ADAS

Cameras and Brackets – Spare Parts

Installation Instructions

WABCO

Original document:
The English version is the original document.

Translation of the original document:
All non-English language editions of this document are translations of the original document.

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You will find the current edition at:
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1 List of abbreviations

Abbreviation	Description
AEBS	Advanced Emergency Braking System
ACC	Adaptive Cruise Control
ADAS	Advanced Driver Assistance System
AM	Aftermarket
DTC	Diagnostic Trouble Code
ECU	Electronic Control Unit
LDWS	Lane Departure Warning System
OEM	Original Equipment Manufacturer
PN	Part Number
UDT	Unifed Diagnostic Tool
VIN	Vehicle Identification Number

2 Information about this document

2.1 Validity

This document applies to the following WABCO part numbers:

- 446 070 190 0
- 446 070 191 0
- 446 070 390 0
- 446 070 391 0
- 446 070 909 0
- 446 070 920 0
- 446 070 924 0

2.2 Symbols used

i	Important information, notes and/or tips

Descriptive text

▸ For individual action steps

1. Action step 1
2. Action step 2

   ↳ Consequence of an action

- Listing

2.2.1 Explanation of the warning notes

⚠ CAUTION

Indicates a hazard that may result in slight or moderately serious injury if not avoided.

NOTICE

Indicates a hazard that may result in material damage if not avoided.

2.3 Structure and explanation of the warning notes

Warnings are structured as follows:

- Signal word and pictogram
- Correct naming of the hazard
- Description of the consequences if the hazard is ignored
- Description of the measure(s) to prevent the danger

3 Basic safety instructions

3.1 Intended use

The cameras and brackets are spare parts (replacements) for OEM cameras and brackets already installed in IVECO and DAF trucks.

The relationships between the replacement parts and the OEM parts are described in detail in chapter "5.1 Camera and bracket replacements", page 11.

NOTICE

Risk of material damage.

Medium to extensive material damage possible.

– Do not install spare parts that do not correspond to the OEM equivalents, see chapter "5.1 Camera and bracket replacements", page 11.

– Do not install spare parts in vehicles initially not equipped with OEM cameras and brackets.

3.2 Obvious misuse

Any use other than that described in the intended use is not in accordance with this intended use and is therefore not permitted.

WABCO/ZF accepts no liability for damage caused by improper use. The risks of improper use lie solely with the user.

3.3 Qualification and knowledge of the personnel

The activities described in this documentation require basic knowledge of mechanics, electrics, pneumatics and knowledge of the associated technical terms.

Workshop staff must have experience and detailed knowledge of operating diagnostic software and performing the dynamic calibriation.

3.4 General safety instructions

- Follow all safety information, instructions and notices in this document to avoid personal injury and material damage.
- Follow regional and national regulations on accident prevention.
- Ensure cleanliness throughout the application.
- Keep this document and other documentation supplied with the product.
- Make sure your workplace is dry as well as adequately lit and ventilated.
- Repairs may only be carried out by authorised personnel of the manufacturer or by authorised workshop personnel.

3.5 Personal protective equipment

- To prevent injury, wear personal protective equipment suitable for the intended activity according to the instructions at the workplace, e.g.:
  - Safety boots
  - Safety goggles
  - Ear protection

4 Production description

The Lane Departure Warning System (LDWS) is a camera-based warning system designed to help drivers avoid unintentional lane changes. The LDW system uses a camera and bracket mounted near the top/bottom centre of the windscreen to monitor the position of the vehicle in its lane. In the event of an unintentional lane change, the system alerts the operator by sounding audible warnings through a set of speakers.

The system operates automatically when the vehicle is moving on a road with painted lane markings. It identifies intentional lane changes by monitoring the turn signals, brake switch and vehicle speed.

If the system cannot provide assistance, the vehicle's yellow *LDW Not Avavailable* indicator turns on. When the factors causing the problem are resolved, the system automatically returns to normal operation and the yellow *LDW Not Avavailable* indicator turns off.

