# UPDATE DATA

<table>
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<tr>
<th>Section</th>
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<th>Page</th>
<th>Revision date</th>
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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 Body builder 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 described in this manual and not expressly authorized will relieve IVECO of any liability and the warranty, if present, will immediately be null and void.

The same applies to individual assemblies and components; those described in this manual have been deliberated, approved and tested by IVECO and are part of normal production. The adoption of any type of unit that is not approved (e.g. PTO, tyres, horns, etc.) shall relieve IVECO of any responsibility.

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Data and information contained in this publication may be outdated as a result of changes adopted by IVECO, at any time, for technical or commercial reasons or due to the need to adapt the vehicle to new legal requirements.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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Danger for persons&lt;br&gt;Failure to comply with these prescriptions can result in the risk of serious injury.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Risk of serious damage to the vehicle&lt;br&gt;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.</td>
</tr>
<tr>
<td>⚠️</td>
<td>General danger&lt;br&gt;Includes the dangers of both above described signals.</td>
</tr>
<tr>
<td>🌿</td>
<td>Environmental protection&lt;br&gt;Indicates correct behaviour in order that vehicle use is as environmentally friendly as possible.</td>
</tr>
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NOTE<br>Indicates an additional explanation for a piece of information.
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GENERAL INFORMATION

1.1 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.

1.2 TECHNICAL DOCUMENTATION AVAILABLE ELECTRONICALLY

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

- Directives 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.

1.3 IVECO AUTHORISATION

Modifications or out fittings included in these Directives and carried out in compliance with the instructions provided do not require a specific authorisation.

If this is not the case, 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).
1.4 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. Upon completion of the interventions the bodybuilder shall be responsible for attainment of definitive approval from the competent authority.

1.5 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.

1.6 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.

1.7 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.
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.
1.9 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.

1.10 ACCIDENT PREVENTION

Do not allow unauthorised personnel 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 vehicles must comply with the applicable regulations for accident prevention, and with safety regulations required in the individual countries where the vehicles are 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 manufacturer 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.

1.11 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.
1.12 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 Bodybuilder must:

- calibrate its production (vehicle and/or equipment) and verify functionality and safety;
- for items which will be subjected to the intervention, carry out the controls set out in the Pre Delivery Inspection (PDI) list, available in the IVECO network;
- 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.
### 1.13 VEHICLE NAMES

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

**Type approval name**

<table>
<thead>
<tr>
<th>DAILY 40C15HA8 SV /P</th>
</tr>
</thead>
</table>

- **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
  - F1A Euro 6 engine or F1C Euro 6 engine
  - F1C Euro VI Engine (combined with engine power codes 15 or 18)
  - F1C CNG engine (combined with engine power code 14)
  - F1C Natural Power Engine (Bi-Fuel - combined with engine power code 14)
- **A8** – Type of transmission
  - Manual gearbox
  - Automatic transmission
- **SV** – Version
  - Cab
  - Dual cab (6+1)
  - Van
  - Semi-windowed
  - Preparation for camper
  - Short cowl version for camper
  - Vendor
  - Cowl
  - Cowl (short)
  - Cut Away / Cut Away with max.height of load area
- **/ P** – Rear pneumatic suspensions
1.14 IDENTIFICATIONS

Logos, identification tradenames and nameplates must not be modified, displaced or removed since the original design appearance of the vehicle must be safeguarded.

The application of trademarks relating to the transformation or outfitting must be authorised. They must not be applied near to the IVECO tradenames or logos.

In the event of cowl vehicles, the positioning of the IVECO logo on the engine bonnet must be done only after final paint spraying and must respect the measurements indicated qualitatively in the following figure.

![Figure 2](image)

1. Front view
2. Side view

For the actual measurements and for the realization of a possible template, please consult the design 5801620982.

IVECO reserves the right to withdraw its tradenames and logos if the above requirements are not met.

1.15 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

The body length limits mainly depend on:

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

On DAILY E6, this width is 2550 mm.

Rear-view mirrors

Depending on the width of the version, the rear visibility angles imposed by the Regulations can be respected choosing the most appropriate of the three rear-view mirrors with arms of varying widths available in the catalogue (opt. 8643, 8644, 76129).
**Determination of the centre of gravity of the superstructure and the payload**

To determine the position of the centre of gravity of the superstructure and of the payload, proceed according to the following examples.

The specific technical documentation for each model (cab version diagram) illustrates the positions allowed with the standard version vehicle. The masses and the positioning of the individual components of the vehicle are shown on the chassis and weight allocation diagram.

\[
\begin{align*}
W &= \text{Payload plus superstructure} \\
W1 &= \text{Measurement of payload on front axle} \\
W2 &= \text{Measurement of payload on rear axle} \\
L1 &= \text{Distance of centre of gravity from centre line of rear axle} \\
L &= \text{Actual wheelbase}
\end{align*}
\]

For the purposes of payload distribution on the axles, it is assumed that this is evenly distributed, except in cases in which the shape of the load surface results in a different load distribution.

For equipment, the centre of gravity is obviously 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 axles, 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.

*Even distribution of load*  
*Uneven distribution of load*
Even distribution of load

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

**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:

- fixed loads,
- mobile loads;
- loads that result in increased aerodynamic actions.

**a) Fixed loads**

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

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

**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 Ws is only the tare weight of the superstructure (considering for Hv 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 1.1

<table>
<thead>
<tr>
<th>Models</th>
<th>Height of centre of mass (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>33S</td>
<td>1400</td>
</tr>
<tr>
<td>35S</td>
<td>1500</td>
</tr>
<tr>
<td>35C - 40C (Frontal transverse leaf)</td>
<td>1800</td>
</tr>
<tr>
<td>35C - 40C (front longitudinal torsion bar)</td>
<td>1900</td>
</tr>
<tr>
<td>45C - 50C</td>
<td>1950</td>
</tr>
<tr>
<td>60C - 65C - 70C</td>
<td>2050</td>
</tr>
</tbody>
</table>

**b) 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.

**c) 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 parts (in accordance with the procedure outlined in Chapter 29.), 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 careful evaluation of the outfitting characteristics, the wheelbase and the distribution of transverse 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 may be performed in the presence of concentrated loads behind the cab (e.g. cranes) or of 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 ± 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.
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.

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.

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.
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 on the wings of the side members** (except for that stated in 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 reused, 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**

▶ **During operations involving welding, drilling, grinding or cutting carried out near the brake pipes or wiring, always disconnect the battery to prevent damage to the electronic control units. It is also necessary to adopt appropriate measures to protect these pipes and cables, even including removal if necessary (respect the indications provided in Chapters 2.15 and 5.4).**
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>
<thead>
<tr>
<th>Name of steel</th>
<th>Breaking strength [N/mm²]</th>
<th>Yield stress [N/mm²]</th>
<th>Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVECO Fe E420</td>
<td>530</td>
<td>420</td>
<td>21%</td>
</tr>
<tr>
<td>Europe S420MC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany Q5e420TM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Table 2.2 - Section dimension and chassis thickness

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Wheelbase [mm]</th>
<th>Rear overhang chassis [mm]</th>
<th>A x B x t Side member section wheelbase area [mm]</th>
<th>A x B x t Side member section rear overhang area [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>33S - 35S</td>
<td>truck</td>
<td>3000</td>
<td>920</td>
<td>144 x 56 x 3</td>
<td>94 x 56 x 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3450</td>
<td>1355</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3750</td>
<td>1655</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100</td>
<td>1305</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>van</td>
<td>3000</td>
<td>840</td>
<td>144 x 56 x 3</td>
<td>94 x 56 x 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3520</td>
<td>840</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3520 long overhang</td>
<td>1240</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100</td>
<td>1825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35C</td>
<td>lightened camper</td>
<td>3750</td>
<td>1655</td>
<td>144 x 56 x 3</td>
<td>94 x 56 x 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100</td>
<td>1825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35C - 50C</td>
<td>truck</td>
<td>3000 (1)</td>
<td>1240</td>
<td>174 x 70 x 4</td>
<td>114 x 70 x 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3450</td>
<td>1355</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3750</td>
<td>1655</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100 (1)</td>
<td>1715</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4350</td>
<td>1885</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4750 (2)</td>
<td>2350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35C - 40C</td>
<td>van</td>
<td>3520</td>
<td>840</td>
<td>174 x 69 x 3</td>
<td>114 x 69 x 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3520 long overhang</td>
<td>1240</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100</td>
<td>1825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45C - 50C</td>
<td>van</td>
<td>3520</td>
<td>840</td>
<td>174 x 70 x 4</td>
<td>114 x 70 x 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3520 long overhang</td>
<td>1240</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100</td>
<td>1825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60C - 70C</td>
<td>truck</td>
<td>3450</td>
<td>1355</td>
<td>174 x 69 x 5</td>
<td>174 x 69 x 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3750</td>
<td>1655</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100</td>
<td>1715</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4350</td>
<td>1885</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4750</td>
<td>2350</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>van</td>
<td>4100</td>
<td>1825</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4100 long overhang</td>
<td>2220</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(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 | Permitted static stress on the chassis: $\sigma_{adm} = 120 \text{ N/mm}^2$ |

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.

![Figure 2](image-url)
### 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>
<thead>
<tr>
<th>Resistance class</th>
<th>Use</th>
<th>Breaking strength [N/mm²]</th>
<th>Yield stress [N/mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.8</td>
<td>Intermediate resistance screws (crossbars, shear resistant plates, brackets)</td>
<td>800</td>
<td>640</td>
</tr>
<tr>
<td>10.9</td>
<td>High resistance screws (springs supports, stabiliser bars and shock absorbers)</td>
<td>1000</td>
<td>900</td>
</tr>
</tbody>
</table>

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).

![Figure 3](image-url)

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**

- Cut the side members with a skewed or vertical cut. Cuts are not permitted in areas where there are a high concentration of stresses (e.g. spring brackets). The cutting line must not go through the holes on the side member (see Figure 4).

![Figure 4](image1)

- 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).

![Figure 5](image2)

- 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.
- 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 of 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)**

<table>
<thead>
<tr>
<th>Class</th>
<th>Part requirements</th>
<th>Examples of parts involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Parts in direct contact with atmospheric agents</td>
<td>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.</td>
</tr>
<tr>
<td>B</td>
<td>Parts in direct contact with atmospheric agents</td>
<td>Chassis and relative parts, including its fasteners</td>
</tr>
<tr>
<td></td>
<td>mainly have structural characteristics, in clear sight</td>
<td>Parts below the radiator grille (class B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External cab ramps</td>
</tr>
<tr>
<td>B1</td>
<td>Only for rear axles and front axles</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Parts in direct contact with atmospheric agents, not in clear view</td>
<td>Engine and relative parts</td>
</tr>
<tr>
<td>D</td>
<td>Parts not in direct contact with atmospheric agents</td>
<td>Pedals - Seat coverings - Fastening elements - etc., mounted inside the cab</td>
</tr>
</tbody>
</table>

**Table 2.5 - Unpainted aluminium parts - IVECO Standard 18 - 1600 (Table IV)**

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>IVECO standard</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>18-0506</td>
<td>–</td>
</tr>
<tr>
<td>Geomet</td>
<td>GEO 321-8</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td>GEO 500-8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GEO 321-8 PM</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2.6 - Painted parts - IVECO Standard 18 - 1600 (Prospectus III)

<table>
<thead>
<tr>
<th>Cycle phase description</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td><strong>MECHANICAL SURFACE CLEANING</strong> (*)</td>
<td></td>
</tr>
<tr>
<td>Sand/shot blasting</td>
<td>–</td>
</tr>
<tr>
<td>Brushing</td>
<td>yes</td>
</tr>
<tr>
<td>Sandpapering</td>
<td>–</td>
</tr>
<tr>
<td><strong>PRE-TREATMENT</strong></td>
<td></td>
</tr>
<tr>
<td>Iron phosphating (only for non-precoated ferrous materials)</td>
<td>–</td>
</tr>
<tr>
<td>Zinc phosphating (**)</td>
<td>–</td>
</tr>
<tr>
<td><strong>CATAPHORETIC PAINTING</strong></td>
<td></td>
</tr>
<tr>
<td>High thickness (30-40 μm)</td>
<td>yes</td>
</tr>
<tr>
<td>Medium thickness (20-30 μm)</td>
<td>yes</td>
</tr>
<tr>
<td>Acrylic finishing (&gt;35 μm)</td>
<td>–</td>
</tr>
<tr>
<td><strong>RUST PREVENTER</strong></td>
<td></td>
</tr>
<tr>
<td>B-component (30-40 μm)</td>
<td>–</td>
</tr>
<tr>
<td>Single-component (30-40 μm)</td>
<td>–</td>
</tr>
<tr>
<td><strong>ANTIROCK PRIMER</strong></td>
<td></td>
</tr>
<tr>
<td>Single (130 °C) or bicomponent (30-40 μm)</td>
<td>yes</td>
</tr>
<tr>
<td><strong>VARNISH</strong></td>
<td></td>
</tr>
<tr>
<td>Single (130 °C) or bicomponent (30-40 μm)</td>
<td>yes</td>
</tr>
<tr>
<td>Powders (40-110 μm)</td>
<td>yes</td>
</tr>
<tr>
<td>Low temperature single-component (30-40 μm)</td>
<td>–</td>
</tr>
</tbody>
</table>

(1) Coupling with other materials must not cause the "battery effect".
(2) Coatings free from chromium salts.
(3) Coatings free of hexavalent chromium.

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>IVECO standard</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B - B1 - B2</td>
</tr>
<tr>
<td><strong>Geomet (3)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEO 321-8 PML</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>GEO 321-8 PL</td>
<td>–</td>
<td>yes</td>
</tr>
<tr>
<td>GEO 500-8 PL</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>GEO 321-5</td>
<td>–</td>
<td>yes</td>
</tr>
<tr>
<td>GEO 500-5</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>GEO 321-5 PM</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>GEO 321-5 PML</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>GEO 321-5 PL</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>GEO 500-5 PL</td>
<td>yes</td>
<td>Class B1</td>
</tr>
<tr>
<td><strong>Zinc coating (3)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe/Zn 12 II</td>
<td>18-1101</td>
<td>–</td>
</tr>
<tr>
<td>Fe/Zn 7 IV</td>
<td>18-1102</td>
<td>–</td>
</tr>
<tr>
<td>Fe/Zn 12 IV</td>
<td>18-1102</td>
<td>–</td>
</tr>
<tr>
<td>Fe/Zn 7 IV S</td>
<td>18-1102</td>
<td>–</td>
</tr>
<tr>
<td>Fe/Zn 12 IV S</td>
<td>18-1102</td>
<td>–</td>
</tr>
<tr>
<td><strong>Alloy Zn-Ni</strong></td>
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<td></td>
</tr>
<tr>
<td>Fe/Zn Ni 7 VII S</td>
<td>FIAT 9.57409</td>
<td>–</td>
</tr>
<tr>
<td>Fe/Zn Ni 7 IV</td>
<td>18-1148</td>
<td>yes</td>
</tr>
<tr>
<td><strong>Aluminium</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode oxidation</td>
<td>18-1148</td>
<td>yes</td>
</tr>
<tr>
<td>Painting</td>
<td>See Table III</td>
<td>yes</td>
</tr>
</tbody>
</table>

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

(1) Coatings free from chromium salts.
(3) Coatings free of hexavalent chromium.
This operation must be performed when dealing with cutting burr, oxidation, weld slag, or laser-cut surfaces.

Two-layer bodywork cycle.

Three-layer bodywork cycle.

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

Only rear/front axles.

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

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

For fuel tanks in ferrous or pre-coated sheets.

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

<table>
<thead>
<tr>
<th>Cycle phase description</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A - B - D</td>
</tr>
<tr>
<td>Mechanical surface cleaning</td>
<td>Brushing/sanding/sanding blasting</td>
</tr>
<tr>
<td>(including elimination of burrs/oxidation and cleaning of cut parts)</td>
<td></td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>Degreasing</td>
</tr>
<tr>
<td>Rust preventer</td>
<td>Bi-component (30-40 μm)</td>
</tr>
<tr>
<td>Varnish</td>
<td>Bi-component (30-40 μm)</td>
</tr>
</tbody>
</table>

(1) Modifications on rear axles, from axles and engine (classes B1 and C) not allowed

(2) Preferably epoxy

(3) Preferably polyurethane

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

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A - B</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>yes</td>
</tr>
<tr>
<td>Geomet</td>
<td>yes</td>
</tr>
<tr>
<td>Zinc coating (1)</td>
<td>–</td>
</tr>
</tbody>
</table>

(1) Free from hexavalent chromium
Precautions

**a) 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.

**b) On engines and their electric and 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.

**Note**  
When the painting operation has been completed, and prior to oven drying (max. temperature: 80 °C), all parts which may be damaged by exposure to heat, must be removed or protected.
2.4 WHEELBASE MODIFICATION

General information

Note 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 and existing "datasets" for ESP and AEBS (see Section 5 - Chapter 5.8 - Paragraph "Safety electronical devices ").

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:

a) for extensions

- another one of the lengths available in production for the vehicle model is to be created;
- the thickness of the side member to be extended does not differ from that of the standard side members taken as reference, or differs (downwards) by just one "step" (see Table 2.2);
- number, type and position of the crossbars, the existing circuits and systems on the series chassis corresponding to this length are replicated.

b) for shortenings

- another one of the lengths available in production for the vehicle model is to be created;
- number, type and position of the crossbars, the existing circuits and systems on the series chassis corresponding to this length are replicated.

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

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

Note 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.
2.4 WHEELBASE MODIFICATION

Table 2.9 - Maximum permitted wheelbase extension

<table>
<thead>
<tr>
<th>Model</th>
<th>Front suspension</th>
<th>Maximum Wheelbase [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>33S, 35S</td>
<td>Crossways leaf spring</td>
<td>4100</td>
</tr>
<tr>
<td>35C, 40C</td>
<td>Crossways leaf spring</td>
<td>4100</td>
</tr>
<tr>
<td>35C, 40C, 45C, 50C</td>
<td>Torsion bar</td>
<td></td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>Torsion bar</td>
<td></td>
</tr>
</tbody>
</table>

**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 check the conditions of the permitted conversion (brake cylinders, minimum tare weights, theoretically admissible loads, tyres, height of the centre of gravity).

Table 2.10 - Braking, wheelbase modification limits

<table>
<thead>
<tr>
<th>Model</th>
<th>Version</th>
<th>Minimum wheelbase [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>33S, 35S</td>
<td>Cab version</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>3450</td>
</tr>
<tr>
<td>33S CNG</td>
<td>Cab version</td>
<td>3450</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>3450</td>
</tr>
<tr>
<td>35C, 40C</td>
<td>Cab version</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>3450</td>
</tr>
<tr>
<td>35C CNG</td>
<td>Cab version</td>
<td>3450</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>4100</td>
</tr>
<tr>
<td>45C, 50C</td>
<td>Cab version</td>
<td>3450</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>4350</td>
</tr>
<tr>
<td>50C CNG</td>
<td>Cab version</td>
<td>3450</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>4350</td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>Cab version</td>
<td>3450</td>
</tr>
<tr>
<td></td>
<td>Double cab</td>
<td>4350</td>
</tr>
<tr>
<td>60C CNG, 65C CNG</td>
<td>Cab version</td>
<td>3450</td>
</tr>
</tbody>
</table>

⚠️ Modifications to the wheelbase of vehicles equipped with electronic braking control, grip and stability systems involves updating the setting parameters of the relative control units through IVECO teleservices.
**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 or 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.

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.
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 (دليل Page 8)". In any case, any more restrictive limits imposed by national standards shall be valid.

**Gearbox modifications**

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

**2.5 REAR OVERHANG MODIFICATION**

**General information**

When modifying the rear overhang, the limits set by national standards must be respected. This is also the case for the maximum distances from the rear structural edge and distance from the ground, defined for the tow 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 ÷ 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 chassis elongation as well as shortening to the shortest value for each model of the series does not require authorisation if performed in compliance with the instructions provided herein.

Note  If you need to adjust the length of the electrical circuits, see Chapter 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.

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.

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

**Note** 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 Service 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.
1. Free field for towing hooks

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

In cases where the connection flange of the drawbar coupling does not have holes suitable to those on the existing rear crossbar of the vehicle, the latter may be authorised for modification upon application of adequate reinforcements.

The Body builder has the duty of realising and installing the superstructure so as to allow coupling connection and checks without impairment or hazard of sort.

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>
<thead>
<tr>
<th>Type</th>
<th>Class</th>
<th>D [kN]</th>
<th>DC [kN]</th>
<th>S [kN]</th>
<th>N° ECE type approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS500</td>
<td>S</td>
<td>23</td>
<td>–</td>
<td>2.8</td>
<td>E11 55R-010533</td>
</tr>
<tr>
<td>GA381</td>
<td>S</td>
<td>30</td>
<td>–</td>
<td>3.5</td>
<td>E11 55R-011613</td>
</tr>
</tbody>
</table>

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 central axle trailers therefore requires the use of suitable tow hooks and appropriate reinforcement to the tractor chassis (see Table 2.12).

