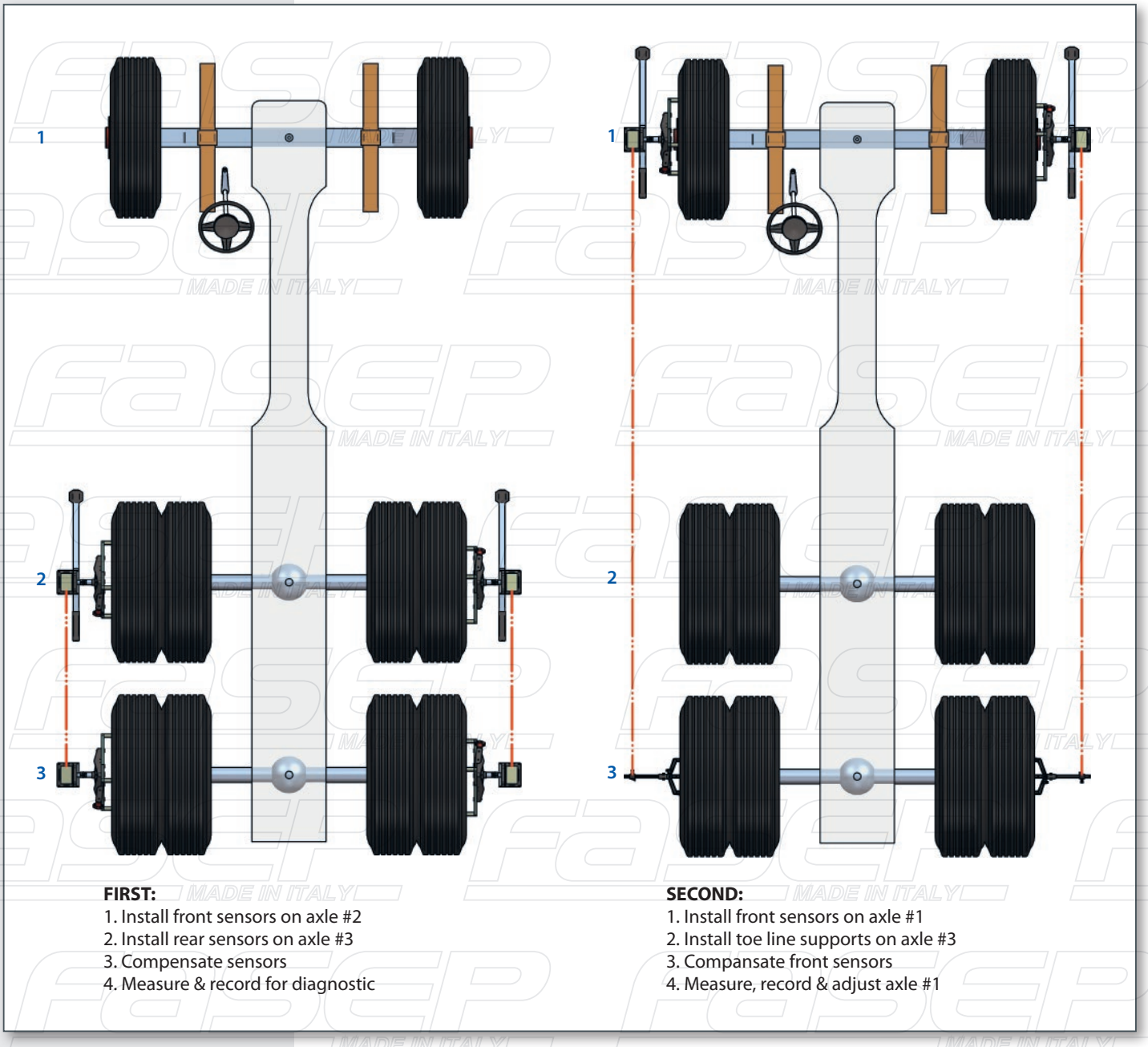


Figure B
End view

2. TOE/THRUST ANGLE ALIGNMENT PROCEDURES TRUCKS/BUSES AND TRAILERS

FIGURE	TYPE	DESCRIPTION
1	1	Botr Drive Axle fixed
2	2	Forward Drive Axle Fixed / Rear Drive Axle Adjustable
3	1	Rear Drive Axle Fixed / Forward Drive Axle Adjustable
4	1	Both Drive Axle Adjustable
5	1	Single Drive Axle with Forward Tag / All Axles Adjustable
6	2	Single Drive Axle with Rear Tag / Drive Axle Fixed
7	4	Twin Steer-Tandem Rear Axle / All Axles Adjustable
8	3	Twin Steer-Single REar Axle / Twin Steer Adjustable
9		Traielr / Full Trailer/Semi-Trailer