4.1 Technical data

Cameras:

Weight	~180 g
Operating temperature	-40 °C to +85 °C
Nominal supply voltage	12/24 V
Current consumption	500 mA @ 24 V
Dimensions	118 mm x 118 mm x 65 mm
Output current for seat vibrators and status lamps	max. 1 A @ nominal voltage
Mounting	Locks on the dedicated bracket
Camera performance	Identical to OEM

Brackets:

Weight	~50 g
Dimensions	117 mm x 115 mm x 39 to 52 mm* * depends on the version
Mounting	Adhesive tape
Bracket versions	Top mount: 22°; 16° Bottom mount: 14°

4.2 Product maintenance and warning statements

- Read this publication carefully.
- Adhere to all instructions, information and safety information to prevent injury to persons and damage to property.
- Always abide by the vehicle manufacturer's specifications and instructions.
- Observe all accident regulations of the respective company as well as regional and national regulations.

WABCO will only guarantee the safety, reliability and performance of their products and systems if all the information in this publication is adhered to.

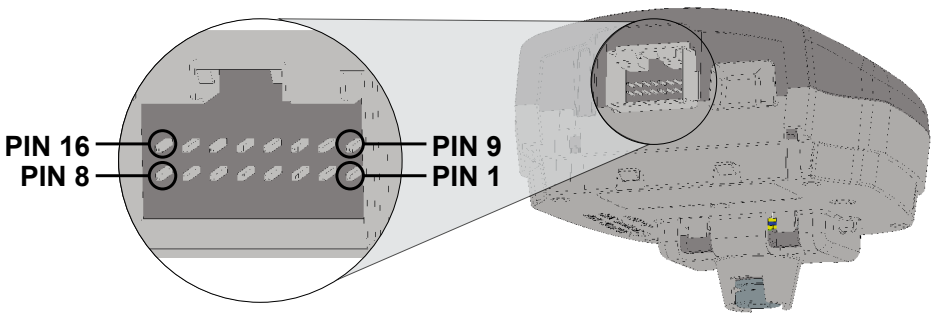
Driver assistance systems do not release the driver from his duty to actively follow the traffic regulations.

4.3 Electrical connector

Pin assignment for the following devices:

PN WABCO OE	PN WABCO AM	PN DAF
446 070 125 0	446 070 190 0	2032261
446 070 126 0	446 070 191 0	2119707

PN WABCO OE	PN WABCO AM	PN IVECO
446 070 325 0	446 070 390 0	5802125554
446 070 326 0	446 070 391 0	5802125558



Pin	Name/connection
1	Terminal 30 (battery)
2	Terminal 31 (ground)
3	Terminal 15 (ignition)
4	CAN J1939 High
5	CAN J1939 Low
6	Private CAN High
7	Private CAN Low
8	Switch input

Production description

Pin	Name/connection
9	Left turn signal
10	Right turn signal
11	Status lamp
12	Enabled lamp/radio mute
13	Left speaker +
14	Left speaker -/left haptic
15	Right speaker +
16	Right speaker -/right haptic

5 Device installation/component replacement

5.1 Camera and bracket replacements

The tables below show the relationship between OEM devices and AM spare parts.

Device	PN WABCO OE	PN WABCO AM	PN DAF	Mount type (on the windscreen)
Camera	446 070 125 0	446 070 190 0	2032261	Top mount
Camera	446 070 126 0	446 070 191 0	2119707	Top mount
Bracket	446 070 933 0	446 070 909 0	2032262	Top mount
Bracket	446 070 934 0	446 070 924 0	2032263	Top mount

Device	PN WABCO OE	PN WABCO AM	PN IVECO	Mount type (on the windscreen)
Camera	446 070 325 0	446 070 390 0	5802125554	Bottom mount
Camera	446 070 326 0	446 070 391 0	5802125558	Bottom mount
Bracket	446 070 910 0	446 070 920 0	5802187075	Bottom mount

In order to select the correct AM spare parts, it is first necessary to check which OEM camera/bracket is appropriate for the vehicle.

This can be checked via the DAF ePortal (Repair and Maintenance Information) or the IVECO POWER parts catalogue. (If the camera and bracket match the vehicle, they also match each other.)

Then you can select the spare part based on the OEM camera/bracket number (see table above).

AM spare parts have the same backward compatibility as OEM devices.

For example:

The OEM camera 2032261 (DAF) can replace old camera version 2119558.

