

# DAILY VEHICLE 4x4 RANGE BODYBUILDER INSTRUCTIONS



L I G H T   R A N G E

## IVECO

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# DAILY 4x4

Bodybuilders instructions  
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## UPDATE DATA

Section	Description	Page	Revision date





Update data

## Foreword

This publication provides the data, features and instructions for vehicle fitting and modifications.

It is intended for qualified, skill personnel. The body builder is responsible for designing the fitting, its modification and execution, and will have to ensure compliance with the provisions both of this publication and the law regulations in force.

Prior to carrying out any work, make sure you have the publication of the vehicle model on which you are about to work. Also make sure that all the accident-prevention equipment such as, for instance, goggles, helmet, gloves, boots, etc. as well as the working, lifting and handling equipment are available and in good working order. Finally, make sure that you operate on the vehicle in such conditions as to ensure maximum safety.

The execution of the work by strictly complying with the above provisions, as well as the use of the components shown, ensure that the work is carried out correctly and safely.

Any change, modification or fitting not covered by this manual and not expressly authorized in written by IVECO will relieve the latter of any responsibility and make, in particular, the vehicle guarantee null and void.

IVECO is available to provide all and every explanation required to carry out the work and also help you handle the cases not dealt with in this publication.

After every single intervention, the functioning, efficiency and safety conditions established by IVECO shall be restored. Contact the IVECO service network for vehicle set-up, if necessary.

IVECO shall not be responsible for any change, modification or fitting concerning the vehicle.

The data and information contained in this publication may not be updated due to the changes made by IVECO, at any time, for technical or commercial reasons, or to make the vehicles comply with the law regulations in force in the different countries.

In case of disagreement between the provisions included herein and the actual vehicle make-up, contact IVECO prior to carrying out any work.

## Symbols - Warnings



### Danger for persons

Missing or incomplete observance of these prescriptions can cause serious danger for persons' safety.



### Danger of serious damage for the vehicle

Partial or complete non observance of these prescriptions can cause serious damages to the vehicle and sometimes guarantee lapse too.



### General danger

It includes the dangers of above described signals.



### Environment protection

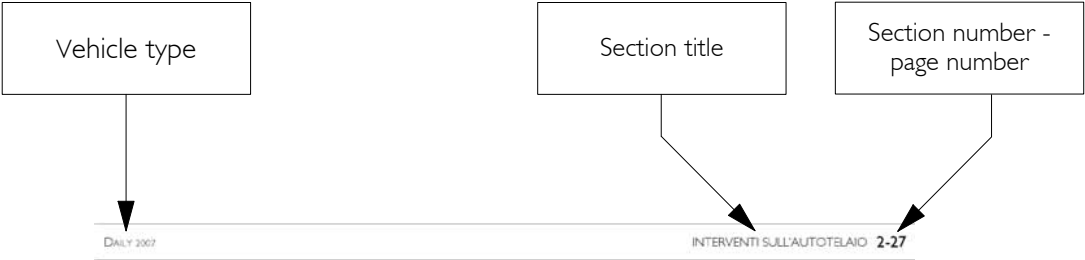
It indicates correct behaviour in order that vehicle use is environmentally friendly as much as possible.

**NOTE** It indicates an additional explanation for a piece of information.



Foreword

Page header and footer interpretation



2.7 Applicazione di un asse supplementare

Non è prevista l'applicazione di assi supplementari sul veicolo.

2.8 Modifiche alla trasmissione

L'intervento sulla trasmissione, a seguito della modifica del passo, dovrà essere fatto utilizzando, in linea di massima lo schema della trasmissione di un analogo veicolo avente all'incirca lo stesso passo. Dovranno essere rispettati i valori massimi delle inclinazioni degli alberi di trasmissione previsti sui veicoli di serie; ciò vale anche per i casi di interventi sulle sospensioni e sull' asse posteriore motore.

