

NEW DAILY

BODYBUILDERS INSTRUCTIONS



L I G H T R A N G E

IVECO

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IVECO S.p.A
Technical Application & Homologation
Strada delle Cascinette, 424/34
10156 Torino (TO) - Italy

www.iveco.com

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UPDATE DATA

Section	Description	Page	Revision date

INTRODUCTION

This publication provides information, features and instructions for transformation and fitting of the vehicle; considering the type of content, it is meant for qualities and specialised staff.

The Bodybuilder is manager of the project and its execution, and must assure compliance with what is set forth in this publication and in the laws in forth.

Any modification, transformation or fitting not provided by this manual and not expressly authorised, will result in exemption of any liability by IVECO and in particular, if the vehicle is covered by a guarantee, the immediate dissolution of the same.

This criterion also applies with regard to single units and components, those described in this manual have been submitted by IVECO to for deliberations, approvals and inspections and belong to normal production. The use of any type of unit not recognised (such as PTO, tyres, horns, etc.) relieves IVECO from any liability.

IVECO is available to provide information on the implementation of the interventions and to provide instructions for any cases and situations not covered in this publication.

Before performing any operation, it is necessary to:

- verify that you have the manuals for the vehicle model on which you are about to work;
- ensure that all the safety devices (goggles, helmet, gloves, shoes, etc.), as well as the equipment used for work, lifting and transport, is available and working;
- ensure that the vehicle is placed in safe conditions.

At the end of the operation, the operational, efficiency and safety conditions set by IVECO must be restored. Contact the Service network for vehicle calibration if necessary.

Data and information contained in this publication may be outdated as a result of changes adopted by IVECO, at any time, for technical or commercial reasons or due to the need to adapt the vehicle to new legal requirements.

In the event of discordance between the information herein and the actual vehicle, please contact the Product Manager operating on the market before performing any interventions.

SYMBOLS - WARNINGS

	Danger for persons Failure to comply with these prescriptions can result in the risk of serious injury.
	Risk of serious damage to the vehicle Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle and can sometimes result in the guarantee being voided.
	General danger Includes the dangers of both above described signals.
	Environmental protection Indicates correct behaviour in order that vehicle use is as environmentally friendly as possible.
NOTE	Indicates an additional explanation for a piece of information.

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GENERAL INFORMATION

I.1 SCOPE OF THE GUIDELINES

The scope of this publication is to provide information, features and instructions for fitting and transformation of the original IVECO vehicle in order to ensure its functionality, safety and reliability.

These Guidelines also aim to indicate to Bodybuilders:

- the quality level to be obtained;
- obligations regarding the safety of operations;
- obligations regarding the objective responsibility of the product.

It should be noted that the collaboration with IVECO is based on the assumption that the Bodybuilder uses the maximum of their technical and organisational skills and that operations are technically and perfectly complete. As outlined below, the topic is extensive and we can only provide the rules and minimum precautions that can allow development of the technical initiative.

Faults or defects caused by total or partial failure to comply with these Guidelines are not covered by the guarantee on the chassis or relative mechanical units.

I.2 TECHNICAL DOCUMENTATION AVAILABLE ELECTRONICALLY

On the website www.ibb.iveco.com the following technical documentation is available:

- Guidelines for transformation and fitting of vehicles;
- technical specifications;
- truck diagrams;
- tractor diagrams;
- chassis diagrams;
- other range-specific data.

Requests to access the site must be made exclusively at www.ibb.iveco.com.

I.3 IVECO AUTHORISATION

Modifications or fittings proved in these Guidelines and carried out in respect of the same do not require a specific authorisation.

On the other hand, IVECO authorisation is required to carry out:

- particular changes to the wheelbase;
- work on the braking system;
- modifications to the steering system;
- modifications to the stabiliser bars and suspensions;
- modifications to the cab, cab mounts, locking and tilting devices;
- modifications to intake, engine exhaust and SCR components;
- applications of retarders;
- power take-off applications;
- variations in tyre measurements;
- modifications to hook organisms (hooks, fifth wheels).

I.4 AUTHORISATION REQUEST

Authorisation requests, when necessary, must be sent to the responsible IVECO Departments on the market.

The Bodybuilder must provide vehicle data (cab, wheelbase, overhang, chassis No.) and adequate documentation (drawings, calculations, technical report, etc.) showing the realisation, use and operating conditions of the vehicle. The drawings should evidence everything that differs from these instructions.

The Bodybuilder will be responsible for obtaining final approval from the competent authority for completed operations.

I.5 RESPONSIBILITIES

The authorisations issued by IVECO are exclusively related to the technical/conceptual feasibility of the modification and/or fitting.

The Bodybuilder is therefore responsible for:

- the design;
- the choice of materials;
- the implementation;
- the compliance of the design and implementation to any specific indications provided by IVECO and the laws in force in the countries where the vehicle is destined;
- effects on functionality, safety, reliability and, in general, good behaviour of the vehicle;
- the supply of spare parts for a minimum period of 10 years starting from the last fitting of an order and for all pieces and components that are installed.

I.6 LEGISLATIVE REQUIREMENTS

The Bodybuilder must verify that the final product is compliant, without exception, to all applicable legal requirements, on the municipal/autonomous/national level of each State in which it is registered and/or will circulate (Highway code, Official Regulations, etc.) and on the international level (European Union Directives, ONU/Geneva ECE Regulations, etc.). It is also necessary to comply with all requirements for accident prevention, instructions for assistance, the environment, etc.

The regulations on accident prevention or the legal indications cited in these Guidelines may be considered the most important, but are not meant in any way to replace or eliminate the obligation and responsibility of the Bodybuilder to stay properly informed.

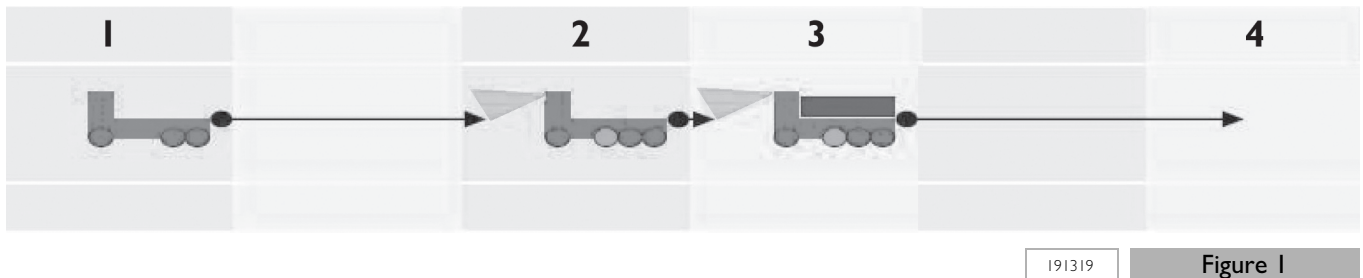
For this reason, IVECO shall not be held liable for any consequences due to errors caused by insufficient knowledge or incorrect interpretation of the legal provisions in force.

I.7 MULTI-STAGE APPROVAL - COLLABORATION (only for EU countries, Switzerland and Turkey)

Attachment XVII of Directive 2007/46/EC concerns *Multi-stage approval*.

This procedure requires that each manufacturer is responsible for the approval and compliance of the production of systems, components and "separate technical units" produced by the same or applied to the vehicle.

The manufacturer of the vehicle is defined as *first-stage manufacturer*, while the bodybuilder is defined as *Second-stage manufacturer* or that of the next stage.



1. IVECO
2. Dealer

3. Bodybuilder
4. Customer

Based on this Directive, IVECO (main vehicle manufacturer) and a Bodybuilder intending to launch the multi-stage approval process must sign a specific Collaboration Contract, called *Technical Agreement*, which sets out the content and reciprocal obligations in detail.

Consequently:

1. IVECO has the responsibility of providing, in the agreed form, the approval documents (EC/ECE approvals) and the technical information necessary for the proper implementation of the fitting and/or transformation (manuals, drawings, specifications);
2. the Bodybuilder has the following responsibilities:
 - the design and implementation of modifications to the basic vehicle received from IVECO,
 - reattainment of approvals of systems already approved in a previous stage when, due to changes on the basic vehicle the approvals need to be updated,
 - compliance with national/international laws and in particular the laws of the destination country, for all changes made,
 - presentation of the changes made to a technical service, for evaluation,
 - appropriate documentation of the changes made, in order to give objective evidence of compliance to the aforementioned provisions of law (e.g. approval documents/test reports).

Before signing the *Technical Agreement* IVECO reserves the right to visit the Bodybuilder, in order to verify qualifications to carry out the fittings and/or processing for which the above collaboration is requested.

The contents of the *Technical Agreement* can be evaluated in detail upon request to the Manager for relations with the Bodybuilder for the single Market.

1.8 GUARANTEES

The guarantee that the work has been performed to standard must be given by the Bodybuilder who made the superstructure or modifications to the chassis, in full compliance with the instructions in these Guidelines.

IVECO reserves the right to void the guarantee on the vehicle, if:

- unauthorised fittings or transformations have been carried out;
- a chassis not suitable for the fitting or intended use has been used;
- the standards, specifications and instructions, provided by IVECO for proper execution of the work, have not been respected;
- original spare parts or components made available by IVECO for specific operations have not been used;
- safety regulations have not been respected;
- the vehicle is used for purposes other than those for which it was designed.

I.9 QUALITY SYSTEM MANAGEMENT

IVECO has always promoted the training and development of a Quality System for Bodybuilders.

This requirement is not only due to regulations on product liability, but also to the increasingly higher quality level demands, new organizational forms in various sectors and the search for more advanced levels of efficiency.

IVECO therefore considers it appropriate for Bodybuilders to be equipped with:

- organizational charts for roles and responsibilities;
- quality objectives and indicators;
- design technical documentation;
- process documentation, including controls;
- plan for product improvement, also obtained through corrective actions;
- post-sales assistance;
- training and qualification of staff.

The availability of ISO 9001 certification, even though not required, is considered very important by IVECO.

I.10 ACCIDENT PREVENTION

Do not allow unauthorised staff to intervene or operate on the vehicle.

It is forbidden to use the vehicle with safety devices that have been tampered with or are damaged.



- ▶ **Structures and devices installed on the vehicle must comply with the applicable regulations for accident prevention, and with safety regulations required in the individual countries where the vehicles will be used.**

All precautions dictated by technical knowledge must be taken to avoid damage and functional defects.

Compliance with these requirements must be overseen by the builders of the structures and devices.



- ▶ **Seats, coatings, gaskets, protective panels, etc., may pose a fire hazard when exposed to an intense heat source. Remove them before working with welding and with flames.**

I.11 CHOICE OF MATERIALS TO USE: ECOLOGY - RECYCLING

In the study and design phase, the choice of materials to be used by be made carefully, even from the ecological and recycling point of view.

To this regard, please note that:

- it is forbidden to use materials that are harmful to health, or at least which may pose a risk, such as those containing asbestos, lead, halogen additives, fluorocarbons, cadmium, mercury, hexavalent chromium, etc.;
- it is advisable to use materials whose processing produces limited waste quantities and allows easy recycling after first use;
- in synthetic materials of the composite type, it is advisable to use components that are compatible with each other, allowing use with the possible addition of other recovery components. Prepare the required markings in accordance with the regulations in force;
- the batteries contain substances that are very dangerous for the environment. To replace the batteries it is possible to go to the Service Network, equipped for disposal in accordance with the nature and the law.



- ▶ **To comply with Directive 2000/53 EC (ELVs), IVECO prohibits the in-vehicle installation of components that contain lead, mercury, cadmium and hexavalent chromium; exceptions are made in cases allowed by Annex II of the above Directive.**

I.12 VEHICLE MANAGEMENT ON THE PART OF BODYBUILDER

Acceptance of chassis

The Bodybuilder receiving a chassis/vehicle from IVECO or from a Dealer must perform a preliminary check, notifying of any missing accessories or damage attributable to the transporter.

Maintenance

To preserve the chassis/vehicle in its full efficiency, even while parking in the warehouse, maintenance operations may be necessary within a predetermined time.

The expenses for carrying out these operations are borne by the owner of the vehicle in that moment (Bodybuilder, Dealer or Customer).



- ▶ **In case of long periods of vehicle inactivity, it is advisable to disconnect the negative pole of the battery to maintain optimal charging status.**

Delivery of the vehicle to the final customer

Before delivering the vehicle, the Body builder must:

- calibrate its production (vehicle and/or equipment) and verify functionality and safety;
- carry out the controls set forth in the Pre-Delivery Inspection (PDI) list available in the IVECO network, for the items being worked on (obviously the other items of the PDI will be the responsibility of the Dealer, such as the guarantee pamphlet);
- measure battery voltage with a digital multimeter (2 digit decimal), keeping in mind that:
 1. optimal value is equal to 12.5 V,
 2. between 12.1 V and 12.49 V the battery should be put under a slow charge,
 3. with values less than 12.1 V the battery should be replaced.

Note *The batteries must be maintained at regular intervals (refer to IVECO Std 20-1812 and/or IVECO Std 20-1804) until delivery of the vehicle to the Customer/Dealer to avoid problems of insufficient charging, short circuit or corrosion.*

IVECO reserves the right to nullify the guarantee on the battery if the prescribed maintenance procedures are not respected.

- carry out a functional road test (in case of vehicle transformation). Any defects or problems should be notified to the IVECO Assistance Service to verify conditions for inclusion in the PDI costs;
- prepare and deliver to the final Customer the necessary instructions for service and maintenance of the fitting and any added units;
- report new data on special labels;
- provide confirmation that the operations carried out comply with the indications of the vehicle Manufacturer and legal requirements;
- draw up a guarantee covering the changes made.

Instructions for additional units

For additional units, the Body builder must provide all necessary maintenance instructions upon vehicle delivery.

All the units that make up the same order must be equipped with components of the same brand, model and quality.

I.13 VEHICLE NAMES

The commercial name of IVECO vehicles (for example **New DAILY 40-150**) does not match the type approval name. A complete example is provided below.

Type approval name

New DAILY 40C15HA SV /P

- **New DAILY** – Vehicle name
- **40** – Gross mass - GVW (no/10 = weight in t)

33	2.8÷3.49 t
35	3.5 t
40	4.2 t
45	4.5 t
50	5.0 t
60	6.0 t
65	6.5 t
70	7.0 t

- **C** – Rear wheels

S	Single rear wheels
C	Twin rear wheels

- **15** – Engine power (no. x 10 = power in HP)
- **H** – Engine type

/23	FIA Engine (combined with engine power code 15)
N	Natural Power Engine (Bi-Fuel - combined with engine power code 14)
G	CNG Engine (combined with engine power code 14)
H	Euro VI Engine (combined with engine power codes 15 and 17)

- **A** – Type of transmission

–	Manual gearbox
A	automatic transmission
A8	Automatic transmission

- **SV** – Version

–	Cab
D	Dual cab (6+1)
V	Van
SV	Semi-windowed
Camper	Preparation for camper
CCSCamper	Short cowl version for camper
CV	Vendor
CC	Cowl
CCS	Cowl (short)
CA / CAH3	Cut Away / Cut Away con altezza massima del vano carico

- **/ P** – Rear pneumatic suspensions

I.14 TRADEMARKS AND SYMBOLS

Trademarks, symbols and names may not be altered or moved from their original placement, as the originality of the vehicle image must be protected.

The application of transformation or fitting trademarks must be authorised; their placement should not be in the immediate vicinity of the IVECO trademark and symbols.

IVECO reserves the right to withdraw trademarks and symbols if the fitting or transformation present features that do not comply with requirements. the Body builder assumes full responsibility for the entire vehicle.

I.15 DIMENSIONS AND GROUND

General information

The dimensions and masses of vehicles allowed on the axles are shown in the drawings, the technical descriptions and, more generally, on the documents on the official IVECO website. Defects refer to vehicles in their standard versions; the use of special equipment may lead to changes on the masses and their distribution on the axles.

Weighing of the chassis

It should be noted that variations are possible on the masses of the order of 5%.

For this reason, before carrying out the fitting, it is a good idea to determine the mass of the vehicle cab and its distribution on the axles.

Vehicle adaptability

Depending on the vehicle, adaptability limits essentially depend on:

- wheelbase length
- distribution of mass on the axles;
- maximum permitted width

The positioning of clearance lights and rear view mirrors is usually correlated with outline widths of up to 2350 mm.

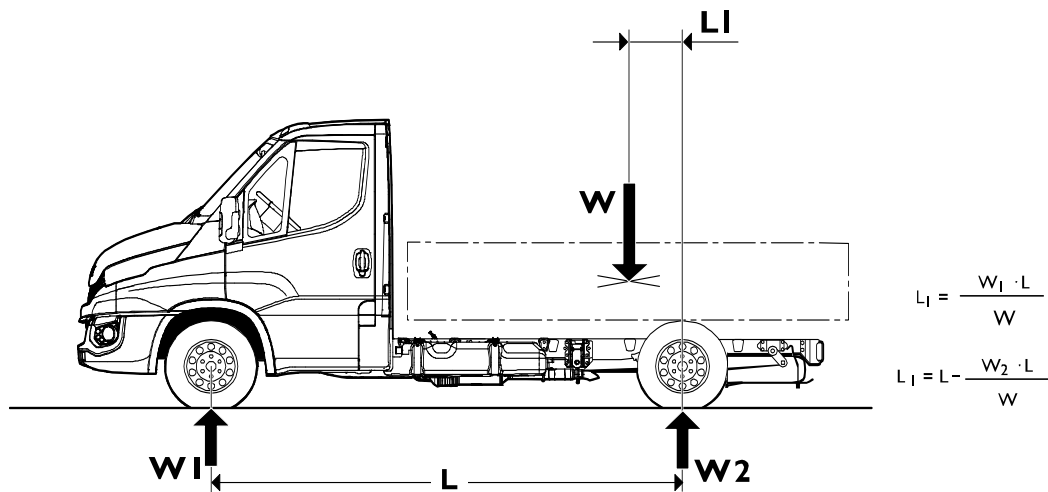
For larger widths (special body set-ups, refrigerated vans, etc.), reference can be made to the composition of IVECO optionals or an assessment of the intended solution can be requested.

Determination of the centre of gravity of the superstructure and the payload

Positioning on the longitudinal plane

To determine the position of the centre of gravity of the superstructure and the payload, you can proceed according to the examples given below.

On the technical documentation for each model (cab version diagram), you can see the positions allowed by the vehicle in the standard version. The masses and the positioning of the individual components of the vehicle are shown on the chassis and weight allocation diagram.



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Figure 2

Example for calculating the position of the centre of gravity of the payload plus superstructure

W = Payload plus superstructure

W1 = Measurement of payload on front axle

W2 = Measurement of payload on rear axle

L1 = Distance of centre of gravity from centre line of rear axle

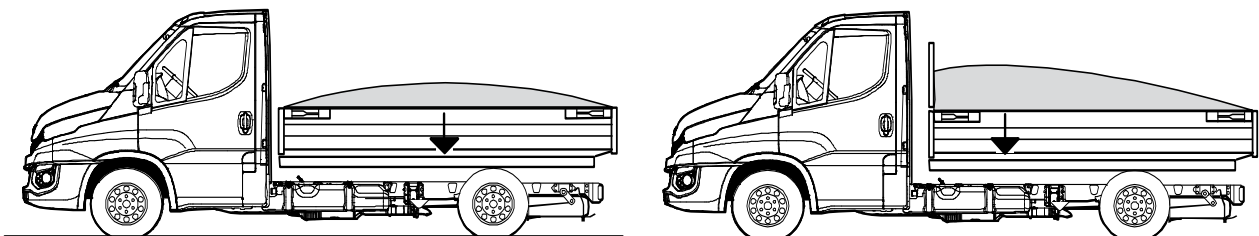
L = Actual wheelbase

For the purposes of breakdown of the payload on the axes, it should be considered that this is evenly distributed, except in cases in which the shape of the load surface leads to a different load distribution.

For equipment, the centre of gravity is obvious considered for its actual position.

In the realisation of the superstructure or containers, automatic loading and unloading of the goods transported must be provided to avoid excessive variations of the distribution and/or excessive loads on the axes, providing information for users if necessary.

The Body builder should also provide a suitable anchoring systems for the load on the superstructure, so that transport can occur in maximum security.

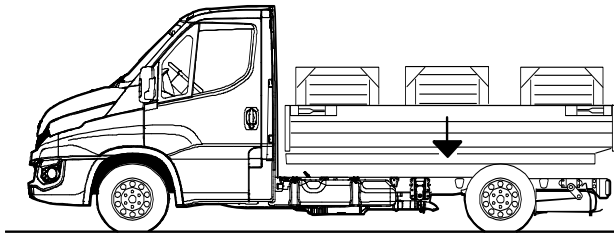


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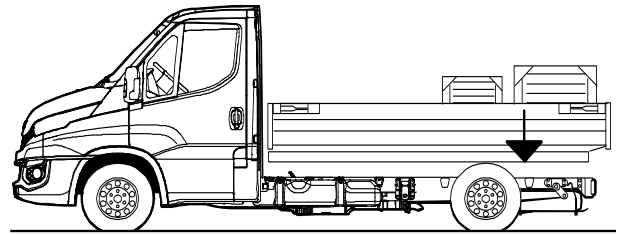
Figure 3

Even distribution of load

Uneven distribution of load



Even distribution of load



Uneven distribution of load (attention to loads on axles and minimum ratio)

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Figure 4

Height of centre of gravity

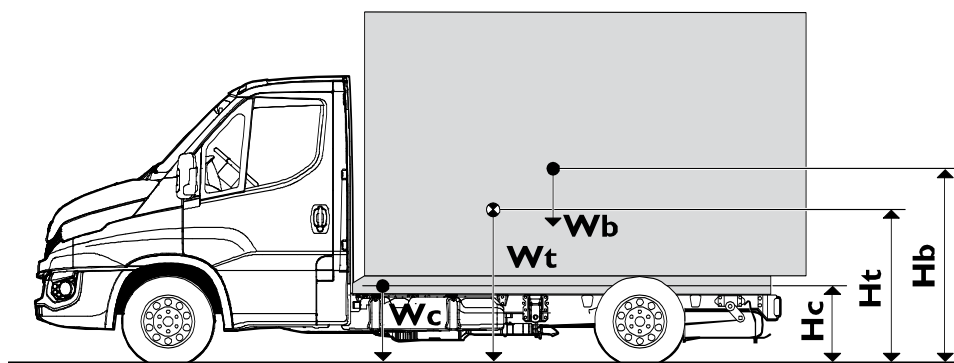
For the cab version and no-load vehicle, the value of the height of the centre of gravity is shown on the specific technical documentation for each model (cab version diagram).

For the vehicle complete with super structure and full load, this height must comply with the maximum values allowed by national or international standards, in particular, Directives ECE 13 on longitudinal stability and ECE 111 on lateral stability while driving.

The following cases should be distinguished:

1. fixed loads,
2. mobile loads;
3. loads that result in increased aerodynamic actions.

1. Fixed loads



$$H_t = \frac{W_v \cdot H_v + W_s \cdot H_s}{W_v + W_s}$$

$$H_s = \frac{(W_v + W_s) \cdot H_t - W_v \cdot H_v}{W_s}$$

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Figure 5

Control at full load

H_v = Vehicle centre of gravity height (loaded)

H_s = Height of payload centre of gravity from the ground

H_t = Complete full-load vehicle centre of gravity height

W_v = Vehicle tare weight

W_s = Payload

W_t = Complete vehicle ground at full load

For any inspections with the vehicle set up without payload you can proceed similarly, assuming W_s is only the tare weight of the superstructure (considering for H_v a value appropriate for the load and between the no-load cab version trim and the full-load trim).

The following table lists the maximum indicative heights of the overall centre of mass (payload + dump body and/or equipment) with reference to the vehicle's crossways stability.

Table I.1

Models	Height of centre of mass (mm)
33S	1400
35S	1500
35C - 40C (Frontal transverse leaf)	1800
35C - 40C (front longitudinal torsion bar)	1900
45C - 50C	1950
60C - 65C - 70C	2050

2. Mobile loads

In the versions where the load can be moved laterally while cornering (e.g.: suspended loads, liquid transport, animal transport, etc..) high lateral dynamic forces may be generated which may jeopardise the stability of the vehicle.

With reference to the indications of ECE 111, special attention should therefore be paid:

- in defining the height of the fitted vehicle's centre of gravity and at full load;
- in assessing the dynamic forces and the lateral displacement of the centre of gravity;
- in considering (for liquids) the density;
- in prescribing the adoption of adequate precautions for driving.

Any cases where evaluation is difficult should be submitted to IVECO for approval.

3. Loads that result in increased aerodynamic actions

In fittings characterised by high vertical and surface development (e.g.: advertising panelling), the height of the centre of thrust, determined in the case of cross-wind, must be evaluated very carefully.



- **Even with the low centre of gravity, a vehicle fitting that has a high surface area may not provide sufficient lateral stability and may be exposed to the danger of tilting.**

Special attention must therefore be paid:

- in defining the height of the fitted vehicle's centre of gravity and at full load,
- in assessing the aerodynamic forces,
- in prescribing the adoption of adequate precautions for driving.

Any cases where evaluation is difficult should be submitted to IVECO for approval.

Adoption of stabiliser bars

The application of additional or reinforced stabiliser bars, where available, reinforcing the springs or rubber elastic elements (in accordance with the procedure outlined in Section 2.9 (► Page 31)), may allow higher values of the centre of gravity of the payload, to be determined on a case by case basis. The operation must be carried out after a careful evaluation of the features of the fitting, the wheelbase and the subdivision of lateral forces on the suspension, and should generally concern both the front and the rear. However, it should be kept in mind that in many cases it is advisable to carry out the operation only on the rear axle; acting on the front axle would give the driver an incorrect sensation of greater stability, making it actually harder to perceive the safety limit. Interventions on the front axle can be made in the presence of concentrated loads behind the cab (e.g. cranes) or superstructures with high rigidity (e.g. vans).

Respect of the permitted masses

All the limits shown on IVECO documentation must be respected. It is particularly important to evaluate the maximum ground on the front axle in any load condition, in order to ensure the necessary steering features in all road surface conditions.

Special attention must therefore be paid to vehicles with concentrated load on the rear overhang (e.g.: cranes, tail lifts, trailers with centre axle) and short wheelbase vehicles and high centre of gravity.

Note *In the positioning of the auxiliary bodies and superstructure, a proper load distribution in the transverse direction must be ensured. A variation on the nominal load may be permitted for each wheel (50% load on the corresponding axle) of $\pm 4\%$ (e.g.: load allowed on the axle 3,000 kg; allowed for each wheel side from 1,440 to 1,560 kg) in compliance with what is permitted by the tyres, without affecting the braking and driving stability characteristics of the vehicle.*

Unless other specific dispositions are provided for individual vehicles, one must consider for the mass on the front axle a minimum value of 25% of the effective mass of the vehicle (with loads distributed uniformly as well as with loads on the rear overhang or associated with a trailer, if attached).

The rear overhang of the superstructure must be implemented in full compliance with the permitted axle loads, the minimum load required on the front axle, length limits, the position of the tow coupling and the under-run protection as envisaged by various standards and regulations.

Variations on permitted masses

Special exemptions from the maximum permissible masses may be granted for specific uses, for which, however, there are precise limits for use and reinforcements to be made to parts of the vehicle.

These exceptions, if they exceed the limits of the law, must be authorised by the Administrative Authority.

In the authorisation request, you must indicate:

- type of vehicle, wheelbase, chassis number, intended use;
- division of the tare weight on the axles (in fitted vehicles, e.g.: crane with flatbed), with the position of the payload centre of gravity;
- any proposals for strengthening the parts of the vehicle.

The permitted reduction of mass on vehicles (derating), can lead to interventions on some parts, such as suspensions and brakes, and may require a new calibration for the braking correction operation; in these cases the necessary indications may be provided.

I.16 INSTRUCTIONS FOR PROPER FUNCTIONING OF THE VEHICLE PARTS AND ACCESSIBILITY

In carrying out the transformations and applying any type of equipment, there should be no alteration to what enables the proper functioning of the vehicle units and parts under various working conditions.

For example:

- free access must be guaranteed to the places that need inspection, maintenance or periodic controls (e.g., battery replacement, access to the air suspension compressor) and, in the case of enclosed superstructures, special compartments and doors should be provided;
- the possibility of disassembling the various groups for assistance operations must be maintained;
- in the fitting that provides the tipping of the lateral tails, consider the size of the most protruding parts of the vehicle, in order to avoid limitations to tipping or damage to the parts.
- conditions should not be affected regarding cooling (radiator grille, radiator, air passages, cooling etc.), fuel supply (pump positioning, filters, pipe diameter, etc.) and engine air intake;
- the soundproofing panels must not be altered or moved so as not to affect the approved sound emission limits. If any openings need to be made (e.g. for the passage of pipes or added sections), they must be thoroughly closed, using fireproof and soundproofing materials equivalent to the original materials used;

- adequate ventilation must be maintained for the brakes and battery casing (particularly in the execution of truck bodies);
- in the placement of fenders and wheel arches, free shaking of the rear wheels must be guaranteed, even under the conditions of use with chains.
- adjustment of the vehicle's headlamps must be checked once construction is completed, to correct any changes in their structure; for adjustment, proceed according to the instructions given in the "Use and Maintenance Handbook";
- for any elements supplied loose (e.g. spare wheel, chocks), the Body builder must position and fasten them in an accessible and secure way, in compliance to any national regulations.

I.17 GENERAL REGULATION FOR THE PREVENTION OF FIRE RISK

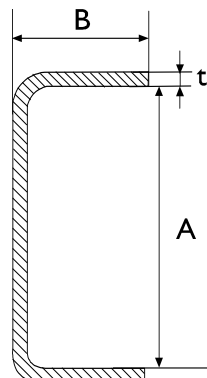
Particular attention must be paid to prevent the spillage of hydraulic fluids or inflammable liquids above components which may become hot or overheated.

Therefore, when pipes must be inevitably installed near the engine, exhaust system, catalytic converter or turbocharger, suitable insulating shields or protective plates must be provided.

I.18 CONVENTIONS

In these Guidelines the following conventions are adopted:

- **Wheelbase:** distance between the centre lines of the first steering axle and the first rear axle (engine or not).
- **Rear overhang:** distance between the centre line of the last axle and the rear extremity of the chassis side members.
- **Dimensions A, B and t** of the chassis section: see the picture on the side.



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Figure 6

SECTION 2

**CHASSIS
INTERVENTIONS**

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CHASSIS INTERVENTIONS

2.1 GENERAL CHASSIS MODIFICATION STANDARDS

Keep in mind that:

- **weldings on the supporting structures of the chassis are absolutely forbidden** (except as prescribed in Paragraph "Weldings" (➡ Page 9) and in Chapters 2.4 (➡ Page 15), and 2.5 (➡ Page 19));
- **no holes may be drilled in the wings of the side members** (except as indicated in Chapter 2.2 (➡ Page 8) and Chapter 3.3 Paragraph "Choosing the type of connection" (➡ Page 11));
- for cases where modifications to nailed unions are allowed, the nails may be replaced with flanged head screws or with hex head screws classed 8.8 with the next higher class diameter and nuts fitted with an anti-unscrewing system. Screws larger than M14 may not be used (maximum hole diameter of 15 mm), unless otherwise specified;
- for cases where unions that require screws are restored, the suitability of these screws must be checked before being re-used, and they must be tightened to the appropriate torque;



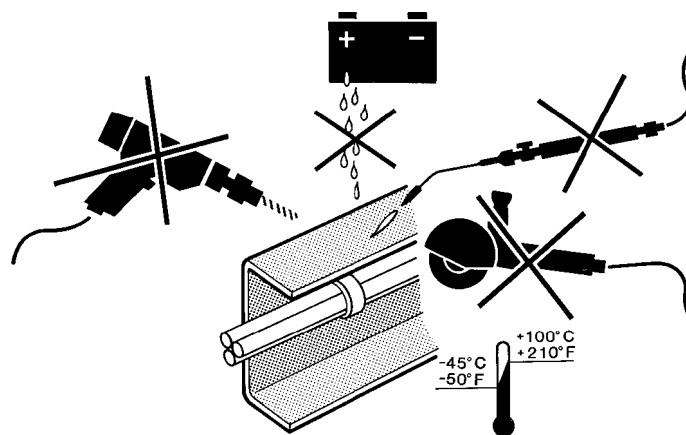
- ▶ **As regards remounting safety components, it is prohibited to re-use the same screws and tightening must be done at the specified torque (contact the Service Network for the value).**

- for cases involving remounting of safety components where nails are replaced by screws, the union must be checked again after about 500 - 1000 km of travel.

Preventive measures



- ▶ **When welding, drilling, milling and cutting near brake hoses and electrical wires, be sure to adopt appropriate precautions for their protection; disconnect these parts if necessary (respect the prescriptions in Chapters 2.15 and 5.7).**



91444

Figure 1

Precautions for alternators and electric/electronic components

In order to avoid damage to the rectifier diode, the battery must never be disconnected (or the isolator switch opened) while the engine is running.

In cases where the vehicle must be started by towing (strongly discouraged), make sure that the battery is charged and connected so as to ensure minimum supply voltage to the engine ECU.

Recharge the battery only after disconnecting it from the vehicle circuit. If the engine must be started-up with external charging equipment, be sure to avoid using the "Start" function (should these devices feature this function) in order to avoid peak currents that may damage electric and electronic components.

Start-up must be performed only via an external battery trolley, making sure that polarity is respected.

Earth connection

The original earth connections of the vehicle should never be altered; in cases where these connections must be moved or new connections added, use the holes present on the chassis to the extent possible, taking care to:

- mechanically remove - either by filing and/or with a suitable chemical based solution - the paint on both the chassis and terminal side, thus creating a contact surface free of indentations and edges;
- paint the area between the terminal and metal surface with a suitable high conductivity paint.
- connect to earth within 5 minutes after application of the paint.

For ground connections at the signal level (e.g. sensors or devices with low absorption), absolutely never use standardised IVECO M1 points (ground connection of the batteries), M2 or M8 (grounding the starter motor, depending on the position of the guide) and connect the signal cable ground on points separate from the power cables and wires that serve as radio frequency screens.

Avoid earth connections between devices in a concatenated fashion for electronic equipment; install individual earth connections of optimal length (favour the shortest routes).

Braking and electrical systems

For additional details on the braking and electrical systems see Chapters 2.15 (► Page 47) and 5.4.

Characteristics of the material used in chassis modifications

For chassis modifications on the vehicle (all models and wheelbases) and for applications of reinforcements on the side members, the material used must correspond to the original chassis material in terms of quality and thickness (see Tables 2.1 and 2.2).

If it is not possible to procure materials of the thickness indicated, materials having immediately higher standard thickness may be employed.

Table 2.1 - Material to be used in chassis modifications

Name of steel		Breaking strength [N/mm ²]	Yield stress [N/mm ²]	Elongation
IVECO	Fe E420	530	420	21%
Europe	S420MC			
Germany	QStE420TM			

Table 2.2 - Section dimension and chassis thickness

Class	Type	Wheelbase [mm]	Rear overhang chassis [mm]	A x B x t Side member section wheelbase area [mm]	A x B x t Side member section rear overhang area [mm]
33S - 35S	truck	3000	920	144 x 56 x 3	94 x 56 x 3
		3450	1355		

Class	Type	Wheelbase [mm]	Rear overhang chassis [mm]	A x B x t Side member section wheelbase area [mm]	A x B x t Side member section rear overhang area [mm]
33S - 35S	truck	3750	1655	144 x 56 x 3	94 x 56 x 3
		4100	1305		
	van	3000	840	144 x 56 x 3	94 x 56 x 3
		3520	840		
		3520 long overhang	1240		
35C	lightened camper	4100	1825	144 x 56 x 3	94 x 56 x 3
		3750	1655		
35C - 50C	truck	3000 ⁽¹⁾	1240	174 x 70 x 4	114 x 70 x 4
		3450	1355		
		3750	1655		
		4100 ⁽¹⁾	1715		
		4350	1885		
		4750 ⁽²⁾	2350		
35C - 40C	van	3520	840	174 x 69 x 3	114 x 69 x 3
		3520 long overhang	1240		
		4100	1825		
45C - 50C	van	3520	840	174 x 70 x 4	114 x 70 x 4
		3520	1240		
		4100	1825		
		4100 long overhang	2220		
60C - 70C	truck	3450	1355	174 x 69 x 5	174 x 69 x 5
		3750	1655		
		4100	1715		
		4350	1885		
		4750	2350		
	van	3520	1240		
		4100	1825		
		4100 long overhang	2220		

⁽¹⁾ Only 35C - 40C⁽²⁾ Only 45C - 50C

Stresses on the chassis

The following stress value in static conditions cannot be exceeded for any reason whatsoever:

Note static stress σ allowed on chassis: 120 N/mm²

In any case, respect any more restrictive limits placed by national standards.

Welding causes material property deterioration; therefore, when checking stresses in thermally altered zones, a resistance reduction of 15% must be accounted for.

2.2 DRILLS ON THE CHASSIS

Installation of auxiliary equipment onto the chassis must be done using the factory drilled holes whenever possible.



- **It is strictly forbidden to drill holes into the side member flaps, with exception to what is indicated in Chapter 3.3 - Paragraph "Choosing the type of connection".**

When new holes must be made for specific applications (installation of shelves, corner shelves, etc.), these must be drilled into the upright rib of the side member and must be thoroughly de-burred and bored.

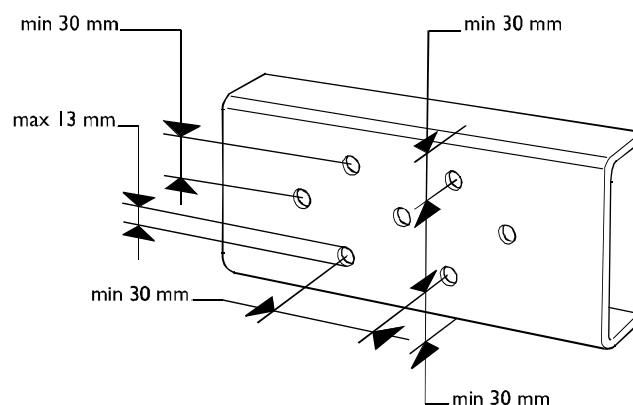
Hole position and size

The new holes must not be drilled into the areas subjected to greater stresses (such as spring supports) or where the side member section varies.

Hole diameter must be suited to sheet metal thickness but cannot exceed 13 mm (unless otherwise stated). The distance of the axis of the holes from the edge of the side member must not be less than 30 mm; in the same way, the axes of holes must not be less than 30 mm from each other or from other existing holes.

The holes must be offset as in Figure 2.

The original hole layout must be maintained when moving spring supports or crossbars.



102420

Figure 2

Screws and nuts

We generally recommend the use of the same type and class of screws and nuts as those employed for similar anchorages on the original vehicle (see Table 2.3).

Table 2.3 - Screws resistance classes

Resistance class	Use	Breaking strength [N/mm ²]	Yield stress [N/mm ²]
8.8	Intermediate resistance screws (crossbars, shear resistant plates, brackets)	800	640
10.9	High resistance screws (springs supports, stabiliser bars and shock absorbers)	1000	900

Screws classed 8.8 and 10.9 must be well cleaned and, for applications using a screw with a diameter of ≤ 6 mm; we recommend protection FeZnNi 7 IV.

Screw treatment allowed is Geomet or zinc coating. Geomet treated screws are discouraged when using them in welding operations.

Use flange headed screws and nuts if there is sufficient space.

Use nuts with an anti-unscrewing system and keep in mind that the tightening torque must be applied to the nut.

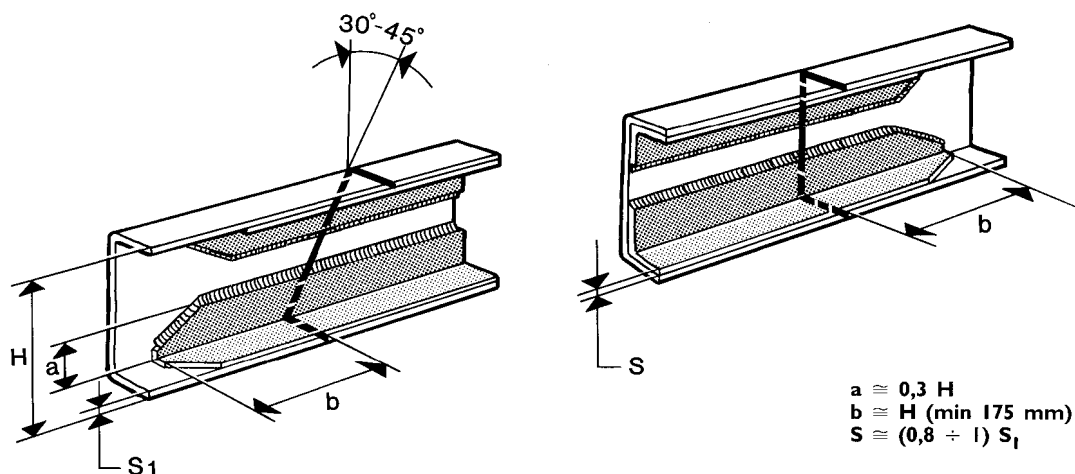
Welds



- **When welding, drilling, milling and cutting near brake hoses and electrical wires, be sure to adopt appropriate precautions for their protection; disconnect these parts if necessary (respect the prescriptions in Chapters 2.15 and 5.4).**

Welds are allowed:

- in side member unions for elongations or trimming;
- in the application of corner reinforcements in the area regarding side member modification, as hereafter specified (see Figure 3).



91448

Figure 3

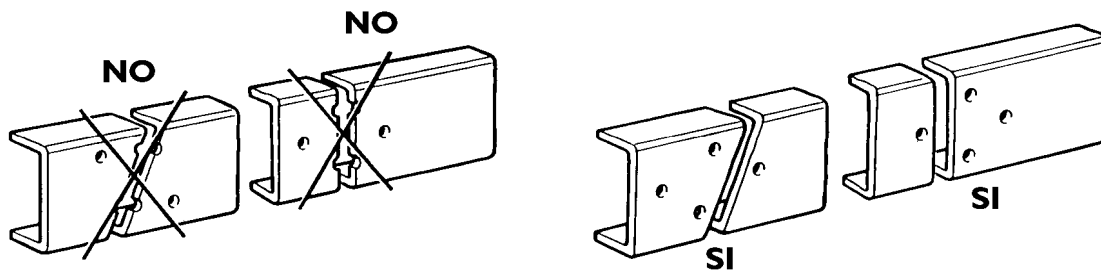
The following instructions must be respected when performing electric arc welding and in order to protect electrical components and ECUs:

- before disconnecting the power cables ensure there are no active electric users;

- if an electric circuit breaker (main switch) is present, wait for it to complete the cycle;
- disconnect the negative pole from the battery;
- disconnect the positive pole of the battery without connecting it to earth; do NOT short-circuit the negative pole;
- disconnect all ECU connectors, proceed with caution and do not touch the ECU connector pins;
- disconnect the ECU from the vehicle for welds close to the ECU;
- connect the welder earth directly to the weld piece;
- protect the plastic pipes from heat and disconnect them if necessary;
- protect the surfaces of the leaf and air springs against any weld splashes when welds are performed nearby;
- avoid touching the spring leaves with the electrodes or pliers.

Weld operations

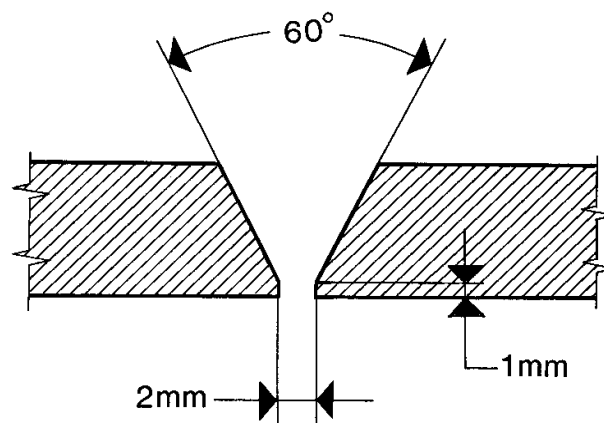
- Thoroughly remove paint and rust from the chassis where welds will be made, as well as all parts that will be covered by reinforcements.
- Cut the side members with a skewed or vertical cut. The side members must not be cut at the points where the chassis contour and width changes or where stress is greater (e.g. spring mounts). The cutting line must not go through the holes on the side member (see Figure 4).



91446

Figure 4

- Make a 60 degree bevel cut on the internal part of the side member of the parts to be joined, along the entire length of the weld area (see Figure 5).



91447

Figure 5

- Arc weld the area with multiple steps and use base electrodes that are thoroughly dried. Avoid power overloads; the welds must be free of marginal incisions and slag.
- Start from the opposite end and weld as in the previous item.
- Let the side members cool slowly and in a uniform fashion. No cooling with air jets, water or other means is allowed.

- Grind off the excess material.
- Mount steel corner reinforcements that have the same characteristics as the chassis; the minimum indicative sizes are shown in Figure 3.
Reinforcement anchorage must regard only the vertical rib of the side member and can be realised with a weld bead, staples, bolts or nails (even Huck nails).
Area and length of the weld bead, number and distribution of staples, number of nails or bolts must be adequate to transmit the bending and shearing moments.
- Once work is complete, use anti-rust protection (see Paragraph "Added or Modified Parts" (► Page 13)).

Sealing holes by welding

If new holes are located near old holes (see Figure 2), these last can be welded shut.

Good results are obtained by:

- chamfering the outer edge of the hole;
- applying a copper plate on the inner edge of the side member to hold the welding material;
- welding the side member on both sides with elimination of all residual material.

Holes of 20 mm diameter can be sealed off by using chamfered washers welded on both sides.

2.3 RUST AND PAINT PROTECTION

Note All components mounted on the chassis must be painted in compliance with IVECO Standard 18-1600 Colour IC444 RAL 7021 - 70/80 gloss.

Original vehicle parts

The following tables show, respectively, the classes of coating and protection required for the original vehicle components, the protections required for the parts not painted or in aluminium and treatments required for the painted parts.

Table 2.4 - Class of protection - IVECO Standard 18 - 1600 (Prospectus I)

Class	Part requirements	Examples of parts involved
A	Parts in direct contact with atmospheric agents	Bodywork - Rear-view mirrors - Windscreen wipers - Metallic structured sun visors - Metallic bumpers - Cab hook lock - Door stop device - Bodywork fastening elements (screws, bolts, nuts, washers), etc.
B B2	Parts in direct contact with atmospheric agents that mainly have structural characteristics, in clear sight	Frame and relative parts, including its fasteners Parts below the radiator grille (class B) External cab ramps
B1		Only for rear axles and front axles
C	Parts in direct contact with atmospheric agents, not in clear view	Engine and relative parts
D	Parts not in direct contact with atmospheric agents	Pedals - Seat coverings - Fastening elements - etc., mounted inside the cab

Table 2.5 - Various parts and components not painted and in aluminium - IVECO Standard 18 - 1600 (Prospectus IV)

Type of protection		IVECO standard	Classes			
			A	B - B1 - B2	C	D
Stainless steel ⁽¹⁾		18-0506	–	–	–	–
Geomet ⁽²⁾	GEO 321-8	18-1101	yes	–	–	–

Type of protection		IVECO standard	Classes			
			A	B - B1 - B2	C	D
Geomet ⁽²⁾	GEO 500-8	18-1101	yes	–	–	–
	GEO 321-8 PM					
	GEO 321-8 PML					
	GEO 321-8 PL					
	GEO 500-8 PL					
	GEO 321-5		–	yes		
	GEO 500-5					
	GEO 321-5 PM					
	GEO 321-5 PML					
	GEO 321-5 PL					
	GEO 500-5 PL		yes Class B1 wheel studs			
Zinc coating ⁽³⁾	Fe/Zn 12 II	18-1102	–	–	yes	yes
	Fe/Zn 7 IV		–	–	yes	yes
	Fe/Zn 12 IV					
	Fe/Zn 7 IV LUB					
	Fe/Zn 7 IV S					
	Fe/Zn 12 IV S					
Alloy Zn-Ni	Fe/Zn Ni 7 VII S	FIAT 9.57409	–	yes	yes	yes
	Fe/Zn Ni 7 IV					
Aluminium	Anode oxidation	18-1148	yes	yes	yes	yes
	Painting	See Table III	yes			

⁽¹⁾ Coupling with other materials must not cause the "battery effect".

⁽²⁾ Coatings free from chromium salts.

⁽³⁾ Coatings free of hexavalent chromium.

Table 2.6 - Painted parts - IVECO Standard I8 - I600 (Prospectus III)

Cycle phase description		Classes					
		A	B ⁽⁸⁾	BI ⁽⁵⁾	B2	C	D
MECHANICAL SURFACE CLEANING ⁽¹⁾	Sand/shot blasting	–	yes ^(*)	–	yes ^(*)	yes ^(*)	yes ^(*)
	Brushing	yes ^(*)					
	Sandpapering						
PRE-TREATMENT	Iron phosphating (only for non-precoated ferrous materials)	–	yes ^(*)	–	yes ^(*)	yes ^(*)	yes ^(*)
	Zinc phosphating ^(**)	yes					
CATAPHORETIC PAINTING	High thickness (30-40 µm)	yes ⁽²⁾	yes ^(*) ⁽⁶⁾	–	yes ^(*) ⁽⁶⁾	yes ^(*) ^{(6) (9)}	yes ^(*) ⁽⁶⁾
	Medium thickness (20-30 µm)	yes ⁽³⁾			–		
	Acrylic finishing (>35 µm)	–					
RUST PREVENTER	Bi-component (30-40 µm)	–	yes	–	yes	yes ^(*) ⁽⁹⁾	yes ^(*)
	Single-component (30-40 µm)		–	yes	–		
ANTIROCK PRIMER	Single (130 °C) or bicomponent (30-40 µm)	yes ⁽³⁾	–	–	–	–	–
VARNISH	Single (130 °C) or bicomponent (30-40 µm)	yes	yes ^(*)	–	–	yes ^(*)	yes ^(*) ⁽⁷⁾

Cycle phase description		Classes					
		A	B ⁽⁸⁾	BI ⁽⁵⁾	B2	C	D
VARNISH	Powders (40-110 µm)	yes ⁽⁴⁾	yes ^(*)	–	–	yes ^(*)	yes ^(*)
	Low temperature single-component (30-40 µm)	–	–	yes	–	yes ^(*)	yes ^(*)

⁽¹⁾ This operation must be performed when dealing with cutting burr, oxidation, weld slag, or laser-cut surfaces.

⁽²⁾ Two-layer bodywork cycle.

⁽³⁾ Three-layer bodywork cycle.

⁽⁴⁾ In alternative to single and bi-component paint only for particular bodywork (windscreen wipers, rear-view mirrors, etc.).

⁽⁵⁾ Only rear/front axles.

⁽⁶⁾ Excluding parts that cannot be immersed in pre-treatment baths or undergo painting because of compromised functionality (e.g.: mechanical parts).

⁽⁷⁾ Only if the colour is defined in a drawing according to I.C.

⁽⁸⁾ For fuel tanks in ferrous or pre-coated sheets.

⁽⁹⁾ Only parts to mount on the engine.

^(*) Alternative products and cycles for the same phase under the condition of comparability with the part to treat.

^(**) Specific phosphates must be used for zinc coated or aluminium sheets.

Added or modified parts

All vehicle parts (body, chassis, equipment, etc.) that are add-ons or subjected to modifications must be protected against oxidation and corrosion.

Areas free of protection on ferrous materials are not accepted.

Tables 2.7 and 2.8 indicate the minimal treatment that modified or added components must receive when it is not possible to have protection that is similar to that of original components. Different treatment is allowed if it ensures similar oxidation and corrosion protection.

Do not use powder varnish directly after degreasing has been performed.

Lightweight alloy, copper and brass parts must be protected.

Table 2.7 - Painted modified parts or add-ons

Cycle phase description	Class
	A - B - D ⁽¹⁾
Mechanical surface cleaning (including elimination of burrs/oxidation and cleaning of cut parts)	Brushing/sandpapering/sand blasting
Pre-treatment	Degreasing
Rust preventer	Bi-component (30-40 µm) ⁽²⁾
Varnish	Bi-component (30-40 µm) ⁽³⁾

⁽¹⁾ Modifications on rear axles, from axles and engine (classes BI and C) not allowed

⁽²⁾ Preferably epoxy

⁽³⁾ Preferably polyurethane

Table 2.8 - Unpainted or aluminium modified parts or add-ons

Type of protection	Class	
	A - B ⁽¹⁾	D
Stainless steel	yes	–
Geomet		–
Zinc coating ⁽¹⁾	–	yes

⁽¹⁾ Free from hexavalent chromium

Precautions

On the vehicle

Appropriate precautions must be taken to protect parts on which paint could be harmful to the conservation and operation thereof:

- hoses for pneumatic and hydraulic systems in rubber or plastic, **with particular reference to the braking system;**
- gaskets, rubber or plastic parts;
- drive shaft and PTO flanges;
- radiators;
- suspension, hydraulic/pneumatic cylinder stems;
- air vent valve (mechanical assembly, air tank, thermostarter preheat tanks, etc.)
- sediment bowl and fuel filter assembly;
- plates, codes.

If painting is required after wheels are removed, it is necessary to:

- Protect the wheel rim mounting surfaces on the hubs and the contact areas of the locking lugs/wheel studs;
- ensure adequate protection of brake discs.

The electronic components and modules must be removed.

Engines and their electric/electronic components

Appropriate precautions must be taken to protect:

- engine wiring and ground contacts;
- the sensor/actuator side connectors and wiring side;
- the sensors/actuators on the flywheel and on the flywheel rpm sensor mounting bracket;
- pipes (plastic and metal) of the fuel circuit;
- complete basic diesel filter;
- the ECU and its base;
- the entire internal part of the sound-proof cover (injectors, rails, pipes);
- the common rail pump and its control valve;
- the vehicle electric pump;
- tank containers;
- the front V-belts and relative pulleys;
- the power steering pump and relative pipes.



- ▶ **When painting is complete and before oven drying (max. temperature 80 °C), the parts that risk heat damage must either be removed or protected.**

2.4 WHEELBASE MODIFICATION

General information



- ▶ **Any wheelbase modifications that regard the electric circuits and/or relocation of the electric/electronic components requires IVECO approval and must be carried out in compliance with chapter 5.7 instructions.**

Usually, wheelbase modification must be performed on the standard wheelbase that is closest to the target value.

If the dimensions of the superstructure are suitable, it is best to use wheelbases in standard production because this allows the use of original drive shafts and pre-defined crossbar positions.

Nevertheless, IVECO must issue its authorisation for wheelbases below the minimum or maximum approved standard sizes on the market.

Authorisation

Wheelbase variation in the 4x2 versions is allowed without IVECO authorisation only when:

- the target wheelbase is listed in the catalogue for the type of vehicle being transformed;
- the structure (area of side members; number, type and position of the crossbars), the existing circuits and systems on the series chassis corresponding to this length will be replicated.

When these conditions do not exist in combination at the same time, which ensure that the schematics of the transformed frame is equal to that of the original, the modification must undergo approval.

The workshop that performs the transformation must provide sufficient guarantees in terms of technology and inspections (qualified personnel, appropriate operational processes, etc.).

For the 4x4 versions, variation in the wheelbase is only allowed with specific approval from IVECO.

The operations must be performed in compliance with these directives, taking into account the suitable adjustments and adaptations, as well as all required precautions (e.g.: check whether the ECUs must be reparameterized, exhaust pipe adjusted, observance of minimum tare weight on the rear axle, etc.) provided for on the corresponding original wheelbases.

Effects on steering

Generally speaking, extending the wheelbase will have a negative effect on steering.

When required by standard, the maximum thresholds for cornering path, steering wheel force and relative time to negotiate curves should not be exceeded (e.g.: ECE Regulation of EC Directive in force).

Table 2.9 lists the maximum wheelbase elongation values allowed for the vehicle with series steering, maximum load and tyres.

Longer wheelbases require approval and technical solutions must be adopted to improve steering, such as reduction of maximum load on the front axle or the implementation of a caster trail with a restricted set of values.

The installation of an additional pump must also be authorised, while successive installations require the participation of the specialised Company.

Table 2.9 - Maximum permitted wheelbase extension

Model	Front suspension	Maximum Wheelbase [mm]
33S, 35S	Crossways leaf spring	4100
35C, 40C	Crossways leaf spring	4100
35C, 40C, 45C, 50C	Torsion bar	4750
60C, 65C, 70C	Torsion bar	4750

For the pneumatic fitting see Chapter 2.14 (➡ Page 46).

Effects on braking

Generally speaking, shortening the wheelbase will have a negative effect on braking.

Table 2.10 indicates the wheelbase modification limits. Contact the IVECO Department - Homologation & Technical Application to find out at what conditions (brake cylinders, minimum tare, theoretically admissible loads, tyres, height of centre of gravity) transformation can be allowed.

Table 2.10 - Braking, wheelbase modification limits

Model	Version	Wheelbase	
		Minimum (mm)	Maximum (mm)
33S, 35S	Truck, van	3000	4100
35C, 40C	Truck, van	3000	4100
45C, 50C	Van	3000	4750
45C, 50C	Truck	3450	4750
60C, 65C, 70C	Truck, van	3520	4750



- **The changes of the wheelbase on vehicles equipped with ASR necessarily lead to the updating of the setting parameters of its control unit.**

Intervention procedure

Proceed as follows to obtain good results:

- position the vehicle so that the chassis is perfectly horizontal, use appropriate trestles;
- detach the drive shafts, braking system hoses, cables and all other equipment that may interfere with proper work execution;
- identify the reference points on the frame (e.g: guide holes, suspension supports);
- mark the reference points with a slight punch mark on the top flaps on both side members, after having verified that the conjunction line is at a perfect right angle with the longitudinal axle of the vehicle;
- if moving the suspension supports, identify the new position using the previously determined references;
- make sure that the new measurements are identical on both the right and left sides; the diagonal check, for lengths of at least 1500 mm must not yield deviations of over 2 mm;
- make the new holes using as jig - if any other tools are unavailable - the supports and gusset plates of the crossbars;
- secure the supports and crossbars using nails or screws; if using screws, bore the holes and use calibrated screws class 10.9 with anti-unscrewing nuts; if size allows, flanged head screws may be employed;
- if cutting the frame (to be carried out according to indications of the second item in "Welding Operations" - Paragraph "Welding" (➡ Page 9)) mark a second line of reference points so that the work area is set between the two lines (plan for a distance of at least 1500 mm upon work completed). Carry over the points relative to the cutting area between the two lines; proceed as instructed in Paragraph "Welding" (➡ Page 9);
- before welding, check that the side members and any added parts are perfectly aligned and perform the check measurements on both sides and along the diagonal line, as previously indicated. Apply the reinforcements as in Paragraph "Welding" (➡ Page 9).

Additional information

- Protect the surfaces against oxidation as in Paragraph "Added or modified parts" (➡ Page 13).
- Restore the braking and electrical systems as according to Chapters 2.15 (➡ Page 47) and 5.4 .
- Follow the instructions in Chapter 2.8 (➡ Page 26) for interventions on the transmission.

Checking chassis stress

With regard to wheelbase elongation, aside from local reinforcement in the joint area of the side members, the Bodybuilder must also account for reinforcements - along the entire contour of the wheelbase - until achieving area strength modulus equal to IVECO values for the same wheelbase or for the next admissible greater length. In alternative, for cases allowed by local standards, larger counter-frame profiles can be adopted.

The Bodybuilder must make sure that the stress limits prescribed by national standards are respected. These stresses must not be greater than those of the original wheelbase frame, assuming an evenly distributed load and considering the frame as a beam positioned in place of the suspension supports.

When an elongation is performed starting from the longest original wheelbase, the reinforcements adopted must account for wheelbase elongation, type of chassis produced and vehicle use.

Cross members

The need to apply one or more cross members is subordinate:

- to the entity of lengthening;
- to the position of the transmission support;
- to the welding area;
- to the points where forces caused by superstructures are exerted;
- to the vehicle's conditions of use.

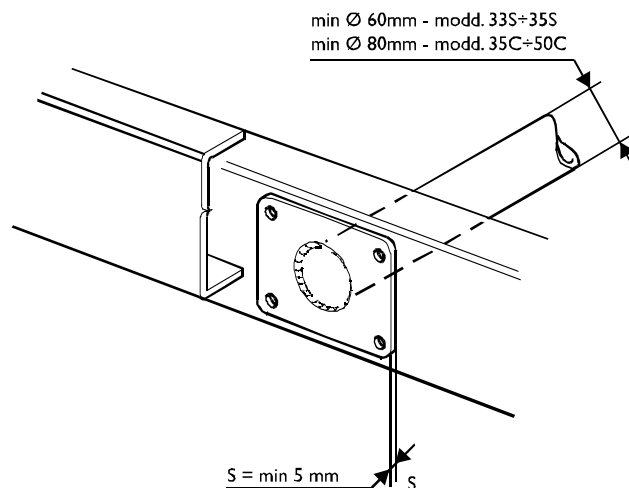
Any additional cross members must have the same characteristics of those already mounted on the frame (bending and torsion strength, material quality, connection to side members, etc.).

Figure 6 shows an example.

In any case an additional crossbar must be installed for elongations exceeding 600 mm.

The distance between the two cross members must generally be within 1000 ÷ 1200 mm.

The minimum distance between the cross members, especially for "heavy duty use" must not be less than 600 mm; this restriction excluded "lightweight" cross member supporting the transmission and shock absorbers.



208210

Figure 6

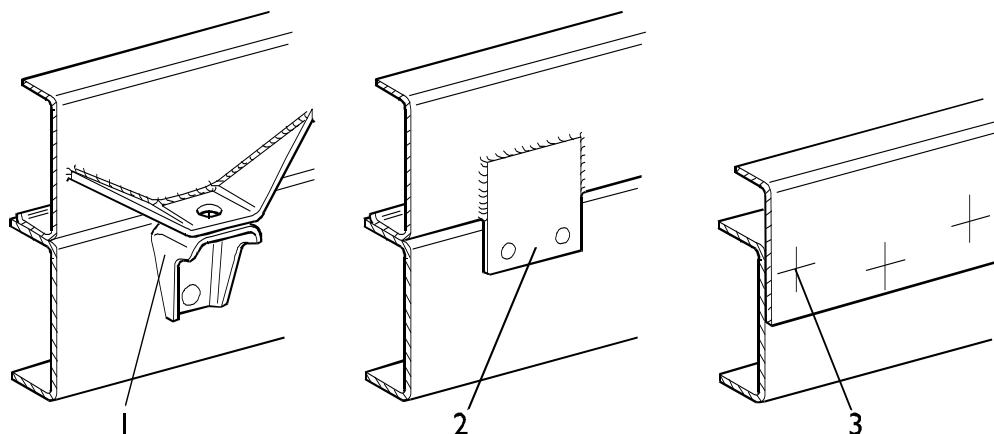
Reinforcements on the chassis

Figure 7 shows some examples of possible solutions.

The reinforcements must be continuous and extend over the entire length of the vehicle's chassis, up to the cab. To connect them to the side member, in the case of an angle profile, rivets or screws of resistance class 8.8 must be used; diameter and distribution must ensure that the profile provides the expected reinforcement resistance.

We recommend creating a cut-resistant joint in the area of the rear overhang and for about half of the wheelbase length (and always for lengths of at least 2 m from the front axle).

On the chassis converted in this way, bending stresses must be envisaged that do not exceed those of the chassis of the original vehicle in the corresponding sections.



102422

Figure 7

1. Bracket
2. Plate

3. Screws or rivets

To avoid affecting the resistance of the original sections, reinforcement plates may not be mounted directly onto the side member wings via holes filled with welding material;

Only when there is a proven necessity associated with subsequent superstructure installation stages may IVECO issue an exceptional authorisation.

In these cases, because of the deterioration caused by welding, a reduction of the characteristics of the material of about 15% should be borne in mind.

When calculating the dimensions of the reinforcements, use the material suggested in Table 2.1 and do not exceed the static stress values on the chassis given in the Paragraph "Stresses on the chassis (➡ Page 8)".

In any case, any more restrictive limits imposed by national standards shall be valid.