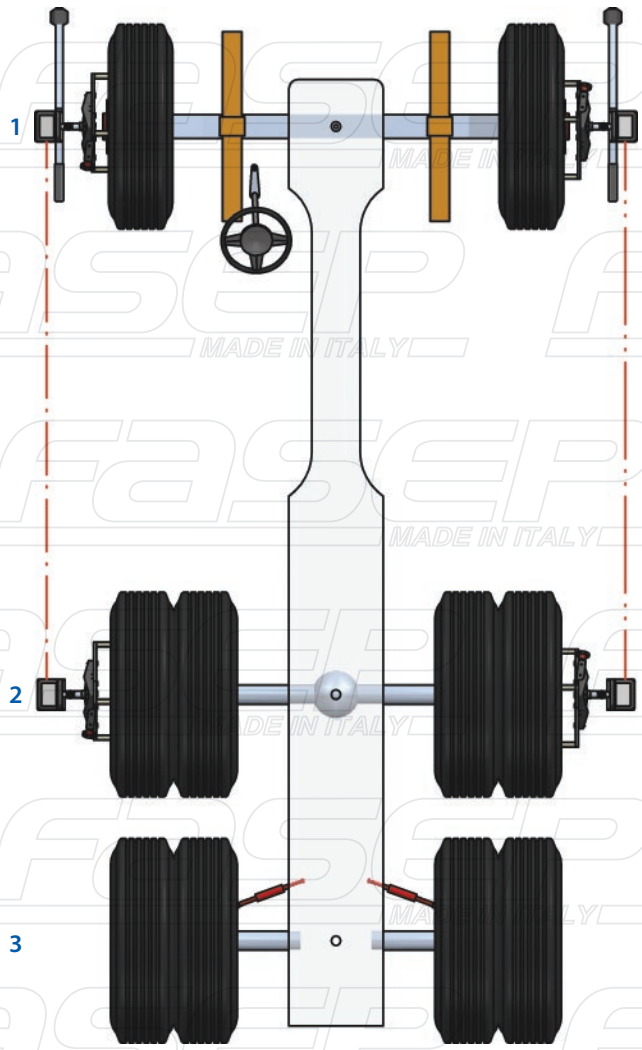
2.1 Both drive axles fixed



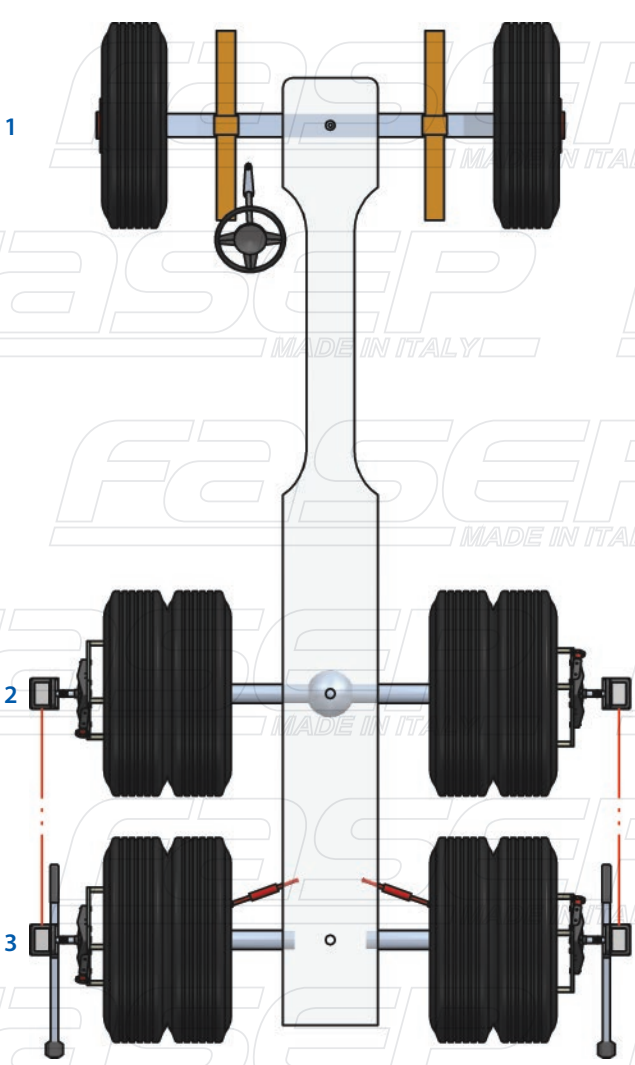
FIRST:
1. Install front sensors on axle #2
2. Install rear sensors on axle #3
3. Compensate sensors
4. Measure & record for diagnostic