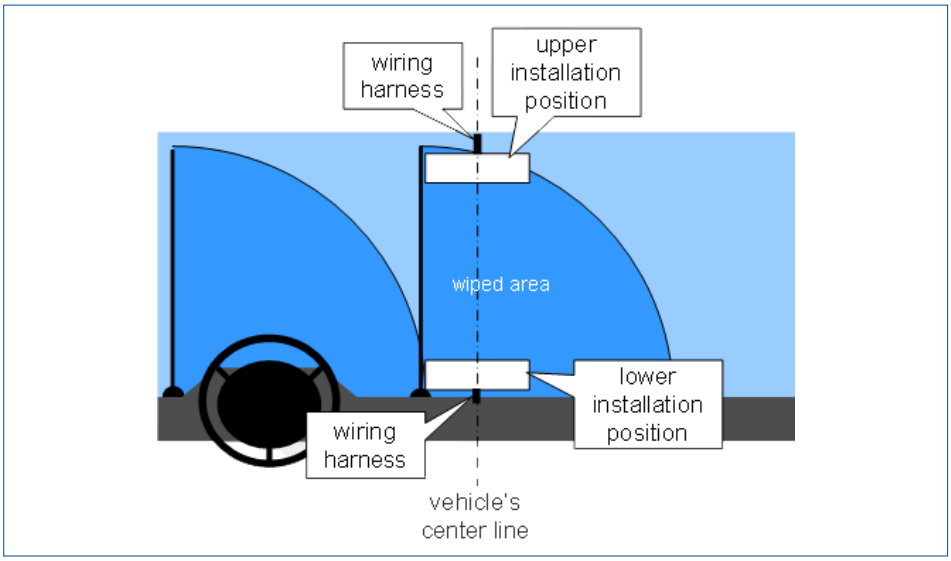
This means that the spare part 446 070 190 0 can also replace this older version (spare parts have the same functionality as their OEM equivalents).

i This chapter must be always considered together with chapter "5.3.1 Installation in DAF vehicles", page 13 and chapter "5.3.2 Installation in IVECO vehicles", page 17

5.2 Installation position

> Consult the DAF ePortal (Repair and Maintenance Information) or IVECO eTIM platform for detailed information and instructions regarding your specific vehicle type. Workshop instructions for the OEM parts also apply to the AM spare parts.

The installation of the camera and bracket depends on the vehicle type/model.



- Take the following points into consideration when planning the installation of the camera:
- The windscreen must not be subjected to temperature differences.
- The vehicle should have an ambient temperature > 15 °C.
- The viewing area of the camera must be within the wiping area of the windscreen wipers.
- The camera must not restrict the driver's view.
- The camera's installation location must allow for an appropriate channel for the wiring harness.

Example installations:

Top mount

Bottom mount

5.3 Installation

This chapter and its sub-chapters ("5.3.1 Installation in DAF vehicles" and "5.3.2 Installation in IVECO vehicles") should be regarded as a general guide for the replacement of spare parts.

> – Always check the match between the OEM device and its AM equivalent, see chapter "5.1 Camera and bracket replacements", page 11).
>
> Spare parts have the same funcionality as their OEM equivalents, i.e. their installation can be carried out in the same way.

5.3.1 Installation in DAF vehicles

Installation steps:

1. Switch the transmission to neutral and activate the park brake.
2. Secure the vehicle with brake wedges.

⚠ CAUTION

Risk of electric shock, malfunction and damage to electrical components or abnormal operation.

Minor to moderate injuries possible.

– Make sure that the engine and ignition are turned off before disconnecting the battery clamp (negative pole).

– Always wait two minutes between switching off the engine and ignition and disconnecting the battery clamp..

3. Remove the battery cover box.

> – Always check that the driver card is ejected before disconnecting the battery clamp (negative terminal).

4. Disconnect the battery clamp (negative pole).

Device installation/component replacement

NOTICE

Risk of material damage.

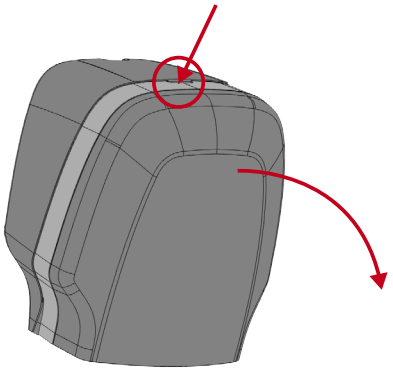
Medium to extensive material damage possible.

– Ensure that only trained and qualified personnel are allowed to replace the camera / bracket on the vehicle.

5. Disassemble the old LDWS camera module:

   a. Disconnect the wiring harness from the camera module.

   b. Press down the detent on the top of the camera and at the same time pull the camera backwards out of the bracket.



i You may need to use a tool (e.g. a screwdriver) to push the detent down.

i Steps 6 and 7 only apply in the event of damage to the bracket or windscreen. If the windscreen and bracket are not damaged (replacement not required), these steps can be skipped.