Gearbox modifications

See Chapter 2.8 (➡ Page 26) for checks of modifications allowed.

2.5 REAR OVERHANG MODIFICATION

General information

When modifying the rear overhang it is necessary to take note of the variations that this modification inflicts on distribution of axle loads, in compliance with loads established by IVECO (see Chapter 1.15 (➡ Page 11)). Limits set by national law must also be respected, as well as maximum distances from the rear structural edge and heights from ground, defined for towing hook and under-run protection. The distance from the tip of the frame to the rear edge of the superstructure must, as a rule, not exceed $350 \div 400$ mm.

If it is necessary to move the rear crossbar fixed using screws, it is necessary to maintain the same type of union as in the series (number of screws, dimensions, strength class).

If a drawbar shall be attached, it is necessary to leave sufficient space (approx. 350 mm) between the rear crossbar and that nearest, for any drawbar assembly/disassembly operations.

If all works are performed in a professional manner and according to the instructions contained herein, the original towing capacity may remain the same.

In all cases, the parties performing the work shall be liable thereof.

Authorisation

Rear frame elongation as well as shortening to the smallest value for each model of the series do not require authorisation if performed in compliance with the instructions provided herein.

For vehicles destined to special uses, where load distribution is predefined and fixed, the rear overhang can be extended with values greater than 60% of the wheelbase, as long as the conditions stated in Chapter 1.15 (➡ Page 11), Directive CEE 97/27 and their relative national laws are respected in terms of cornering path.



- **If you need to adjust the length of the electrical circuits, see Section 5, "Special instructions for electronic subsystems".**

Chassis Shortening

The last crossbar must be moved forward when shortening the rear overhang of the frame.

When the rear crossbar is too close to another crossbar, the latter can be eliminated if it plays no role in suspension support.



- **For vehicles equipped with the ESP system, see Chapter 2.15 - Paragraph "Derating of the ESP system".**

Elongation

Possible solutions, in relation to the length of the extension, are shown in Figures 8, 9 and 10.

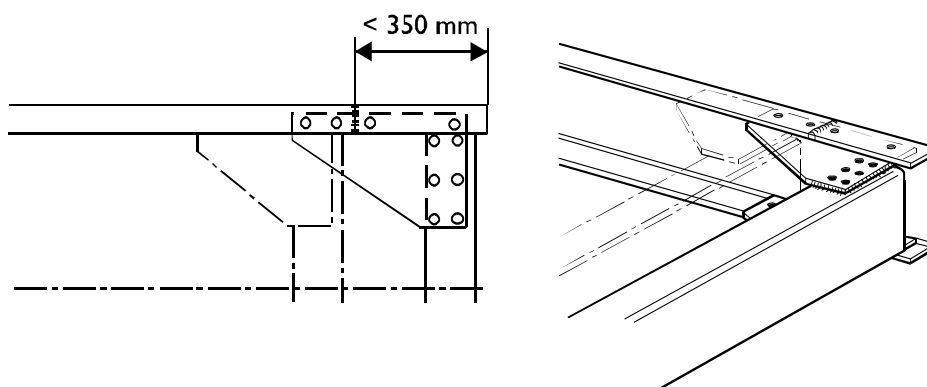
Cuts can be of straight type. The minimum dimensions of the reinforcements to apply in the area of modification are shown in Figure 2.3.

The solution for elongations no greater than 300 ÷ 350 mm is shown in Figures 8 and 9. In this case, the corner reinforcements, which also serve as junction between cross member and frame, must have the same width and thickness of the original gusset plate. The union between the cross member and plate, originally performed using nails, can be done with screws class 8.8 having the next largest scale diameter and anti-unscrewing nuts.

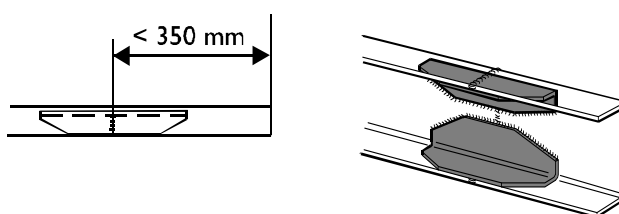


- **For vehicles equipped with the ESP system, see Chapter 2.15 - Paragraph "Derating of the ESP system".**

The solution for elongations greater than 350 mm is shown in Figure 10.

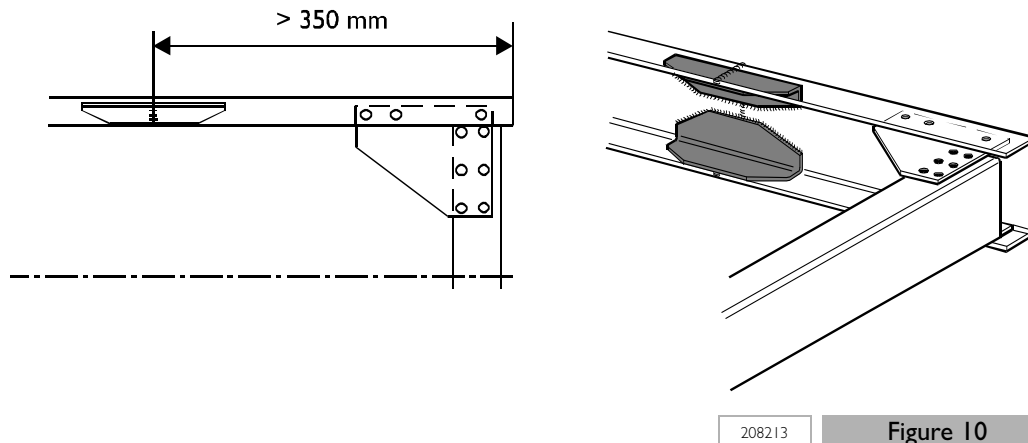


208211

Figure 8

208212

Figure 9



208213

Figure 10

When the elongation is rather large, the need of an additional crossbar must be evaluated on a case to case basis in order to ensure proper torsional strength of the frame. The insertion of an extra crossbar having characteristics similar to the series is necessary, however, when two cross members are spaced more than 1200 mm apart.

2.6 INSTALLING THE TOW HOOK

General information

Conversion from non-trailer version to type approved trailer version is allowed without requiring specific authorisation from IVECO.

A vehicle not originally intended for towing may be adapted to this purpose by adding the specific “trailer section”, i.e. inserting the set of components listed in the type-approval documentation for the trailer version (chassis cross member, electrical coupling union, tow coupling, chronotachograph, etc...).

However, bear in mind that fitting the chronotachograph, when necessary in relation to current legislation, must be only carried out by the IVECO Assistance Network.

Precautions for Installation

The towing hook must be suited for the loads allowed and must be of a type approved by national standards.



- ▶ **Given their importance related to safety, the drawbar couplings must not undergo modifications.**

In addition to the requirements of the hook manufacturer, it is necessary to respect the limitations imposed by the Regulations on:

- clearances required for the coupling of the brakes and electrical system;
- distance between the pivot axle of the hook and the rear edge of the superstructure (see Figure 11).

In the European Community (UN-ECE Regulation No. 55), this will normally be about 420 mm, but values are allowed up to 550 mm if an appropriate mechanism is adopted for safe operation of the hand lever. For even higher values it is advisable to consult the aforementioned Regulation.



196787

Figure 11

1. Free field for towing hooks
2. Free field for coupling hooks according to standard DIN 74058 ESC-152

The trailer drawbar must be guaranteed freedom of movement.

Types of hook

The following types of hook are available:

1. ball-joint
2. automatic

Hooks with pins can only be installed on the truck version and require the use of a suitable cross member.

Both types, if not supplied directly by IVECO, must be type-approved in compliance with current legislation.

Table 2.11 lists certain data for the tow couplings available from the production line.

Table 2.11 - Type-approved hooks

Type	Class	D [kN]	DC [kN]	V [kN]	N° ECE type approval
GS500	A50-X	22.5	–	25	E11 55R-010533 ext 02
GA381	S	22.5	–	25	E11 55R-011613

Drawbar couplings for centre axle trailers

Centre axle trailers are defined as those that have the drawbar rigidly connected to the frame and the axle (or more close axles) placed at half the length of the same chassis.

Compared to the articulated drawbars, the rigid drawbar acts on the drawbar coupling with the increase of the static vertical loads and, in the braking phase or in the oscillations caused by the road surface, the increase of the dynamic vertical loads. By means of the hook, these loads lead to increases in the torsion of the rear crossbar of the vehicle, as well as push-ups on the overhang.

The use of centre axle trailers therefore requires the use of suitable towing hooks.

The values of the towed weights and vertical loads allowed are listed on the technical documents of the drawbar coupling manufacturer and on the part manufacture plate (see DIN 74051 and 74052).

Towing hooks that bear special approvals and with values greater than those listed in the above standards may be used. However, these towing hooks may pose restrictions in relation to the type of trailer used (e.g. drawbar length); In addition, the drawbar may require reinforcement for the towing vehicle as well as larger counter chassis profile section.

For mechanical coupling devices for trailers with a central axle, refer to the following formulas:

$$D_c = g (T \cdot C) / (T + C)$$

$$V = a \cdot C (X^2 / L^2)$$

D_c = representative value of drawbar class [kN]. This is defined as the determination of the theoretical reference value for horizontal load between tractor

g = acceleration of gravity [m/s^2]

T = maximum weight of tractor

R = maximum weight of trailer

S = value of vertical static load that, in static conditions, is transmitted to the coupling point. S must be $\leq 0.1 \times R \leq 1000$ kg of the trailer

C = sum of maximum axial loads of the centre axle trailer at full load. It is equal to the maximum mass of the trailer decreased by the vertical static load ($C = R - S$)

V = value of the theoretical dynamic vertical load [kN]

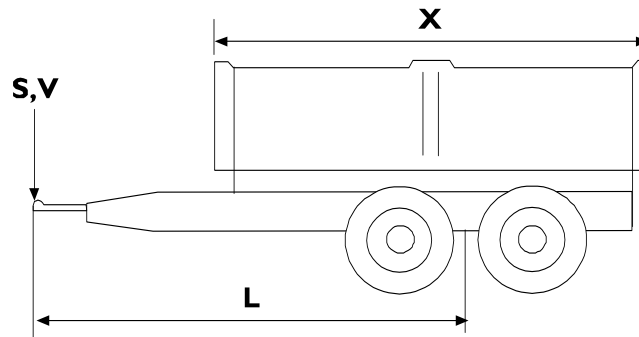
a = vertical acceleration in the area of the drawbar coupling/hook. in function of the rear tractor suspension, use the following values:

- $a = 1.8 \text{ m/s}^2$ of air suspensions
- $a = 2.4 \text{ m/s}^2$ for other types of suspensions

X = length of the load bed [m], (see Figure 12)

L = theoretical drawbar length, distance between the centre of the drawbar eye and the centre line of the trailer axles [m], (see Figure 12)

$X^2 / L^2 \geq 1$ if the result is less than the unit, use the value 1



193864

Figure 12

X . Length of the trailer load bed

L . Theoretical drawbar length

The table below lists the maximum permitted values of S for towing cross members in production for trailers with a centre axle.

Table 2.12

Model	Maximum S [kN]
33S	14
35S, 35C, 40C	14
45C, 50C, 60C, 65C, 70C	14

Example of calculations for connection device class for centre axle trailers

We shall consider a DAILY 65C15 vehicle with maximum weight of 6250 kg that must tow a centre axle trailer of 3500 with $S = 250$ kg length of load bed 5 m and theoretical drawbar length of 4 m.

The data at hand yields:

- $S = 0.25$ t
- $C = R - S = 3.5 - 0.25 = 3.25$ t
- $(T + S) = 6.25 + 0.25 = 6.5$ t
- $X^2 / L^2 = 25 / 16 = 1.5$

we obtain:

$$D_c = 9.81 \cdot (6.5 \cdot 3.25) / (6.5 + 3.25) = 21.3 \text{ kN, and } V = 1.8 \cdot 1.5 \cdot 3.25 = 8.8 \text{ kN}$$

To tow centre-axle trailers the vehicle must have an adequate connection between the chassis and the counter chassis and, in particular, in the area that goes from the rear end of the overhang to the front support of the rear suspension, longitudinal and transverse sealing plates need to be provided.

Moreover, in the case of long rear overhangs and depending on the masses to be towed, it may be necessary to adopt sections of the counter chassis having a larger size than those normally provided (see Section 3, Table 3.2).

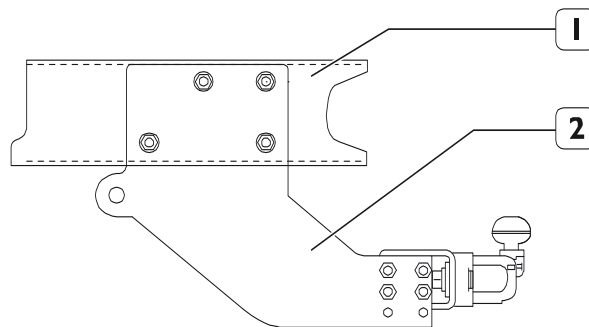
Rear crossbar in lowered position

When the drawbar coupling must be lowered from its original position, IVECO may issue an authorisation to lower the original drawbar or install an additional drawbar, which is the same as the original, in a lowered positioned.

Figures I3 and I4 show the examples respectively.

Connection of the drawbar in its new position must be performed in the same way and using screws of the same type (diameter and resistance class) in relation to the original connection.

Anti-unscrewing systems must be used in the connections.

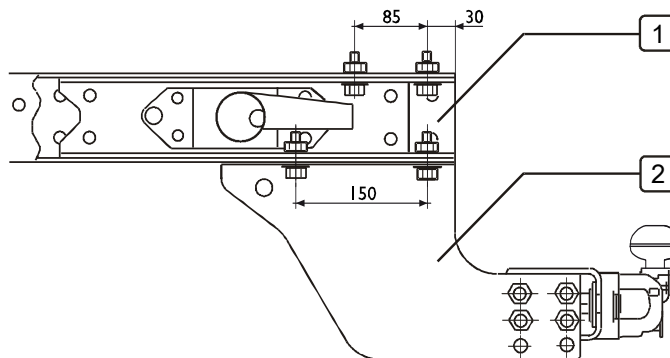


I73258

Figure I3

1. Chassis side member

2. Bracket for lowered cross member



I73259

Figure I4

1. Chassis side member

2. Bracket for lowered cross member

Observations of payload

Static load on the drawbar coupling must not surpass the load allowed on the rear axle or axles of the vehicle. Furthermore, the minimum front axle load must be respected as indicated in Chapter I.15 (► Page 11).

Increase of tow weight

As regards tow vehicles, IVECO may evaluate - in certain cases and for particular applications - the possibility to authorise greater tow weights than those normally allowed.

These authorisations include the towing conditions and, when necessary, provide the instructions relevant to any vehicle modifications or work required: standard crossbar reinforcements, or installation of a reinforced crossbar when available, or adjustments to the braking system.

The drawbar coupling must be suited for the new use, and its connection flange must coincide with that of the crossbar.

Fix the crossbar to the chassis by using flanged head screws and nuts or hex head screws of 8.8 min. class.

Use anti-unscrewing systems.

Plates

Some countries require a plate to be applied on the towing device, which must list maximum tow load and maximum vertical load allowed.

If not already mounted, the Outfitter shall see to its manufacture and installation.

2.7 ASSEMBLING AN ADDITIONAL AXLE

The installation of extra axles on the vehicle is not envisaged.

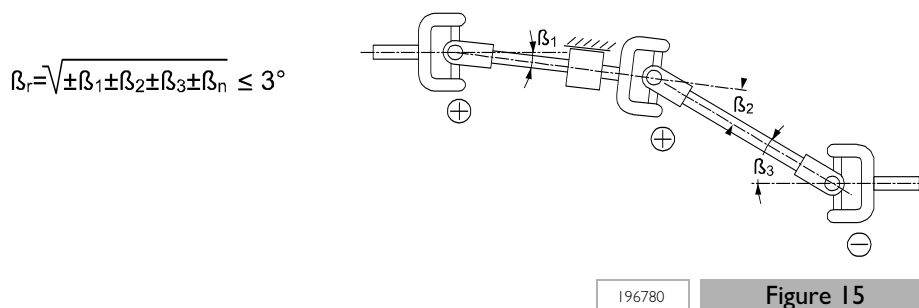
2.8 GEARBOX MODIFICATION

Gearbox adjustment, following wheelbase modification, must be done using the gearbox diagram of a similar range vehicle having almost the same wheelbase.

The maximum tilt values of the drive shaft for the vehicle series must be respected, even for interventions on the rear engine axle suspensions.

Contact the IVECO Technical Application for any difficulties; and send them a diagram with the length and tilt of the new transmission for a constant-velocity check.

The technical specifications in the gearbox Manufacturer manual must be used for correct production and installation of the sections.



Maximum allowed angularity

n = engine speed

$\beta \cdot n < 20.000$ for classes 2040-2045-2050

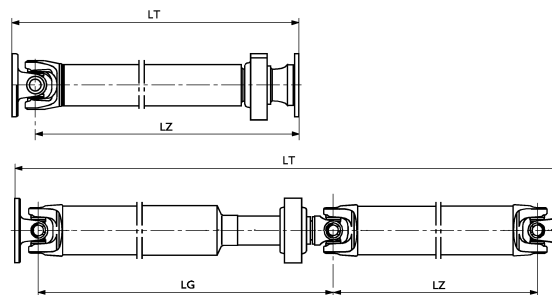
$\beta \cdot n < 25.000$ for classes 2025-2030-2035

Values that must be valid both when the vehicle is empty (tare only) and when the vehicle has a static load considering the maximum allowed load on the rear axle.

The scope of these instructions is to safeguard proper operation of the gearbox, limit sound level and avoid stress transmitted by the drive assembly. In no way does this relieve the Outfitter of any work related liabilities.

Lengths allowed

- The maximum work lengths which can be produced, both for the middle and sliding sections “LG” or “LZ” (see Figure 16), can be determined in relation to the external diameter of the existing vehicle pipe and the maximum running rpm (see formula and Table 2.13).
If the shaft length calculated in this fashion is insufficient for the modification at hand, it is necessary to insert a new section with the same characteristics as those mounted.
- In some cases, a drive shaft with a larger diameter can be used and calculated (again, see Table 2.13) in relation to the length required and the maximum number of engine rpm.



192345

Figure 16

LG Length of intermediate sections

LZ Length of sliding sections

LT Total length

For sliding shafts, the length LG must be evaluated between the universal joint centres and with the sliding stem in the intermediate position. Always check both stems LG and LZ.

The maximum number of engine rpm must be calculated with the following formula:

$$n_G = n_{\max} / i_G$$

n_G	maximum engine speed [rpm]
$n_{\max}$	engine speed [rpm] at maximum output power, see Table 2.13
i_G	gear ratio at highest speed, see Table 2.13

Table 2.13 - Engine speed [rpm] at maximum output power and gear ratio

Engine	Engine code ⁽¹⁾	$n_{\max}$ [rpm]	Power [HP]	Gearbox	i_G
.11 WG	F1AFL411A*A	3600	106	2835.6 6AS400	0,701 0.791
.13 WG	F1AFL411B*A		126	2835.6 6AS400	0,701 0.791
.15 VGT	F1AFL411C*A		146	2835.6	0,701
.15 WG	F1CFL411J*C		146	2840.6	0.791
.17 VGT	F1CFL411H*C		170	2840.6 6AS400	0.791 0.791
.21 DST	F1CFL411G*C		205	2850.6	0,685
.15 WG	F1CFL411E*A		146	2840.6	0.791
.17 VGT	F1CFL411F*A		170	2840.6 6AS400	0.791 0.791

Engine	Engine code ⁽¹⁾	n _{max} [rpm]	Power [HP]	Gearbox	i _G
.14G WG	FICFA401A*A FICFA401A*B	3600	136	2840.6	0.791

⁽¹⁾ Check the engine code on the engine plate

Note Usually, the fork universal joints of the same shaft must not be rotated.

Pipe thickness

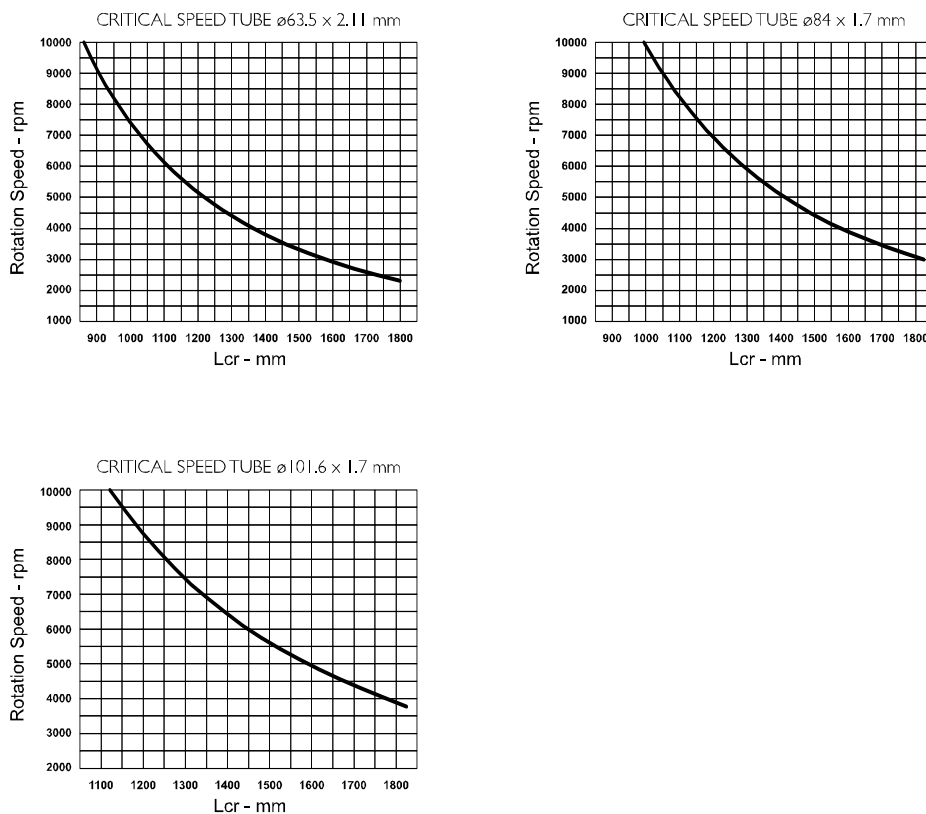
Valid tube thickness is usually not possible.

In fact, pipe thickness depends on the torque that the original shaft must transmit, as well as on the specifications of the transmission line (torque, powertrain ratio, axle loads or drive axles).

If using a pipe with a greater diameter than the original, thickness should in theory be reduced until reaching the same torsional capacity; nevertheless, the dimensions of the fork male-end, need for adaptor rings, and the dimensions of pipes on the market must also be taken into account.

Hence, the pipe thickness must be established on a case to case basis in relation to the dimensions of the driver shaft (e.g. cardan joint size), in concert with the drive shaft Manufacturer authorised shops.

Minimum operating length (from flange to flange) must be at least 600 mm for sliding shafts and 300 mm for intermediate shafts.



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Figure 17

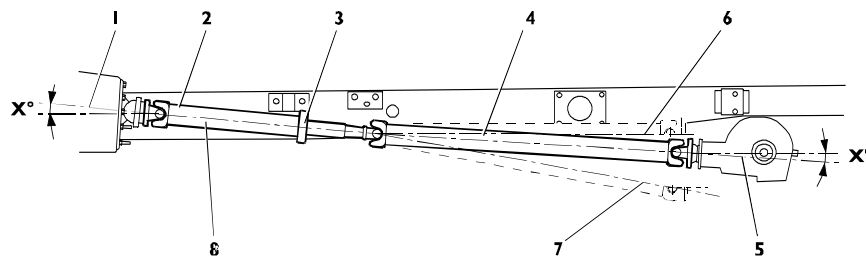


- The maximum lengths obtainable that are indicated above refer to original shafts; plan for shorter lengths (-10%) for sections obtained after machining.

Positioning the sections

The transmissions that comprise several sections, each axle must be of approximately the same length. Generally speaking, the distance between an intermediate shaft and sliding shaft (see Figure 18) must be no greater than 600 mm, while between two intermediate shafts this difference must not be greater than 400 mm. As regards sliding shafts, there must be a minimum margin of 20 mm between minimum operating length and maximum sealing length.

In compliance with effective travel, position the static set-up as close as possible to the central zone.



173260

Figure 18

1. Drive shaft, clutch, gearbox
2. Cardan shaft with sliding
3. Shaft support
4. Cardan shaft
5. Rear axle casing tilt (static load)

6. Rear axle casing tilt (max compression)
7. Rear axle casing tilt (no load on vehicle)
8. The cardan shaft (sliding) and rear axle casing axis must have the same angle x° compared to horizontal

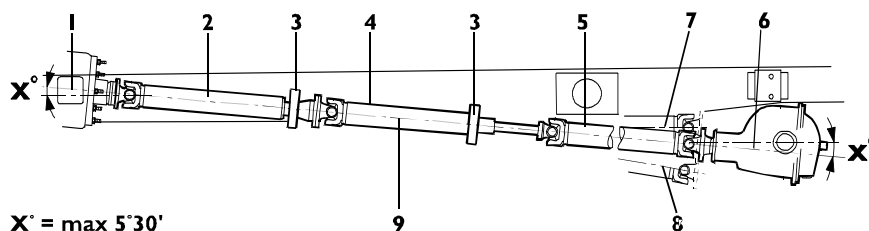
The intermediate shaft and the axle casing axis must be aligned.

Angle may vary by a maximum of 1° compared to the engine-clutch-gearbox axis and this may be achieved by inserting a wedge between the rear axle casing and the spring.

The maximum angle of the rear axle casing must in any case be between 4° and 6° (5° nominal) compared to horizontal.

Note For vehicles equipped with the "antibooming" solution (with a flexible coupling on gearbox output), the following geometric restriction must be considered: the relative angle between the gearbox axis and the section of shaft on gearbox output must not exceed 1° . If it is between 1° and $1^\circ 30'$ it must be authorised by IVECO. If it is more than $1^\circ 30'$ it should be assumed as not authorised.

When wheelbase lengthening is substantial, it may be necessary to mount an additional intermediate section, as indicated in Figure 19. In this case, make sure that the engine-gearbox axle, the second intermediate shaft and the axle casing axis when in static load are all aligned with the same tilt.

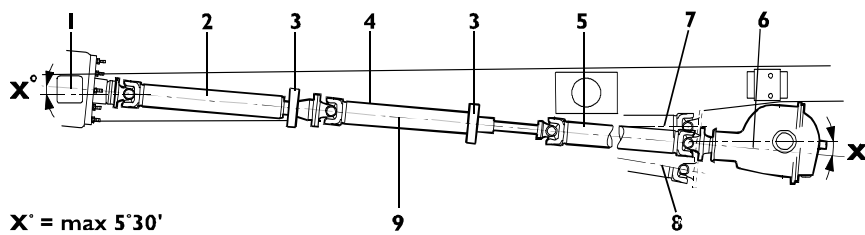
 $x^\circ = \max 5^\circ 30'$

173261

Figure 19

1. Drive shaft, clutch, gearbox
2. Intermediate shaft
3. Intermediate shaft bearing

4. Cardan shaft (sliding)
5. Cardan shaft (fixed part)
6. Rear axle casing tilt (static load)



173261

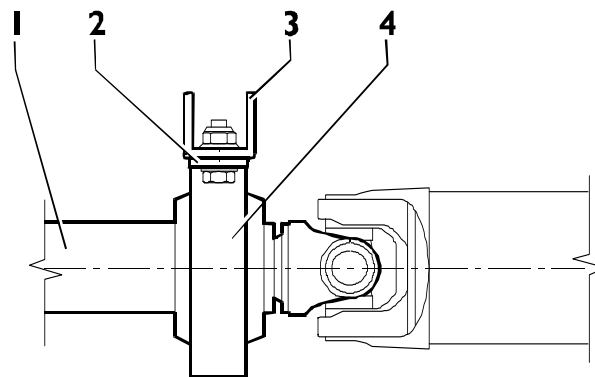
Figure 19

7. Rear axle casing tilt (max compression)
8. Rear axle casing tilt (no load on vehicle)

9. Gearbox, sliding articulated (cardan) shaft and axle casing axis must all have the same angle.

The application of elastic bearings must be done using support plates at least 5 mm thick (see Figure 20), connected to cross members with characteristics similar to those specified by IVECO.

In modifying the wheelbase, it is best to plan for disassembly of intermediate shafts when shaft length is less than approximately 600 mm.



102426

Figure 20

1. Intermediate shaft
2. Support plate

3. Rest plate
4. Intermediate shaft bearing

The considerations made up to this point are valid for vehicles with separate gearboxes.

Furthermore, the wheelbase on these vehicles may not be reduced beyond the shortest value for the series (e.g. tipper truck).

We recommend using original IVECO gearboxes; if this is not possible, the use of raw steel pipes with a yield load of at least 420 N/mm² (42 kg/mm²) may be used.

The universal joints may not be modified.

For every transformation of the transmission, of any of its parts, a thorough dynamic balancing must be performed on each section modified.



- **Given that the transmission is an important part of the vehicle in terms on safety, we strongly recommend that all modifications made to it stand up to maximum safety standards. Therefore, all modifications should be made only by highly specialised Companies that are qualified by the transmission Manufacturer.**

2.9 WORK ON SUSPENSIONS



- **Modifications to the suspensions and springs (e.g. addition leafs, variations in camber, etc...) affect the driving safety of the vehicle and inasmuch may only be implemented after obtaining approval from IVECO.**

In general, work on parabolic suspensions is not allowed. On vehicles with this type of suspension spring, exception is made for set-ups or special uses for which, in order to increase suspension rigidity, the application of rubber elastic elements may be authorised. In exceptional cases and for specific uses, the possibility may be evaluated of allowing the addition of extra leaf springs on the parabolic springs; this must be carried out by a specialised spring manufacturer after approval by IVECO.

It is not allowed to use a parabolic spring on one end of the axle and a semi-elliptic spring on the other end.

For vehicles equipped with the optional "Braking corrector for braking system", modifications of the rear suspension also require modification of the corrector (see Paragraph "Braking corrector" (► Page 50)).



- **On vehicles equipped with an ESP system, modifications of the suspensions are not permitted. See Chapter 2.15 - Paragraph "Derating of the ESP System".**

Converting from mechanical to air-operated suspension

This type of conversion is extremely critical since it involves vital groups and components for the active safety of the vehicle; so, technical approval is required from IVECO.

Moreover, such conversion requires the exclusive use of solutions (layout, groups and finalisation) in use for routine production and in any case IVECO is waived from any liability.

Camper 35C, wheelbase 3750 mm or 3950 mm, lightened chassis

Following approval by IVECO, adaptations are allowed of the original mechanical suspension by adding air-operated bellows of appropriate dimensions. The maximum inflation pressures envisaged by the manufacturer must be strictly observed in order to avoid excessive vehicle stiffness and consequent reduction of comfort and driving performance.

Note *Adaptation of the suspension assumes a corresponding adaptation of the ESP system controlling stability (see Paragraph "Derating of the ESP system" (► Page 54)).*

Modifications to the air-operated suspension (shop van outfit)

After approval by IVECO, modifications of the original air-operated suspension are allowed.

Modifications to the rear suspension (only vehicles with braking corrector)

Modifying the spring characteristics of the rear suspension (e.g. n° of leafs, intervention loads, etc.) also requires adapting braking corrector adjustment data. If, on the other hand, the vehicle is equipped with ABS no adjustment is necessary.

When action on the suspension is caused by significant axle load variations or variations in the overall mass of the vehicle, it may also be necessary to adapt the braking forces to ensure compliance with legal requirements. The authorisations issued by IVECO list the necessary indications.

On the other hand, if the modification of rear spring characteristics does not envisage load variations on the axles and overall mass, modification of braking corrector calibration can be performed by an Authorised Workshop.

To avoid altering the vehicle's braking capacity in various load conditions, the "load on ground/braking pressure" ratio indicated on the specific corrector plate must be observed.

To adjust the latter, proceed as indicated in Paragraph "Braking corrector" (► Page 50), envisaging for the load to be applied at hole **(9)** a value matching the stiffness characteristics of the new spring.

If it is not possible to comply with this ration in all load conditions, contact IVECO for a new check of compliance with legal requirements.

The variation of the corrector data indicated on the plate requires replacement with a new plate indicating the new data.

Protecting the air springs

The bodywork must have a partition protecting the air springs separating them from the wheels and preventing damage caused by sand, mud or stones.

The partition must leave a free space of 350 mm around the spring and must not obstruct access for inspections and maintenance of the other suspension components.

2.10 MODIFYING THE ENGINE AIR INTAKE AND EXHAUST SYSTEMS

Note The characteristics of the engine air intake and exhaust systems must not be modified. Modifications, if authorised by IVECO, must not vary the original intake vacuum and exhaust counter-pressure values.

Table 2.14 - Maximum allowed counter-pressure at intake and exhaust under normal operating conditions and at full load

Engine	Engine code	Exhaust counter-pressure [kPa]	Min - max intake counter-pressure [kPa]
.11 WG	F1AFL411A*A	35	1 - 9
.13 WG	F1AFL411B*A	37	1 - 9
.15 VGT	F1AFL411C*A	37	1 - 9
.15 WG	F1CFL411J*C	48	1 - 9
.17 VGT	F1CFL411H*C	57	1 - 9
.21 DST	F1CFL411G*C	57	1 - 9
.15 WG	F1CFL411E*C	43	1 - 9
.17 VGT	F1CFL411F*C	43	1 - 9
.14G WG	F1CFA401A*A F1CFA401A*B	27	$\Delta P = 2$

Intake

The air intake must be mounted as to avoid intake of hot air from the engine compartment, or dust and water.

The intake compartment must be sealed airtight and fitted with rubber gaskets that prevent hot air recirculation. The gaskets must be of high quality as to support a steady temperature of 100 °C, with short durations of 120 °C, without undergoing visible deformations or deteriorations. The compartment must keep airflow sections efficient for the entire circuit.

The holes that must be made in the box part of the van must have an area of about twice that of the cross-section of the pipe upstream of the filter; these openings (e.g. grille holes) must have minimal dimensions to prevent possible clogging.

The following are not allowed:

- alterations or replacement of the original air filter with one of lower capacity;
- modifications to the silencer body;
- interventions on equipment (injection pump, control valve, injectors, etc.) that may compromise good engine performance and affect exhaust gas emissions.
- change the succession Humidity sensor → Brakes air → Blow by in the segment between air filter and turbine

Lastly, it is necessary to check if new system approval is required in relation to specific national standards (sound level, smokiness).

Engine exhaust

If it is necessary to change the pipe layout despite the availability of various optional solutions in the catalogue, it is advisable to envisage:

- the simplest possible route (curvatures with radii of no less than 2.5 times the outer diameter, passage sections no smaller than those of the original solution, absence of throttling);
- suitable distances (min. 150 mm) from electrical systems and plastic pipes (shorter distances progressively require plate guards, thermal insulators or the replacement of plastic pipes with steel ones).

Authorisation must always be obtained from IVECO.

2.11 MODIFYING THE ENGINE COOLING SYSTEM

The good operating conditions of the original system must not be altered, especially for what concerns the radiator, free surface of the radiator and pipes (dimension and layout).

In any case, if modifications are required (e.g. cab modifications) that entail interventions on the engine cooling system, keep in mind that:

- The air passageway area for radiator cooling must not be less than that on vehicles with series standard cabs;
- maximum air expulsion from the engine compartment must be guaranteed, making sure that there are no hot air pockets of recirculation by adopting guards or deflectors;
- fan performance must not be modified;
- any modifications of the water piping must not compromise complete filling of the circuit (done with a steady flow and without any backflow from the intake until the circuit is filled) and regular water flow; in addition, these modifications must not alter maximum water stabilisation temperature, even in the most demanding conditions of use;
- pipe layout must be done so as to avoid the formation of air pockets (e.g. eliminating siphoning bends or installing required vents) that may make water circulation difficult;
- check that water pump activation at engine start-up and successive operation during idling is immediate (accelerate a few times), even when circuit is not pressurised. During checks make sure that the water pump supply pressure, with engine at top speed and no load, is less than 1 bar.

To check the operation of the cooling circuit we must account for the water supply, bleed and circulation proceeding as follows:

- fill the circuit while the engine is off with a flow rate of 8 - 10 l/min, until water seeps from the overflow vent;
- start the engine and run idle for 5 minutes, successively check to see that the water level in the supply tank has not dropped below minimum level;
- gradually rev the engine, checking that average pressure in the water pump outlet pipes steadily increases without and discontinuities;
- keep accelerating the engine until the thermostat opens, causing air bubbles to pass through transparent pipes installed between:
 - engine output and radiator;
 - water supply tank and water pump;
 - engine bleed and water supply tank;
- check, after the thermostat has been open for 15 minutes, that there are no more bubbles in the circuit;
- check that, with thermostat open and engine running idle, that average pressure in the water pump inlet pipe is greater than 500 mm water column (0.05 bar).

2.12 MODIFICATIONS TO THE HEATING/CONDITIONING PLANT

Installing an additional heating system

We recommend using IVECO type heating systems whenever it is necessary to install an additional heating system.

On vehicles where IVECO does not employ these heaters, installation must be done in compliance with the instructions issued by the equipment Manufacturer (installation of heaters, pipes, electric system, etc.) and in relation to the following indications.

The additional heating system must respect all national standards on the subject (e.g. tests, specific installations for the transport of hazardous materials, etc.). It must avoid the use of vehicle equipment that requires certified approval whenever such equipment may cause a negative impact on performance.

In addition, be sure to:

- care for the proper operation of all other vehicle systems (e.g.: engine cooling system);
- check that the battery capacity and alternator power are sufficient for increased current draw (see Chapter 5.4) and install a protection fuse on the new circuit;
- connect - for the fuel supply - the supply system to a supplementary tank that is installed along the return pipe of the engine fuel. Direct connection to the vehicle tank is allowed under the condition that it occurs independently from the engine fuel supply, and the new circuit must be perfectly airtight;
- route piping and wiring layout (and installation of brackets and flexible fittings) in relation to the spaces available and the influence of heat on the chassis parts. Avoid any exposed parts that may be dangerous, and adopt suitable guards when necessary.

The system must allow easy access and prompt maintenance.

The Body builder must provide all necessary maintenance instructions.

a) Water heaters

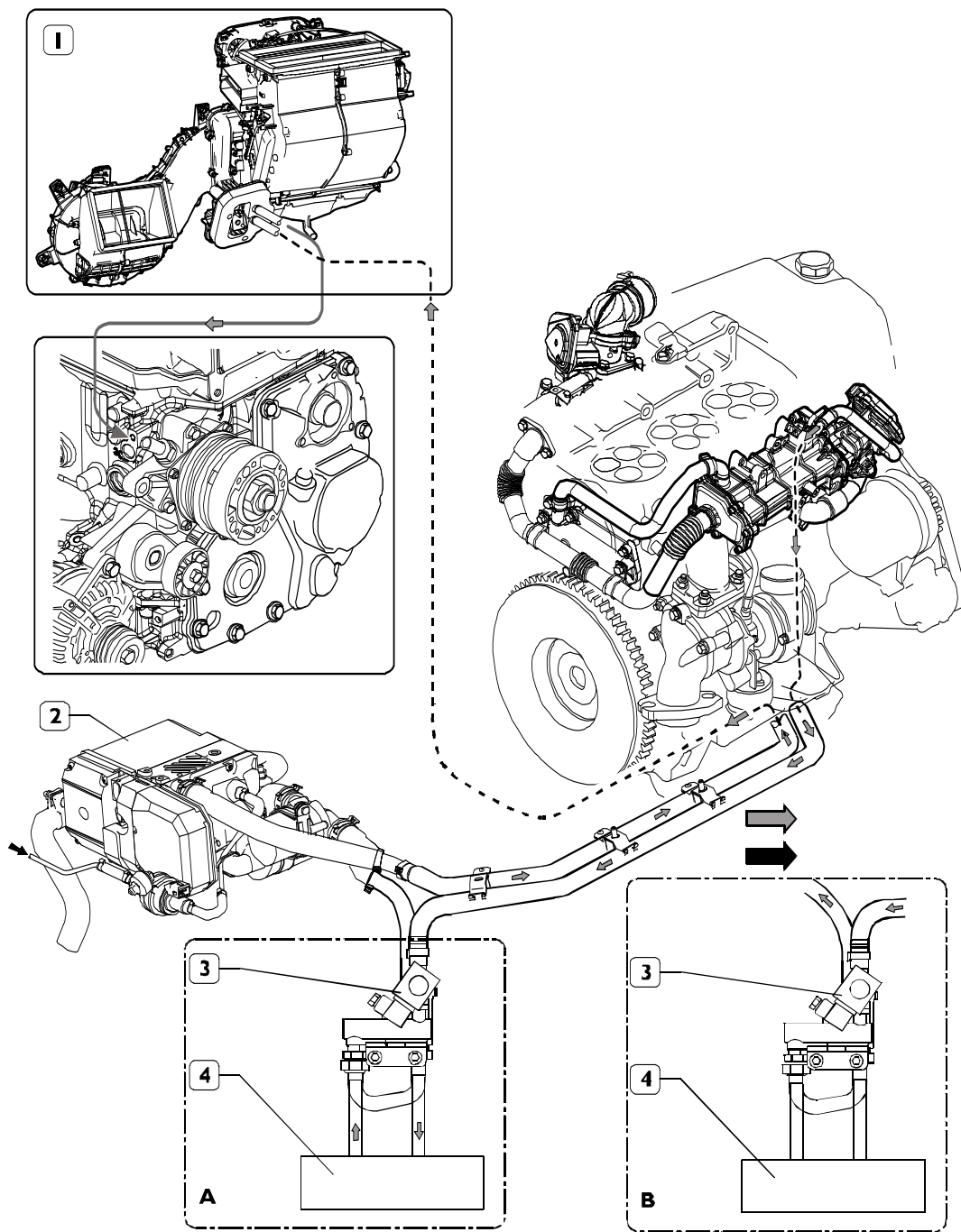
When the original vehicle heating and engine cooling circuits are involved (see Chapter 2.11 (➡ Page 33)), the following must be done to ensure good system operation and safety of the original system:

- carefully define the connection points between the additional and original systems, in agreement with IVECO, if necessary. The added pipes must be made of brass or other alloy resistant to the corrosive action of coolant, the coupling sleeves must respect the requirements put forth by the standard IVECO I8-0400;
- plan for a rational layout of pipes, avoiding bottlenecks and siphoning bends;
- install venting valves (bleed points) to allow proper system filling;
- allow complete circuit discharge, also by installing any additional plugs;
- adopt, when necessary, suitable protections to limit heat loss.

b) Air heaters

As regards these heaters and for direct cab installation, be particularly cautious with the exhausts (to avoid combustion gasses from being trapped in the vehicle) and correct distribution of hot air (in order to avoid direct flow).

Figure 21 shows a layout for a supplementary heating system with an additional heater.



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Figure 2I

- 1. Main heater
- 2. Optional supplementary heater
- 3. Solenoid valve
- 4. Additional heater installed by body builder

- A. Solenoid valve (3) open
- B. Solenoid valve (3) closed

N.B. Heaters (2) and (4) may even be present on their own.

Installing an air conditioning system

We recommend using original IVECO units for the installation of an air conditioning system.

When this is not possible, aside from complying with the specific requirements provided by the manufacturer of the equipment, it is necessary to:

- maintain good performance of the vehicle parts that may be involved in the intervention;
- check that the battery capacity and alternator power are sufficient for increased current draw (see Chapter 5.4 - Paragraph "Additional equipment") and install a protection fuse on the new circuit;
- plan the compressor installation modes with IVECO, if installed on the engine;
- route piping and wiring layout (and installation of brackets and flexible fittings) in relation to the spaces available and the influence of heat on the chassis parts;
- avoid layouts and installations where exposure may be dangerous when the vehicle is moving; fit suitable guards when necessary;
- the system must allow easy access and ensure prompt maintenance.

The Bodybuilder must provide all necessary maintenance instructions upon vehicle delivery.

In addition, in function of the type of system:

a) cab installed system:

- condenser installation must not cause negative effects on the engine cooling characteristics (reduction of exposed radiator-engine area);
- the condenser must not be installed together with the engine radiator but in a specific and suitably ventilated bay, unless a condenser is used that is equivalent (in shape and performance) to the standard model envisaged by IVECO;
- installation of the evaporator unit and of the bellow inside the cab (in cases where not provided directly from IVECO) must be planned as not to negatively impact control functions and access to equipment;

b) cab roof-installed systems :

- it is necessary to verify that the mass of the equipment does not exceed the weight allowed by the cab; in addition, the Bodybuilder must define the structural reinforcements to apply to the cab roof in relation to the unit's weight and type of intervention performed;
- contact IVECO or specific applications that involve an unoriginal compressor (e.g. fridge).

Note *Note that in relation to Directive 2006/40/EC on the emissions of air conditioning systems for motor vehicles, the use of fluorinated GHG with overall heating potential over 150 in comparison to CO₂ is prohibited.*

2.13 WORK ON SHEET METAL

General information

All interventions on the steering cab must be authorised by IVECO in advance.

The modifications must not hinder operation of the control devices located in the area of the modification (e.g. pedals, switches, pipes, etc.) nor alter the strength of load-bearing elements (frames, reinforcement profiles, etc.). Care must be taken when dealing with operations that regard the engine cooling and air intake pipelines.

In relation to variation of cab weight, it is necessary to consider the position of the load in order to respect division of allowed axle loads 1.15 (► Page 11)).

As regards operations that entail the removal of internal sound barriers or protective panels (panelling, cladding) be sure to remove only the minimum amount possible; restore the protections as intended in the original design along with their original functionality.

Cab installation of controls and equipment (PTO engage switch, external operator cylinder control, etc.) is allowed as long as:

- installation is rational, performed in good detail and easy to access by the driver;
- the proper safety, control and signalling devices called for by national law are installed.

Make sure that the pipes and cables are installed correctly; adopt the necessary retainers and be sure to plan for appropriate distances from the engine, heat sources and moving parts.

Each structural modification must bear protection against corrosion (see Chapter 2.3 (► Page 11)).

The use of zinc coated sheet metal is recommended on both ends of newly inserted sheet metal on cut bodywork in order to avoid ferrous corrosion of the welds (I.S. 18-1317 class ZNT/F/10/2S or I.S. 18-1318 class ZNT/10/2S); both surfaces must undergo protective treatment.

Install gaskets with care and apply sealant to areas in need of protection.

Make sure that the seals are water, dust and smoke tight.

The Bodybuilder must check that the chassis, after its structural modifications, complies with the standards in force for what concerns both internal and external structure.

Work on the cab

Any cab modifications performed to create specific configurations must be done with care in order to protect the resistance and maintain cab functionality and protections intact.

In any applications or units or equipment on the roof (e.g. conditioning plant, spoilers), make sure that the mass of the equipment does not exceed that permitted by the cab. The applicable limits can be provided on request, depending on the version.

If an opening has to be made, the following is required:

- envisage coupling radii of no less than 50 mm;
- do not modify any ribbing that may be present;
- do not modify the curvature of the roof.

Fitting a spoiler or baggage rack

On request, versions are available developed for IVECO on the basis of its design and verifications.

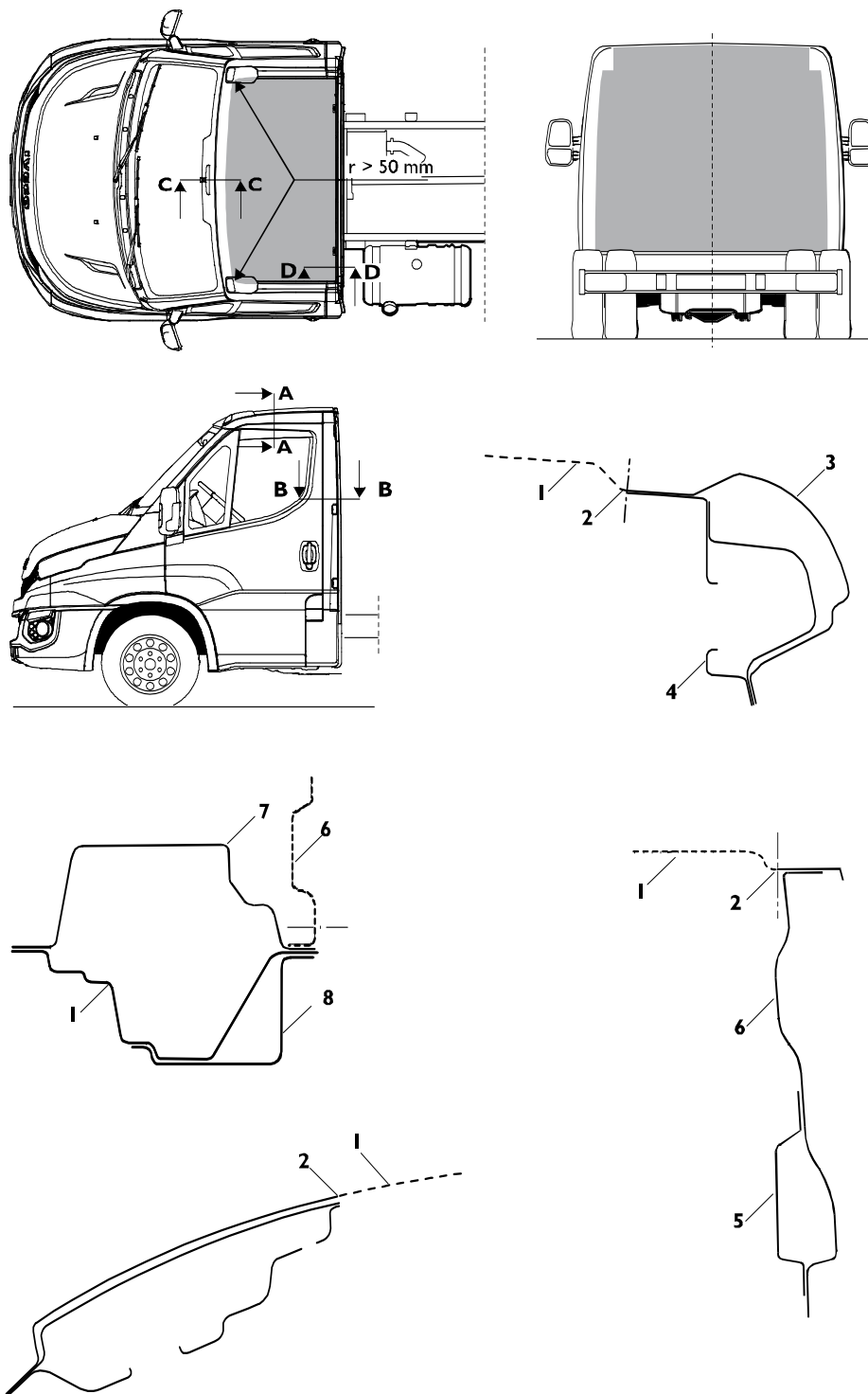
If "kits" of other origins are fitted, follow the specific indications supplied by the manufacturer.

If the national standards require it, these installations must be controlled by relevant type-approval authorities.

Work on the roof and rear wall of the cab

If the rear wall and part of the roof have to be removed (e.g. auto-caravan set-ups), bear in mind the following indications:

- make the cut as shown in Figure 22, making sure to comply with the minimum coupling radii indicated;
- eliminate the rear cross member structure at roof level;
- implement a structure capable of ensuring that uprights cannot be deformed in order to retain the efficiency of the upper couplings of the safety belts;
- this structure should have a compression strength of at least 800 daN;
- implement the connection with the new structure following the general indications provided above.



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Figure 22

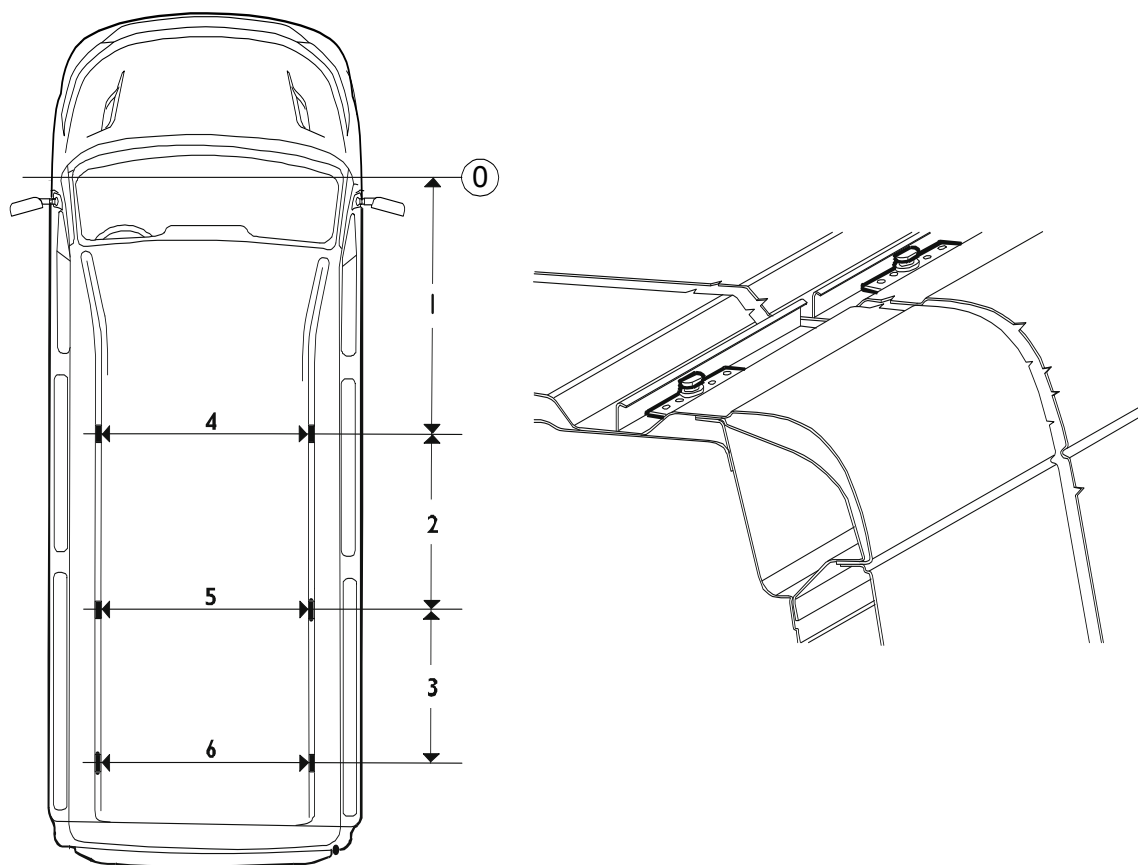
1. Roof panel
2. Cutting limit area
3. Side finishing of roof
4. Door support ring

5. Internal rear cross member
6. Rear wall
7. Door area rear finishing
8. Side finishing

Work on bodywork (vans)**Fitting baggage racks**

The installation must be carried out using the fixing devices specifically envisaged on the roof (low roof and medium roof versions), bearing in mind the following indications:

- the fixing element must include the baggage rack anchoring device and ensure the necessary resistance to longitudinal and crossways forces. 3+3 fixing elements are envisaged for all pitches;
- to avoid altering the vehicle's cornering stability, the load must not exceed a total of 200 kg;
- the mass allowed on each fixing element must not exceed 25 kg.



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Figure 23**Table 2.15**

Dimensions [mm]	1	2	3	4	5	6
Van wheelbase 3000 low roof - short overhang	1760	754	932	1548	1548	1548
Van wheelbase 3520 SL medium roof (H2)	2549	1082	935	1229	1229	1229
Van wheelbase 4100 SC medium roof (H2)	3713	1082	935	1229	1229	1229

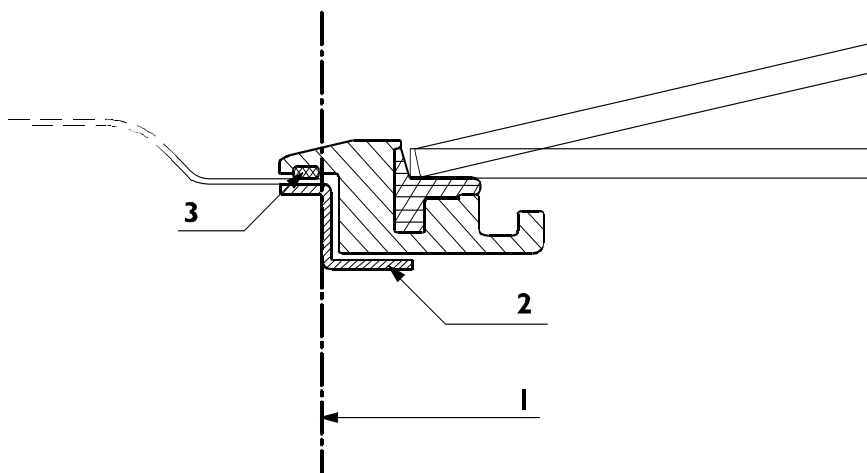
Work on the roof**a) Fitting a transparent roof**

At the time of publication of these Directives, it is still not possible to collect information and components for this kind of conversion.

b) Fitting an hatch

It is possible to fit an hatch on the roof provided that this task does not affect the ribbing and that the seal and strength of the modified parts are not affected.

Figure 24 shows an installation example.



208216

Figure 24

1. Cutting area

2. Anchorage profile

3. Sealant

c) Modifying the height of the roof

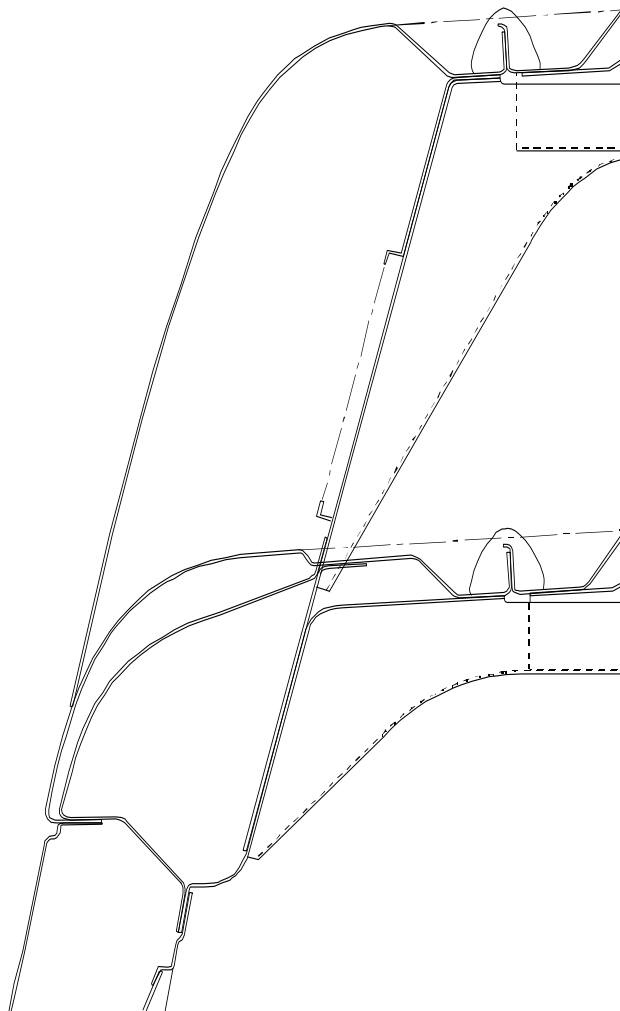
Three roof versions are available in production having respective inside heights of:

- low roof = 1595 mm
- medium roof = 1900 mm
- high roof = 2100 mm

Modifying the height of the roof is a very demanding and difficult task: this task should therefore only be performed on medium and high roofs, since they have the same roof structure.

Figure 25 shows the cross-section of the two versions, highlighting that the roof is a standardised structure.

To allow correct connection with the original roof, the Body builder must envisage appropriate intervention on the side ribbing.



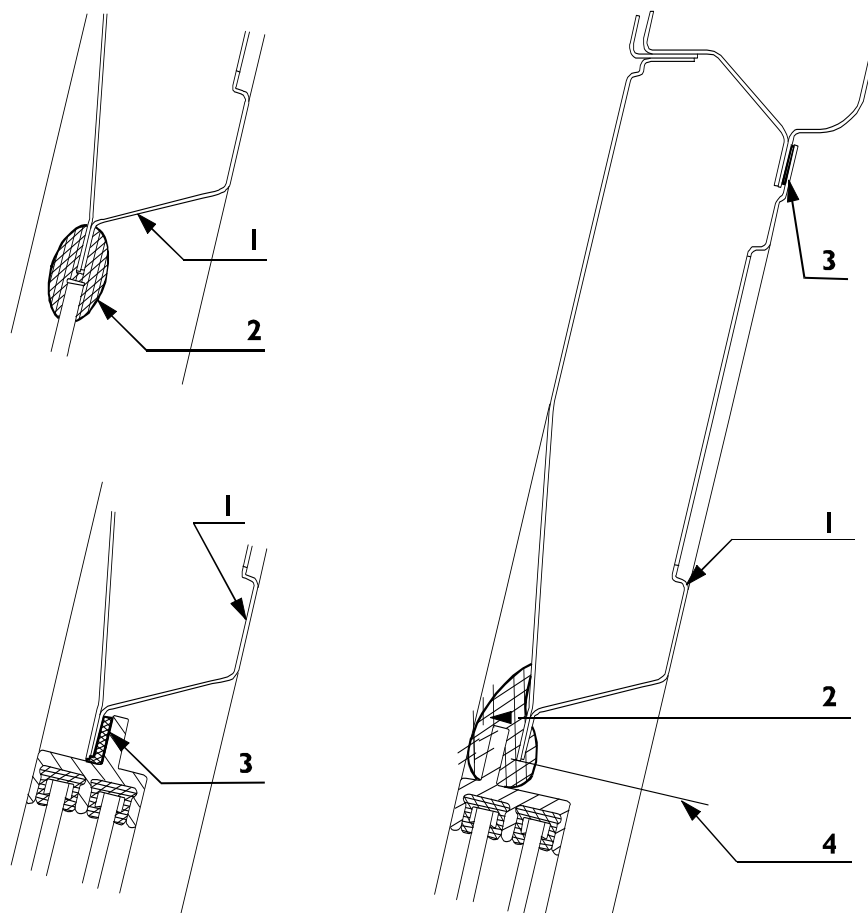
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Figure 25

d) Opening side windows

Opening side windows in van vehicles requires the specific precautions and expedients indicated below.

- Cut the sheet metal, taking care to maintain a profile with a minimum width of:
 - 15 mm (for fixed window with gasket seal);
 - 20÷25 mm (for a bonded window).
- Create an internal support structure (see Figure 26) in order to ensure the necessary strength and make the connection as shown in the figure.
- Remove the upright in the area affected by the new window and implement appropriate reinforcement at the base point.



208214

Figure 26

1. Internal support structure
2. Gasket

3. Bonding with semi-structural material
4. Cutting area

e) Interior shelves

Installing inside shelves must be carried out with great care to ensure suitable stiffness and self-support. The lower support must involve the floor support structure (cross members and longitudinal profiles) and must be implemented in a manner that ensures uniform load distribution.

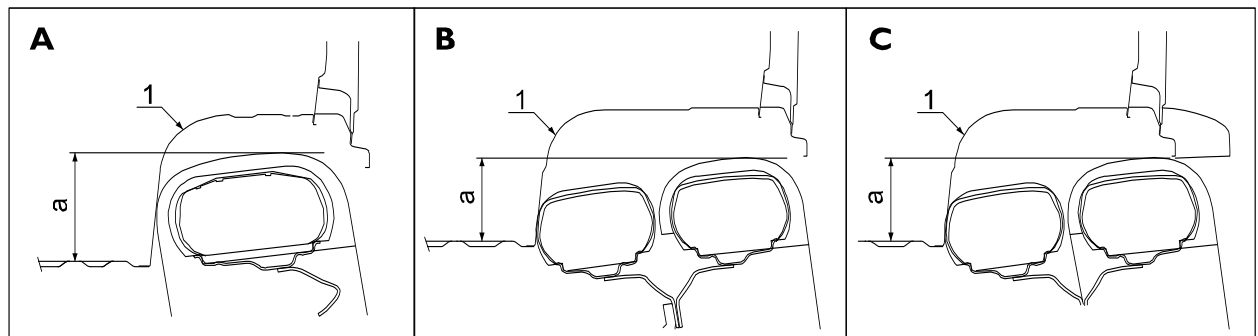
Anchoring of the side structure must avoid creating pre-load effects and may involve:

- the box uprights, where holes are already present;
- the upper connecting small beams.