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.

With mechanical coupling devices suitable for trailers with a central axle, the following formulas are valid:

\[ D_c = g \left( \frac{T \cdot C}{T + C} \right) \]

\[ V = a \cdot C \left( \frac{X^2}{L^2} \right) \]

\( D_c = \) 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/s²]
\( T = \) maximum weight of the towing vehicle [kg]
\( R = \) maximum weight of trailer at full load [kg]
\( S = \) vertical static load on the hook [kg], namely the mass part which in static conditions, is transmitted to the coupling point on the vehicle. Regulations require that the value of S is at least 4% of R; Therefore the original hook is type-approved for \( S = 0.04 \times 3500 \) kg (Rmax with braking inertia) = 140 kg. However, in the case of a centre axle trailer, where \( R = 750 \) kg (limit without braking), the value of S must be at least 25 kg.
C = sum of maximum axial loads of the centre axle trailer at full load. Equal to the maximum weight of the trailer minus the vertical static load \((C = R - S)\) [kg]

\(V\) = value of the intensity of the theoretical dynamic vertical force between the vehicle and the trailer [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

\[
\begin{align*}
S, V & \quad X \\
L & \quad \text{Figure 12}
\end{align*}
\]

\(X\). Length of the trailer load bed

\(L\). Theoretical drawbar length

Table 2.12 contains some data for the towing cross members in production, in the case of trailers with a central axis.

<table>
<thead>
<tr>
<th>type</th>
<th>Class</th>
<th>(D) [kN]</th>
<th>(Dc) [kN]</th>
<th>(S) [kN]</th>
<th>N° ECE type approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI2018 - TH4018</td>
<td>S</td>
<td>18</td>
<td>–</td>
<td>2.0</td>
<td>E11 55-017533</td>
</tr>
<tr>
<td>TI2019 - TH4019 - TH4000</td>
<td>S</td>
<td>23</td>
<td>–</td>
<td>2.8</td>
<td>E11 55-017534</td>
</tr>
</tbody>
</table>

**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 13 and 14 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.
2.6 INSTALLING THE TOW HOOK

**Observations of payload**

The static load on the tow hook must not exceed the load allowed on the rear axle of the vehicle. Furthermore, the minimum weight on the front axle must be respected as indicated in Chapter 1.15 (➔ 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 performed using the gearbox diagram of an equivalent standard production vehicle with a similar wheelbase.

The maximum tilt values of the standard propeller shafts must be respected, also in the event of interventions on the suspension and on the engine rear axle.

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.

\[
\beta_t = \sqrt{\beta_1^2 + \beta_2^2 + \beta_3^2} \leq 3°
\]

Maximum allowed angularity

\[n = \text{engine speed}\]
\[
\beta_t \cdot n < 20,000 \text{ for classes 2040-2045-2050}
\]
\[
\beta_t \cdot n < 25,000 \text{ for classes 2025-2030-2035}
\]

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

1. The maximum possible operating lengths, both for "LG" sliding sections as well as for "LZ" intermediate ones (see Figure 16), may be determined based on the outer diameter of the vehicle’s existing pipe and on the maximum number of operating revs. (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.
2. 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.
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:

\[ n_G = \frac{n_{\text{max}}}{i_G} \]

- \( n_G \): maximum engine speed [rpm]
- \( n_{\text{max}} \): 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

<table>
<thead>
<tr>
<th>Engine</th>
<th>Engine code (1)</th>
<th>( n_{\text{max}} ) [rpm]</th>
<th>Power [kW] - [HP]</th>
<th>Gearbox</th>
<th>( i_G )</th>
</tr>
</thead>
<tbody>
<tr>
<td>.12 WG</td>
<td>F1AGL411H*C</td>
<td>3600</td>
<td>85 - 116</td>
<td>2835.6</td>
<td>0.701</td>
</tr>
<tr>
<td>.13 WG</td>
<td>F1AGL411F*C</td>
<td>3600</td>
<td>96 - 130</td>
<td>Hi-Matic</td>
<td>0.667</td>
</tr>
<tr>
<td>.14 VGT</td>
<td>F1AGL411J*C</td>
<td>3600</td>
<td>100 - 136</td>
<td>2835.6</td>
<td>0.701</td>
</tr>
<tr>
<td>.16 VGT</td>
<td>F1AGL411G*C</td>
<td>3500</td>
<td>115 - 156</td>
<td>Hi-Matic</td>
<td>0.667</td>
</tr>
<tr>
<td>.15 WG</td>
<td>F1CGL411A*E</td>
<td>3500</td>
<td>110 - 150</td>
<td>2840.6</td>
<td>0.791</td>
</tr>
<tr>
<td>.18 VGT</td>
<td>F1CGL411B*E</td>
<td>3500</td>
<td>132 - 180</td>
<td>2840.6</td>
<td>0.791</td>
</tr>
<tr>
<td>.21 DST</td>
<td>F1CGL411C*E</td>
<td>3500</td>
<td>150 - 205</td>
<td>Hi-Matic</td>
<td>0.667</td>
</tr>
<tr>
<td>.15H VG</td>
<td>F1CFL411V*E</td>
<td>3500</td>
<td>110 - 150</td>
<td>2840.6</td>
<td>0.791</td>
</tr>
<tr>
<td>.18H VGT</td>
<td>F1CFL411W*E</td>
<td>3500</td>
<td>132 - 180</td>
<td>2840.6</td>
<td>0.791</td>
</tr>
<tr>
<td>.14G WG</td>
<td>F1CFA401A*E</td>
<td>3500</td>
<td>100 - 136</td>
<td>Hi-Matic</td>
<td>0.667</td>
</tr>
<tr>
<td>.14N WG</td>
<td>F1CFA401A*D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(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

The pipe thickness depends on the torque that the shaft must transmit, as well as on the construction setting of the transmission line (engine torque, power train ratio, engine axle load).

If using a pipe with a greater diameter than the original pipe, then the thickness should in theory be reduced until the same torsional capacity is achieved; 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.

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.

![Figure 18](image)

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 axle 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°30' it must be authorised by IVECO. If it is more than 1°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.
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.

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 of 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 setups 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.

Modification or replacement of stabilising bars

Any modification or replacement of the stabilising bars must ensure the operating characteristics remain unchanged compared to the original assemblies and in any case must be authorized by IVECO.

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, this conversion requires the exclusive use of solutions (layout, assemblies groups and finalisation) used for normal production.

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").

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

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

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

<table>
<thead>
<tr>
<th>Engine</th>
<th>Engine code</th>
<th>Exhaust counter-pressure [kPa]</th>
<th>Min - max intake counter-pressure [kPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>.12 WG</td>
<td>FIAGL411H*C</td>
<td>25</td>
<td>1 - 9</td>
</tr>
<tr>
<td>.13 WG</td>
<td>FIAGL411F*C</td>
<td>25</td>
<td>1 - 9</td>
</tr>
</tbody>
</table>
2.10 MODIFYING THE ENGINE AIR INTAKE AND EXHAUST SYSTEMS

### 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;
- intervene on equipment (injection pump, regulator, injectors, etc.) that may compromise good engine performance and affect exhaust gas emissions.
- change the Humidity sensor → Blow-by sequence in the segment between the 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.

<table>
<thead>
<tr>
<th>Engine</th>
<th>Engine code</th>
<th>Exhaust counter-pressure [kPa]</th>
<th>Min - max intake counter-pressure [kPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>.14 VGT</td>
<td>F1AG4111I*C</td>
<td>30</td>
<td>1 - 9</td>
</tr>
<tr>
<td>.16 VGT</td>
<td>F1AG411G*C</td>
<td>30</td>
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</tr>
<tr>
<td>.15 WG</td>
<td>F1CGL411A*E</td>
<td>38</td>
<td>1 - 9</td>
</tr>
<tr>
<td>.18 VGT</td>
<td>F1CGL411B*E</td>
<td>50</td>
<td>1 - 9</td>
</tr>
<tr>
<td>.21 DST</td>
<td>F1CGL411C*E</td>
<td>57</td>
<td>1 - 9</td>
</tr>
<tr>
<td>.15H WG</td>
<td>F1CFL411V*E</td>
<td>38</td>
<td>1 - 9</td>
</tr>
<tr>
<td>.18H VGT</td>
<td>F1CFL411W*E</td>
<td>50</td>
<td>1 - 9</td>
</tr>
</tbody>
</table>
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;
● to draw off the fuel, connect the fuel supply system to an auxiliary tank. 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 (à 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 18-0400;

● 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.
1. Main heater
2. Optional additional heater
3. Solenoid valve
4. Additional heater installed by body builder

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

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

Second air conditioner compressor

If the intervention requires the removal of the engine drive belt organs (e.g.: installation of an additional compressor, specific compressors for fridges, etc.), the belt must be refitted respecting the indications provided in the Repair Manual (print no. 603.95.723) indicated in Fig. 22. This manual highlights the need to only use the specific tool 99360191 which can be obtained from IVECO Parts.
**Removal**

Cut elastic belt (4), as it cannot be reused.

**Refitting**

On the pulley (1) apply the specific chock 99360186 (2) with the elastic belt (4), placing the latter on the roller (3) and pulley (5) paying attention to place the ribs of the belt in the corresponding pulley grooves (1, 5).

Rotate the crankshaft in an anti-clockwise direction (→) until the belt (4) fits correctly on the pulley (1).

---

### 2.13 BODYWORK INTERVENTIONS

**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 cab version

a) 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 the installation of units on the roof (e.g. air-conditioning systems), make sure that the weight 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.

b) Installation of spoiler or box on the roof

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.

In any case, please note that the possible lack of contact between the superstructure and roof may trigger air turbulence resulting in fastidious vibrations or resonances; therefore the application of gaskets or sealing systems that protect the aerodynamics is strongly recommended.

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

c) Roof and cab rear wall

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 23, 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.
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
d) Realization of sleeper cabs

In the realization of sleeper cabs (e.g. 8+1), for special vehicles, municipal applications, fire brigade etc., the suspension must be adapted to the increased weight and to any extra places that are realized.

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 parts 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.](image)

**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.
Work on van vehicles

a) Installation of luggage compartments

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.
- to avoid altering the vehicle’s cornering stability, the load must not exceed a total of 150 kg;
- the mass allowed on each fixing element must not exceed 25 kg.

<table>
<thead>
<tr>
<th>Dimensions [mm]</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van wheelbase 3000 low roof - short overhang</td>
<td>1760</td>
<td>754</td>
<td>932</td>
<td>1548</td>
<td>1548</td>
<td>1548</td>
</tr>
<tr>
<td>Van wheelbase 3520 SL medium roof (H2)</td>
<td>2549</td>
<td>1082</td>
<td>935</td>
<td>1229</td>
<td>1229</td>
<td>1229</td>
</tr>
<tr>
<td>Van wheelbase 4100 SC medium roof (H2)</td>
<td>3713</td>
<td>1082</td>
<td>935</td>
<td>1229</td>
<td>1229</td>
<td>1229</td>
</tr>
</tbody>
</table>
b) 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.

c) Fitting a hatch
It is possible to fit a 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 26 shows an installation example.

Figure 26

1. Cutting area
2. Anchorage profile
3. Sealant

d) 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 27 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.
e) 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).
- Implementing an internal support structure (see Figure 28), in order to ensure the necessary resistance 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.
f) Inner 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.

g) Box sections 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 29 highlights the cases that may arise and Table 2.16 shows the related maximum possible lowering measurements.
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.

a) 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

As the configuration of the vehicle’s safety electronics must not be changed, the Airbag system may not be retrofitted and may also not be removed.

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

c) 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 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 a different size or load bearing capacity compared to the specifications recorded during vehicle type approval requires IVECO certification and verification of whether the electronic management of the braking system requires reprogramming.

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 56));
- 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

<table>
<thead>
<tr>
<th>N.</th>
<th>CONNECTING ELEMENTS</th>
<th>Thread</th>
<th>CLASS</th>
<th>Torque [Nm]</th>
<th>FEATURES “S” (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>1</td>
<td>Front and rear wheel mounting (33S-35S)</td>
<td>Stud bolt M14</td>
<td>II</td>
<td>144</td>
<td>176</td>
</tr>
<tr>
<td>2</td>
<td>OPT Alloy wheels (33S-35S)</td>
<td>Stud bolt M14</td>
<td>II</td>
<td>200</td>
<td>245</td>
</tr>
<tr>
<td>3</td>
<td>Front and rear wheel mounting (35C-50C)</td>
<td>Nut M18x1.5</td>
<td>II</td>
<td>290</td>
<td>350</td>
</tr>
<tr>
<td>4</td>
<td>Front and rear wheel mounting (60C-65C-70C)</td>
<td>Nut M18x1.5</td>
<td>II</td>
<td>290</td>
<td>350</td>
</tr>
</tbody>
</table>

(*) Characteristic “S”: safety tightening (see IVECO std. 19-0405).

- 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 braking system, together with its components, is of fundamental importance in terms of safety.

- Any modification to the braking system requires authorisation from IVECO, it being understood that no changes may be made to the following parts: brake cylinders and callipers, adjustment units and valves, parking brake, brake control and auxiliary systems.

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 the minimum internal dimensions, material and curvature radii of the pre-existing pipes must be respected.

For procurement please contact IVECO Assistance Service, whereas for assembly the directions in IVECO STD 17-2403 must be complied with.

⚠️ The total or partial painting of the brake pipes must be absolutely avoided and, for this purpose, appropriate masking of the pipes must be provided.

**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 \( \phi = 4.76 \text{ mm} \)): 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 cor-
rector.

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

- in areas were 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 \( \phi \)

**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 30) 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.
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

<table>
<thead>
<tr>
<th>Thread</th>
<th>Tightening torque [Nm ± 10%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 8 x 1 mm</td>
<td>20</td>
</tr>
<tr>
<td>M 12 x 1.5 mm</td>
<td>24</td>
</tr>
<tr>
<td>M 14 x 1.5 mm</td>
<td>28</td>
</tr>
</tbody>
</table>

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 31 shows two examples of brackets complete with retainer clamps used to secure pipelines along the chassis.
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 32.

▶ After each intervention, thoroughly bleed the air, using only the specific equipment used in the IVECO Authorized Workshops.

Note The fluid discharged from the hydraulic circuit must not be used again. Top up using only new fluid of the prescribed type, contained in original, sealed containers that should only be opened when using the fluid.
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 34. 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.

![Figure 33](image)

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
- LAC (Load Adaptive Control) to adapt the extent of braking to the distribution of the load on the vehicle
- HHC (Hill Holder Control) to facilitate breakaway from a standstill in ascent

Variation of GVW

Variations of vehicle GVW must be authorised since it involves the verification of the availability of an appropriate ESP system management software; degrading is only possible in the cases 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 which does not correspond to any of those in production for the specific vehicle model, the availability of a suitable system management software must be verified; degrading is only possible in the cases 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.
### 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.

### 2.16 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

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 35 and 36 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.
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.
**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 37 indicates the types of IVECO tanks available.

![Figure 37 indicating types of IVECO tanks available](image)

1. 100 litres shaped  
2. 70 litres shaped  
3. 70 litres rectangular  
4. 90 litres rectangular  
5. 120 litres rectangular  
6. 90 litre right trapezoidal  
7. 90 litre left trapezoidal

To obtain indications relating to fuel consumption and tank range, the signals relating to fuel level must be associated with the tank emptying law. This is provided by the Body Computer (see Chapter 5.1 ([Page 5])).

**Note** In the event of tank replacement the processing logic of the Body Computer must be adjusted.

The adjustment must be carried out by the IVECO Customer Service.

---

### 2.18 TRANSPORT OF HAZARDOUS MATERIALS (ADR)

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, may be given a "Declaration" containing details of the paragraphs of document ECE/TRANS/WP.15/213 that have already been complied with by the vehicle since its origin.
2.19 INSTALLING A RETARDER

The installation of a retarder brake is complex and requires the perfect integration with electric and electronic vehicle systems, through the use of suitable “datasets”: therefore approval by IVECO is always necessary.

The suitability of the vehicle for the installation of a retarder (only an electronically controlled electromagnetic type) must be checked based on:

- the product grid (e.g. the 33S and 35S models are excluded)
- the content of the original wiring (data exchange between the retarder and vehicle must be possible via CAN)
- the wheelbases and versions to be implemented

With this in mind:

Note: On vehicles 60C-70C, wheelbase 3450, the retarder can only be fitted if, with the complete version, the following minimum load is guaranteed on the rear axle:

- 2500 kg, with semi-elliptical leaf springs
- 3000 kg, with leaf spring + beam

Installation involves, between the various phases, considerable work on the propeller shaft (safety component) and therefore must be performed by a workshop authorised by the brake manufacturer, who bears all responsibility.

After the intervention, it is compulsory to reprogram certain control units (Body Computer, dashboard, robot-controlled gearbox if fitted) through an IVECO Service Centre.

The retarder selection must be carried out according to the formula:

\[ \frac{i_p \cdot C_f}{R' \cdot PPT} \approx 1 \]

1. \(i_p\) = rear axle ratio
2. \(C_f\) = Maximum braking torque [Nm]
3. \(R'\) = radius under load of the used tyre [m]
4. \(GWW\) = Gross Vehicle Weight [kN]

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 MUDGUARDS AND WHEEL ARCHES

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

For the construction of the mudguards, the wheel arch compartments 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 may be made on the vertical rib of the side members of the vehicle (only using the existing holes) or directly under the applied superstructure (see Figure 39).

The first and second point are also to be considered in the realisation of the wheel arch compartments. In this regard, Figure 29 highlights the cases that may occur and Table 2.16 provides the maximum lowering values allowed.

2.22 RAIN FLAP

Once outfitting is complete, the mudflaps must be included in the vehicle equipment if and as indicated by the regulations 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 subframe or directly on the frame. 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 following specific instructions complement the regulations contained in Section 1 "GENERAL INFORMATION".