If the windscreen is damaged and has to be replaced with a new one, step 6 can also be skipped (the old bracket must be disposed of along with the damaged windscreen).

6. Remove the old mounting bracket.

   a. Disassemble the LDWS camera module (see step 5).

   b. Remove the old mounting bracket from the windscreen.

i You may need to use a screwdriver or flat tool and apply heat to the surface of the adhesive tape in order to release the bracket from the windscreen.

   c. Clean the windscreen at the desired mounting location with a mixture of 50 % isopropyl alcohol and 50 % water.

7. Install the new mounting bracket.

> The ideal application temperature for the tape ranges from 21 °C to 38 °C.
> The recommended minimum application temperature is 15 °C.

> Detailed workshop instructions for fitting the bracket to the windscreen (depending on the vehicle and bracket type) can be found on the DAF ePortal (Repair and Maintenance Information). Pay particular attention to the dimensions given in the workshop instructions. If the clamp is placed inaccurately, the further calibration procedure may fail.

a. Clean the application area of the windscreen of oil, moisture, dirt and dust and allow the area to dry completely.

b. Remove the protective layer from the adhesive surface on the mounting bracket.

c. Press the bracket against the windscreen for at least 30 seconds to allow the adhesive tape to bond. You can apply pressure, but make sure that only the flat surface of the bracket is pressed (not the area with the snaps or airflow grooves).

d. Check the contact area of the adhesive from the outside of the windscreen to ensure full contact. If any air pockets appear, apply pressure to the corresponding area from the inside.

e. Having installed the bracket, wait at least 1 hour before inserting the new camera into the bracket.

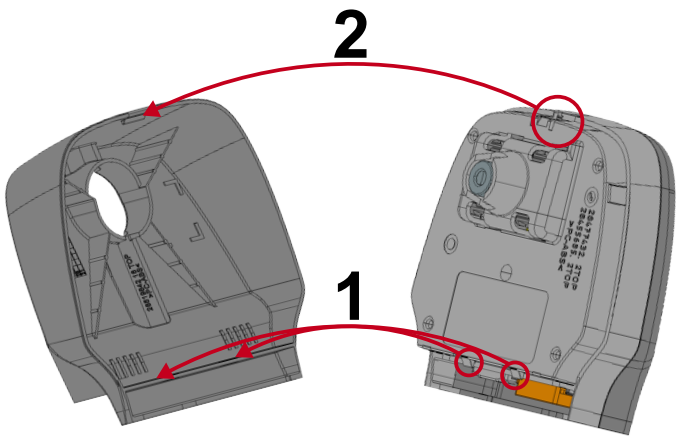
8. Install the new LDWS camera module.

a. Remove the protective cap from the camera lens.

> – Ensure that the camera lens remains free from contamination and do not touch the lens.

b. Guide the catches on the underside of the camera into the holes provided on the mounting bracket (1).

c. Press the upper part of the camera into the mounting bracket until it snaps into place (2).



9. Connect the battery clamp (negative pole).
10. Install the battery box cover.
11. Run the diagnostic program (DAVIE).

> – Ensure a stable internet connection.

12. Program the new camera (spare part).

WABCO AM cameras are equipped with a pre-installed functional software version (without specific vehicle parameters).

The first thing to do before the installation via DAVIE is to check which OEM camera (hardware number) fits the vehicle and then select the correct AM spare part (based on chapter "5.1 Camera and bracket replacements", page 11).

Also check that there are no bulletins (e.g. PB00294) for the OEM hardware number in the DAF Repair and Maintenance Information (DAF ePortal).

In some cases (based on the information provided in the bulletin), the software ID card may have to be changed before the installation to provide the appropriate SW version for the new camera unit. In order to change the SW ID card (software component), the workshop must send the ticket to the DAF support center.

> **i** Always indicate the OEM hardware number on the ticket, even if a spare part will be installed instead of an OEM unit.

NOTICE

Risk of blocked cameras.

Medium to extensive material damage possible.

– Never start programming the new ECU if there is no compatibility between the SW versions. In this case, the software ID card must be updated via the DAF ePortal / support center.

If the SW compatibility is given, you can start the programming.