Work on the structure and floor

Over and above the indications and precautions already mentioned, also bear in mind that:

- when drilling holes in the box sections, avoid areas where stresses are more concentrated (especially uprights A and B);
- The holes used for anchorage to the floor must be protected and sealed against infiltration of water, dust and exhaust gas;
- any lowering of the rear wheel arches must bear in mind possible juddering of the suspension and the possibility that snow chains may also be present. In this regard, Figure 27 highlights the cases that may arise and the related maximum possible lowering measurements.



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Figure 27

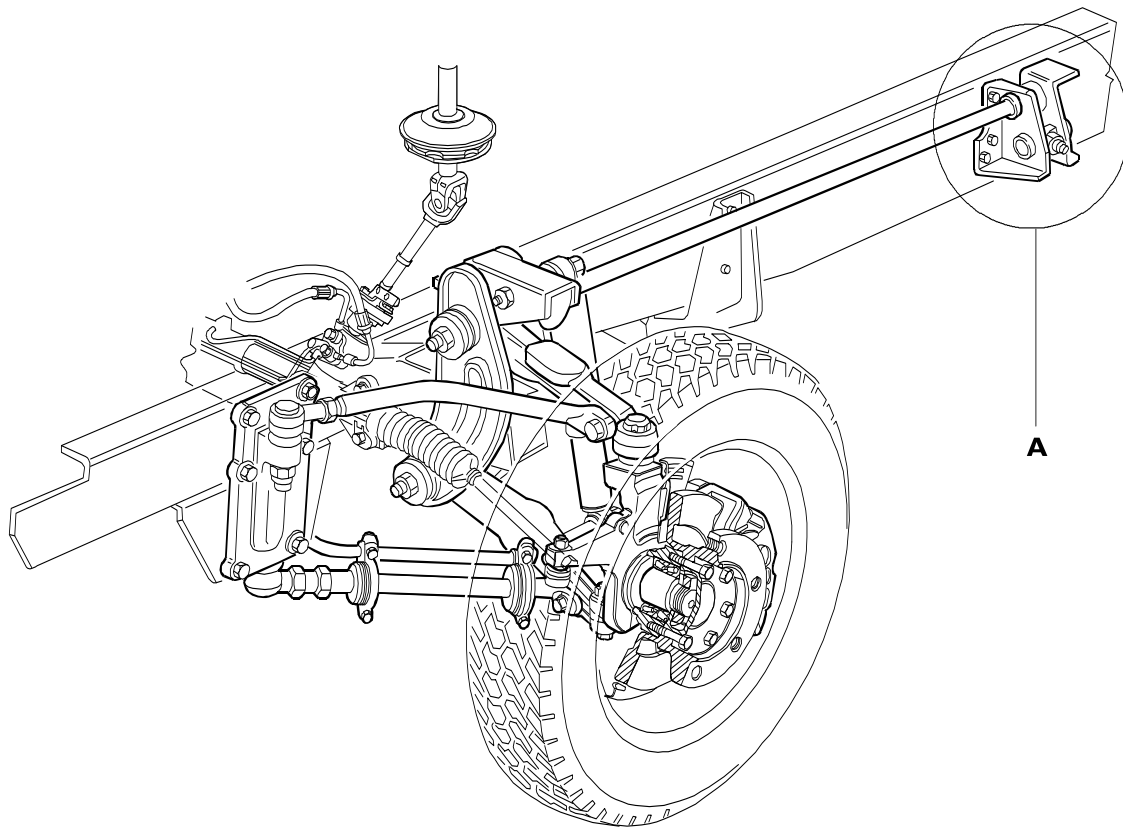
- A. Van with windows/Vendor 3.5 t
 B. Minibus-Vendor/Van with windows 4.2-4.5-5 t
 C. Van 6.5-7 t

1. Standard wheel arch profile, van version
 a. Maximum possible lowering

Table 2.16

Maximum permitted overall weight [t]	Tyres	Measurements [mm]
3,5 (side member of straight chassis)	225 / 65 R16	195
	235 / 65 R16	210
4.2 - 4.5 - 5 (side member of straight chassis)	195 / 75 R16	165
6.5 - 7 (side member of straight chassis)	225 / 75 R16	165

Note For work on the bodywork of vehicles equipped with front suspension with torsion bar, it is vital to ensure access to the trim adjustment system.



208218

Figure 28

A. Area free of obstructions for access to the adjustment system

Realization of sleeper cabs

When implementing deep cabs (e.g. 8+1) for special vehicles, municipal applications, fire brigade, etc., the suspension must be adapted to the higher mass and possible extra places made.

To perform work of this kind, confirmation must be obtained from IVECO of the suitability of the original suspension devices.

In outline, it may be possible to adopt solutions that are equivalent to those envisaged in routine production for similar versions.

Defining a suitable suspension system must:

- respect the cab structure provided in the standard vehicle;
- avoid that added weight causes serious damage to the original parts of the cab and relative suspension;
- ensure the normal oscillations along the vertical, longitudinal and transverse plane.

To help maintain the integrity of the cab, it is recommended to keep the rear structure as much as possible unchanged. The cut must be made laterally without damaging the door ring.

The body builder must make the necessary connections to the load-bearing structure, comprising the longitudinal profiles and the uprights, connecting the new floor to them; inspection panels must also be provided, if necessary.

It is advisable to pay special attention to the surface preparation of items to be welded (using a zinc primer) and to adopt the necessary precautions to ensure good preparation of the base for subsequent painting (see Chapter 2.3 (► Page 11)).

When modifying the cab, components such as the air intake and the filter may be involved. The use of original elements already provided for similar fittings, can be a good solution and allow the compliance with legislative regulations.



- **A deep cab may affect the handling and safety of the vehicle (suspension, commands). Inasmuch, it must be carried out with the utmost care and all necessary precautions.**

Protection of occupants

Airbags, safety belt fittings, the positioning of reels and pre-tension devices and anchorage of seats are all an integral part of passive safety.

Any modification of these components may compromise the protection of persons on-board and compliance with legal requirements.

Airbag/Window bag

Work or component installations must not be carried out in areas that may inhibit the correct operation of the airbags.

Consequently, the following must be avoided:

- modifications to the front structure of the vehicle, floor, firewall, sides and dashboard fixture points;
- alterations in the airbag control unit installation area (located under the floor between the front seats) and points involved in the system of sensors and related wiring harness;
- installation of components near the dashboard aperture;
- modifications to the steering column;
- replacements or installations of seats a different "H" point compared to the original versions.

Note *With a passenger side airbag, comply with regulations for the installation and use of baby seats.*



- **The additional circuits must be separated from the main circuit of the vehicle and protected by means of a specific fuse.**

Anchorage of safety belts

Work in the body areas where there are seat belt fittings may affect the function/operation of these devices.

It is therefore the responsibility of the Body builder to comply with regulations concerning:

- mounting and tightening torques
- choice of seat belts other than original versions;
- uniform operation between original seat belts and seats that may have a different configuration to the originals.

Seats

Moving the seats or mounting additional seats (e.g. in a cat. N1 van) are only allowed on vehicles already fitted at origin with supplementary fittings and already provided with alternative type approval.

Any other solution is implemented under to total responsibility of the body builder as regards installation and final test procedures (destructive).

2.14 CHANGING TYRE SIZE

Note Replacing the tyres with others of measure or load bearing capacity that differs from the specifications recorded at vehicle approval require IVECO certification, as well as a test to determine whether the braking system requires adjustment.

The vehicle must then be presented to the competent Body that will inspect the new tyres and the vehicle documents.

Mounting larger tyres:

- always requires a size check in relation to mechanical components, wheel arches, etc., in the various dynamic, steering and vehicle shaking conditions;
- may entail rim replacement with the consequential need to verify the spare tyre holder modification;
- may affect distance from ground of the rear under-run protection device and, in this case, a check on standard compliance is required; if necessary the support brackets must be replaced with appropriate and approved counterparts (see chapter 2.20 (► Page 60));
- requires the need to check compliance of the limit transversal contour allowed in relation to the various standards.

Prescriptions

Note Replacing tyres with others of different external diameter affects vehicle performance (e.g.: speed, max. vehicle ramp slope, tow load, braking force, etc.); therefore the body-computer (speedometer, tachograph and speed limiter) must be subject to recalibration at an authorised IVECO workshop.



► **Tyres of different size and type of structure cannot be mounted on the same axle.**

The tyre load bearing capacity and the relative reference speed must be suitable to the vehicle's performance.

Mounting tyres with lower load bearing capacity or reference speed entails a reduction of allowed loads; on the other hand, mounting tyres with greater load bearing capacity does not automatically entail an increase of load allowed on the axles.

The dimensions and load bearing capacity of the tyres are established by international and national standards (ETRTO, DIN, CUNA, etc.) and are listed in the manuals of their respective Manufacturers.

Particular performance values may be envisaged by national standards for special uses, fire-protection, winter services, airport tank trucks, buses, etc.



► **If vehicle configuration requires the wheels to be removed, make sure that the contact surfaces between rim and connection flange are clean and free of corrosion when remounting the wheels. In addition, tighten the wheel studs at the tightening torque according to the IVECO standard (see the following Table).**

Table 2.17 - Wheel tightening torque according to IVECO STD 17-9219

CONNECTING ELEMENTS		Thread	TIGHTENING			
N.	Name		CLASS	Torque [Nm]		FEATURES “S” ^(*)
				Min	Max	
I	Front and rear wheel mounting (33S-35S)	Stud bolt M14	II	144	176	“S”
2	OPT Alloy wheels (33S-35S)	Stud bolt M14	II	200	245	“S”
3	Front and rear wheel mounting (35C-50C)	Nut M18x1.5	II	290	350	“S”

CONNECTING ELEMENTS		Thread	TIGHTENING			
N.	Name		CLASS	Torque [Nm]		FEATURES “S” (*)
				Min	Max	
4	Front and rear wheel mounting (60C-65C-70C)	Nut M18x1.5	II	290	350	“S”

(*) Characteristic "S": safety tightening (see IVECO std. I 9-0405).



- If using brackets to mount aesthetic studs positioned between the rim / lug or stud, or if using rims thicker than the original, geometric mounting functionality must be ensured through appropriate lengths of stud threading in the locking hole.

2.15 WORK ON THE BRAKING SYSTEM

General information



- The brake system and its components are vitally important for the safe on-road use and operation of the vehicle.



- Modifications may not be made to brake cylinders and callipers, adjustment units and valves, parking brake, braking control and servo systems.



- Any modification of the braking system **MUST** be authorised by IVECO.

If the national standards provide it, the vehicle must be presented to the competent authority for inspection.

Brake pipes



- It is absolutely forbidden to weld the pipes.

Note In the case of changes to the cantilever, the brake lines involved should preferably be replaced with new pipes and in one piece. If it is not possible to use one-piece pipes, the couplings to be used must be of the same type as the original ones in the rest of the system.

In the event of replacements, it is necessary to comply with the minimum internal dimensions of the existing pipes.

The characteristics and the material of the new pipes must match those originally used on the vehicle.

For the supply of materials, it is advisable to contact a Service Centre or Authorised Workshop.

The installation must be carried out so that the system is adequately protected.



- We would like to underline the dangers related to the full or partial painting of the pipes; therefore, during the intervention, the pipes must be properly masked.

Metal pipes

Additions and replacements must envisage:

- for materials, dimensions, couplings: Standard ISO 4038
- radii of curvature (referring to the centre line of the pipe $\varnothing = 4.76$ mm): min 25 mm
- tightening torque:
 - stiff pipes, couplings M10x1 and M12x1: 14÷18 Nm
 - hoses, male couplings M10x1: 17÷20 Nm

Plastic pipes

Used on vehicles with air-operated suspension to connect air springs to the built-in control unit and to operate the braking corrector.

When making a replacement, bear in mind that plastic materials are not permitted:

- in areas where the temperature may exceed 80 °C, (e.g. within 100 mm of the engine exhaust system);
- between the chassis and moving parts, where special flexible pipes (hoses) should be used;

Operations must provide:

- materials and dimensions: Standards DIN 73378 and 74324 (Maximum operating pressure 11 bar)
- radii of curvature (referring to the centre line of the pipe): min 6 mm• outer $\varnothing$

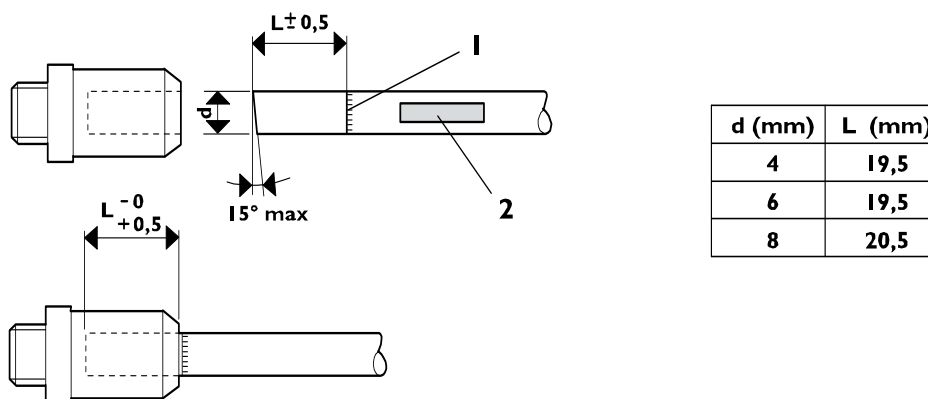
Preparation and assembly (IVECO STD 17-2403)

Cut the pipe at right angles (15° maximum error), using a special tool in order to avoid imperfections that affect the sealing.

Permanently mark the section of pipe (dimension L in Figure 29) to be inserted into the coupling to ensure secure sealing.

Mark the pipe to avoid assembly errors in case of subsequent repair operations.

As much as possible, use the same couplings as the original ones, or otherwise belonging to the normal production of specialised manufacturers in the sector.



208209

Figure 29

1. Identification of pipe limit

2. Marking

As much as possible, use quick-fit couplings.



- **For each intervention on the piping, verify whether there is the need, depending on the supplier, to use always new couplings or if it is possible to reuse those originally present through the use of appropriate tools (pliers).**

When the space conditions require it (e.g. in proximity of curves), couplings with metal inserts can be used.

Before inserting the pipe into the coupling, screw the coupling into the threaded insert of the same component (e.g. pneumatic valve), using the following values for tightening:

Table 2.18

Thread	Tightening torque [Nm $\pm$ 10%]
M 8 x 1 mm	20
M 12 x 1.5 mm	24
M 14 x 1.5 mm	28

Insert the pipe into the coupling for the previously marked stretch of length L, using a force of between 30 and 120 N, depending on the size of the tube.

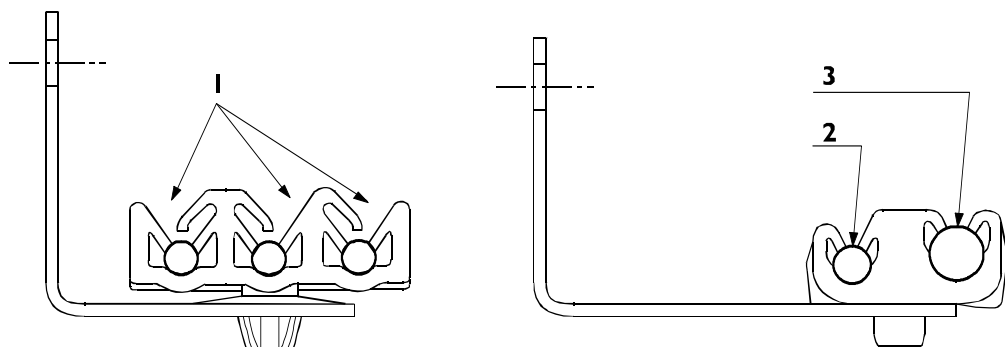
The replacement of components (valves, etc..) is made possible because the engagement and coupling allow an internal rotation during the operation of unscrewing and screwing.

Vehicle pipe installation

Before use, the new pipes must be thoroughly cleaned inside, for example by blowing air with a compressor.

The pipes must be fixed to the frame with elements which envelop the pipe completely and which may be metal with rubber/plastic protection or be made of plastic material.

Figure 30 shows two examples of brackets complete with retainer clamps used to secure pipelines along the chassis.



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Figure 30

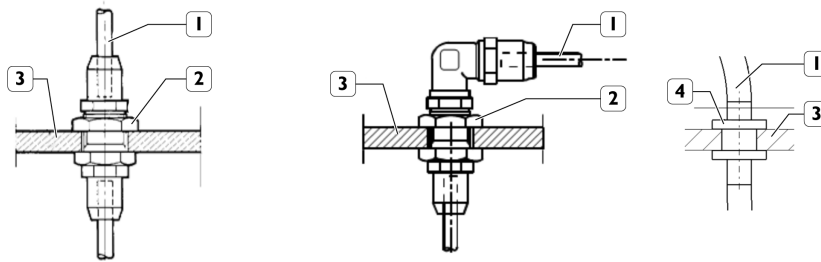
1. Three seats for pipes $\varnothing 4 \div 6$
2. for pipe $\varnothing 4,8$

3. for pipe $\varnothing 7,5 \div 8$

Provide appropriate distances between one fastening element and the other: generally, max. 500 mm for plastic pipes and max. 600 mm for metal pipes can be considered.

In order to avoid deformations and tensions at the time of closure of the couplings for the plastic pipes, it is necessary to take care of the line and the accommodation of the fastening elements, rubbing should be avoided with the fixed parts of the vehicle and meet the necessary safety distances from moving parts and heat sources.

In passing the pipes through the chassis (side members or crossbars), take precautions to avoid damage. One solution would be to use a coupling passing directly through or at an angle, or a rubber protective eyelet, as shown in Figure 31.



193866

Figure 31

1. Pipe
2. Through-coupling

3. Chassis
4. Rubber protection



- **After every task on the plant and its equipment, perform a complete air bleed operation. The fluid expelled from the hydraulic circuit during the bleed operation must not be re-used. For topping up, only use the type of fluid prescribed, contained in sealed original recipients which must only be opened at the time of use. Then verify the correct efficiency of the brake system.**

Air bleed using “MODUS” or “E.A.SY.” on vehicles with ABS/ABD/EBD system

On vehicles equipped with ABS/ABD/EBD system, the conventional manual bleed operation may not be sufficient.

In this case, proceed with the operation piloted by the program included in “MODUS” or “E.A.SY.”.

This program ensures a complete bleed (primary circuit and secondary circuit of modulator) at item Fill/Empty Plant.

Follow the instructions as they are displayed, making sure not to exceed the pump and solenoid activation time to avoid superheating the components.

If this happens, the system switches off and you must wait for the preset time before resuming the operation.



- **When replacing the modulator (supplied by IVECO Parts already filled with brake fluid in every part), it is enough to use the manual bleed procedure, taking care however not to empty it and not to cycle the pump and solenoid before filling is completed.**

The ABS, ABD, EBD modulating devices are located on the chassis in the engine bay and must not be moved.



- **Any such work must pay special attention to ensure correct connect on pipelines for each and every wheel. Perform the necessary checks and controls after every such task at an Authorised Workshop having specific equipment.**

Load sensing valve

For vehicles that are still requested without ABS/ESP, a braking corrector version is envisaged for a single circuit linked with the twin rear wheels (35C models).

Adjusting the corrector

Adjustment is performed at origin in the production factory and enables the vehicle to transport loads or to receive routine superstructures, in compliance with the deceleration and road-holding values required by the related EC Directives.

Adjustment and control data are notified by a specific plate; its location on the vehicle is indicated in specific documentation.

If the corrector has to be adjusted differently, proceed as indicated below (see Figure 32).

Note If there are new springs, prior to adjustment make sure that the rear suspension has settled correctly.

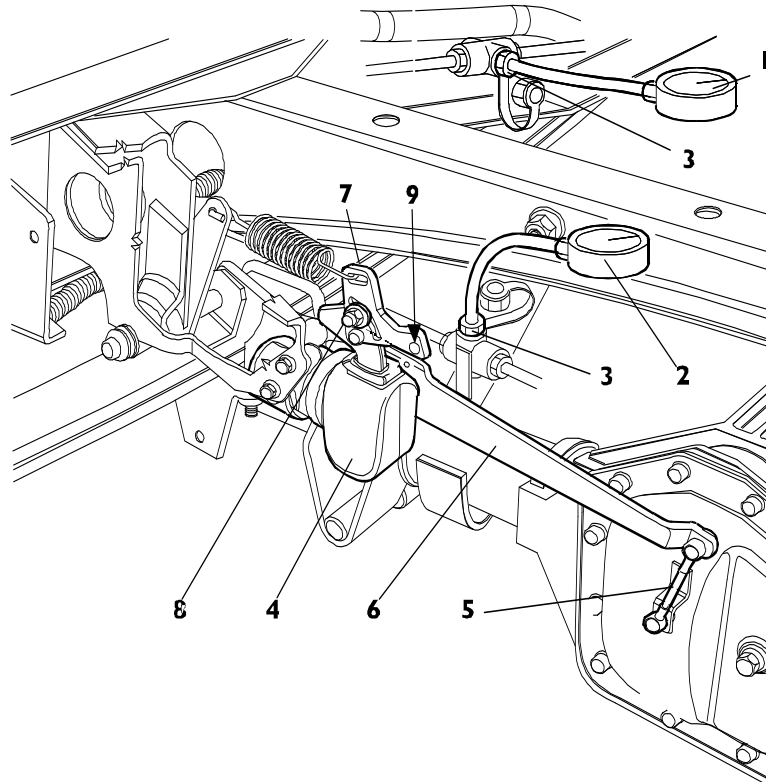
To do this, partially load the vehicle (about 2/3 of maximum limit), drive over bumpy ground and brake several times in forward and reverse gear.

- Connect pressure gauge **(1)** and **(2)** to the pressure sockets up-line and down-line of the corrector using the test couplings **(3)**.
- Slacken coupling screw **(8)** on corrector adjustment lever **(7)**.
- Apply to hole **(9)** the specific adjustment load for each model and each spring, after having loaded the drive axle to the reference value (see Table 2.19).

Table 2.19

Models	Rear leaf spring Type	Load on lever used for adjustment [kg]	Load on ground for reference on rear axle [kg]
35C	semi-elliptical	3.5	1500

- Tighten the coupling screw **(8)** to the prescribed torque ($16 \div 19$ Nm).
- Operate the brake pedal until the circuit up-line of the control pressure corrector reaches 100 bar.
- Check that the outlet pressure reaches the value indicated on the plate, corresponding to the ground mass attained.

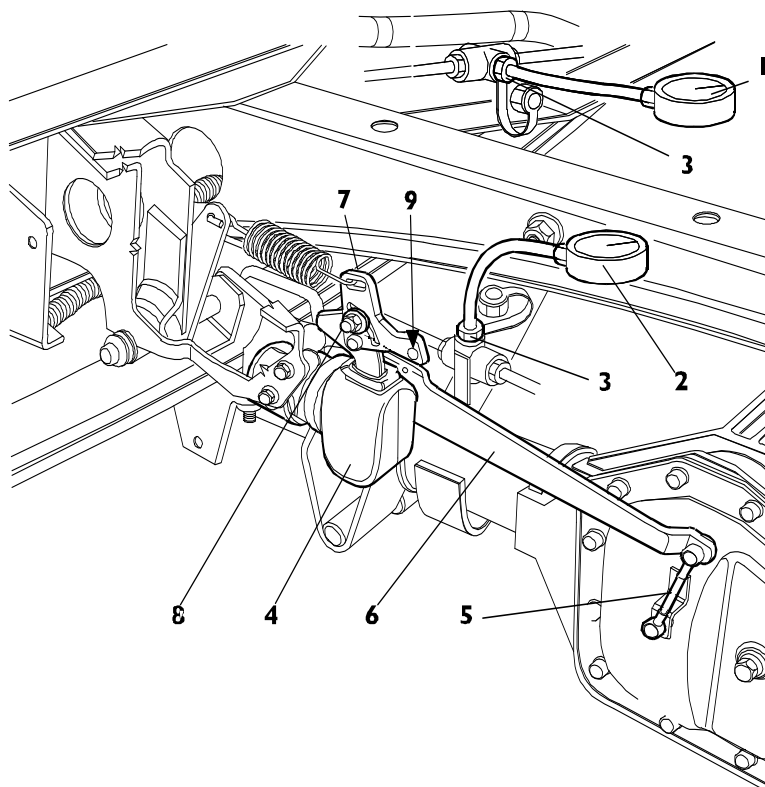


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Figure 32

1. Pressure gauge up-line of the corrector
2. Pressure gauge down-line of the corrector
3. Test couplings

4. Load sensing valve
5. Rod
6. Main lever
7. Adjustment lever



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Figure 32

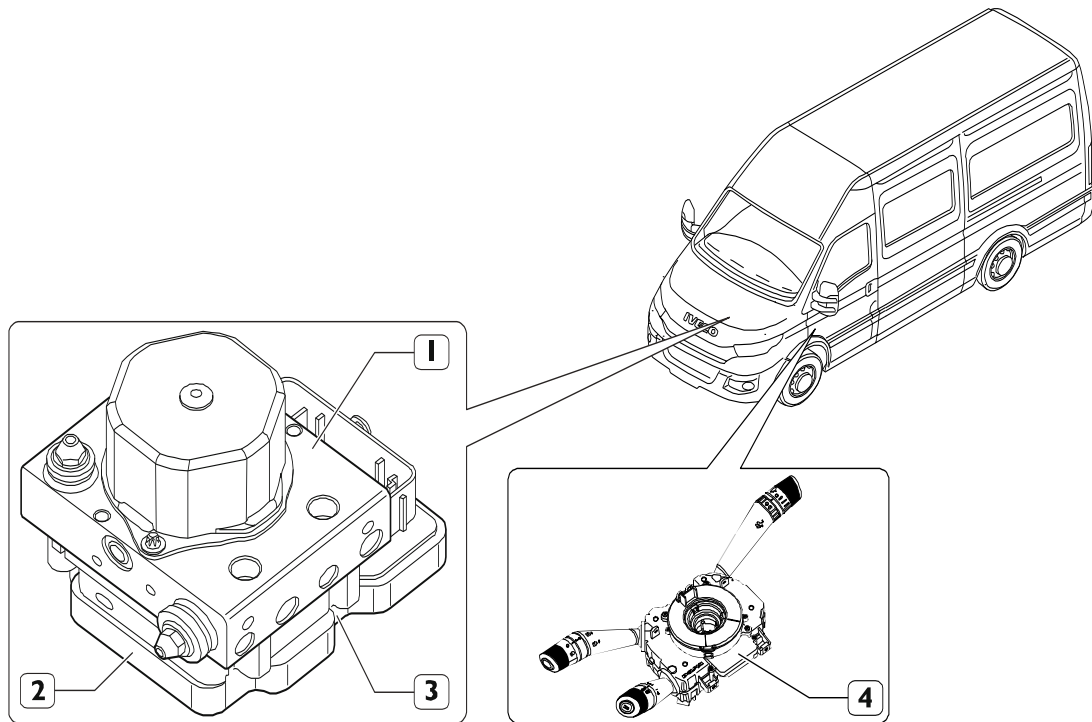
8. Union screw

9. Hole for application of calibration load

ESP (Electronic Stability Program)

ESP is an electronic function that contributed to the active safety of the vehicle and inasmuch is compulsory under European Regulations.

This function ensures control of crossways dynamics and stability by means of the components indicated in Figure 33. In particular, in the event of potential vehicle instability and through the electro-hydraulic modulator, the control unit activates modulated braking of one or more wheels simultaneously.



204650

Figure 33

1. Electro-hydraulic modulator
2. Braking system control unit

3. Yaw and acceleration sensor
4. Steering angle sensor

To ensure correct programming of the ESP control unit (or Body Computer), the following parameters are important:

- vehicle configuration (van, truck, camper,...);
- wheelbase
- P.T.T.;
- type of suspension;
- type of gearbox/transmission
- wheel circumference;
- retarder (if equipped).

Every variation of one or more of these parameters requires re-programming of the ESP control unit (or Body Computer) or the functional degrading of the system.

The following paragraph describes the main situations that may arise.

Note Reprogramming the control unit or degrading of the ESP system must exclusively be performed by the IVECO Assistance Service.

ESP SYSTEM Derating

- **The Derating of the ESP system is only possible for certain vehicle categories: for their identification and relative dispositions, refer to Attachment XI of Directive 2007/46/EC - latest version amended. The Derating of the ESP system involves the complete deactivation of vehicle stability control.**

If derating is implemented, functions nonetheless remain active:

- ABS (Antilock Braking System) to avoid wheel locking
- EBD (Electronic Brake Force Distribution) to distribute the braking force between front and rear axles
- ASR (Anti Slip Regulator) to reduce drive wheel slipping on breakaway
- MSR (Motor Schleppmomenten Regelung) to control the braking effect of the engine when released
- HBA (Hydraulic Brake Assist) to increase system pressure in the event of sudden braking
- HHC (Hill Holder Control) to facilitate breakaway from a standstill in ascent

Variation of P.T.T.

Variations of vehicle P.T.T. must be authorised by IVECO and only in certain special cases is this compatible with the presence of the ESP system.

In the event of compatibility, system management software must be reprogrammed; in all other cases, Derating is compulsory, except as indicated in Attachment XI of Directive 2007/46/EC.

Wheelbase variation

a) To values included in the product grid

If the conversion involves a wheelbase value among those in production for the specific vehicle model, ESP system software has to be reprogrammed.

a) To values not included in the product grid

If the conversion involves a wheelbase value NOT corresponding to any of those in production for the specific vehicle model, Derating of the ESP system is compulsory, except as indicated in Attachment XI of Directive 2007/46/EC.

Modification or replacement of suspensions

If an ESP system is present:

- modifications are not allowed of any suspension element;
- total replacement of the suspension is permitted with another suspension already type approved for the specific vehicle model;
- air-operated suspensions may be replaced by mechanical suspensions and vice versa provided that already type-approved groups are used for the specific vehicle model.

Such intervention may only be performed after obtain authorisation from IVECO and require the reprogramming of ESP system software.

Modification or replacement of stabilising bars

The modification or replacement of stabilising bars must be authorised by IVECO and is not compatible with the presence of the ESP system.

Inasmuch, if authorisation is granted, Derating of this system is compulsory, except as indicated in Attachment XI of Directive 2007/46/EC.

Changing tyres

See Chapter 2.14 (➡ Page 46)



► **It is forbidden to modify the characteristics of the tyres outside the range type-approved by IVECO.**

Retarders

Post-sale installation of an electro-magnetic retarder is possible, after requesting "Authorisation", exclusively if the group is an electronic management type and if the contents of the vehicle's original wiring harness are compatible (it must be possible to swap data between the retarder and the vehicle via CAN).

Bear in mind in any case that, after such intervention, it is compulsory to reprogram certain control units (Body Computer, dashboard, robot-controlled gearbox if fitted) through an IVECO Service Centre.

If the retarder is removed, the normal electronic functions of the vehicle must be restored, once again through an IVECO Service Centre.

Other indications can be consulted in Chapter 2.19 (➡ Page 59).

2.16 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

Note For information on work on the electrical system, refer to what is described in Section 5 - Chapter 5.4 .

2.17 PART RELOCATION AND ANCHORAGE OF ADDITIONAL UNITS AND EQUIPMENT

The movement of units (various components, fuel and urea tanks, batteries, spare wheel, etc.) for the installation of equipment is allowed on the condition that:

- the functionality of the unit is not compromised;
- the original type of connection is restored;
- the new placement and distribution of mass is compatible with that originally established.

Horn

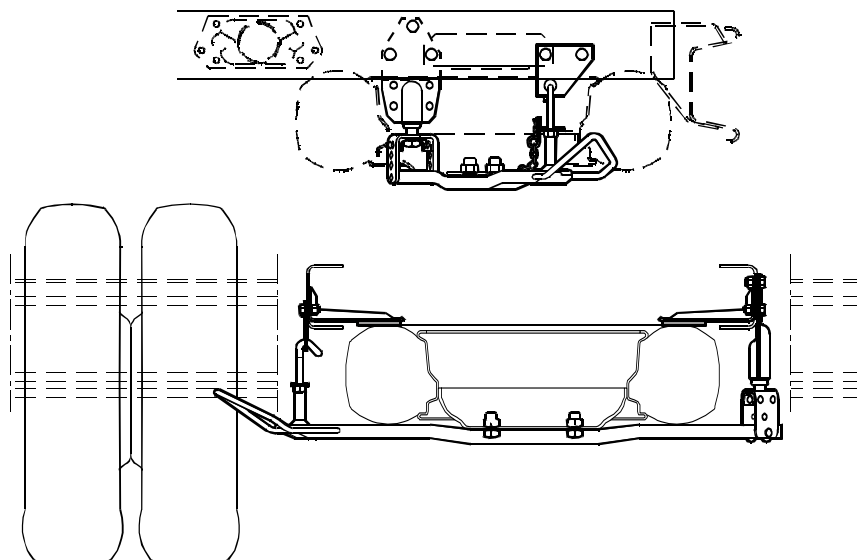
The displacement of the horn obligates the body builder for a new approval. Also in the new position, the device must ensure the acoustic performance set by the regulations and must be adequately protected from exposure of weathering and/or soiling. IVECO reserves the right to void the warranty on the moved component.

Wheel holder

For chassis cabs not supplied with a spare wheel holder, or in cases where it is necessary to move the spare wheel, a special support must be made that allows rapid extraction and meets a minimum entry angle of 7°.

Figures 34 and 35 show two possible solutions.

To secure the spare wheel to the side of the vehicle with a support applied to the rib of the side member, we recommend the application of a local reinforcement plate arranged inside or outside the side member itself and sized depending on both the mass of the wheel and the presence or absence of other reinforcements on the side member.



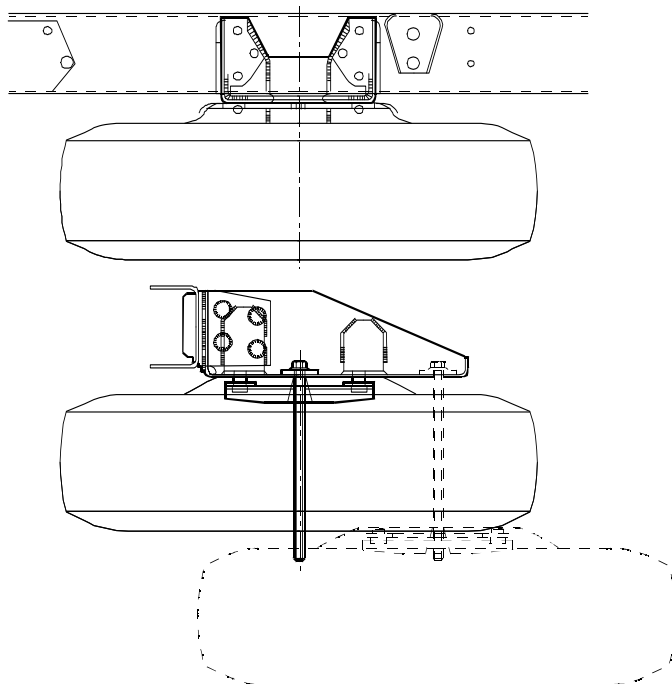
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Figure 34

To minimise torsional stress on the chassis of the vehicle it is advisable to perform the installation in correspondence with a cross-bar, especially in the case of high mass units.

Similarly, it must act for the installation of tanks, compressors, etc.; the distribution of weight must also be taken into account for their placement (see Chapter 1.15 (► Page 11)). In all these applications, one should always provide a sufficient margin in their height from the ground in relation to the use of the vehicle.

The holes to be drilled for the new arrangements should be made on the rib of the side member, according to the regulations given in Chapter 2.2 (► Page 8) and taking care to use the existing holes as much as possible.



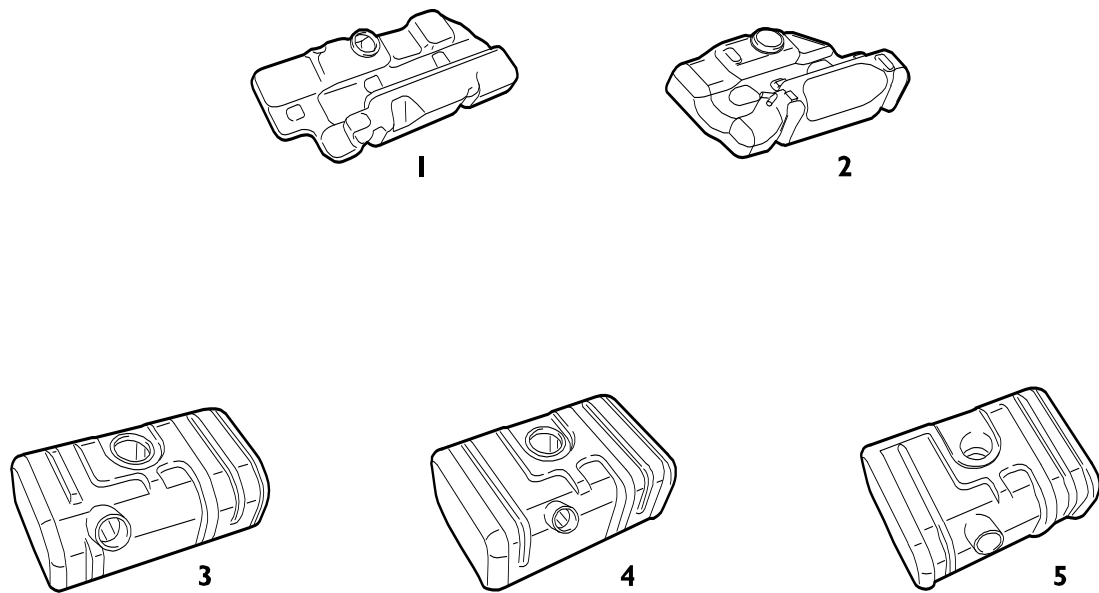
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Figure 35

Fuel tank

When it is necessary to increase autonomy compared to the original configuration, it is possible to replace the reservoir with another chosen from standard models.

Figure 36 indicates the types of IVECO tank available.



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Figure 36

1. 100 litre shaped tank
2. 70 litre shaped tank
3. 70 litre rectangular tank

4. 90 litre rectangular tank
5. 120 litre rectangular tank

Note Replacing the tank requires updating the Body Computer (see Chapter 5.1). Since the Body Computer processes fuel level signals by associating them with the emptying rule for the specific tank, the use of different tanks requires resetting indications for consumption, remaining autonomy, etc..

Since the Body Computer processes fuel level signals by associating them with the emptying rule for the specific tank, the use of different tanks requires resetting indications for consumption, remaining autonomy, etc..

2.18 TRANSPORT OF HAZARDOUS MATERIALS (ADR)

Depending on the specific ECE/TRANS/WP.15/213 document and its national implementations, dangerous goods are classified under "Explosives", "Flammable Liquids", "Gas", "Hydrogen" and must be transported on a specially crafted vehicle. The type of preparation is specific according to the above categories (see end of paragraph).

IVECO does not provide versions fully prepared for the ADR, although production vehicles do already comply for some electrical parts, mechanical components and materials inside the cab. The Bodybuilder, upon request, is given a "declaration" containing details of the sections in the ECE document that have already been complied with by the vehicle up from the origin.

A higher level of compliance can be obtained through the optional 2342 (ADR preparation) which brings the vehicle to have:

- specific digital tachograph (to select within two versions)
- specific electric switch (only in cab or both on chassis and in cab)
- emergency switch

- protected electrical connections
- wiring protected with polyamide conduit
- ADR approval plate
- instructions on functioning

Note that with this option, the centralised closing of the doors can be activated only if the ADR transport is not running; Otherwise the doors can be closed only with the normal keys.

What is still missing for the complete adjustment of the vehicle to the specific type of goods to be transported remains in charge of the body builder.

For example: the realization of vehicles for the transport of category "OX - Peroxides" materials, for which the regulations require that the windows of the rear wall of the cab have specific characteristics and so their frames. Since this is not within the content of the ADR preparation given by IVECO, when ordering the vehicle must be chosen the optional 00741 "Without rear glazing".

Note *The complete transformation must still be authorised by the authorities responsible for the relative tests.*

By way of example, below is some information concluded by the Regulation ECE/TRANS/WP.15/213 on the topic.

- **Electrical system.**
Conductors suitably insulated and protected in ducts, protected from shock, stones, heat, etc.
Circuits protected from overvoltage with appropriate connections for use in hazardous environments, with fuses or automatic circuit breakers.
Main power switch (excluding tachograph, power directly by batteries with suitable safety systems) on dashboard.
- **Braking.**
Compliance with specific EC Directives.
Obligation of the anti-lock system (ABS) and a device for slowing down, in the cases provided by law.
- **Cab protection.**
Use of fire-resistant materials, according to ISO 3795, with a burn rate not exceeding 100 mm/min; otherwise adoption of a protective wall between the cab compartment and transport.
- **Exhaust system.**
Suitable insulation for the components that reach temperatures above 200° C and cannot be moved in front of the protective wall.
Exhaust outlet facing towards the outer side; in the event of transport of explosives, the ends must be equipped with a spark arrester device.
- **Fuel tank.**
Location protected from shocks; in case of spills or leaks, the fluid should flow directly on the ground.
- **Independent heater.**
Safe with regard to protection against the fire; placed in front of the rear cab panel, at least 80 cm from the ground, with protection of the heated parts.
- **Speed limiter.**
Compliant with the ECE Directives in force.
- **Equipment.**
At least two fire extinguishers and two portable lamps, independent from the vehicle's electrical system, whose operation can not cause the combustion of the transported goods.

2.19 INSTALLING A RETARDER



- **The installation of a retarder brake is complex and requires the perfect integration with electric and electronic vehicle systems: therefore approval by IVECO is always necessary.**

Fitting an additional retarder (always and only an electro-magnetic type with electronic management) requires action on the propeller shaft and inasmuch must be authorised by IVECO.

Models 33S and 35S cannot accept the device, while suitability for the others must be verified in relation to the product grid (wheelbases, versions).

The retarder selection must be performed based on the following formula:

$$\frac{i_p \cdot C_f}{R' \cdot PTT} \approx 1$$

204640

Figure 37

i_p = rear axle ratio

C_f = Maximum braking torque [Nm]

R' = radius under load of the used tyre [m]

GVW = Gross Vehicle Weight [kg]

Example of calculation of max braking torque

We consider a vehicle DAILY 50C15V/P, with axle ratio 3.15 and tyres 195/75R16.

From data:

1. $i_p = 3.15$
2. $R' = 0.317$ m
3. GVW = 5.200 kg

we obtain:

$$C_f = (5.200 \cdot 0.317) / 3.15 = 520 \text{ Nm}$$

Can be applied a retarder brake with maximum deceleration torque of 500 Nm.

The installation must be in charge of the brake manufacturer, through its authorized service centres, in accordance with Chapters 2.2 (► Page 8), 2.8 (► Page 26) and 5.4 of these Directives. He has the responsibility of the sizing of the coupling parts, the correct functioning and the proper execution of the work.



- **For vehicles equipped with the ESP system, see Chapter 2.15 - Paragraph "Derating of the ESP system".**

2.20 REAR UNDER-RUN PROTECTION (RUP)

The maximum distance between the rear under-run protection device (RUP = Rear Underrun Protection) and the rear-most point of the superstructure is 400 mm, less the deformation observed in the approval phase (on average 10 mm).

If the changes on the chassis require the adaptation of the rear overhang, the under-run protection must be placed by performing the same connection to the chassis as provided in the original version.

In the transformation of the vehicle or in the application of special equipment (e.g. rear tail lifts), it may be necessary to modify the structure of the under-run. The intervention shall not change the resistance characteristics and the original rigidity.

The compliance of the modified device with standards in force must be demonstrated to the competent authorities by appropriate documentation or test certificates.

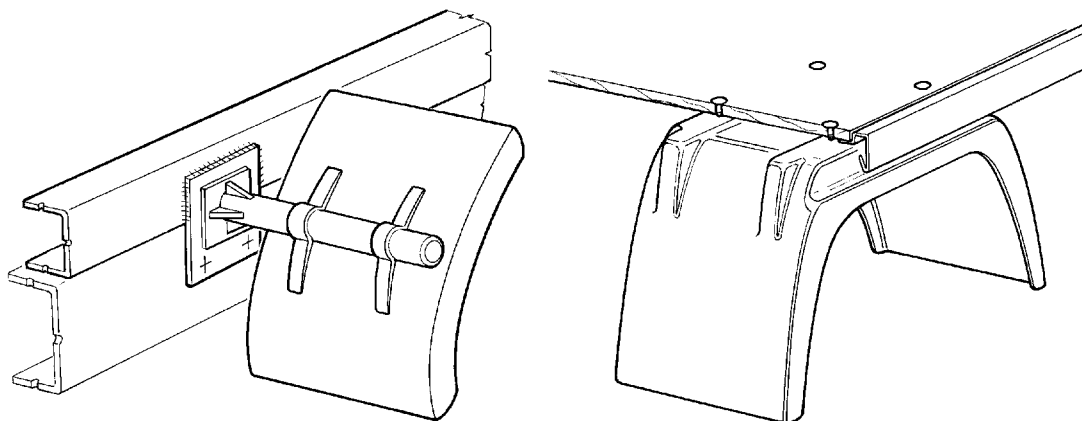
2.21 REAR MUD GUARDS AND WHEEL ARCHES

On cab version vehicles without rear fenders, the Body builder must implement solutions equal to those provided by IVECO.

For the realisation of the fenders, the wheel arch boxes and the shaping of the superstructure, keep in mind that:

- the free shaking of the wheels must be ensured even in the conditions of use with chains; any indications on limit values can be requested via the Support Service;
- the width of the fender must be greater than the maximum dimensions occupied by the tyres, within the limits set by the regulations;
- the support structure of the fender must have adequate strength and be able to limit the vibrations;
- the connection can be made on the vertical rib of the side members of the vehicle (using only the already existing holes) or directly applied under the superstructure (see Figure 38).

The first and the second point are also to be considered in the implementation of wheel arches.



91472

Figure 38

2.22 RAIN FLAP

In cases where legislation requires it and if not present yet, it is necessary to ensure that the complete vehicle is equipped with suitable rain flaps. For installation, it is necessary to comply with the distances required by the laws in force.

2.23 SIDE PROTECTIONS

In some countries, regulations (national or EC) require the application of side protections. Compliance with the required characteristics should be assured by the Bodybuilder who handles completion of the vehicle, if it was not already equipped as such originally (optional setting).

In permanently applied superstructures (e.g. fixed bodies, vans) side protection can be applied on the basis of their structure (e.g. frame of the floor beams), while for mobile superstructures (e.g. tippers) the connection can be made by means of suitable supports on the counter chassis or directly on the chassis. In the latter case, use the existing holes on the vertical rib of the side member as much as possible, in compliance with Chapter 2.2 (➡ Page 8).

In implementing the outer protection, as required by the regulations (e.g. EC Directive), it is permitted to use either a single section with a surface extending in the vertical longitudinal sections, with pre-set dimensions and distances between them.

The protection must be connected to the support structures in order to be quickly removed or reversed in case of maintenance or repair of the units behind them

SECTION 3

**APPLICATIONS OF
SUPERSTRUCTURES**

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APPLICATIONS OF SUPERSTRUCTURES

NOTE The specific instructions below are integrated into the requirements stated in Section I "GENERAL INFORMATION" in the general rules.

3.1 CONSTRUCTION OF THE COUNTER CHASSIS

The purpose of the counter chassis is to ensure a uniform load distribution on the vehicle chassis and the necessary cooperation with it to the effects of resistance and stiffness, depending on the vehicle's specific use.

Material

In general, if the stresses on the counter chassis are not high, the material for its realisation may have characteristics inferior to those of the frame, notwithstanding the need to have good characteristics of weldability and limits that are not lower than the values **(I)** shown in Table 3.1.

In cases where the stress limits require it (e.g. for crane applications), or if you want to avoid high section height, materials with superior mechanical characteristics may be used. You should, however, keep in mind that the reduction of the time of inertia of the reinforcing section involves bending and higher stresses on the main chassis.

Following are the characteristics of certain materials which were taken into account in some of the applications stated below.

Table 3.1 - Material to be used for the construction of superstructures Std IVECO 15-2110 and 15-2812

Name of steel		Breaking strength [N/mm ²]	Yield stress [N/mm ²]	Elongation
IVECO	Fe 360D	360 (I)	235 (I)	25% (I)
EUROPE	S235J2G3			
GERMANY	ST37-3N			
U.K.	40D			
IVECO	Fe E420	530	420	21%
EUROPE	S420MC			
GERMANY	QStE420TM			
U.K.	50F45			
IVECO	Fe 510D	520	360	22%
EUROPE	S355J2G3			
GERMANY	ST52-3N			
U.K.	50D			

Sizing of profiles

The following table shows the values of resistance modulus W_x for C section profiles recommended by IVECO.

The indicated value W_x refers to the actual section and takes into account the radii of curvature of the section (can be calculated with good approximation by multiplying the value obtained by 0.95 considering the section composed of simple rectangles). Profiles of different section may be used in lieu of those specified, provided that resistance modulus W_x and inertia time J_x of the new C section are not of a lesser value.

Table 3.2 - Profile dimensions

Resistance modulus W_x [cm ³]	Recommended C profile [mm]		
$16 \leq W \leq 19$	80 X 50 X 4	80 X 60 X 4	80 X 50 X 5
$20 \leq W \leq 23$		80 X 60 X 5	

Resistance modulus W_x [cm ³]	Recommended C profile [mm]		
$24 \leq W \leq 26$		80 × 60 × 6	
$27 \leq W \leq 30$		80 × 60 × 7	100 × 50 × 5
$31 \leq W \leq 33$		80 × 60 × 8	100 × 60 × 5
$34 \leq W \leq 36$		100 × 60 × 6	
$37 \leq W \leq 41$		100 × 60 × 7	
$42 \leq W \leq 45$	80 × 80 × 8	100 × 60 × 8	
$46 \leq W \leq 52$	120 × 60 × 6	120 × 60 × 7	
$53 \leq W \leq 58$		120 × 60 × 8	
$59 \leq W \leq 65$		140 × 60 × 7	120 × 70 × 7
$66 \leq W \leq 72$		140 × 60 × 8	120 × 80 × 8
$73 \leq W \leq 79$		160 × 60 × 7	
$80 \leq W \leq 88$		180 × 60 × 8	
$89 \leq W \leq 93$	160 × 70 × 7	180 × 60 × 7	140 × 80 × 8
$94 \leq W \leq 104$		180 × 60 × 8	
$105 \leq W \leq 122$	200 × 80 × 6	200 × 60 × 8	180 × 70 × 7
$123 \leq W \leq 126$		220 × 60 × 7	
$127 \leq W \leq 141$		220 × 60 × 8	
$142 \leq W \leq 160$	200 × 80 × 8	240 × 60 × 8	
$161 \leq W \leq 178$	220 × 80 × 8	240 × 70 × 8	
$179 \leq W \leq 201$	250 × 80 × 7	260 × 70 × 8	
$202 \leq W \leq 220$	250 × 80 × 8	260 × 80 × 8	
$221 \leq W \leq 224$	220 × 80 × 8	280 × 70 × 8	
$225 \leq W \leq 245$	250 × 100 × 8	280 × 80 × 8	
$246 \leq W \leq 286$	280 × 100 × 8		
$290 \leq W \leq 316$	300 × 80 × 8		
$316 \leq W \leq 380$	340 × 100 × 8		
440	380 × 100 × 8		
480	400 × 100 × 8		

While the form of resistance represents a decisive value for the stress of the material, the moment of inertia is important mainly for the flexural hardness and for the quota of the bending moment to be taken, depending on the connection used.

Counter-chassis dimension

In case of elastic connection between chassis and counter-chassis the bending moment M_f must be subdivided proportionately between chassis and counter-chassis at the moments of inertia of the sections:

$$\begin{aligned}
 M_f &= M_c + M_t \\
 \frac{M_c}{M_t} &= \frac{I_c}{I_t} \\
 M_c &= M_f \cdot \frac{I_c}{I_t + I_c} \\
 M_t &= M_f \cdot \frac{I_t}{I_t + I_c} \\
 \sigma_c &= \frac{M_c}{W_c} \leq \sigma_{amm} \\
 \sigma_t &= \frac{M_t}{W_t} \leq \sigma_{amm}
 \end{aligned}$$

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Figure 1

M_f = static bending moment generated by the superstructure [Nmm]

M_c = proportional share of the static bending moment M_f applied to the counter-chassis [Nmm]

M_t = proportional share of the static bending moment M_f applied to the chassis [Nmm]

I_c = moment of inertia of the section of the counter-chassis [mm⁴]

I_t = moment of inertia of the section of the chassis [mm⁴]

σ_c = maximum static stress applied to the counter-chassis [N/mm²]

σ_t = maximum static stress applied to the chassis [N/mm²]

W_c = resistance module of the section of the counter-chassis [mm³]

W_t = resistance module of the section of the chassis [mm³]

σ_{amm} = maximum static stress allowed on chassis [N/mm²] see chapter 2.1, Paragraph "Stresses on the chassis" (► Page 8)

Aluminium counter chassis

When using materials with different characteristics from those of steel (e.g. aluminium), the size and structure of the counter chassis must be appropriately adjusted.

1. When the contribution of the counter chassis is mainly that of providing a uniform distribution of load and the chassis has the fundamental task of resistance, aluminium longitudinal profiles having dimensions similar to those indicated for the steel can be used. Typical examples are fixed bodies, vans and tanks, provided that the supports are continuous and close-up or in the immediate vicinity of the suspension mounts. An exception is made in cases where high stresses on the chassis require relatively large sections of the steel reinforcement, cut-resistant links.
2. When the counter chassis is prompted to make a contribution in terms of strength and hardness (e.g. superstructures with high concentrated loads, tipping bodies, cranes, centre axle trailers, etc.), the use of aluminium is generally not recommended and should be authorised from time to time by IVECO.

Please note that in defining the minimum size of the reinforcement profiles in addition to the limit of the allowable stress for aluminium, reference must be made to the different Elastic Modulus with respect to steel (approx. 7,000 kg/mm² against 21,000 kg/mm² for steel) which involves greater dimensioning of the profiles.

Similarly, when the connection between the chassis and counter chassis is such as to ensure the transmission of the shear stresses (connection with plates), in checking the stresses at the two ends of the individual section, it is necessary to define the new neutral axis for this, on the basis of the different elastic modulus of two materials.

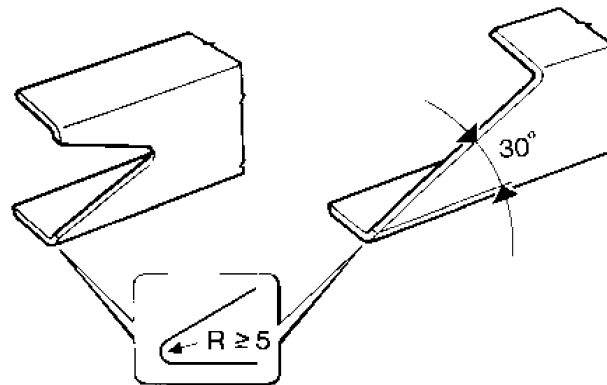
The collaboration requirement for aluminium means, in short, large and not very convenient dimensions.

3.2 ELEMENTS MAKING UP THE COUNTER CHASSIS

Longitudinal profiles

The side members of the added structure must be continuous, extended as much as possible toward the front of the vehicle and towards the rear area of the front spring support; in addition, they must rest on the chassis and not on the brackets.

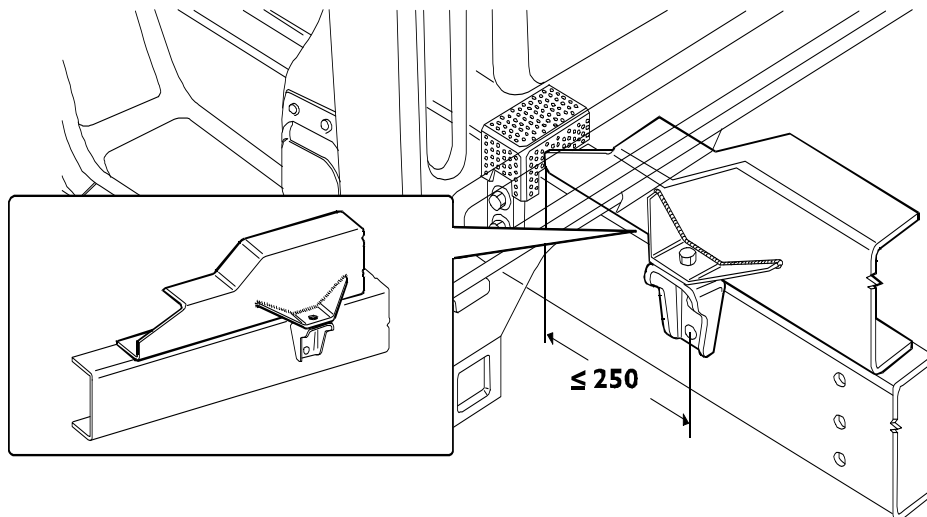
In order to achieve a gradual reduction of the resistant section, the front ends of the profile must be tapered in height with an angle not exceeding 30° , or another form of equivalent tapering (see Figure 2); the front end in contact with the chassis must be properly coupled, with min. radius of 5 mm.



91136

Figure 2

In cases in which the components of the cab rear suspension (e.g. deep cabs) do not allow the passage of the profile in the entire section, this can be realised as in Figure 3. This may require verification of the minimum section of resistance in the presence of high front bending moments (e.g. with a crane behind the cab when operating towards the front of the vehicle) and requires fixing if possible at no more than 250 mm from the front end of the sub-chassis.

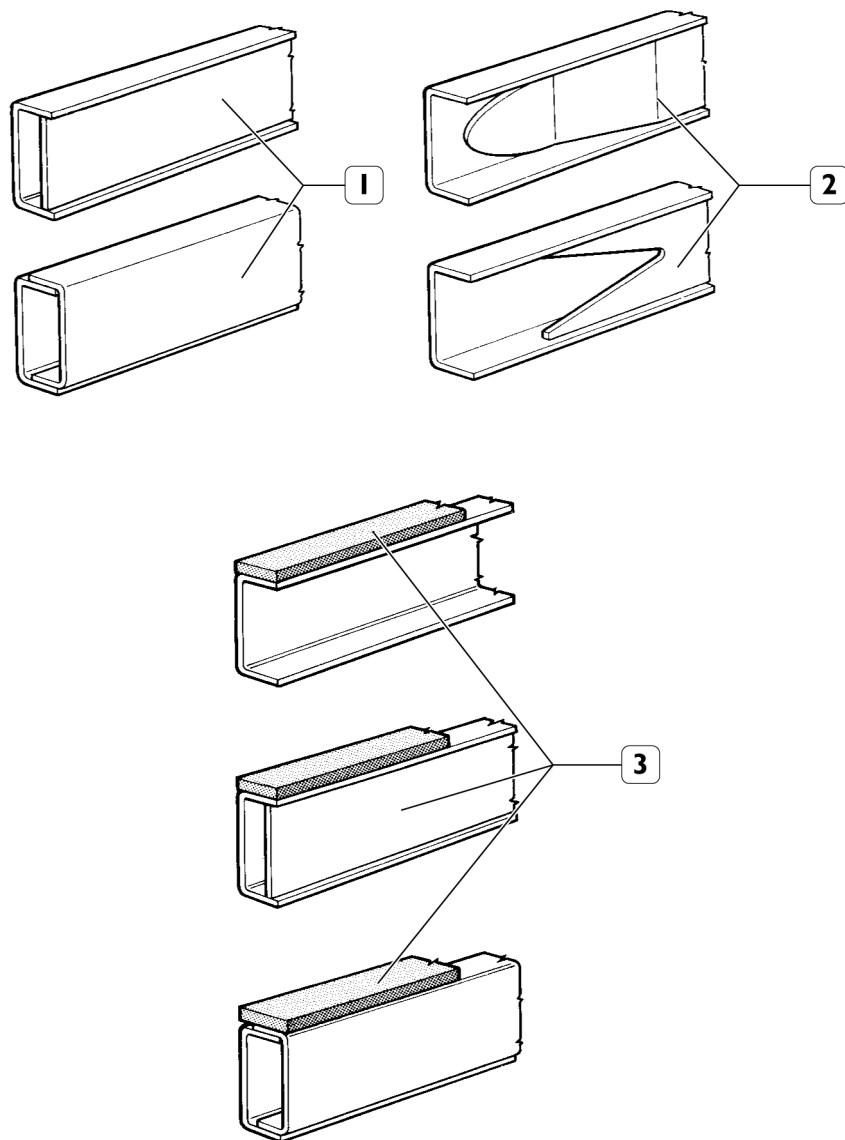


102455

Figure 3

The shape of the profile section is defined taking into account the function of the counter chassis and the type of overlying structure. Open C profiles are advisable when the counter chassis needs to adapt elastically to the vehicle chassis and boxed sections when you require greater stiffness of the assembly.

Care should be taken to achieve a gradual transition from the boxed section to the open section, as in the examples in Figure 4.



193867

Figure 4

1. Normal boxed profiles
2. Gradual passage from the boxed section to the open section

3. 15 mm lintel (width of the wing of the profile)

It is necessary to create continuity of support between the profiles of the counter chassis and those of the chassis; if this is not obtained, the continuity can be restored by means of interposition of strips of sheet metal or light alloy.

If there is to be a rubber undercrawl element we recommend characteristics and thicknesses similar to those used for normal production (hardness 80 Shore, max thickness 3 mm). Its use can prevent abrasive actions that can cause corrosion in the joining between materials of different composition (e.g. aluminium and steel).

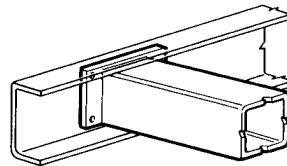
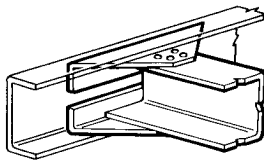
The sizing prescribed for the side members of the various types of superstructures are the recommended minimum values and, as a rule, are valid for vehicles with wheelbases and rear overhangs provided as standard (see Tables from 3.4 to 3.11). In all cases similar profiles can be used, but with moments of inertia and resistance that are not lower. These values can be obtained from the technical documentation of the profile manufacturers.

Cross members

A sufficient number of crossbars, possibly to be placed in correspondence with the fastening clamps to the chassis, must brace the two sections of the counter chassis.

The crossbars may be open section (e.g. C), or closed section where you would want to impart greater stiffness.

In their connection, suitable gusset plates must be used to give adequate resistance to the connection (see the following Figure on the left). When you want to achieve greater stiffness in the connection, it can be carried out according to the following Figure on the right.



193868

Figure 5

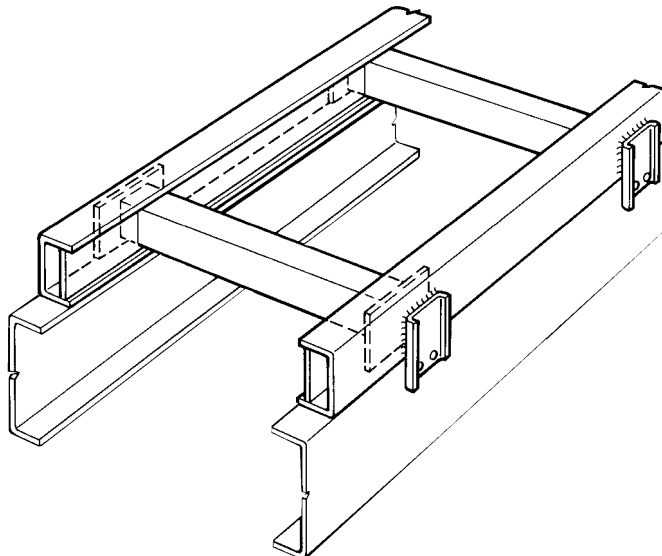
Stiffening of the counter chassis

For some superstructures (e.g. tipping bodies, concrete mixers, cranes on rear overhang, superstructures with high centre of gravity), the counter chassis should be stiff in the back.