3.1 CONSTRUCTION OF THE SUBFRAME

The purpose of the subframe 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 subframe are not high, the material for its realisation may have characteristics inferior to those of the chassis, notwithstanding the need to have good characteristics of weldability and limits that are not lower than the values 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

<table>
<thead>
<tr>
<th>Name of steel</th>
<th>Breaking strength [N/mm²]</th>
<th>Yield stress [N/mm²]</th>
<th>Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVECO Fe 360D</td>
<td>360 (1)</td>
<td>235 (1)</td>
<td>25% (1)</td>
</tr>
<tr>
<td>EUROPE S235J2G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GERMANY ST37-3N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.K. 40D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVECO Fe E420</td>
<td>530</td>
<td>420</td>
<td>21%</td>
</tr>
<tr>
<td>EUROPE S420MC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GERMANY Q5E420TM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.K. 50F4S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVECO Fe S10D</td>
<td>520</td>
<td>360</td>
<td>22%</td>
</tr>
<tr>
<td>EUROPE S355J2G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GERMANY ST52-3N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.K. 50D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sizing of profiles

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

The indicated value Wₓ 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 Wₓ and inertia time Jₓ of the new C section are not of a lesser value.
### Table 3.2 - Profile dimensions

<table>
<thead>
<tr>
<th>Section modulus $W_x$ [cm$^3$]</th>
<th>Recommended C profile [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>$16 \leq W \leq 19$</td>
<td>$80 \times 50 \times 4$</td>
</tr>
<tr>
<td>$20 \leq W \leq 23$</td>
<td>$80 \times 60 \times 5$</td>
</tr>
<tr>
<td>$24 \leq W \leq 26$</td>
<td>$80 \times 60 \times 6$</td>
</tr>
<tr>
<td>$27 \leq W \leq 30$</td>
<td>$80 \times 60 \times 7$</td>
</tr>
<tr>
<td>$31 \leq W \leq 33$</td>
<td>$80 \times 60 \times 8$</td>
</tr>
<tr>
<td>$34 \leq W \leq 36$</td>
<td>$100 \times 60 \times 6$</td>
</tr>
<tr>
<td>$37 \leq W \leq 41$</td>
<td>$100 \times 60 \times 7$</td>
</tr>
<tr>
<td>$42 \leq W \leq 45$</td>
<td>$80 \times 80 \times 8$</td>
</tr>
<tr>
<td>$46 \leq W \leq 52$</td>
<td>$120 \times 60 \times 6$</td>
</tr>
<tr>
<td>$53 \leq W \leq 58$</td>
<td>$120 \times 60 \times 8$</td>
</tr>
<tr>
<td>$59 \leq W \leq 65$</td>
<td>$140 \times 60 \times 7$</td>
</tr>
<tr>
<td>$66 \leq W \leq 72$</td>
<td>$140 \times 60 \times 8$</td>
</tr>
<tr>
<td>$73 \leq W \leq 79$</td>
<td>$160 \times 60 \times 7$</td>
</tr>
<tr>
<td>$80 \leq W \leq 88$</td>
<td>$180 \times 60 \times 8$</td>
</tr>
<tr>
<td>$89 \leq W \leq 93$</td>
<td>$160 \times 70 \times 7$</td>
</tr>
<tr>
<td>$94 \leq W \leq 104$</td>
<td>$180 \times 60 \times 8$</td>
</tr>
<tr>
<td>$105 \leq W \leq 122$</td>
<td>$200 \times 80 \times 6$</td>
</tr>
<tr>
<td>$123 \leq W \leq 126$</td>
<td>$220 \times 60 \times 7$</td>
</tr>
<tr>
<td>$127 \leq W \leq 141$</td>
<td>$220 \times 60 \times 8$</td>
</tr>
<tr>
<td>$142 \leq W \leq 160$</td>
<td>$200 \times 80 \times 8$</td>
</tr>
<tr>
<td>$161 \leq W \leq 178$</td>
<td>$220 \times 80 \times 8$</td>
</tr>
<tr>
<td>$179 \leq W \leq 201$</td>
<td>$250 \times 80 \times 7$</td>
</tr>
<tr>
<td>$202 \leq W \leq 220$</td>
<td>$250 \times 80 \times 8$</td>
</tr>
<tr>
<td>$221 \leq W \leq 224$</td>
<td>$220 \times 80 \times 8$</td>
</tr>
<tr>
<td>$225 \leq W \leq 245$</td>
<td>$250 \times 100 \times 8$</td>
</tr>
<tr>
<td>$246 \leq W \leq 286$</td>
<td>$280 \times 100 \times 8$</td>
</tr>
<tr>
<td>$290 \leq W \leq 316$</td>
<td>$300 \times 80 \times 8$</td>
</tr>
<tr>
<td>$316 \leq W \leq 380$</td>
<td>$340 \times 100 \times 8$</td>
</tr>
<tr>
<td>$440$</td>
<td>$380 \times 100 \times 8$</td>
</tr>
<tr>
<td>$480$</td>
<td>$400 \times 100 \times 8$</td>
</tr>
</tbody>
</table>

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.
Subframe dimension

In case of elastic connection between chassis and subframe the bending moment \( M_f \) must be subdivided proportionately between chassis and subframe at the moments of inertia of the sections:

\[
\begin{align*}
M_f &= M_c + M_t \\
M_c &= \frac{l}{I_c} \\
M_t &= \frac{l}{I_t}
\end{align*}
\]

\[
\begin{align*}
M_c &= M_f \cdot \frac{l}{I_c + l} \\
M_t &= M_f \cdot \frac{l}{I_t + l} \\
\sigma_c &= \frac{M_c}{W_c} \leq \sigma_{amm} \\
\sigma_t &= \frac{M_t}{W_t} \leq \sigma_{amm}
\end{align*}
\]

\( M_f \) = static bending moment generated by the superstructure [Nmm]
\( M_c \) = proportional share of the static bending moment \( M_f \) applied to the subframe [Nmm]
\( M_t \) = proportional share of the static bending moment \( M_f \) applied to the chassis [Nmm]
\( l_c \) = moment of inertia of the section of the subframe [mm\(^4\)]
\( l_t \) = moment of inertia of the section of the chassis [mm\(^4\)]
\( \sigma_c \) = maximum static stress applied to the subframe [N/mm\(^2\)]
\( \sigma_t \) = maximum static stress applied to the chassis [N/mm\(^2\)]
\( W_c \) = section modulus of the section of the subframe [mm\(^3\)]
\( W_t \) = section modulus of the section of the chassis [mm\(^3\)]
\( \sigma_{amm} \) = maximum static stress allowed on chassis [N/mm\(^2\)] see chapter 2.1, Paragraph “Stresses on the chassis” \( \Rightarrow \) Page 8

Aluminium subframe

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

1. When the contribution of the subframe 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 subframe 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/mm\(^2\) against 21,000 kg/mm\(^2\) for steel) which involves greater dimensioning of the profiles.
Similarly, when the connection between the chassis and subframe 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 SUBFRAME

#### 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.

![Figure 2](image2)

![Figure 3](image3)

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.
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.

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.

**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.
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 SUBFRAME

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 drilled 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 subframe; 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 subframe allows you to achieve greater resistant capacity compared to the connections with brackets or clamps, obtaining the following benefits:

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

**Connection with brackets**

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

![Diagram of connection with brackets](image)

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 subframe is $1 \div 2$ 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 subframe, 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 subframe 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.

![Figure 9](image)

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 subframe 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 subframe 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 subframe 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.
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.

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**

<table>
<thead>
<tr>
<th>Chassis and counter chassis height/section ratio</th>
<th>Max. distance between the centre lines of the cut-resistant plates [mm] (1)</th>
<th>Models (3)</th>
<th>Minimum characteristics of the plates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Thickness [mm]</td>
</tr>
<tr>
<td>&gt; 1.0</td>
<td>700</td>
<td>35C, 40C</td>
<td>4</td>
</tr>
<tr>
<td>≤ 1.0</td>
<td>500</td>
<td>45C, 50C</td>
<td>4</td>
</tr>
<tr>
<td>≤ 1.0</td>
<td>500</td>
<td>60C, 65C, 70C</td>
<td>5</td>
</tr>
</tbody>
</table>

(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.

![Figure 12](image_url)

1. Subframe
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 1 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>
<thead>
<tr>
<th>Models</th>
<th>Minimum reinforcing profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelbase [mm]</td>
<td>Section modulus Wₓ [cm²]</td>
</tr>
<tr>
<td>33S, 35S</td>
<td>up to 3750</td>
</tr>
<tr>
<td></td>
<td>4100</td>
</tr>
<tr>
<td>35C, 40C, 45C, 50C</td>
<td>All</td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>Up to 3750</td>
</tr>
<tr>
<td></td>
<td>and 3750</td>
</tr>
</tbody>
</table>

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.

**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.
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.

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 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.

2. 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.

3. 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.

4. 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.

5. 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 1600 kg/m$^3$ 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).

6. 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.

---

### Table 3.5

<table>
<thead>
<tr>
<th>Models</th>
<th>Minimum reinforcing profile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Section modulus $W_x$ [cm$^3$]</td>
</tr>
<tr>
<td>35C, 40C</td>
<td>19</td>
</tr>
<tr>
<td>45C, 50C, 60C, 65C, 70C</td>
<td>36</td>
</tr>
</tbody>
</table>

**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 bodybuilder must observe, the masses allowed and provisions on use. Below are some general indications.

Fifth wheel supporting structure

The application of a suitable subframe structure (see Figure 17) has the task of distributing the load on the articulation and ensuring the vehicle has a suitable torsional and bending contribution. 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

<table>
<thead>
<tr>
<th>Models</th>
<th>Wheelbase [mm]</th>
<th>Minimum reinforcing profile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Section modulus $W_x$ [cm$^3$]</td>
</tr>
<tr>
<td>35C, 50C</td>
<td>3450</td>
<td>24</td>
</tr>
</tbody>
</table>

Note For the dimensions of the profiles see Table 3.2.
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 bodybuilder has to provide the fulfilment 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.
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>
<thead>
<tr>
<th>Models</th>
<th>Wheelbase [mm]</th>
<th>Minimum reinforcing profile</th>
<th>Minimum value of the modulus of resistance of the counter chassis section W, [cm²] (1) with ultimate tensile strength of the material equal to 360 N/mm²</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35C, 40C, 45C, 50C</td>
<td>All</td>
<td>16</td>
<td>80x50x4</td>
<td></td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>up to 3750 and 3750</td>
<td>21</td>
<td>80x60x5</td>
<td>100x50x5</td>
</tr>
</tbody>
</table>

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 18) 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.

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 m);
- 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.

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 55)) 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.

\[
M_G [kNm] = \frac{g (W_L \times L + W_C \times I)}{1000}
\]

\( g = \) 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]
\( I = \) 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 subframe 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.

![Figure 21](image)

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)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frame section [mm]</th>
<th>Total torque Mₖ max [kNm]</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>35C, 40C</td>
<td>174x70x4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45C, 50C</td>
<td>174x70x4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>174x69x5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Minimum value of the modulus of resistance of the counter chassis section Wₓ [cm³] (1)

with yield point of the material equal to 360 N/mm²

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.

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Frame section [mm]</th>
<th>Total torque Mₖ max [kNm]</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>35C, 40C</td>
<td>174x70x4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45C, 50C</td>
<td>174x70x4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>174x69x5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Minimum value of the modulus of resistance of the counter chassis section Wₓ [cm³] (1)

with yield point of the material equal to 360 N/mm²

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.

Close the reinforcement section in the crane assembly area.

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 Lᵥ) - 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 Lᵥ 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)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frame section [mm]</th>
<th>Total torque $M_c \text{ max [kNm]}$</th>
<th>Minimum value of the modulus of resistance of the counter chassis section $W_x$ with yield point of the material equal to 360 N/mm² (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35C, 40C</td>
<td>114x70x4</td>
<td>20 30 40 50 60 70 80 90 100</td>
<td>32 57 71 E</td>
</tr>
<tr>
<td>45C, 50C</td>
<td>114x70x4</td>
<td>20 30 40 50 60 70 80 90 100</td>
<td>32 57 71 110 E</td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>174x69x5</td>
<td>20 30 40 50 60 70 80 90 100</td>
<td>23 23 32 42 71 E</td>
</tr>
</tbody>
</table>

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.

---

1. **Counter chassis on the entire body length**
2. **Plates**
3. **Brackets**
4. **Crane connections**
5. **Stabilisers**
6. **Connecting corner**

---

![Diagram](image)
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 subframe does not cause additional stress to the vehicle chassis.

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 presence of trucks with rear overhangs as standard;
- using the specifications of Figure 23, in the presence of trucks with non-standard overhangs or specific tail lifts (e.g. aluminium) and noting that the flexing moments on the chassis, depending on the board capacities, must be calculated each time;
- using assessments to be carried out each time, in the case of vans, when tail lifts with capacities exceeding 3 kN (300 kg) are used.

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).

Procedure for calculating the chassis bending moment during loading of tail lift

\[
W_{TL} = \text{Weight of tail lift} \\
W_{L} = \text{Tail lift capacity}
\]

The bending moment on the chassis may be obtained using the following ratio:
M [Nm] = W_L • A + W_TL • B  for tail lifts without stabilisers
M [Nm] = W_L • C + W_TL • 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

<table>
<thead>
<tr>
<th>Models</th>
<th>Overhang [mm]</th>
<th>3 (300)</th>
<th>5 (500)</th>
<th>7.5 (750)</th>
<th>10 (1000)</th>
<th>12.5 (1250)</th>
<th>15 (1500)</th>
</tr>
</thead>
<tbody>
<tr>
<td>33S, 35S</td>
<td>–</td>
<td>E</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35C, 40C</td>
<td>1240 - 1355</td>
<td>16</td>
<td>21</td>
<td>26 + S</td>
<td>31 + S</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>45C, 50C</td>
<td>1655 - 1715</td>
<td>21</td>
<td>21 + S</td>
<td>26 + S</td>
<td>31 + S</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>45C, 50C</td>
<td>1885 - 2350</td>
<td>26</td>
<td>26 + S</td>
<td>31 + S</td>
<td>36 + S</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>60C, 65C, 70C</td>
<td>1355 - 1655</td>
<td>21</td>
<td>21</td>
<td>26 + S</td>
<td>26 + S</td>
<td>31 + S</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>1885 - 2350</td>
<td>26</td>
<td>21 + S</td>
<td>26 + S</td>
<td>26 + S</td>
<td>36 + S</td>
<td>E</td>
</tr>
</tbody>
</table>

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.

- 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 electro-hydraulic tail lifts, ensure that the capacity of the batteries and the power of the alternator are adequate (see Chapter 5.4).

The bodybuilder is also responsible for:
- any modifications to the underrun cross member or the arrangement of another new type (see Chapter 2.20 (► Page 56));
- the observance of the visibility of the rear lights,
- the observance of the overhang angles,
- the positioning of the tow hook,

based on the various national legislation.
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 33));
- 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 53)), 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 a platform or aerial platform must comply with national standards (for example, CUNA, DIN) and international standards (e.g. ISO, CEN), as well as 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.

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.

View from below

1. Reinforcement flap
2. First counter chassis attachment
3. Cab block
4. Chassis flap section detail

The flaps must have a minimum thickness of 4 (never less than 1050 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 subframe (see Figure 25).

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.

Note In the case of vehicles with a shaped fuel tank with 70 or 100 litres (see Chapter 2-17 (⇒ Page 53) - Figure 36) it is not possible to install the reinforcement flaps due to the interference they would create between the heads of the rivets and the upper wall of the tank itself.
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:

- on the gearbox (if manual);
- 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 \[CV\] = \frac{M \cdot n \cdot i}{7023} \\
P [kW] = \frac{M \cdot n \cdot i}{9550}
\]

- \(P\) = Available power
- \(M\) = Torque permitted for the power take-off, expressed in [kgm] or [Nm]
- \(n\) = 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 $\phi$ (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 $\phi$ 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).
4.2 POWER TAKE-OFF ON THE GEARBOX

Drive may be taken from the layshaft via flanges or fittings located to the rear side or lower part of the gearbox.

Table 4.1 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 synchronizers.

When the PTO is used with the vehicle in motion, no gearshift must be carried out.

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 electrical system. Therefore, before proceeding, please carefully read Chapter 4.6.

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 - Transmission PTO data

<table>
<thead>
<tr>
<th>Gearbox</th>
<th>Position (1)</th>
<th>Output (1)</th>
<th>Direction of rotation (2)</th>
<th>Maximum torque $C_{\text{max}}$ [Nm] (3)</th>
<th>PTO ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2835.6</td>
<td>Left side</td>
<td>Rear</td>
<td>Clockwise</td>
<td>120</td>
<td>1.00</td>
</tr>
</tbody>
</table>
4.3 POWER TAKE-OFF FROM TRANSFER BOX

<table>
<thead>
<tr>
<th>Gearbox</th>
<th>Position (1)</th>
<th>Output (1)</th>
<th>Direction of rotation (2)</th>
<th>Maximum torque $C_{\text{max}}$ [Nm] (3)</th>
<th>PTO ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2840.6</td>
<td>Left side</td>
<td>Rear</td>
<td>Clockwise</td>
<td>180</td>
<td>1.04</td>
</tr>
</tbody>
</table>

(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 power 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; always follow the specific instructions for the power take-off during use (working times, 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.

4.4 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 POWER TAKE-OFF ON THE ENGINE

The use of these PTOs is intended for equipment requiring continuous power and with low torque values (e.g.: driving AC systems).

Power taken from the front part of the engine can take place via a transmission belt. This belt must engage in a specific pulley, which is added externally of the one present on the crankshaft. For its definition, useful data can be found in Table 4.2.

#### Table 4.2 - PTO from the front part of the engine

<table>
<thead>
<tr>
<th>engine</th>
<th>Engine code (1)</th>
<th>$n_{\text{max}}$ [rpm] (2)</th>
<th>Maximum speed with no load [rpm]</th>
<th>Max. torque available [Nm]</th>
<th>Maximum moment of inertia [kgm^2]</th>
<th>Maximum flexural moment [Nm] (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.12 WG</td>
<td>F1AG411H*C</td>
<td>3600</td>
<td>4600</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.13 WG</td>
<td>F1AG411F*C</td>
<td>3600</td>
<td>4600</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.14 VGT</td>
<td>F1AG411J*C</td>
<td>3600</td>
<td>4600</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.16 VGT</td>
<td>F1AG411K*C</td>
<td>3500</td>
<td>4600</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.15 WG</td>
<td>F1CGL411A*E</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.18 VGT</td>
<td>F1CGL411B*E</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.21 DST</td>
<td>F1CGL411C*E</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.15H WG</td>
<td>F1CFL411V*E</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.18H VGT</td>
<td>F1CFL411W*E</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.14G WG</td>
<td>F1CFA401A*E</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
<tr>
<td>.14N WG</td>
<td>F1CFA401A*D</td>
<td>3500</td>
<td>4200</td>
<td>35</td>
<td>0.005</td>
<td>42</td>
</tr>
</tbody>
</table>

1. Check engine code on the engine plate
2. Maximum number of revolutions corresponding to the maximum power
3. With respect to the front crankcase wire
4.6 SETTINGS

Up to two power take-offs can be installed on the vehicle, and one of them (PTO1) must be installed on the gearbox. For first equipment the vehicle can be alternatively equipped with:

a) **PTO pre-installation** (opt. 77910 on gearbox 2840.6 and 2850.6; Opt. 75977 on gearbox 2835.6)

PTO pre-installation consists of:

- cover on gearbox (see Figure 3);
- bonnet cable.

b) **PTO pre-installation** (opt. 77910 on gearbox 2840.6 and 2850.6; Opt. 75977 on gearbox 2835.6) and **Expansion Module** (opt. 8657)

The Expansion Module (EM) is an electronic interface that manages various types of equipment (additional lights, alarms, "after-sales" PTO, etc...).

c) **PTO1** (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).

![Figure 4](image)

**Note** For the description of the features and ways of using the Expansion Module, consult the specific IVECO manual no. 603.95.826.

"Aftersales" PTO

If an after-sales PTO is to be installed, then the following is necessary:

- check if the vehicle is equipped with the Cruise Control opt.;
- obtain approval for the intervention from IVECO and any specific instructions that may be required.

**Note** The after-sales installation of a PTO means, once installation is complete, referring to IVECO Customer Service to update the ECU software through the teleservice.
PTO management on gearbox

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 5)

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 5 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.

With Cruise Control activated, you can return to the minimum engine speed condition (setting erased) by placing the selector shown in Figure 5 to OFF or by pressing the brake pedal or clutch pedal (if equipped).

Note To manage engine speed control, requested torque and other parameters programmable on the Expansion Module, consult the specific IVECO manual.

Multiple State Switch

To control the number of engine revolutions with power take-off engaged, create the circuit shown in Figure 6, which provides a connection to pins 3 and 8 of the bodybuilder connector 72075A (see Section 5, Chapter 5.2 "Bodybuilders connectors").

### 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>
<thead>
<tr>
<th>Resistance Values [Ohm]</th>
<th>R0</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>120</td>
<td>390</td>
<td>900</td>
<td>2900</td>
</tr>
</tbody>
</table>
Table 4.4

<table>
<thead>
<tr>
<th>Programmable speed [rpm] - basic settings</th>
<th>PTO 0</th>
<th>PTO 1</th>
<th>PTO 2</th>
<th>PTO 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>900</td>
<td>1200</td>
<td>900</td>
<td>1200</td>
</tr>
<tr>
<td>CA</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
</tr>
</tbody>
</table>

Resistance ¼ 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.
SECTION 5

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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

A. Instrument panel
B. Trailer control unit
C. Steering wheel column and ignition switch
D. Body Computer
E. Oil control unit
F. "ECM" engine control unit
G. CBA1 control unit on battery
H. CBA2 control unit in the engine compartment
I. Automated gearbox control unit on the chassis
L. SCM connection panel (engine)
M. Expansion Module “EM”
N. Airbag control unit
O. ABS/ESP control unit
P. ECAS Electronic Control Air Suspension
Q. Control unit for glow plug pre-heating
R. Automated gearbox control unit
5.2 BODYBUILDER CONNECTORS

Note: Given the multiplicity of vehicular variants and of associated wiring, the present chapter only provides information concerning the basic version of the electrical system; please contact the IVECO Customer Service should you require more specific information.

The vehicle’s electrical system contains specific connectors for connecting the bodybuilder installations; access to these allows the system’s functional integrity and validity of the warranty to be preserved.

The standard connectors are the 61071A and 72075A, interfaced with the cab dashboard cable, which are accessible after removing the panel of the passenger side glove compartment (see Figure 2).

▶ Any taking of signals from the vehicles to the outfitting must be performed using suitable diodes, relays and bridles. Direct connection to connectors 61071A and 72075A is strictly forbidden, otherwise the warranty shall become invalid.

1. Bodybuilder Connector 61071A
2. Bodybuilder Connector 72075A
3. Connector EM 61071B
4. Connector EM 72075B
5. Connector EM 72071

In the event in which the vehicle is ready for the optional installation of the Expansion Module, the electrical system in the cab is also equipped with connectors 61071B, 72071 and 72075B (Figure 2), to which another connector ST13 is added inside the engine compartment, on the left side (see Figure 3).