Nei casi di difficoltà, potrà essere interpellata IVECO, trasmettendo uno schema con riportate lunghezza ed inclinazione della nuova trasmissione proposta.

Le indicazioni tecniche riportate sulla manualistica dei Costruttori delle trasmissioni, potranno essere utilizzate per la corretta realizzazione e disposizione dei tronchi.

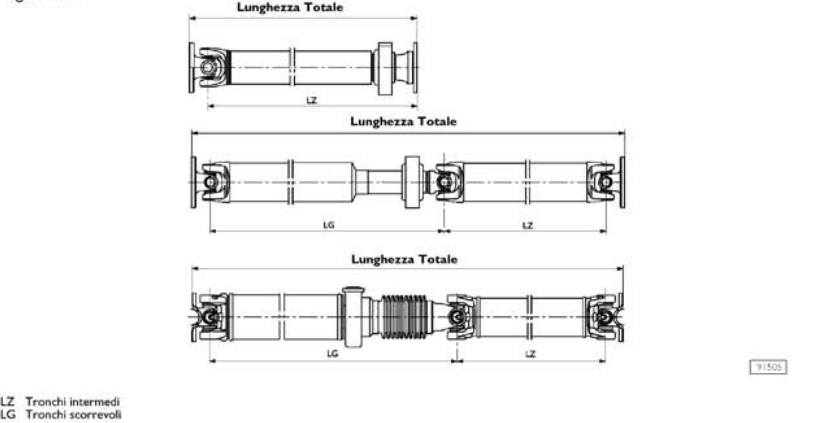
Le indicazioni qui contenute hanno lo scopo di salvaguardare il corretto funzionamento della trasmissione, limitarne la rumorosità ed evitare l'innescio di sollecitazioni trasmesse dal gruppo motopropulsore; ciò non esenta tuttavia l'allestitore dalla responsabilità dei lavori eseguiti.

2.8.1 Lunghezze ammesse

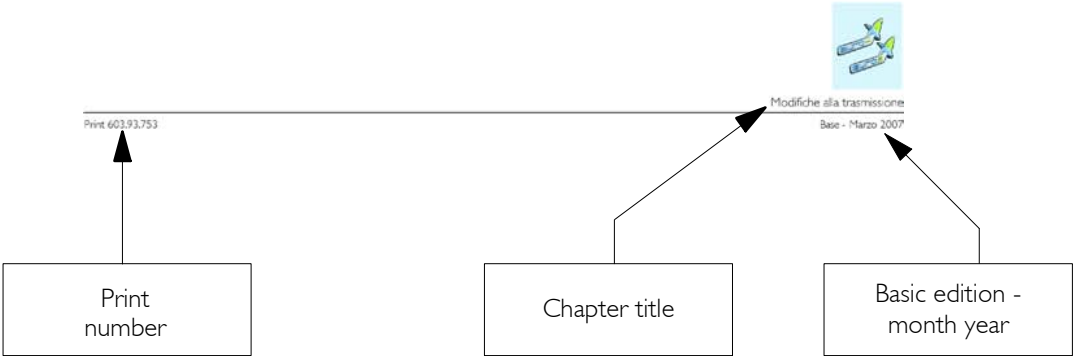
Le massime lunghezze di esercizio realizzabili, sia per i tronchi intermedi che scorrevoli "LG" o "LZ" (ved. Figura 2.11), possono essere determinate in base al diametro esterno del tubo esistente sul veicolo e dal numero dei giri massimo di esercizio (vedere formula) e sono riportate nella Tabella 2.15.

Qualora la lunghezza dell'albero indicato in Tabella 2.15, in funzione del diametro del tubo non risulti sufficiente, si dovrà prevedere l'inserimento di un nuovo tronco con le stesse caratteristiche di quelli esistenti. In alternativa in alcuni casi potrà essere utilizzato un albero di trasmissione avente un diametro del tubo di maggiori dimensioni; la dimensione occorrente del tubo potrà essere determinata in base alla lunghezza necessaria ed al numero di giri massimo di esercizio, direttamente dalla Tabella 2.15.