This can be achieved by increasing the scope of stiffness to obtain:

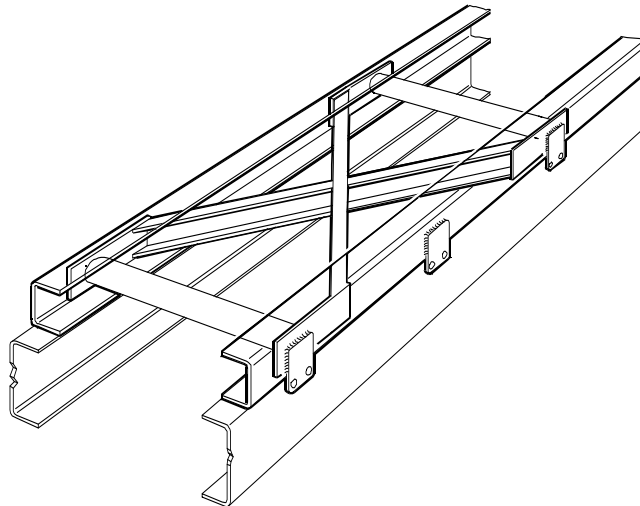
- boxing the longitudinal sections in the rear area;
- adopting closed section crossbars (see Figure 6);
- applying cross diagonals (see Figure 7);

In general the use of boxed longitudinal sections should be avoided in the front part of the counter chassis.



166684

Figure 6



166685

Figure 7

Self-supporting superstructures with counter chassis functions

The interposition of a counter chassis (longitudinal and transverse) can be omitted in the case of installation of self-supporting superstructures (e.g. vans, tanks), or when the underlying structure of the equipment to be installed already has the counter chassis conformation.

3.3 CONNECTION BETWEEN CHASSIS AND COUNTER CHASSIS

Choosing the type of connection

The choice of the type of connection to be used, if not provided by IVECO originally, is very important for the purposes of contribution of the counter chassis in terms of strength and stiffness.

It can be elastic (brackets or clamps) or rigid, resistant to shear stress (plates sealed longitudinally and transversally); the choice must be made according to the type of superstructure to be applied (see Chapters 3.4 to 3.14), evaluating the stresses that the added equipment transmits to the chassis, both in static and dynamic conditions. Number, size and construction of the anchors, reasonably allocated in the length of the counter chassis, must be such as to ensure a good connection between the chassis and the counter chassis.

The screws and the clamps must have material strength class of not less than 8.8, and the nuts must be fitted with systems that prevent unscrewing. The first anchor should be positioned, if possible, at a distance of about 250÷350 mm from the front end of the counter chassis.

The elements for the original connection already existing on the vehicle chassis must be preferred.

The respect of the distance indicated above for the first anchoring must be ensured especially in the presence of superstructures with concentrated loads behind the cab (e.g. crane, front body tilting cylinder, etc.), in order to improve the magnitude of the chassis stresses and contribute more to the stability. Provide additional connections if necessary.

If you have to install a superstructure with features different from those for which the chassis was designed (e.g. a tipping body on a chassis built for a fixed body) suitable connections must be provided (e.g. replacement of brackets with shear resistant plates in the rear area of the chassis).



- ▶ **In anchoring the structure to the chassis, welding must not be performed on the vehicle chassis, nor may holes be put into its wings.**

In order to improve the longitudinal and transverse containment of the connection, drilling is permitted on the wings of the side members but only at the rear end of the side members, in a section which is no longer than 150 mm and without weakening the anchoring of any cross members (see Figure 12).

Alternatively, use the connection in Figure 11, using the screws that connect the rear crossbar to the frame.



► **In all other cases, it is absolutely forbidden to put holes in the wings.**

Connection characteristics

Elastic connections (see Figures 8, 9 and 10) allow limited movement between the chassis and the counter chassis; These connections make it possible to consider parallel cooperation of the two resistant sections, where each assumes a share of the bending moment proportional to its moment of inertia.

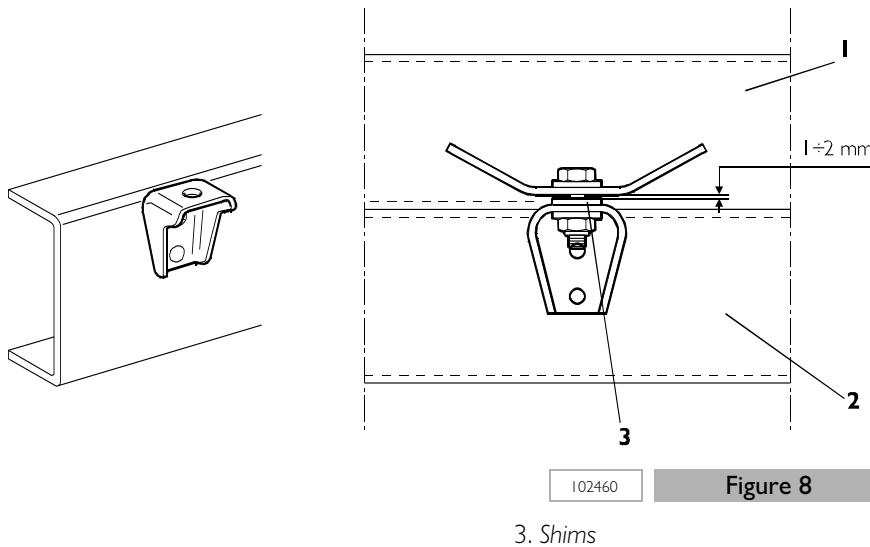
In the rigid connections (see Figure 11), a single resistant section can be considered for the two profiles, on the condition that the number and distribution of the connections are such as to withstand the consequent cutting forces.

The possibility of establishing a single resistant section between the chassis and the counter chassis allows you to achieve greater resistant capacity compared to the connections with brackets or clamps, obtaining the following benefits:

- lower height of the counter chassis profile to equal bending moment acting on the section;
- greater bending moment allowed, equal to the dimensions of the counter chassis profile,
- further increase in the resistance capacity if materials with high mechanical properties are adopted for the counter chassis.

Connection with brackets

Some examples of this type of connection are shown in Figures 8 and 9.



For the elasticity of the connection it is necessary that, before the closure of the clamping screws the distance between the brackets of the chassis and the counter chassis is 1 ± 2 mm; greater distances should be reduced by means of suitable spacers. At the closure of the screws, brackets must be brought into contact.

The adoption of screws of a suitable length promotes the elasticity of the connection.

The brackets must be fixed to the rib of the side members of the vehicle by means of screws or nails.

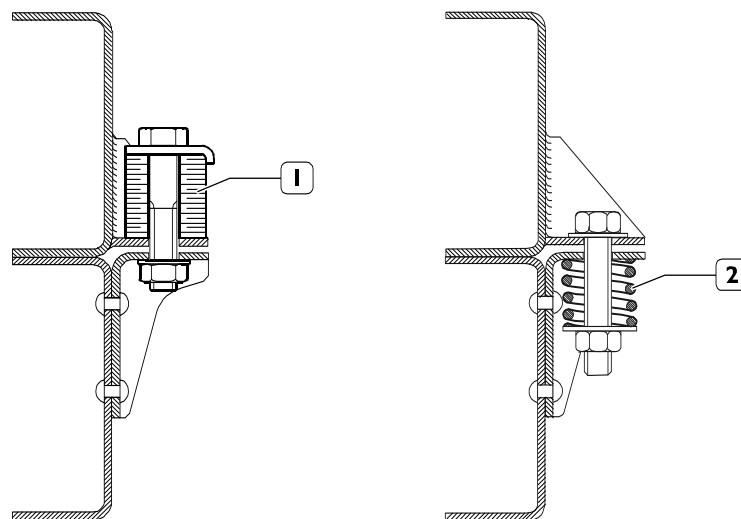
In order to better contain the loads in the transverse direction, the brackets are normally applied so that there is a slight protrusion perpendicular to the upper edge of the chassis. If instead the brackets must be applied exactly to the wire, the side guide for the superstructure must be assured with other devices (e.g. using guide plates connected only to the counter chassis, or only to the

vehicle chassis, see. Figure 11). When the front connection is elastic (see Figure 9), the lateral containment must be assured even in conditions of maximum torsion of the chassis (e.g. off-road applications).

In the event in which the vehicle chassis is already equipped with brackets for the attachment of a body of a type established by IVECO, these brackets must be used for this purpose. For the brackets applied to the counter chassis or to the superstructure, resistance characteristics not less than those originally mounted on the vehicle should be provided (see Table 2.7 and Table 3.1).

Connections with greater elasticity

When the connection needs greater flexibility (e.g. vehicles with high stiffness of the superstructure such as vans, tanks, etc., used on winding roads or in poor conditions, vehicles for special use, etc.), hardware similar to the type indicated in Figure 9 should be adopted in the area behind the driver's cab. Brackets accompanied by rubber plugs (1) or coil springs (2) should be used.



193872a

Figure 9

1. Rubber block

2. Coil spring

Bear closely in mind that:

- the elastic element characteristics should be suited to the stiffness of the superstructure, the wheelbase and the type vehicle use (irregular road conditions);
- stiffness must progressively increase for fixing points closer to the rear part of the chassis;
- the overall connection capacity must also include fixing points resistant to shear stress to be positioned near the rear suspension.

Consequently, the first fixing behind the cab must be made using one of the solutions shown in Figure 9; especially when the vehicle has a long wheelbase, this solution must also be replicated for the next fixing, modifying only the stiffness.

For example, in the case of brackets with rubber pads, elements must be used having the same hardness ($sh = 83$), assembled in dual pairs for the first bracket and single pairs for the next bracket, with M10 screws and tightening torques of $di\ 15-18\ Nm$.

Also bear in mind that:

- for rubber plugs, use materials that ensure good elasticity over time.
- every solution requires the preparation of appropriate instructions for interval controls and possible resetting of the tightening torques of parts.
- In versions where the vehicle is lifted by hydraulic stabilisers (e.g. cranes, aerial work platforms), limit the collapse of the elastic element to ensure sufficient cooperation of the counter chassis and avoid excessive bending moments on the original chassis.

Also bear in mind that:

1. in the case of superstructures that generate high bending and twisting moments (e.g. a crane behind the cab), the counter chassis must be properly sized to support them;
2. In versions where the vehicle is lifted by hydraulic stabilisers (e.g. cranes, overhead work platforms), limit the collapse of the elastic element to ensure sufficient cooperation of the counter chassis and avoid excessive bending moments on the original chassis.

Connections with clevis fasteners or clamps

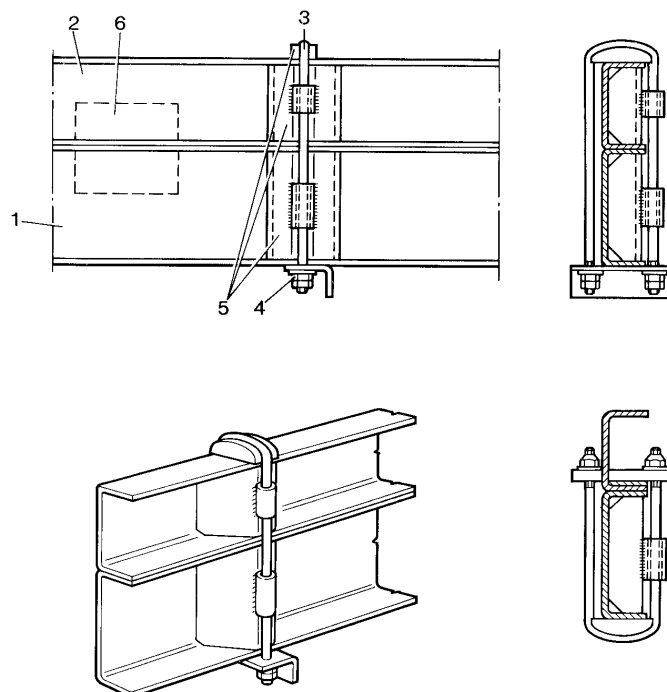
Figure 10 shows the main constructions of this type.

In this case the Body builder must interpose a spacer (preferably metal) between the wings of the two side members and in correspondence to the clevis fasteners, in order to avoid the bending of the wings under the pull of the clevis fasteners.

In order to drive and better contain the transverse direction of the structure added to the chassis, this type of fixing can be completed with the addition of plates welded to the counter chassis as shown in Figure 11.

The characteristics of this connection advise against a general integral use on the vehicle; in any case, to give the added structure the suitable containment in the longitudinal direction as well as adequate stiffness, it is necessary to integrate the fastening to the rear part with longitudinal and transverse sealing plates.

For this purpose, it is also possible to use connections by means of screws at the rear end of the chassis as shown in Figure 12.



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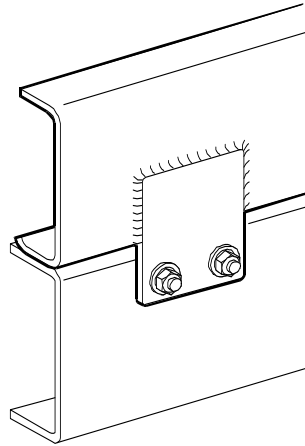
Figure 10

1. Chassis
2. Counter chassis
3. Clevis fasteners

4. Closure with anti-unscrewing system
5. Spacers
6. Guide plates (if necessary)

Connection with longitudinal and transverse sealing plates (rigid junction)

The type of mounting shown in Figure 11, made with plates that are welded or bolted to the counter chassis and fixed with nails or screws to the vehicle chassis, ensures a good capacity for reacting to longitudinal and transverse thrusts and the greatest contribution to the stiffness of the assembly.



102462

Figure 11

For the correct use of these plates, please keep in mind that:

- the vertical rib of the chassis should be fastened only after making sure that the counter chassis is snug against the chassis itself;
- the distribution must be limited to the central and rear area of the chassis;
- the number and the thickness of the plates and the number of fixing screws must be adequate to withstand the bending moments and cutting of the section.

In cases where the superstructure generates high bending and twisting moments on the chassis and its resistant capacity should be increased by adopting a cut-resistant connection between the chassis and the counter chassis, or if you want to contain the height of the counter chassis as much as possible (e.g. centre axle trailers, crane on rear overhang, tail lifts, etc.), use the information supplied in the table below (valid for all models):

Table 3.3

Chassis and counter chassis height/section ratio	Max. distance between the centre lines of the cut-resistant plates [mm] ⁽¹⁾	Models ⁽³⁾	Minimum characteristics of the plates	
			Thickness [mm]	Dimensions of the screws ⁽²⁾ (min. 3 screws per plate)
> 1,0	700	35C, 40C	4	M 12 (min.2 screws per plate)
≤ 1,0	500	45C, 50C	4	M 12 (3 screws per plate)
≤ 1,0	500	60C, 65C, 70C	5	M 12 (3 screws per plate)

⁽¹⁾ The increase in the number of screws for each plate makes it possible to proportionally increase the distance between the plates (a double number of screws may allow a greater distance between the plates). In high stress areas (e.g. the rear spring supports, the tandem axle springs and the air springs), it is necessary to provide a distance between the plates, reduced as much as possible.

⁽²⁾ In the presence of contained thicknesses of the plates of the chassis and the counter chassis, it is advisable to connect by adopting spacer bushes, in order to use longer screws.

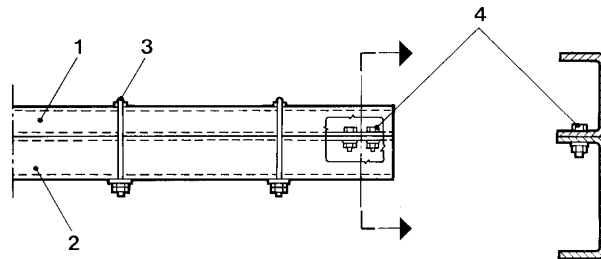
⁽³⁾ For models 33S and 35S, the application of plates resistant to shear stress must be evaluated on an individual basis.

Mixed connection

Based on the indications in Chapter 3.1 (► Page 5) for realisation of the counter chassis and the considerations of Chapter 3.3 (► Page 11), the connection between the vehicle chassis and the reinforcing counter chassis may be of mixed type, i.e. obtained by rationally using the elastic connections (brackets, clevis fasteners) and rigid connections (longitudinal and transverse sealing plates).

Generally, it is preferable to have elastic connections in the front part of the counter chassis (one or two per side), while connections are recommended with plates toward the rear of the vehicle when the added structure requires a greater contribution to the overall stiffness (e.g. tippers, cranes on rear overhang, etc.).

For this purpose, it is also possible to use connections by means of screws at the rear end of the chassis as shown in Figure 12.



193874

Figure 12

1. Counter chassis
2. Chassis

3. Clevis fasteners
4. Hardware for longitudinal and transverse containment

3.4 CONTAINER APPLICATION**Dimensions and centres of gravity**

Check the correct load distribution and in particular, respect the indications regarding the height of the centre of gravity as provided in Section I using suitable construction precautions and ensure that the transported load has maximum stability while running.

Fixed bodies

The application on normal cab vehicles, valid only for road services, is normally made through a support structure consisting of longitudinal and transverse profiles. The minimum Approximate sizes of the longitudinal sections are shown in Table 3.4.

Table 3.4

Models	Minimum reinforcing profile	
	Wheelbase [mm]	Modulus of resistance W_x [cm ³]
33S, 35S	up to 3750	9
	4100	16
35C, 40C, 45C, 50C	All	16
60C, 65C, 70C	Up to 3750	21
	and 3750	26

Note For the dimensions of the profiles see Table 3.2.

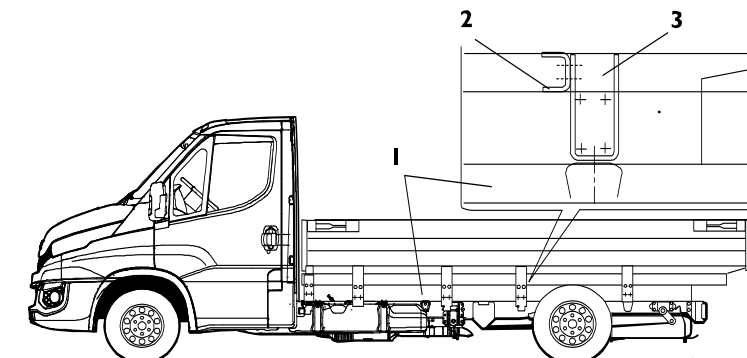
Fastening is achieved through specially crafted brackets along the vertical rib of the side members; if such connections have not already been specified by IVECO, they must be made according to the instructions in Chapter 3.3 - Paragraph "Connection with brackets" (► Page 12). To achieve adequate longitudinal containment, in the case of connections with brackets or clamps it is good

practice to provide a rigid connection on the end of the rear overhang (one per side), obtained with screws or plates on the upper wing of the side member (see Figures 11 and 12).

In no other case should new holes be made on the wings of the main side members.

In cases in which the body uses elevated supports above the counter chassis (e.g. crossbars), it is necessary to suitably stiffen such supports, to contain the longitudinal thrusts, as shown in Figure 13.

The front wall of the bodywork must have the necessary strength and toughness to support the forces generated by the transported load, in the case of sudden and high decelerations.



208205

Figure 13

- 1. Counter chassis
- 2. Brackets

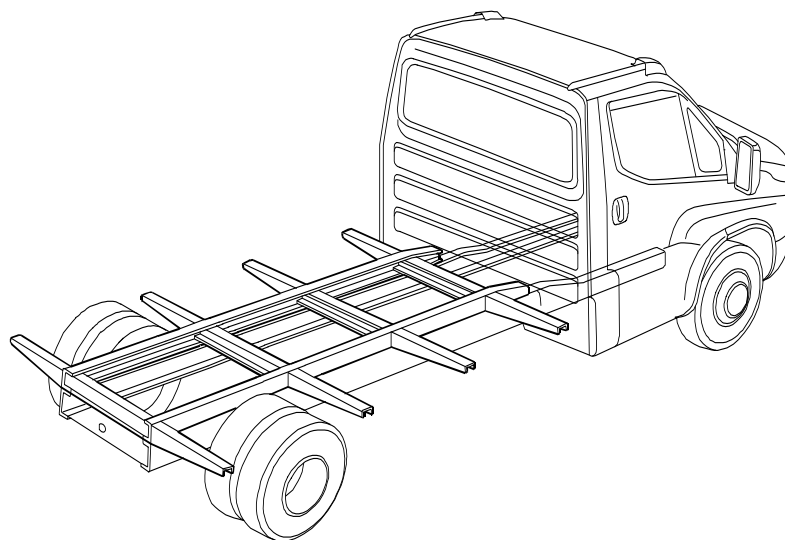
- 3. Cross members

Implementing van versions

A structure consisting of box section longitudinal and cross members may be used for connection to the chassis of the vehicle. For the longitudinal profiles, refer to the indications in Table 3.4.

Figure 14 shows an example installation where, in order to contain the height of the superstructure, the longitudinal profiles are integrated with cross members and brackets over the entire length.

In this case, the rear wheel arches may be inserted into the base of the structure.

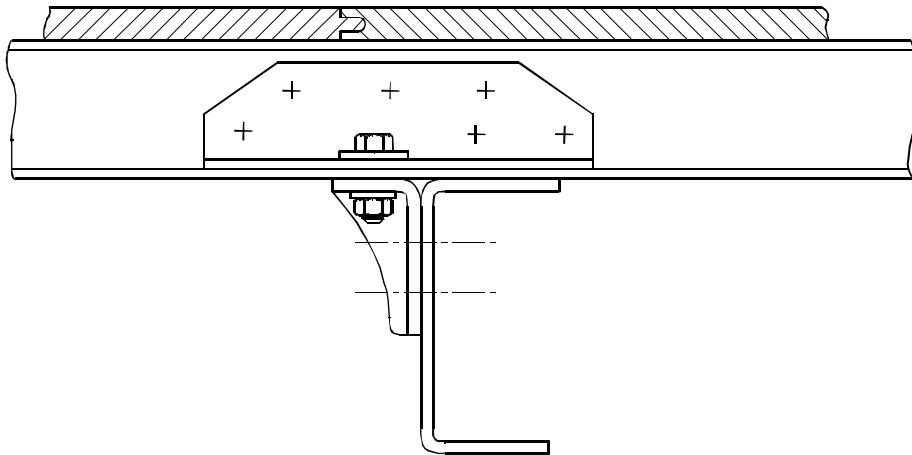


208206

Figure 14

When the floor makes use of cross beams which are no more than 700 mm apart and connected in such a way as to create a sufficiently rigid structure (self-supporting), it may not be necessary to use longitudinal profiles (see Figure 15).

To ensure the stability required for the cross members and avoid stiffening the front part of the vehicle chassis excessively, consider the indications given in the previous paragraph .



102466

Figure 15

The mounting of dump bodies and structures having high torsional rigidity in general requires the use of flexible couplings towards the front part of the structure to avoid excessive reduction of the deformation characteristics of the main chassis.

Front wall

It must have the necessary strength and toughness to withstand the forces generated by the transported load, in the case of sudden and high decelerations.

Vans integrated with the cab

The coupling in these cases must be implemented so as to limit the stress transmitted to the vehicle cab.

For couplings and fitting reinforcements, bear in mind that:

- no welding should be performed on the sheet metal of the cab and only mechanical fixture systems should be used;
- the self-supporting structure of the van must not require additional support provided by the cab;
- the parts of the cab affected by the conversion must be protected against oxidation and corrosion (see Chapter 2.2 (► Page 8)).

Tipper bodies

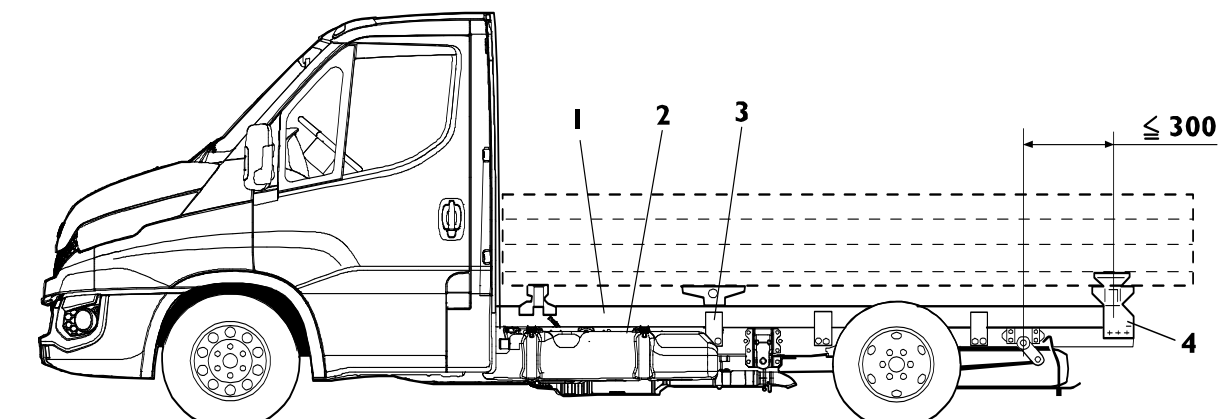
The use of tipper bodies, rear and three sided, generally subjects the chassis to considerable stress.

Therefore, please observe the following indications.

1. The use of a stabiliser bar on all IVECO models for which it is an optional, is recommended.
2. The counter chassis must be:
 - suitable for the type of vehicle and conditions of use,
 - with appropriately sized cross members and side members,
 - with the rear end stiffened with boxing and crossbraces (see Figure 6 and Figure 7). The connections to the chassis must be flexible (brackets or supports) at the front end, whereas the rear section requires stiff connections (cleat plates) (see Figure 11) to allow the added structure to contribute more to the stiffness of the assembly. Omega shelves can be used on vehicles on where these are originally fitted.

3. The rear tipping hinge must be fitted on the counter chassis; its position must be as near as possible to the rear support of the rear suspension. In order not to affect the stability of the vehicle during tipping and to not excessively increase the stress on the chassis, it must be respected the distances indicated in Figure 16. If for technical reasons this cannot be achieved, small increases may be permitted provided a higher strength counter chassis is used, in order to increase the rigidity of the rear end. Where long bodies are needed to transport large volumes, it is advisable to lengthen the wheelbase of the vehicle.
4. Great care must be given to the positioning of the lifting device both in terms of providing support of adequate strength and in order to correctly position the mountings. In any case, it is advisable to place the ram to the front of the centre of gravity of the body and payload so as to reduce the extent of the localized load.
5. In rear tipping it is recommended that a stabiliser is fitted to guide the container, particularly when the lifting cylinder is located behind the cab.
6. The lifting device hinge must be mounted on the counter chassis. The useful volume in the body must conform with the maximum permissible load on the axles, to the density of the material to be transported (a density mass of approximately 1 600 kg/m³ is to be used for excavated material). In the case of transporting freight with a low density, the useful volume may be increased within the limits established for the maximum height of the centre of gravity of the payload (plus the fixtures).
7. The Body builder must ensure the functioning and safety of all parts of the vehicle (e.g. the positioning of lights, towing hook etc.) and ensure that, following the addition of the structure, vehicle stability is guaranteed during tipping operations.

Note To ensure stability on vehicles with air suspension it is required to deflate the air bellows completely.



208207

Figure 16

1. Counter chassis
2. Brackets

3. Plates
4. Retainer with hinge

Table 3.5

Models	Minimum reinforcing profile	
	Modulus of resistance W_x (cm ³)	Dimensions (mm)
35C, 40C	19	80x50x5
45C, 50C, 60C, 65C, 70C	36	100x60x6

Note For the dimensions of the profiles see Table 3.2.

3.5 TRACTOR FOR SEMI-TRAILER

Note *The range does not include vehicles designed to tow trailers. To carry out conversion of a cab vehicle (in category N2 or N3), a specific IVECO authorisation is required.*

This authorisation provides the indications that the body builder must observe, the masses allowed and provisions on use. Below are some general indications.

Fifth wheel supporting structure

The application of a suitable secondary chassis structure (see Figure 17) in addition to distributing the load on the fifth wheel, provides a suitable torsional and bending contribution for the vehicle. The minimum sizes of the longitudinal sections are shown in Table 3.6.

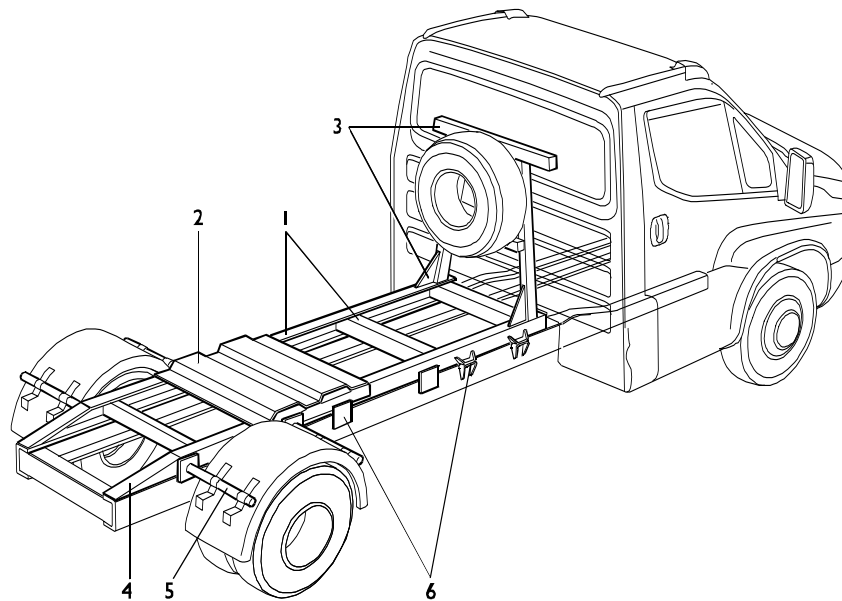
To implement this, it should also be noted that:

- the structure must be suitably dimensioned for vertical and horizontal loads which the fifth wheel transfers;
- the material characteristics of the structure must refer to what is set out in Chapter 3.1 (➡ Page 5).
- the upper and lower surfaces of the structure must be level so as to ensure a good contact on the chassis;
- the structure components, when this is formed by several elements, must be welded and/or nailed to form a single assembly;
- the structure should be fastened to the tractor by means of cleat plates in the middle and back of the chassis and brackets in the front. For fastening, use screws of a minimum class of 8.8 (number and diameter so as to achieve a tightening resistant to longitudinal and transversal forces) and use systems that prevent unscrewing.

Table 3.6

Models	Wheel base (mm)	Minimum reinforcing profile	
		Modulus of resistance W_x (cm ³)	Dimensions (mm)
35C, 50C	3450	24	100x50x4

Note *For the dimensions of the profiles see Table 3.2.*



208924

Figure 17

- 1. Longitudinal and cross members
- 2. Fifth wheel support plate or crankcase
- 3. Rear cab structure, electric and brake joints support, can also be used to support spare wheels

- 4. Tapered rear
- 5. Mudflap support
- 6. Connections to chassis

Fifth wheel

All fifth wheels can be used on IVECO vehicles if their load capacity, size and performance are declared suitable by the manufacturer depending on their specific use.

Fifth wheel couplings must meet national and/or international legal requirements and be of an approved type. For mounting on the support structure and the number of screws, as well as the size and placement of the longitudinal and transversal stops, it is advisable to follow the manufacturer's instructions.



- **The fifth wheel must not be modified in any way since it is of particular importance for vehicle safety.**

Brake system

The body builder has to provide the fulfillment of the specific system for semi-trailer braking.



- **Considering the importance of its effects on the active safety of the vehicle, extreme care must be given to the braking system in both design and implementation. Components, pipes and fittings of the same type as those used on the original vehicles must be used.**

Depending on the total masses realised, the performance of the braking system (service, emergency and parking brake) must comply with national regulations or EC Directives in terms of deceleration, heat behaviour, response times, etc.

Documentation on the grip and compatibility curves should also be available (if not otherwise stated).

On request, IVECO can provide the technical documentation containing the system features and the braking capacity of the original vehicle.

Electric system

Make changes in compliance with the general provisions in Chapter 5.4 .

Note For vehicles equipped with ESP system, it is necessary to perform system degradation as indicated in Chapter 2.15 - Paragraph "Electronic Brake Control Devices ABS ".

Tractor and semi-trailer combination

The semi-trailer must not have construction features (i.e.: excessive chassis flexibility, inadequate braking capacity, etc.) that would have adverse effects on the driving behaviour of the articulated vehicle. All movements must be verified in the tractor and semi-trailer combination in various conditions of use; the necessary safety margins obviously must be ensured in compliance with any legislative or regulatory requirements.

3.6 TRANSPORT OF INSEPARABLE MATERIALS (TRAILER TRUCKS)

Not provided.

3.7 INSTALLATION OF TANKS AND LOOSE MATERIAL CONTAINERS**a) Installation with a counter chassis**

The installation of tanks and containers is carried out, as a rule, using a suitable counter chassis.

The Approximate dimensions of the section to be used for the counter chassis are shown in Table 3.7.

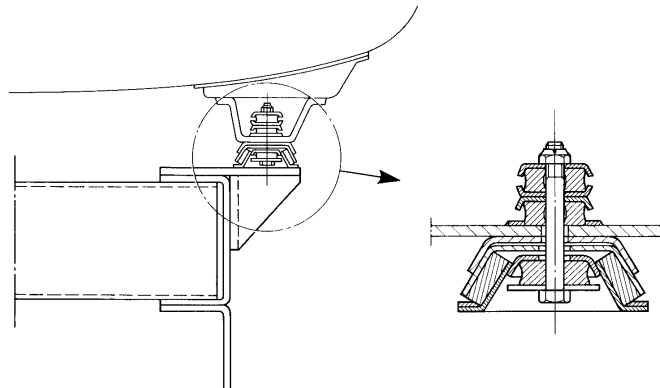
Table 3.7 - Tank installation

Models	Wheelbase [mm]	Minimum reinforcing profile	
		Minimum value of the modulus of resistance of the counter chassis section W_x [cm ³] ⁽¹⁾ with ultimate tensile strength of the material equal to 360 N/mm ²	Dimensions (mm)
35C, 40C, 45C, 50C	All	16	80x50x4
60C, 65C, 70C	up to 3750 and 3750	21	80x60x5
		26	100x50x5

Note For the dimensions of the profiles see Table 3.2.

The assembly of tanks, or stiff torsional structures in general, must ensure sufficient and gradual flexibility of the chassis, in order to avoid high stress areas.

The use of elastic elements (see Figure I 8) on the front end and stiff mounts resistant to longitudinal and transverse forces on the rear end are recommended for connecting the tank to the counter chassis.



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Figure 18

As previously mentioned, the stiff connections positioned in correspondence with the rear suspension mounts are more suitable for transmitting forces directly to the suspension elements; elastic connections are to be arranged near the front suspension rear mount.

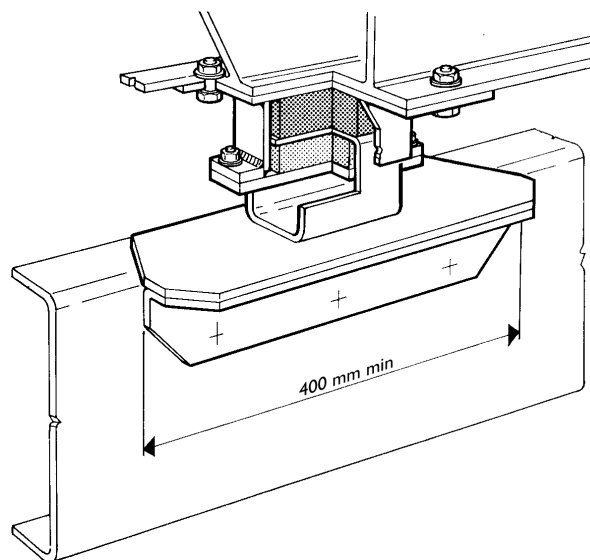
If this is not carried out, use suitably oversized longitudinal reinforcement sections with respect to those shown in Table 3.7.

When defining elastic connections, consider the rigidity of the chassis in the area where the connections are to be applied and the type of functions for which the vehicle is intended.

b) Installation without a counter chassis

The application of tanks directly on the chassis is possible under the following conditions:

- the distance between the various rests must be established according to the load to be transmitted (approximately no more than 800 mm);
 - the rests must be made to uniformly distribute the load on a suitably wide surface (see Figure 18) and with bracing to contain longitudinal and transverse forces;
 - anchoring must be sufficiently extended in width (approximately 400 mm – see Figure 19) and arranged near suspension mounts.
- Specifically, the front anchoring flexibility must be suited to contain the necessary torsional movements of the chassis;
- other anchoring solutions must be authorised by IVECO.



208921

Figure 19

The maximum volume, the degree of filling of the container and the volumetric mass of the transported goods must be defined in observance of the axle weight limits. In the case of tanks and single containers made with separate compartments, the minimum ratio between front axle weight and total fully loaded weight (see Chapter 1.15 (► Page 11)) as well as the maximum axle loads must be observed for all loading conditions.

In consideration of the type of outfit, the use of vehicles equipped with stabilizer bars is recommended and particular attention should be paid to limiting, as far as possible, the height of the overall centre of gravity (see Chapter 1.15 (► Page 11)); use of a vehicle with stabiliser bars is recommended.

In tanks and containers for liquids, transversal and longitudinal partitions are to be used in. In fact, if these are not completely full, the dynamic thrust which the liquid generates while the vehicle is in motion could negatively influence the vehicle's handling and resistance.

Follow the safety laws in force (see Chapter 2.18 (► Page 57)) for containers intended to carry flammable liquids.

3.8 INSTALLING A CRANE

The selection of the crane must be made with due consideration to its characteristics and in relation to the performance of the vehicle.

The positioning of the crane and of the payload must be done within the load limits permitted for the vehicle. Installation of the crane must be carried out in compliance with statutory requirements, national standards (e.g. CUNA, DIN) and international standards (e.g. ISO, CEN) and verifying those required for the vehicle.

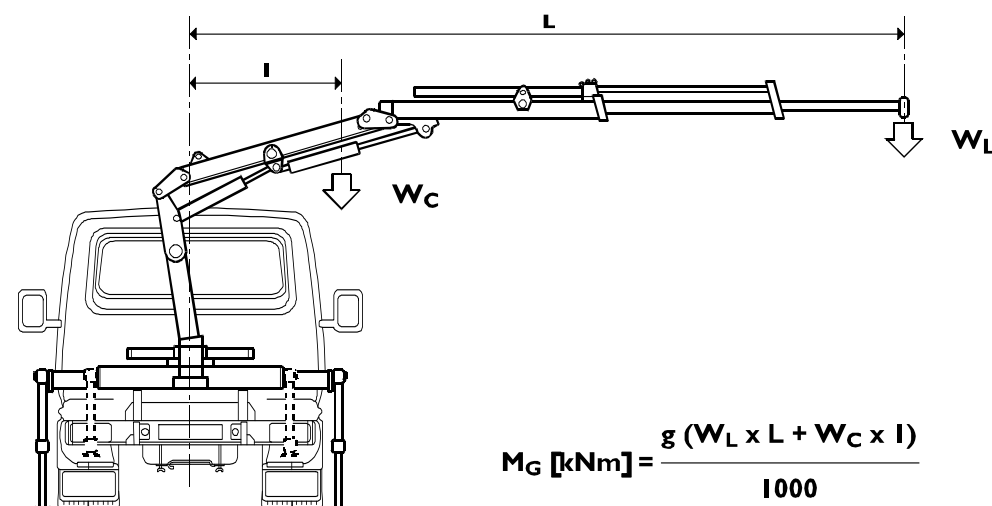
While the crane is operating, the stabilisers (hydraulic if possible) must be used and be in contact with the ground.

As a general rule, the installation of a crane requires the use of a suitable counter chassis, the construction of which must take into account all general specifications (see Chapter 3.1 (► Page 5)), and with the dimensions of the sections given in Tables 3.8, 3.9 and 3.10.

The dimensions of the counter chassis resistance modulus refer to the maximum total static moment of the crane (M_G), deduced from the formula shown in Figure 20.

If the vehicle outfitting requires the use of a section with modulus resistance greater than that required for the crane (e.g. tipper), this section may also be considered for the crane.

Special cases, whose M_G value falls within the areas designated by letter "E" in the mentioned Table (or for higher values) must be checked individually each time and must receive specific authorisation from IVECO.



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Figure 20

g = acceleration of gravity equals 9.81 m/s^2

W_L = mass applied to crane extremity [kg]

L = horizontal distance between the payload application point W_L and vehicle centre line [m]

W_C = mass of the crane at its centre of gravity [kg]

l = horizontal distance between centre of gravity of crane and vehicle centre line [m]



- **The Bodybuilder must, case by case, check the vehicle stability and take all necessary precautions for its correct and safe use. The crane manufacturer and the Bodybuilder are responsible for defining the type and number of stabilisers as well as selecting the counter chassis on the basis of the maximum static moment and the position of the crane.**

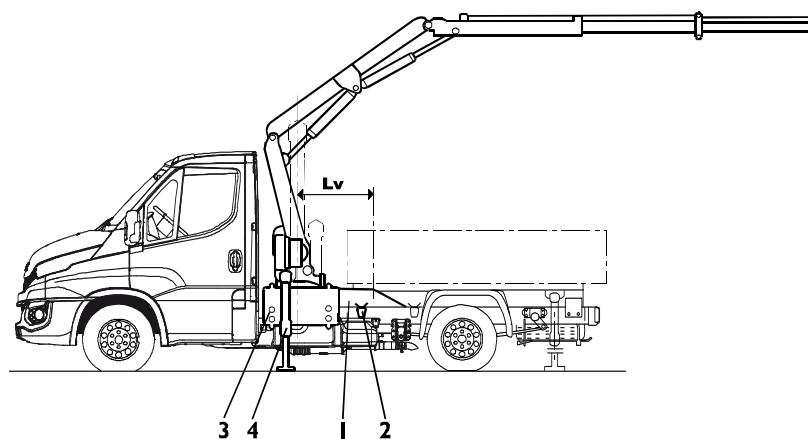
Crane behind cab

The standard shelves should be used for fastening the reinforcement sections to the chassis (see Figure 3.21) integrating, where necessary, other elastic fasteners (shelves or flanges) to maintain the bending and torsional characteristics of the chassis as much as possible. The dimensions of the reinforcement sections to be used for this type of connection are shown in Table 3.8.

On vehicles for road use only, shearing resistant connections may be used for fastening the counter chassis to reduce the counter chassis section height. The minimum reinforcement section dimensions for all these applications are given in Table 3.9.

The implementation of constant diameter sections for the entire length of the vehicle is recommended.

The section of the crane counter chassis (Figure 21) can be integrated towards the rear end with that envisaged for another possible superstructure; the length " L_v " must in no case be less than 35% of the wheelbase if the superstructure section diameter is smaller.



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Figure 21

1. Reinforcing profile
2. Brackets

3. Crane connections
4. Stabilisers

In installations of cranes on vehicles with deep cab (e.g. 6 + 1), the counter chassis must continue to underneath the cab (see Figure 2), otherwise, depending on the capacity of the crane, it will be necessary to limit the crane's range of rotation, so as not to exceed the permissible bending moment from the chassis.

Elastic connections between chassis and counter chassis (see Figure 8) may be needed to avoid excessive constraint on the chassis torsional movement for application of crane on off-road vehicles on the front and middle parts. The crane is practically connected to the counter chassis only, the dimensions of the longitudinal sections must therefore be suited to withstand the moment induced during use.

The container or equipment must normally be retracted to arrange the crane behind the cab. In the specific case of tipping equipment, particular attention must be paid to arranging the mounts of the lifting device and the tipper rear hinges which must be as retracted as possible.

Table 3.8 - Crane behind driver's cab (counter chassis secured with shelves or flanges)

Model	Frame section [mm]	Total torque M_G max [kNm]								
		20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100
		Minimum value of the modulus of resistance of the counter chassis section W_x [cm ³] ⁽¹⁾ with yield point of the material equal to 360 N/mm ²								
35C, 40C	174x70x4	21	36	57	89	E				
45C, 50C	174x70x4	21	36	57	89	105	E			
60C, 65C, 70C	174x69x5	19	21	46	57	89	105	E		

Table 3.9 - Cranes mounted behind driver's cab (counter chassis secured with shear resistant plates)

Model	Frame section [mm]	Total torque M_G max [kNm]								
		20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100
		Minimum value of the modulus of resistance of the counter chassis section W_x [cm ³] ⁽¹⁾ with yield point of the material equal to 360 N/mm ²								
35C, 40C	174x70x4	19	21	31	57	E				
45C, 50C	174x70x4	19	21	31	27	89	E			
60C, 65C, 70C	174x69x5	19	19	21	46	57	89	E		

Close the reinforcement section in the crane assembly area.

E = To be checked case-by-case. Send IVECO technical documentation with verification of stress and stability.

⁽¹⁾ When a higher modulus of resistance is required for the superstructure also use the latter for the crane.

Note For the dimensions of the profiles see Table 3.2.

Crane at rear overhang

The counter chassis should extend for the entire length of the vehicle to the rear part of the cab; The dimensions of the longitudinal sections are shown in Table 3.10.

Considering the particular distribution of weights on the vehicle (load concentrated on overhang) and to ensure the necessary torsional stiffness for good performance on the road and during the working phase of the crane, the counter chassis must be suitably stiffened in relation to the crane capacity. Boxed sections and bracing must be used (see Chapter 3.2 (► Page 8)) in correspondence with the rear suspension and for the entire rear overhang (distance L_v) - see Figure 22. The passage between box section s and open sections must be well fitted as shown in Figure 3.

Shear resistant connections (a sufficient number of plates spaced at a maximum distance of 400 mm) must be used in the box section for fastening to the chassis, given that elastic fastenings are used on the front end. Check that the ratio between the front axle and rear axle weight respects the limit defined for each vehicle under any load condition (see Chapter 1.15 (► Page 11)).

Considering that the necessary counter chassis rigidity depends on various factors (e.g. crane capacity, resting surface dimensioning, vehicle tare weight, chassis overhang), instructions valid for all situations cannot be given. For this reason body builders shall, if necessary, proceed also by testing the vehicle's stability. If the test results show that rigidity is insufficient, the body builder will adopt suitable precautions so as to obtain correct realisation.

The rear crane overhang (distance L_k see Figure 22) must be as limited as possible (not exceeding 40% of the wheelbase) in order to ensure good vehicle handling characteristics and acceptable levels of chassis stress.

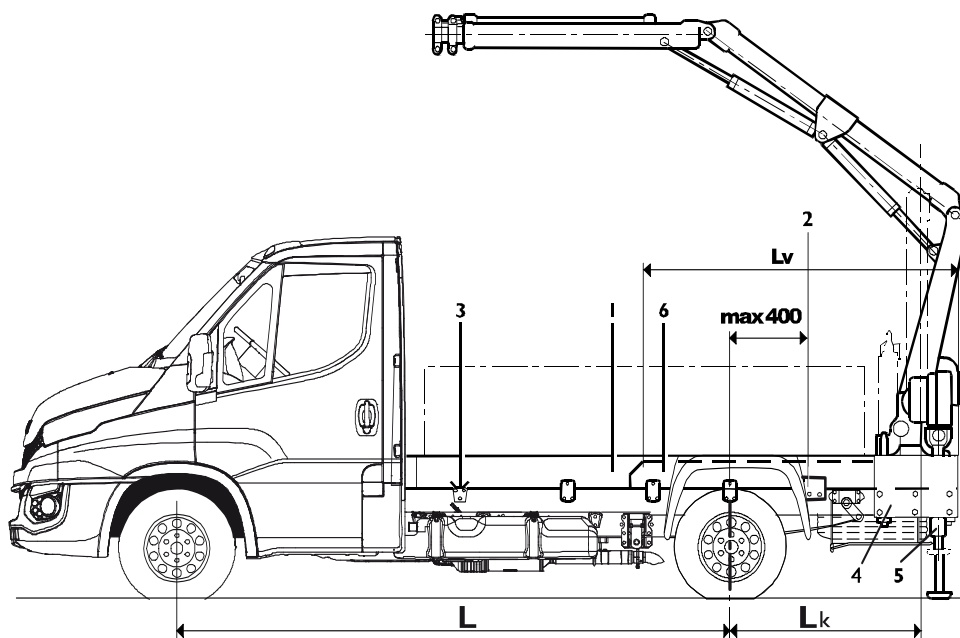
Table 3.10 - Crane at rear overhang (counter chassis secured with shear resistant plates)

Model	Frame section [mm]	Total torque M_G max [kNm]								
		20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100
		Minimum value of the modulus of resistance of the counter chassis section W_x [cm ³] ⁽¹⁾ with yield point of the material equal to 360 N/mm ²								
35C, 40C	114x70x4	32	57	71	E					
45C, 50C	114x70x4	32	57	71	110	E				
60C, 65C, 70C	174x69x5	23	23	32	42	71	E			

E = To be checked case-by-case. Send IVECO technical documentation with verification of stress and stability.

⁽¹⁾ When a higher modulus of resistance is required for the superstructure also use the latter for the crane.

Note For the dimensions of the profiles see Table 3.2.



208923

Figure 22

1. Counter chassis on the entire body length
2. Plates
3. Brackets

4. Crane connections
5. Stabilisers
6. Connecting corner

Removable cranes

The installation of removable cranes on the rear overhang may be carried out according to the specifications of the previous paragraph provided the type of fixing used between the crane and the counter chassis does not cause additional stress to the vehicle's frame.

Since the vehicle may be used with or without the crane (where permitted), it is recommended that the position of the payload is marked on the superstructure.

If the vehicle retains its ability to tow a trailer, all regulations concerning the proper coupling of the vehicle must be observed.

3.9 INSTALLATION OF TAIL LIFTS

Note The installation of tail lifts must be carried out with due regard for the maximum permissible weights on the rear axles of the vehicle and of the minimum load established for the front axle (see Chapter 1.15 (► Page 47)). If this is not possible, the rear overhang will have to be reduced.

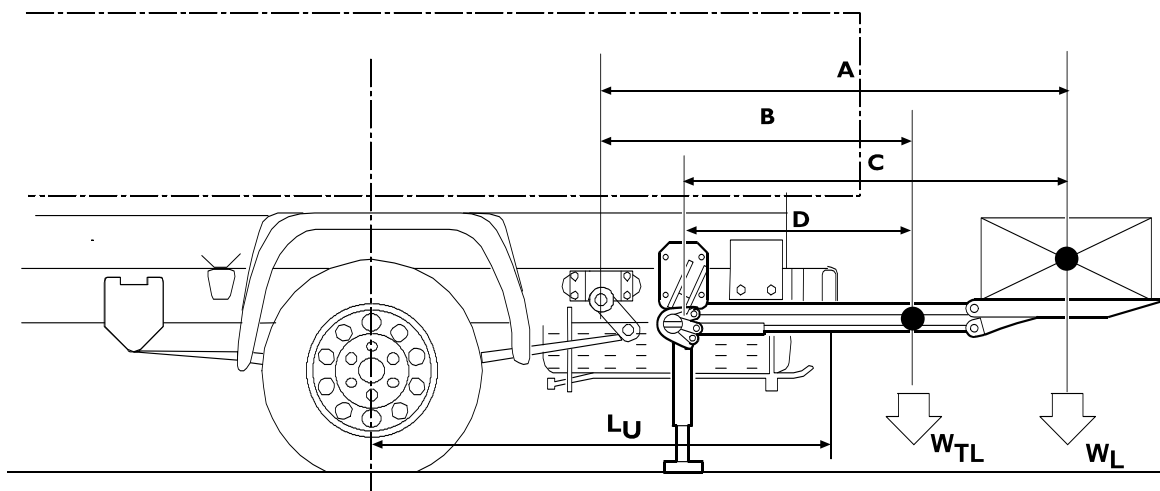
The tail lift must be fastened with a structure that ensures appropriate weight distribution, especially in the case of specific outfits with no adequate counter chassis (e.g. box truck bodies, pick-up bodies with cross-members).

The dimensions of the sections to be used can be defined:

- using Table 3.11, in the case of standard rear overhangs and with mean bending moments induced by tail lifts, as a function of their capacity. The table also indicates the capacity values above which suitable stabilisers are to be used;
- using the specifications in Figure 23 in the case of other overhangs and/or with specific tail lifts (e.g. aluminium tail lift).

In the first case the bending moments on the chassis, depending on the capacity of the tail lifts, have average values which are already defined; in the second case, these moments must be calculated from time to time.

Procedure for calculating the chassis bending moment during loading of tail lift



166690

Figure 23

W_{TL} = Weight of tail lift

W_L = Tail lift capacity

The bending moment on the chassis may be obtained using the following ratio:

$$M [Nm] = W_L \cdot A + W_{TL} \cdot B \quad \text{for tail lifts without stabilisers}$$

$M [Nm] = W_L \cdot C + W_{TL} \cdot D$ for tail lifts with stabilisers

To compensate for frame flexing, which is inevitable when the tail lift is in operation, the body builder may use reinforcement structures with larger dimensions than those indicated in Table 3.11.

This consideration applies even more in the case of high and non-standard overhangs; in this case the necessity to adopt the stabilisers must also be verified.

Table 3.11 - Installation of tail lifts

Models	Overhang [mm]	Tail lift capacity in kN (kg)					
		3 (300)	5 (500)	7.5 (750)	10 (1000)	12.5 (1250)	15 (1500)
		Minimum value of the modulus of resistance of the counter chassis section W_x [cm ³] ⁽¹⁾ with yield point of the material equal to 360 N/mm ²					
33S, 35S	–	E	E	E			
35C, 40C 45C, 50C	1240 - 1355	16	21	26 + S	31 + S	E	
35C, 40C 45C, 50C	1655 - 1715	21	21 + S	26 + S	31 + S	E	
45C, 50C	1885 - 2350	26	26 + S	31 + S	36 + S	E	
60C, 65C, 70C	1355 - 1655	21	21	26 + S	26 + S	31 + S	E
	1885 - 2350	26	21 + S	26 + S	26 + S	36 + S	E

E = To check on a case by case basis (send the technical documentation with stress and stability checks).

S = Application of stabilisers necessary.

Note For the dimensions of the profiles see Table 3.2.

The possibility of using materials with superior mechanical characteristics requires verification of the total moment of resistance of the chassis plus counter chassis.

To ensure the necessary strength and rigidity, and especially in the case of overhangs exceeding 1200 mm, the connection between the chassis and the counter chassis must be made using shear-resistant plates (spaced no further than 400 mm from one another) in the area of the overhang, and must continue up to the front mount of the rear suspension (see Figure 23).



- **Carefully assess any variations in the stability and attitude of the vehicle caused by suspension compression and chassis flexing during all stages in the operation of the tail lift. Always evaluate whether using stabilisers is advisable even if their use is not rendered necessary by the stresses sustained by the chassis.**

The stabilisers must be attached to the support structure of the tail lift, and should be preferably hydraulically operated.



- **The stabilisers must be put into operation in all tail lift loading conditions.**

When installing an electro-hydraulic tail lift, ensure that the capacity of the batteries and the power of the alternator are adequate (see Chapter 5.5).

The Body builder will be responsible for any modification to the under-run protection cross member, or for installing a different type (see Chapter 2.20 (► Page 60)), for preserving visibility of the rear lights, for the overhang angles, and for the positioning of the tow hook as provided by the respective national requirements.

3.10 TILT BEDS (BREAKDOWN RECOVERY)

Using a tilt bed typically subjects the chassis to considerable stress. The vehicle used should therefore specifically indicated for this application. These vehicles are listed in Table 3.5 together with the indicative characteristics for the counter chassis necessary

Where a very long bed is necessary, it is preferable to use a vehicle that already has a sufficiently long wheelbase rather than create a long overhang.

The counter chassis must be suitably sized and stiffened at the rear with boxing and diagonal crossbraces (see Figures 6 and 7).

Connections to the chassis must be elastic (brackets or supports) at the front end and stiff at the rear end (cleat plates, see Figure 11) to allow the additional structure to contribute more effectively towards the rigidity of the assembly.

The rear tilt pivot must be installed on the counter chassis, and must be situated longitudinally as close as possible to the rear suspension mount. To prevent the risk of the tilt bed compromising vehicle stability when operating and to avoid excessively increasing the stress sustained by the chassis, the distance between the tilt pivot and the rear suspension mount must comply with the specifications given in Figure 16. Should this not be possible, the counter chassis profiles must be larger than normal and additional stiffening must be applied to the rear.

The position of the lift system must be defined with particular attention to protect the structural integrity of the rams and permit a precise and practically location for the mountings. The ram should preferably be situated in the most practical position available ahead of the centre of gravity of the combined body and payload in order to reduce localised load.

The body builder must equip the vehicle appropriately to ensure stability during bed tilting manoeuvres.

All equipment and structures must comply with any applicable national legislation.

3.11 VEHICLES FOR COUNCIL, FIRE SERVICE AND SPECIAL USES

The outfitting of vehicles for municipal use (compactor trucks, road rollers; road cleaning vehicles) in many cases require:

- the realization of a particularly robust counter chassis towards the rear and elastic type connections to the chassis towards the front of the vehicle;
- shortening of the rear overhang of the chassis.
When very short overhangs are necessary, the chassis may be shortened immediately downstream of the rear spring support (or after the bar coupling in the case of air suspension), thus keeping intact the connection to the chassis of the crossbar applied therein;
- the vertical placement of the exhaust, behind the cab;
- the adoption of rear suspensions with greater rigidity (see Chapter 2.11 (➡ Page 34));
- a new arrangement of the rear lights.



- ▶ **Do not use the reversing light switch, mounted on the gearbox, to activate functions that require increased reliability and safety levels, (e.g. engine stop during reverse, on vehicles for urban waste collection from the personnel present on the rear footboards).**

3.12 FRONT INSTALLATION OF SNOW PLOUGH ATTACHMENTS

The application of a snowplough attachment (blade or ploughshare) to the front part of the vehicle must be carried out using a suitable support structure, appropriately anchored to the core of the chassis side members and in observance of the prescriptions contained in Chapter 2.2 (➡ Page 8).

Since, when used to remove snow, the vehicle is weighted at the rear and the maximum speed is limited (e.g. 40 km/h), a small increase in maximum axle load may be allowed upon specific assessment and authorisation by IVECO.

It should be possible to use all the elements of the vehicle front panel (e.g. tow-bar, supports for windscreen cleaner); otherwise, equivalent systems must be provided in compliance with the safety requirements.

Observance of the required load must be documented and guaranteed by the company that carries out the installation.

3.13 APPLICATION OF A WINCH

The application of a winch on the vehicle can be carried out at the following points:

- on the front part of the chassis (frontal);
- on the chassis of the vehicle, behind the cab;
- between the side members of the vehicle, in a central or lateral position;
- on the rear part of the chassis.

The installation must be carried out so as not to alter the correct functioning of the vehicle's assemblies and components, in observance of the maximum permitted axle limits and following the instructions of the winch manufacturer. The fastening of the idler members and assembly, must be carried out in observance of Chapter 2.2 (➡ Page 8), ensuring that the connection areas are not only reinforced locally (see Chapter 2.17 (➡ Page 55)), according to the pull of the winch cable and particularly its transverse component, when the traction is oblique.

The installation of a winch in the area behind the cab must allow for the insertion of an auxiliary frame, of suitable dimensions and structure (crossbars and diagonals for stiffening) for the winch capacity.

In the event of winches:

- hydraulically controlled: previously installed hydraulic pumps can be used for other services (tipping bodies, cranes, etc.);
- mechanical: for transmission of the control it is necessary to follow the indications contained in Chapter 4.1 (➡ Page 5) and 4.2 (➡ Page 7);
- with worm screw control: the dimensioning of the drive parts must take into account the low efficiency of controls of this type;
- electric: these are used for low power applications of brief duration, given the limited capacity of the vehicle battery and alternator.

3.14 SPECIAL OUTFITS

The body builder must ensure compliance of operations carried out with legal requirements, especially in the case of configurations for the transport of persons.

Cowl chassis versions

They are made specifically for the installation of special bodies or equipment (shop vans, motor homes, etc.).

The indications and precautions shown on the technical documentation (chassis diagram) provided by IVECO must be carefully respected.

Motor home

Mass limits applicable to single axles must be strictly adhered to, as well as the total limit, keeping in mind a sufficient load margin in addition to the number of people expected:

- baggage, tents, sporting equipment;
- water tank, sanitary facilities;
- gas cylinders, etc.

It is necessary to ensure that the load to be transported can be placed in specific compartments, with appropriate safety margins and providing suitable directions.

Special attention must be given to the construction of compartments for gas cylinders, which must be built in compliance with specific regulations in force and adopting the necessary safety precautions.

For repair operations on the rear overhang, see the instructions in Chapter 2.5 (➡ Page 19).

Installation of aerial platforms

The application of an aerial platform or basket must comply with national regulations (e.g. CUNA, DIN) as well as international regulations (e.g. ISO, CEN), and any specific requirements.

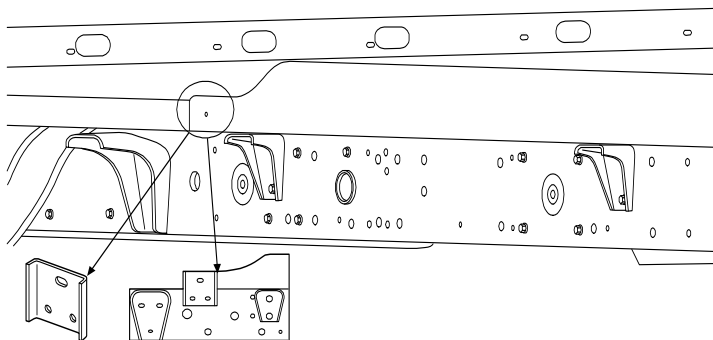
The choice of the type must be made by checking compatibility with the features of the vehicle chassis, which is available.

Positioning on the vehicle must respect limits and distribution of permitted load.

Special cases must be assessed individually each time and must receive specific authorisation from IVECO.

The installation of a platform/aerial basket requires the interposition of a suitable counter chassis. For its implementation, as well as any general indications (see Chapter 3.3 (► Page 11) and Table 3.2 and Table 3.3), the body builder must:

- assess the maximum static moment and the intended location of the superstructure;
- avoid abrupt sections changes;
- create a fastening solution such as that in Figure 3 or, in cases of high stress, that in Figure 24, in which the first fastening of the counter chassis is highlighted.



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Figure 24



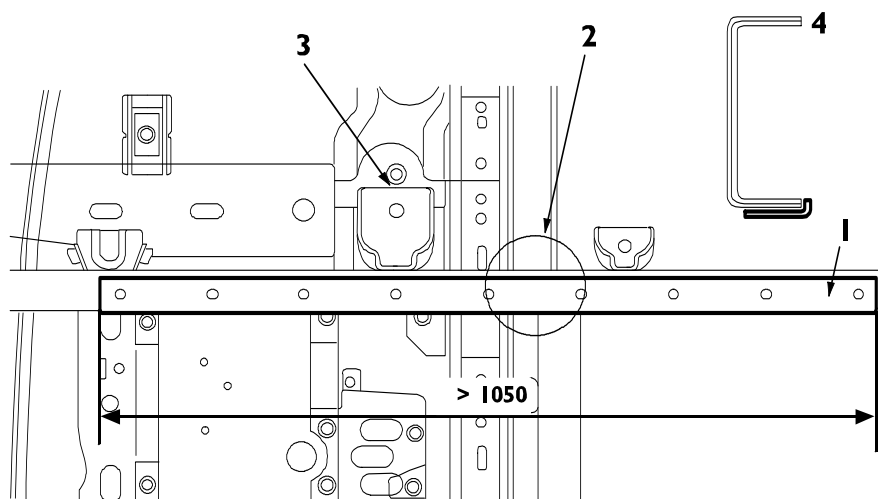
- **The body builder must adopt all the precautions to ensure the vehicle's proper use and operational stability. Falling within this context is the responsibility of defining the type and number of the stabilisers together with the manufacturer of the superstructure.**

The body builder must therefore also:

- provide vehicle lifting/lower speed control on the stabilisers through appropriate flow control valves in the hydraulic system;
- indicate that it is necessary to limit, as much as possible (3-5 cm), lifting of the front axle of the vehicle from the ground, compatible with the condition of keeping the horizontal alignment.