The function of these connections is described in the specific section 7 of this manual.
1. Connector ST13

**Bodybuilder 20-pin connector, blue (61071A)**

![Diagram of connector ST13](image)

<table>
<thead>
<tr>
<th>Table 5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
</tr>
<tr>
<td>500314820 EZ</td>
</tr>
<tr>
<td>500314824 EZ</td>
</tr>
<tr>
<td>504005092 EZ</td>
</tr>
</tbody>
</table>
# Table 5.2 - Basic functions of connector 61071A

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal Description</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engine start up</td>
<td>8888</td>
<td>Input Max 20 mA</td>
<td>BCM A/19</td>
<td>The engine starts only when the key is turned in the ignition block (K15 ON) (1) +12 V = engine start-up Open wire = no action</td>
</tr>
<tr>
<td>2</td>
<td>Engine shut down</td>
<td>9903</td>
<td>Input Max 10 mA</td>
<td>BCM F/22</td>
<td>The engine only switches off with vehicle speed &lt; 4 km/h (2) +12 V = engine stop Open wire = no action</td>
</tr>
<tr>
<td>3</td>
<td>Service braking</td>
<td>1176</td>
<td>Output Max 500 mA (with decoupling diode)</td>
<td>BCM D/S7</td>
<td>+12 V = brake activated no signal = brake not activated</td>
</tr>
<tr>
<td>4</td>
<td>Vehicle at standstill</td>
<td>0000</td>
<td>Output Max 500 mA (with decoupling diode)</td>
<td>BCM H/32</td>
<td>Ground = vehicle stopped no signal = vehicle is not stationary</td>
</tr>
<tr>
<td>5</td>
<td>Parking braking</td>
<td>6662</td>
<td>Output Max 500 mA (with decoupling diode)</td>
<td>BCM F/44</td>
<td>Ground = parking brake engaged (5) no signal = parking brake not engaged</td>
</tr>
<tr>
<td>6</td>
<td>Battery positive</td>
<td>7772</td>
<td>max 15 A</td>
<td>BCM E/19</td>
<td>Positive protected by fuse on Body Computer - F33</td>
</tr>
<tr>
<td>7</td>
<td>Ignition of side lights</td>
<td>3320</td>
<td>Output Max 500 mA (with decoupling diode)</td>
<td>Relay managed by BCM</td>
<td>A positive signal is obtained when the side lights are on (4) +12 V = side lights active no signal = side lights inactive</td>
</tr>
<tr>
<td>8</td>
<td>Engine running</td>
<td>7778</td>
<td>Output Max 500 mA</td>
<td>EDC</td>
<td>Ground = engine off Open circuit = engine running (&gt; 500 rpm)</td>
</tr>
<tr>
<td>9</td>
<td>Clutch actuation</td>
<td>9273</td>
<td>Output Max 500 mA (with decoupling diode)</td>
<td>EDC</td>
<td>+12V = clutch engaged Open circuit = clutch disengaged</td>
</tr>
<tr>
<td>10</td>
<td>Engaging reverse</td>
<td>2268</td>
<td>Output Max 100 mA (with decoupling diode)</td>
<td>BCM C/17</td>
<td>+12V = reverse gear engaged (5) no signal = reverse gear not engaged</td>
</tr>
<tr>
<td>11</td>
<td>Positive with key</td>
<td>8879</td>
<td>Output 5 A</td>
<td>BCM G/12</td>
<td>Positive with key protected by fuse on Body Computer - F49</td>
</tr>
<tr>
<td>12</td>
<td>Cruise Control Command</td>
<td>8156</td>
<td>n.a.</td>
<td>BCM H/56</td>
<td>Cruise Control interface (6)</td>
</tr>
<tr>
<td>13</td>
<td>Reference ground for Cruise Control command</td>
<td>0000</td>
<td>n.a.</td>
<td>BCM H/45</td>
<td>Ground for Cruise Control interface</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>17</td>
<td>Ground</td>
<td>0000</td>
<td>Output max 15 A</td>
<td>Ground connection</td>
<td>Ground connection</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
</tbody>
</table>

(1) The vehicle does not supply any safety check. The vehicle does not prevent engine start-up with gear engaged, nor monitors the release of the clutch pedal. The bodybuilder must adopt preventative measures to avoid any unintentional movements of the vehicle.
The engine start-up control must be permanently active until the engine starts running.
The engine only functions with the key turned in the ignition block (K15 ON).
Activating the remote signal K15 from pin 5 of connector 72075A and then inserting the key in the ignition block (K15 ON) prevents engine start-up and an Immobilizer Error is signalled. In this case it is necessary to remove both the remote signals K15 and K15 ON.
When the procedure has been performed successfully it remains valid for the entire K15 ON cycle and this allows the bodybuilder to repeatedly stop and restart the engine until K15 stays active.
The starter motor is only activated when the engine is NOT running.

(2) Stopping the engine is only permitted when the vehicle is stationary or at a speed of < 4 km/h.
The engine stop control must be permanently active until the engine stops.

(3) If the “parking brake engaged” signal indicates “ground”, it means the parking brake has not been fully released. Therefore a residual braking torque on the rear axle cannot be excluded. IVECO does not recommend use of the signal as an indication of a stationary vehicle.
Obligatory insertion of a 10 kΩ pull-up resistor between 61071A / pin 11 (signal K15) and 61071A / pin 05 as outlined in Figure 5.

(4) The output signal of the side markers may also be extracted from the chassis connector ST38. If necessary, consult Chapter 5.4 – Paragraph “Arrangement of side position lights (Side Marker Lamps) ( ➤ Page 45)”. 
For vehicles in the Hi-MATIC version, refer to the indications provided in Annex C (Page 9).

Only supported with Cruise Control option.

The resistors must be connected between pin 12 and pin 13. Different functions may be activated depending on the resistor value:

- **R = 2490 Ohm:** CC stays active, just like the PTO modes (important for vehicles without Cruise Control)
- **R = 649 Ohm SET+:** the speed increases by +50 revs/min pulse (only when the vehicle is stationary) or adjustment of the CC speed (only at V > 30 km/h)
- **R = 261 Ohm SET-:** the speed decreases by -50 revs/min pulse (only when the vehicle is stationary) or adjustment of the CC speed (only at V > 30 km/h)
- **R = 133 Ohm RES:** activation of ISC MEMO speed or resumption of the memorized CC speed

For this purpose IVECO recommends use of a relay which enables utilization of the same functions available on the steering wheel lever.

The Cruise Control option must be configured on both the ECM and BCM systems.

Please note that the driver must position the Cruise Control switch on the steering wheel lever to OFF, otherwise the external controls will be ignored.

<table>
<thead>
<tr>
<th>Function</th>
<th>Short-cut necessary</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CC Resume</td>
<td>Pin 2</td>
<td>Pin 6</td>
</tr>
<tr>
<td>CC Set-</td>
<td>Pin 2</td>
<td>Pin 8</td>
</tr>
<tr>
<td>CC Set+</td>
<td>Pin 2</td>
<td>Pin 5</td>
</tr>
</tbody>
</table>

---

---

---

---
### Bodybuilder 12-pin connector, black (72075A)

![Figure 8](image)

**Existing part on vehicle (male)**

**Counterpart to be coupled (female)**

### Table 5.3

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>500314820 EZ</td>
<td>Male contact for 0.35 to 0.5 mm² cable</td>
</tr>
<tr>
<td>500314824 EZ</td>
<td>Male contact for 0.75 to 1.5 mm² cable</td>
</tr>
<tr>
<td>504005092 EZ</td>
<td>Male contact for 2.5 mm² cable</td>
</tr>
</tbody>
</table>

### Table 5.4 - Basic functions of connector 72075A

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2nd Speed limiter</td>
<td>0000</td>
<td>Input Max 10 mA</td>
<td>BCM H/41</td>
<td>Activation of 2nd speed limiter (30 km/h by default) (1) Minimum value 10 km/h, which may be set by the Assistance Service Ground = 2nd speed limiter activated Open wire = no action</td>
</tr>
<tr>
<td>2</td>
<td>Programmable speed limiter;</td>
<td>9968</td>
<td>Input Max 10 mA</td>
<td>EDC K/22</td>
<td>Activation of programmable speed limiter Ground = programmable speed limiter activated Open wire = no action</td>
</tr>
<tr>
<td>3</td>
<td>Ground for Multiple State Switch</td>
<td>0000</td>
<td>n.a.</td>
<td>BCM H/38</td>
<td>Ground for EDC (2) Multiple State Switch pin 8</td>
</tr>
<tr>
<td>4</td>
<td>Speed signal (B7)</td>
<td>5517</td>
<td></td>
<td>BCM D/56</td>
<td>Mandatory to introduce 5 kΩ pull-up (3) Use signal K15 of 61071A/pin 11 Pulse Signal, see the description in Table 5.5</td>
</tr>
</tbody>
</table>
### 5.2 BODYBUILDER CONNECTORS

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>K15 Remote</td>
<td>8879</td>
<td>Input Max 500 mA</td>
<td>BCM G/02</td>
<td>By providing a positive, the first turn of the key is simulated (key set to ON). Only the main loads are powered but it is not possible to start the vehicle from outside since the vehicle key recognition is missing. Open wire = no action</td>
</tr>
<tr>
<td>6</td>
<td>Signal of PTO 1 in operation</td>
<td>6993</td>
<td>Input Max 10 mA</td>
<td>EM X3/08</td>
<td>PTO 1 feedback Ground = PTO 1 engaged Open circuit = PTO 1 not engaged</td>
</tr>
<tr>
<td>7</td>
<td>Horn</td>
<td>0000</td>
<td>Output Max 10 mA</td>
<td>BCM B/28 BCM D/31</td>
<td>Remote activation of horn Ground = horn active Open wire = no action</td>
</tr>
<tr>
<td>8</td>
<td>Multiple switch</td>
<td>0000</td>
<td>n.a.</td>
<td>BCM H/36</td>
<td>ISIC input (Idle Speed Control) mode 1/2/3 Note: the ISIC mode must be reactivated after every engine start-up.</td>
</tr>
<tr>
<td>9</td>
<td>Reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Engine speed (rpm)</td>
<td>5587</td>
<td>n.a.</td>
<td>EDC K/73 (F1A Euro 6) EDC K/70 (F1C Euro 6 / F1C Euro VI)</td>
<td>Engine speed signal</td>
</tr>
<tr>
<td>11</td>
<td>Emergency control ON</td>
<td>7772</td>
<td>Input Max 100 mA</td>
<td>BCM</td>
<td>In the presence of central emergency control (opt. 2546) Open wire = no action Ground = active emergency</td>
</tr>
<tr>
<td>12</td>
<td>Reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) If you wish to change the value of the 2nd speed limiter with the instrument available at the IVECO Assistance Service, please note that:

- the accuracy of the speed limiter is reduced at low speeds
- The accuracy of the speed limiter is reduced at low engine speeds: interference with the engine idle speed regulator is possible, particularly below 1000 rpm.
- the speed limiter must only be used in 1st gear or in reverse gear
- the speed limiter can be adjusted in steps of 1 km/h by the IVECO Assistance Service
- the Bodybuilder must check the functionality of the speed limiter for each application and is also responsible for preparing the relative specific instructions

(2) The signals to the Multiple State Switch may also be simultaneous to requests coming from the Expansion Module through CAN open (object 0x2001, sub 0x0C) or through activation of "PTO1/PTO2/PTO3 Memo Speed". The highest value prevails in the event of contemporaneity.
For this purpose IVECO recommends use of a relay (not identical to that for the Cruise Control interface) which enables utilization of the same functions available on the steering wheel lever.

The Cruise Control option must be configured on both the ECM and BCM systems.

Please note that the driver must position the Cruise Control switch on the steering wheel lever to OFF, otherwise the external controls will be ignored.

<table>
<thead>
<tr>
<th>Resistance Values [Ohm]</th>
<th>R0</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>120</td>
<td>390</td>
<td>900</td>
<td>2900</td>
</tr>
</tbody>
</table>

(3) Mandatory introduction of a 5kΩ Pull-up Resistor as well as a diode as outlined in Figure 12.

The pull-up resistor and the diode must be fitted by the Bodybuilder.

The resistor must be inserted between 72075A / Pin 4 and 61071A / Pin 11.
Without the pull-up resistor no B7 signal is available.

1. Outfitting
2. Connector 61071A
3. Connector 72075A

The B7 output provides the signal relating to the speed according to [ISO16844-2].

**Table 5.5 - Tachimetric signal characteristics**

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>min</th>
<th>max</th>
<th>Unit of measurement</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachograph output B7</td>
<td>Voltage $U_{\text{low}}$</td>
<td>1.5</td>
<td>V</td>
<td>$I = 1 \text{ mA}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voltage $U_{\text{high}}$</td>
<td>5.5</td>
<td>V</td>
<td>$I = 1 \text{ mA}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency $(1/T)$</td>
<td>1.6</td>
<td>kHz</td>
<td></td>
<td>Square wave</td>
</tr>
<tr>
<td></td>
<td>Pulse duration $(t)$</td>
<td>0.64</td>
<td>4</td>
<td>ms</td>
<td></td>
</tr>
</tbody>
</table>
1. Speed signal (terminal B.3) of the movement sensor fitted on the gearbox

2. Temporal diagram and form of the pulse speed signal (terminal B.7) from tachograph
   a. Pulse delay: max 40 μs ± 10 μs jitter

**Note**

On vehicles without tachograph DTCO, the B.7 signal is not available at speeds below 5 km/h.

It is however possible to obtain this signal at speeds exceeding 0.5 km/h if, on contacting the IVECO Service, a tachograph sensor is installed and the Body Computer is reconfigured.

On vehicles with tachograph MTCO this operation is not permitted.

---

**(4) WARNING:**

When the K15 Remote control was activated and the operator removed the ignition key with the engine running, the engine would not stop and it would be possible to move the vehicles with the steering locked. Therefore:

- **The K15 Remote control must not be activated with the engine running.**
- **Similarly, to avoid unexpected movements of the vehicle with gear engaged, the engine must not be running when the K15 Remote control is activated.**

If, in spite of such requirements, engine operation must still be possible, IVECO recommends using the RunLock function offered by the Expansion Module (if present): please consult the specific manual EM 603.95.826 (currently being updated at the time of publication of the present document).

Remember that, due to immobilizer, the engine cannot be started unless the ignition key is inserted.

---

**(5) Rpm signal**

The rpm signal is a square wave.

The characteristics of the rpm signal are:

- 2 pulses for each revolution of the crankshaft;
- frequency field 0 - 200 Hz (corresponding to 0-6000 revs/min);
- duty-cycle fixed at 50%.
## 5.2 Bodybuilder Connectors

### Table 5.6a - Characteristics of engine speed signal for F1A Euro 6

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Condition</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_EMI</td>
<td></td>
<td>3.76</td>
<td>5.64</td>
<td>nF</td>
</tr>
<tr>
<td>C_IO</td>
<td></td>
<td>3.76</td>
<td>5.64</td>
<td>nF</td>
</tr>
<tr>
<td>I_Out</td>
<td></td>
<td></td>
<td>2.20</td>
<td>A</td>
</tr>
<tr>
<td>I_Out_SC</td>
<td></td>
<td>4</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>I_Leak_Off</td>
<td></td>
<td>20</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>I_Out_Diag</td>
<td></td>
<td>650</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>V_OC</td>
<td></td>
<td>3.13</td>
<td>3.87</td>
<td>V</td>
</tr>
<tr>
<td>V THR</td>
<td></td>
<td>4.70</td>
<td>5.40</td>
<td>V</td>
</tr>
<tr>
<td>V_Out_Low</td>
<td></td>
<td>1.58</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>R_ON</td>
<td></td>
<td>0.72</td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>E_Clamp</td>
<td></td>
<td>4</td>
<td></td>
<td>mJ</td>
</tr>
<tr>
<td>V_Out_Clamp</td>
<td></td>
<td>60</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>R_Load_Diag</td>
<td></td>
<td>923</td>
<td></td>
<td>Ω</td>
</tr>
</tbody>
</table>

Table 5.6a notes that Max. current capacity of the power stage. The maximum permissible current depends on the derating caused by the current of the other power stages and the temperature conditions of use.

### Table 5.6b - Engine speed signal characteristics for F1C Euro V

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Condition</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_EMI</td>
<td></td>
<td>3.76</td>
<td>5.64</td>
<td>nF</td>
</tr>
<tr>
<td>C_IO</td>
<td></td>
<td>3.76</td>
<td>5.78</td>
<td>nF</td>
</tr>
<tr>
<td>I_Out</td>
<td></td>
<td>45.7</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I_Out_SC</td>
<td></td>
<td>116</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I_Leak_Off</td>
<td></td>
<td>5</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>I_Out_Diag</td>
<td></td>
<td>-4.82</td>
<td>0.45</td>
<td>mA</td>
</tr>
<tr>
<td>V_Out_Low</td>
<td></td>
<td>1.11</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>R_ON</td>
<td></td>
<td>22.1</td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>t_Fall</td>
<td></td>
<td>1</td>
<td></td>
<td>μs</td>
</tr>
</tbody>
</table>

### Table 5.6c - Characteristics of engine speed signal for F1C Euro 6 / Euro VI

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Condition</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_EMI</td>
<td></td>
<td>3.76</td>
<td>5.64</td>
<td>nF</td>
</tr>
<tr>
<td>C_IO</td>
<td></td>
<td>3.76</td>
<td>6.14</td>
<td>nF</td>
</tr>
<tr>
<td>I_Out</td>
<td></td>
<td>2.20</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>I_Out_SC</td>
<td></td>
<td>4</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>I_Leak_Off</td>
<td></td>
<td>20</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>I_Out_Diag</td>
<td></td>
<td>980</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>V_OC</td>
<td></td>
<td>3.23</td>
<td>3.77</td>
<td>V</td>
</tr>
<tr>
<td>V THR</td>
<td></td>
<td>4.70</td>
<td>5.40</td>
<td>V</td>
</tr>
<tr>
<td>V_Out_Low</td>
<td></td>
<td>1.76</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>R_ON</td>
<td></td>
<td>800</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>E_Clamp</td>
<td></td>
<td>4</td>
<td></td>
<td>mJ</td>
</tr>
<tr>
<td>V_Out_Clamp</td>
<td></td>
<td>60</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>
Characteristics | Condition | Minimum | Maximum | Unit of measurement
--- | --- | --- | --- | ---
R_Load_Diag |  |  | 4.69 | kΩ

(b) Maximum current (not all the ASIC outputs are ON at the same time, the current may be reduced in case of high temperatures of the ASIC or the ECU).

**Legend:**
- C_EMI: EMI capacity at the connector terminals
- C_IO: capacity between input and output (in the event of output stage: C_IO is valid if the output stage is turned off)
- I_Out: output current
- I_Out_SC: output current
- I_Leak_Off: loss of current if the ECU is no longer powered
- I_Out_Diag: loss of current with ECU powered, but PS no longer powered. This parameter defines the ability of the hardware to provide a diagnostic current. The actual existence of the diagnostic current depends on the software configuration
- V_OC: voltage between CON_PIN and ground with open circuit
- V_THR: open load threshold voltage
- V_Out: output voltage
- V_Out_High: output voltage, HIGH level
- V_Out_Low: output voltage, LOW level
- R_ON: output resistor ON
- E_Clamp: energy at the output terminals
- V_Out_Clamp: voltage at the output terminals
- R_Load-Diag: Maximum diagnosable load resistance
- t_Fall: signal fall time from 90% to 10%

The bodybuilder must install a special separation diode so as not to lower the $V_{ON}$ voltage.

The designer of the signal processor must ensure an input interface equal to that represented with a max. voltage $V_{CC}$ of 5 V and "pull-up / pull-down" so as not to lower the voltage $V_{ON}$ and to raise the response time set by the vehicle interface.
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 CBA1 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.

Warnings

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.

Any electrical work that is carried out in non-compliance with regulations may cause substantial damage (e.g. short circuits with the possibility of fire and destruction of the vehicle) and authorises IVECO to annul the warranty.
It is prohibited to make any changes or connections to the CAN lines where any change is strictly prohibited. Diagnostic and maintenance operations can only be carried out by authorised personnel with IVECO approved equipment.

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

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);
- 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, please 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. suitable bracket); The device must not be rotated in relation to the chassis so as to avoid potential malfunctions (e.g. infiltration of water). Therefore the original positioning must also be maintained;
- the electronic control units must not be fitted on the subframe;
- the covering must always be reinstalled;
- the control units must not be subjected to impact from road debris or stones coming from the vehicle's wheels when the vehicle is moving.

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, refer to the NEW DAILY Repair Manual, printed material 603.95.721.

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) making absolutely certain that the cable does not come into contact with any metal surfaces of the structure which could affect its 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"): 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.