Figura 2.11



LZ Tronchi intermedi  
LG Tronchi scorrevoli



# INDEX OF SECTION

	Section
General specifications	<b>I</b>
Chassis modifications	<b>2</b>
Fitting superstructures	<b>3</b>
Power Take-offs	<b>4</b>
Specific information and instructions	<b>5</b>







## SECTION I

**General specifications**

	Page
I.1 Aim of bodybuilders instructions	I-3
I.2 IVECO approval for changes and fittings	I-3
I.3 Liabilities	I-4
I.4 Guarantees	I-4
I.5 Request for approval	I-4
I.6 IVECO technical documents available by means of computer	I-5
I.7 Trademarks and Logos	I-5
I.8 Legal Provisions	I-5
I.9 Prevention of accidents	I-6
I.10 Choice of material to use: Ecology - Recycling	I-6
I.11 Vehicle delivery	I-7
I.12 Vehicles identification	I-8
I.13 Dimensions and masses	I-9
I.13.1 General Specifications	I-9
I.13.2 Determining the Centre of Gravity of the Body and Payload	I-10
I.13.3 Observing the Permitted Weights	I-13
I.14 Instructions for the Correct Functioning of the Parts of the Vehicle and Accessibility for Maintenance	I-14
I.15 Quality System management	I-15
I.16 Vehicle maintenance	I-15
I.17 Conventions	I-16





## **I.1 Aim of bodybuilders instructions**

The purpose of this publication is to provide data, specifications and instructions for the bodybuilding and conversion of an original IVECO vehicle to ensure the functionality, safety and reliability of the vehicle and its components.

## **I.2 IVECO approval for changes and fittings**

Changes must be carried out in accordance with the requirements set out in the following guidelines.

The following may be carried out only with IVECO's approval after submitting a copy of the documentation required for technical evaluation of the proposed change (drawings, calculations, technical report etc.):

- wheelbase modifications, whereby the value of the newly obtained wheelbase does not fall within the minimum and maximum values available within the IVECO range for the same vehicle;
- work carried out on the braking system;
- work carried out on the suspension system;
- steering wheel modifications;
- changes to the stabiliser bars and suspensions;
- changes to the cab, cab supports, locking and tipping devices;
- changes to the engine intake and exhaust systems
- engine cooling system modifications;
- power unit and driving component modifications;
- work carried out on front and rear axles;
- fitting decelerator brakes;
- fitting power take-offs;
- changing the tyre dimensions;
- coupling device (hooks, fifth wheels) modifications;
- electric/electronic unit modifications.

The other modifications of fittings covered by the following standards and made in compliance with the same do not require specific approval from IVECO. Any modification or fitting not covered by these standards shall, on the contrary, be authorized by IVECO in advance.



### 1.3 Liabilities

The authorizations issued by IVECO concern solely the technical/conceptual feasibility of the modification and/or fitting to be made on a genuine IVECO vehicle.

The bodybuilder is responsible for the:

- project of the modification or fitting;
- choice and features of the products used;
- workmanship of the modification or fitting;
- compliance of the project and its implementation with all the instructions provided by IVECO;
- compliance of the project and its implementation with all the current regulations in the country where the vehicle is registered;
- the functionality, safety and reliability and in general the effective performance of the vehicle and also the effects that the changes and the conversion may have on vehicle performance and specifications.

### 1.4 Guarantees

The bodybuilder/chassis converter who has built the body or who has modified the chassis must guarantee that the work was undertaken in a professional manner in full compliance with the specifications contained in this manual. IVECO reserves the right to declare void its own warranties for the vehicles where:

- these specifications have not been adhered to or where unauthorised equipment was installed, or unauthorised modifications were carried out;
- an unsuitable frame has been used for the required conversion or application;
- the specifications, standards or instructions issued by the Manufacturer for the flawless execution of the operations have not been heeded;
- original spare parts or components which the Manufacturer has made available for specific interventions were not used;
- read and respect the safety standards and symbols applied before any operation;
- do not use the vehicle for applications other than those for which it is designed.