Aerial platforms on 33S-35S vehicles

The installation of this outfit on 33S-35S (single-wheel) vehicles is possible with prior adoption of specific reinforcement flaps on the chassis, which can be ordered in original with specific opt. No. 74131 or at IVECO Parts with spare part No. 504267869.



208929

Figure 25

View from below

- | | |
|-------------------------------------|--------------------------------|
| 1. Reinforcement flap | 3. Cab block |
| 2. First counter chassis attachment | 4. Chassis flap section detail |

The flaps must have a minimum thickness of 4 mm and enough length to cover the side members of the chassis in front of the cab block area and behind the first fastening point of the counter chassis (see Figure 25); the total length must not be less than 1050 mm.

The additional flaps must be fastened to the wing of the chassis by means of rivets with a maximum spacing of 110 mm and must be made of high-strength steel.

SECTION 4

POWER TAKE-OFFS

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POWER TAKE-OFFS

4.1 GENERAL SPECIFICATIONS

Different types of power take-offs (PTO) for motion withdrawal can be mounted for operating auxiliary units. Depending on the type of use and performance required, the application can be fitted to:

- the gearbox;
- the driveline;
- the rear of the engine.

The characteristics and performances are given in the paragraphs which follow and in the relevant documentation which will be supplied upon request.

For the definition of the power necessary for the apparatus to be controlled, particularly when the values requested are high, the absorbed power should also be considered during the drive transmission phase (5 to 10% for the mechanical transmissions, belts and gears, and greater values for the hydraulic controls).

The choice of transmission ratio for the power take-off should be made so that the absorption of power occurs in a flexible engine operating range; low speeds (below 1000 rpm) must be avoided to prevent irregular running.

The available power can be calculated in relation to the power take-off speed and the established torque.

$$P \text{ [CV]} = M \cdot n \cdot i / 7023$$

$$P \text{ [kW]} = M \cdot n \cdot i / 9550$$

P = Available power

M = Torque permitted for the power take-off

n = Engine revolutions per minute

i = Transmission ratio = PT output rpm / engine rpm

Type of use

The maximum torque take-off values indicated are with reference to continuous usage up to 60 seconds

Torque take-off values exceeding the maximum values indicated for occasional, limited usage (less than 30 s), must be approved on a case by case basis in relation to the type of application.

In the case of continuous usage exceeding 60 seconds, where the function is comparable to that of a stationary motor, the necessity of reducing torque take-off in relation to other, peripheral conditions (such as engine and transmission cooling necessities) must also be evaluated.

In the case of continuous usage which may lead to high oil temperatures, it is advisable to contact the PTO supplier to determine whether the installation of a dedicated external oil circuit kit is necessary.

The scheduled take-off values are also applicable for uses which do not involve large variations of torque either in frequency or magnitude.

In other cases, to avoid overload (e.g hydraulic pumps, compressors) it may be necessary to include the application of devices such as clutches or safety valves.



- ▶ **During prolonged use, the gearbox oil temperature must not exceed 110 °C and the water temperature must not exceed 100 °C.**



- ▶ **Not all types of power take-offs are suitable for continuous use; always follow the specific instructions for the power take-off during operation (working times, breaks etc.).**

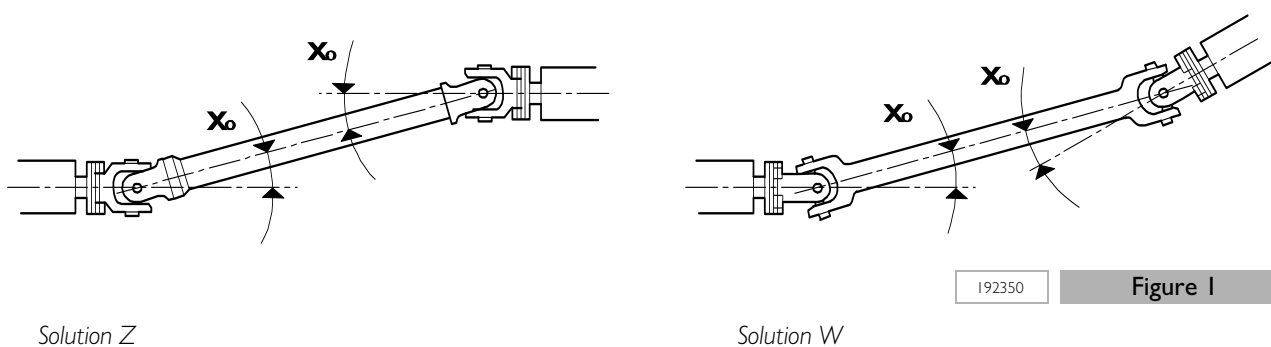
PTO transmission

In full compliance of the Manufacturer's transmission specifications, the kinematic forces from the power take-off to the relevant apparatus should be carefully considered (angles, rpm, moment) during the design phase as well as the dynamic behaviour in the installation phase.

This means that:

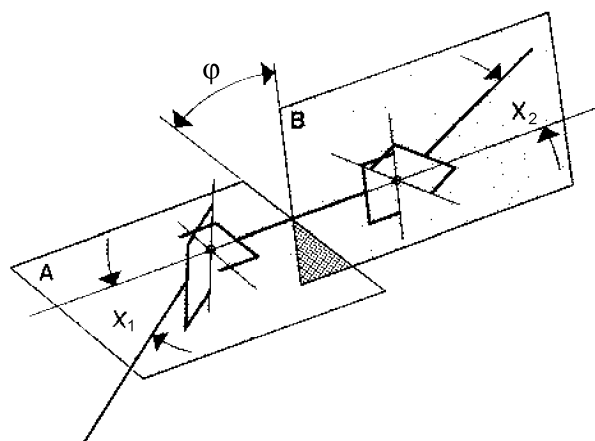
- the dimensions should take into consideration the forces which might occur under maximum power and torque conditions;
- to ensure effective kinetic forces, the shaft ends must be at the same angle (see Figure 1), and this angle must not exceed 7° ;
- solution Z is preferred to solution W due to the lower loads on the bearings of the power take-off and the equipment being driven. When it is necessary to obtain a different transmission line with spatial inclinations according to angle ϕ (as shown in Figure 2), it is important to remember that the kinetic forces of the assembly can only be ensured if the intermediate section has forks offset by the same angle ϕ and if equal conditions are respected between the angles at the extremities X_1 and X_2 .

For transmissions employing multiple sections, please refer to the indications provided in Chapter 2.8 (► Page 26).



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Figure 1



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Figure 2

4.2 PTO FROM GEARBOX

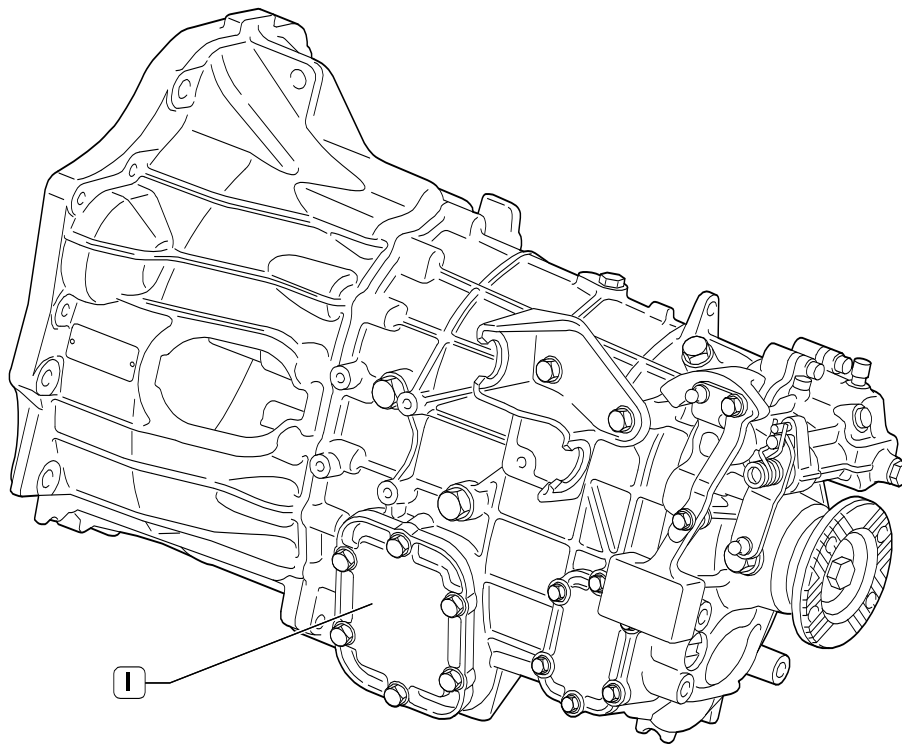
Drive may be taken from the layshaft via flanges or fittings located to the rear side or lower part of the gearbox.

Table 4.I shows available torque levels and the ratios between output rpm and engine rpm for the different types of IVECO optional gearbox/PTO combinations.

IVECO must authorize high torque take-offs for sporadic use, according to the type of use.

The PTO must normally be used with the vehicle at a standstill and must be engaged and released with the clutch disengaged so as to avoid excessive stress on synchronisers.

When the PTO is used with the vehicle in motion, no gearshift must be carried out.



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Figure 3

I. Cover for power take-off pre-installation

Transmission PTO data

The installation of a P.T.O. post vehicle production requires the reprogramming of gearbox electronic control (if automated), as well as interventions on the wiring system. Therefore, before proceeding, please carefully read Chapter 4.5 (► Page 9).

Re-programming of the control unit must be carried out in accordance with the instructions in the IVECO technical manual using exclusively the diagnostic instrument (available from IVECO dealers and authorised IVECO service centres), providing the information regarding the specific PTO requirements.

Table 4.1

Gearbox	Position ⁽¹⁾	Output ⁽¹⁾	Direction of rotation ⁽²⁾	Maximum torque C_{max} [Nm] ⁽³⁾	PTO ratio
2835.6	Left side	Rear	Clockwise	120	1.00
2840.6 6AS400	Left side	Rear	Clockwise	180	1.04
2850.6	Left side	Rear	Clockwise	220	0.94

⁽¹⁾ With respect to the direction of travel

⁽²⁾ Frontal view of the PTO output

⁽³⁾ The maximum available torque refers to a speed of 1500 rpm in output from the PTO. For higher speeds, proportionally reduce the available torque value.



- ▶ IVECO reserves the right to void the guarantee on the gearbox if malfunctions are due to the PTO and, in that case, if the PTO installed by the body builder has performance other than those indicated in Table 4.1.

Direct application of pumps

When the application of pumps of other equipment is carried out directly from the power take-off, without the use of intermediate shafts and after checking that the size of the pump permits margins of safety with the chassis and engine unit, the static and dynamic torques exerted by the mass of the pump and by the power take-off should be checked for compatibility with the resistance of the walls of the gearbox.

Furthermore, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine.



- ▶ Observe values in Table 4.1 for torque take-offs. During prolonged use, the gearbox oil temperature must not exceed 110 °C and the water temperature must not exceed 100 °C. Not all types of power take-offs available on the market are suitable for continuous use; the specific instructions for the power take-off must be followed during use (working period, breaks etc.).

The power take-offs provided by IVECO include a flange for direct mounting of pumps with UNI 4-hole attachment.

The output is formed by a 21 ISO 14 splined shaft.

4.3 POWER TAKE-OFF FROM TRANSFER BOX

Note Not available on Daily 4x2.

4.4 POWER TAKE-OFF FROM DRIVE LINE

The authorisation for the application of a power take-off on the drive line downstream of the gearbox is issued after examination of the complete documentation presented to the IVECO.

The power and torque values will be evaluated as each occasion arises on the basis of the conditions of use.

In general, the following should be noted:

- The drive take-off may be operated only when the vehicle is stationary. The PTO engagement /disengagement shall be performed in gearbox Neutral. During engagement and disengagement power absorption from BodyBuilder must be reduced to 0 Nm;
- the power take-off rpm is dependent on the gear selected;

- the power take-off must be located immediately downstream of the gearbox; for vehicles with the drive line in two or more sections, the power take-off may also be fitted at the flexible support between the first and second sections (respect the indications given in Chapter 2.8 (➡ Page 26));
- the angles of the drive line on the horizontal plane and vertical plane must be kept as close as possible to the original values;
- masses and rigidity added to the drive line must not provoke a loss of balance or abnormal vibrations or damage the transmission drive line (from engine to axle) either during vehicle movement or during operation with the power take-off;
- the power take-off must be fixed to the chassis with its own suspension.



▶ **The transmission is an important part for the safety of the vehicle, and as such any intervention on the transmission must only be carried out by specialist companies approved by the manufacturer.**

Note Any intervention on the driveshaft carried out without prior authorisation from IVECO will immediately invalidate the warranty.

4.5 PTO MANAGEMENT

Note At the time of publication of these Directives, the information in this Chapter may have been subject to changes. It is therefore recommended that any possible modifications are verified by consulting www.ibb.iveco.com.

General information

For first equipment the vehicle can be alternatively equipped with:

a) PTO pre-installation (Opt. 77910 on gearbox 2840.6 and 2850.6 and Opt. 75977 for gearbox 2835.6);

PTO pre-installation consists of:

- cover on gearbox (see Figure 3);
- bonnet cable (see Figure 5).

Refer to the following paragraph for PTO installation (point 1)

Note There is always a cover on the gearbox on gearboxes 2840.6 and 2850.6 (see Figure 3), while the cover is only present with option 75977 on gearbox 2835.6).

b) PTO pre-installation (Opt. 77910 on gearbox 2840.6 and 2850.6 and Opt. 75977 for gearbox 2835.6) **and Expansion Module** (opt. 8657)

PTO pre-installation consists of:

- cover on gearbox (see Figure 3);
- bonnet cable (see Figure 5).

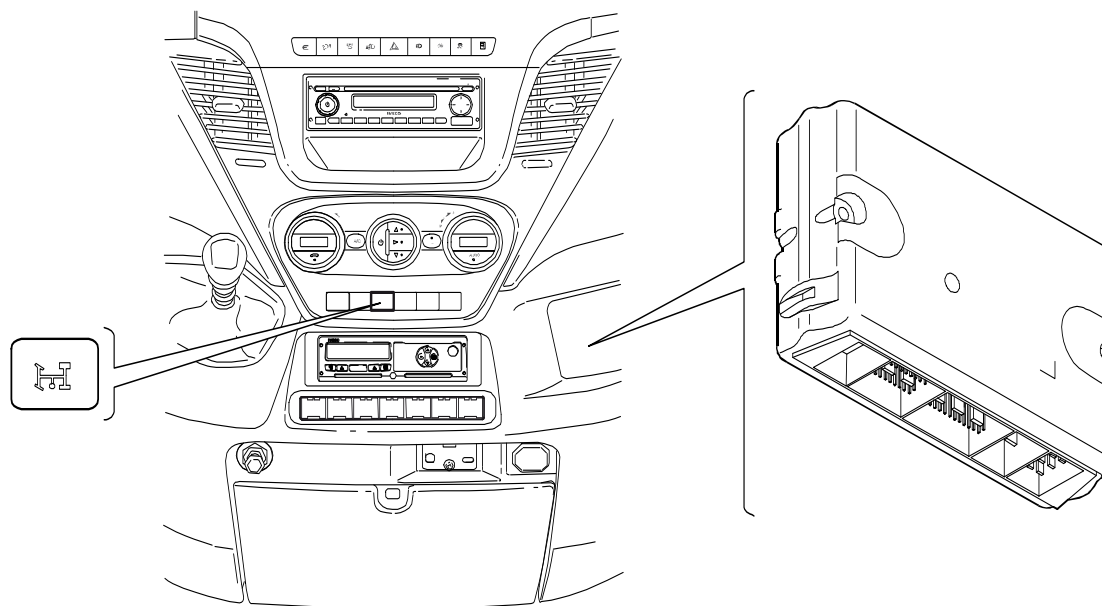
The Expansion Module is an electronic interface designed to manage certain types of configurations (additional lights, alarms, "after market" PTOs, etc.) and is pre-installed on the vehicle.

Refer to the following paragraph for PTO installation (point 2)

Note There is always a cover on the gearbox on gearboxes 2840.6 and 2850.6 (see Figure 3), while the cover is only present with option 75977 on gearbox 2835.6).

c) PTO (Opt. 75076/75077/75078) **and Expansion Module** (opt. 8657)

In this case the switch for PTO actuation is fitted on the dashboard (see Figure 4).



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Figure 4

Note For the description of the features and ways of using the Expansion Module, consult the specific IVECO manual.

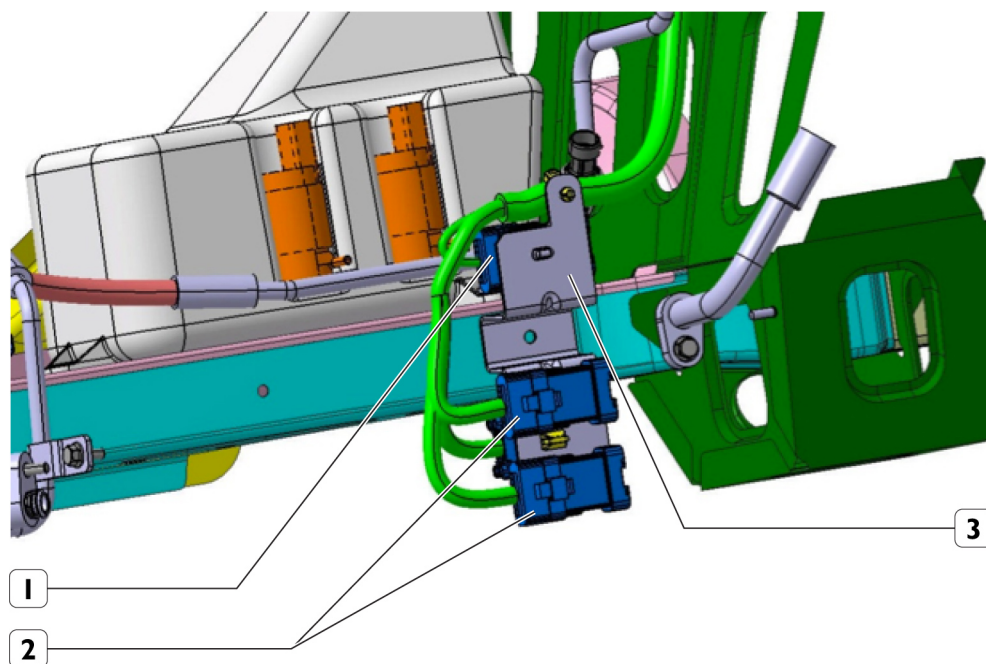
"After market" PTO installation

If you plan to install a PTO "after market", it is necessary to verify that the vehicle is equipped with opt. Cruise Control.

The PTO can be installed post-sales on vehicles equipped with the relative preparations, whether or not there is an Expansion Module.

I) If the vehicle is equipped with PTO pre-installation, the following is to be ordered from IVECO Parts:

- The PTO installation kit (PTO + Hydrocar control unit). Not yet available at the time of publication of these Directives.
- the wiring for the electrical connection of the PTO to the pre-installation on the bonnet (Figure 5) on the right of the engine compartment;
- PTO actuation switch.



208926

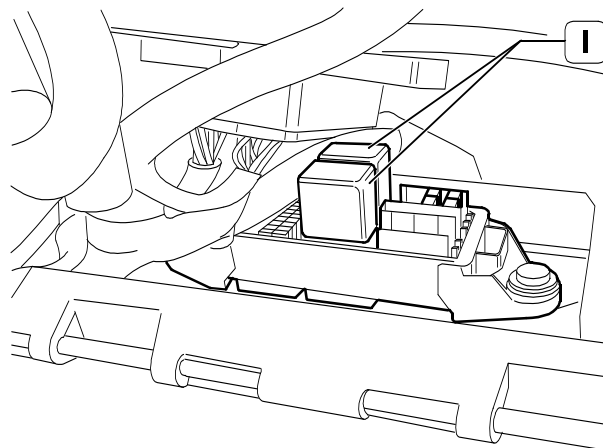
Figure 5

1. PTO configured connector

2. Pneumatic suspension configured connectors
3. Bracket for optional connectors

2) If the vehicle is equipped with the Expansion Module, the following is to be ordered from IVECO Parts:

- the PTO installation kit;
- the wiring for the electrical connection of the PTO to the pre-installation on the bonnet (Figure 5) on the right of the engine compartment;
- the two relays to insert into the Expansion Module pre-installation (see Figure 6);
- the switch (see Figure 4) to connect to the pre-installation on the dashboard cable.



166054

Figure 6

I. Relay for PTO with Expansion Module

Table 4.2

SCMI/C	Type Power Supply	Protection	Presence		Capacity [A]	Type
			STD	OPT		
T61		Expansion Module		X	20	
T62		Expansion Module		X	20	
T63		FF		X	20	
T64		FF		X	20	
T65		FF		X	20	
T66		available		X	20	
–						
F79	30	T61 relay (30-87) for PTO from Expansion Module		X	15	A0
F80	30	T62 relay (30-87) for PTO from Expansion Module		X	15	A0
–						

Note The "after market" installation of a PTO means, once installation is complete, referring to IVECO Customer Service to update the ECU software through the teleservice.

PTO Mode

Given the distinction between PTOs for manual or automatic transmission, up to two homogenous PTOs can be installed on the vehicle. For instructions on how to insert and remove the PTO, refer to the Use and Maintenance Manual.

The operation of the engine and transmission depend on their respective control units and, in the case of automated gearbox and activated PTO, operation of the Expansion Module can be communicated with the control units.

The behaviour of the gearbox can be affected therefore when the PTO is configured as **"stationary"** or **"not stationary"**: in the first case the gearbox remains in neutral, in the second case it allows engagement of the first gear or the reverse gear.



- **For safety reasons, when the non-stationary PTO is engaged, gear changes are not possible (involving the automatic switch-off) and the vehicle should not exceed a speed of 20 km/h.**



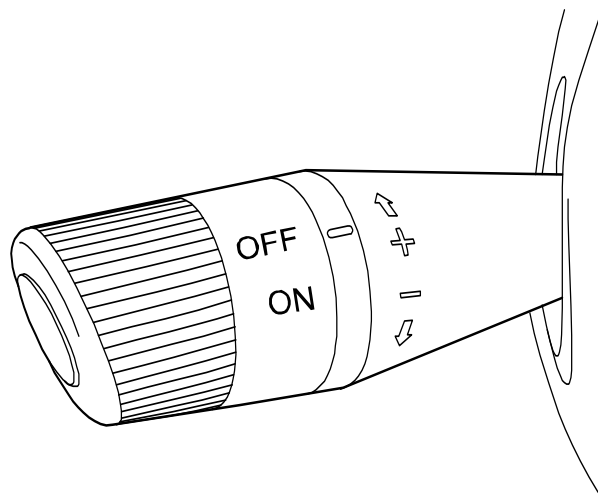
- It is necessary to switch off the PTO when a torque withdrawal is not in progress.



- Before turning off the engine using the body builder connector, the PTO must be disengaged. In any case, the engine cannot be restarted from the connector while the PTO is still connected.

Adjust the engine speed for removing the engine

The engine management electronic control unit provides a function with which you can simultaneously adjust the engine revs and power take-off from the Cruise Control lever (see Figure 7)



208927

Figure 7

The control unit is also able to perform the control of the set revolutions and maintain or restore balance depending on the applied load.

Note Adjustment of engine speed through Cruise Control (Working Engine Speed Demand) can only be done between 10 and 20 km/h, depending on the equipment.

After turning the selector of Figure 7 in the ON position, actuating in the direction + or - makes it possible to increase or decrease the number of revolutions in two ways:

- a) with steps of 50 rpm if the lever is operated for between 0.5 and 2 seconds;
- b) with a ramp of 400 rpm for each second of continuous activation of the lever, beyond 2 seconds.

It is possible to store a new speed (with PTO on) by pressing and holding the RESUME button for at least 5 seconds.

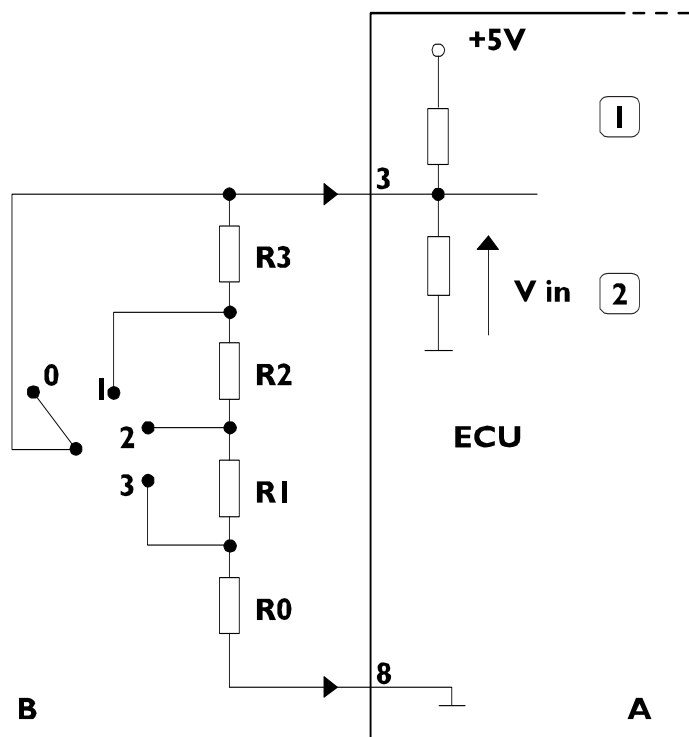
To manage engine speed control, requested torque and other parameters programmable on the Expansion Module, consult the specific IVECO manual.

Note With Cruise Control activated, you can return to the minimum engine speed condition (setting erased) by placing the selector shown in Figure 4.7 on or off by pressing the brake pedal or clutch pedal (if equipped).

Multiple State Switch

An additional feature used to manage the number of revolutions with PTO engaged, available on the 12-way body builder connector (pin 3 - pin 8).

To obtain this feature, the circuit shown in the diagram in Figure 8 must be implemented.



208928

Figure 8

Multiple State Switch (example)

- A. 12-pin body builder connector
B. Responsibility of the body builder

1. Pull-up (in ECU)
2. Pull-down (only for EDC7CI)

Table 4.3

Resistance Values [Ohm]	R0	R1	R2	R3
	120	270	510	2000

Programmable speed [rpm] - basic settings		PTO 0	PTO 1	PTO 2	PTO 3
	CM	900	1200	900	1200
	CA	1200	1200	1200	1200

Resistance 1/4 of W and tolerance 1%.

Operation:

1. With the vehicle stopped and the switch on position 0:
- Manual operation - press the RESUME button on the Cruise Control to increase the engine speed to the programmed speed

- Assisted operation mode - providing a positive to pin 15 of the 20-way body builder connector, the engine speed is positioned to the set speed.
2. With the vehicle stopped and the switch on position 0:
- without pressing the RESUME button, the engine speed stays in idle. When the switch position is changed, the number of engine revolutions will move to the programmed speed for each switch position.

By moving the Cruise Control switch to OFF, or by pressing the brake pedal or clutch pedal, the engine speed control function is switched off regardless of the switch position.

If the user wishes to store engine speed values other than those set by IVECO, the system allows the desired value for each switch position to be programmed following the procedure described in the Paragraph "PTO Mode - Engine speed adjustment for motion withdrawal".

SECTION 5

**ELECTRONIC
SUB-SYSTEMS**

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ELECTRONIC SUB-SYSTEMS

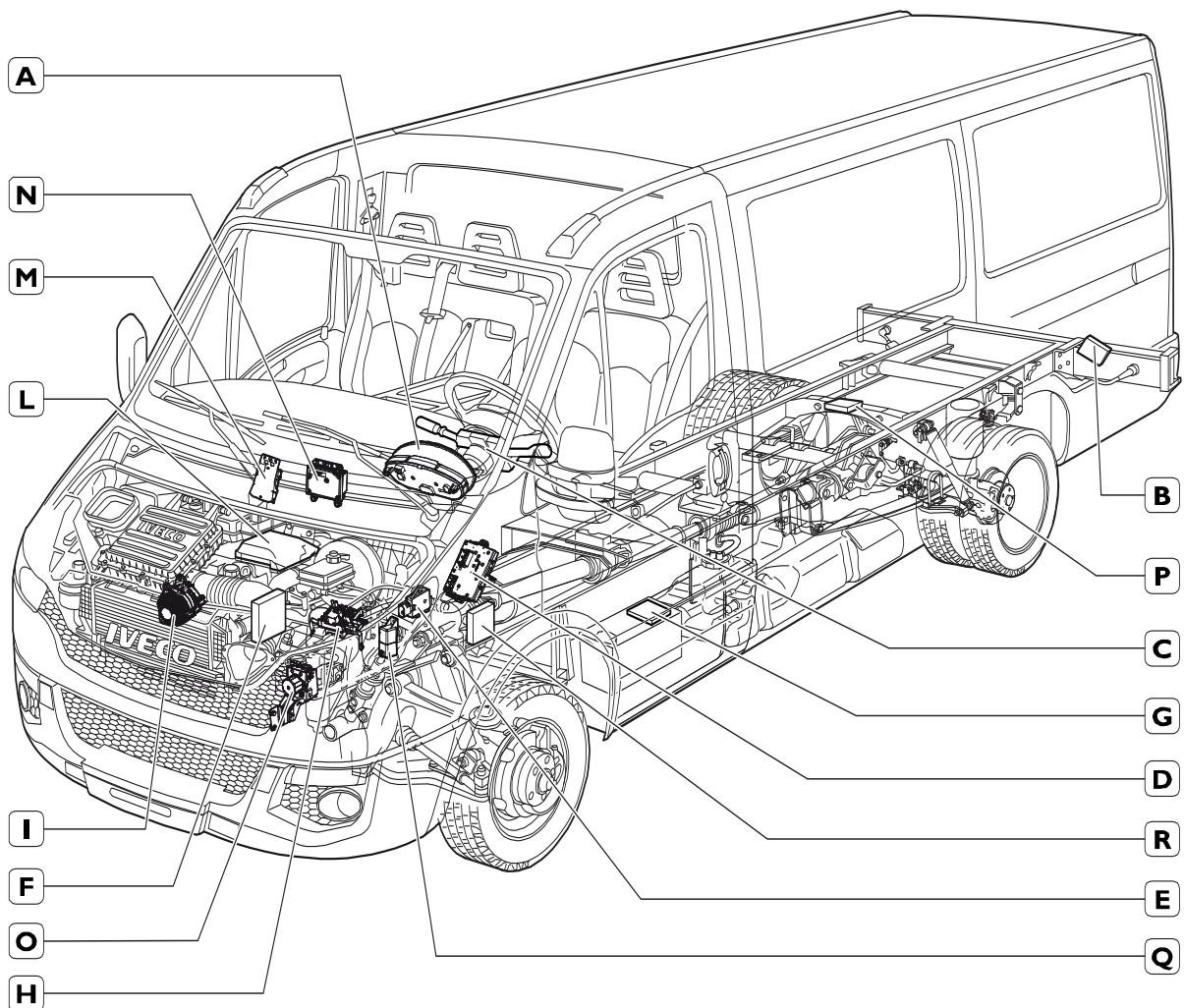
5.1 ELECTRONIC SYSTEM

Below is the location of the ECUs and connectors that can be installed on the vehicle.



- It is not permitted to connect devices or electrical circuits directly to the control units described below. Only the connectors listed in the following paragraphs may be used.

Location of control units



208934

Figure I

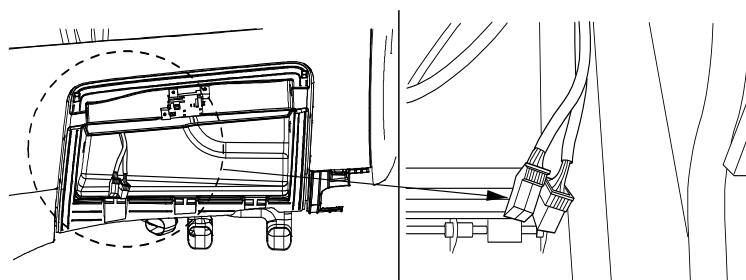
- | | |
|--|---|
| A. Instrument panel | I. Automatic Transmission Control Unit on chassis |
| B. Trailer control unit | L. SCM connection panel (engine) |
| C. Steering wheel column and ignition switch | M. Expansion Module |
| D. Body Computer | N. Airbag ECU |
| E. Oil control unit | O. ABS/ESP control unit |
| F. Engine Management control unit | P. ECAS Electronic Control Air Suspension |
| G. CBA1 control unit on battery | Q. Glow-plugs preheating control unit |
| H. CBA2 control unit in the engine compartment | R. Automatic transmission control unit |

5.2 BODY BUILDER CONNECTORS

Specific connection points for body builder applications have been prepared in the electrical system in the vehicle; this way it is possible to maintain the functional integrity of the system and the validity of the guarantee.

More precisely, inside the cab there are connectors 61071 and 72075, to be used after the creation of a special bridge.

Note Since it is only possible to detect signals and not power from the connectors, each interface between configuration and vehicle must take place by means of diodes and relays.



208935

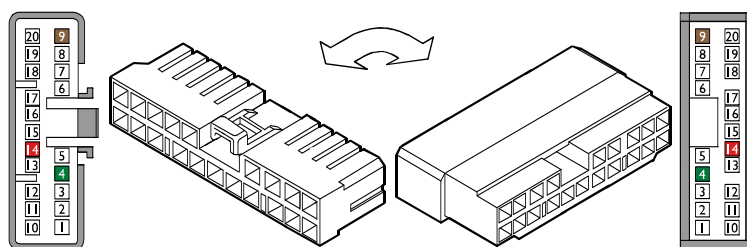
Figure 2

Note The connectors are located behind the passenger side drawer in an easily accessible area.



► **DIRECT CONNECTION TO CONNECTORS IS STRICTLY FORBIDDEN, WITH A PENALTY OF IMMEDIATE REVOCATION OF WARRANTY.**

20-pole connector (61071)



101564

Figure 3

A. Existing part on vehicle (male)

B. Counterpart to be coupled (female)

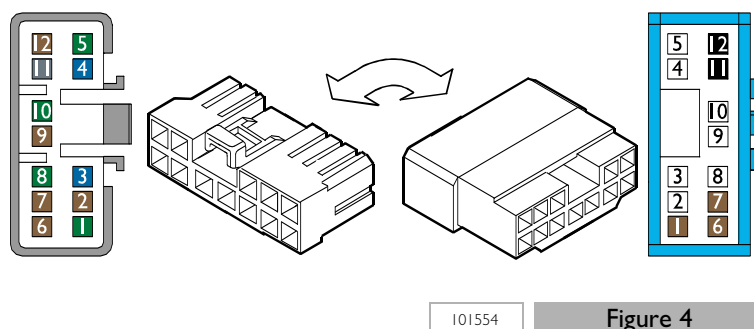
Table 5.1

Code	Description
500314817	20-way male door seal
500314820	Male contact for cable 0.3 to 0.5 mm ²
500314821	Male contact for cable 1 to 1.5 mm ²

Table 5.2 - Basic functions of 20 pin connector

Pin	Description	Signal	Remarks
1	Engine Start	input Max 20 mA	By providing a positive, the motor which starts the vehicle engine is powered. Operation only takes place when the key is turned in the lock. During the start phase, NO SAFETY CHECKS OF ANY KIND ARE ENVISAGED e.g. gear engaged, etc. Both for normal vehicles and for Start & Stop vehicles +12V = starter motor Open wire = no action
2	Engine switch off	input Max 10 mA	By providing a positive, the vehicle engine switches off +12V = engine off Open wire = no action
3	Service braking	Output Max 500 mA (interfacing with decoupling diode)	A positive is obtained when the brake pedal is activated +12V = service brake active Open circuit = service brake not active
4	Vehicle standstill	Output Max 500 mA	Ground is obtained when the vehicle is stopped Ground = vehicle stopped Open circuit = vehicle in motion
5	Parking braking	Output Max 500 mA (interfacing with decoupling diode)	Ground is obtained when the parking brake is activated Ground = brake engaged Open circuit = brake disengaged
6	Battery positive	Output max 20 A	Positive protected by fuse on Body Computer - F34
7	External light activation	Output Max 500 mA	A positive signal is obtained when the side lights are on +12V = lights on Open circuit = lights off
8	Alternator operation	Output Max 500 mA (interfacing with decoupling diode)	A positive is obtained when the alternator is driven +12V = battery charging Open circuit = battery not charging
9	Clutch actuation	Output Max 500 mA (interfacing with decoupling diode)	An open circuit is obtained when the clutch pedal is pressed +12V = clutch engaged Open circuit = clutch disengaged
10	Engaging reverse	Output max. 500 mA (interfacing with decoupling diode)	A positive is obtained when reverse gear is engaged +12 V = reverse gear engaged Open circuit = reverse gear disengaged
11	Positive with key	Output max 5 A	Positive with key protected by fuse on Body Computer - F49
12	Cruise Control Command	input Max 10 mA	Cruise Control negative analogue signal (in parallel with steering wheel switch) See specification 3
13	Reference ground for Cruise Control command transfer box	input Max 10 mA	See specification 3
14	Not connected		
15	Not connected		
16	Not connected		

Pin	Description	Signal	Remarks
17	Ground	Output max 15 A	
18		Not connected	
19		Not connected	
20		Not connected	

12-pole connector (72075)

Existing part on vehicle (male)

Counterpart to be coupled (female)

Table 5.3

Code	Description
500314814	12 way male connector
500314820	Male contact for cable 0.3 to 0.5 mm ²
500314821	Male contact for cable 1 to 1.5 mm ²

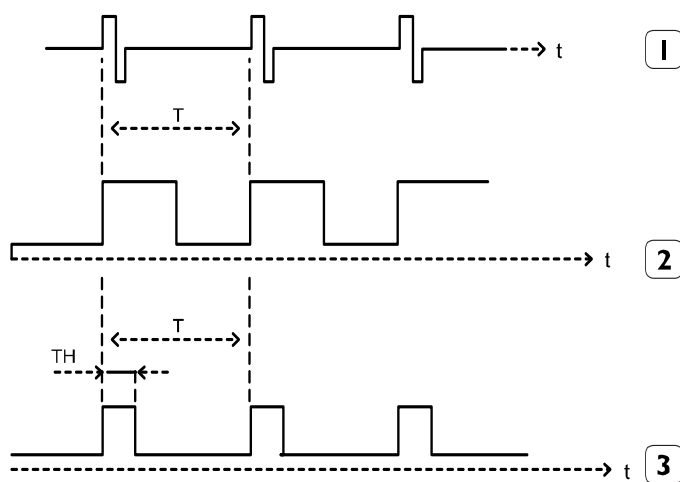
Table 5.4 - Basic functions of 12 pin connector

Pin	Description	Signal	Remarks
1	Speed limitation	input Max 10 mA	By providing a ground, vehicle speed is limited to 30 km/h Ground = speed limitation active
2	Programmable speed limiter;	input Max 10 mA	By providing a ground, the current speed limitation activates / deactivates Ground = speed limitation activated / deactivated
3	Multiple switch		Available for power take-offs
4	Speed signal (B7)		See specification I
5	Key ON-replicate	input Max 500 mA	By providing a positive, the first turn of the key is simulated (key set to ON). Only main loads are powered but it is not possible to start the vehicle from the outside since the vehicle key recognition is missing. +12V = key active Open circuit = key not activated
6	Power take-off activation	Output Max 500 mA	Ground is obtained when the power take-off is engaged Ground = power take-off engaged Open circuit = power take-off disengaged

Pin	Description	Signal	Remarks
7	Horn	Output Max 150 mA	Additional horns (to interface with the relay) Ground = horn active Open circuit = horn not active
8	Multiple switch	Available for power take-offs	
9			
10	Engine speed (rpm)	See specification 2	
11	Not connected		
12	Not connected		

Specification 1**Vehicle speed signal**

B7 is a square wave signal with equal frequency of the input signal (from the pulse generator) and variable "duty-cycle", due to the constant tachometry of the vehicle.



208222

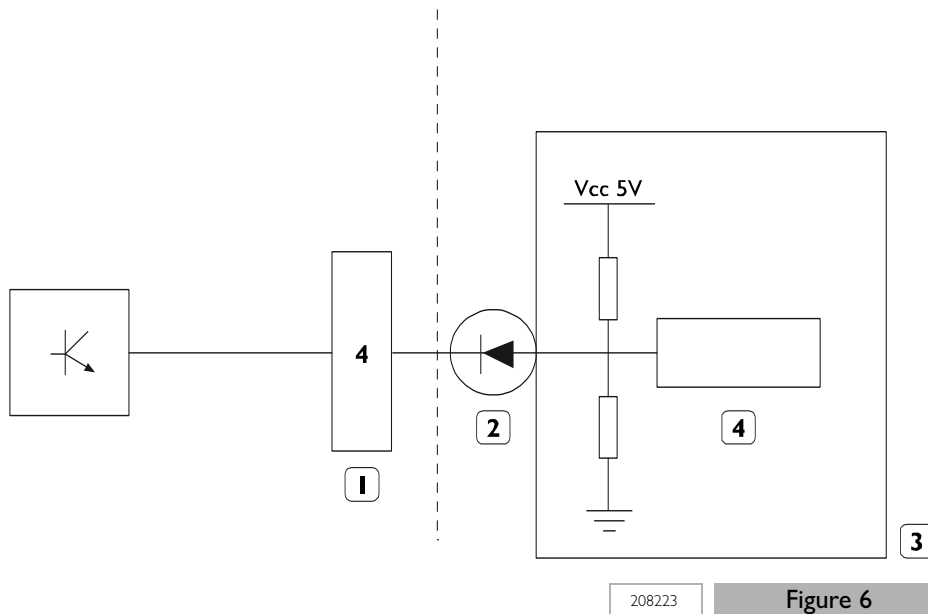
Figure 5

1. Impulse transmission input signal
2. Impulse transmission output signal

3. B7 signal from tachograph

The electric characteristics of the signal are:

- Minimum voltage level < 1.5 V
- Maximum voltage level < 5.5 V
- Maximum frequency 1.5 kHz
- Impulse duration (TH) 0.67 ÷ 6.7 ms
- Tolerance on impulse duration $\pm 1\%$
- Minimum value of load impedance 5.5 k Ω
- Typical value of load impedance 15 k Ω



208223

Figure 6

1. Body builders connector
2. Separation diode **REQUIRED**

3. Interface responsibility of the designer of the processor
4. Signal processor

The body builder must install a special separation diode so as not to lower the V_{ON} voltage.

The designer of the signal processor must ensure interface input equal to that represented with a max V_{CC} voltage of 5 V and "pull-up / pull-down" so as not to lower the V_{ON} voltage and raise the response time set by the vehicle interface.

The calculation of the speed, following the reading of the B7 signal, involves management of both the frequency and "duty-cycle" of the signal, as the frequency depends on the vehicle and the duty cycle depends on the constant tachometry.

The formula to calculate the speed of the vehicle from the B7 signal is as follows.

$$\text{Vehicle Speed} = 225 \cdot TH/T$$

where the speed is shown in km/h and TH, T in milliseconds.

Specification 2

Engine rpm signal

The rpm signal is a square wave.

The characteristics of the rpm signal are:

Table 5.5

Characteristics	Condition	Minimum	Typical	Maximum	Unit of measurement
C-IO	To container / VBat-	1,20		1.85	nF
R-IO	To the VBat+	2,57		2,65	kΩ
I-Out				50	mA
t-Rise	Signal rise time from 10% to 90%			10,5	μs
R-ON	Output current < 0.05 A			33,8	Ω
V-I		5,4	13,5	15,7	V
Impulse per revolution			4		

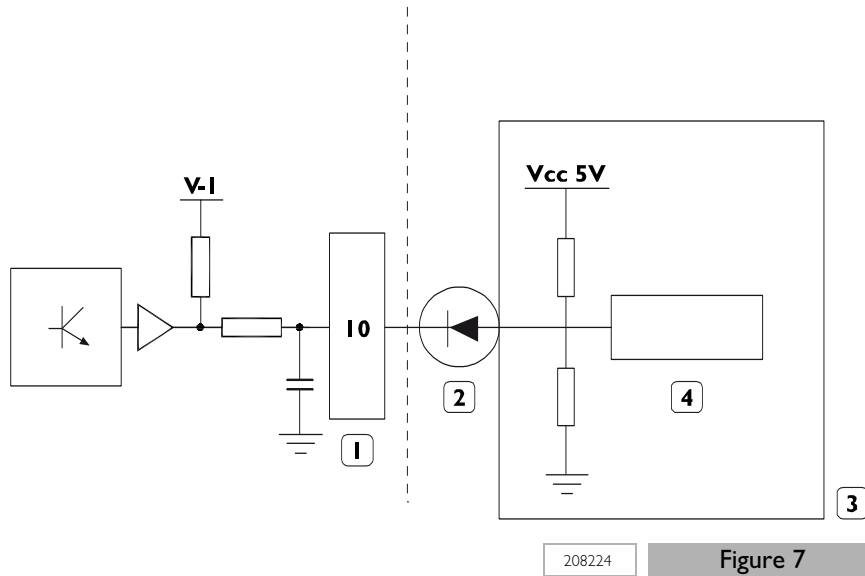


Figure 7

1. Body builders connector
2. Separation diode **REQUIRED**

3. Interface responsibility of the designer of the processor
4. Signal processor

The body builder must install a special separation diode so as not to lower the V_{ON} voltage.

The designer of the signal processor must ensure interface input equal to that represented with a max VCC voltage of 5 V and "pull-up / pull-down" so as not to lower the V_{ON} voltage and raise the response time set by the vehicle interface.

Specification 3

Cruise Control Commands via Body builder socket

The body builder must mount the divider outlined below by connecting the 20-pole body builder connector referring to the pins indicated.

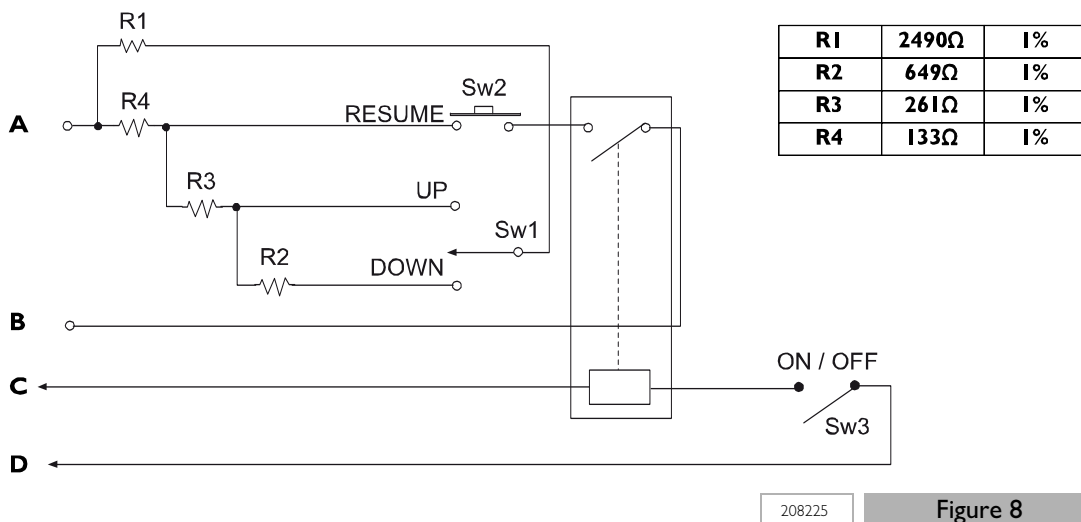


Figure 8

Prescribed diagram for body builder platform

- A. Pin 12 20-pin body builders connector
- B. Pin 13 20-pin body builders connector (ground)
- C. Pin 4 20-pin body builders connector (ground if $V=0$)
- D. Pin 11 20-pin body builders connector(+15)

5.3 ELECTRONIC CONTROL UNITS

Precautions to be used with electronic control units installed

In order to avoid operations that could permanently damage or degrade the functioning of the vehicle ECUs, it is advisable to:

- remember that connection and disconnection from battery terminals may generate voltages that adversely affect vehicle electronic systems and control units;
- do not disconnect and/or connect connectors from/to the control units with engine running or control units powered;
- detach the electronic control units where particular processing operations involve temperatures above 80°C;
- absolutely never employ a rapid battery charger for emergency start-up because it could damage the electronic systems, particularly the control units that manage the ignition and power supply functions;
- do not supply current to components served by electronic modules with jumper cables
- connect the control units equipped with metal casing to the ground of the system using a screw or bolt unless otherwise specified.

In case of any work on the chassis requiring arc welding:

- disconnect CBA I from the battery positive terminal and do not connect it to the chassis ground;
- disconnect the control unit connector;
- disconnect the control unit from the chassis (in case of welding near the control unit itself);
- perform welding with continuous current;
- ground the welding machine as close as possible to the welding point;
- do not place the battery cables parallel to the vehicle's electric cables.



- ▶ **Use only fuses with the features prescribed for the specific function. NEVER USE FUSES WITH A CAPACITY HIGHER THAN THE PRESCRIBED. Replace using only keys and disconnected users.**

Restore the original conditions of the wiring (paths, protections, strips, **completely** preventing the cable from coming into contact with the surface of the metal structure that can affect its integrity), if operations have been carried out on the system.

Warning

The vehicles are equipped with sophisticated electrical/electronic systems that monitor their operation (e.g. ABS, EDC, etc.).

Therefore, before installing additional heaters, power take-offs, speed limiters, anti-theft devices, mobile phones or refrigerator compressors for systems that can interact with these electronic systems, it is advisable to verify the feasibility of the application with IVECO.

In addition, it is necessary that adequate diagnostic checks are carried out to verify the proper construction of the system.

For more detailed information on the vehicle's electrical system, refer to the specific Repair Manuals.



- ▶ **Electrical work (e.g. removing cables, adding circuits, replacing equipment or fuses, etc.), performed in a manner inconsistent with the IVECO instructions or by unqualified personnel, can cause serious damage to electronic control units and compromise driving safety.**



- ▶ **Electrical work carried out inconsistently with cause substantial damage (e.g. short circuits with the possibility of fire and destruction of the vehicle) and authorises IVECO to void the warranty.**

Note For any exception to mounting instructions, IVECO's written authorisation is necessary.

Lack of observance of above described prescriptions involves guarantee lapse.

Disconnecting electronic control units



- **Operations which do not comply with the instructions specified by IVECO or carried out by non qualified personnel can cause severe damage to on-board systems which is not covered by warranty. Driving safety, reliability and good operation of the vehicle could also be affected.**

Follow the instructions below carefully before disconnecting an electronic control unit:

- turn the ignition key to OFF and remove it;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light of the corresponding key will go out);
- open the TGC (Main Current Contactor);
- isolate the battery by disconnecting the battery cables: disconnect the negative terminal first followed by the positive terminal;
- disconnect the control unit.

Repositioning electronic control units

IVECO recommends avoiding modifications which entail the repositioning of the electronic control units. However, if repositioning is unavoidable, follow the instructions below:

- the electronic control units must be positioned on the chassis or in the cab and secured with a fastening similar to the original one (i.e. bracket);
- in order to avoid any malfunctions the electronic control units must not be turned in relation to the chassis and must maintain the original orientation (e.g. to avoid water ingress).
- electronic control units must not be fitted on the counter chassis;
- the cover must always be refitted;
- avoid subjecting electronic control units to knocks from debris and stones from the road when travelling.

5.4 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

General information

Vehicles are set to function normally with a 12 V electrical system.

The chassis represents the grounding (it acts as a current return conductor between the components located on it and the battery power source/alternator) and it is connected to the negative pole of the battery and components, if an isolated return is not provided for this.

When installing additional equipment or additional circuits, the following indications must be taken into account and, depending on the complexity of the operation, there must be proper documentation (e.g. wiring diagram) to match that of the vehicle.

The use of cables and connections with colours/codes identical to those used on the original vehicle makes installation correct and facilitates any repair work.

For effective and proper use of the electrical system, specific connection points for additional equipment have been prepared. This was necessary to exclude any type of alteration of the basic design, so as to ensure its functional integrity and therefore maintain the vehicle guarantee.

Note For more detailed information on the vehicle's electrical system of, refer to the NEW DAILY Repair Manual, printout No. 603.95.723.

This manual is available at the Service Network and can also be obtained from Sales Agencies.

Precautions for work on the system



- **Interventions on the electrical system (e.g. removal of cables, addition of circuits, replacement of equipment or fuses etc.) carried out in a manner which is not compliant with IVECO's instructions or carried out by non qualified personnel, can cause severe damage to on-board systems (control units, wiring, sensors etc.), affect driving safety and good operation of the vehicle and cause serious damage to the vehicle (e.g. short circuits with the possibility of fire risk or destruction) which is not covered by warranty.**

Before removing any electrical/electronic equipment, disconnect the ground cable from the battery negative pole and then the positive cable.

To prevent damage to the vehicle's electrical system, follow the instructions of the cable manufacturer.

- The cables must have suitable sectioning for the type of load and the position of the load in the vehicle.
- The power cables (+ direct) must be:
 - individually intubated in conduits (of suitable diameter) and not together with other different cables for signal and negative;
 - placed at least 100 mm (reference value = 150 mm) from high heat sources (turbine, engine, exhaust manifold, etc.);
 - placed at least 50 mm from containers of chemical agents (batteries, etc.);
 - placed at least 50 mm from moving parts.
- The path of the cables must be defined with brackets and clamps dedicated and reconciled, to avoid hanging parts and to be able to restore the same installation after repairs or interventions.
- The cables must have a suitable sectioning for the type of load and the position of the load in the vehicle.
- The passage of cables through holes and on the edges of metal sheets must be protected by cable gaskets in addition to the corrugated tube
It is not possible to specially drill the chassis to allow the cables path.
- The corrugated tubing must completely protect the entire cable and be connected (with heat shrinking or taping) to the rubber caps on the terminals.
- All the positive terminals and cable terminals must be protected by rubber caps (for hermetic in areas exposed to weathering or with possible stagnation of water).

Use fuses with the prescribed capacity for the specific function, and do not under any circumstances use higher capacity fuses.

Restore the original condition of the wiring (paths, protections, strips) completely avoiding the cable to come in contact with metallic surfaces of the structure that can impact the integrity.

Precautions for work on the chassis

For work on the chassis, to protect the electrical system, its equipment and ground connections, respect the precautions shown in Chapter 2.1 - Paragraph "Special precautions (► Page 5)" and Chapter 2.3 - Paragraph "precautions (► Page 14)".

In cases where the application of additional devices requires it, the installation of protective diodes for inductive current spikes must be provided for.

The ground signal from the analogue sensors must be wired exclusively on the specific receiver; additional ground connections may distort the output signal from this sensor.

The cable bundles for low signal intensity electronic components must be arranged parallel to the metal plane of reference, that is adherent to the chassis/cab structure, in order to minimise parasitic capacities; space the path of the cable bundle added to the existing one as much as possible.

The added systems must be connected to the ground of the system with the utmost care (see Chapter 5.4 - Paragraph "Ground points (► Page 16)"); the related wiring harnesses should not be coupled to the electronic circuits that already exist on the vehicle in order to avoid electromagnetic interference.

Ensure that the wiring of the electronic devices (length, type of conductor, dislocation, strips, cable shielding connection, etc.) comply with the original IVECO provision.

Carefully restore the original system after any operations.

Starting the engine



Attention!

Starting the engine Warning

- ▶ **If the failed operation is due to low battery voltage and there are no problems with the electrical system, do not tow the vehicle in order to start the engine.**
- ▶ **In order to prevent any damage to the engine, when starting ensure that there is sufficient fuel in the tanks.**
- ▶ **Attempting to start the engine with an insufficient amount of the fuel can seriously damage the injection system.**
- ▶ **Do not start the engine without first connecting the battery permanently.**
- ▶ **Only recharge the battery after having disconnected it from the vehicle circuit.**
- ▶ **It is strictly forbidden to use a quick battery charger for emergency start-up: due to the high voltage applied, the electronic systems and in particular the control units which manage the ignition and power supply functions could be damaged.**

Start-up with auxiliary methods must be carried out only using the external battery trolley, according to the following procedure:

- respect all applicable regulations for prevention of accidents (including the use of gloves);
- use a battery trolley with specifications similar to those of the vehicle assembly;
- using a suitable cable, connect the positive pole of the battery trolley to the positive pole of the CBA2 installed in the engine compartment (see Figure 5.33 Paragraph "Current draws (► Page 33)");
- using a suitable cable connect the negative terminal of the battery trolley to vehicle ground with the battery discharged;
- in the event of engine start-up on vehicles with manual transmission: turn the key to ON and wait until all the lights of the motor on the instrument panel disappear. Start the vehicle engine. The starter motor must not be used for more than 10 seconds. Do not press the accelerator pedal during start-up;
- in the event of engine start-up on vehicles with automatic transmission: turn the key to ON and press the brake pedal; turn the key to ON and wait until all the lights of the motor on the instrument panel disappear and "Transmission OK" appears on the display. Start the vehicle engine. The starter motor must not be used for more than 10 seconds. Do not press the accelerator pedal during start-up;
- wait for the vehicle engine to reach the minimum speed;
- do not activate the electrical components of the vehicle, e.g. low beams, heater, to allow the accumulation of a sufficient quantity of energy and to avoid any current spikes that may damage the electronic control units when the battery trolley is disconnected;
- first disconnect the negative terminal of the vehicle and then the negative pole of the battery trolley;
- first unplug the cable from the positive pole of the CBA2 installed in the engine compartment and then from the positive pole of the battery trolley;
- afterwards the battery must be recharged in any case by disconnecting it from the circuit with the correct slow and low current recharging procedure;
- do not use other devices (battery charger) to start the engine. When in doubt, contact the IVECO assistance network.



- ▶ **Any damage to the electronic control units caused by failure to comply with the procedure described above is not covered by warranty. For precautions to be implemented on installed units see Chapter 5.3.**

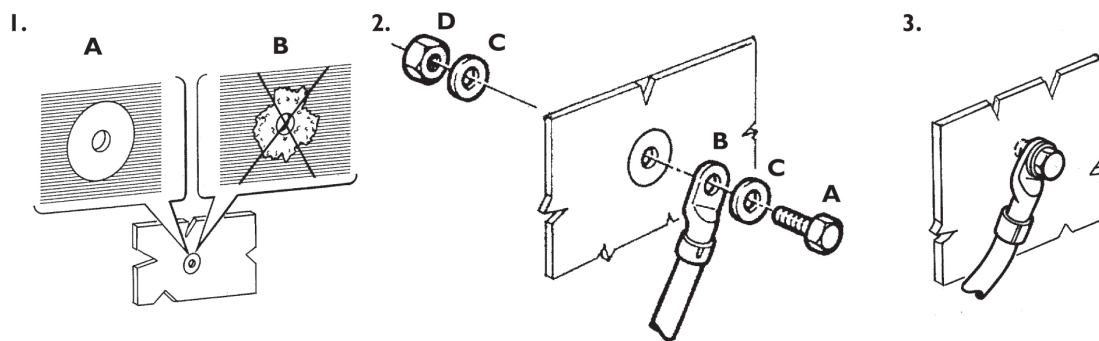
Ground points

In general, original vehicle ground connections are not to be modified; in cases where these connections must be moved or new connections added, use the holes present on the chassis to the extent possible, taking care to:

- mechanically remove - either by filing and/or with a suitable chemical based solution - the paint on both the chassis and terminal side, thus creating a contact surface free of indentations and edges;
- paint the area between the terminal and metal surface with a suitable high conductivity paint
- connect to earth within 5 minutes after application of the paint.

As regards the signal related ground connections (e.g. sensors or low-absorption devices), do not use the standardized points. Under no circumstances use standardized points for engine ground connection and chassis ground connection.

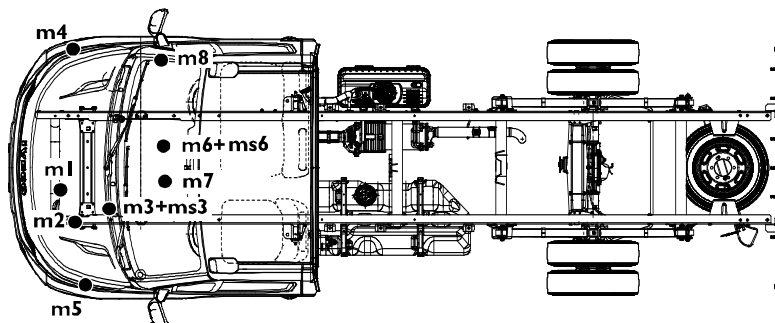
Additional signal grounds must be positioned at different points from the power ground.