**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.

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
Position of ground points on vehicle

M1. Power ground below cab access step
M2. Power ground on side member
M3. Power ground on fire guard
MS3. Signal ground on fire guard
M4. Power, engine compartment ground near front right headlight
M5. Power, engine compartment ground near front left headlight
M6. Power ground, in the cab, wall below dashboard
MS6. Signal ground, in the cab, wall below dashboard

M7. Power ground, in the cab, wall below dashboard
MS7. Signal ground, in the cab, wall below dashboard
M8. Power ground, in the cab on the side panels
M8S. Signal ground, in the cab, below the floor mat
M9. Power ground on fire guard
M10. Power, engine compartment ground near front left headlight
M11. Power ground on side member
M12. Power ground on engine crankcase, left side
M13. Power ground, engine compartment, left side
5.4 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

**Figure 17**

- **M2.** Engine compartment ground on side member
- **M12.** Power ground on engine crankcase
- **M13.** Power ground, engine compartment, left side

**Figure 18**

- **M3/MS3.** Signal/power ground on fire guard
- **M9.** Power ground on fire guard
M4. Power, engine compartment ground near front right headlight

M5. Power, engine compartment ground near front left headlight

M10. Power, engine compartment ground near front left headlight
M6. Power ground, in the cab, wall below dashboard
MS6. Signal ground, in the cab, wall below dashboard

M7. Power ground, in the cab, wall below dashboard
MS7. Signal ground, in the cab, wall below dashboard

M8. Power ground, in the cab on the side panels
5.4 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

**Figure 23**

MS8. *Signal ground, in the cab, below the floor mat*

**Figure 24**

M11. *Engine compartment ground on side member*
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 5.7 - Electromagnetic emission levels**

<table>
<thead>
<tr>
<th>Type of emission</th>
<th>Type of transducer</th>
<th>Type of disturbance</th>
<th>Type of detector</th>
<th>Frequency range and limits acceptable in dBμV/m</th>
<th>Unit of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>radiated</td>
<td>Aerial at a distance of 1 metre</td>
<td>Broad-band</td>
<td>almost peak</td>
<td>63</td>
<td>54</td>
</tr>
<tr>
<td>radiated</td>
<td>Broad-band</td>
<td>peak</td>
<td>76</td>
<td>67</td>
<td>48</td>
</tr>
<tr>
<td>radiated</td>
<td>Narrow band</td>
<td>peak</td>
<td>41</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>conduit</td>
<td>LISN 50 Ω 5 μH 0.11 μF</td>
<td>Broad-band</td>
<td>almost peak</td>
<td>80</td>
<td>66</td>
</tr>
<tr>
<td>conduit</td>
<td>Broad-band</td>
<td>peak</td>
<td>93</td>
<td>79</td>
<td>65</td>
</tr>
<tr>
<td>conduit</td>
<td>Narrow band</td>
<td>peak</td>
<td>70</td>
<td>50</td>
<td>45</td>
</tr>
</tbody>
</table>

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:

![Diagram](image)

\[ a \geq 6 \text{ mm} \]

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:

a) amateur two-way transmitter units for CB (City Band) and 2 m bands

b) two-way transmitter equipment for mobile phones and TETRA / TETRAPOL

c) GPS reception and satellite navigation equipment

**General instructions**

1. The equipment must be approved according to the law and be of a fixed nature (not potable).
   
   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 27);
   - 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 26).
   
   Installation on the center of the roof is to be considered the best by far, as the grounding is proportional in all directions.
   
   Inside the cab, the transmitter equipment must be positioned as shown in Figure 28.

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.
Some specific instructions are given below for each type of equipment.

**a) 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 at 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 < 1 V/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.

---

**B) equipment for GSM / PCS / UMTS mobile phones and TETRA / TETRAPOL**

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 1 meter 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 380-460 MHz band and 870-960 MHz and 2 dB in the 1710-2000 MHz band.
- The IRRADIATED FIELD in cab value must be as low as possible, and however < 1 V/m.
  - In any case, limits set by the applicable European legislation must never be exceeded.

An optimum position for the antenna would be the front of the cab roof, at a distance of not less than 30 cm from other antennas.
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.

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.
Table 5.8

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
<td>White</td>
</tr>
<tr>
<td>2</td>
<td>Signal + Vcc</td>
<td>Shielded</td>
</tr>
</tbody>
</table>

The connector of the microphone connection, on the cab wiring side, is located in correspondence with the ceiling connectors.
c) 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.

▶ 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) please contact IVECO in order to establish the compatibility checks.

▶ Any damage caused by the use of non-certified transceivers or by the application of additional amplifiers is not covered by the warranty.

Additional equipment

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 frame 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).

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 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 hear 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 must be made using a cable (the shortest possible) of adequate section.
5.4 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

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 versions of the NEW DAILY are equipped with an advanced alternator ("smart") controlled by the engine management 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 the mechanical requirements necessary for compatibility with the vehicle and under the responsibility of the bodybuilder) according to the diagram in Figure 33.

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

B) The "smart" alternator is not provided on the CNG powered NEW DAILY. For the connection of an additional unit, refer to indications provided in Annex B.

The installation of additional equipment must include suitable protections and should not overload the vehicle system.

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.
Current draw and fuses

In general it is advisable to:

- use suitable protective fuses near the current draw area;
- protect cables inserted into the proper sheathing or corrugated cables, installing them as indicated in Chapter 5.4 (Page 19) - Paragraph: "Precautions for operations on the system”.

> It is absolutely forbidden to draw current from unauthorised points. FIRE HAZARD.

a) Current draw from the CBA2 control unit in the engine compartment

Inside the CBA2 there are two fuses (FF and FG) reserved for the bodybuilders; terminals (HI and MI) downstream of these fuses are the only authorised points for current draw (see Figure 37).
Fuses FF and FG have a 30 A load 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 terminals) equal to 130 A.

Only on vehicles without a retarder the terminal upstream of the FN fuse can also be used as a drawing point, where maximum current of 160 A can be drawn.

**Note**  Each connection on the CBA2 must strictly maintain the integrity and correct positioning of the protective cover.

### b) Fuses

- Fuses on the CBA1 control unit
Table 5.9 - List of fuses on CBA1

<table>
<thead>
<tr>
<th>Location</th>
<th>Amperage [A]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>Power supply CBA2</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>Power supply SCM and Body builders</td>
</tr>
<tr>
<td>3</td>
<td>500</td>
<td>Starter and Retarder</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>Body Computer power supply</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>TGC (opt)</td>
</tr>
</tbody>
</table>

- Fuses on the CBA2 control unit

![Figure 39]

Table 5.10 - List of fuses on CBA2

<table>
<thead>
<tr>
<th>Location</th>
<th>Amperage [A]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>Retarder</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
<td>SCM Power supply</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>Body builders pre-installation</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>Body builders pre-installation</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>Pre- / post- heating unit</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>Urea module</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
<td>PTC power supply</td>
</tr>
<tr>
<td>8</td>
<td>40</td>
<td>ABS</td>
</tr>
</tbody>
</table>
Cable path between cab and engine compartment

The electrical cables can pass between the cab interior and the engine compartment through 5 holes in the bulkhead connector (Figure 38) located near the servo brake (Figure 34).

To avoid the infiltration of fumes from the engine compartment into the cab, suitable sealing is suggested.

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 19) 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. nylon) and at suitable 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 positioning 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.

Note  The section of the cables must be suitably sized based on the current absorbed, the length of the cable, the voltage drop and the type of fuse used; intervention of the protection for overload or for short circuit must be guaranteed along the entire length of the protected line.

Use cables and fuses with the characteristics shown in the following table in accordance with the current draw:
Table 5-11 - Use cables and fuses in accordance with the current draw

<table>
<thead>
<tr>
<th>Max. continuous current (1) (A)</th>
<th>Cable cross-section (mm²)</th>
<th>Fuse capacity (2) (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>0.5</td>
<td>5</td>
</tr>
<tr>
<td>4 - 8</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>8 - 16</td>
<td>2.5</td>
<td>20</td>
</tr>
<tr>
<td>16 - 25</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>25 - 33</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>33 - 40</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>40 - 60</td>
<td>16</td>
<td>70</td>
</tr>
<tr>
<td>60 - 80</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>80 - 100</td>
<td>35</td>
<td>125</td>
</tr>
<tr>
<td>100 - 140</td>
<td>50</td>
<td>150</td>
</tr>
</tbody>
</table>

(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.
- It is necessary to avoid coupling with the signal transmission cables (eg. ABS), for which preferential routing has been provided in order to meet 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.

⚠️ 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 the vehicle is not equipped with a trailer socket, it is possible to order a special kit comprising of:

- control unit with fastening bracket and guard;
- chassis cable with trailer configuration;
- rear bridle for trailer socket.

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 40;
- replace the chassis cable with the new cable configured for the trailer socket (see Figure 41);
- fit the connection bridle for the 13-pin socket compatible with the type of hook (high or low) (see Figure 42);
- update the programming of the vehicle enabling the trailer control unit (contact the IVECO Service Network).

---

![Figure 42](image-url)
Chassis cable with 13 pin socket and trailer control unit

1. Chassis cable
2. Connections with cab wiring
3. Trailer electronic control unit
4. 13-pin trailer socket
5. Tail lights

**Note** The graphic is for illustration purposes only.

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 5.12 - 13-pin trailer socket

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rear left turn indicator</td>
<td>1120</td>
<td>1 21 W - 12 V lamp</td>
</tr>
<tr>
<td>2</td>
<td>Rear fog lamp power supply</td>
<td>2283</td>
<td>2 21W - 12V lamps</td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
<td>0000</td>
<td>−</td>
</tr>
<tr>
<td>4</td>
<td>Rear right turn indicator</td>
<td>1125</td>
<td>1 21 W- 12 V lamp</td>
</tr>
<tr>
<td>5</td>
<td>Front left and rear right parking light</td>
<td>3335</td>
<td>3 5 W - 12V lamps</td>
</tr>
<tr>
<td>6</td>
<td>Stop signal lights power supply</td>
<td>1175</td>
<td>2 21W - 12V lamps</td>
</tr>
<tr>
<td>7</td>
<td>Front right and rear left parking light</td>
<td>3334</td>
<td>3 5 W - 12V lamps</td>
</tr>
<tr>
<td>8</td>
<td>Power supply for reverse light</td>
<td>2268</td>
<td>2 21W - 12V lamps</td>
</tr>
<tr>
<td>9</td>
<td>After fuse F67 present on SCM1/B</td>
<td>7777</td>
<td>Battery positive</td>
</tr>
<tr>
<td>10</td>
<td>After fuse F49 present on Body Computer</td>
<td>8879</td>
<td>Positive with key</td>
</tr>
<tr>
<td>11</td>
<td>Ground</td>
<td>0000</td>
<td>−</td>
</tr>
</tbody>
</table>
| 12  | Trailer connection signal (Ground)                                         | 6676       | 1. Signal to be supplied through connection on the trailer, to permit trailer lights and parking sensor diagnostics (if present)  
2. Pin 12 could be absent as it may have been replaced by a switch integrated in the socket; in this case it is not necessary to perform any connection on the trailer |
| 13  | Ground                                                                      | 0000       | −                                                                 |

**Note**  
If using LED lights, diagnostics of an open circuit is ensured on pins 1 - > 8 if the absorbed current is ≥ 100 mA for each pin.  
To disable any diagnostic function, compatible with the legal restrictions, contact the IVECO Service Network.

---

**The electrical connection of a trailer entails a considerable increase in the length of the cables and results in a larger voltage drop on the line. Therefore the use of cables with the biggest possible cross-section is recommended, which are compatible with the system layout and with the 13-pin socket; on this it is then necessary to the split the ground return using pins 3, 11 and 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 43).  
In order to keep the electrical characteristics of the contacts of the female socket unchanged, the hood supplied by IVECO must be left attached.

---

**It is not possible to draw current from side marker lights.**
Table 5.13

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>98435331 EZ</td>
<td>3-way male connector</td>
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<tr>
<td>98457375 EZ</td>
<td>Male contact for 0.35 to 0.5 mm² cable</td>
</tr>
<tr>
<td>98455370 EZ</td>
<td>Male contact for 0.5 to 1.5 mm² cable</td>
</tr>
</tbody>
</table>

Table 5.14 - Connector ST38 for Side Marker Lamps

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Max. current [A]</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
<td>0000</td>
<td>2.5</td>
<td>ST43/1</td>
<td>Ground for left and right side markers</td>
</tr>
<tr>
<td>2</td>
<td>Vehicle left side clearance lights</td>
<td>3390</td>
<td>1.25</td>
<td>ST43/2</td>
<td>+12 V = vehicle left side markers on no signal = vehicle left side markers off</td>
</tr>
<tr>
<td>3</td>
<td>Vehicle right side clearance lights</td>
<td>3390</td>
<td>1.25</td>
<td>ST43/2</td>
<td>+12 V = vehicle right side markers on no signal = vehicle right side markers off</td>
</tr>
</tbody>
</table>

The side markers are mandatory for vehicles with a total length exceeding 6 m.

Installation of side markers requires the intervention of the IVECO Service Network in order to enable the Body Computer.
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 remove controlled door on the body in combination with a centralised remove 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 (Remove Control Lock) + Predisposition for rear door.

These options 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).

The following diagram (Figure 45) shows the connections between the rear door socket and the actuator/door lock switch.

**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.*

---

**Figure 48**

The body builder must also provide an identical connection to the driver and passenger side doors for the side outlets.

**Driver and passenger side door connection diagram**

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 stripped chassis cowl, cowl, stripped chassis 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.

![Figure 50](image1)

**Engine bonnet button connection diagram**

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 stripped chassis cowl, cowl, stripped chassis cowl for camper with opt 5865

Open circuit → when the door is closed  
Closed circuit → when the door is open

![Figure 51](image2)

1. Bonnet open sensor  
2. Engine bonnet socket  
3. Alarm siren

For the operation mode refer to the Use and Maintenance Manual.
SECTION 6

ADBLUE AND
SCRT SYSTEM
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ADBLUE AND SCRT SYSTEM

6.1 GENERAL INFORMATION

To comply with Euro 6 (F1C engines) and Euro VI Regulations on engine gas emissions, IVECO has developed the SCRT system (Selective Catalytic Reduction Technology) consisting of the combined action of a diesel particulate filter (DPF) and post-treatment of exhaust gases (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 into the catalytic converter and chemically transforms NO\(_x\) into nitrogen and water, which are harmless to the environment.

Main components of SCRT system

![Diagram of SCRT system](image)
6.3 INSTRUCTIONS

The following instructions are intended for the AdBlue injection system of the Bosch DeNO\(_X\) 3.1 type.

**Note** The materials and layouts of normal IVECO production are specifically approved; all other circumstances of variation must be specifically authorized.

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 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).

**Materials**

The AdBlue solution may be corrosive for ferrous steels and, in turn, may be contaminated by additives used for moulding plastic materials. Therefore any parts of specific form may only be realized upon IVECO approval and only with the following materials:

- Molybdenum austenitic chromium-nickel steel in compliance with DIN EN 10088
- Polyethylene HD
- Polypropylene HD
- Polyfluoroethylene
- Polyvinylidene fluoride
- Perfluoroalkoxy
- Polyisobutylene
- Titanium
- Viton

**AdBlue tank**

- No modifications to the original tank are permitted; However, the tank can be replaced as long as it is replaced with the versions used for normal production (see Figure 5).
1. AdBlue tank
2. AdBlue refuelling filler
3. Heated pipe for AdBlue delivery to dosing module DM
4. SM Pumping module
5. Fastening ring nut
6. Heating pot
7. Locking ring welded to tank housing
8. Urea quality sensor (only for Euro VI engines)

It should be noted that:

- 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 unit (6) / Supply Module (4) / Tank (1) may only be disassembled by IVECO Authorized Workshops and must be repositioned according to the approved layout of normal production; any modifications must be authorized.
- The hydraulic connections must comply with Standard SAE J2044 ¼.
- To ensure the seal of the SM pumping module on the tank, the ring nut tightening torque must be 85 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.

**Note** If the filler door on the bodywork is modified, the original accessibility to the underlying plug must be maintained.

The following points are mandatory since AdBlue crystallises at -11 °C:

- ensure the pipes are at an incline which prevents urea from accumulating (syphons) inside;
- respect the original incline of the filler in relation to the ground.

### 6.4 MOVING ADBLUE SYSTEM COMPONENTS

**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.

---

**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 the position of one or more of the components in the AdBlue system must be changed for equipping reasons, this must be done so that the new arrangement corresponds to one of the normal production layouts.

To this end, note that:

a) the original position of the dosing module DM on the exhaust pipe must never be modified;
b) if the AdBlue tank is moved, the installation heights must correspond to the SM module already approved;
c) any new heated pipe (by configuration or length) must only be selected from those used in production.

All modifications must in any case be described and authorised by IVECO.

Note After moving the AdBlue tank, contact the IVECO Service Network for the software upgrade connected to the management of the relative system.

### Representative vehicles

Table 6-1 lists 20 reference vehicles to which the versions of the AdBlue system used for the production of the whole DAILY MY16 range correspond.

The following tables show the application criteria of the main components of the systems on the aforementioned 20 vehicles. Users are reminded that, if the outfitting of the vehicle requires modifications to the original layout of the AdBlue system, one of the fundamental 20 layouts must be replicated.

**Table 6-1**

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle 1</td>
<td>CAB 35C-50C, wheelbase 3450</td>
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<tr>
<td>Vehicle 2</td>
<td>CAB 35C-50C, wheelbase 3750</td>
</tr>
<tr>
<td>Vehicle 3</td>
<td>MIXED USE 6+1 35C-50C, wheelbase 3750</td>
</tr>
<tr>
<td>Vehicle 4</td>
<td>CAB 60C-70C, wheelbase 3750</td>
</tr>
<tr>
<td>Vehicle 5</td>
<td>MIXED USE 6+1 60C-70C, wheelbase 3750</td>
</tr>
<tr>
<td>Vehicle 6</td>
<td>VAN 35S, wheelbase 3520</td>
</tr>
<tr>
<td>Vehicle 7</td>
<td>VAN 35S, wheelbase 4100</td>
</tr>
<tr>
<td>Vehicle 8</td>
<td>VAN 35C-50C, wheelbase 3520</td>
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<tr>
<td>Vehicle 9</td>
<td>VAN 60C-70C, wheelbase 3520</td>
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<tr>
<td>Vehicle 10</td>
<td>VENDOR 35S, wheelbase 3520, left-hand drive</td>
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<tr>
<td>Vehicle 11</td>
<td>VENDOR 35S, wheelbase 3520, right-hand drive</td>
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<tr>
<td>Vehicle 12</td>
<td>VENDOR 35C-50C, wheelbase 3520, right-hand drive</td>
</tr>
<tr>
<td>Vehicle 13</td>
<td>VENDOR 35C-50C, wheelbase 3520, left-hand drive</td>
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<tr>
<td>Vehicle 14</td>
<td>VENDOR 35C-50C, wheelbase 4100, left-hand drive</td>
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<td>Vehicle 15</td>
<td>VENDOR 35C-50C, wheelbase 4100, right-hand drive</td>
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<tr>
<td>Vehicle 16</td>
<td>CAB 35S, wheelbase 3450</td>
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<tr>
<td>Vehicle 17</td>
<td>BUS 60C-70C, wheelbase 4100</td>
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<td>Vehicle 18</td>
<td>VAN 35S, wheelbase 3000, Euro 6 engine</td>
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<tr>
<td>Vehicle 19</td>
<td>VAN 35S, wheelbase 3520, Euro 6 engine</td>
</tr>
<tr>
<td>Vehicle 20</td>
<td>CAB 35S, wheelbase 3450, Euro 6 engine</td>
</tr>
</tbody>
</table>
The left-hand drive CUT-AWAY versions have the same AdBlue system layout as the left-hand drive CAB versions.
The right-hand drive CUT-AWAY versions have the same AdBlue system layout as the tight-hand drive VENDOR versions.

**AdBlue pipe**

![AdBlue pipe diagram]

**Table 6-2**

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AdBlue tank

Table 6-3

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6.4 MOVING ADBLUE SYSTEM COMPONENTS

AdBlue refuelling inlet

Table 6-4

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Table 6-6

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<tr>
<td>471</td>
<td>435</td>
<td>X</td>
<td></td>
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</tr>
<tr>
<td>320</td>
<td>390</td>
<td>X</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>280</td>
<td>220</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.5 TYPE-APPROVED LAYOUTS

Vehicle 1 - This position of the AdBlue tank is also valid for the following vehicles:

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Version</th>
<th>Wheelbase</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRUCKS</td>
<td>29L - 35S</td>
<td>3450 - 3750 - 4100</td>
</tr>
<tr>
<td>CAB VERSIONS Aerial platform</td>
<td>35S</td>
<td>3450 - 3750</td>
</tr>
<tr>
<td>U.P.S. CAB VERSIONS</td>
<td>35S</td>
<td>3450</td>
</tr>
<tr>
<td>TRUCKS</td>
<td>35C - 40C</td>
<td>3450 - 4100</td>
</tr>
<tr>
<td>TRUCKS</td>
<td>45C - 50C</td>
<td>3450 - 4350 - 4750</td>
</tr>
<tr>
<td>TRUCKS - COWL - MIXED USE 6+1</td>
<td>35S</td>
<td>3750</td>
</tr>
<tr>
<td>MIXED USE 6+1</td>
<td>35C - 40C</td>
<td>4100</td>
</tr>
<tr>
<td>TRUCKS</td>
<td>60C - 70C</td>
<td>3450 - 4100 - 4350 - 4750</td>
</tr>
</tbody>
</table>

Vehicle 2 - This position of the AdBlue tank is also valid for vehicles: CAB VERSIONS 70C, wheelbase 3750 mm.
Vehicle 3

Vehicle 4 - This position of the AdBlue tank is also valid for vehicles: CAB VERSIONS 35C, wheelbase 3750 mm.
Figure 13

Vehicle 5

Vehicle 6 - This position of the AdBlue tank is also valid for vehicles: VAN 29L, wheelbase 3520 mm.
Vehicle 7 - This position of the AdBlue tank is also valid for vehicles: VAN 29L and CAMPER 29L - 35S, wheelbase 4100 mm.