SECOND:
1. Install front sensors on axle #1
2. Install toe line supports on axle #3
3. Compansate front sensors
4. Measure, record & adjust axle #1

2.2 Forward drive axle fixed, rear drive axle adjustable

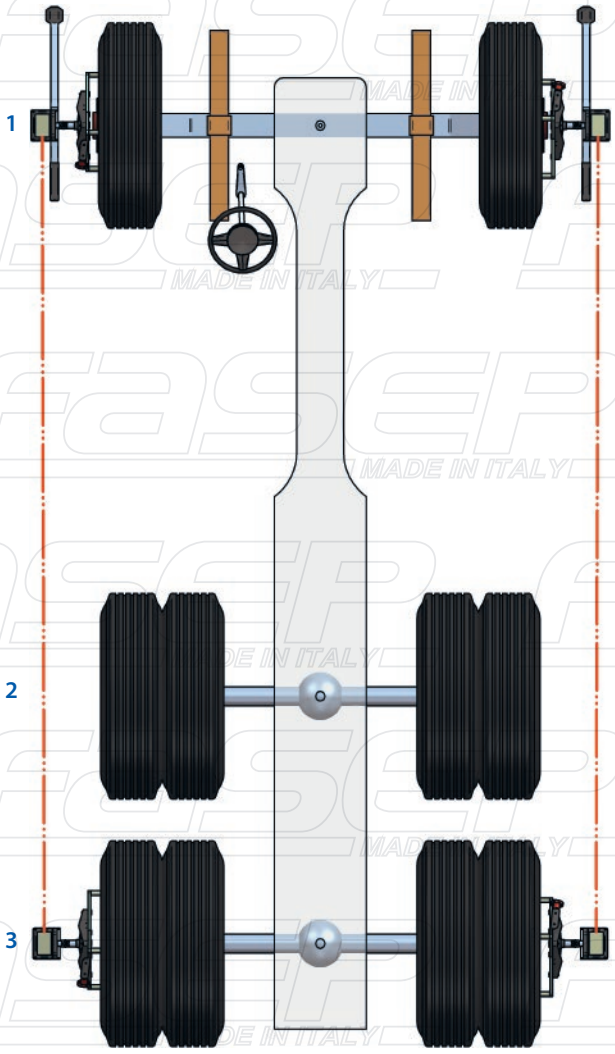


FIRST:
1. Install front sensors on axle #1
2. Install rear sensors on axle #2
3. Compensate sensors
4. Measure, record & adjust axle #1

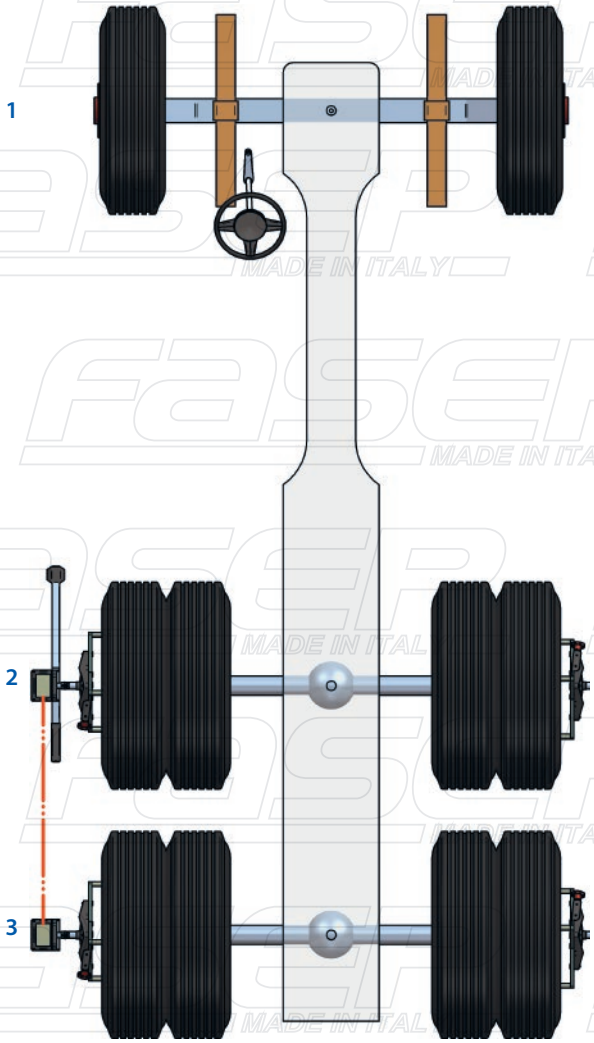


SECOND:
1. Install rear sensors, facing rear, on axle #2
2. Install front sensors, facing rear, on axle #3
3. Compensate sensors
4. Measure, record & adjust axle #3