#### **Maintaining the functionality of vehicle components.**

**The effective operation of vehicle components, all component safety and running conditions, compliance with national and international regulations (e.g. EC Directives) and also accident prevention standards must naturally be guaranteed in all permitted conversions and applications.**

**All our vehicles are covered by a warranty as laid down in the specific documents.**

**The bodybuilder must arrange to carry out operations at least in an equivalent manner.**

### 1.5 Request for approval

The requests for approval or support to carry out work or make modifications or fittings shall be forwarded to the IVECO marketing offices in charge.

To obtain the approval, the body builder shall provide adequate documents that illustrate the anticipated implementation, utilization and conditions of use on the vehicle. The drawings shall highlight any item differing from the instructions contained in this manual. The body builder shall submit the modification and/or fitting to the competent authorities for approval.



## **I.6 IVECO technical documents available by means of computer**

The following technical documents are available on the Internet at [www.thbiveco.com](http://www.thbiveco.com):

- directives for transformation and equipping of vehicles;
- technical cards;
- chassis cab diagrams;
- chassis diagrams;
- other specifications concerning the vehicle range.

The body builder shall submit the modification and/or fitting to the competent authorities for approval.

## **I.7 Trademarks and Logos**

Trademarks, nameplates and denominations must not be modified or displaced in relation to the original design. The appearance of the vehicle must not be changed or modified.

The application of trademarks tied to the transformation or trim levels must be authorised by IVECO. They must not be applied near to the IVECO tradenames or logos.

IVECO reserves the right to withdraw the tradenames and logos if the fitting or conversion fails to conform with requirements. The bodybuilder accepts all responsibility for the entire vehicle.

### **Instruction for added assemblies**

Where assemblies are added, the bodybuilder must provide the necessary service and maintenance instructions when the vehicle is delivered.

## **I.8 Legal Provisions**

On completing the vehicle, the bodybuilder/chassis converter must check the work (modifications, body + equipment etc.) to ensure that the legal provisions required in the country of registration are observed (e.g. weights, dimensions, braking, noise, emissions etc.). Information regarding these matters may be obtained from the competent Authorities or the IVECO Area Network. The vehicles manufactured at our plant (except some versions for Extra-European countries) comply with the EC directives. Converted vehicles must also comply with these directives. The only permissible exception is granted where local type approval differs from EC homologation.



## 1.9 Prevention of accidents

Do not allow unauthorised personnel to work on or operate the vehicle.  
It is forbidden to use the vehicle if its safety devices have been tampered with or damaged.



**The structures and devices fitted to the vehicles must comply with the current regulations concerning the prevention of accidents and safety regulations in force in the countries where the vehicle is to be used.**

All the precautions dictated by technical awareness must be adopted to prevent malfunction and functional defects.  
Compliance with these regulations will be the responsibility of the manufacturers of the structures and devices.



**Components such as seats, coverings, linings, protective panels etc. may represent a potential fire hazard if they are exposed to an intense heat source.**

**Arrange for their removal before working with welding equipment and flames.**

## 1.10 Choice of material to use: Ecology - Recycling

Increasingly greater attention should be paid, at the study and design stage, to the choice of materials to be used.  
This is especially the case as regards the aspects connected with ecology and recycling in the light of domestic and international regulations that are constantly being developed in the sector.

In this connection:

- everyone must be aware of the prohibitions on using harmful or potentially hazardous materials, such as ones containing asbestos, lead, halogen additives, fluorocarbons, cadmium, mercury, hexavalent chrome, etc.
- Use materials whose processing produces limited waste and that permit easy recycling after their first use.
- With composite synthetic materials, use components that are compatible with each other, envisaging also their possible utilization with the addition of other salvaged components. Affix the markings required in compliance with the current regulations.
- Batteries contain substances that are very hazardous to the environment. When replacing batteries, we advise contacting the service network, which is suitably equipped for battery disposal in compliance with environmental policies and laws.