Vehicle 8 - This position of the AdBlue tank is also valid for vehicles: VAN 35C - 50C, wheelbase 4100 mm.
Vehicle 9 - This position of the AdBlue tank is also valid for vehicles: VAN 60C - 70C, wheelbase 4100 mm.

Vehicle 10
Vehicle 11

Vehicle 12 - This position of the AdBlue tank is also valid for vehicles: VENDOR 40C, wheelbase 3520 mm, right-hand drive.
Vehicle 13 - This position of the AdBlue tank is also valid for vehicles: VENDOR 40C, wheelbase 3520 mm, left-hand drive.

Vehicle 14 - This position of the AdBlue tank is also valid for vehicles: VENDOR 40C - 50C, wheelbase 3520 mm.
Vehicle 15 - This position of the AdBlue tank is also valid for vehicles: VENDOR 40C, wheelbase 4100 mm, right-hand drive.

Vehicle 16 - This position of the AdBlue tank is also valid for: see Vehicle 1 and Table 6-7.
Vehicle 17 - This position of the AdBlue tank is also valid for vehicles: VENDOR 60C - 70C, wheelbase 4100 mm.

Vehicle 18
Vehicle 19

Vehicle 20
Position of the AdBlue tank

A. Vehicle zero axis

Table 6-8

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Z [mm]</th>
<th>X₁ [mm]</th>
<th>X₂ [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle 1</td>
<td>19.5</td>
<td>392.5</td>
<td>1680</td>
</tr>
<tr>
<td>Vehicle 2</td>
<td>19.5</td>
<td>392.5</td>
<td>1883</td>
</tr>
<tr>
<td>Vehicle 3</td>
<td>19.5</td>
<td>417.5</td>
<td>1680</td>
</tr>
<tr>
<td>Vehicle 4</td>
<td>58</td>
<td>392.5</td>
<td>1863</td>
</tr>
<tr>
<td>Vehicle 5</td>
<td>27</td>
<td>377.5</td>
<td>1763</td>
</tr>
<tr>
<td>Vehicle 6</td>
<td>19.5</td>
<td>354.5</td>
<td>1931</td>
</tr>
<tr>
<td>Vehicle 7</td>
<td>19.5</td>
<td>362.5</td>
<td>1893</td>
</tr>
<tr>
<td>Vehicle 8</td>
<td>19.5</td>
<td>354.5</td>
<td>1718</td>
</tr>
<tr>
<td>Vehicle 9</td>
<td>58</td>
<td>354.5</td>
<td>1738</td>
</tr>
<tr>
<td>Vehicle 10</td>
<td>19.5</td>
<td>393</td>
<td>2072.5</td>
</tr>
<tr>
<td>Vehicle 11</td>
<td>19.5</td>
<td>363</td>
<td>2072.5</td>
</tr>
<tr>
<td>Vehicle 12</td>
<td>19.5</td>
<td>422</td>
<td>2072</td>
</tr>
<tr>
<td>Vehicle 13</td>
<td>21</td>
<td>330</td>
<td>2268</td>
</tr>
<tr>
<td>Vehicle 14</td>
<td>21</td>
<td>330</td>
<td>2268</td>
</tr>
<tr>
<td>Vehicle 15</td>
<td>21</td>
<td>362.5</td>
<td>2809</td>
</tr>
<tr>
<td>Vehicle 16</td>
<td>19.5</td>
<td>392.5</td>
<td>1680</td>
</tr>
<tr>
<td>Vehicle 17</td>
<td>21</td>
<td>393</td>
<td>2799</td>
</tr>
<tr>
<td>Vehicle 18</td>
<td>19.5</td>
<td>335</td>
<td>1575</td>
</tr>
<tr>
<td>Vehicle 19</td>
<td>19.5</td>
<td>354.5</td>
<td>1931</td>
</tr>
<tr>
<td>Vehicle 20</td>
<td>19.5</td>
<td>392.5</td>
<td>1680</td>
</tr>
</tbody>
</table>
SECTION 7

EXPANSION MODULE
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EXPANSION MODULE

General information

The Expansion Module (EM), shown in Figure 1, is an electronic interface provided for the management of various types of versions.

This manual provides information regarding:

- power take-off (PTO) management
- wiring diagram
- management of additional functions (additional lights, alarms, "after-sales" PTO, etc...)
7.1 PTO MANAGEMENT

The Expansion Module control unit, which is housed on the passenger side under the dashboard, is able to manage up to two power take-offs (PTO1, installed only on the gearbox, and PTO2).

For engagement and disengagement of the PTO1, there is an unstable button (1) in the centre of the dashboard (Figure 2) together with a warning light that indicates:

- if off: PTO1 disengaged (a),
- if on fixed: PTO1 engaged (b),
- if flashing: transient stage from (a) → (b) or from (b) → (a) in which the EM searches, respectively, to engage or disengage PTO1.

The engagement and disengagement of the PTO2 requires a stable switch, which is the responsibility of the bodybuilder, together with the connections between the PTO2 and the available connector (see Chapter 7.2 - Paragraph “Electrical connections for PTO2 connection” (Page 18).

Standard configuration of the PTO

IVECO can originally fit the vehicle with the EM control unit, the PTO1 configured in standard mode and the activation button. This makes it possible to engage and disengage the PTO1 according to the procedures described in the vehicle’s operator’s manual.

Customized PTO configurations

To activate a specific function of the power take-off, the Expansion Module must be programmed by IVECO Customer Service. Keeping to the following instructions, the Bodybuilder will be able to organise system configuration in advance. IVECO Customer Service can configure different parameters for each PTO:

- engagement restrictions;
- disengagement conditions;
- engine controls (engine rpm request of maximum torque limit configuration or maximum rpm limit configuration).

Note The engine control parameter cannot be configured for a CNG engine.
a) Engagement restrictions

Engagement restrictions are used if the user wishes to impede engagement of the PTO to check (or not) the set conditions. The restriction conditions are considered as such only if they have a temporary duration of a few seconds or more. When this time has elapsed the EM control unit detects the presence of the restriction. A warning message will be displayed on dashboard and engagement will not take place.

The table below provides a list of all possible engagement restrictions; The user chooses which to enter for their own application from those indicated.

Table 7.1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Possible Restriction 1</th>
<th>Possible Restriction 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake</td>
<td>Depressed</td>
<td>Not depressed</td>
</tr>
<tr>
<td>Handbrake</td>
<td>Activated</td>
<td>Not activated</td>
</tr>
<tr>
<td>Clutch pedal (#)</td>
<td>Depressed</td>
<td>Not depressed</td>
</tr>
<tr>
<td>Coolant temperature</td>
<td>40 - 150 °C</td>
<td></td>
</tr>
<tr>
<td>Gear in neutral (+)</td>
<td>In neutral</td>
<td>Gear engaged</td>
</tr>
<tr>
<td>Reverse gear</td>
<td>Engaged</td>
<td>Not engaged</td>
</tr>
</tbody>
</table>

Open circuit on the pressure switch if fitted on PTO2 (§)
Short circuit to ground on the pressure switch if fitted on PTO2 (§)
Low engine oil pressure
Min rpm for engagement
Max rpm for engagement
Min vehicle speed
Max vehicle speed
Lower gear engaged (+)
Higher gear engaged (+)

(#) only for manual gearbox
(+ for automated gearbox only
(§) see Chapter 7.2 “wiring diagram” ( -> Page 12) for the electrical connections

Note These conditions can be modified only by IVECO Customer Service.

b) Disengagement conditions

The disengagement conditions are those in which the PTO switches itself off automatically. The disengagement conditions are considered as such only if they have a temporary duration of a few seconds or more. When this time has elapsed the EM control unit detects the presence of the disengagement condition. A warning message will be displayed on the instrument panel and the PTO will automatically disengage.
Note  The automatic disengagement by the EM depends on the PTO load. In some situations, when the warning message is displayed in the instrument panel, the PTO is not switched off automatically. In this case it is necessary to:

a) with a manual transmission
   • with the stationary vehicle, operate the clutch
   • with the vehicle moving, engage neutral

b) with an automated gearbox
   • with the vehicle moving, engage neutral

The table below contains the list of possible disengagement conditions; The user chooses which to enter for their own application from those indicated.

Table 7.2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Possible condition disengagement 1</th>
<th>Possible condition disengagement 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake</td>
<td>Depressed</td>
<td>Not depressed</td>
</tr>
<tr>
<td>Handbrake</td>
<td>Activated</td>
<td>Not activated</td>
</tr>
<tr>
<td>Clutch pedal (#)</td>
<td>Depressed</td>
<td>Not activated</td>
</tr>
<tr>
<td>Coolant temperature</td>
<td>40 - 150 °C</td>
<td></td>
</tr>
<tr>
<td>Gear in neutral (+)</td>
<td>In neutral</td>
<td>Gear engaged</td>
</tr>
<tr>
<td>Reverse gear</td>
<td>Engaged</td>
<td>Not engaged</td>
</tr>
<tr>
<td>Open circuit on the pressure switch if fitted on PTO2 (§)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short circuit to ground on the pressure switch if fitted on PTO2 (§)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low engine oil pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min rpm for disengagement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max rpm for disengagement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min vehicle speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max vehicle speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower gear engaged (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher gear engaged (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clutch slipping percentage (@)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(#) only for manual gearbox
(++) for automated gearbox only
(§) see Chapter 7.2 “wiring diagram” (➤ Page 12) for the electrical connections
(@) condition applicable only with automated gearbox and only for stationary PTO

Note  These conditions can be modified only by IVECO Customer Service.
c) Checks on the engine

When the PTO is engaged the following checks on the engine are connected:

- RPM request (not available on CNG engines);
- configuration of maximum RPM limit (not available on CNG engines);
- configuration of maximum torque limit (a limit at lower torque values than necessary to support idling should not be set for CNG engines, otherwise the engine will cut out).

**Note** During the “rpm request” check the engine speed cannot be changed using the Cruise Control and/or the accelerator pedal.

Engine control ends when the PTO is released.

The parameter `PTO[x]_SwActCfg` (x = 1, 2 represents the PTO involved) defines whether to associate the control on the engine with the pressure of the button for PTO engagement:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>PTO[x]_SwActCfg</code></td>
<td>No control requested</td>
</tr>
<tr>
<td></td>
<td>Engine control requested as soon as the PTO engagement button is pressed</td>
</tr>
</tbody>
</table>

When the aforementioned parameter is set and when there are engagement restrictions, the engine control is applied for a certain period of time (a few seconds) until the EM control unit no longer detects the restriction.

**Note** These conditions can be modified only by IVECO Customer Service.

The parameter `PTO[x]_FbkActCfg` (x = 1, 2 refers to the PTO involved) defines whether to associate the engine control to the successful engagement of the PTO, therefore only after the engine has sent a positive feedback to the EM.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>PTO[x]_FbkActCfg</code></td>
<td>No control requested</td>
</tr>
<tr>
<td></td>
<td>Engine control requested only after the PTO has been successfully engaged.</td>
</tr>
</tbody>
</table>

**Note** These conditions can be modified only by IVECO Customer Service.
### Standard parameters for PTO1 supplied by IVECO

**Table 7.5**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Manual gearbox</th>
<th>Unit</th>
<th>Automated gearbox</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engagement restrictions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service brake pressed</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Service brake not pressed</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Handbrake activated</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Handbrake not activated</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Low engine oil pressure</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Clutch pedal pressed</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Clutch pedal not pressed</td>
<td>yes</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gear not in neutral</td>
<td>n.a.</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Reverse gear</td>
<td>n.a.</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Open circuit on the pressure switch if fitted on PTO2</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Min rpm for engagement</td>
<td>750 rpm</td>
<td>no</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Max rpm for engagement</td>
<td>1300 rpm</td>
<td>750 rpm</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Min vehicle speed</td>
<td>no km/h</td>
<td>1300 rpm</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Max vehicle speed</td>
<td>no km/h</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Lower gear engaged</td>
<td>no gear</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Higher gear engaged</td>
<td>no gear</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Maximum coolant temperature</td>
<td>110 °C</td>
<td>110 °C</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Disengagement conditions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service brake pressed</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Service brake not pressed</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Handbrake activated</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Handbrake not activated</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Low engine oil pressure</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Clutch pedal pressed</td>
<td>yes</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Clutch pedal not pressed</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gear not in neutral</td>
<td>n.a.</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Reverse gear</td>
<td>n.a.</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Min rpm for disengagement</td>
<td>500 rpm</td>
<td>500 rpm</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Open circuit on the pressure switch if fitted on PTO2</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Short circuit to ground on the pressure switch if fitted on PTO2</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Max rpm for disengagement</td>
<td>2000 rpm</td>
<td>2000 rpm</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Min vehicle speed</td>
<td>no km/h</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Max vehicle speed</td>
<td>no km/h</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Lower gear engaged</td>
<td>no gear</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Higher gear engaged</td>
<td>no gear</td>
<td>no km/h</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Maximum coolant temperature</td>
<td>110 °C</td>
<td>110 °C</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Clutch slipping percentage</td>
<td>no %</td>
<td>no %</td>
<td>-</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Table 7.6

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Manual gearbox</th>
<th>Unit</th>
<th>Automated gearbox</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine control requested on PTO1 engagement request</td>
<td>No control requested</td>
<td>yes</td>
<td>–</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Engine control requested only after the PTO has been successfully engaged.</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
</tr>
<tr>
<td>Engine control requested on PTO1 engagement feedback</td>
<td>No control requested</td>
<td>yes</td>
<td>–</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Engine control requested only after the PTO has been successfully engaged.</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
</tr>
<tr>
<td>Type of engine control</td>
<td>No request/ Disabled</td>
<td>yes</td>
<td>–</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Rpm request</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Torque request</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Torque limit request/ rpm limit request</td>
<td>no</td>
<td>–</td>
<td>no</td>
<td>–</td>
</tr>
<tr>
<td>PTO[X]TSC1FIELD5</td>
<td>Control in rpm/ rpm limit request</td>
<td>no</td>
<td>rpm</td>
<td>no</td>
<td>rpm</td>
</tr>
<tr>
<td>PTO[X]TSC1FIELD6</td>
<td>Control in torque/ torque limit request</td>
<td>no</td>
<td>%</td>
<td>no</td>
<td>%</td>
</tr>
</tbody>
</table>

Key:
n.a. = not applicable

Note  On CNG engines checks cannot be carried out on the engine (rpm request, configuration of the maximum rpm limit, configuration of the maximum torque limit).

Note  During the “rpm request” check the engine speed cannot be changed using the Cruise Control and/or the accelerator pedal.

Parameters can only be set for PTO2

a) Engagement Timeout

If power take-off PTO2 requires a greater engagement time than two seconds, it is possible to act on the Engagement Timeout parameter PTO[x]_ERevtimeout (x = 2, represents the PTO involved) that stabilises the time level outside of which an engagement restriction condition (if configured) is considered as such.

The EM control unit assesses the outcome of the PTO2 engagement and, if engagement has not been successful, displays any Engagement Timeout errors only once the “Engagement Timeout” time has elapsed.

Note  The PTO[x]_ERevtimeout parameter can be set by IVECO Customer Service.
b) Disengagement Timeout

If power take-off PTO2 requires a greater disengagement time than two seconds, it is possible to act on the Engagement Timeout parameter \( \text{PTO}[x] \text{~S} \text{timeout} \) (\( x = 2 \), represents the PTO involved) that stabilises the time level outside of which an engagement restriction condition (if configured) is considered as such.

The EM control unit assesses the outcome of the PTO2 disengagement and, if disengagement has not been successful, displays any Disengagement Timeout errors only once the Disengagement Timeout.

Therefore, the EM control unit will detect the presence of the disengagement condition only once the Disengagement Timeout time has elapsed. Within 10 seconds a warning message will be displayed on the Instrument Panel and the PTO will automatically disengage.

Note: The \( \text{PTO}[x] \text{~S} \text{timeout} \) parameter can be set by IVECO Customer Service.

7.2 WIRING DIAGRAM

To guarantee the functional integrity of the electrical system, IVECO has provided specific connection points to be used for the additional systems (see Chapter 5.4 - Paragraph "Current draws and fuses" (PageIndex 38)).

Optional connectors for Expansion Module

The Expansion Module control unit terminals are available through two connectors 61071B and 72075B (see also section 5 - Figure 2).

The vehicle may also have two other optional connectors: 72071 and ST13.

20-pin connector, black (61071B)

![Figure 3](image)

Table 7.7

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>500314820 EZ</td>
<td>Male contact for 0.35 to 0.5 mm² cable</td>
</tr>
<tr>
<td>500314824 EZ</td>
<td>Male contact for 0.75 to 1.5 mm² cable</td>
</tr>
<tr>
<td>504005092 EZ</td>
<td>Male contact for 2.5 mm² cable</td>
</tr>
</tbody>
</table>
Table 7.8 - Basic functions of connector 61071B

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right stop light</td>
<td>9131</td>
<td>Output 1.5 A</td>
<td>EM X1/1</td>
<td>(1) +12 V = stop light activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = stop light not activated</td>
</tr>
<tr>
<td>2</td>
<td>Right turn indicator lights</td>
<td>6985</td>
<td>Output 1.5 A</td>
<td>EM X1/3</td>
<td>(1) +12 V = turn indicator light activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = turn indicator light not activated</td>
</tr>
<tr>
<td>3</td>
<td>Left stop light</td>
<td>9132</td>
<td>Output 1.5 A</td>
<td>EM X1/4</td>
<td>(1) +12 V = stop light activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = stop light not activated</td>
</tr>
<tr>
<td>4</td>
<td>Left turn indicator lights</td>
<td>6986</td>
<td>Output 1.5 A</td>
<td>EM X1/8</td>
<td>(1) +12 V = turn indicator light activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = turn indicator light not activated</td>
</tr>
<tr>
<td>5</td>
<td>Solenoid PTO 2/CS: Additional light 2</td>
<td>9123</td>
<td>Output 1.5 A</td>
<td>EM X1/6</td>
<td>(1) (2) 12 V = PTO activation engaged</td>
</tr>
<tr>
<td></td>
<td>CS: Blue light 2</td>
<td></td>
<td></td>
<td></td>
<td>0 V = PTO activation disengaged</td>
</tr>
<tr>
<td>6</td>
<td>Reserved /CS: Additional light 1</td>
<td>9995</td>
<td>3 A</td>
<td>EM X1/7</td>
<td>(1) (2) (3) 12 V = light activated</td>
</tr>
<tr>
<td></td>
<td>CS: Blue light 1</td>
<td></td>
<td></td>
<td></td>
<td>0 V = light deactivated</td>
</tr>
<tr>
<td>7</td>
<td>PTO 2 feedback</td>
<td>6132</td>
<td>Input 5 mA</td>
<td>EM X3/9</td>
<td>Ground connection for PTO2 feedback reading</td>
</tr>
<tr>
<td>8</td>
<td>Reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>PTO 2 pressure switch</td>
<td>0392</td>
<td>Input 5 mA</td>
<td>EM X3/12</td>
<td>Connect to ground if active; It can be used to permit PTO engagement by the bodybuilder</td>
</tr>
<tr>
<td>10</td>
<td>Reserved</td>
<td>0393</td>
<td></td>
<td>EM X3/16</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Run-Lock switch</td>
<td>0132</td>
<td>Input 5 mA</td>
<td>EM X3/6</td>
<td>(1) (4) Critical for safety, see Attention note</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = RunLock activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = no action</td>
</tr>
<tr>
<td>12</td>
<td>Scene light switch</td>
<td>0992</td>
<td>Input 5 mA</td>
<td>EM X3/18</td>
<td>(1) (5) +12 V = scene light activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 V = no action</td>
</tr>
<tr>
<td>13</td>
<td>Additional light switch 1</td>
<td>0993</td>
<td>Input 5 mA</td>
<td>EM X3/19</td>
<td>(1) (5) +12 V = additional lights 1 activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 V = no action</td>
</tr>
<tr>
<td>14</td>
<td>Additional light switch 2</td>
<td>0994</td>
<td>Input 5 mA</td>
<td>EM X3/20</td>
<td>(1) (5) +12 V = additional lights 2 activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 V = no action</td>
</tr>
<tr>
<td>15</td>
<td>EMCY bodybuilders (for future applications)</td>
<td>0995</td>
<td>Input 5 mA</td>
<td>EM X3/21</td>
<td>Input for activating the vehicle stop status, only if the bodybuilder enabling input (61071B/Pin18) is also activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = bottom side switch activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = no action</td>
</tr>
<tr>
<td>16</td>
<td>PTO 2 switch</td>
<td>0391</td>
<td>Input 5 mA</td>
<td>EM X3/11</td>
<td>PTO 2 mode (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = not activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Without physical PTO, 2 ISC mode activated</td>
</tr>
<tr>
<td>17</td>
<td>PTO 3 switch</td>
<td>0123</td>
<td>Input 5 mA</td>
<td>EM X3/7</td>
<td>PTO 3 mode (only for ISC) (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = not activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = activated</td>
</tr>
</tbody>
</table>
### 7.2 Wiring Diagram

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Bodybuilder Enable</td>
<td>0991</td>
<td>Input 5 mA</td>
<td>EM X3/17</td>
<td>To be activated by the bodybuilder with bodybuilder mission active</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = bottom side switch activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = no action</td>
</tr>
<tr>
<td>19</td>
<td>Spare</td>
<td>5983</td>
<td>EM X4/29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Run-Lock relay</td>
<td>6987</td>
<td>Output 1 A</td>
<td>EM X4/1</td>
<td>Reconfiguration possible via Customer Service (CS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = RunLock activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = RunLock not activated</td>
</tr>
</tbody>
</table>


Output only supported with K15 engaged. The outputs are disabled if K15 is disengaged.