191316

Figure 9

1. Ground connections: (A) connection is correct; (B) connection is incorrect
2. Correct cable fastening to the ground point using: (A) screw, (B) cable terminal, (C) washer, (D) nut
3. Cable connected to ground

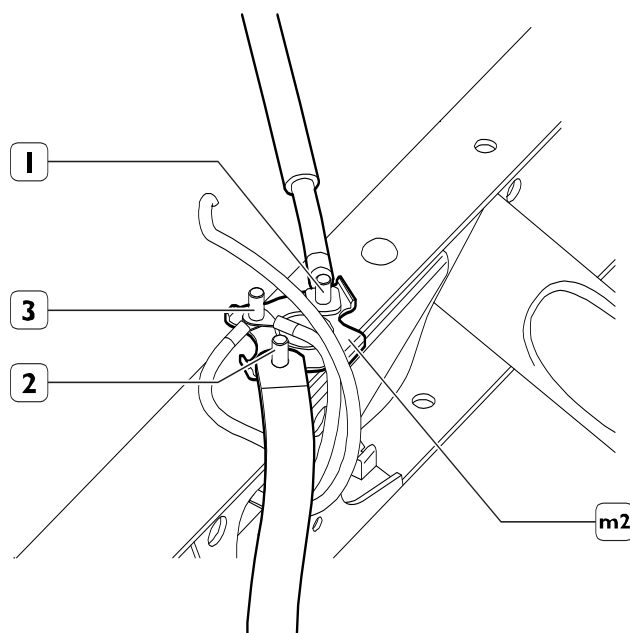


208939

Figure 10

Position of ground points on vehicle

- | | | | |
|---------|---|---------|---|
| m1. | Ground on crankcase | m5. | Engine compartment ground near front left headlight |
| m2. | Engine compartment ground on left chassis side member | m6/ms6. | Cab interior ground, central section |
| m3/ms3. | Engine compartment ground under servobrake | m7. | Cab interior ground, central section |
| m4. | Engine compartment ground near front right headlight | m8. | Cab interior ground, front right section |

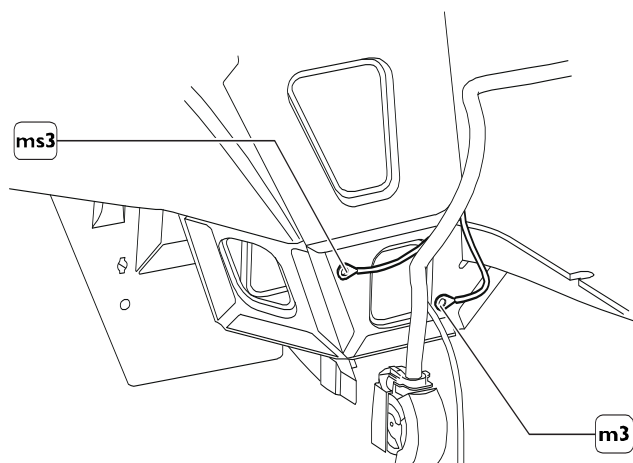


208940

Figure 11

m2. Engine compartment ground on left chassis side member

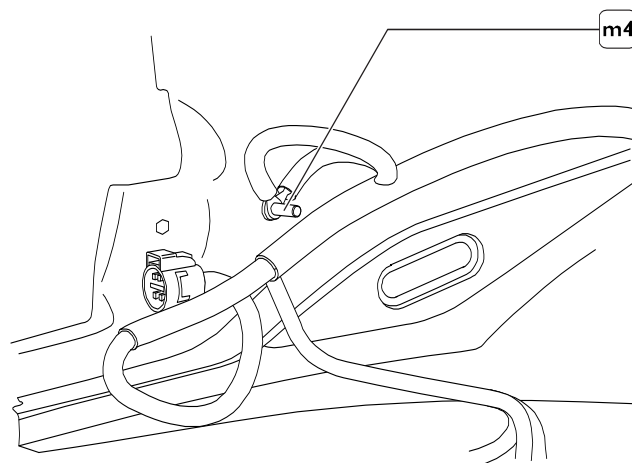
1. Engine earth
2. Battery ground
3. Chassis cable ground



208941

Figure 12

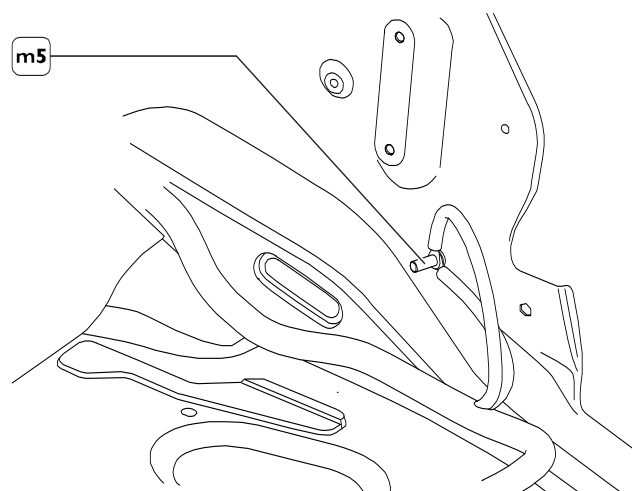
m3/ms3 Engine compartment signal/power ground below servo-brake



208942

Figure I3

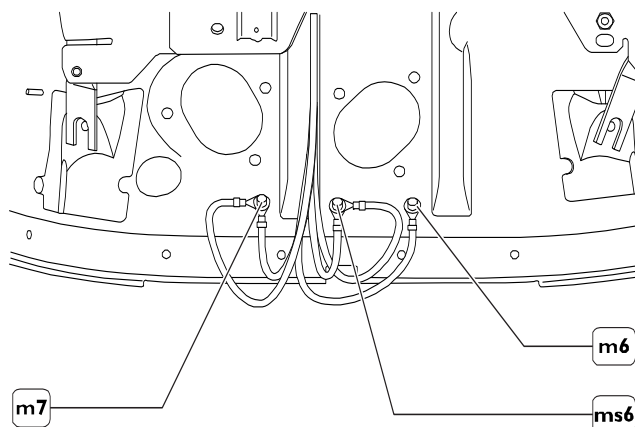
m4. Engine compartment ground near front right headlight



208943

Figure I4

m5. Engine compartment ground near front left headlight

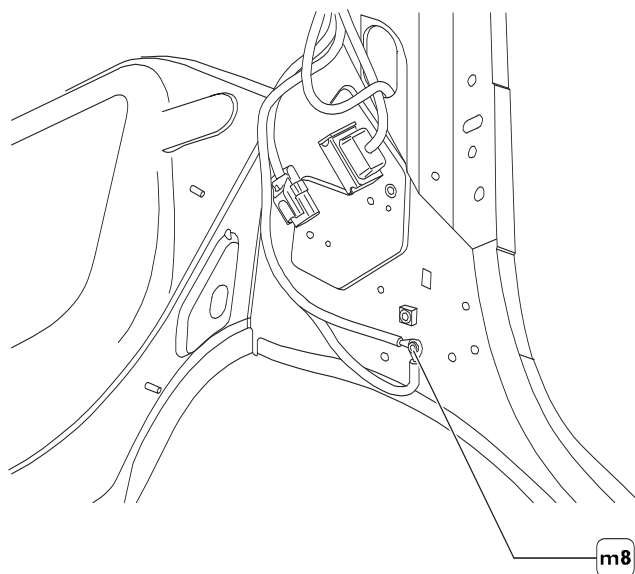


208944

Figure 15

m6/ms6. Signal/power ground inside cab on the central body panel below the tachograph

m7. Ground inside cab on the central body panel below the tachograph



208945

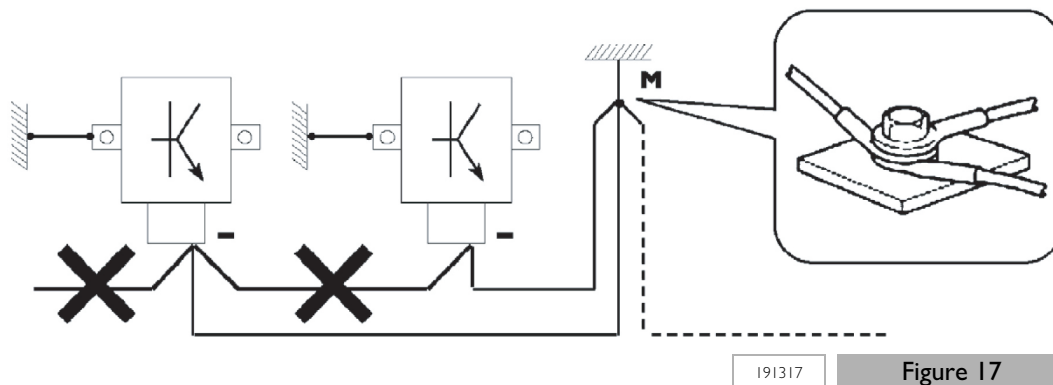
Figure 16

m8. Cab interior ground, front right section

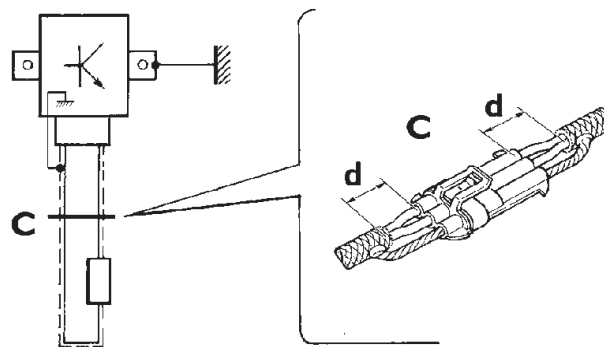
The negative leads connected to a ground point in the system must be as short as possible and must be connected to each other in a "star" formation, while tightening must be done in an orderly and adequate manner.

As far as electronic components are concerned, the following instructions should be followed:

- electronic control units must be connected to the system ground when equipped with metal housings
- the negative cables of the electronic control units are to be connected to a system ground point, connected to the negative terminal of the battery;
- the analogue grounds (sensors), while not being connected to the system ground/negative terminal of the battery, are to have good conductivity. Consequently, particular care should be given to terminal parasitic resistances: oxidation, scratches, etc
- the metal braid of the shielded circuits must be in electrical contact only at the control unit side to which the signal is to be sent
- In the presence of junction connectors the unshielded section d, near them, should be as short as possible;
- The cables must be routed in such a way as to be parallel to the reference plane, as close as possible to the chassis/body.



"STELLA" connections of various negatives with the system ground



Shielding by means of a metal braid of a cable leading to an electronic component

Electromagnetic comparability

It is recommended that electrical, electro-mechanical and electronic devices which comply with the following immunity requirements for electromagnetic emissions, both irradiated and conducted, are used, as shown below:

The level of electromagnetic immunity of the electronic devices equipping the vehicle at a distance of one metre from the transmitting aerial must be:

- 50 V/m immunity for devices performing secondary functions (not impacting on direct vehicle control), for frequencies varying from 20 MHz to 2 GHz
- 100 V/m immunity for devices primary secondary functions (not impacting on direct vehicle control), for frequencies varying from 20 MHz to 2 GHz;

The maximum excursion allowed for transient voltage with appliances powered at 12 V is +60 V, measured at the terminals of the artificial network (L.I.S.N.) if tested at the bench; otherwise, if tested on the vehicle, the excursion must be recorded in the most accessible location close to the disruptive device.

Note Devices powered at 12 V be immune to interferences such as negative spikes of -300 V, positive spikes of +100 V, bursts of +/- 150 V.

They must operate correctly during the phase when voltage drops to 5 V for 40 ms and to 0 V for 2 ms.

They must also resist the load dump phenomena up to 40 V.

The maximum radiated emission levels measured at the bench and the levels of conducted emissions generated by devices and also by 12 V power supplies are given in the following table:

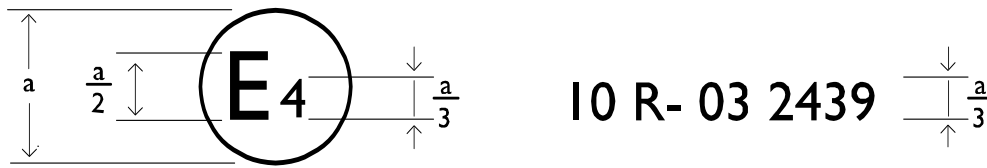
Table 5.6 - Electromagnetic emission levels

Type of emission	Type of transducer	Type of disturbance	Type of detector	Frequency range and limits acceptable in dBµV/m									Unit of measurement
				150-300 kHz	0.53-2 MHz	5.9-6.2 MHz	30-54 MHz	68-87 MHz mobile services only	76-108 MHz broadcast only	142-175 MHz	380-512 MHz	820-960 MHz	
radiated	Aerial at a distance of 1 metre	Broad-band	almost peak	63	54	35	35	24	24	24	31	37	dBµV/m
radiated		Broad-band	peak	76	67	48	48	37	37	37	44	50	
radiated		Narrow band	peak	41	34	34	34	24	30	24	31	37	
conduit	LISN 50 Ω 5 µH 0.11 µF	Broad-band	almost peak	80	66	52	52	36	36	Not applicable			dBµV
conduit		Broad-band	peak	93	79	65	65	49	49				
conduit		Narrow band	peak	70	50	45	40	30	36				

Use electrical/electronic equipment in compliance with the UNECE directive on electromagnetic compatibility.

Only components with certified approval and with mark "e" are allowed: the "CE" marking is not sufficient.

By way of example, the mark prescribed by the current UNECE 10R3 on electromagnetic compatibility in the automotive field is shown below:



191312

Figure 19

$a \geq 6 \text{ mm}$

The values in the table are only to be considered respected if the device comes from "IVECO Spare Parts" or it has been certified as per the international standards ISO, CISPR, VDE etc.

Whenever equipment is used which runs on mains power (220 V AC) for its primary or secondary source of power, it must be checked to ensure that its characteristics are in line with IEC regulations.

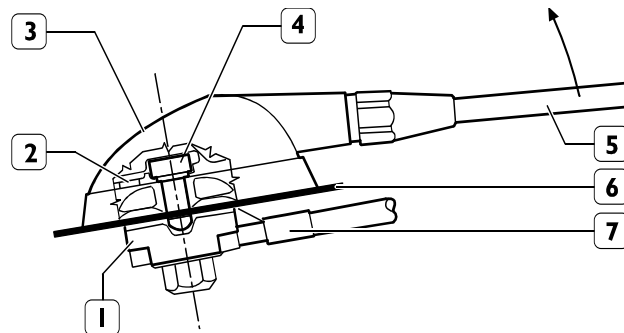
Reception/transmission systems

The most frequent applications include:

- amateur receiver-transmitter units for CB (City Band) and 2 m bands.
- GPS receiver and satellite navigation units.

General instructions

1. The equipment must be approved according to the law and be of a fixed nature (not portable).
The use of non approved transmitters or supplementary amplifiers could seriously impede the correct functioning of the electrical/electronic devices normally supplied, with negative effects for the safety of the vehicle and/or the driver.
2. The system already provided on the vehicle must be used to power the transmitters and they must be connected to terminal K30 of the connector ST40 (and K15 where necessary) via a supplementary fuse.
Any additional power lines must be created respecting the correct sizing of cables and protection.
3. The coaxial antenna cable must be positioned taking care to:
 - use a low loss, top quality product with the same impedance as the transmitter and the antenna (see Figure 21);
 - in order to avoid interference and malfunctioning, create a path (the shortest possible) which maintains a suitable distance (min. 50 mm) from pre-existing cabling or from other cables (radio, amplifiers and other electronic equipment), keeping the minimum distance from the metal structure of the cab and using existing holes in the sheet metal;
 - do not shorten or lengthen; avoid unnecessary tangles, tension, folds and crushing.
4. Outside the cab, the antenna must be installed on the vehicle on a metal base with a wide surface; it must also be fitted as vertically as possible with the connection cable pointing downwards and therefore following the Manufacturer's fitting instructions and warnings (see Figure 20).
Installation at the centre of the roof is to be considered the absolute best as the ground plane is proportional in all directions.
Inside the cab, the transmitter equipment must be positioned as shown in Figure 22.
5. The quality of the antenna, the mounting position and a perfect connection to the vehicle structure (ground) are factors of fundamental importance to guarantee the best performance of the transmitter equipment.

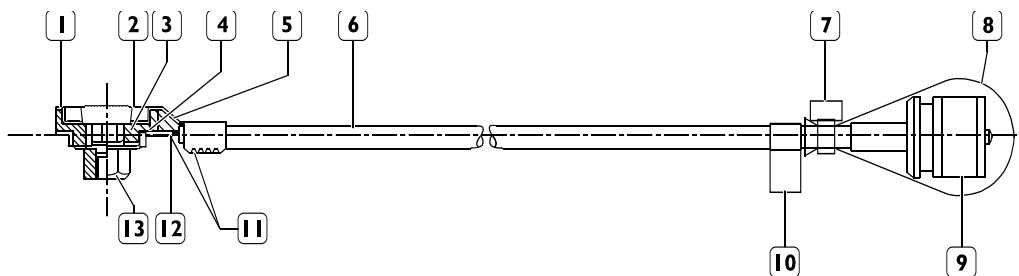


98915

Figure 20

1. Antenna support
2. Gasket
3. Fixed joint cover

4. Fastening screw M6x8.5 (tighten to a tightening torque of 2 Nm)
5. Aerial
6. Roof panel
7. Antenna extension cable



99349

Figure 21

1. Antenna connector
2. Ground wire
3. Insulator
4. Signal wire
5. Condenser (100 pF)
6. Cable RG 58 (characteristic impedance = 50 Ω)
7. Clamp
8. Protection cap

9. Connector (N.C. SO - 239) transreceiver side
10. Test executed sticker
11. The 100 pF condenser must be soldered on the lower pin and crimped to the ground braid
12. The lower pin must be soldered to the core conductor of the cable
13. Nut

Some specific instructions are given below for each type of equipment.

Amateur equipment for CB (27 MHz) and 2 m band (144 MHz)

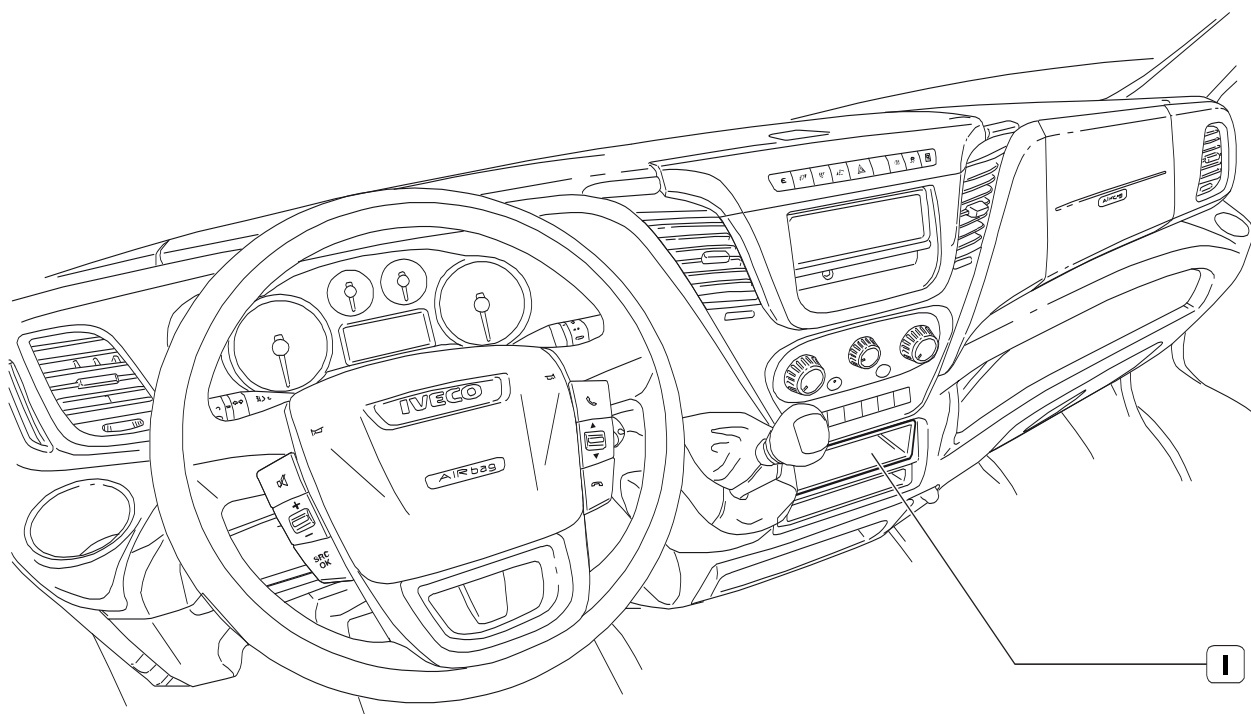
The transmitter part must be installed in a separate area from the vehicle's electrical components; if the transmission is impulsive it must be at a distance of least one metre away from other devices.

- The ROS value (Stationary Wave Ratio) must be as close as possible to the unit (the recommended value is 1.5), while the maximum acceptable value must never be greater than 2.
 - The ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the typical CB band (26.965-27.405 MHz).
 - The IRRADIATED FIELD in cab value must be as low as possible, and however < 1V/m.
- In any case, limits set by the applicable European legislation must never be exceeded.

To determine whether the system is functioning well and to check that the antenna is calibrated, it is suggested that the following information is taken into account:

1. if the ROS (Stationary Wave Ratio) is higher on the lower channels than on the higher ones, the antenna should be lengthened
2. if the ROS (Stationary Wave Ratio) is higher on the higher channels than on the lower ones, the antenna should be shortened

After having calibrated the antenna, it is advisable to re-check the ROS (Stationary Wave Ratio) value on all the channels.



208937

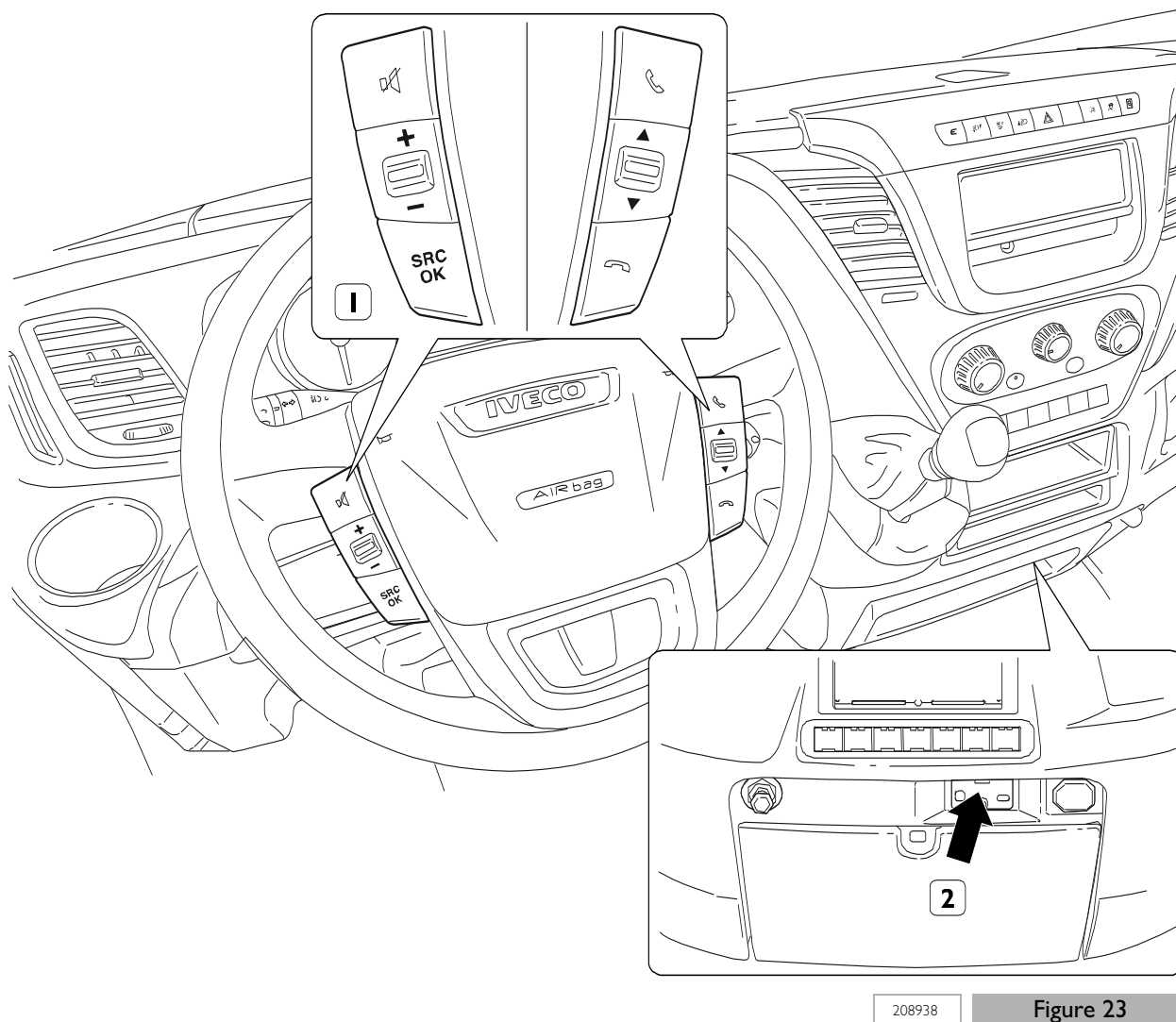
Figure 22

I. Location of the CB receiver-transmitter equipment

Bluetooth setup

The Bluetooth setup consists of:

- specific control unit, positioned above the radio and hidden by a plastic cover,
- buttons on the steering wheel;
- ceiling fixture with microphone;
- USB socket;
- wiring.



208938

Figure 23

1. Buttons on the steering wheel

2. USB socket

For cowl version vehicles the ceiling fixture with microphone is provided in the box of accompanying material.

If installation in the cab requires it, the microphone can be removed and recovered; its position, however, must be made at a point as far away as possible from sources of noise and with respect to the reception area described in the following image.

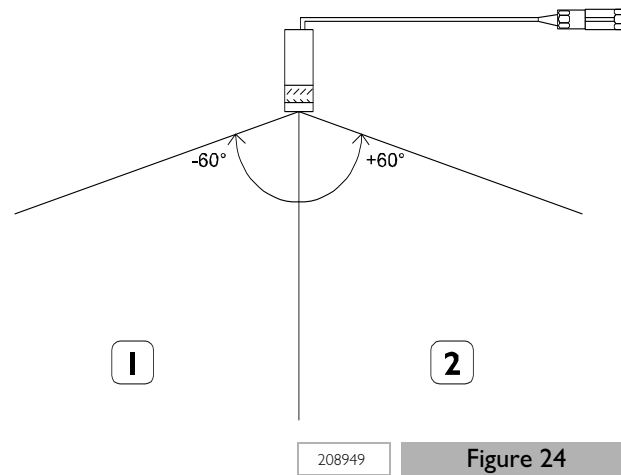


Figure 24

1. Driver's side

2. Passenger side

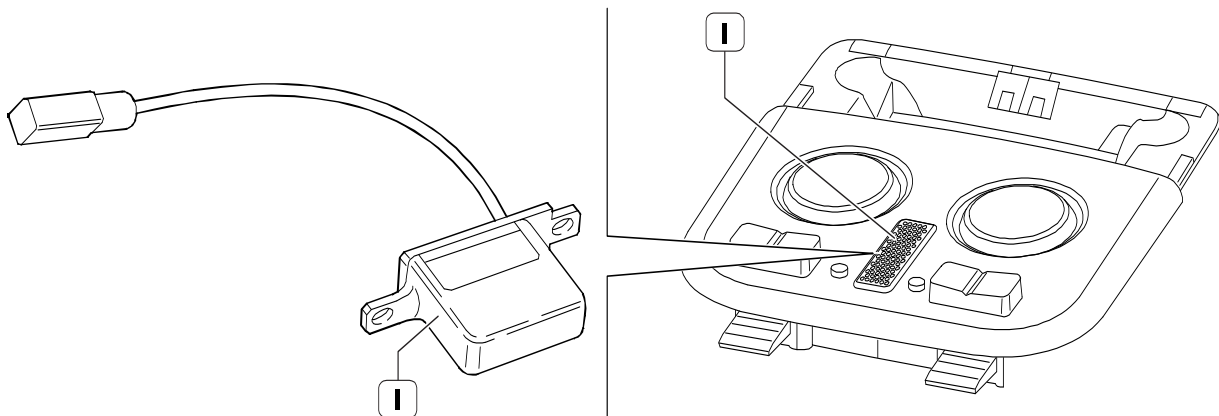


Figure 25

1. Bluetooth microphone

Table 5.7

Pin	Description	Cable		
1	Ground	White		
2	Signal + Vcc	Shielded		

The connector of the microphone connection, on the cab wiring side, is located in correspondence with the ceiling connectors.

GPS reception and satellite navigation equipment

Install the transmitting part in a flat, dry area, separate from the electronic components of the vehicle, away from humidity and vibrations. If the transmission is impulsive it must be at a distance of at least one meter away from other devices.

The GPS antenna must be installed so as to have the maximum visibility possible of the sky.

In fact, as the signals received from the satellite are at very low power (approximately 136 dBm), almost any obstacle can influence the quality and performance of the receiver.

The following should therefore be guaranteed:

- an absolute minimum angle of vision of the sky of 90°
- a distance no less than 30 cm from any other antenna
- a horizontal position and never underneath any metal which makes up part of the cab structure.

Moreover:

- the ROS value (Stationary Wave Ratio) must be as close as possible to the unit (the recommended value is 1.5), while the maximum must never be greater than 2 in the GPS frequency range (1575.42 ± 1.023 MHz).
- the ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the 1575.42 ± 1.023 MHz band.

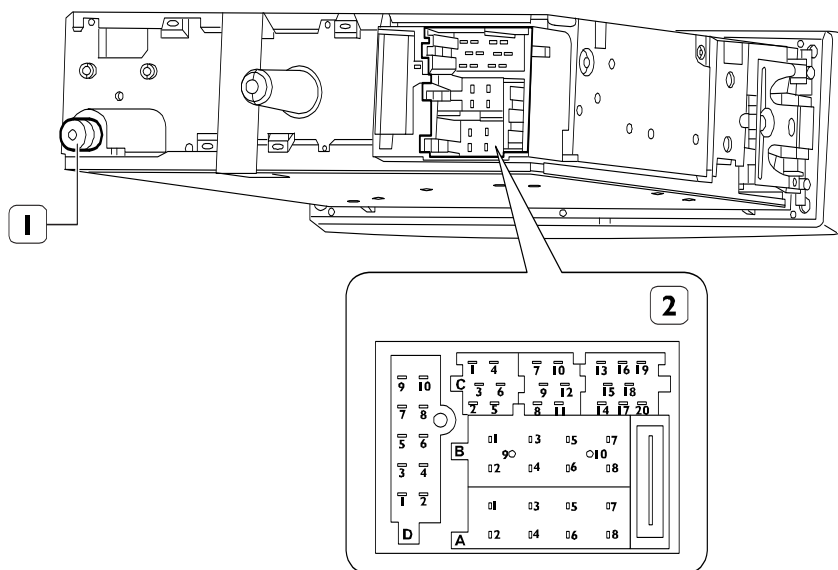
Radio installation

The original IVECO radio, either as original equipment or aftermarket, is integrated into the system on the CAN network and allows:

- repeat messages on the comfort dashboard panel;
- volume adjustment depending on vehicle speed;
- integration with Convergence V2 system;
- integration with Bluetooth system;
- recognition/antitheft system with Body Computer.

Other types of radio do not allow access to the previously listed functions.

The terminals available for installation are listed in Figure 26.



208948

Figure 26

1. Antenna connector

2. Radio connector

Table 5.8

Connector block	Pin	Description
A	1	CAN H (Low speed – high signal)
	2	Not connected
	3	CAN L (Low speed signal - low)
	4	Ignition (+12 V)
	5	12V switch (output) maximum 150 mA
	6	Lighting
	7	Battery (+ 12V)
	8	Ground
B	1	Right door panel speaker +
	2	Right door panel speaker -
	3	Tweeter right column +
	4	Tweeter right column -
	5	Tweeter left column +
	6	Tweeter left column -
	7	Left door panel speaker +
	8	Left door panel speaker -
C	1-17	Not connected
D	1-10	Not connected



- **Caution:** the connection is standard but the signal settings are not. In the case of installation of devices different from the official IVECO product, see the relative documentation and verify the correspondence of the signals present on the connector to interface with the vehicle.

Additional equipment

Power for the equipment, when the voltage required is different to that for the system, must be obtained using a suitable DC/DC 12-24V converter if not already provided. The power cables must be as short as possible, avoiding any twists (coils) and maintaining the minimum distance from the reference plane.



- ▶ **If devices are fitted which could interact with the electronic systems already present (retarders, additional heaters, power take-offs, air conditioners, automatic gearboxes, telematics and speed limiters) contact IVECO to optimize the application.**

Note For operations that may interfere with the basic framework, it is necessary to run diagnostic checks to ensure the correct installation of the system. These tests can be performed using the ECU (electronic control units), on-board diagnostic or IVECO service. IVECO reserves the right to lapse the guarantee on the vehicle if any work not in accordance with its guidelines is performed.



- ▶ **The use of non approved transmitters or supplementary amplifiers could seriously impede the correct functioning of the electrical/electronic devices normally supplied, with negative effects for the safety of the vehicle and/or the driver.**



- ▶ **Any damage to the system caused by the use of non-certified transceivers and the application of additional amplifiers is not covered by warranty.**

The vehicle system is set up to supply the necessary power to the equipment provided, for each of which, as part of their function, the specific protection is assured as well as the correct sizing of cables.

The installation of additional equipment must include suitable protections and should not overload the vehicle system.

The connection of the added users to ground must be made with an adequately sectioned cable, as short as possible and made to allow for any movements of the added equipment with respect to the chassis of the vehicle.

Having the need for higher capacity batteries, due to added loads, it is appropriate to request the optional with increased batteries and alternators.

In any case, when increasing battery capacity, it is advisable not to exceed 20-30% of the maximum values provided as optional by IVECO, so as not to damage some of the components (e.g. starter motor). When higher capacities are necessary, use additional batteries, making the necessary provisions for recharging as indicated below.

Additional batteries

The addition of a battery in the vehicle electrical system requires the provision of a circuit that, during start-up, makes it possible to section this battery with respect to the original. Given the new "smart" recharge strategies, the auxiliary battery must be equivalent to the originally installed battery and must have the same capacity (110 Ah).

The batteries can be traditional or "recombination" (AGM or gel).

Due to the normal chemical reaction that generates acid vapours during charging, installation must be performed in a way that ensures the safety of people and the protection of the vehicle.

Therefore, regardless of the type of battery, if you do not already have a segregated compartment, it is necessary to:

- a) provide an airtight container corresponding to the passenger compartment, equipped with a system that vents vapours to the outside of the vehicle,

or

- b) use a battery equipped with a lid with a vapour extraction system, anti-backfire (flame arrestor) system and a vent tube to the outside of the housing.

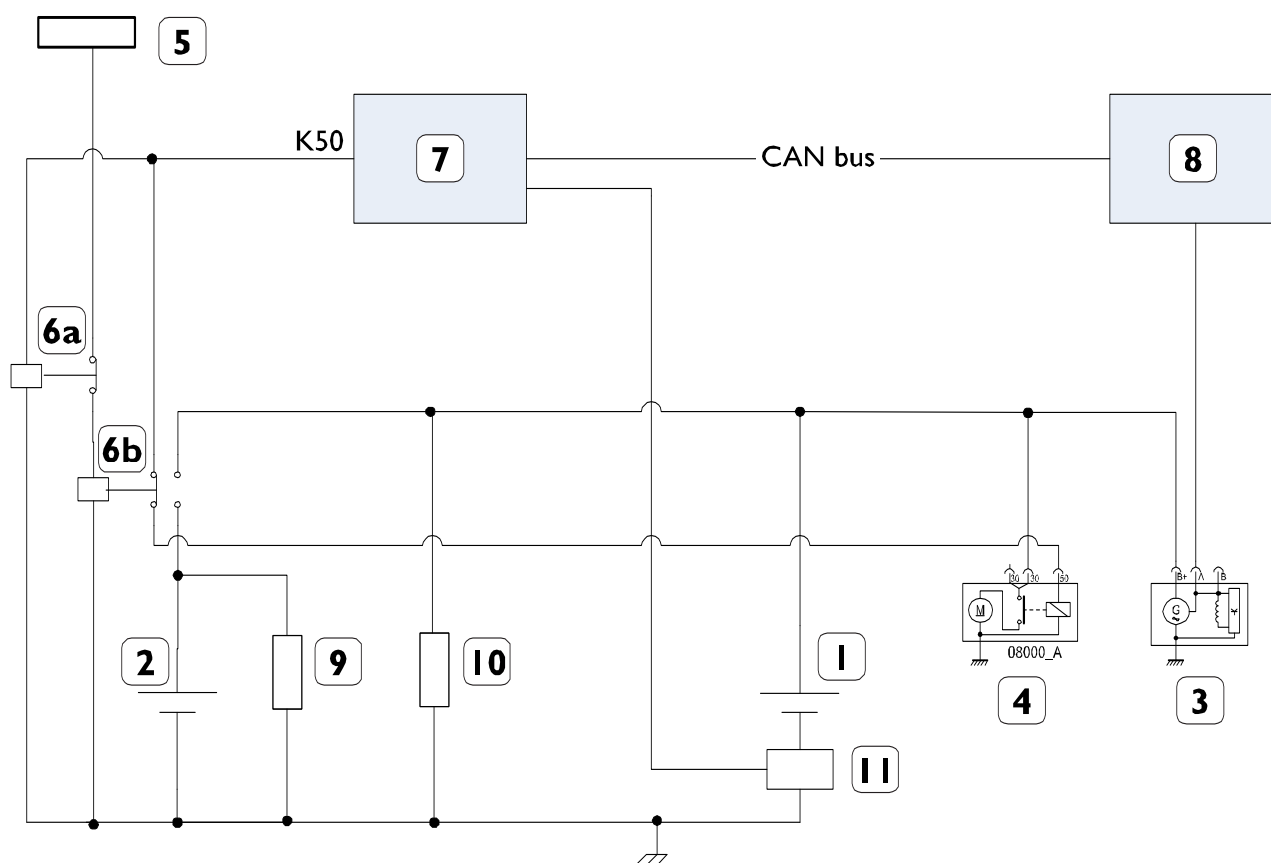
Also bear in mind that:

- vent systems should not cause depression inside the battery;

- the vapour release point must not be in areas where sparks can be triggered or near heat sources;
- the maximum allowable temperatures, for a short period of time, are 50°C for conventional batteries and 40°C for AGM or gel batteries.



- **Ground connection of the additional battery is to be made using a cable of adequate section, as short as possible.**



208936

Figure 27

- | | |
|---------------------------------------|-----------------------------------|
| 1. Standard battery | 7. Body Computer |
| 2. Additional batteries | 8. Engine Management control unit |
| 3. Alternator with built-in regulator | 9. Auxiliary load |
| 4. Starter motor | 10. Vehicle load |
| 5. Ignition switch | 11. LIN bus |
| 6. Contactor switches | |



- **All the lines downstream of all batteries are to be adequately protected, under any fault condition. Failure to ensure adequate protection may pose a fire hazard and a danger to persons.**

Additional alternators

a) the diesel-powered NEW DAILY is equipped with an advanced ("smart") alternator commanded by the engine control unit. This alternator is capable of delivering electrical current only when it is really necessary, and is able to always guarantee a correct state of battery charge through the sensor on the negative pole.

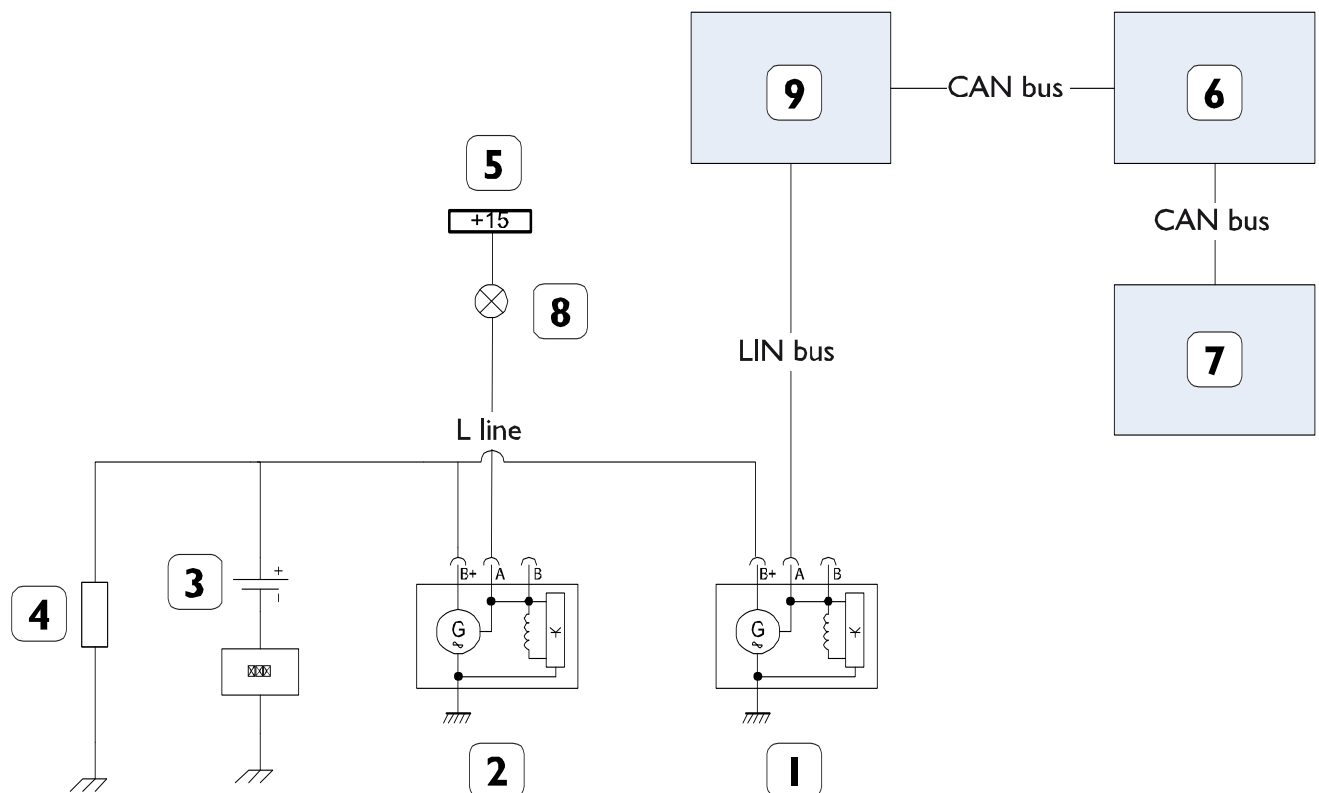
In cases where there are very onerous electrical loads a second alternator may be used, and it must be installed (with all mechanical requirements necessary for compatibility with the vehicle and under responsibility of the body builder) according to the diagram in Figure 28.

The additional alternator must be of the traditional type, with pin L connected in order to ensure excitation with a current between 150 and 200 mA. The diagnostic light is optional, but a resistance is still necessary to ensure excitation.

Dual alternator operation requires that the additional traditional alternator is the one that delivers in any condition (as it is not controlled), while the original "smart" alternator intervenes when the electrical balance becomes negative (the battery charge status is monitored)

The diagnosis of the two alternators is ensured by:

- a battery indicator on the instrument panel, with regard to the first alternator
- an external diagnostic light (if installed) for the additional alternator



208950

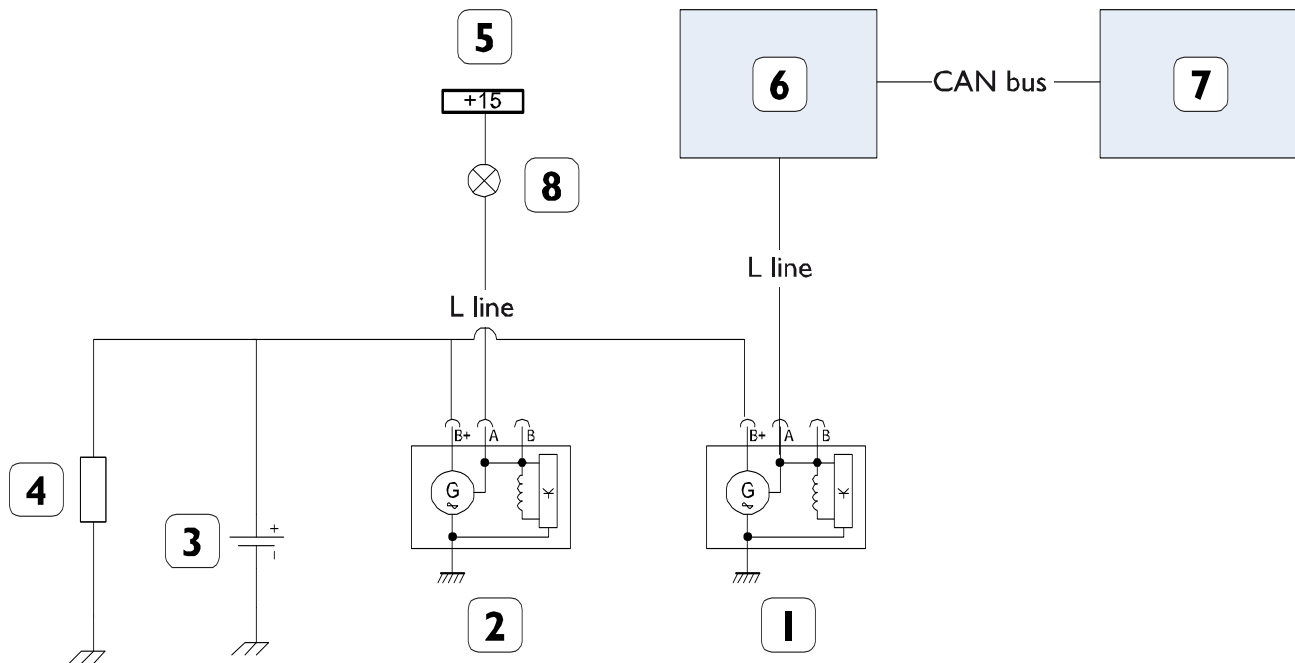
Figure 28

1. "Smart" first use alternator
2. Additional standard alternator
3. Battery
4. Electrical loads
5. Signal +15 from ignition switch

6. Body Computer
7. Instrument panel
8. Diagnostics Lamp or LED +Res. (current between 150 and 200 mA)
9. Engine Management control unit

b) On the CNG powered NEW DAILY the "smart" alternator is not provided and the connection between alternators must be made as in Figure 29.

The first equipment alternator has the L line connected directly to the Body Computer which carries out excitation and diagnosis, while the additional alternator is connected, as for the previous version, with a diagnostic light and external excitation.



209811

Figure 29

1. Standard first use alternator
2. Additional standard alternator
3. Battery
4. Electrical loads
5. Signal +15 from ignition switch
6. Body Computer
7. Instrument panel
8. Diagnostics Lamp or LED +Res. (current between 150 and 200 mA)

The installation of additional equipment must include suitable protections and should not overload the vehicle system.

In cases where it is necessary to use an additional battery in parallel with the series, we recommend the use of a larger alternator or the installation of an extra alternator.

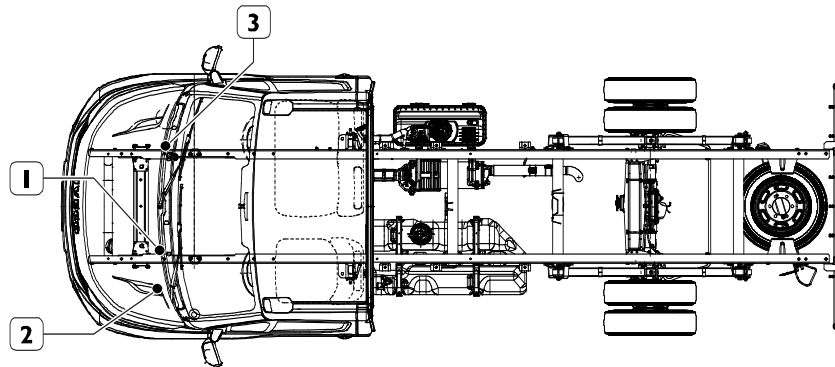
The additional alternators must be the type with Zener diode rectifiers to avoid damaging electric/electronic equipment due to accidental battery disengagement. Each alternator must also have a light or LED indicating low battery charge.

The additional alternator must have electrical features identical to those of the standard alternator and the cables must be correctly sized.

If you need to modify the system in a way other than described in this manual (for example, adding batteries in parallel), it is necessary to share the operation with IVECO.

Drawing current

Information about the points where you can take samples of available current and directions to be followed are below.



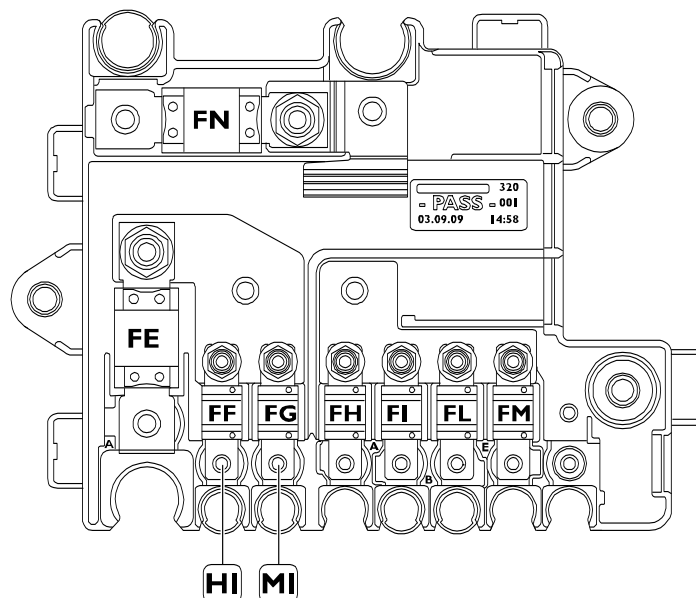
209809

Figure 30

1. CBA2
2. Cable path between cab and engine compartment
3. Body builders Connector (inside cab)

Current sample from the CBA2 control unit in the engine compartment

There are two fuses (FF and FG) installed in CBA2, reserved for the body builders; the terminals **(HI)** and **(MI)** downstream of these fuses are the only two points reserved and authorised for sampling currents.



209810

Figure 31

HI. Current take off point protected by Body builders fuse FF

MI. Current take off point protected by Body builders fuse FG

The fuses for body builders supplied with the original equipment have a capacity of 30 A each.

If necessary they can be replaced with ones of a higher load respecting the indication of a maximum total withdrawal (sum of the two fuses) equal to 130 A.

Precautions

In general it is advisable to:

- adopt, where necessary, adequate protection fuses applied in the vicinity of the sample;
- protect cables inserted into the proper sheathing or corrugated cables, installing according to the recommendations in Chapter 5.4 (➡ Page 13) - Paragraph: "Precautions for operations on the system".

And in CBA2 installation it is necessary to:

- avoid removing the fuses from their position;
- put the terminals on the studs and secure them with the nuts (M5 flanged nut, self-locking, etc.), tightening to torque (4 to 6 Nm);

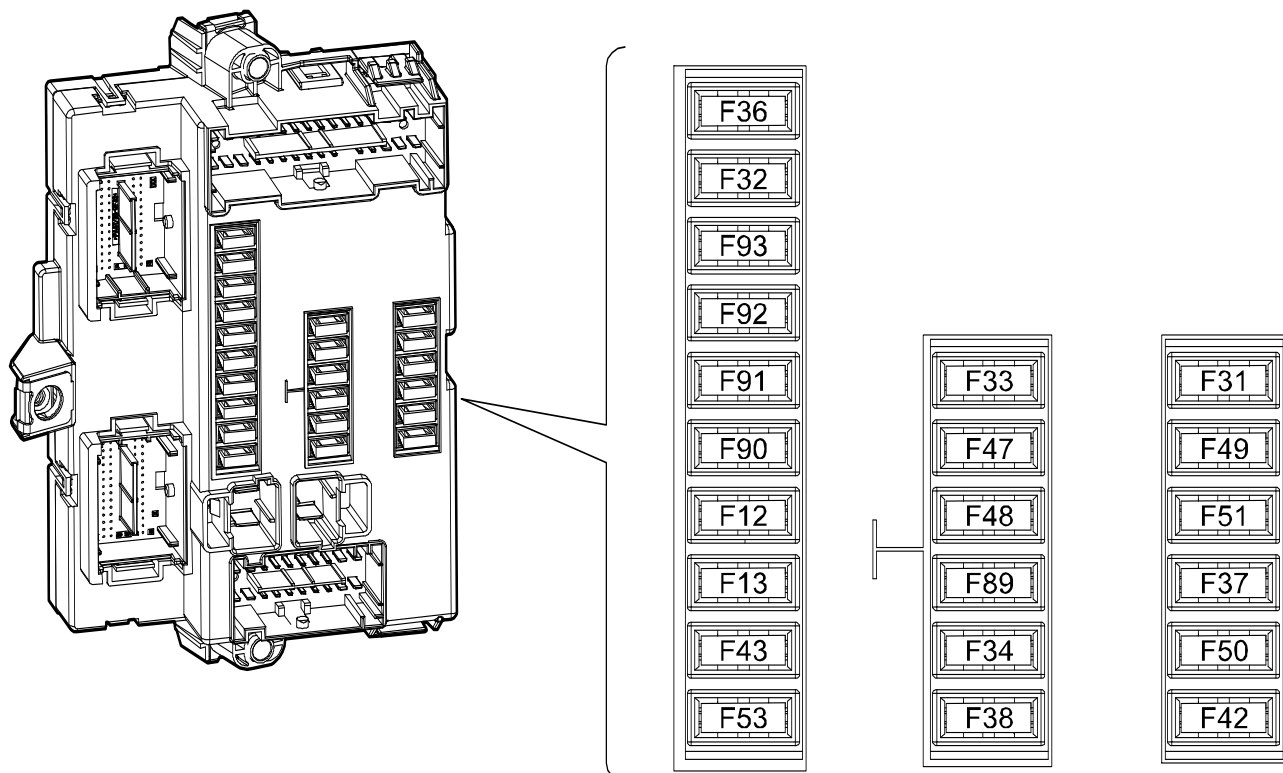


► **It is absolutely forbidden to draw current from unauthorised points. FIRE HAZARD.**

Fuses and relays on the Body Computer

The Body Computer is located on the left side of the dashboard and is housed in a special compartment, closed by and interlocking drawer.

The provision of the fuses is shown in Figure 32 (relays are not visible).



I62235

Figure 32

Table 5-9 - List of Fuses on Body Computer

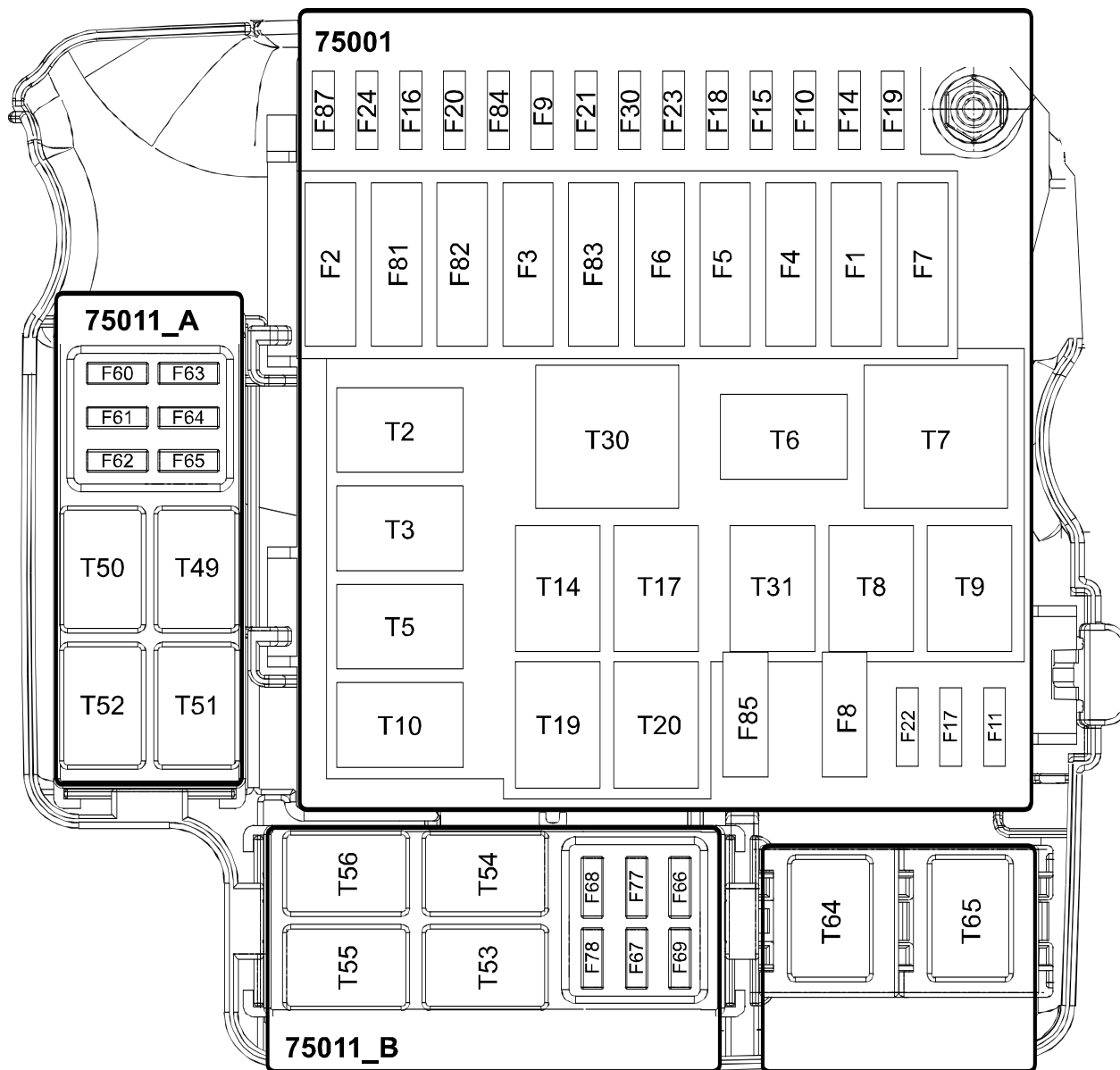
Location	Amperage [A]	Description
F12	–	Spare
F13	–	Spare
F31	5	Coils of T17 - T19 - T30 - T50 - T52 - T53 - T64
F32	–	Spare
F33	15	Outswinging - 13 poles
F34	20	Body builders socket
F36	15	EOBD - Antitheft siren - Radio - Tachograph
F37	7.5	Dashboard - Stop lights
F38	20	Central locking
F42	5	ESP - Speed sensor
F43	20	Windscreen washer
F47	25	Driver's side power window
F48	25	Passenger's side power window
F49	5	Ill. Int. and CSS - Tachograph - Telma ECU - ECU exp. mod. - Socket to ECU trailer socket - 13 poles- ECU roto - ECU post. diff. lock. - ECU climate - Steering column
F50	5	ECU Airbag
F51	5	Radio - Park. sensor - PM Light - Gear Sel. - Green Filter TRM - LDWS - Proximity for roto
F53	5	Instrument panel - Timer heat. suppl.
F89	–	Spare
F90	–	Spare
F91	–	Spare
F92	7.5	Left fog light
F93	7.5	Right fog light



► **Use only fuses of the specified type and with the prescribed nominal current. FIRE HAZARD.**

Replace the fuses only after removing the cause of their intervention and verify the integrity of the cables.

Fuses and replays on the engine compartment SCM control unit



208475

Figure 33

Table 5-10 - List of fuses on SCM Diesel version

Location	Amperage [A]	Description
F1	40	pneumatic suspensions
F2	30	Ignition switch
F3	40	Climate control system fans and additional heater
F4	30	ESP (valves)
F5	40	pneumatic suspensions
F6	40	Power supply F61-F62-F66
F7	40	Power sockets and cigarette lighter

5.4 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

Location	Amperage [A]	Description
F8	15	Fuel pump
F9	30	ESVI
F10	7.5	Heated mirrors
F10	15	Heated mirrors and windscreen
F11	15	EDC (main loads)
F14	10	Main relay and automated gearbox
F15	10	Cooling pump
F16	15	Cigarette lighter
F17	10	EDC (secondary loads - not for FIC E5)
F18	–	Spare
F19	7.5	Horn
F20	–	Spare
F21	30	ESVI
F22	25	EDC (main loads)
F23	30	Wiping
F24	20	Power socket
F30	5	Side Marker Lights
F81	20	IBS sensor
F82	70	Body computer (2 nd power supply)
F83	40	Internal cab fans
F84	7.5	Baruffaldi coupling
F85	25	Fuel filter heater
F87	5	ECU EDC and automated gearbox
F60	20	Heated seats
F61	30	Rear differential lock
F62	30	Heated rear windows
F63	10	Blow-By and climate control unit compressor
F64	15	urea
F65	20	urea
F66	15	Headlight washer
F67	7.5	Trailer socket
F68	10	Heated windscreen
F69	–	Spare
F77	5	Unit heater
F78	7.5	Trailer socket

Note F9 of 10A if 8HP70
F21 of 15A if 8HP70

Table 5.11 - List of relays on Diesel version SCM

Location	Amperage	Description
T2	–	Cooling pump
T3	–	Side Marker Lights

Location	Amperage	Description
T5	–	Baruffaldi coupling (from climate control unit)
T6	–	Horn
T7	–	Power drainage of key
T8	–	Fuel pump
T9	–	Main relay
T10	–	Engine start-up prevention
T14	–	Baruffaldi coupling (from EDC)
T17	–	Windscreen wiping (1 st or 2 nd speed)
T19	–	Wiping
T20	–	Modus Diagnosis
T30	–	Internal cab fans
T31	–	Fuel filter heater
T49	–	Urea or Stop & Start
T50	–	Heated windscreen and mirrors
T51	–	Climate control unit compressor
T52	–	Heated rear windows
T53	–	Unit heater
T54	–	TGC
T55	–	TGC
T56	–	TGC
T64	–	Headlight washer
T65	–	Spare

Table 5.12- List of fuses on SCM CNG version

Location	Amperage [A]	Description
F1	40	pneumatic suspensions
F2	30	Ignition switch
F3	40	Climate control unit fans
F4	30	ESP (valves)
F5	40	pneumatic suspensions
F6	40	Power supply F61-F62-F66
F7	40	Power socket and cigarette lighter
F8	15	Fuel pump
F9	30	ESVI
F10	7.5	Heated mirrors
F10	15	Heated mirrors and windscreen
F11	15	Injectors
F14	10	Main relay and automated gearbox
F15	15	Cylinder solenoid valve
F16	15	Cigarette lighter
F17	10	Smart Drive Unit
F18	–	Spare
F19	7.5	Horn

5.4 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

Location	Amperage [A]	Description
F20	–	Spare
F21	30 or 15	ESVI or 8HP70
F22	25	IAW
F23	30	Wiping
F24	20	Power socket
F30	5	Side Marker Lights
F81	20	IBS sensor
F82	70	Body computer (2 nd power supply)
F83	40	Internal cab fans
F84	7.5	Baruffaldi coupling
F85	–	Spare
F87	5	ECU EDC and automated gearbox
F60	20	Heated seats
F61	30	Rear differential lock
F62	30	Heated rear windows
F63	10	Blow-By and climate control unit compressor
F64	–	Spare
F65	–	Spare
F66	15	Headlight washer
F67	7.5	Trailer socket
F68	10	Heated windscreen
F69	–	Spare
F77	5	Unit heater
F78	7.5	Trailer socket

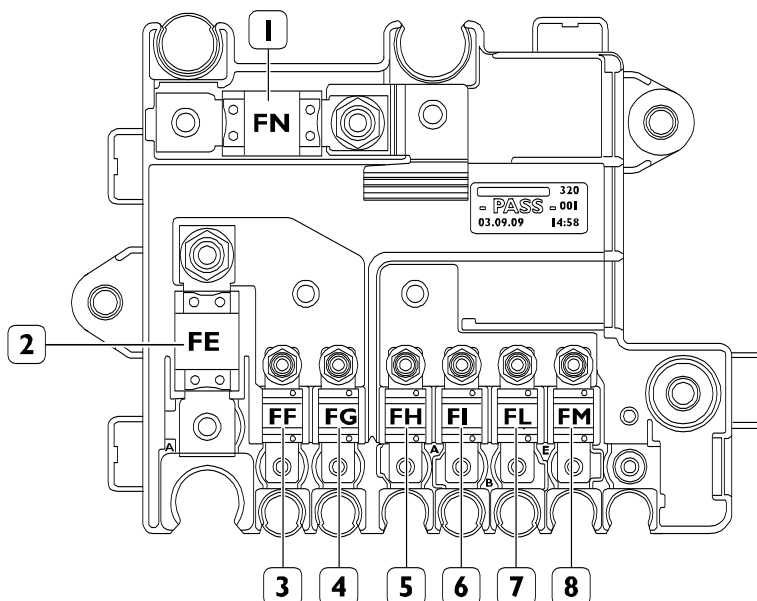
Note F9 of 10A if 8HP70
F21 of 15A if 8HP70

Table 5.13 - List of relays on CNG version SCM

Location	Amperage	Description
T2	–	Baruffaldi coupling (from climate control unit)
T3	–	Side Marker Lights
T5	–	Spare
T6	–	Horn
T7	–	Power drainage from key
T8	–	Fuel pump
T9	–	Main relay
T10	–	Engine start-up prevention
T14	–	Actuators
T17	–	Windscreen wiping (1 st or 2 nd speed)
T19	–	Wiping
T20	–	Modus Diagnosis
T30	–	Internal cab fans

Location	Amperage	Description
T31	–	Spare
T49	–	Spare
T50	–	Heated windscreen and mirrors
T51	–	Climate control unit compressor
T52	–	Heated rear windows
T53	–	Unit heater
T54	–	TGC
T55	–	TGC
T56	–	TGC
T64	–	Headlight washer
T65	–	Spare

Fuses on CBA2 control unit in the engine compartment

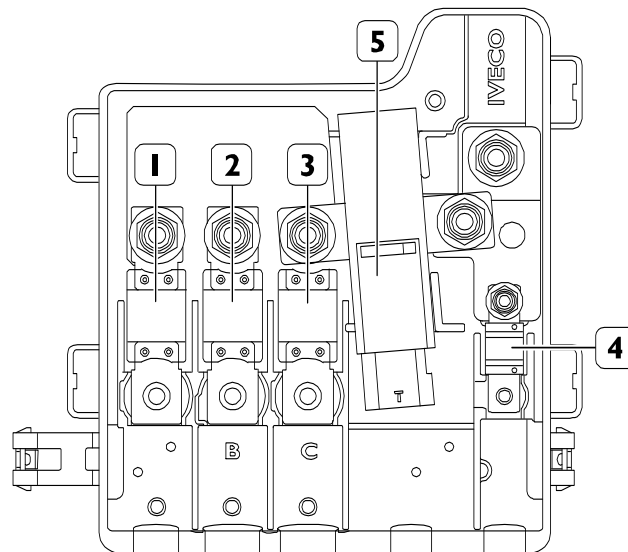


209812

Figure 34

Table 5.14 - List of fuses on CBA2

Location	Amperage [A]	Description
1	150	Retarder
2	150	SCM Power supply
3	30	Body builders pre-installation
4	30	Body builders pre-installation
5	60	Pre- / post- heating unit
6	30	UREA module
7	100	PTC power supply
8	40	ABS

Fuses on CBA I control unit on battery

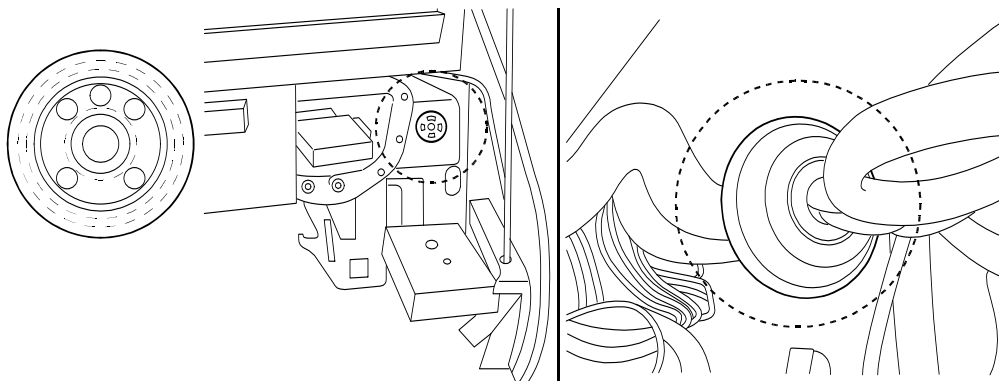
208221

Figure 35**Table 5.15 - List of fuses on CBA I**

Location	Amperage [A]	Description
1	150	Power supply CBA2
2	200	Power supply SCM and Body builders
3	500	Starter and Retarder
4	80	Body Computer power supply
5		TGC (opt)

Passage of cables from cab interior to cab exterior

In the engine compartment, close to the servo brake, through the five premade 10 mm holes in the bulkhead, it is possible to pass the electric cables from the cab to the engine compartment. Adequately seal the cable passage area to avoid passing fumes from the engine compartment to the cab.