**In order to comply with EC directive 2000/53 (ELVs), IVECO S.p.A. prohibits fitting parts containing lead, mercury, cadmium and hexavalent chrome to vehicles (except for the departures referred to in Attachment II of the above directive).**



Prevention of accidents

## 1.11 Vehicle delivery

Prior to delivering the vehicle, the body builder shall:

- verify that the work has been made correctly;
- perform vehicle and/or equipment set-up;
- check the operation and safety of the vehicle and/or equipment;
- prepare and deliver the necessary instructions for service and maintenance of the fitting and any additional units to the end customer;
- write the new data down on the special tags;
- confirm that the work carried out complies with the indications provided by the vehicle manufacturer and with the law regulations;
- carry out the checks included in the "IVECO Pre-Delivery inspection" list (available from the IVECO network) with regard to the items affected by the work done;
- provide a guarantee for the modifications made;
- in the event that the connections originally provided with screws have been mounted and restored, the same screws shall not be used. In such an instance, and in the event that nails have been replaced with screws, you must check again the closing of the connection after travelling approximately 500-1000 km.
- measure the battery voltage. Ensure there is a minimum charge of 12.5 V. If the voltage reading is between 12.1 and 12.49 V, recharge the battery (slow charge). If the voltage is less than 12.1 V, the battery must be scrapped and replaced with a new one;
- the batteries must be serviced at regular intervals until the vehicle is handed over to the customer to prevent problems of low charge, short-circuits or corrosion. IVECO reserves the right to terminate the battery warranty if the maintenance procedures required by the IVECO network are not observed.



Vehicle delivery

## I.12 Vehicles identification

The commercial designation of IVECO vehicles is not the same as the type approval (homologation) designation. Two types of commercial designation are shown below with the meaning of the codes used:

GVW (tx10)		Class	Engine rating (HP:10)		Version			Suspension	
3	5	S	I	8	W			-	-
5	5	S	I	8	W			-	-

<u>Class</u>	<u>Rear wheels</u>	<u>GVW (t)</u>	<u>Version</u>
S	single	3.5	- Truck D Crewcab 6+1

<u>Suspension</u>
- mechanic



Vehicles identification



## I.13 Dimensions and masses

### I.13.1 General Specifications

The dimensions and maximum permissible weight on the axles are indicated on the bodybuilder layout drawings, on technical specification sheets and, in greater details, on the official documentation issued by the Company. The kerb weights refer to vehicles with standard equipment. Special equipment may involve considerable modification to the weight and its distribution on the axles. On our vehicles, lights and rear-view mirrors are designed for widths of up to 2350 mm.

#### Weighing the Chassis

As a result of production factors there could be at a  $\pm 5\%$  variation in the published weights for models 35S and a  $\pm 3\%$  for models 55S.

It is therefore, advisable to weigh the vehicle in the chassis cab condition before fitting the body and equipment and establish the weight distribution on the axles.

#### Body conversions

The body building limits for each model are mainly defined by the following:

- weight distribution on the axles;
- width of the mirrors used;
- position of the rear under run-bar.

Greater values in compliance with the weights permitted on the axles may be authorized by IVECO after modifying such components as the chassis, under run-bar, mirrors, etc.