(2) With the additional lights function enabled, the PTO functions are no longer available (see Chapter 7.3 (Page 19)). This also applies for the activation of the stored PTO/ISC speeds for PTO mode 1,2,3; also these functions are no longer available.

(3) If additional light 1 or the blue light 1 are activated by Customer Service, then full vehicle CAN operation 72075B/12 is no longer available (see Chapter 7.3 (Page 19)).

To avoid possible problems, IVECO requires removing the relay for full vehicle CAN operation.

(4) The RunLock function is used for missions in which the operator is no located inside the cab.

1. The RunLock function must be enabled via TeleService.
2. The bodybuilder must remove the relay, if provided.
3. See also Chapter 7.3 (Page 19).

(5) The EM offers various configurations that can be selected upon specific customer request. An overview of the available combinations is listed in Chapter 7.3 - paragraph "Compatibility between PTO and the additional functions" (Page 19).

---

12-pin EM connector, black (72075B)

![12-pin EM connector](image_url)

Existing part on vehicle (male)

Counterpart to be coupled (female)
### Table 7.9

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>500314820 EZ</td>
<td>Male contact for 0.35 to 0.5 mm² cable</td>
</tr>
<tr>
<td>500314824 EZ</td>
<td>Male contact for 0.75 to 1.5 mm² cable</td>
</tr>
<tr>
<td>504005092 EZ</td>
<td>Male contact for 2.5 mm² cable</td>
</tr>
</tbody>
</table>

### Table 7.10 - Basic functions of connector 72075B

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right low beam headlight relay</td>
<td>6988</td>
<td>Output 1 A</td>
<td>EM X4/2</td>
<td>To be activated via TeleService</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If PTO is enabled/the memorised ISC speed is not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = low beam headlight activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = low beam headlight not activated</td>
</tr>
<tr>
<td>2</td>
<td>Left low beam headlight relay</td>
<td>6989</td>
<td>Output 1 A</td>
<td>EM X4/3</td>
<td>To be activated via TeleService</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If PTO is enabled/the memorised ISC speed is not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = low beam headlight activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = low beam headlight not activated</td>
</tr>
<tr>
<td>3</td>
<td>Reserved</td>
<td>0996</td>
<td>EM X4/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Alarm command</td>
<td>5981</td>
<td>Output 5 mA</td>
<td>EM X4/14</td>
<td>Reconfiguration possible via Customer Service (CS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = alarm function activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 V = no action</td>
</tr>
<tr>
<td>5</td>
<td>Reserved</td>
<td>5982</td>
<td>EM X4/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reserved</td>
<td>5991</td>
<td>EM X4/16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Engine stop command</td>
<td>6990</td>
<td>Output 1 A</td>
<td>EM X4/21</td>
<td>Wired output to ST 61071A / Pin2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = engine stop activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = no action</td>
</tr>
<tr>
<td>8</td>
<td>Side lights 10W</td>
<td>6991</td>
<td>Output 1 A</td>
<td>EM X4/22</td>
<td>Reconfiguration possible via CS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If the memorised PTO speed is available/ISC Memo is not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = side lights enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = side lights not activated</td>
</tr>
<tr>
<td>9</td>
<td>Scene lights relay</td>
<td>6992</td>
<td>Output 1 A</td>
<td>EM X4/23</td>
<td>Reconfiguration possible via CS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If the memorised PTO speed is available/ISC Memo is not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = scene light activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No signal = scene light not activated</td>
</tr>
<tr>
<td>10</td>
<td>Reserved</td>
<td>5992</td>
<td>EM X4/38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Ground</td>
<td>0000</td>
<td>5 A</td>
<td>Fuse holder and distributor case Terminal 14/17</td>
<td>N.D. with additional light configuration via CS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+12 V = vehicle with full CAN operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = vehicle NOT with full CAN operation</td>
</tr>
<tr>
<td>12</td>
<td>Vehicle with full CAN operation</td>
<td>0980</td>
<td>3 A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9-pin EM connector, yellow (72071)

![Diagram of 9-pin EM connector]

This connector is only present with an EM installation with CANopen (opt 75979).

**Table 7.11**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>500314820 EZ</td>
<td>Male contact for 0.35 to 0.5 mm² cable</td>
</tr>
<tr>
<td>500314824 EZ</td>
<td>Male contact for 0.75 to 1.5 mm² cable</td>
</tr>
<tr>
<td>504005092 EZ</td>
<td>Male contact for 2.5 mm² cable</td>
</tr>
</tbody>
</table>

**Table 7.12 - Basic functions of connector 72071**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K30 +</td>
<td>7772</td>
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<td>6</td>
<td>Bodybuilders CAN L</td>
<td>6111</td>
<td>n.d.</td>
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<td></td>
<td></td>
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12-pin EM connector, black (ST13)

**Table 7.13**

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>1/09314/54 EZ</td>
<td>Male contact for 0.35 mm² cable</td>
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<tr>
<td>504079557 EZ</td>
<td>Male contact for 0.5 to 1.0 mm² cable</td>
</tr>
<tr>
<td>504079558 EZ</td>
<td>Male contact for 1.0 to 2.5 mm² cable</td>
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**Table 7.14 - Basic functions of connector ST13**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
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<td>PTO1 activation-</td>
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<td>PTO1 feedback switch</td>
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<tr>
<td>12</td>
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</tr>
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</table>
Electrical connections for PTO2 connections

Figure 7 shows the connections that must be made to install a PTO2.

The Bodybuilder must see to:

- assembly of the switch (it must be a stable type);
- the wiring between the PTO and the 20-pin EM connector, black (61071B).

For the ground connection, can be chosen to use:

- terminal 17 of the 20-pin Bodybuilder connector, blue (61071A);
- the ground points available on the vehicle (see Chapter 5.4 - Paragraph Ground points).

---

1. **EM 20-pin connector, black (61071B)**
2. **PTO 2 switch**
   - a. Solenoid
   - b. Feedback
   - c. Pressure switch
7.3 ADDITIONAL FUNCTIONS

The Expansion Module control unit makes available additional functions:

1. Run-Lock;
2. Safety / Alarms;
3. Additional lights 1 and additional lights 2.

Compatibility between PTO and additional functions

It is not possible to use all functions of the Expansion Module (PTO and additional functions) simultaneously. Each line of the following table indicates the maximum permitted configuration, bearing in mind that the sum of the electrical currents associated with the functions used should NOT exceed 10 A.

However note that the additional lights 1 are not compatible with the use of the signal "Vehicle with full CAN operation", while the additional lights 2 are not compatible with the use of PTO2.

<table>
<thead>
<tr>
<th>N.</th>
<th>PTO1</th>
<th>PTO2</th>
<th>Rear lights</th>
<th>Additional lights 1</th>
<th>Additional lights 2</th>
<th>Scene lights</th>
<th>Run-Lock</th>
<th>Low beams flash</th>
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</tr>
</tbody>
</table>
I. "Run-Lock"

The Expansion Module can control a relay that by-passes the ignition switch to allow the ignition key from being extracted, when the vehicle is stationary, without stopping the engine. This function is used in police vehicles and ambulances for powering various electrical equipment.

Other possible uses are the remote activation of vehicle PTO, platform lifting, etc.

Connections

Figure 8 shows the connections to be made in order to use the Run-Lock function. Switch is low active.

The Bodybuilder must see to:

- use of a switch
- the switch connection to terminal 11 of the EM BLACK 20-pin connector (61071B)
- the connection between terminal 20 of this connector and terminal 5 of the bodybuilder's 12-pin connector, black (72075A)

For the ground connection, can be chosen to use:

- terminal 17 of the 20-pin Bodybuilder connector, blue (61071A);
- the ground points available on the vehicle (see Chapter 5.4 - paragraph Ground points)

"Run-Lock" engagement procedure

- engine running
- Stationary vehicle
- gearbox in neutral and clutch not pressed (for a mechanical gearbox) or gearbox in neutral (for an automated gearbox)
- parking brake engaged
- operate the Run-Lock switch
- Remove the key
**Note**  During operation of Run-Lock mode, the engine will be shut down if one of the following conditions is detected:
- clutch pressed (for a mechanical gearbox) or gearbox not in neutral (for an automated gearbox)
- parking brake released
- vehicle speed $> 0$ km/h

"Run-Lock" disengagement procedure
- turn the key to position 2
- return the Run-Lock switch to the OFF position

2. Safety/Alarm function
The Safety/Alarm function can be applied in all cases in which the vehicle is under attack. In this situation the engine is switched off or limited to a certain number of revs; the activation of the flashing low beam lights is possible.

Safety mode is turned on by operating the Alarm State switch.

The Expansion Module applies a different strategy according to whether the vehicle is parked or in motion. The details are as follows:

a) with the stationary vehicle:
- the engine is turned off and immobilised and maybe started up only and exclusively if the alarm state switch is turned OFF
- both low beam lights will flash (a flashing period equal to 1 second is set by default);

b) with vehicle in motion:
- the speed is limited to 30 km/h;
- once the vehicle has been stopped, stationary vehicle management begins to operate;
- both low beam lights will flash (a flashing period equal to 1 second is set by default).

Connections
Figure 9 shows the connections to be made in order to use the Alarm function. Switch is high active.

The Bodybuilder must see to:
- use of a switch;
- its connection to terminal 4 of the 12-pin EM connector, black (72075B) and to terminal 6 of the 20-pin Bodybuilder connector, blue (61071A);
- the connection between terminal 7 of the 12-pin EM connector, black (72075B) and terminal 2 of the 20-pin Bodybuilder connector, blue (61071A).

If low beam flashing is necessary, the Bodybuilder is responsible for providing:
- the two relays for the low beam lights;
- connecting the relays on the same line that runs from the low beam relay on the normal production vehicle (relay T01 is present on the fuse box and under-dashboard relay) towards the headlights.

**Note**  IVECO Customer Service must disable the diagnosis of relay T01.

For the ground connection, the Bodybuilder can choose to use:
• terminal 17 of the 20-pin Bodybuilder connector, blue (61071A);
• the ground points available on the vehicle (see Chapter 5.4 - paragraph Ground points)

![Diagram of connector with labels]

1. 12-pin connector, black (72075B)
2. 20-way bodybuilder connector, blue (61071A)

**Flashing of low/high beam headlights**

When the Alarm function is activated, the low beam lights or the high beam headlights can also flash at the same time. Bear in mind that, irrespective of the type of lights chosen, the flashing is interrupted if the low beam lights are activated via the steering column switch unit.

A flashing period can also be configured:

• the standard is equal to 1 second;
• the minimum, corresponding to maximum frequency, is 0.5 seconds.

**Note** If the additional lights 1 and/or additional lights 2 (see paragraph "3. Additional lights" (◂ Page 23)) and the Alarm function are configured as present and if for each of these functions there has been a request for the flashing of the low beam lights, the system takes the flashing time as the shortest period or the maximum frequency.

**Note** The flashing period may only be modified by IVECO Customer Service.
Speed limit
The speed limit for the Alarm function is set at 30 km/h as standard, but it can be changed. Keep in mind that the limit cannot be increased beyond the level set by the main Speed Limiter.

Note If the additional lights 1 and/or additional lights 2 (see paragraph "3. Additional lights" (➠ Page 23)) and/or the Alarm function and/or the scene lights are configured as present, and if for each of them there has been a request for a speed limit, the system will always use the minimum limit.

Note The speed limit may only be modified by IVECO Customer Service.

3. Additional Lights
The Additional Light function offers the option of installing various additional lights managed directly by the Expansion Module control unit:

- Additional lights 1
- Additional lights 2
- Scene lights
- Rear lights

Connections
Figure 10 shows the connections to be made in order to use the additional light function. All the switches are high active.
The Bodybuilder must see to:

- the use of switches;
- the use of the scene light relay;
- the connection of the switches to the terminals of the 20-pin EM connector, black (61071B);
- the connection of the relays to the terminals of the 12-pin EM connector, black (72075B);
- installing the lights.

If low beam flashing is required, the Bodybuilder must see to:

- the two relays for the low beam lights;
- connecting the relays on the same line that runs from the low beam relay on the normal production vehicle (relay T01 is present on the fuse box and under-dashboard relay) towards the headlights.

Note IVECO Customer Service must disable the diagnosis of relay T01.

For the ground connection, the Bodybuilder can choose to use:

- terminal 17 of the 20-pin Bodybuilder connector, blue (61071A);
- the ground points available on the vehicle (see Chapter 5.4 - paragraph Ground points).
1. 20-pin connector, black (61071B)
2. 12-pin connector, black (72075B)

a. Right brake light - 21 W  
b. Right turn indicator - 21 W  
c. Left brake light - 21 W  
d. Left turn indicator - 21 W  
e. Additional lights 2 - 21 W  
f. Additional lights 1 - 21 W  
g. Scene light switch  
h. Additional light switch 1  
i. Additional light switch 2  
j. Right low beam relay  
k. Left low beam relay  
l. Side lights - 10 W  
m. Scene lights relay
a) Additional lights 1

For example, the additional lights 1 can be the blue ambulance and Police lights.
The maximum power consumption is 3 A, and the maximum power is 36 W.
Different functions can be associated with these lights, all configurable upon request of the bodybuilder:

- flashing of additional lights 1
- flashing of low beam lights
- speed limit when additional lights 1 are ON
- speed limit when additional lights 1 are OFF

**flashing of additional lights 1**

A flashing period can be configured taking the following into account:

- flashing is disabled by default;
- the minimum period, corresponding to maximum frequency, is 0.5 seconds.

**Note**  The flashing period may only be modified by IVECO Customer Service.

**Flashing of low/high beam headlights**

When the additional lights 1 are activated, the low beam lights or the high beam headlights may also flash at the same time.
Bear in mind that, irrespective of the type of lights chosen, the flashing is interrupted if the low beam lights are activated via the steering column switch unit.

A flashing period can also be configured taking the following into account:

- flashing is disabled by default;
- the minimum period, corresponding to maximum frequency, is 0.5 seconds.

**Note**  If the additional lights 1 and/or the additional lights 2 and the Alarm function are configured as present and if for each of these functions there has been a request for the flashing of the low beam lights, the system takes the flashing time as the shortest period or the maximum frequency.

**Note**  The flashing period may only be modified by IVECO Customer Service.

**Speed limit**

It is possible to configure a speed limit when the additional lights 1 are ON and/or when they are OFF.
This option is disabled by default.

**Note**  If the additional lights 1 and/or additional lights 2 and/or the Alarm function and/or the scene lights are configured as present, and if for each of them there has been a request for a speed limit, the system will always use the minimum limit.

**Note**  The speed limits may only be modified by IVECO Customer Service.
b) Additional lights 2

For example, additional lights 2 may take the form of blue ambulance and Police lights.
The maximum power consumption is 1.5 A, and the maximum power is 21 W.
Different functions can be associated with these lights, all configurable upon request of the bodybuilder:

- Flashing of additional lights 2;
- flashing of low beam lights;
- speed limit when additional lights 2 are ON;
- speed limit when additional lights 2 are OFF.

Note Additional lights 2 are incompatible with the use of PTO2.

Flashing of additional lights 2
See what is described for additional lights 1.

Flashing of low/high beam headlights
See what is described for additional lights 1.

Speed limit
See what is described for additional lights 1.

c) Scene lights

The maximum absorption is 1 A.

Speed limit
It is possible to configure a speed limit when the scene lights are ON and/or when the lights are OFF.
This option is disabled by default.

Note If the additional lights 1 and/or additional lights 2 and/or the Alarm function and/or the scene lights are configured as present, and if for each of them there has been a request for a speed limit, the system will always use the minimum limit.

Note The speed limit may only be modified by IVECO Customer Service.

d) Rear lights

They consist of:

- right and left turn lights;
- right and left brake lights;
- Side lights.

As indicated in Figure 10 of paragraph "Safety/Alarm Functionality - Connections" (Page 21), rear lights can be installed providing that the maximum power of a single light is equal to 21 W for the “turn” and “brake” lights and 5 W for the “side” lights.
The maximum absorption is 7 A.
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 ± 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 107/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 107/ECE or the Standard for the country where the vehicle will be sold.

Driver’s seat characteristics

a) Heating

There must be a sufficient number of hot air vents to demist the windscreen.

b) 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.

c) 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.

d) Ergonomics of the driver’s seat

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 (R118.01)

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.

Seat securing floor frame
Example: Fixed seat installation diagram (see Drawing 5801805133)
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.

**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 SOUNDPROOFING

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>
<thead>
<tr>
<th>Vehicle</th>
<th>Without air conditioning at maximum power</th>
<th>With air conditioning at maximum power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-urban</td>
<td>72 dBA</td>
<td>74 dBA</td>
</tr>
<tr>
<td>Urban or suburban</td>
<td>74 dBA</td>
<td>76 dBA</td>
</tr>
</tbody>
</table>

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.
A.5 HEATED INSULATION AND CLIMATE CONTROL

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.

High temperatures

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.

Second air conditioner compressor

If the intervention requires the removal of the engine drive belt organs (e.g.: installation of an additional compressor), the belt must be refit following the instructions in the Repair manual (version no. 603.95.723) shown in Fig. 5. This manual highlights the need to only use the specific tool 99360191 which can be obtained from IVECO Parts.
**Removal**
Cut elastic belt (4), as it cannot be reused.

**Refitting**
On the pulley (1) apply the specific chock 99360186 (2) with the elastic belt (4), placing the latter on the roller (3) and pulley (5) paying attention to place the ribs of the belt in the corresponding pulley grooves (1, 5).

Rotate the crankshaft in an anti-clockwise direction (→) until the belt (4) fits correctly on the pulley (1).

---

**A.6 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.

![Figure 6](image)

**Table A.2**

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Fuse capacity</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150A</td>
<td>Power supply CBA 2</td>
</tr>
<tr>
<td>2</td>
<td>200A</td>
<td>Power supply SCM and Body builders</td>
</tr>
<tr>
<td>3</td>
<td>500A</td>
<td>Starter and Retarder</td>
</tr>
<tr>
<td>4</td>
<td>80A</td>
<td>Body Computer power supply</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Battery master switch</td>
</tr>
</tbody>
</table>

To restore the original vehicle conditions, restart the vehicle.
A.7 BODYBUILDER CONNECTORS

Note  For information relating to the 20 pin connector (61071A), refer to Section 5 - Chapter "Connector 61071A, blue, 20-pin".