13. Start a dynamic calibration of the new camera unit during the test drive.

5.3.2 Installation in IVECO vehicles

Installation steps:

1. Switch the transmission to neutral and activate the park brake.
2. Secure the vehicle with brake wedges.

⚠ CAUTION

Risk of electric shock, malfunction and damage to electrical components or abnormal operation.

Minor to moderate injuries possible.

– Make sure that the engine and ignition are turned off before disconnecting the battery clamp (negative pole).

– Always wait two minutes between switching off the engine and ignition and disconnecting the battery clamp.

3. Remove the battery box cover.

i – Always check that the driver card is ejected before disconnecting the battery clamp (negative terminal).

4. Disconnect the battery clamp (negative pole).

NOTICE

Risk of material damage.

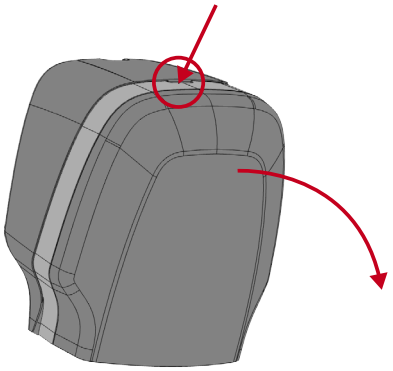
Medium to extensive material damage possible.

– Ensure that only trained and qualified personnel are allowed to replace the camera / bracket on the vehicle.

5. Disassemble the old LDWS camera module:

   a. Disconnect the wiring harness from the camera module.

   b. Press down the detent on the top of the camera and at the same time pull the camera backwards out of the bracket.



i You may need to use a tool (e.g. a screwdriver) to push the detent down.

i Steps 6 and 7 only apply in the event of damage to the bracket or windscreen. If the windscreen and bracket are not damaged (replacement not required), these steps can be skipped.

If the windscreen is damaged and has to be replaced with a new one, step 6 can also be skipped (the old bracket must be disposed of along with the damaged windscreen).

6. Remove the the old mounting bracket.

   a. Disassemble the LDWS camera module (see step 5).

   b. Remove the old mounting bracket from the windscreen.

i You may need to use a screwdriver or flat tool and apply heat to the surface of the adhesive tape in order to release the bracket from the windscreen.

   c. Clean the windscreen at the desired mounting location with a mixture of 50 % isopropyl alcohol and 50 % water.

7. Install the new mounting bracket.

> The ideal application temperature for the tape ranges from 21 °C to 38 °C.
> The recommended minimum application temperature is 15 °C.

> Detailed workshop instructions for fitting the bracket to the windscreen (depending on the vehicle and bracket type) can be found on the IVECO eTim platform. Pay particular attention to the dimensions given in the workshop instructions. If the clamp is placed inaccurately, the further calibration procedure may fail.

a. Clean the application area of the windscreen of oil, moisture, dirt and dust and allow the area to dry completely.

b. Remove the protective layer from the adhesive surface on the mounting bracket.

c. Press the bracket against the windscreen for at least 30 seconds to allow the adhesive tape to bond. You can apply pressure, but make sure that only the flat surface of the bracket is pressed (not the area with the snaps or airflow grooves).

d. Check the contact area of the adhesive from the outside of the windscreen to ensure full contact. If any air pockets appear, apply pressure to the corresponding area from the inside.

e. Having installed the bracket, wait at least 1 hour before inserting the new camera into the bracket.

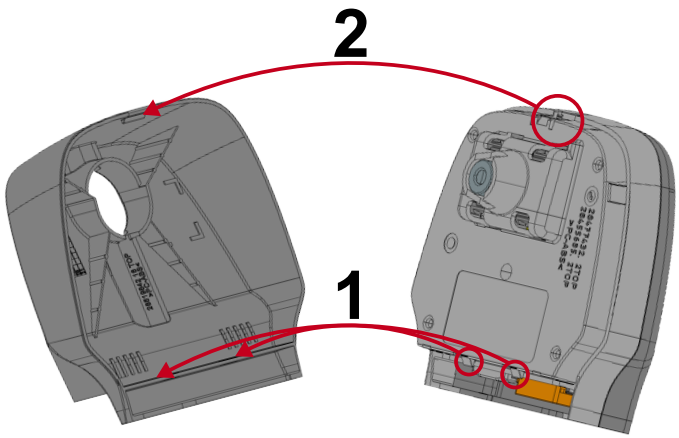
8. Install the new LDWS camera module.

a. Remove the protective cap from the camera lens.