2.3 Rear drive axle fixed, forward drive axle adjustable

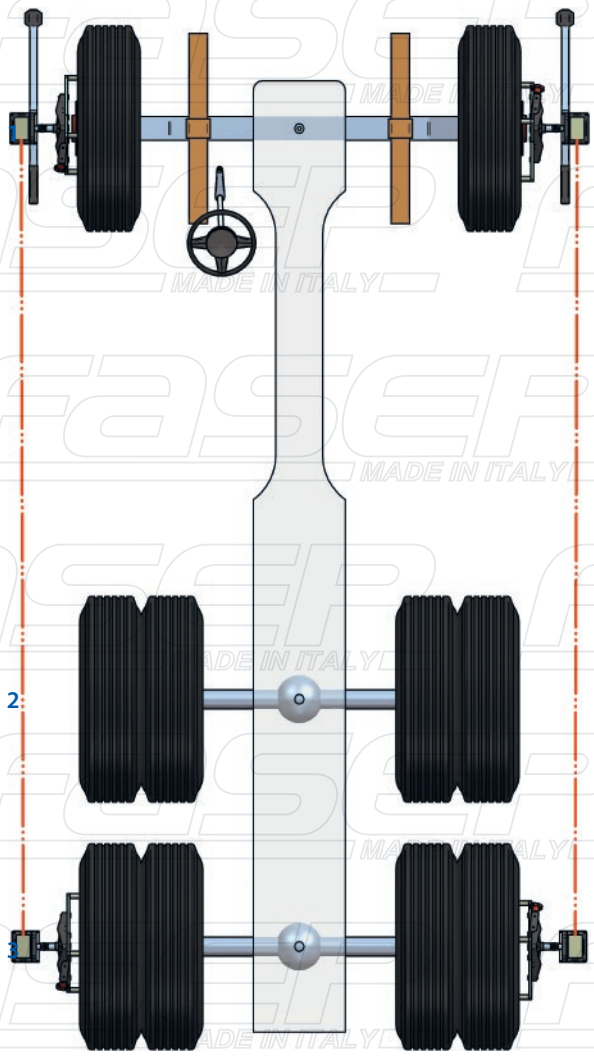


FIRST:
1. Install front sensors on axle #1
2. Install rear sensors on axle #3
3. Compensate sensors
4. Measure, record & adjust axle #1

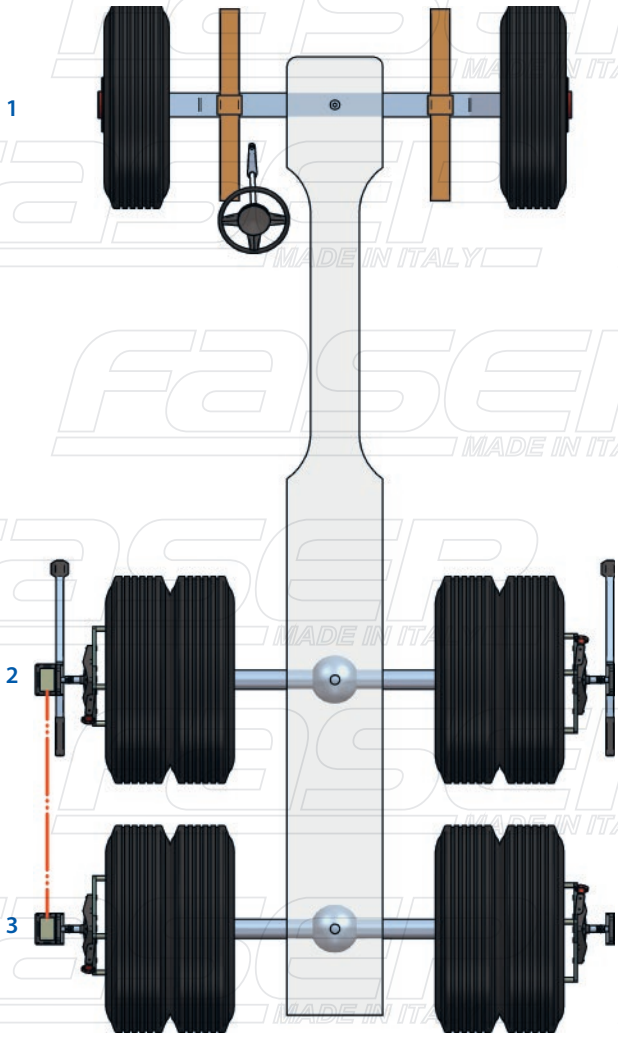


SECOND:
1. Install front sensors on axle #2
2. Compensate front sensors
3. Measure, record & adjust axle #2