12 pin connector (72075A) for People Carrier

Table A.3

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>500314814</td>
<td>12 way male connector</td>
</tr>
<tr>
<td>500314820</td>
<td>Male contact for cable from 0.3 to 0.5 mm²</td>
</tr>
<tr>
<td>500314821</td>
<td>Male contact for cable from 1 to 1.5 mm²</td>
</tr>
</tbody>
</table>

Table A.4 - Basic functions of the 12-pin connector 72075A

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Cable code</th>
<th>Signal</th>
<th>Connected to</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emergency lights signal</td>
<td>1114</td>
<td>Output 500 mA</td>
<td>BCM H/08</td>
<td>Hazard light request +12V (flashing) = Hazard lights</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = emergency lights not requested</td>
</tr>
<tr>
<td>2</td>
<td>Programmable speed limiter;</td>
<td>9968</td>
<td>Input 10 mA</td>
<td>EDC K/22</td>
<td>Activation of programmable speed limiter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = programmable speed limiter activated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open wire = no action</td>
</tr>
<tr>
<td>3</td>
<td>Outswinging door control</td>
<td>0003</td>
<td>Output 10 mA</td>
<td>Door control device A/03</td>
<td>Only present with OPT outswinging door</td>
</tr>
<tr>
<td></td>
<td>status</td>
<td></td>
<td>(interfacing with decoupling diode)</td>
<td></td>
<td>Ground = outswinging door open</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = outswinging door closed</td>
</tr>
<tr>
<td>4</td>
<td>Speed signal (B7)</td>
<td>5517</td>
<td></td>
<td>BCM D/56</td>
<td>Mandatory to introduce 5 kΩ pull-up (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Use signal K15 of 61071A/pin 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pulse signal, see B7 tachograph signal description</td>
</tr>
<tr>
<td>5</td>
<td>Deterrence LED/lights</td>
<td>8879</td>
<td>Input 500 mA</td>
<td>BCM H/23</td>
<td>Indicates CDL functions (2)</td>
</tr>
<tr>
<td>6</td>
<td>Signal of PTO 1 in operation</td>
<td>6993</td>
<td>Input 10 mA</td>
<td>EM X3/08</td>
<td>PTO 1 feedback</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = PTO 1 engaged</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open circuit = PTO 1 not engaged</td>
</tr>
<tr>
<td>7</td>
<td>Horn</td>
<td>1116</td>
<td>Output 10 mA</td>
<td>BCM D/51</td>
<td>Remote activation of horn</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground = horn active</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open wire = no action</td>
</tr>
</tbody>
</table>
A.8 ROAD TESTS

a) The following checks must be performed prior to beginning functional testing:

- tyre pressure;
- brake oil, power steering oil, engine cooling water levels;
- efficiency of the parking brake;
- operation of the doors, emergency buttons, windscreen wipers, windscreen washers, horn, external lights, engine shutdown from the interior compartment;
- alignment of the body with respect to the frame, suspension heights, lack of interference with steering components;
- operation and visibility of the warning lights and buzzers.

b) The following must be checked during a 50 km drive over various roads (level ground, curves, uphill, downhill and uneven surface):

- the various chassis and body assemblies do not generate vibration or abnormal noise;

(1) Refer to Section 5 - Chapter "Connector 72075A, black, 12-pin"

(2) The signal indicates that the central locking system has blocked the doors. It allows the Bodybuilder to add an additional deterrence warning light. The functionality is the same as the vehicle deterrence indication.

- Indication with at least one door open
  For 3 seconds: Flashing signal (3 Hz, duty-cycle at 30%)
  After 3 seconds: Signal off
- Indication with all the doors closed
  For 3 seconds: Continuous signal active
  After 3 seconds: Flashing signal (1 Hz, duty-cycle at 5%)

(3) Refer to Section 5 - Chapter "Connector 72075A, black, 12-pin"
● no fault or hazard messages appear on the instrument panel;
● the response times of the retarder (if installed) are brief and the effect is always progressive;
● The speed limiter does not cause any jolting;
● actuating the "battery OFF" button stops the engine, activates the alarm and deactivates the battery;
● the heating and climate control unit work efficiently;
● the internal and external acoustic levels comply with standards;
● the dashboard and driver’s seat (if different than the original ones) do not limit the movements of the gearshift lever;
● position, longitudinal sliding and backrest adjustment of the driver’s seat are effective;
● the steering wheel (if different than the original type) does not obstacle the visibility of the instrument panel.

c) Proceed as follows when the road test is complete:

● make sure there are no infiltrations during and after being present below jets of pressurised water (rain test);
● identify any fluid leaks (water, oil, diesel oil, brake fluid, power steering fluid and clutch fluid);
● retighten the wheel nuts to 290 - 350 Nm.
APPENDIX B

CNG -
NATURAL POWER
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**CNG - NATURAL POWER**

**B.1 GENERAL INFORMATION**

**Note** The instructions of this Appendix do not exclude the need to also refer to those of the "Use and Maintenance handbook" and the "Services Manual".

Additional information can be requested from IVECO Customer Service.

Natural gas is a mixture of methane (main component), ethane, propane, carbon dioxide and nitrogen. In order to use this as fuel in motor vehicles, this mixture is compressed in specific cylinders, which is why it is called CNG (Compressed Natural Gas).

In the DAILY range, the CNG (or Natural Power) versions are distinguished by the specific aspects of the engine and control electronics, by the presence of cylinders and the relative pipes as well as by an optional reserve/emergency petrol tank. Therefore, the greater technical complexity must be taken into consideration both in the study of the transformation as well as in 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 (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 that:

a) use components other than the original ones (even if approved as an independent technical unit)

b) modify the original architecture (movement or addition of cylinders, fastening types, etc.),

require **re-approval** of the vehicle.

In this case, the designated Authority may require the complete documentation (calculations, diagrams, test reports) that can certify 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 MAIN SAFETY STANDARDS**

**During refuelling operations**

- Do not smoke or generate naked flames.
- Keep the vehicle blocked, switch the engine off and remove the ignition key from the ignition.
- Wear protective gloves, to avoid any symptoms of freezing due to the small spillage of gas during rapid decompression (from 200 bar to atmospheric pressure).
- Keep suitable fire extinguishers to hand; appropriate for fire class C.
In the event of gas leaks

⚠️ A gas leak can lead to an EXPLOSION; therefore the origin must be found as quickly as possible.

- Close the shut-off valves on the cylinders.
- Disconnect the electrical circuit master power switch of the vehicle.
- Prevent access to the surrounding area and ensure that non-authorised persons move away.
- Immediately notify the competent authorities and request urgent action.

In the event of a fire

- Do not put out the emerging flame; cool down the burning object if necessary
  **BURNING GAS LEAK = CONTROLLED GAS**
- Close the gas cylinder cocks and the cocks on the filling risers and tanks.
- Disconnect the electrical circuit master power switch of the vehicle.
- Do not attempt to extinguish the flame and focus on cooling the object involved.
- If the flame continues, use extinguishers and immediately inform the local FIRE SERVICE.

B.3 GENERAL SPECIFICATIONS

**Note** If extending or shortening the wheelbase length from a type-approved length to a type-approved length, authorization from IVECO is not necessary if the gas system remains unchanged in terms of layout and position on the chassis; However, authorization is necessary if one of the possible type-approved configurations is used for the lay-out.

- Before doing any work close the cylinder solenoid valve cocks, start the engine and wait for it to stop as a result of the complete use of the previous gas in the pipes. In the case of vehicles with a dual fuel supply, it is necessary to start the engine and wait for the petrol “Recovery Mode” phase to activate.
- Take care that the parts are kept as clean as possible, making sure that when handling or assembling no dirt of foreign bodies can enter the parts.
- The assembly direction must be respected for all electrical connections.

**Note** All threaded connections must be tightened to the correct torque for special components for the first equipment: the values can be found in the Service Manual.

**Note** Washers, conical washers, self-locking nuts and gaskets are of the special type and contribute to the tightening efficiency via a deformation. Before reassembly, these parts must be replaced and systematically restored where they were originally and according to the original sequence.

⚠️ If the fuel system components are inefficient, they must always be replaced.
Shut-off and safety valves

Each cylinder is fitted with a valve assembly consisting of the following devices:

- manual closure for maintenance and shut-off;
- one-way solenoid valve controlled by the ignition key, to interrupt the flow into the cylinder: so the load must be carried out with non-powered valves.
- the flow limiter which intervenes in the event of a sudden change in pressure, limiting the outward flow of gas from the cylinders (for example, if a pipe breaks);
- the fuse plate which, in the event of fire, melts at 110 ± 10°C and allows the gas to escape directly outwards, preventing an explosion of the cylinder.

**Note** The valves are not interchangeable.

▶ After any work on the high pressure part of the system, the HYDRAULIC TIGHTNESS TEST (at 300 bar) must be performed by the IVECO Customer Service. If the system passes, a Test Certificate is issued.

---

Gas pipes

▶ For reasons of safety, both when outfitting and during maintenance, it is prohibited to use the gas pipes as support for other pipes.

In some situations of limited space, there is provision for fastening some electric cables to the CNG pipes (with straps) as long as these straps only serve as a guide and not as a support.

During the operations, it is necessary to ensure that the pipes do not get damaged and remain free of scratches, cuts or buckling. If needed, provide adequate protection.

**Note** In the gas pipe passage through a side member of the chassis, ensure that the rubber bulkhead fits perfectly and is coaxial to the hole on the chassis itself.

---

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.
B.4 EMPTYING THE GAS CIRCUIT

Before performing any extensive welding work on the vehicle or performing engine maintenance, the gas system must be ventilated (emptied). The emptying operations must be performed with the engine off, outside and at least 5 metres away from any potential flame sources.

It is usually sufficient to partially empty the circuit, namely, empty only the pipes; however, to operate in conditions of greater safety, it is recommended that the entire system is emptied, including the cylinders.

1. Pressure reducer
2. High gas pressure pipes
3. Cylinder
4. Solenoid valve
5. Cock (ON = open, off = closed)

a) Partial emptying

This operation only guarantees ventilation of the system downstream of the gas cylinders.

- Prepare a rubber hose compatible with the gas and of a suitable diameter for coupling with the rigid pipe (2) in Fig. 1.
- Leave one end of the rubber hose at least 5 m from the cylinders and from any possible sources of flame; Position the other end close to the pressure reducer.
- Shut off power to the vehicle's electrical system at the master power switch (if present).
- Disconnect the battery cables and electrically ground the vehicle.
- Check that the cocks of the solenoid valves on all the cylinders are closed.
- Loosen the fastening between the pipe (2) and the pressure reducer (1). Act slowly to prevent sudden decompression of gas and the effects correlated to it (freezing).
- Remove the pipe (2) and insert it quickly into the previously arranged rubber pipe.
- After a few minutes, check that the pressure in the system is null.
b) Emptying fully

After partially emptying the circuit, emptying fully involves ventilating the cylinders by extracting the mobile equipment of each shut-off valve as described below.

Before performing this operation:

- Perform the partial emptying operations described in the previous paragraph.
- Check that all the cocks of the solenoid valves (4, Figure 1) on the cylinders are closed.

![Figure 2](image)

- Disconnect the electrical connection from the coil.
- Unscrew the external nut of the coil (1) with the corresponding O-Ring (2).

![Figure 3](image)

- Using a screwdriver (1), immobilise the threaded pin (4). Using a wrench (2), remove the nut (3) to secure the coil (5).
- Remove the coil (5) from the shaft (6).
- Extract the circlip (4).

- **There is a small amount of highly pressurised gas in the valve. In order to lower the pressure slowly, unscrew the ring nut (2) of the coil shaft (1).**

- If there is no pressure, fully remove the coil shaft (1) with the corresponding O-Ring.

- Remove the piston (3) with the shutter (4) and the spring (2) from the coil shaft (1).
- Screw the empty coil shaft back in with its O-Ring and tighten the ring nut.
- Repeat the previous operations for all the shut-off valves of the cylinders.
- Partially open the valves (4) on the cylinders (see Figure 1).

- **This allows the pressurised gas to enter the pipes which were previously emptied: take maximum care.**

After emptying, ensure that the engine cannot be started.
## B.5 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.

## B.6 CONNECTORS FOR BODYBUILDERS

**Note** For information about connectors for bodybuilders, refer to the descriptions in Section 5 - Chapter 5.2.

### Table B.3 - Basic functions of connector 61071 20-pole CNG version

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Signal</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engine start up</td>
<td>Input max 20 A</td>
<td>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 vehicle start-up phase, NO SAFETY CHECKS OF ANY KIND ARE EXPECTED. For example: Gear engaged, etc. Both for normal vehicles and for Start &amp; Stop vehicles +12V = starter motor Open wire = no action</td>
</tr>
<tr>
<td>2</td>
<td>Engine shut down</td>
<td>Input Max 10 mA</td>
<td>By providing a positive, the engine switches off +12V = engine off Open wire = no action</td>
</tr>
<tr>
<td>3</td>
<td>Service braking</td>
<td>Output Max 500 mA (interfacing with decoupling diode)</td>
<td>A positive is obtained when the brake pedal is activated +12V = service brake active Open circuit = service brake not active</td>
</tr>
<tr>
<td>4</td>
<td>Vehicle at standstill</td>
<td>Output Max 500 mA</td>
<td>Ground is obtained when the vehicle is stopped Ground = vehicle stopped Open circuit = vehicle in motion</td>
</tr>
<tr>
<td>5</td>
<td>Parking braking</td>
<td>Output Max 500 mA (interfacing with decoupling diode)</td>
<td>Ground is obtained when the parking brake is activated Ground = brake engaged Open circuit = brake disengaged</td>
</tr>
<tr>
<td>6</td>
<td>Battery positive</td>
<td>Output max 20 A</td>
<td>Positive protected by fuse on Body Computer - F34</td>
</tr>
<tr>
<td>7</td>
<td>External light activation</td>
<td>Output Max 500 mA</td>
<td>When the side lights are on, a positive is obtained +12V = lights on Open circuit = lights off</td>
</tr>
<tr>
<td>8</td>
<td>Engine running</td>
<td>Output Max 500 mA (interfacing with decoupling diode)</td>
<td>When the engine is running, a positive is obtained +12V = engine running Open circuit = engine off</td>
</tr>
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<td>9</td>
<td>Clutch actuation</td>
<td>Output Max 500 mA (interfacing with decoupling diode)</td>
<td>An open circuit is obtained when the clutch pedal is pressed +12V = clutch engaged Open circuit = clutch disengaged</td>
</tr>
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<td>10</td>
<td>Engaging reverse</td>
<td>Output max. 500 mA (interfacing with decoupling diode)</td>
<td>A positive is obtained when reverse gear is engaged +12V = reverse gear engaged Open circuit = reverse gear disengaged</td>
</tr>
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<td>11</td>
<td>Positive with key</td>
<td>Output max 5 A</td>
<td>Positive with key protected by fuse on Body Computer - F49</td>
</tr>
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</table>
### Pin Description | Signal | Remarks
---|---|---
12 | Cruise Control Command | Input Max 10 mA | Cruise Control negative analogue signal (in parallel with steering wheel switch) See specification 3 - Chapter 5.2
13 | Reference ground for Cruise Control command transfer box | Input Max 10 mA | See specification 3 - Chapter 5.2
14 | Not connected | |
15 | Not connected | |
16 | Not connected | |
17 | Ground | Output max 15 A | |
18 | Not connected | |
19 | Not connected | |
20 | Not connected | |

### B.7 ADDITIONAL ALTERNATOR

The alternator fit as first equipment has the L line connected directly to the Body Computer, which performs the excitation and diagnostics functions.

The additional alternator must have the L pin connected in order to ensure excitation with a current between 150 and 200 mA, with the diagnostics warning light and external excitation.

The additional alternator must have all the mechanical requirements needed for compatibility with the vehicle. Installation is the full responsibility of the bodybuilder.
APPENDIX C

Hi-MATIC
AUTOMATIC GEARBOX
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Hi-MATIC AUTOMATIC GEARBOX

C.1 GENERAL INFORMATION

This document addresses the main specifications correlated with the presence of the Hi-MATIC automatic gearbox on the vehicle as well as the indications that must be followed before outfitting commences.

See the Bodybuilders’ Manual on vehicles equipped with mechanical gearbox for other information.

C.2 LAYOUT

Some essential technical specifications (engine, propeller shaft, bonnet cable and dashboard cable, gearbox additional cooling system) and the need to subject the vehicle to new type-approval make it practically impossible to convert from a manual gearbox to an automatic gearbox, unless the “Power Pack” is replaced (engine / gearbox unit).
C.3 REQUIREMENTS

Gearbox release lever

The lever can be positioned in a different location than its original mounting position, as long as:

- it compulsorily remains inside the cab;
- is accessible from the drivers' seat;
- does not entail great variation of the connected Bowden cable route.

Bowden cable

In order to maintain efficiency (performance) of the release system, the length of the Bowden cable must remain the same despite any new anchoring points and new layout.

Furthermore the Bowden cable must never be bent to an angle below 150°.

Note: The warranty shall be voided if using different cable lengths or types.
Propeller shaft

The automatic gearbox requires a specific propeller shaft for:

- length;
- gearbox connection flange (a);
- flexible coupling in rubber (b);
- centring element (c).

Any modifications which involve changes in one or more of these characteristics (e.g. wheelbase modification) are the full responsibility of the person who makes these modifications.

Additional devices

On the Hi-MATIC automatic gearbox, it is not possible to fit any type of power take-off (PTO).

Vehicles with automatic gearbox and opt. "Electromagnetic retarder on transmission" have a specific gearbox, equipped with torsional vibration pendulum-type centrifugal damper (DAT).

The adoption of this type of retarder post-sales (only for version deliberated by IVECO), involves replacing the standard automatic gearbox with one equipped with DAT and the installation of the following parts in addition to the retarder and relative parts (not doing so will invalidate the warranty):

- Spacer ring between the engine and the gearbox
- Screws securing the gearbox to the engine and screws securing the specific starter motor gearbox with DAT
- Specific gearbox cross member for gearbox with DAT
- Specific gearbox bracket and suspension block for gearbox with DAT

Note  Once installation has been completed, installation of the retarder post-sales and the new automatic gearbox (with DAT) involves IVECO Customer Service being contacted to update the engine control unit software via teleservice.
Supplementary structures

A specific crossbar is mounted to support the transmission from the rear (following Figure); despite this fact, in comparison to manual transmission vehicles, the comparability with structures installed behind the cab (e.g. crane) remains the same. Careful verification is advised before proceeding.

Cooling

Given that the original positions of the cooling assemblies/parts yield the best operating performance and thus efficiency, changes are strictly forbidden and any variations not recommended.

a) Transmission oil radiator and pipes

As the oil characteristics for automatic transmissions must carefully be kept intact, it is necessary to:

- maintain the oil level according to the requirements provided in the technical documents supplied with the vehicle;
- preserve the original connections of the pipes to the radiator and gearbox, in order to prevent extractions and possibility of oil pollution.
Slight displacements are allowed without any advance authorisation by IVECO only for needs of access during outfitting installation, making sure that no pipes are disconnected.

Consistent displacements, definitive and/or with any outstanding characteristics, must always be submitted to IVECO Engineering for approval, which will provide correct instructions for the new layout.

b) Fan

The fan intake air flow must not be altered or decreased in comparison to the original situation. Likewise, also the position of the fan on the radiator must remain the same.

C.4 WARNING INDICATORS

Gear oil temperature

The Hi-MATIC gearbox temperature is monitored by sensors on a mechatronics module. The resulting signals are processed by the module in order to protect the transmission.

In detail:

- if $T \geq 120 \, ^\circ\text{C}$ a warning indication is displayed on the dashboard in the cab in the form of a red indicator light that switches ON, making it necessary to stop the vehicle due to transmission oil overtemperature;
- if $T \geq 125 \, ^\circ\text{C}$ the automatic transmission ECU forces the engine EDC to reduce torque/power (derating). Furthermore, the function that controls derating “GET_M_MOTMAX” forces vehicle operation only in 6th gear;
- if $T \geq 142 \, ^\circ\text{C}$ and the vehicle is still in motion, the automatic transmission ECU “shuts down” the engine and, thus, stops the vehicle.

Reverse gear engagement signal

The electrical system in vehicles with an automatic transmission that were produced up to and including the first half of 2015 have been subjected to changes in successive stages. Therefore, if the signal corresponding to the engagement of reverse gear is not available on pin 10 of connector 61071A (see Section 5, Table 5.2), the following alternative is possible:

- take a signal from the 2-pin connector located on the right rear side of the under-run bar (reversing light)
- Proceed as follows:
  
  **Note** Use a protection diode, max. current absorption. 100 mA

  - disconnect the 60-pin connector from the Body Computer
  - disconnect the 60-pin connector from the Body Computer
  - remove approx. 100 mm of cable protection
  - connect a 0.75 mm² cable to the cable connected to pin LF04 (do not remove the pin from the connector) and insulate the connection properly (see Figure 7)
  - restore the cable protection
  - extract the cable terminal from slot 10 of the 20-pin bodybuilder connector (61071A) and protect it with isolating tape
  - put the 0.75 mm² cable into the available slot (use the female terminal number 500314824) (see Figure 7)
  - the 0.75 mm² cable must be protected with 4.5 mm² corrugated tube and carefully routed in the dashboard from the Body Computer to the Bodybuilders connector
  - connect the 60-pin connector to the Body Computer
1. Body Computer - Connector F - Terminal LF04

2. 20-way bodybuilder connector - 61071A - Terminal 10