> – Ensure that the camera lens remains free from contamination and do not touch the lens.

b. Guide the catches on the underside of the camera into the holes provided on the mounting bracket (1).

c. Press the upper part of the camera into the mounting bracket until it snaps into place (2).



9. Connect the battery clamp (negative pole).
10. Install the battery box cover.
11. Run the diagnostic program (UDT IVECO).

> Ensure a stable internet connection.

12. Program the new camera (spare part).

WABCO AM cameras are equipped with a pre-installed functional software version (without specific vehicle parameters).

The first thing to do before the installation via UDT or EASY is to check which OEM camera (hardware number) fits the vehicle and then select the correct AM spare part (based on chapter "5.1 Camera and bracket replacements", page 11).

You will find the matching OEM camera in the IVECO POWER parts catalogue (the search is based on the VIN).

The IVECO diagnostic tool checks whether the appropriate camera is installed (during installation) - if not, the installation is aborted.

> i After the installation, the VIN (vehicle identification number) is permanently assigned to the camera and the camera cannot be installed in another vehicle.

13. Start a dynamic calibration of the new camera unit during the test drive.

6 Camera calibration and diagnostics for DAF and IVECO

The spare parts diagnostics is the same as for the OES (OEM) devices. The Diagnostic Trouble Code (DTC) and its meaning are also the same.

No special tools or alignment knowledge are required for calibration.

The camera must always be aligned using a diagnostic tool in the workshop when the camera bracket has been removed from the vehicle or a new camera and bracket are installed.

If the camera was already aligned for operation and then removed from the vehicle, it is not necessary to calibrate the camera again. (The bracket is not removed so the alignment is still valid since the camera is fitted to the same bracket after re-installation.)

The calibration process must be carried out after installation.

The calibration can be started (via diagnostic tool) if the camera is already inserted into the bracket and the software installation (via diagnostic tool) has already been carried out.

The calibration process is identical to the OES (OEM) DAF and IVECO processes.

The error codes that may appear are the same as for OES (OEM) DAF and IVECO.

Description of the calibration process:

1. Start the calibration (with DAVIE diagnostic tool for DAF or UDT diagnostic tool for IVECO). When the service alignment is started, a yellow indicator light is visible on the instrument panel.
2. Drive the vehicle according to the information in the diagnostic tool (e.g.: drive at a constant speed of more than 50 km/h - best speed > 60 km/h).
3. Drive a section of road for at least 10 min. The duration of the procedure depends on the volume of traffic, the type of road (straight or winding) and the surface conditions (dry or wet).
4. If the alignment was successful, the yellow warning goes off automatically.

> i If the calibration was successful, the icons on the instrument panel disappear as soon as the key is turned to the OFF/ON position.

5. If the service alignment fails, the yellow warning (icon) is still visible on the dashboard.
6. If the calibration fails, carry out the following checks:

- Were the speed and duration of the ride appropriate and correctly calibrated?
- Does the vehicle have any other faults that affect the calibration procedure?
- Is the camera installed correctly (bracket position on the windscreen)?

Repeat the procedure until the calibration is completed successfully.

7 WABCO contact

You can find your local WABCO contact via the following page:
http://www.wabco.info/i/1489

You can find information on WABCO products here: www.wabco-customercentre.com
Please contact your WABCO partner for further information.

ZF Friedrichshafen AG

ZF is a global technology company and supplies systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. ZF allows vehicles to see, think and act. In the four technology domains Vehicle Motion Control, Integrated Safety, Automated Driving, and Electric Mobility, ZF offers comprehensive solutions for established vehicle manufacturers and newly emerging transport and mobility service providers. ZF electrifies different kinds of vehicles. With its products, the company contributes to reducing emissions and protecting the climate.

ZF, which acquired WABCO Holdings Inc. on May 29, 2020, now has 162,000 employees worldwide with approximately 260 locations in 41 countries. In 2019, the two then-independent companies achieved sales of €36.5 billion (ZF) and $3.4 billion (WABCO).

With the integration of WABCO, the leading global supplier of braking control systems and other advanced technologies that improve the safety, efficiency and connectivity of commercial vehicles ZF will create a new level of capability to pioneer the next generation of solutions and services for original equipment manufacturers and fleets globally. WABCO, with almost 12,000 people in 40 locations worldwide, will now operate under the ZF brand as its new Commercial Vehicle Control Systems division.

Mobilizing Commercial Vehicle Intelligence

WABCO