2.4 Both drive axles adjustable

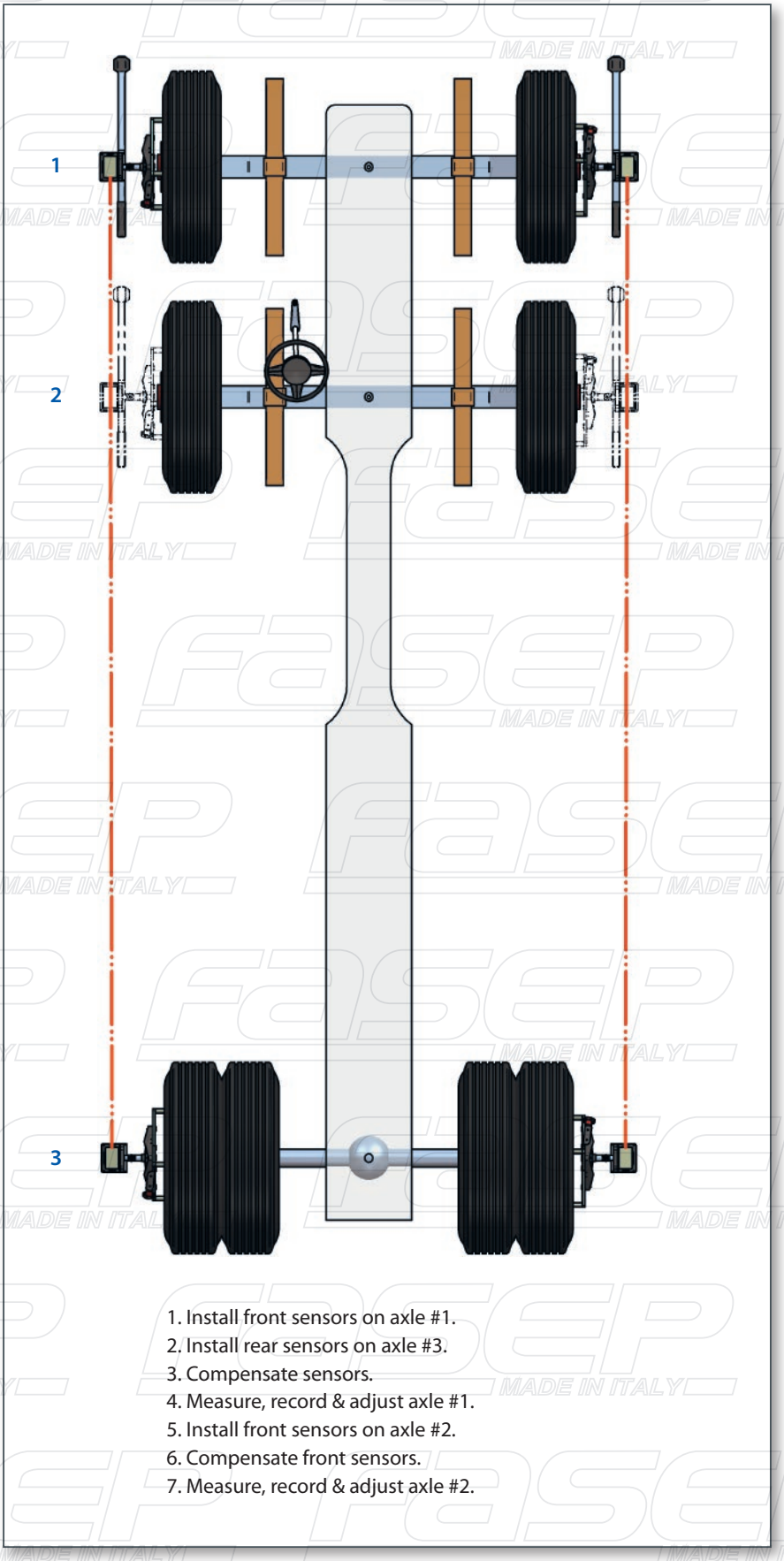


FIRST:
1. Install rear sensors on axle #3
2. Install front sensors on axle #1
4. Measure & record
5. Adjust axle #3



SECOND:
3. Measure and record
4. Adjust axle #3
5. Adjust axle #1

2.5 Twin front axle adjustable



1. Install front sensors on axle #1.
2. Install rear sensors on axle #3.
3. Compensate sensors.
4. Measure, record & adjust axle #1.
5. Install front sensors on axle #2.
6. Compensate front sensors.
7. Measure, record & adjust axle #2.