119355

Figure 36



► **Any damage caused by failure to comply with procedure is not covered by warranty.**

Additional circuits

The additional circuits must be separated from the vehicle and protected by means of a specific fuse

As already seen in chapter 5.4 (► Page 13) Paragraph "Precautions for work on the system", the used cables must be:

- of appropriate sizes and equipped with good original insulation;
- connected to the original system by means of tin joints equivalent to the original ones, protected with sheaths (not PVC) or intubated in polyamide conduits of type 6;
- installed protections from shock, heat, rubbing with other components (in particular with the sharp edges of the bodywork);
- secured separately with insulated cable clamps (e.g. made of nylon) and at adequate intervals (approx. 200 mm).

The passage through crossbars and/or sections must provide special fairleads or protections; it is not possible to drill the chassis and/or the bodywork

In case of external panels, use a specific sealant both on the cable and on the panel to prevent water, dust and fumes from infiltrating.

Where possible it shall also be provided a different cable path that transfers interference signals with high absorbed intensity (e.g. electric motor, solenoid valves) and low absorbed intensity susceptible signals (e.g. sensors); for both must be remained a position as close as possible to the metallic structure of the vehicle.

Plug and terminal connections must be protected, resistant to weathering, and executed using components of the same type as those utilised originally on the vehicle.

Use cables and fuses with the characteristics shown in the following table in accordance with the current draw:

Table 5-16 - Use cables and fuses in accordance with the current draw

Max. continuous current ⁽¹⁾ (A)	Cable cross-section (mm ²)	Fuse capacity ⁽²⁾ (A)
0 ÷ 4	0,5	5
4 - 8	1	10
8 ÷ 16	2,5	20
16 - 25	4	30
25 - 33	6	40
33 ÷ 40	10	50
40 - 60	16	70
60 - 80	25	100
80 ÷ 100	35	125
100 - 140	50	150

⁽¹⁾ For uses of more than 30 seconds.

⁽²⁾ Depending on the position and therefore the temperature that may be reached in the housing, choose fuses that can be loaded to up to 70%- 80% of their maximum capacity.



► **The fuse must be connected as close as possible to the current take-off point.**

Precautions

- Incorrect installation of electrical accessories may affect occupant safety and cause severe damage to the vehicle. Contact IVECO if you have any questions.
- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).
It should be noted that when grouping several cables together, in order to compensate for lower heat dispersal capacity, the current intensity must be reduced with respect to the nominal value of a single cable.
- In vehicles with frequent engine start-ups, with limited current drawn and engine rotations (e.g. vehicles with refrigeration chambers), provide for periodic battery charging to maintain efficiency.
- Plug and terminal connections must be protected, resistant to weathering, and executed using components of the same type as those utilised originally on the vehicle.
- In the event that a component has to be installed just next to the route of a cable belonging to the original system, make sure that its remains integral and avoid any cuts.

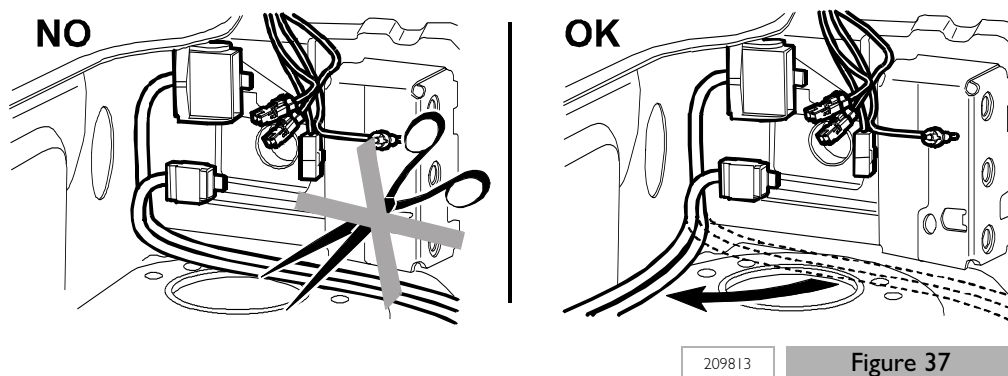


Figure 37



► **Any damage caused by failure to comply with procedure is not covered by warranty.**

Modifying wheelbase and overhang

Should it be necessary to lengthen the wires on the chassis owing to the new dimensions of wheelbase and overhang, a watertight junction box must be used which has the same characteristics as those used on the standard vehicle. The electrical components used such as wires, connectors, terminal blocks, conduits etc. must be of the same type as those used originally and must be correctly fitted.

As for the functionality of the electronic control devices, junctions are not permitted: the cable must be replaced with a new one with similar characteristics to the one used on the vehicle and of adequate length.

Trailer setup

If the repetition of rear lights is necessary, the vehicle must be fitted with the 13 pin trailer socket.

Do not hook up directly to the vehicle's light cables. This results in current overloads which are recognised as malfunctions by the on-board computer.

If you need to make changes to the system other than those described in this manual (for example, to install LED tail lights), you must obtain authorisation from Iveco.

Trailer socket added by body builder

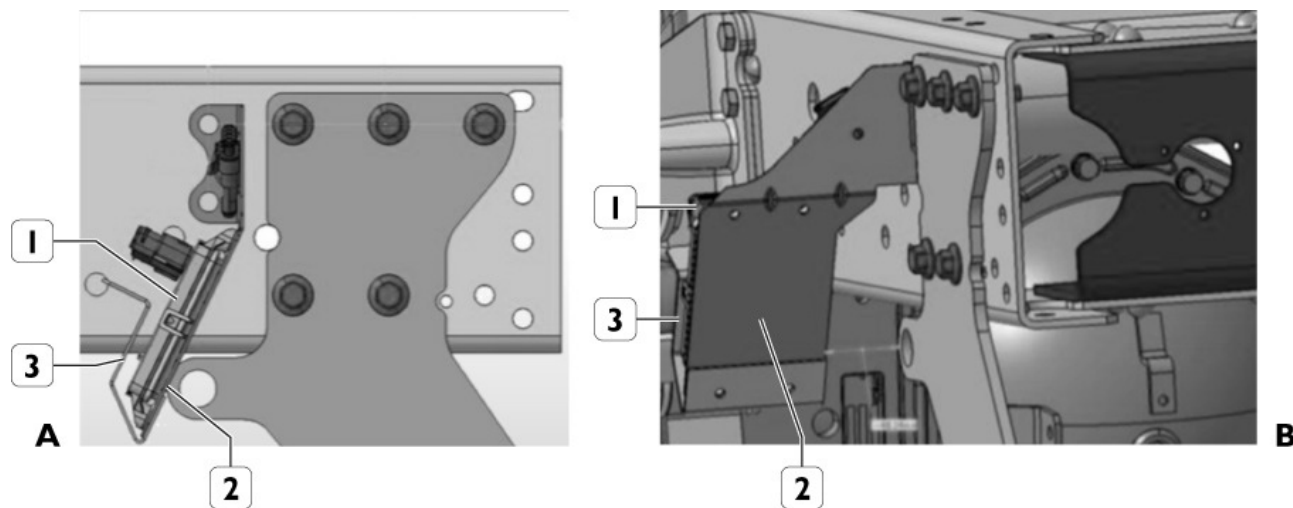
If the vehicle is not ordered with the trailer socket, you can order a KIT, available as a spare part, as follows:

- electronic control unit;
- control unit bracket with guard;
- chassis cable with trailer configuration;
- rear bridle for trailer socket.

Installation

For proper installation it is necessary to:

- mount the electronic control unit onto the bracket; on the cab version also mount the guard;
- mount the entire bracket plus control unit onto the chassis as shown in Figure 38;
- replace the chassis cable with the new cable configured for the trailer socket (see Figure 39);
- mount the connection bridle for the 13-pole socket compatible to the type of hook (high or low) (see Figure 40).



209814

Figure 38

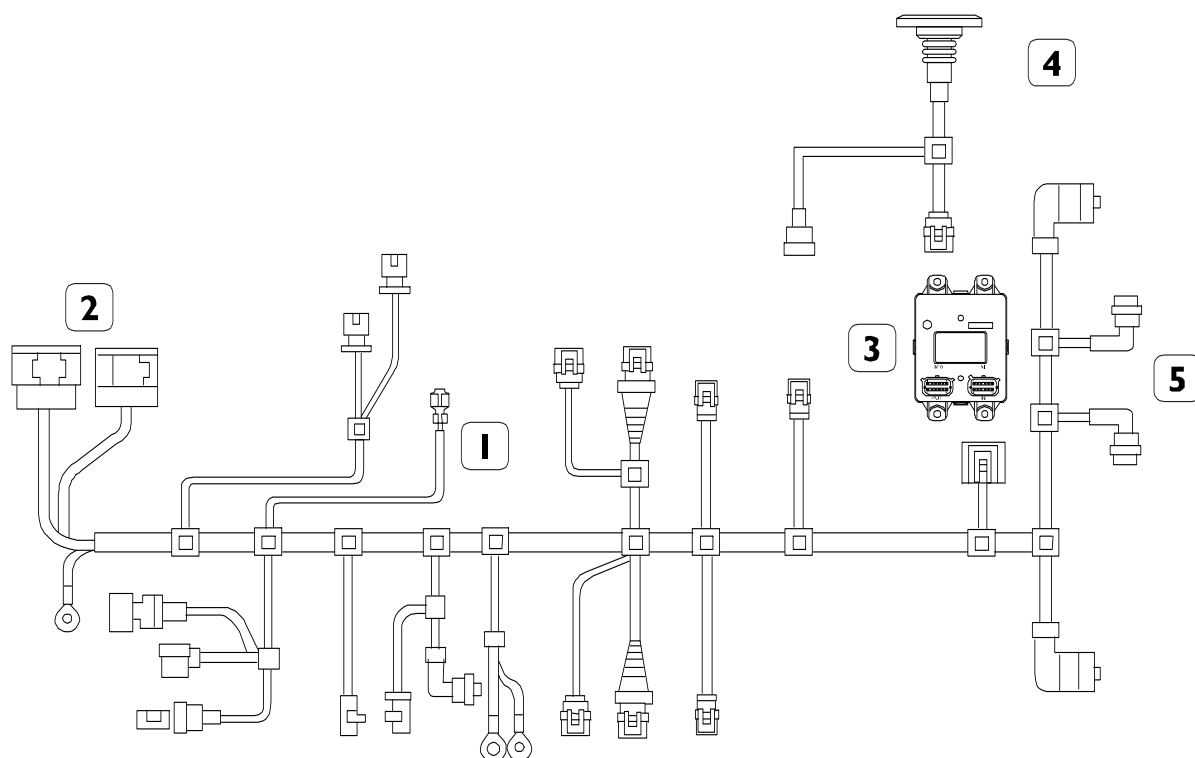
A. Side view

B. Rear view

1. Trailer electronic control unit

2. Support bracket

3. Guard



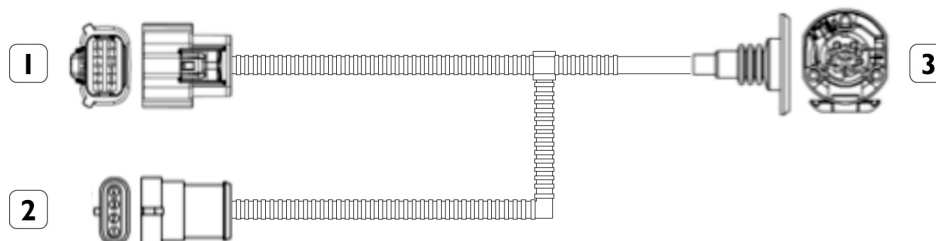
209816

Figure 39

Chassis cable with 13 pin socket and trailer control unit

- | | |
|------------------------------------|--------------------------|
| 1. Chassis cable | 4. 13-pin trailer socket |
| 2. Connections with cab wiring | 5. Tail lights |
| 3. Trailer electronic control unit | |

Note The graphic is for illustration purposes only.



209815

Figure 40

- | | |
|--|--|
| 1. Connector 86046_1 to connect to connector 1 (OUT) of trailer control unit | 2. Connector ST63 to connect to chassis wiring |
| | 3. 13-pin trailer socket 72016 |

For further details on connections and installation, request wiring diagrams from IVECO.



► **Any damage to the light system caused by failure to comply with procedure is not covered by warranty.**

Table 5.17 - 13-pin trailer socket

13-pole connector pin	Cable No.	Description	Notes
1	1120	Rear left turn indicator	1 21 W- 12 V lamp
2	2283	Rear fog lamp power supply	2 21W - 12V lamps
3	0000	Ground	–
4	1125	Rear right turn indicator	1 21 W- 12 V lamp
5	3335	Front left and rear right parking light Left license plate light and left side marker light	3 5 W - 12V lamps
6	1175	Stop signal lights power supply	2 21W - 12V lamps
7	3334	Front right and rear left parking light. Right license plate light and right side marker light	3 5 W - 12V lamps
8	2268	Power supply for reverse light	2 21W - 12V lamps
9	7777	After fuse F67 present on SCM1/B	Battery positive
10	8879	After fuse F49 present on Body Computer	Positive with key
11	0000	Ground	–
12	6676	Trailer connection signal (Ground)	Signal to supply if there are parking sensors
13	0000	Ground	–



- **The electrical connection of a trailer on the electrical systems introduces a significant increase in the length of the positive and negative wires. For practical purposes, this means a greater voltage drop on the connection to the detriment of the actual power dissipated on the load. It is recommended that the body builder adopts the largest electric cable section as possible, consistent with the system layout and the scratch-ability of the plug interface (13-pin) and on this the ground return is split using all 3 pins - 3, 11, 13.**

Side Marker Lamp installation

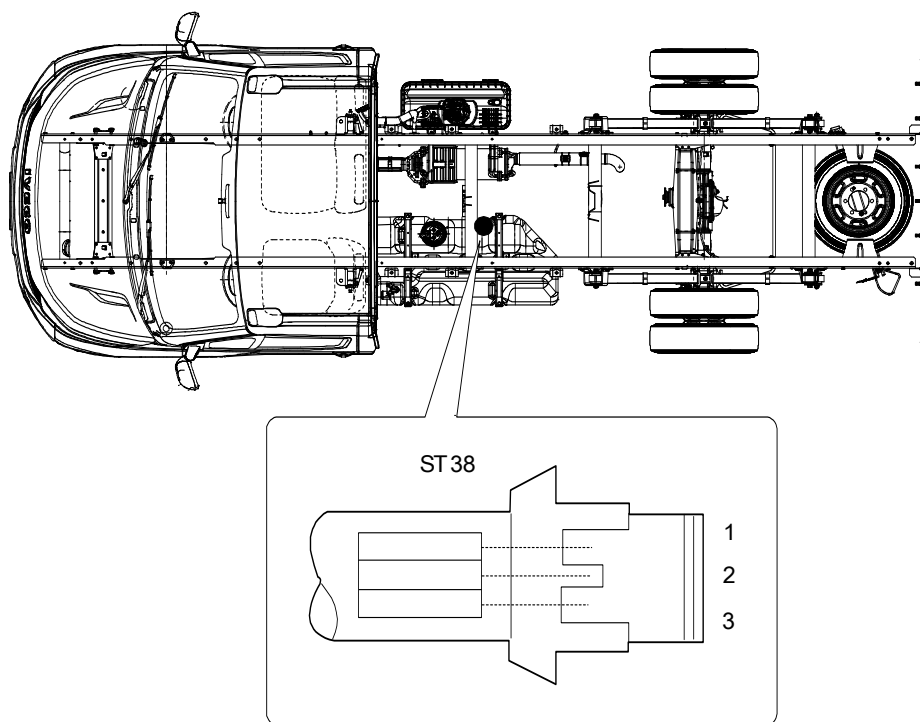
EC regulations require that vehicles are provided with side and clearance lights when the total length exceeds 6 m.

The installation of the lateral lights must be performed on the additional structures (containers, vans, etc.), while the electric power supply must be obtained by the specific ST38 connector on the chassis (see Figure 41).

In order to keep the electrical characteristics of the contacts of the female socket unchanged, the hood supplied by IVECO must be left attached.

The positioning of the above mentioned terminal in the vehicle cab is as follows.

Note *It is not possible to draw current from side marker lights.*



208946

Figure 4I

Table 5.18

Vehicle connectors	IVECO code	Interface to be used	IVECO code	Q.ty
Female connector	98435344	Male connector	98435331	1
		Half-shell		1
		Terminal		3
		Gasket (rubber)		3

Table 5.19 - Connector ST38 for Side Marker Lamps

Pin	Cable code	Function	Cable section (mm ²)	Max. current (A)
1	0000	Ground	1	10
2	3390	Vehicle right side clearance lights	1	10
3	3390	Vehicle left side clearance lights	1	10

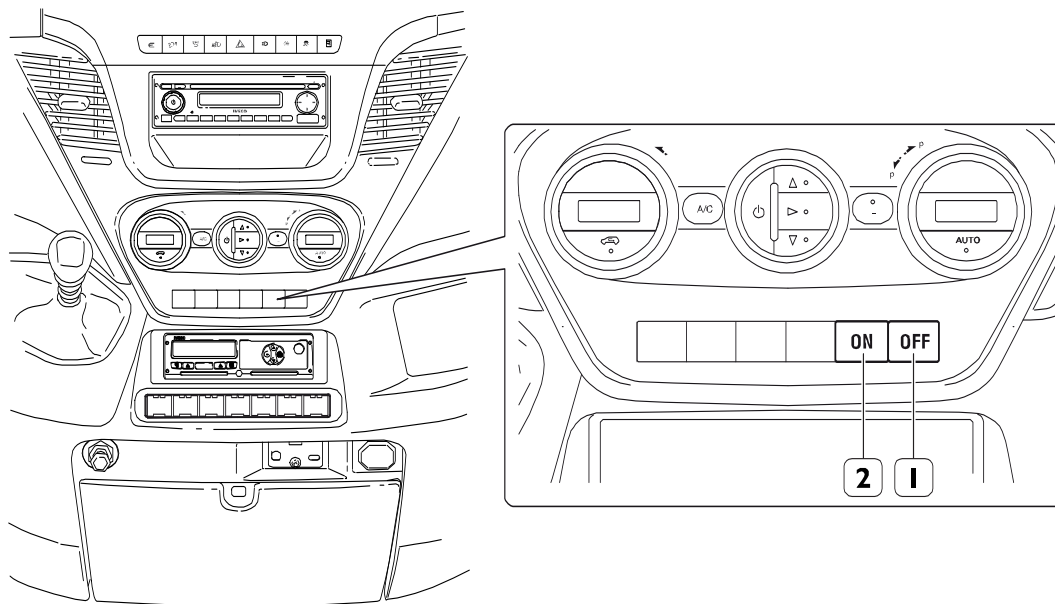
The side marker lamps are mandatory for vehicles with a total length of more than 6 m.

There are no side marker lights for vehicles of a shorter length, as they are not mandatory even though there is a connector..

If it is necessary to install them, you must go to the IVECO service network to enable the Body Computer.

Dashboard emergency command (opt)

The **Emergency Switch** command consists of two switches on the central dashboard (see. Figure 42).



209817

Figure 42

1. OFF button

2. ON button

Pressing the OFF button **(1)** causes the following vehicle responses:

- the engine switches off;
- the turn indicators turn on;
- the circuit breaker on the battery (CBA I) is activated and disables the secondary loads;
- the locks unlock and the out swinging door opens (if IVECO original);
- the ceiling lights stay on;
- the parking lights turn off and all loads are disabled.

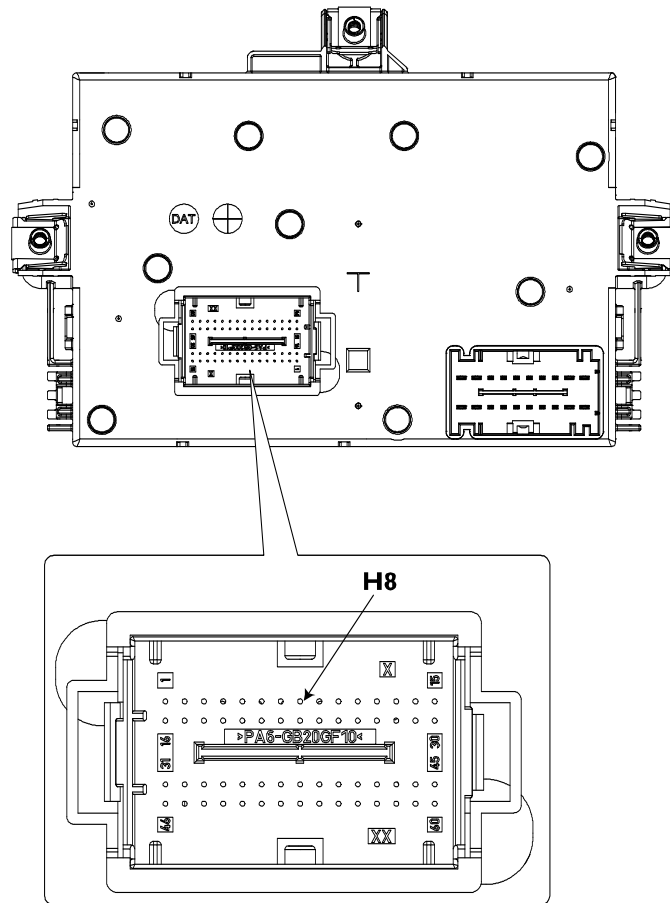
To reset the original vehicle conditions:

- press the ON button **(2)**;
- restart the vehicle.

External hazard command

In some cases the indicator lights are requested to turn on while the configured system is in operation.

This function can be managed by providing a negative unstable signal (using a button) to terminal 8 of connector H of the Body Computer (see Figure 43).



209818

Figure 43

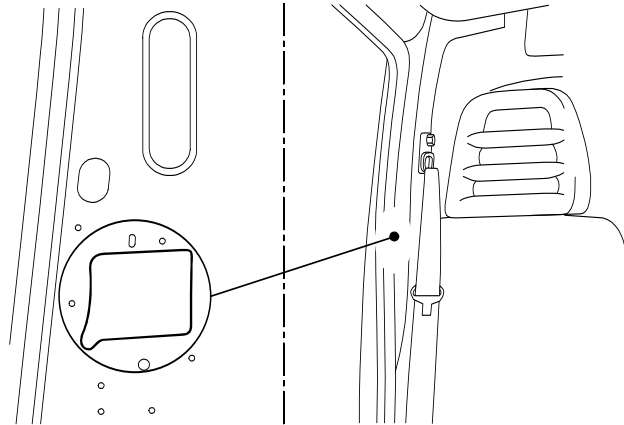
Predisposition for an additional rear central door lock system (Vans)

The "van" versions include the following options:

- opt 5864 "Centralised door locking system + Predisposition for an additional rear centralised door locking system", which provides an outlet on the central column. The body builder can mount a remote controlled door on the body in combination with a centralised remote control central door locking system (lock/unlock).
- opt 5865 "Antitheft system + Predisposition for an additional rear centralised door locking system", which offers the antitheft system in combination with RCL (Remote Control Lock) + Predisposition for rear door.

These optionals offer the key with 3-button remote control (one button is dedicated to the rear door) to command the additional rear door, or with one button (lock/unlock for all the doors) on the dashboard.

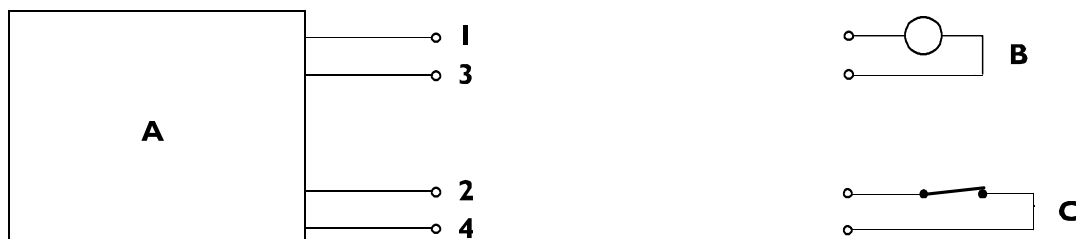
The connector is located under the plastic coating of the column, behind the passenger seat (see Figure 44).



139393

Figure 44

The following diagram shows the connections between the rear door socket and the actuator/door lock switch (Figure 45).



208226

Figure 45

Connection diagram of configuration for rear door

- A. Rear door socket
- B. Body builder actuator
- C. Body builder button switch

- 1. Pin 1: rear door actuator
- 2. Pin 2: door closed signal
- 3. Pin 3: rear door actuator
- 4. Pin 4: door closed signal

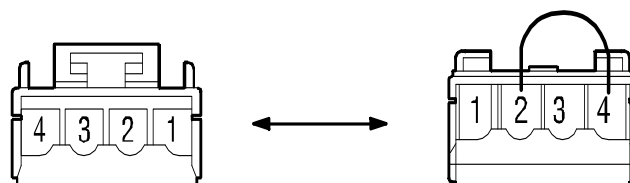
Closed circuit → when the door is closed

Open circuit → when the door is open

For the system to function properly it is essential to have a "closed door" signal (feedback of vehicle with closed door).

Note The vehicle comes with a connector for "closed door" simulation, inserted in the ST62 connector. Without this simulation the Body Computer would send an "open door" signal to the instrument panel and the central locking would not be activated.

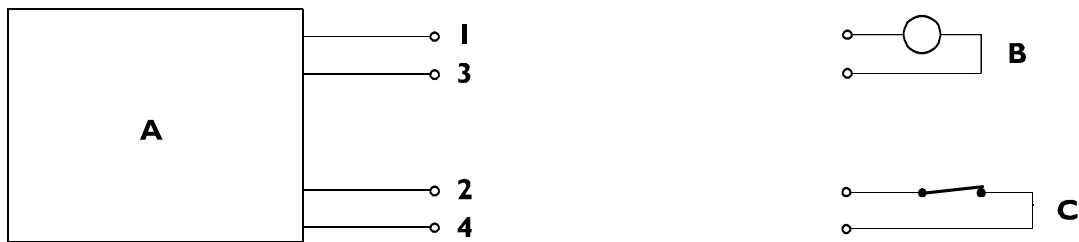
In outfitting the vehicle it is therefore necessary to disconnect the counterpart provided for the simulation and connect the one for the outfit itself.



208228

Figure 46

The body builder must also provide an identical connection to the driver and passenger side doors for the side outlets.



208226

Figure 47

Driver and passenger side door connection diagram ⁽¹⁾

- A. Rear door socket
B. Body builder Actuator
C. Body builder button switch

1. Pin 1: Driver/Passenger door actuator
2. Pin 2: door closed signal
3. Pin 3: Driver/Passenger door actuator
4. Pin 4: door closed signal

⁽¹⁾ Only for versions with reduced cowl, cowl, reduced cowl for camper

Closed circuit → when the door is closed

Open circuit → when the door is open

Antitheft system

In combination with the central locking, the vehicle can be equipped with an alarm system controlled by the Body Computer and a peripheral system.

This system consists of:

- a key with remote control, buttons for distance locking/unlocking;
- actuators for closing the cab doors and sliding side doors in the case of a van;
- open door sensors and engine hood opening perimeter sensor (Figure 49 left);
- alarm siren (12 V) (Figure 49 right).

The antitheft current absorption is 30-40 mA.

The body builder must provide a "closed door" signal so that the antitheft system can also detect engine bonnet break-ins.



208227

Figure 48

Engine bonnet button connection diagram ⁽²⁾

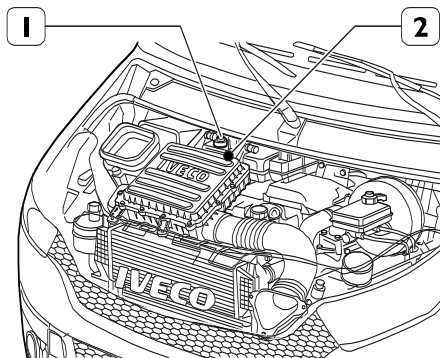
- A. Engine bonnet socket
B. Body builder button switch

1. Pin 1: door closed signal
2. Pin 2: door closed signal

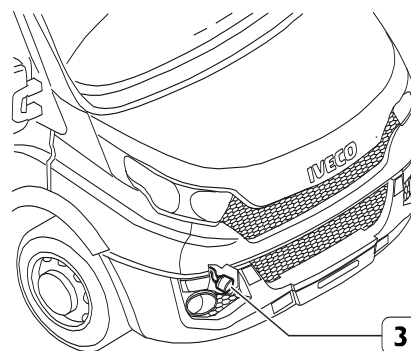
⁽²⁾ Only for versions with reduced cowl, cowl, reduced cowl for camper with opt 5865

Open circuit → when the door is closed

Closed circuit → when the door is open



- 1. Bonnet open sensor
- 2. Engine bonnet socket



208229

Figure 49

- 3. Alarm siren

For the operation mode refer to the Use and Maintenance Manual.

SECTION 6

**ADBLUE AND
SCRT SYSTEM**

Contents

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6.2	THE NITROGEN OXIDE CATALYTIC REDUCTION PRINCIPLE	5
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ADBLUE AND SCRT SYSTEM

6.1 GENERAL INFORMATION

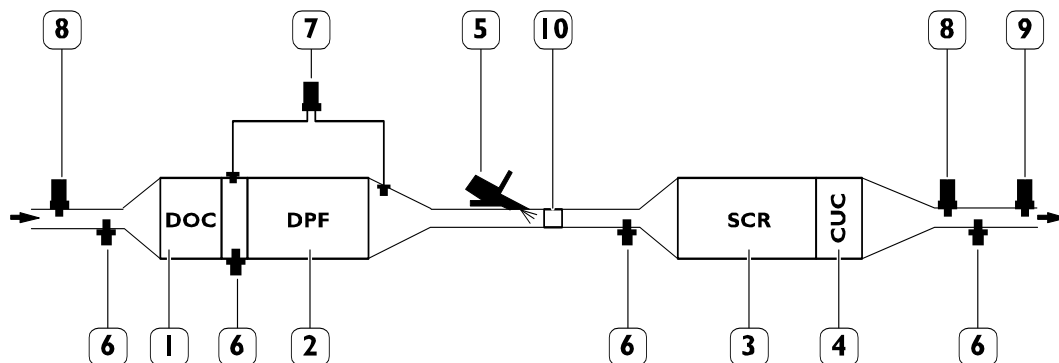
To comply with Euro VI requirements on engine gas emissions, IVECO has developed the "SCRT" (Selective Catalytic Reduction Technology) system, consisting of the combined action of a diesel particulate filter (DPF) and post-treatment of exhaust gas (SCR). This post-treatment requires the use of an additive, commercially known as AdBlue (urea solution+water).

6.2 THE NITROGEN OXIDE CATALYTIC REDUCTION PRINCIPLE

The additive AdBlue, is sent from a dedicated tank by means of a SM (Supply Module) pumping module to a DM (Dosing Module) which injects AdBlue into the exhaust pipe. The mixture of exhaust gas and additive is then fed to the catalytic converter and chemically transforms NO_x into nitrogen and water, harmless to the environment.

In order to comply with Euro VI, new assemblies (DOC, passive DPF, CUC) and sensors are used which act as parameter control functions.

Main components of SCRT system



208930

Figure 1

1. DOC
2. DPF
3. SCR
4. CUC
5. DM (Dosing Module)

6. Temperature sensors
7. DPF Δp sensors
8. NO_x sensors
9. NH_3 Sensor
10. Mixer

DOC (Diesel Oxidation Catalyst): to oxidise the exhaust gas components through the use of oxygen.

DPF (Diesel Particulate Filter): to eliminate the particulate before the SCR through passive regeneration.

SCR (Selective Catalytic Reduction): to reduce the NO_x through the injection of AdBlue.

CUC (Clean Up Catalyst): to eliminate the ammonia residue (NH_3) so as to satisfy legal requirements.

Working area

From $-30\text{ }^{\circ}\text{C}$ to $+140\text{ }^{\circ}\text{C}$, with peaks of $160\text{ }^{\circ}\text{C}$ (short term $< 10\text{ min}$)

Adblue: suction temperature from $-5\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$, at a pressure of 5 bar relative.

6.3 INSTRUCTIONS

The following instructions are intended for the AdBlue injection system of the Bosch DeNO_x 3.1 type.

If changes are made to the chassis which involve this system, the following procedure must be followed under all circumstances:

- all post-treatment components must be installed under extremely clean conditions;
- the protection caps of the SM, DM and the AdBlue pipe bundle may only be removed just before assembly;
- the SM and DM fittings must be handled with care;
- the SM and DM fastening screws must be tightened to the torque specified in the relevant assembly diagrams;
- the following disassembly/assembly sequence on the SM and DM must be respected so as to prevent the AdBlue coming into contact with the electrical connectors:
(disassembly) AdBlue fittings - water fittings - electrical connectors
(assembly) electrical connectors - water fittings - AdBlue fittings;
- the seal of the DM flange on the ATS side must be replaced each time the DM is disassembled (the seal may only be used once);
- the "after-run" phase must not be interrupted using the battery manual switch or the ADR switch (the AdBlue pipes must always be emptied to prevent any crystallization or damage from freezing);
- the DM screw threads must be treated with a sealant paste as specified on the assembly diagrams however, the DM and the inside of the exhaust silencer must not be contaminated with the sealant.

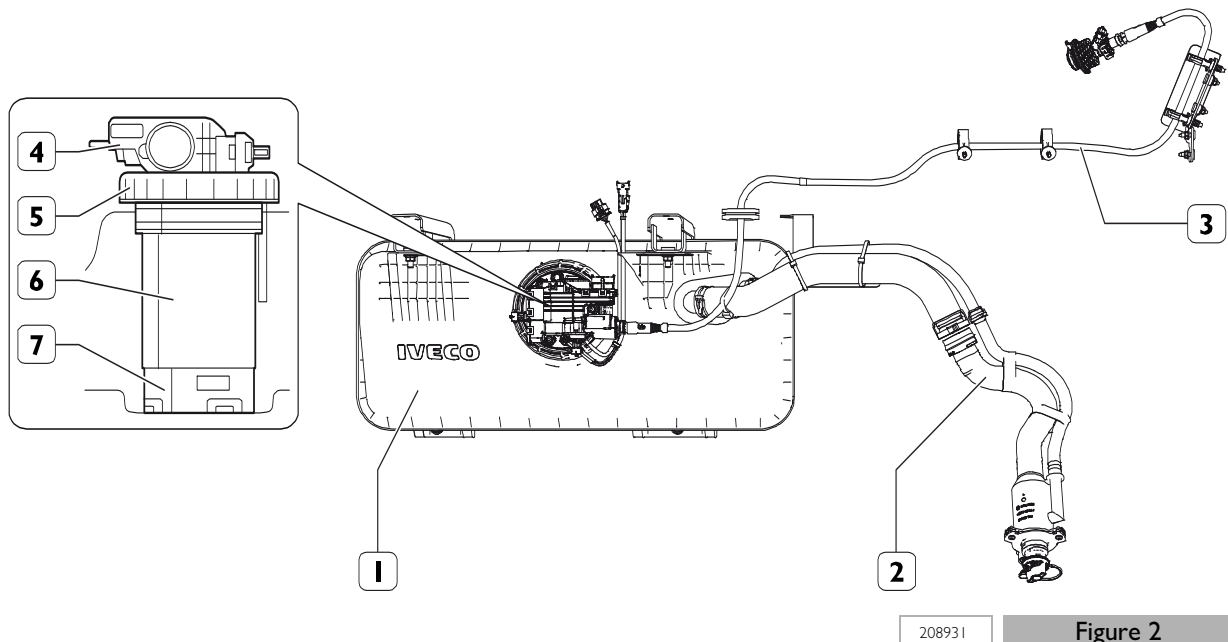
Materials

1. Since the AdBlue solution may be corrosive for ferrous steels, any specifically shaped tanks must be made out of the following material and with IVECO authorization:
 - Molybdenum austenitic chromium-nickel steel in compliance with DIN EN 10088
 - Polyethylene HD
 - Polypropylene HD
 - Polyfluoroethelene
 - Polyvinylidene fluoride
 - Perfluoroalkoxy
 - Polyisobutylene
 - Titanium
 - Viton
2. Plastic material can contain additives to simplify the printing process or to improve some characteristics of the material. Therefore it is necessary to check that these additives do not combine with the urea and contaminate the solution

AdBlue tank

Note *The fuel and AdBlue level sensors are specific to the type of tank to which they are connected. Therefore, the tank and sensor cannot be modified independently of each other.*

Use only the standard tank in order to respect the constraints highlighted in the Note. otherwise the shape modifications and installation must be authorized by IVECO.



208931

Figure 2

- | | |
|--|--|
| 1. AdBlue tank | 5. Fastening ring nut |
| 2. Urea introduction filler | 6. Heating pot |
| 3. Heated urea pipe from AdBlue tank to DM dosing module | 7. Locking ring welded to tank housing |
| 4. SM Pumping module | |

- The tanks must be equipped with fittings for bleeding and with a fitting for adding the AdBlue; the connections between the tank fittings and the inlet must be airtight.
- The tank must be positioned at a minimum height of 200 mm from the ground for an unloaded vehicle and in any case at a height equal to or greater than the lowest wire of the exhaust system.
- The tank is secured to the chassis with specific brackets; any modifications must be authorized by IVECO.
- The Heating Pot / Supply Module must be positioned above the centre of gravity of the tank.
- Heating Pot/ Supply Modules other than those prescribed for first equipment cannot be used without authorization.
- The hydraulic connections must comply with Standard SAE_J2044 1/4.
- To ensure the seal of the SM pumping module on the tank, the ring nut tightening torque must be 75 Nm.

At the end of any operations which involve the AdBlue tank, make sure that:

- the tank ventilation pipe is not closed or restricted;
- the tank contains at least 4 litres of AdBlue to ensure the dosing module is cooled;
- the tank does not contain more than 85% of AdBlue (corresponding to the maximum reading of the level sensor) with respect to the tank total volume, so as to guarantee enough room for AdBlue to expand during freezing at temperatures below -11 °C.

AdBlue refuelling filler

The filler assembly consists of:

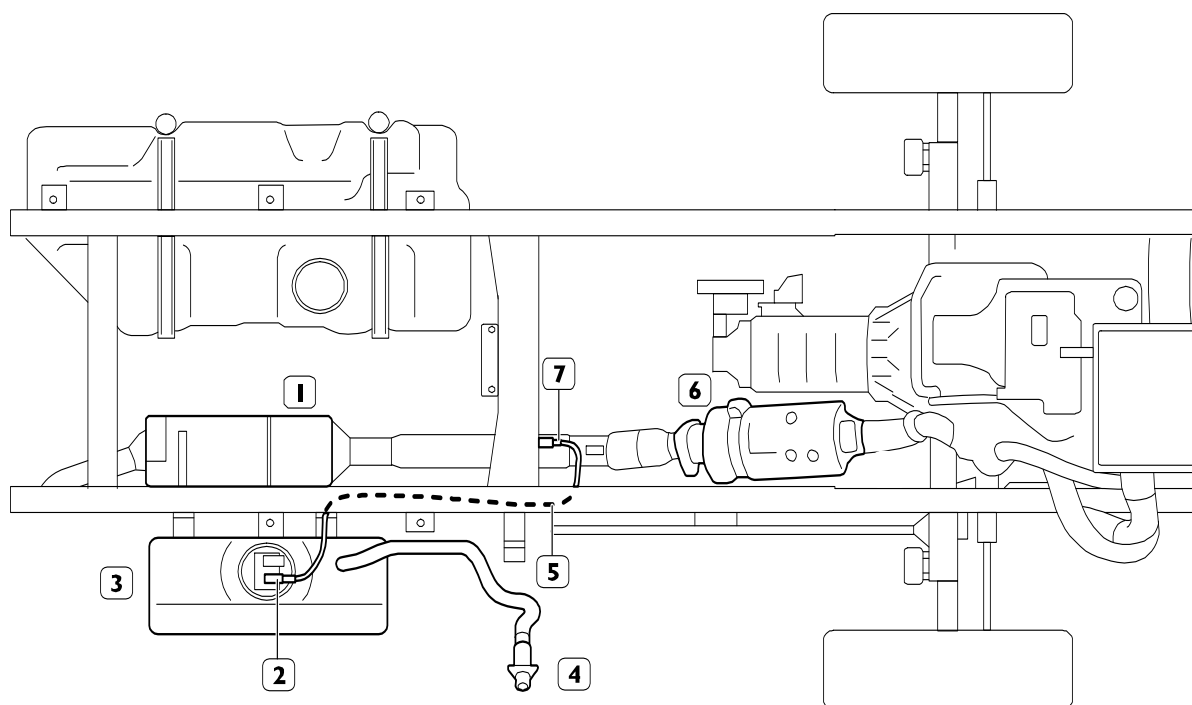
- a filler with a specific plug for AdBlue filler nozzles, a filter and a magnet for opening the nozzle valve;
- a pipe connecting the filler to the tank breather.

if the filler door on the bodywork is modified, best possible access to the plug must be maintained.

The following points are mandatory since AdBlue crystallises at $-11\text{ }^{\circ}\text{C}$:

- ensure the pipe is at an incline which prevents urea from collecting (syphons) inside;
- respect the original incline of the filler in relation to the ground; any variation in this value must be authorized by IVECO.

Note The parts in plastic must be at least 200 mm from any heat source (eg. exhaust system); if heat-protecting panels are used this distance can be reduced to 80 mm.

Moving AdBlue system components

208932

Figure 3

1. SCR catalytic converter
2. Pumping module (SM)
3. AdBlue tank
4. AdBlue refuelling inlet

5. AdBlue delivery pipe
6. DPF Particulate filter
7. Dosing module (DM)

If it is necessary to move the AdBlue tank for outfitting needs, this must be done making sure that the installation heights module of the SM module and the pipes respect the conditions illustrated in Figure 5.

In the diagram it can be seen that the pipes provide an adequate siphoning system in order to prevent any damage occurring following should the AdBlue freeze. the siphon should have an internal collection volume of 12 cm³ and is to be located below the reference distance of the DM (for example S = 10 mm).

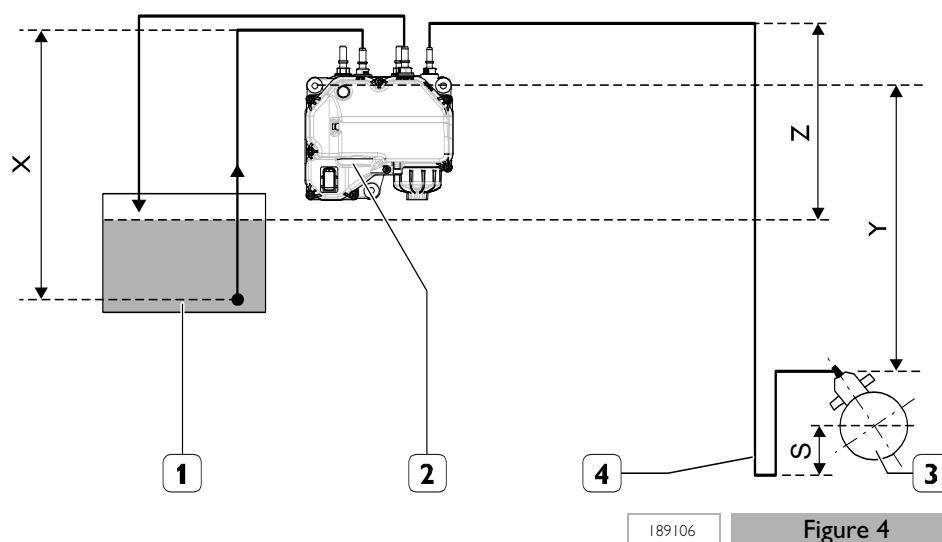


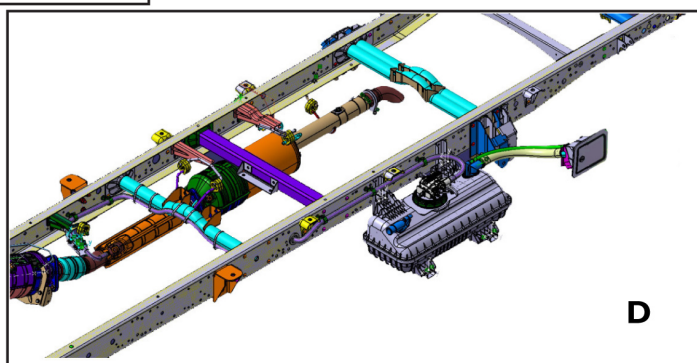
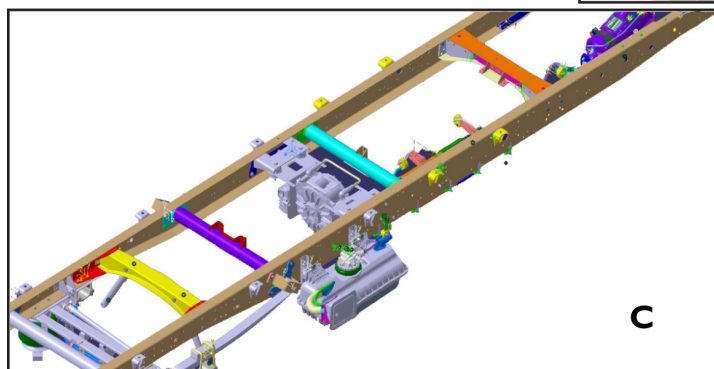
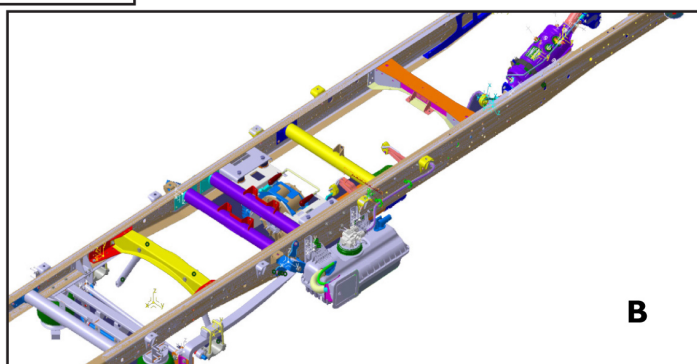
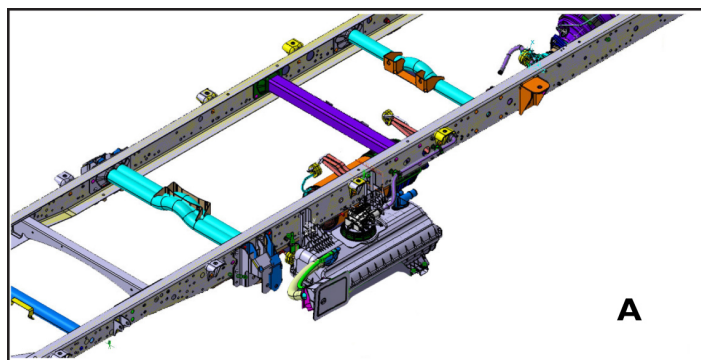
Figure 4

1. AdBlue tank
2. Pump module
3. Dosing module
4. Siphon

- X < 1 metre
Y < 1 metre
Z > 0
S > 0

With regards the position of the DM module, please note that modifications cannot be made to the solutions which are IVECO approved and normally produced.

The reference cases are indicated below



208933

Figure 5

- A. Config. 1 - DAILY 35S - Wheelbase 3520 mm - Gsx
B. Config. 2 - DAILY 40C/50C - Wheelbase 3520 mm - Gsx

- C. Config. 3 - DAILY 40C/70C - Wheelbase 4100 mm - Gsx/Gdx
D. Config. 4 - DAILY 35S/40C - Wheelbase 3520 mm - Gdx

Finally, with regard to the electrical wiring please note that:

- it is only possible to lengthen cables for the temperature sensors
- it is not possible to alter the length of the NO_x sensor cable.

Operations on pipes for AdBlue and heating water

Note Interventions which do not replicate existing solutions in production must be authorized by IVECO.

For this reason, please note the following:

- no type of folding is permitted since during operation constrictions, bends and subsequent overloads could occur on the hydraulic fittings;
- in order to limit the loss of load, only one lengthened stretch is allowed;
- the length between the pumping module and the dosing module must not exceed 3 metres;
- any need to modify the diameter must only be due to exceptional circumstances;
- any changes to the original path must ensure a minimum distance from the ground of 200 mm and ensure distance from any heat sources.

The pipes can be modified by using only specific tools and fittings which must comply with Standard SAE_J2044 1/4; for the most appropriate choice and to obtain them, please contact IVECO Customer Service.

To change the length of the pipes, (ref 8.8x1.4 - PAWD- 0.2 mm - PA/PUR for AdBlue and ref. 13x1.5 - PA12PHL-Y -TFT for water) it is necessary to:

- have the specific fittings of the type indicated in the following Figure;

Pipe fittings

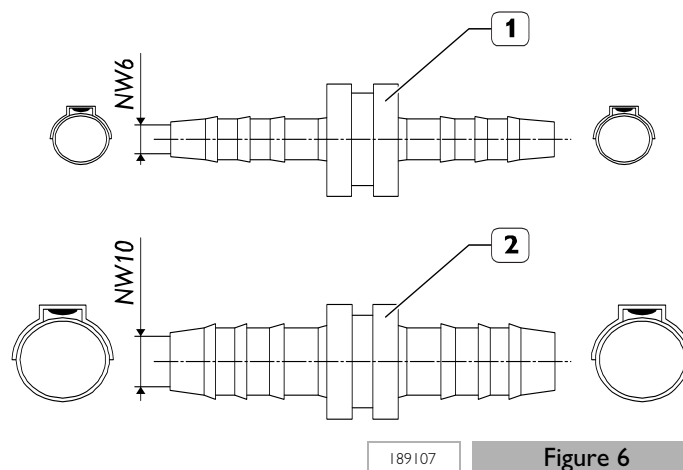


Figure 6

1. NW6 fitting (Part 41283741) for AdBlue pipes

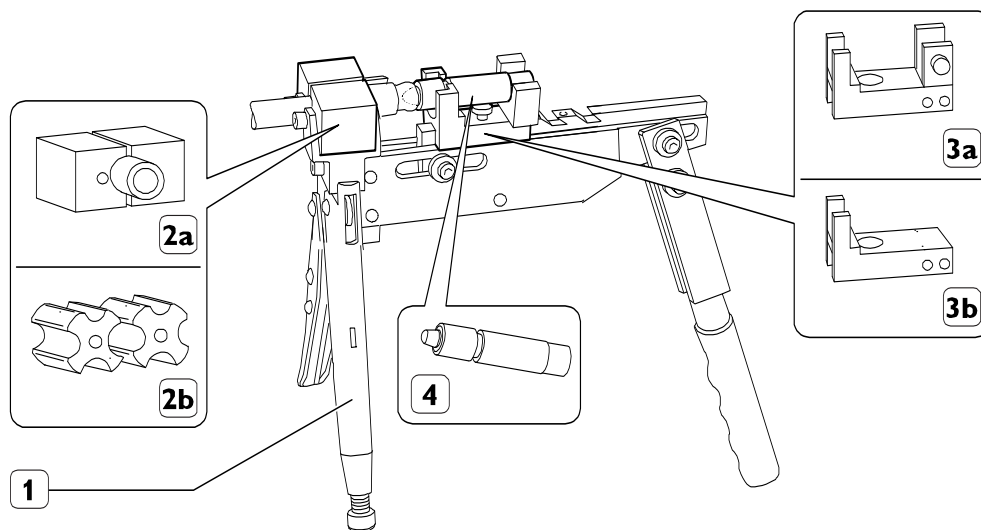
2. Fitting NW10 (Part 41283747) for water pipes

- mark the delivery and return pipes before separating them to ensure there is no confusion during subsequent reassembly;
- cut the pipes with the appropriate pipe cutting clippers in order to ensure an accurate cutting area;
- insert the fittings into the cut parts of the pipe making use of specific tools (pliers, drift, spindle to enlarge the pipe and collar. See following Figure).



► **It is compulsory to work in a completely dust-free environment to prevent dust from reaching the injectors and subsequently clogging them.**

Pipe assembly tools



189108

Figure 7

- 1. Plastic pipe mounting pliers (Part 99387101)
- 2a. Clamping jaws for AdBlue pipe (Part 99387102)
- 2b. Clamping jaws for water pipes (Dis. 99387103)
- 3a. Support for fitting NW6 for AdBlue pipes (Part. 99387104)
- 3b. Support for fitting NW10 for water pipes (Part. 99387105)
- 4. Pipe widening spindle for AdBlue pipes (Part 99387106)

APPENDIX A

DAILY PEOPLE CARRIER

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DAILY PEOPLE CARRIER

A.1 CHASSIS

Transport

The unfitted chassis is not roadworthy and must be transported on a car transporter.

Lifting for transport by ship, train, etc.

When the chassis is loaded onto ships, freight trains, etc it must only be lifted by acting on the axles or wheels.

Note It is strictly prohibited to secure the crane cables to the cross or side members.

The chassis must only be secured to the vehicle during transport by hooking the axles and the weight must only be supported by the wheels.

Delivery

Before delivery, the chassis is to be subjected to strict quality controls.

On delivery the Body builder must carry out an inspection to detect missing materials or faults which could have occurred during transport.

IVECO does not accept claims after delivery or claims not recorded on the designated forms countersigned by the transporter.

For any claim, please provide the vehicle identification number: this number is on the core of the right chassis side member in the wheel arch near the suspension.

Storage

If the vehicle is to be unused for a long period of time, it must be suitably protected from the elements of the area where it is being kept.

The body builder is responsible in particular for the protection of the dashboard, batteries, fuse boxes and relays, etc, the reliability and duration of which must not be compromised.

Weights and weighing

The design of the bodywork, the position of the seats and the loading compartment must be carried out without exceeding the total maximum permitted loads or the maximum permitted load on the individual axle.

In order to account for fabrication tolerances, the data relating to the weight of the models: 40C, 50C, 65C and 70C have a tolerance of $\pm 3\%$. For this reason, before carrying out the fitting, it is a good idea to determine the mass of the vehicle cab (cab version, van or cowl) and its distribution on the axles.

A.2 GENERAL STANDARDS FOR SECURING THE BODY TO THE CHASSIS

Particular attention must be paid to the connection points of the chassis elements to the side of the bodywork: since these connection points must ensure a perfect transmission of stress.

At the same time, a localised application of stress determining high pressure on the connection points must be avoided.

The bodywork structure must be considered a load bearing unit together with the chassis: the bending, torsion and thrust stresses must be absorbed by the unit.

This layout is made necessary by the relative flexibility of the chassis. Please contact the IVECO Quality Department for any relevant queries.

The outfitting can be secured to the bodywork by means of welding or retainers to be screwed in and tightened.

Mixed type of connections are not recommended.

In any case, securing the bodywork elements must be carried out using intermediate plates.

A.3 BODYWORK CONSTRUCTION

This chapter provides instructions for the construction of the bodywork, with the most important technical and regulatory aspects. Defining the bodywork is left to the Body builder's criterion depending on requirements.

Main dimensions

The entry and exit angles for all vehicles must be equal to or greater than 7°.

Bodywork construction must allow a steering radius as prescribed by Standard I 07/ECE or by the equivalent Standard in force in the country where the registered vehicle will be used.

The vehicles must be equipped with mudflaps at the back of each wheel to a height of 75 mm from the ground.

The bodywork configuration must allow for inspection of the vehicle identification number.

Internal configuration and vehicle capacity

The surface area available for the number of seats for each class of vehicle must comply with prescriptions of Standard I 07/ECE or the Standard for the country where the vehicle will be sold.

Driver's seat characteristics

Heating

There must be a sufficient number of hot air vents to demist the windscreen.

Sun visor

The driver must be able to make use of a sun visor, the height of which can be adjusted while driving and can be tilted. A wind up sun blind or partially or totally coloured glass can also be fitted.

Driver's seat (if different from the one provided)

It must be possible to adjust the height, incline and longitudinal distance from the steering wheel and each of these adjustments must be independent from the others.

Driver's seat ergonomics

If the instrument assembly supplied with the vehicle is disassembled and reassembled in a customized dashboard, it is recommended that the position of the instruments and controls remains unchanged.

Furthermore, since the dashboard supplied complies with the Directive on "signalling, controls and luminous plates", after having made the modifications, the Body builder must verify this aspect and obtain new approval if necessary.

When fitting the trim around the driver's seat, the pedal stroke must not be limited.

Requirements of materials relating to fire protection

The materials of the trim used inside the engine compartment must be non-flammable and resistant to fuel or lubricant unless the material has been covered with a water-proof layer.

The rest of the bodywork materials must be "flame retarder" or self-extinguishing depending on the number of passengers the vehicles is permitted to transport and/or the Legislation in force in the country where the vehicle is to be used.

The polyamide conductors or the wiring braids which pass near any hot sections of the engine (manifold or exhaust pipes, turbocharger, etc.) must be protected by a metal shield in either aluminium or stainless steel, with a cladding of insulating material.

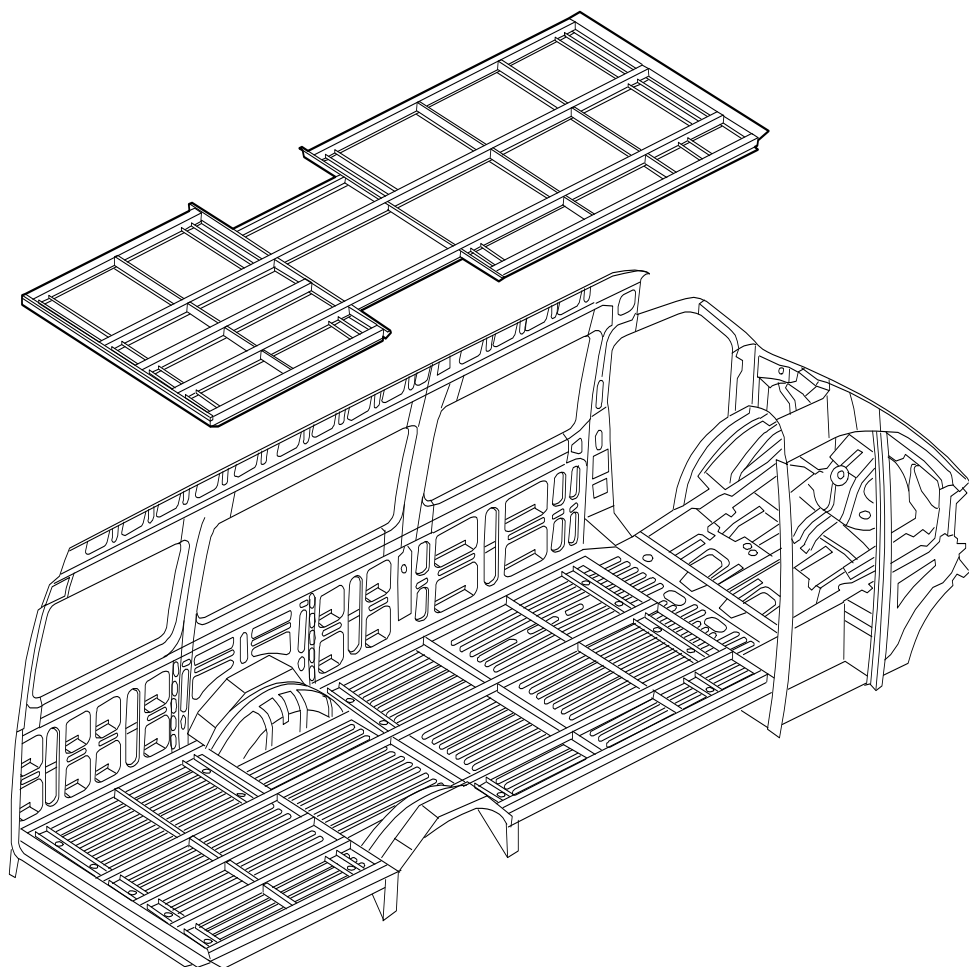
Structure and securing the seat mounts

Anchoring the seats directly to the floor or the wheel arches is not permitted, therefore a designated structure must be provided (frame) to distribute the stress across the entire surface area of the floor.

Note *The Body builder is entirely responsible for anchoring the seats to the frame as well as carrying out the inspection (destructive) and approval tests.*

The figures below show some details of the structure and how to secure the fixed seats and runner seats taken from IVECO drawings no. 5801805133 and 5801752010.