3. TRAILER ALIGNMENT PROCEDURE SEMI TRAILER

- Mount the kingpin gage on the kingpin approximately perpendicular (90°) to the trailer geometric centerline.
- Mount the front sensors, facinc rear, to the rearmost wheels.
- Connect the longitudinal toe lines between the front sensors and the kingpin gage.
- Connect the transverse toe line between the two front sensors. *(See Figure A)*
- Select the 4-wheel alignment mode.
- Connect the air valve assembly and release the trailer brakes.
- Compense the front sensors.
- Observing the "STEER AHEAD" bar graph, adjust the rearmost axle until the bargraph indicates a "NULL" position. The thrust line of the rearmost axle now coincides with the trailer geometric centerline.

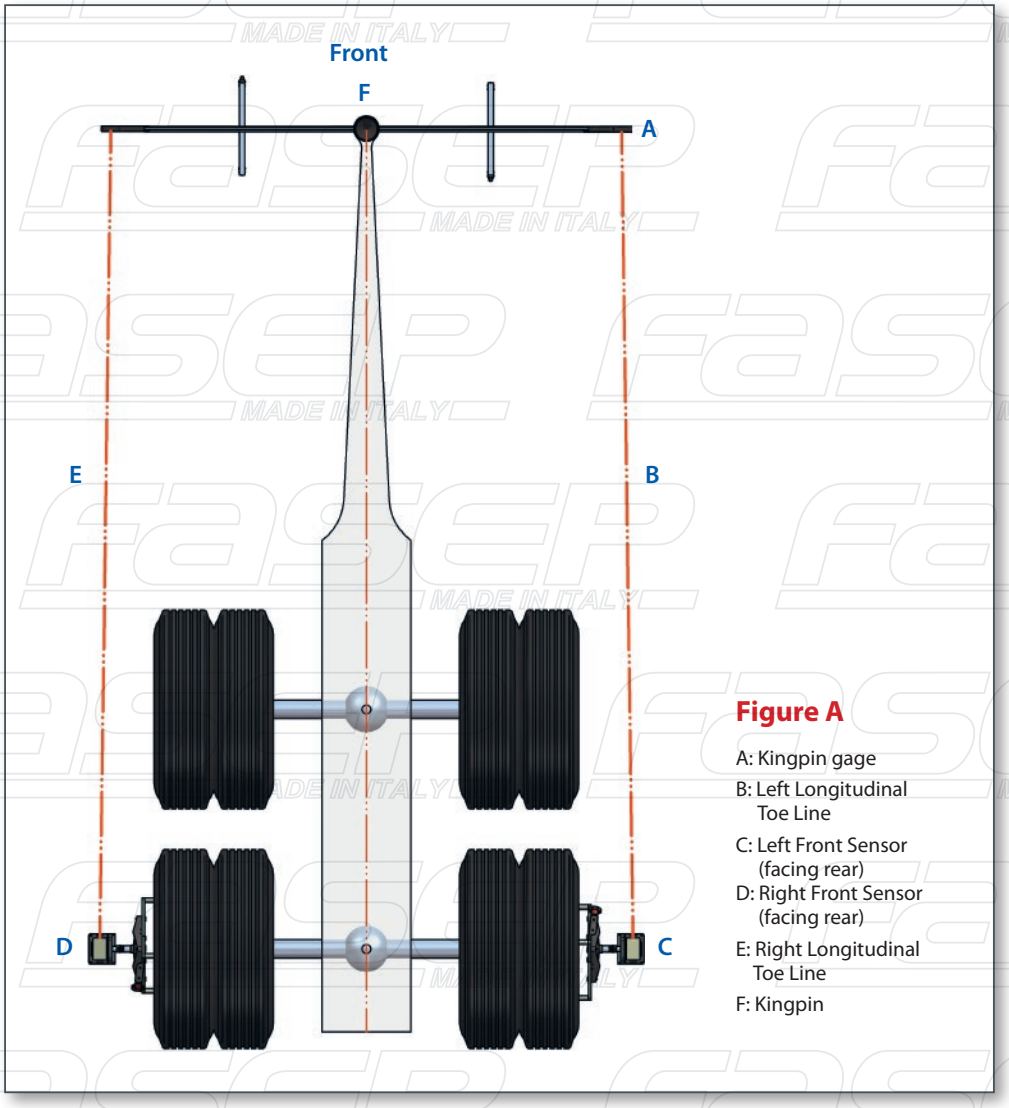


Figure A

A: Kingpin gage
B: Left Longitudinal Toe Line
C: Left Front Sensor (facing rear)
D: Right Front Sensor (facing rear)
E: Right Longitudinal Toe Line
F: Kingpin

- Remove the longitudinal toe lines and mount the rear sensors, facing rear, on the front axle wheels.
- Re-connect the longitudinal toe lines between the front and rear sensors. *(See Figure B)*
- Observing the "STEER AHEAD" bar graph, adjust the front axle until the bar graph indicates a "NULL" position. The thrust line of the front axle is now parallel to the thrust line of the rear axle.
- Check total toe, front and rear, to diagnose bent axles.

Caution: Do not use the THRUST ANGLE measurement on the ALIGNMENT MEASUREMENT display

to adjust the front axle. Always use the STEER AH ED bar graph. If the front axle is offset laterally from the rearmost axle, the STEER AHEAD indication will be cor rect, but the THRUST ANGLE will not be zero. This indication can be used to diagnose front axle offset, but only after both axles have been adjusted correclty.

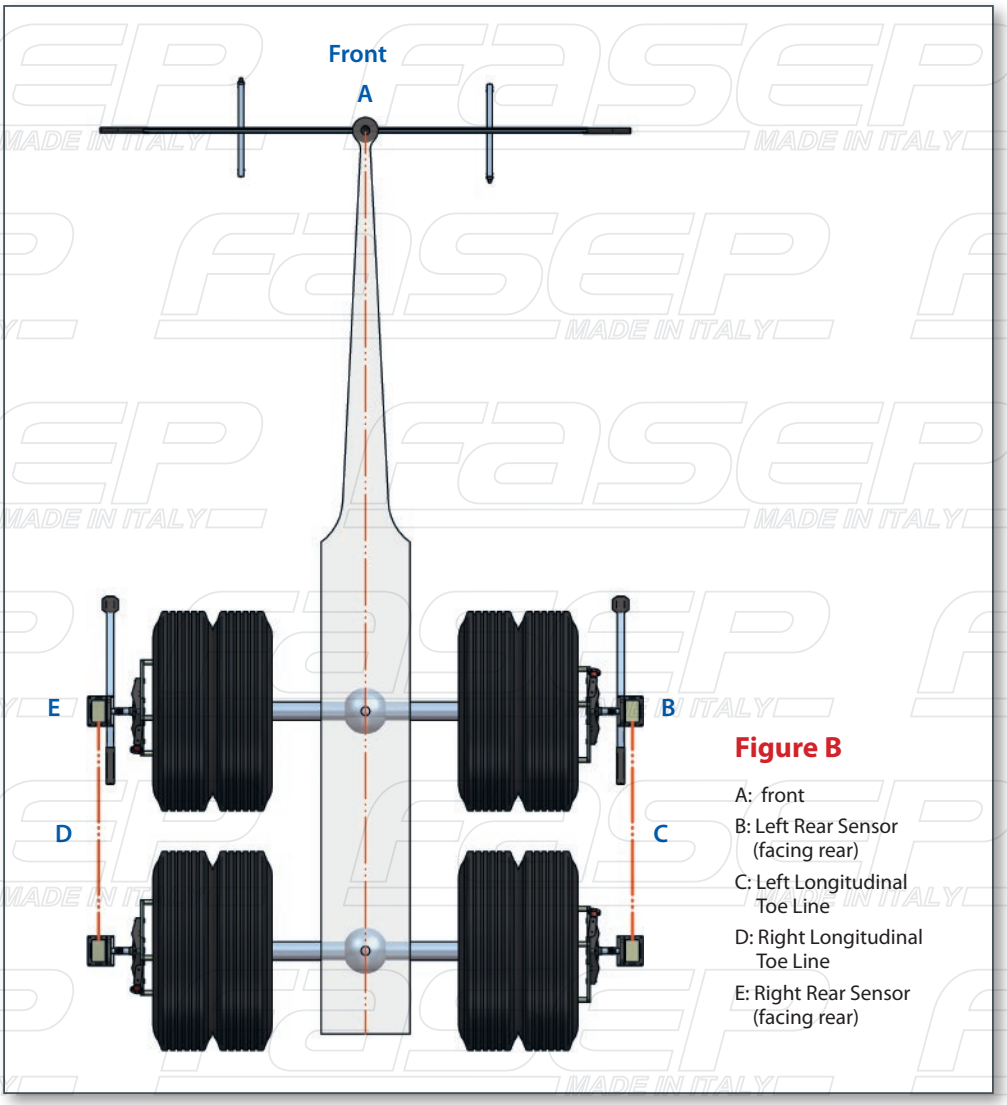


Figure B

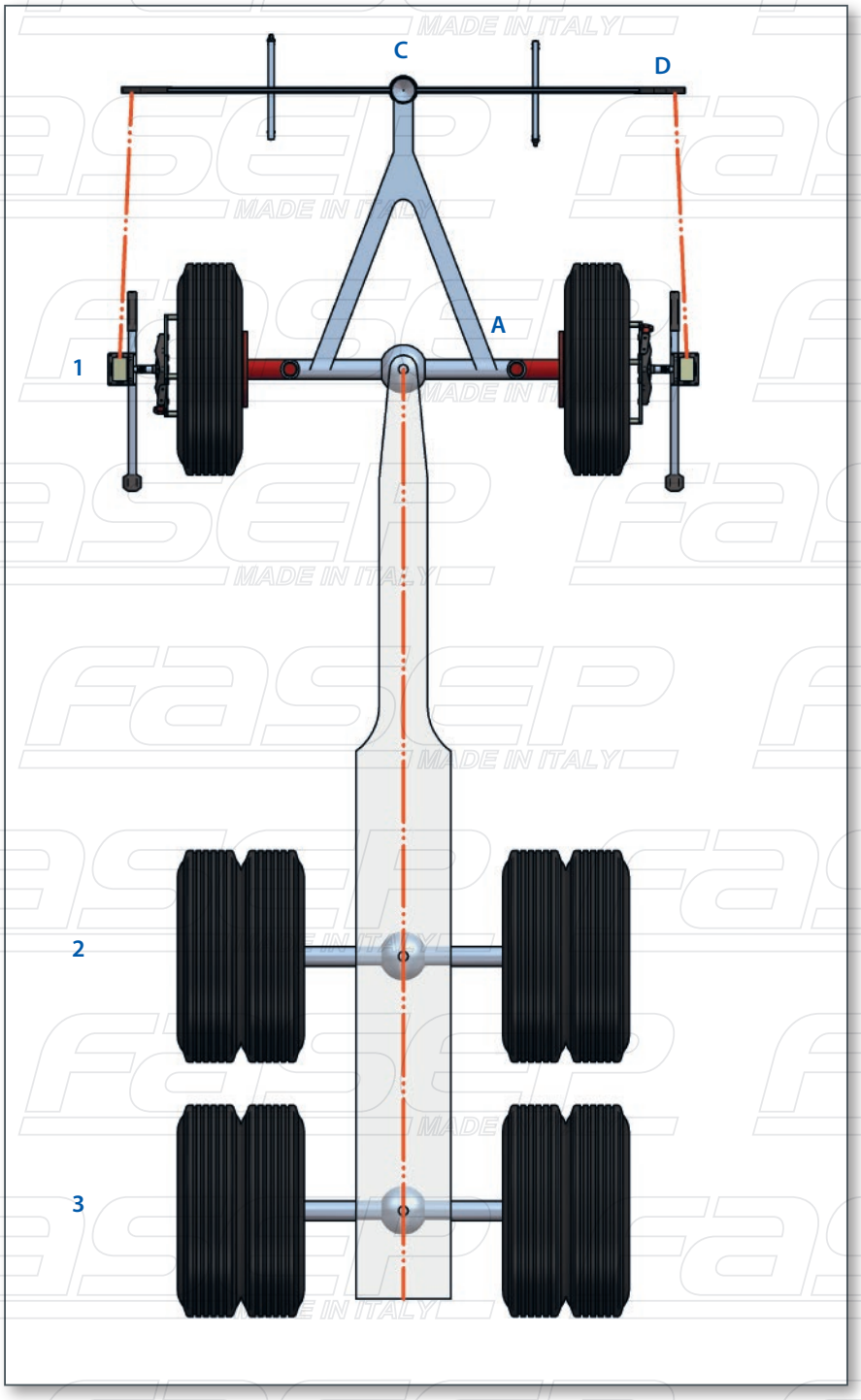
A: front
B: Left Rear Sensor (facing rear)
C: Left Longitudinal Toe Line
D: Right Longitudinal Toe Line
E: Right Rear Sensor (facing rear)

4. FULL TRAILER PUB TRAILER ALIGNMENT

1. Install Gage Bar on dolly stand.
   Rest draw bar on dolly stand.
   Install front sensors on axle #1 facing rear.
   Compensate sensors.
2. Measure, record and adjust axle #1.
3. Install front sensors on axle #3 facing rear.
   Install toe line support on axle #1.
   Compensate sensors.
4. Measure, record & adjust axle #3.

5. Install rear sensors on axle #2.
Compensate rear sensors.
6. Measure, record & adjust axle #2.

NOTE: Always use "STEER AHEAD" bar graph for axle adjustment. If axle #2 is offset laterally from axle #3 the "STERR AHEAD" indication will be correct, but the "THRUST ANGLE" will not be zero.



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FASEP MADE IN ITALY

Someone you can trust.

FASEP 2000 s.r.l. Via Faentina, 96 - 50032 Ronta (Firenze) ITALY
Tel. +39 055 8403126 - Fax +39 055 8403354

www.fasep.it