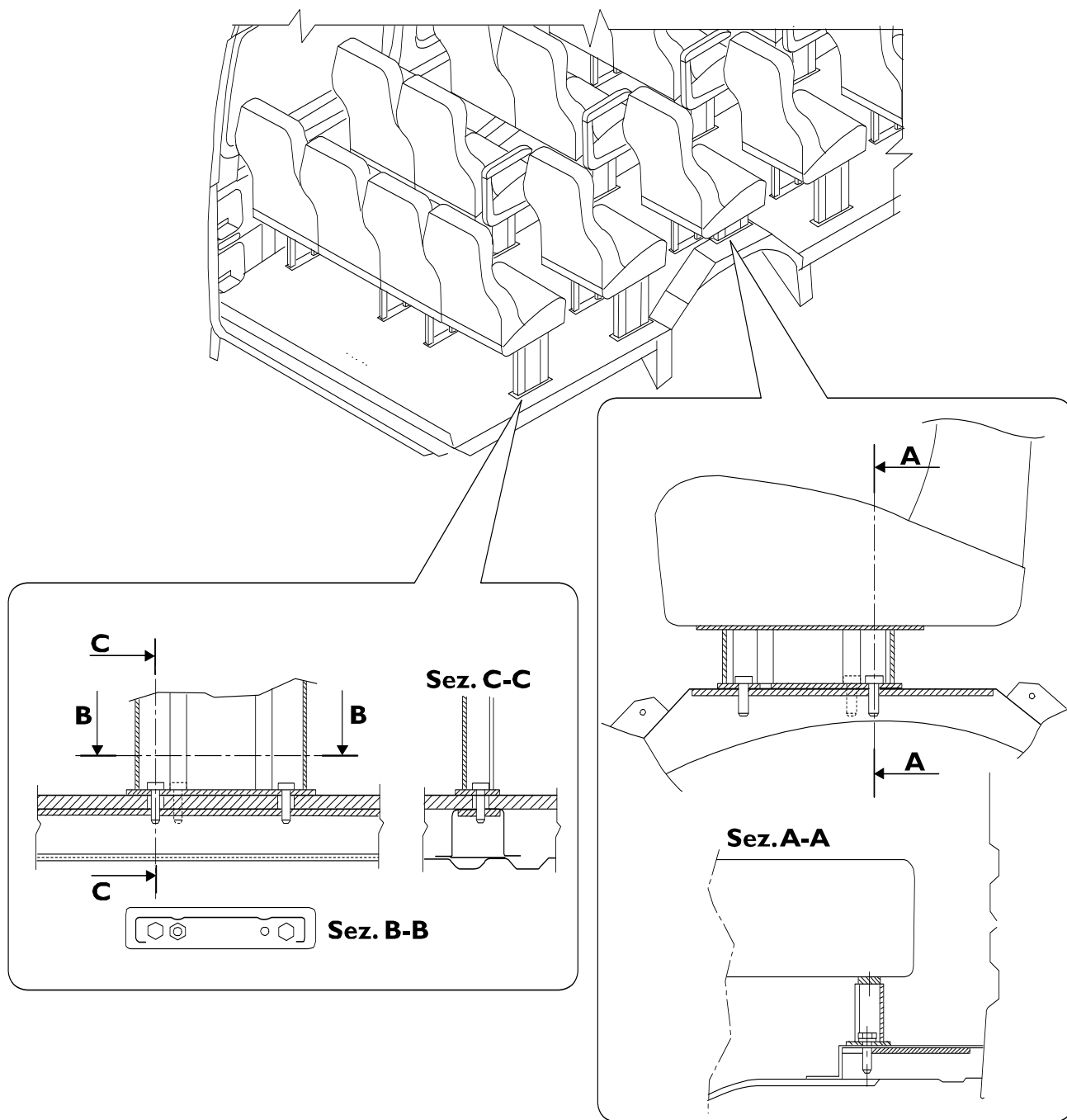
The complete drawings can be requested from www.ibb.iveco.com.



173264

Figure I

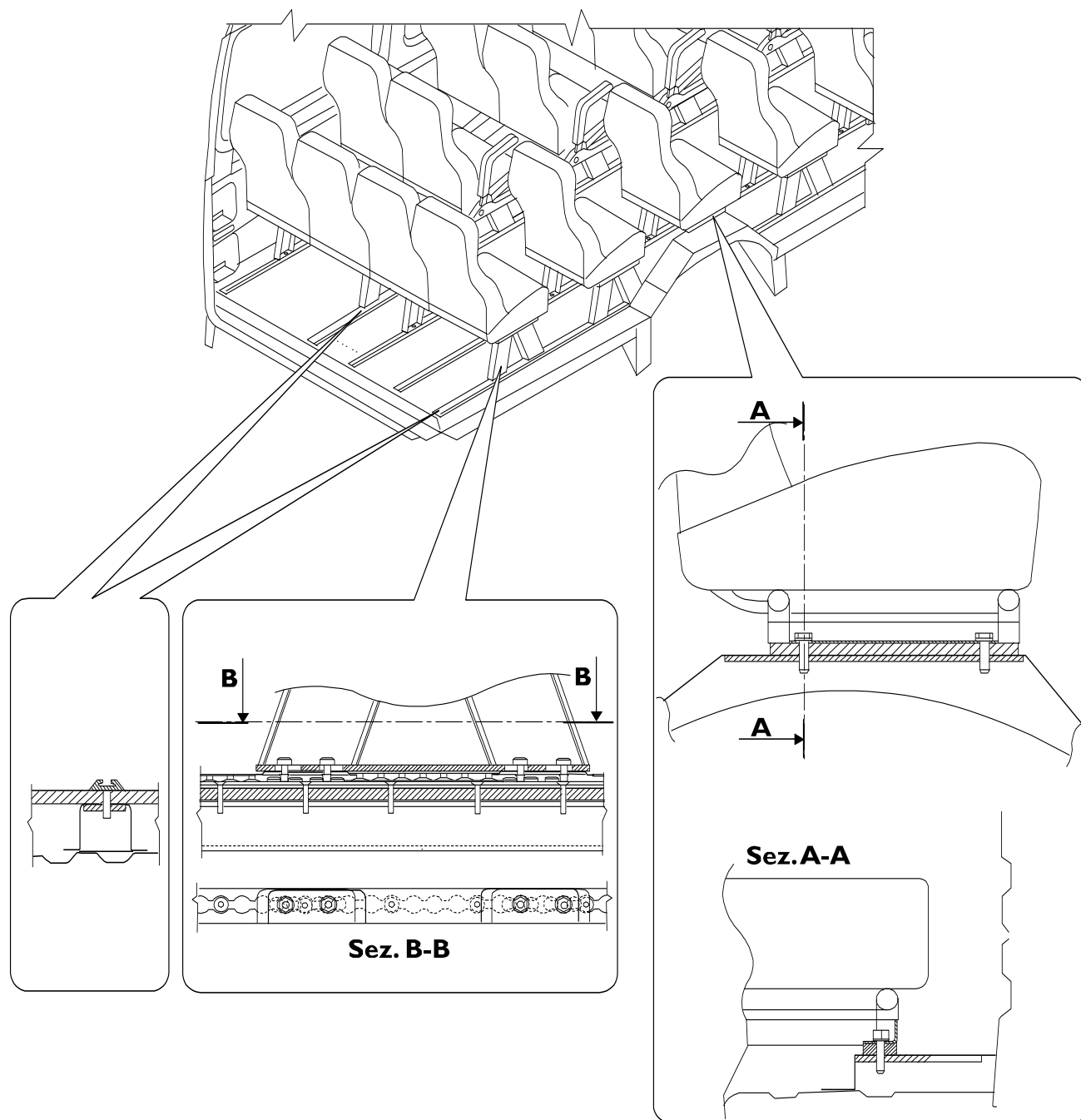
Seat securing floor frame



173265

Figure 2

Example: Fixed seat installation diagram (see Drawing 5801805133)



173266

Figure 3

Example: Runner seat installation diagram (see Drawing 5801752010)

Rear baggage compartment

The baggage compartment volumes is dependent on the maximum permitted technical mass of the vehicle and its axles; Dimensioning and positioning must be validated by structural tests and calculations which are the responsibility of the Body builder.

Side access

Constructing a side access with a width exceeding the standard Minibus version must not alter the indeformability of the panel structure of the area concerned .

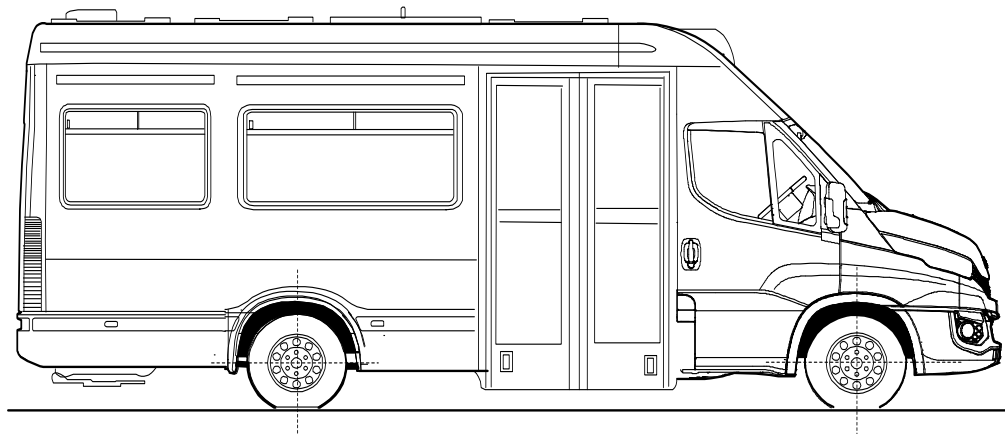
Note *Altering the height of the side door compartment is only permitted for interventions on the top or bottom section of the panel but never on both.*

The dimensions of the compartment and the access steps must comply with Directive ECE107.

To prevent any interference with these elements, the AdBlue tank must be shifted slightly along the chassis side member. In this case, in order to use pipes which are longer but generally available from IVECO Parts, it is recommended that one of the positions provided for in the production of Daily Vendor and Minibus is replicated.

Please refer to Section 6 to view these positions and to obtain further information on the AdBlue pipes and system.

If the size of the shift does not allow for the indications provided above, the conversion must be authorized before work is carried out.



208203

Figure 4

Replicated structure and securing handrails

The handrails must be installed in such a way that passengers do not risk any injury, they must be in a contrasting colour and be non-slip. The construction of the handrails and their application on the vehicle must comply with the European Directive 2001/85/EC or ECE107.

The anchoring sections of the handrail onto the original structure of the vehicle must be suitably reinforced.

Wheelchair lift for disabled passengers

For this type of transport, the access door compartment must be equipped with a lift; furthermore, inside the vehicle there must be a reserved area with specific dimensions. In any case, this area must comply with the European Directive 2001/85/EC or ECE107.

If the rear door is to be used for wheelchair access, please refer to the securing methods for the tail lift described in Chapter 3.9 (► Page 28).

A.4 NOISE EMISSIONS AND THERMAL INSULATION

The Body builder must make sure that the finished vehicle complies with all the indications relating to noise emissions, specific to each case and must also approve/reapprove the vehicle if necessary.

External noise

On the basis of the Directive 2007/34/EC, the noise emissions of the Daily "people Carrier" must not exceed 79 dB(A) as detected at the exhaust silencer.

Internal noise

Measurements must be taken in accordance with the provisions of Standard ISO 5128 and at a stable speed:

a) 60, 80 and 100 km/h in last but one gear

b) 80 and 100 km/h in last gear

with both manual and automatic gearbox.

With regard to the position of the phonometer, it is important to make a distinction between:

- the rear area: in the centre of the last but one row of seats, at the height of the passenger's ears
- front area: at the height of the driver's ears.

In these conditions, the results must not exceed the following values:

Table A.1

Vehicle	Without air conditioning at maximum power	With air conditioning at maximum power
Inter-urban	72 dBA	74 dBA
Urban or suburban	74 dBA	76 dBA

It is however recommended that the required values are verified for the countries of homologation.

Soundproof insulation

The installation of the sound-proof material must be as continuous as possible, without interruptions, in order to ensure good noise insulation; it is important that the hatches which connect the interior with the engine, gearbox and axle areas, etc are as well sealed as possible.

For the floor trim in the passenger area, the door compartment and the steps, it is recommended that a wood panel is used with a minimum thickness of 15 mm and a layer of Septum.

The anchoring of the compartments for the steps must not show any signs of cracks or interruptions which would allow noise to enter inside the vehicle; this is also the case for the section below the doors.

Anchoring of the insulation and sound-proof materials must be strong and long lasting to prevent the material from becoming loose and prevent it from coming into contact with hot or moving parts. It is recommended that a good quality adhesive, metal clips or some other anchoring device is used.

Thermal insulation

As regards the thermal insulation, the most critical parts are the areas near the turbocharger, the manifold and exhaust pipes, the silencer and the electric retarder impellers.

When a non-metallic element of the bodywork is near a critical area it must be protected. This protection could consist of a layer of insulating felt covered with an aluminium's sheet able to withstand a stable heat of 250°C and with a maximum conductivity coefficient of 0.1 W/mK.

In any case, the minimum distance between a critical point and the insulation must not be less than 80 mm.

When the available space is reduced and above all in order to protect the polyamide pipes and wiring braids, it is recommended that a shield made of aluminium sheet with an insulating sandwich is used, with a conductivity coefficient equal to that of the felt; between the protected element and the shield there must be a minimum separation distance of 20 mm.

In order to maintain a comfortable temperature inside the vehicle, the insulation in the engine compartment/gearbox must have a minimum conductivity coefficient of 0.08 W/mK and a minimum temperature of 85 °C.

This noise-thermal insulation must cover the entire area separating the engine housing and the interior, including the steps, walls and other surfaces through which heat could penetrate.

In areas where noise insulation is not required, for example near the electric retarder, polyurethane foam can be used for thermal insulation as long as it has characteristics similar to those described.

Some points are not critical as regards heat transmission but they must however be considered for the insulation of bodywork elements or systems which may be damaged by excessive temperature.

Insulation for cold climates

Vehicle insulation for cold climates must ensure that the engine coolant temperature does not fall below 80°C with stable operation.

The thermostat inside the circuit ensures correct engine operation if the opening temperature is 68 ± 2 °C.

If despite the insulation, the engine operates at less than 80°C and insufficient hot water reaches the heater, a preheater able to provide at least 25000 kcal/h is to be fitted.

The preheater is mandatory when the vehicle normally operates at temperatures below 0 °C.

Once engine insulation has been defined, it is necessary to measure its efficiency by testing the capacity of the cooling system and the heating system.

After the tests it may be necessary to carry out fine tuning consisting in:

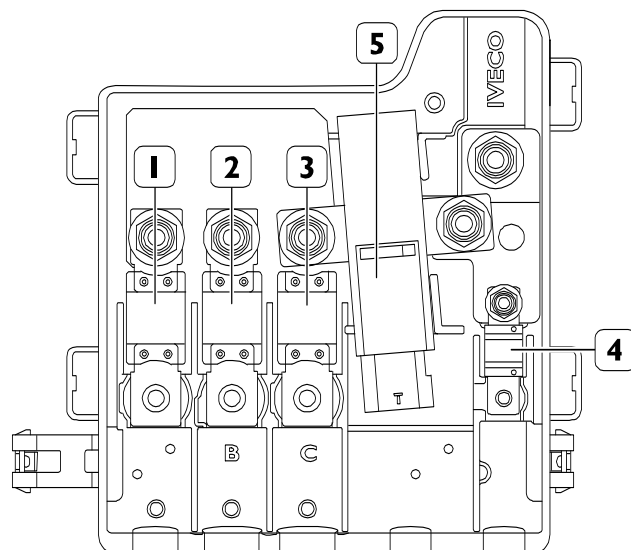
- increasing the power or the insulation if the heating test temperatures are low;
- increasing the air passage and reducing the insulation if the temperatures obtained during the cooling test are too high.

IVECO is to be informed of the results and is to be consulted in relation to any modifications of the fine tuning.

A.5 CURRENT DRAWS

People carrier, CBA version

The distribution and protection control unit located on the battery has a circuit breaker to interrupt loads in the event of an emergency.



208221

Figure 5

Relay and fuse box on the battery CBA 1

Table A.2

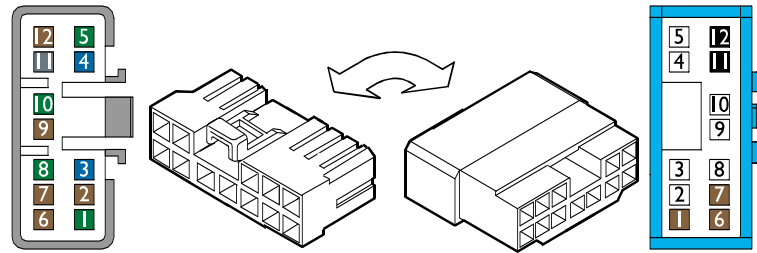
Ref.	Fuse capacity	Function
1	150A	Power supply CBA 2
2	200A	Power supply SCM and Body builders
3	500A	Starter and Retarder
4	80A	Body Computer power supply
5		Battery master switch

To reset the original vehicle conditions:

- press the TGC ON button on the dashboard;
- restart the vehicle.

A.6 BODY BUILDER CONNECTORS

Note For information relating to the 20 pin connector (61071), please refer to Section 5 pin connector.

12 pin connector (72076) for People Carrier

101554

Figure 6*Existing part on vehicle (male)**Counterpart to be coupled (female)***Table A.3**

Code	Description
500314814	12 way male connector
500314820	Male contact for cable from 0.3 to 0.5 mm ²
500314821	Male contact for cable from 1 to 1.5 mm ²

Table A.4 - Basic functions of the 12-pin connector for the People Carrier

Pin	Description	Signal	Observations
1	Hazard lights repetition	Max output 500 mA	A repetition led can be powered with an intermittent positive phased with the hazard lights
2	Speed limiter programming	Input max. 10 mA	By providing a ground, the current speed limitation activates / deactivates Open wire = no action Ground = speed limitation activated / deactivated
3	Outswinging door status	Max. output 10 mA (interfacing with decoupling diode)	Signals when the door is open Open circuit = door open Ground = door closed
4	Speed signal (B7)	See specification 1 - Section 5	
5	Door status	Max output 500 mA	With central locking, an led signals the door status Ground = doors closed Open circuit = doors open
6	Not connected		
7	Additional horn control	Max output 10 mA	Additional horns (to interface with relay) or horn control replicate. Ground = horn active Open circuit = horn not active
8	Emergency handle lock	Max. output 10 mA (interfacing with decoupling diode)	Central locking extension to the emergency handle Ground = handle locked Open circuit = handle open
9	Outswinging door operation	Max. output 10 mA (interfacing with decoupling diode)	Signals outswinging door operating fault Ground = incomplete closure Open circuit = normal conditions
10	Engine speed (rpm)	See specification 2 - Section 5	

Pin	Description	Signal	Observations
I 1	TGC OFF	inlet 100 mA	+12V = TGC OFF
I 2	TGC ON	inlet 100 mA	+12V = TGC ON

A.7 ROAD TESTS

a) Before starting the road test, the following checks must be carried out with the vehicle stopped:

- tyre pressure;
- engine oil level, gearbox and rear axle, brakes and steering, water in cooling tank, battery status and fluid level;
- parking brake operation;
- door operation, emergency button sensitivity, check lights, windscreen wipers, windscreen washers, horn, external lights, switching engine off from inside compartment;
- bodywork alignment in relation to the chassis and suspension height;
- no interference with steering controls, along the entire rotation path of the steering wheel;
- correct operation and visibility of the warning lights and buzzers.

b) While driving a 50 km stretch of road in different driving conditions (flat road, windy roads, uphill, downhill, irregular road surface), the following parameters must be checked:

- no faulty vibrations or noise from the gearbox, rear axle, transmission or other chassis or bodywork assemblies;
- correct operation of the mechanical gearbox;
- braking progression and no excessive effort on the pedal;
- progressive clutch action;
- progressive steering action without resistance or knocks, maintaining vehicle trajectory without the need for repeated corrections.

With regard to "system" operation, check:

- no fault messages appear on the instrument panel and no danger or attention warning lights remain on;
- The electric retarder has a brief response time and determines a progressive action in each of its actuations points;
- The speed limiter does not cause any jolting;
- activating the "battery OFF" switch stops the engine, activates the warning light and deactivates the battery;
- the tachograph is sealed;
- the heating and climate control unit work efficiently;
- the internal and external acoustic levels comply with standards;
- there are no infiltrations during or after driving through rain water/high pressure vehicle cleaning water jets.

As regards the ergonomics, check:

- range, hardness or interference of the gear stick with benches or seats;
- position and longitudinal and backrest adjustment of the driving seat;
- any visual interference caused by the steering wheel in relation to the dashboard as well as the lighting and brightness of the instrument panel.

c) At the end of the drive:

- check for any leaks of water, oil, diesel, brake, steering or clutch fluid;
- check and retighten the wheel nuts to 290-350 Nm.

APPENDIX B

**DAILY CNG AND CNG
WITH “RECOVERY MODE”**

Contents

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DAILY CNG AND CNG WITH "RECOVERY MODE"

Note For anything which is not specified in this attachment, please refer to the indications provided in the previous Sections.

B.1 GENERAL INFORMATION

Natural gas is a mixture consisting mainly of methane (main component), ethane, propane, carbon dioxide and nitrogen.

In order to make it more noticeable, an odorant is added (THT) providing the characteristic smell of sulphur.

The composition of natural gas can vary considerably, therefore also its chemical - physical characteristics can be significantly different.

Natural gas is compressed in cylinders for transport and for use on the vehicle. this is where its name CNG, Compressed Natural Gas comes from.

Within the range of DAILY vehicles, the CNG and CNG with "Recovery Mode" versions represent IVECO's contribution to providing a transport system which respects the environment as much as possible.

These versions differ from the others for the specific solutions applied to some engine components, particularly for the electronic management, the presence of the gas cylinder frame and the relative pipes.

On versions with "Recovery Mode" there is also a small petrol tank which is activated automatically and for short trips if the gas has been depleted.

The increased technical complexity must therefore be taken into account by the Body builder both with regards the study of the conversion and especially during its implementation.



► **The characteristics of highly flammable compressed gas do not permit the outfitting or conversion of vehicles for fire fighting applications or for use in potentially critical environments (eg: airports, refineries, etc.).**

Note IVECO designs, approves and constructs CNG vehicles which comply fully with the Regulation ECE 110 currently in force.

Interventions on the engine power supply system which:

- a) use components other than those approved by IVECO (even if approved as Standard rate Technical Unit)
- b) modify the original architecture (for example: moving or adding a cylinder, cylinder retainer method)

require the reapproval of the vehicle.

To this end, the designated Authority may require the complete documentation (calculations, diagrams, test reports) certifying compliance with the requirements of Regulation ECE 110 for all the modifications made to the original system.

The financial cost involved in reapproving a vehicle are borne by the Body builder.

B.2 SAFETY REGULATIONS

During refuelling operations

- When refuelling, the gas is usually compressed to 200 bar. Small amounts of natural gas can be released during refuelling. Following a rapid decompression a cooling may occur, leading to potential ice burns on the skin. Wear protective gloves when refuelling.
- Do not smoke or handle naked flames or flammable sources of light.
- Before filling the gas pressure system, check it shows no visible defects.
- The vehicles to be refuelled must be locked so as to prevent any movement; The engine must be switched off and the ignition key must be removed from the ignition.
- Keep adequate extinguishers (A, B or C class) and other fire fighting devices close at hand. Fire class C is particularly suited for CNG.
- Do not release the content of pressurised gas pipes or cylinders into the atmosphere.

In case of leaks

- **Gas leaks are an EXPLOSION HAZARD so it is essential, as well as observing all legal regulations and rules of competent authorities, to observe the following safety regulations.**

- Close the cylinder cocks and the cocks on the filling station risers and tanks.
- Disengage the main switch of the electrical system of the plant or the refuelling area.
- Block access to danger areas and move unauthorised persons away from the danger area.
- Immediately notify the competent authorities and request restoration action.
- Ventilate the surrounding area.

In the event of fire

- Do not put out the emerging flame; Cool down the burning object if necessary.
- Close the gas cylinder cocks and the cocks on the filling risers and tanks.

BURNING GAS = CONTROLLED GAS

- If the flames spread to the surroundings, use the fire extinguishers as customary in order to put out the fire. Immediately evacuate any nearby vehicle from the danger area.
- In case of fire, while continuing the fire fighting efforts, immediately inform the local FIRE BRIGADE.
- Provide immediate aid to injured persons. First aid takes priority over the fire-fighting operations.
- Disengage the main switch of the electrical system of the plant or the refuelling area.

B.3 SYSTEM INTERVENTIONS**General warnings**

Note Any change to vehicle layout absolutely requires repeating vehicle type approval.

Take into consideration the following warnings before performing interventions on the engine concerning or involving components of the fuel supply system.

- Before performing any work, you must shut off the cocks of the solenoid valves of each gas cylinder, after which the engine must be started and let to run idle until it uses up the gas in the pipes and the engine cuts out. For the versions with an additional petrol tank, let the engine run until the "Recovery Mode" activates, i.e. until the engine moves over to petrol.
- The parts must be cleaned with maximum care, while making sure that handling and assembly have not facilitated the entry of sludge or foreign bodies. To this end, the protective caps of the components and sensors must be removed immediately prior to placement.
- Pay particular attention to the direction of installation of electrical connections.
- All threaded connections must be tightened to the prescribed torque (see the Paragraph "Tightening torques (► Page 7)").



- **The components of the fuel system cannot be overhauled but have to be replaced when they are inefficient. Washers, conical washers, self-locking nuts and gaskets contribute to the tightening efficiency via a deformation and furthermore, are of a special type. They must therefore be replaced at every disassembly operation. After replacing them, the components must be systematically restored in the same points of origin and according to the original assembly sequence.**



- **After replacing the valves, or after any intervention on the high-pressure system, a HYDRAULIC PRESSURE TEST (300 bar) must be carried out by IVECO CUSTOMER SERVICE, who will issue a test certificate following a positive result.**

Repainting outfitted chassis

The following must be protected from paint:

- the stainless steel pipes of the methane supply system;
- the pipe connection fittings;
- the hose from the pressure reducer to the rail on the engine;
- the solenoid valves and the relative coils on the gas cylinders;
- the gas system pressure reducer;
- the identification plates.

Tightening torques

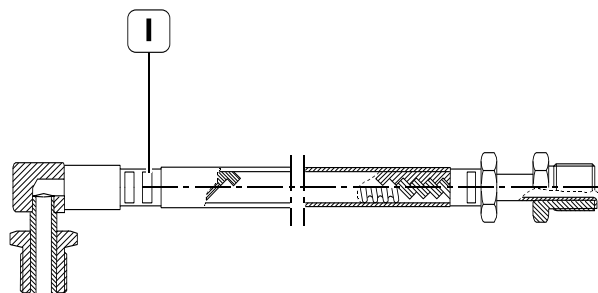
Table B.1

PART	TORQUE	
	Nm	kgm
CNG system		
Connection (M12x1) for high-pressure hose to the filler (Italian type) - Figure B.2	24 ÷ 26	2.4 ÷ 2.6
Connection (M12x1) for high-pressure hose to the filler (EEC type) - Figure B.2	33 ÷ 37	3.3 ÷ 3.7
Connection (M12x1) for high-pressure hose to check valve on solenoid valve VBE- Figure B.2	33 ÷ 37	3.3 ÷ 3.7
Fittings on high-pressure hose - Figure B.3	38 ÷ 42	3.8 ÷ 4.2
Connection (M18x1.5) for medium-pressure hose to the pressure reducer - Figure B.1	67 ÷ 73	6.7 ÷ 7.3
Connection (M18x1.5) for medium-pressure hose to the fitting on the cylinder head - Figure B.1	67 ÷ 73	6.7 ÷ 7.3
Connection (M12x1) for stainless steel pipe on pressure reducer	33 ÷ 37	3.3 ÷ 3.7
Connection (M12x1) for stainless steel pipe on VBE solenoid valve (opposite side to the check valve)	24 ÷ 26	2.4 ÷ 2.6
Connection (M12x1) for stainless steel pipe on VBE solenoid valves	24 ÷ 26	2.4 ÷ 2.6
Blind plug (M12x1) on solenoid valve	33 ÷ 37	3.3 ÷ 3.7
Connection fitting (M14x1.5) for pipes on "T" fittings and bulkhead fittings - Figure B.4 - B.5 - B.6	74 ÷ 82	7.4 ÷ 8.2
Connection fitting (M14x1.5) for securing bulkhead fitting to chassis	67 ÷ 70	6.7 ÷ 7.0
Retainer (M24x1) for filler to support	60 ÷ 70	6.0 ÷ 7.0
Retainer (W28.8x1/14") for solenoid valves on cylinders	260 ÷ 280	26.0 ÷ 28.0
Fastener (M14x2) for brackets supporting cylinders to chassis frame and to rear cross member	151 ÷ 184	15.1 ÷ 18.4
Fastener (M10x1.5) for cylinder support belts	33 ÷ 35	3.3 ÷ 3.5
Fastener (M12x1.75) to brackets framework for rear cross member supporting cylinders	74 ÷ 90	7.4 ÷ 9.0
Fastener (M10x1.25) for rear cross member supporting cylinders	42 ÷ 51	4.2 ÷ 5.1
Fastener (M8x1.25) for cylinder guards	21 ÷ 26	2.1 ÷ 2.6

Note The tightening torques indicated only refer to the special components for the first equipment.

List of components

Medium pressure gas pipe



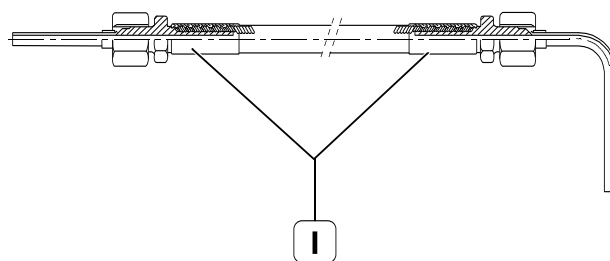
117679

Figure 1

I. Tublex-product code - Date of manufacture - Batch.

The gas pipe connecting the reduction unit to the accumulator (rail) is of the flexible type with helical coils, made of AISI 321 stainless steel, internal diameter 6.5 mm, covered with a AISI 304 stainless steel braid, covered by a heat-shrink sheath, fittings made of AISI 303 stainless steel.

High-pressure gas filling pipe



117680

Figure 2

I. Production date

The gas pipe for connecting the first cylinder filling valve - VBE solenoid valve is of the flexible type made of stainless steel ISO 84342 with a diameter of 6.4x11.8 mm covered with technopolymer and strengthened with two braids of aramidic fibre, fittings made of ISO 84342 stainless steel.

Connecting pipes between VBE solenoid valves

The VBE solenoid valve connecting pipes are made of AISI 304 stainless steel without joint welds, with an outer diameter of 6 mm and an internal diameter of 4 mm.

Fittings

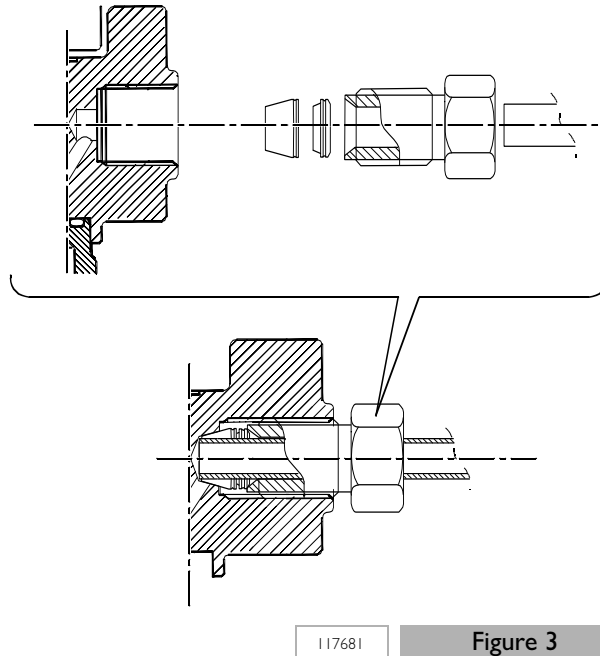


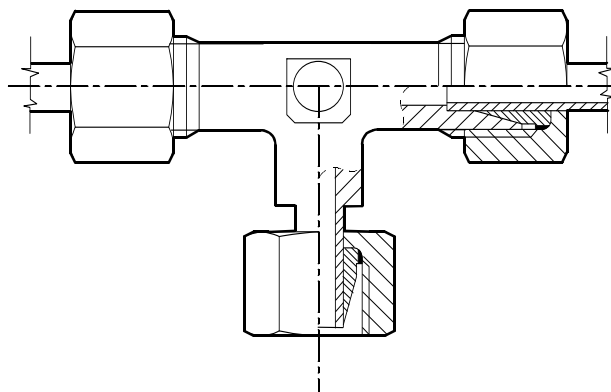
Figure 3

AISI 316 TJ stainless steel ogive joint

For the assembly instructions, refer to the Paragraph "Repair interventions on fittings and pipes" (► Page 18)- Figure B.18.



- **For reasons of safety, both when outfitting and during maintenance, it is PROHIBITED to use the gas pipes as brackets for other pipes. In some situations of limited space, there is provision for fastening some electric cables to the CNG pipes with PVC straps as long as these straps only serve as a guide and not as a support. During maintenance work, pay the utmost attention so that the pipes do not get damaged and anyhow have no scratches, scoring, cuts or buckling visible to the naked eye. If necessary, the pipes must be adequately protected.**

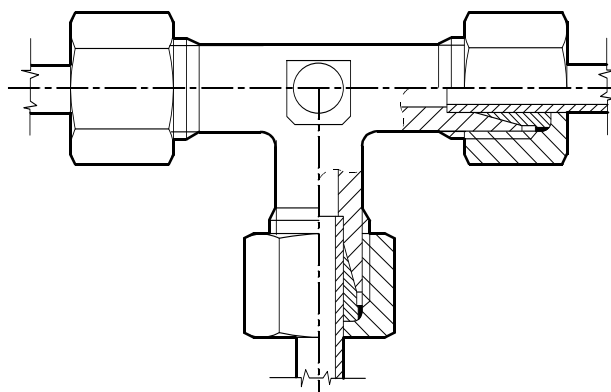


117682

Figure 4

"T" ADJUSTABLE FITTING

AISI 316 TJ stainless steel ogive joint

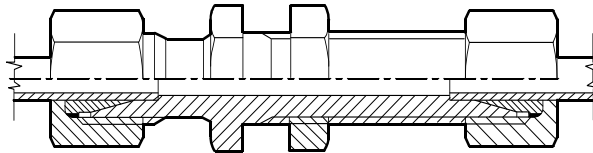


117683

Figure 5

"T" INTERMEDIATE FITTING

AISI 316 TJ stainless steel ogive joint



117714

Figure 6

STRAIGHT CROSSING FITTING

AISI 316 TJ stainless steel ogive joint

Emptying the gas circuit



- **Before important repairs (i.e. welding) on the vehicle or engine the gas system must be ventilated with air.**

It is normally sufficient to partially discharge the circuit, in other words, to discharge only the pipes and not the cylinders; however in some cases it may be necessary to discharge the entire system (including the cylinders).

This must be decided on a case by case basis, depending on the importance and type of work being done.

In case of uncertainty, always opt for the safer solution (complete discharge).

If there are no problems in the circuit (e.g., leaks), it is preferable to use up the gas with the engine.

Running the engine with the circuit pressure below 20 bar may result in incorrect fuel dosing.

Note Below 20 bar, the engine should only be idled to prevent damaging the catalytic converter.

The subsequent emptying must be done with the engine switched off and out in the open in an area where there are no sources of flame or sparks within a radius of at least 5 metres around the vehicle.

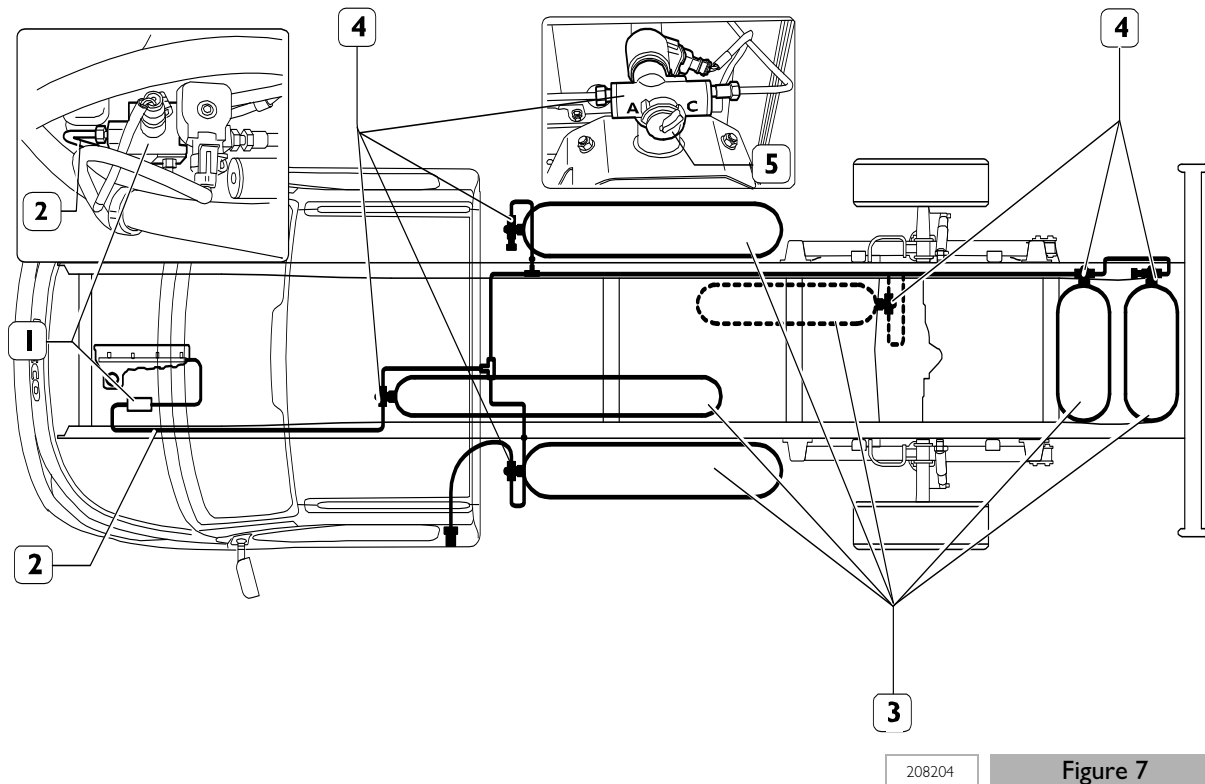
Partial discharge

Figure 7

1. Pressure reducer
2. High gas pressure pipes
3. Cylinder
4. VBE solenoid valve
5. Tap

- A. Open tap
- C. Closed tap



- **This operation only guarantees ventilation of the system downstream of the gas cylinders. Therefore it is imperative to avoid performing operations that could generate sparks (welding, cutting, grinding, drilling) or involve the use of electrically powered equipment or open flames, at a distance of less than 5 m from the cylinders.**

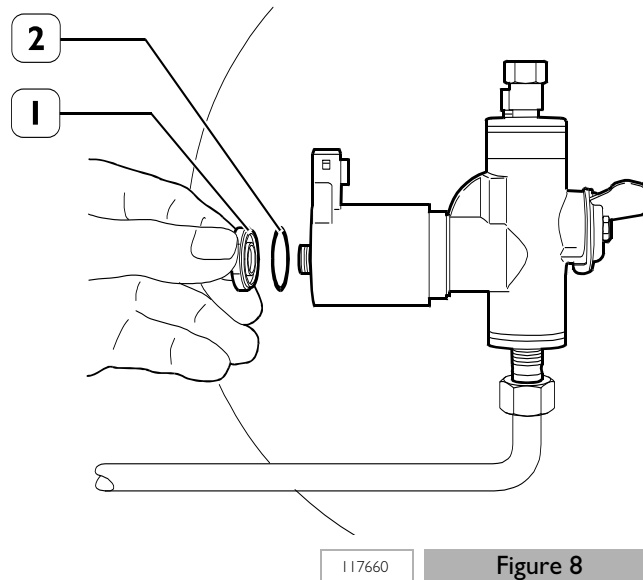
- Shut off power to the vehicle's electrical system at the master power switch (if present).
- Disconnect cables from the battery.
- Ground the vehicle.
- Check that the cocks (5) of the solenoid valves (4) on all the cylinders (3) are closed: cock (5) set to **C**.
- Disconnect the gas delivery pipe (2) from the pressure reducer (1) working slowly and paying attention to the effects of gas pressure in the pipes.
- Connect a rubber pipe (compatible with CNG) to the gas delivery pipe (2) to dispose of the gas, the free end of the pipe must be at least 5 m from any source of flame or spark.
During this operation the rapid decompression can result in icing. Pay attention.
- Check that the pressure in the system is null.

Total discharge

Totally discharging the circuit includes ventilating the cylinders. In order to allow for safe evacuation of the gas, remove the VBE valve shutters and ventilate the circuit downstream of the cylinders' manual cocks.

- Perform the partial emptying operations described in the previous paragraph.
- Check that the taps **(5)** of the solenoid valves **(4)** on all the cylinders **(3)** are closed: cock **(5)** set to **C** and proceed as described below.

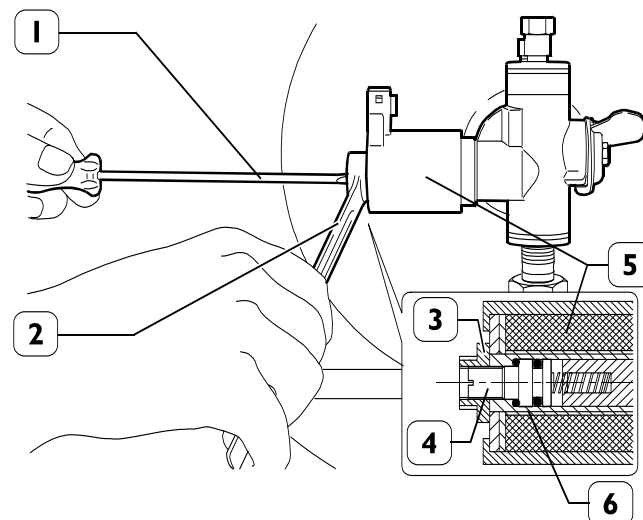
Extracting the solenoid valve mobile equipment and/or coil replacement



117660

Figure 8

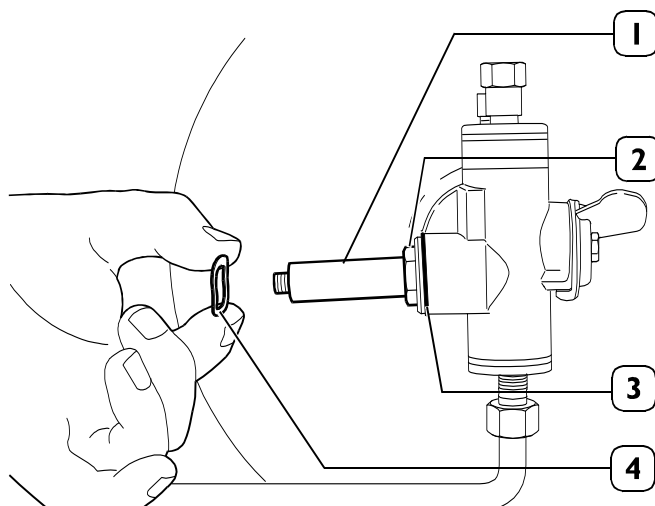
- Disconnect the electrical connection from the coil.
- Unscrew the external nut of the coil **(1)** using the relative O-ring **(2)**.



117661

Figure 9

- Using a screwdriver **(1)** immobilise the threaded pin **(4)**; using a wrench **(2)** remove the nut **(3)** securing the coil **(5)**. Remove the coil **(5)** from the shaft **(6)**.



117662

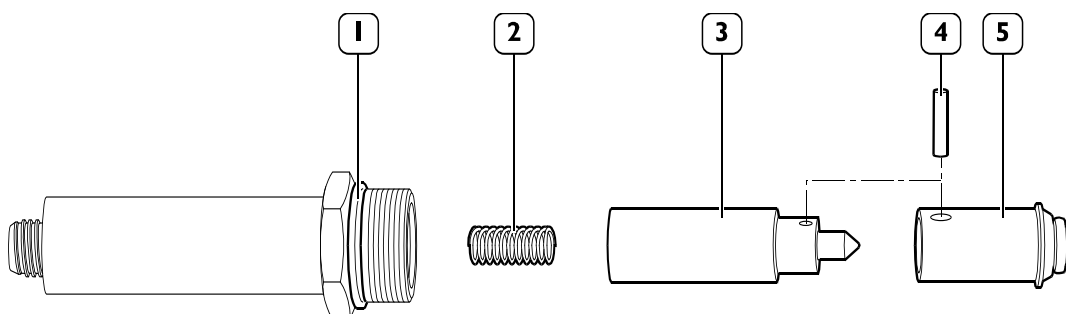
Figure 10

- Extract the circlip (4).



► **The valve still contains a small amount of highly pressurised gas. To avoid any risk of injury, decrease the pressure by slowly undoing the ring nut (2) on the coil shaft (1).**

- If there is no pressure, proceed to completely disassemble the coil shaft (1) with its O-Ring (3).



87391

Figure 11

- Remove the piston (3), shutter (5) and spring (2) from the coil shaft (1) taking care not to lose the pin (4) securing the shutter to the piston;
- If the VBE valve is not scheduled for replacement, check the condition of the disassembled parts, including O-Rings, and replace them, if necessary, on reassembly;
- Screw the empty coil sleeve back in with its O-Ring and tighten the ring nut to 28 Nm.
- repeat the previous operations for all cylinder VBE valves.

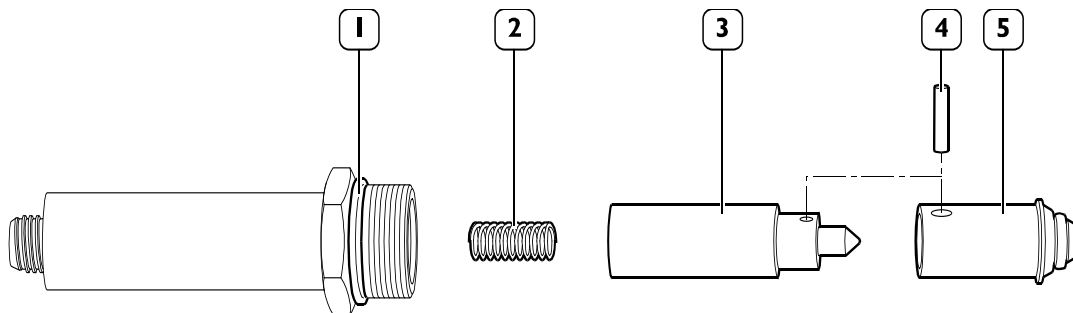
Bleeding

Half open the valve cocks **(5)** (see Figure 7).



- **This allows the pressurised gas to enter the pipes: take maximum care. After emptying, ensure that the engine cannot be started.**

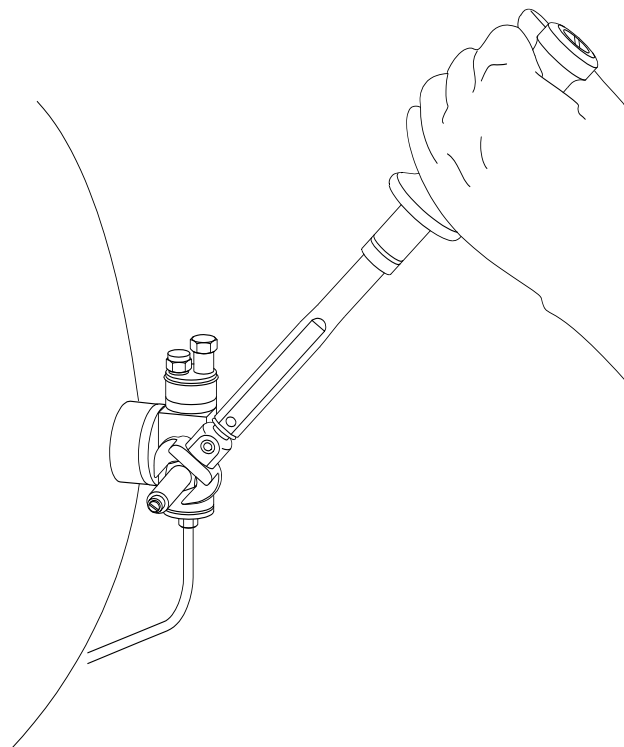
If, after total discharge, the VBE valves are not scheduled for replacement, refit the disassembled parts or their replacements as described in the following paragraph.

Inserting the mobile equipment of the solenoid valve

87391

Figure 12

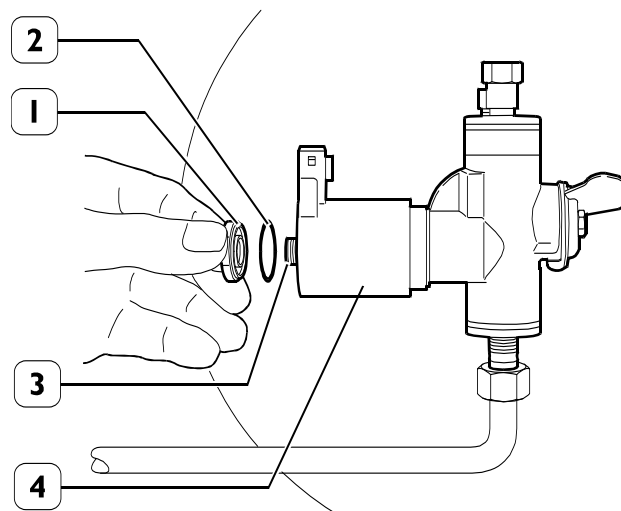
- Fit the piston **(3)** into the shutter **(5)** and secure it with the pin **(4)**.
- Fit and push the spring **(2)** completely into the seat inside the piston **(3)**.
- Fit the complete assembly into the coil shaft **(1)** with the conical end of the shutter **(5)** facing outwards.
- Check that the O-Ring is fitted to the shaft **(1)** and in good condition.



87392

Figure 13

- Fit and screw in the coil shaft ring nut tightening it to a torque of 28 Nm.



117663

Figure I4

- Check that the coil (4) is not damaged. If necessary, replace the coil.
- Fit the spring washer (4) (see Figure I0) and the coil (4) (see Figure I4) to the shaft (1) (see Figure I0).
- Screw in the internal nut (3) securing the coil (4) and lock it at 8 Nm.
- Screw in the nut (1) with the relative O-Ring (2) and tighten it to a torque of 7 Nm.
- Restore electric connection to the coil (4).
- Repeat the previous operations for all cylinder VBE valves.

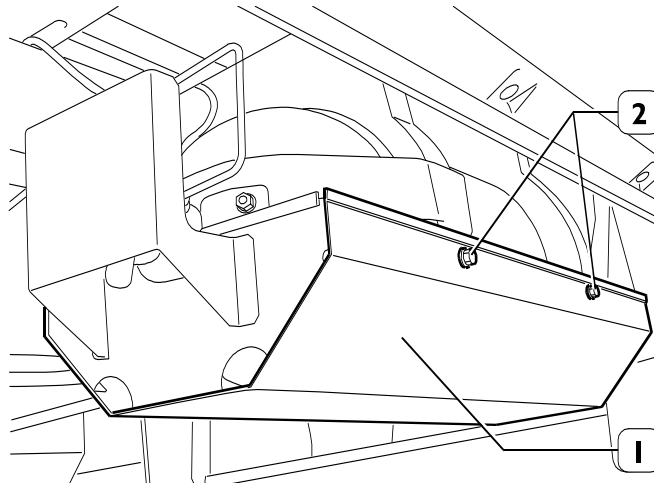
Replacing the VBE solenoid valves

Removal

Note The VBE valves may be replaced following a failure or when the cylinders are being periodically overhauled. Disassembled valves cannot be reused and must be replaced, whatever the reason for their disassembly. We recommend to dispose them right after removal.



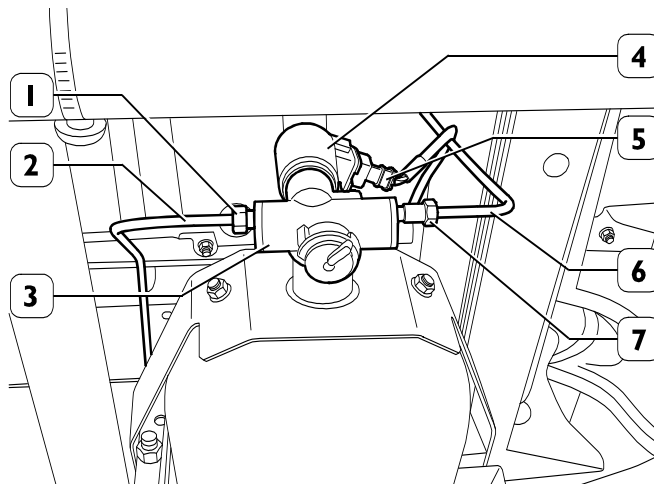
- **Before removing the solenoid valves the circuit must be completely discharged as described in the paragraph "Discharging the CNG circuit".**



117664

Figure 15

- Remove the screws **(2)** and take out the guard **(1)**.



117665

Figure 16

- Unscrew the couplings **(1)** and **(7)** and disconnect the piping **(2)** and **(6)** from the couplings of the VBE valve **(3)** disconnect the electrical connection **(5)** from the coil **(4)**.

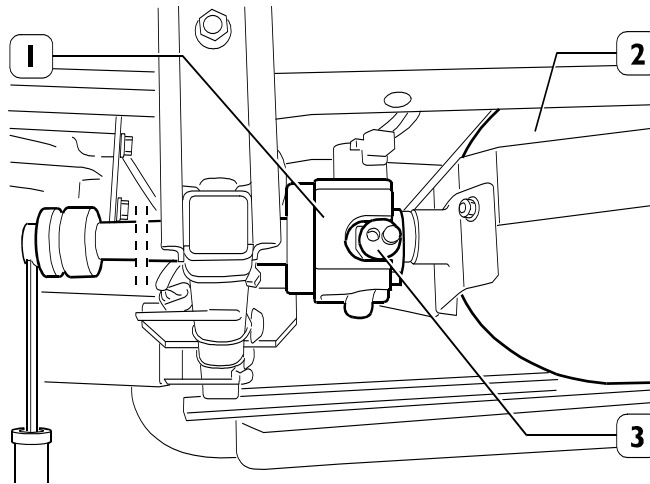


Figure 17

117666

- With the specific wrench 99355018 (1) unscrew and remove the VBE valve (3) from the cylinder (2).

Refitting

To refit, carry out the removal operations in reverse order, observing the following instructions:

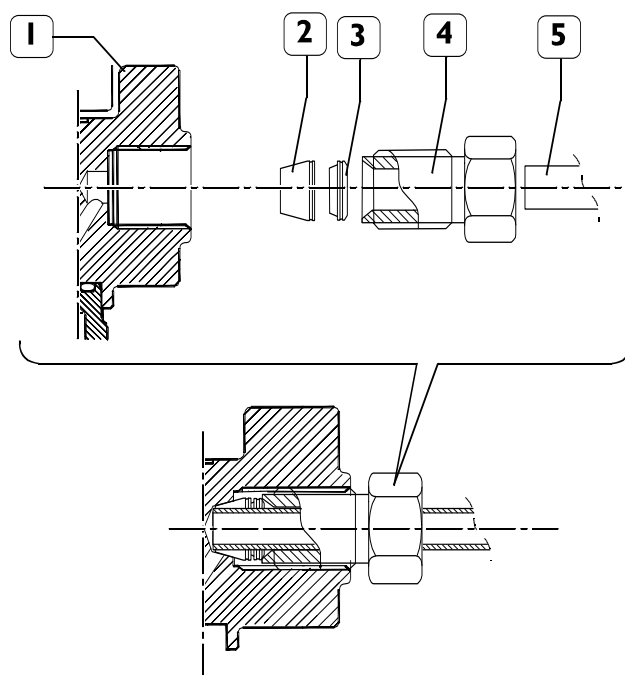
- The protection caps of VBE valves must not be removed in order to avoid damage to the valve during assembly. Never use pneumatic drivers or any other equipment which may damage the valve body and thus affect its functionality;
- if the cylinder has been removed from the vehicle, immobilise it in the vertical position with its neck uppermost;
- Wrap the thread of the valve shank with 2-3 layers of Teflon tape;
- Manually screw the valve in by several turns. Next, using a specific wrench in combination with a torque wrench, tighten to a torque of 270 ± 10 Nm.

Note While doing so, take care not to damage the VBE valve's fuse plate with the wrench 99355018.

Repairs on pipes and fittings

If there is a gas leak from the pipe or from the fittings, the entire pipe must be replaced. The pipe is not supplied with the fittings which must be selected separately.

- Remove the pipe to be replaced together with its end fittings.
- Check the integrity of the new pipe, pre-shape it in the same way as the one being replaced and insert the new fittings and sealing rings into its end.
- Fit the pipe inserting its ends into the seats of the components to be connected and make sure they fit all the way in.
- To avoid pre-tensioning, always check the alignment of the end of the pipe with the fittings.
- Fit and screw in the nuts of the fittings by hand and then tighten them to the prescribed torque. For EMER unions, follow the procedure described elsewhere.
- Fit the securing brackets, making sure not to stress the pipe.
- Restore the system operation by carrying out a hydraulic seal test as indicated in the instructions at the beginning of the chapter.

Fitting assembly

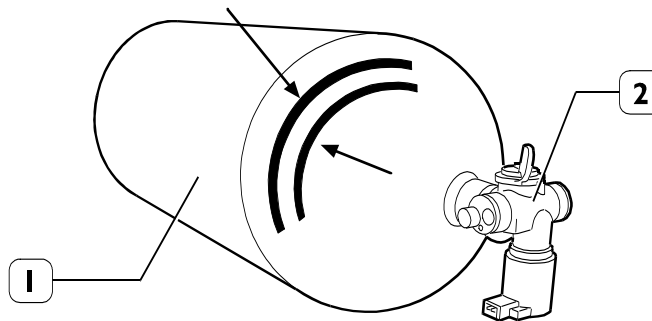
118974

Figure 18

- Fit the seal rings **(2)** and **(3)** onto the pipe.
- Insert the pipe **(5)** into the seat of the valve **(1)**, appropriately adjusting the cylinder to avoid pre-tensioning the piping.
- Keeping the pipe in its seat, screw on the union **(4)** and tighten it to the prescribed torque.
- Unscrew the union **(4)** and check the fastening of the seal on the pipe.
- Fit and screw in the fitting and tighten it to the prescribed torque.
- Carry out the hydraulic test on the system as indicated in the instructions at the beginning of this Chapter.

Note *If subsequently dismantling, change the seals with new ones.*

B.4 CYLINDERS



117674

Figure 19

1. Cylinder

2. Solenoid valve

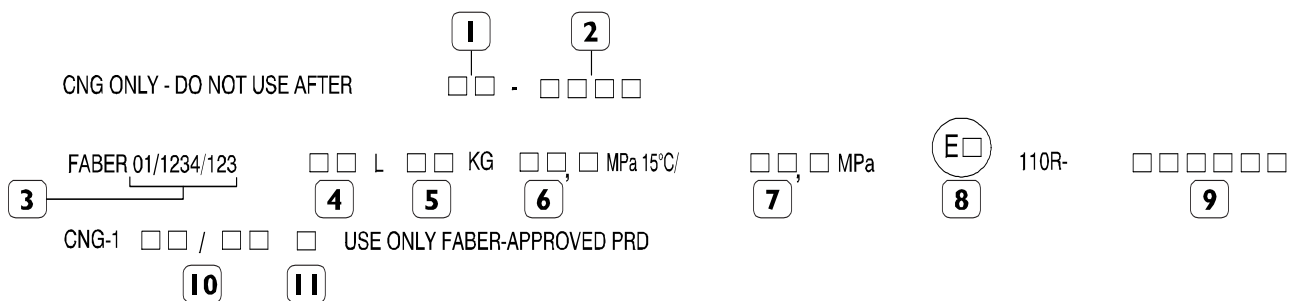
The CNG, compressed at a pressure of 200 bar, is stored in some cylinders, positioned in the chassis frame and protected by special sheet metal guards.

The cylinders, connected together in series, are filled via a filling valve equipped with a check valve.

A second check valve is included in the solenoid valve fitted on the first cylinder connected to the filling union. The function of the check valves is to prevent the gas escaping outwards and the dispenser being removed from the filling valve after refilling.

Note The presence of a malfunctioning flow valve or solenoid valve can lead to incorrect readings of the amount of gas in the cylinders. Please refer to the procedures for checking and replacing solenoid valves described, in the paragraph "VBE solenoid valve replacement (► Page 16)".

The top surface of the cylinder is punched (→) with important information to which particular care should be taken.



208220

Figure 20

1. Month of expiry (previous to that tested)
2. Year of expiry (after 20 years)
3. Nominal capacity
4. Cylinder weight
5. Operating pressure, MPa

6. Testing pressure, MPa
7. Punch identifying country of type-approval
8. ECE/ECE type-approval number
9. Month/year of test
10. Inspector's punch

Periodic overhaul

According to the standard ECE/ONU R110, gas cylinders for vehicles must be checked **AT LEAST EVERY 48 MONTHS** from the first registration date, unless local legislation requires otherwise.

The overhaul must be performed by a competent body, recognised by the regulatory authority.

Note The expiry date is stated on the cylinder and on the documentation supplied with the vehicle.

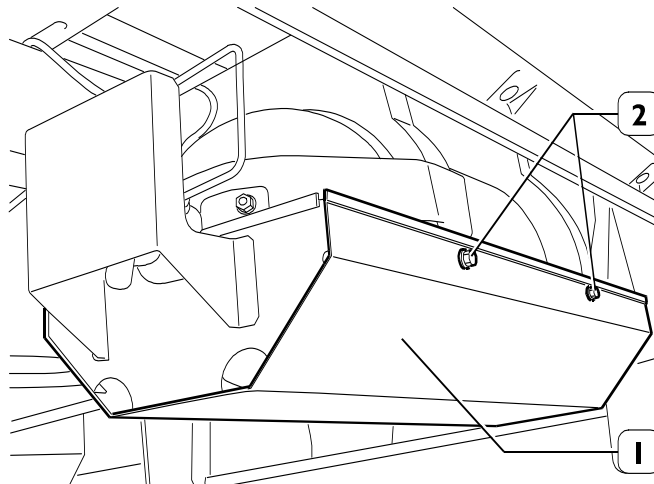
- Cylinders that have been subject to impact during a vehicle collision must be inspected by a body approved by the manufacturer, unless otherwise specified by the competent authority. These cylinders can be returned to service only if they have not suffered any kind of damage; otherwise they must be returned to the manufacturer for an in-depth evaluation survey.
- Cylinders that have been exposed to a possible fire must be inspected by a body authorised by the manufacturer, or declared ineligible and removed from service.

Change cylinders

Removal



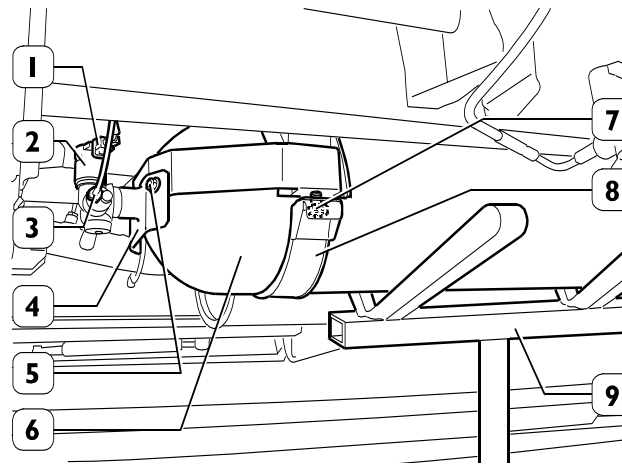
- **Before removing the cylinders the circuit must be completely discharged as described in the paragraph "Discharging the CNG circuit".**



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Figure 21

- Remove the screws **(2)** and take out the guard **(1)**.



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Figure 22

- Unscrew the nuts (5) and remove the cover (4).
- Disconnect the electrical connection (1) from the coil (2) of the VBE solenoid valve.
- Disconnect the gas pipes (3) from the solenoid valve (2).
- Hold up the cylinder (6) with suitable support (9).
- Remove the screws (7), turn the brackets (8) and remove the cylinder (6) from the chassis.
- Remove the VBE valves (2) from the cylinder (6) as described in the corresponding chapter.

Refitting

To refit, carry out the removal operations in reverse order, observing the following instructions:

- Place the cylinders in the framework with the VBE valves pointing in the right direction to allow connecting the pipes;
- tighten the VBE valves (2) and the pipe unions to the prescribed torque, observing the instructions given in the paragraph "Repairs on pipes and fittings (► Page 18)".
- Once refitting is completed, perform the hydraulic sealing test for leaks as indicated in the warnings at the beginning of Chapter B.3 (► Page 6).

B.5 FUSES AND RELAYS

Fuse and relay box under the CNG dashboard

See Chapter 5.4 .

B.6 CONNECTORS FOR BODY BUILDERS

Note For information about connectors for body builders, refer to the descriptions in Section 5 - Chapter 5.2 .

B.7 POWER TAKE-OFFS

The procedures for the engagement and disengagement of power take-offs are similar to those described in Section 4 for diesel engine vehicles, unless it is necessary (in the process of engaging) to increase the engine speed to 1200 rpm before operating the PTO switch as in Figure 4.4.