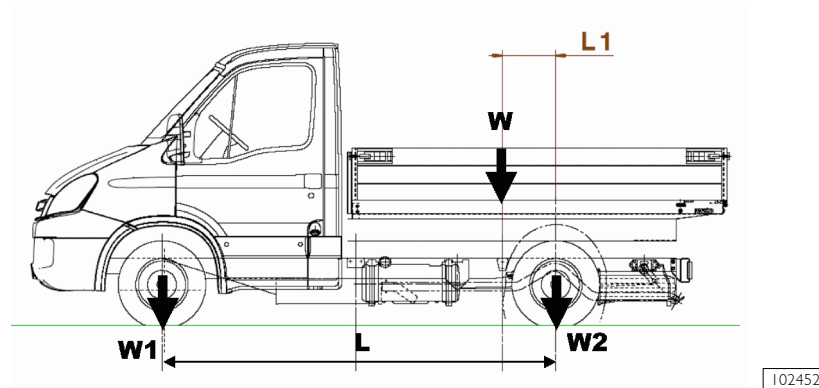


### 1.13.2 Determining the Centre of Gravity of the Body and Payload

#### Positioning on the longitudinal plane

To establish the location of the centre of gravity of the body and payload the following examples below may be used as guidelines. The technical documentation specific to each model (chassis cab drawing) give the positions permitted with the vehicle in its standard form. The masses and positioning of the single components of the vehicle are given in the chassis and weight distribution diagram.

Figure 1.1



$$L_1 = \frac{W_1 \cdot L}{W} \text{ respectively } L_1 = L - \frac{W_2 \cdot L}{W}$$

W = Body + payload (kg)

W1 = Body and payload acting on front axle (kg)

W2 = Body and payload acting on rear axle (kg)

L1 = Distance of the centre of gravity from the rear axle centre line (mm)

L = Wheelbase (mm)

#### Example of calculation of the load barycentre position

Consider a 40C13 vehicle with a wheelbase of 3450 mm with:

1. GWW= 4200 kg (permitted maximum: 1900 kg on the front and 3100 kg on the rear)
2. KERB WEIGHT = 1955 kg (1340 kg on the front axle, 615 kg on the rear)

The permitted maximum load (body + payload) will be  $W = 4200 - 1955 = 2245$  kg. Let us calculate the position of the center of gravity in which the maximum permitted on the front axle is achieved. Let us assume an uniform distributed load.

In this case, out of 2245 kg,  $W_1 = 1900 - 1340 = 560$  kg will affect the front axle, while the remaining  $W_2 = 2245 - 560 = 1685$  kg will affect the rear axle.

Thus, the following will be obtained:

1.  $W_1 = 560$  kg
  2.  $L = 3450$  mm
  3.  $W = 2245$  kg
- $$L_1 = W_1 \times L / W = 860 \text{ mm}$$

The center of gravity of the load (Body + payload) must not be more than 860 mm far from the rear axle; otherwise, the front axle would be overloaded.



In order to determine the payload on the axles, it must be uniformly distributed except when the shape of the loading surface itself entails a different distribution of the load.

Regarding any equipment, the actual position of the centre of gravity must be used.

When building bodies or containers, loading and unloading systems must be devised which preclude excessive variations in the distribution of the load and/or excessive loads on the axles. Relevant instructions should also be given to the operator.

Figure I.2

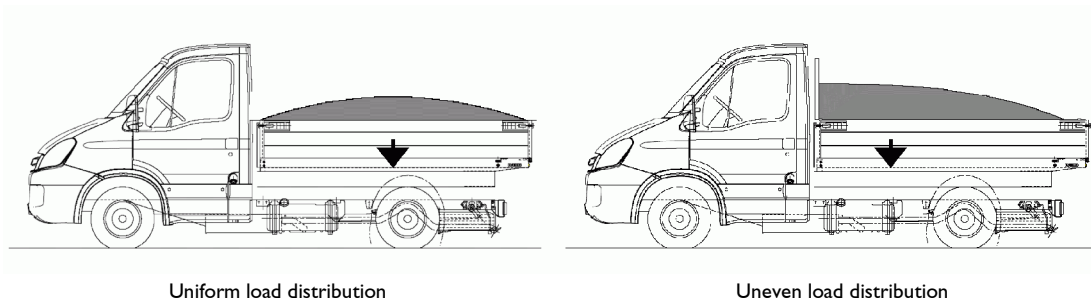
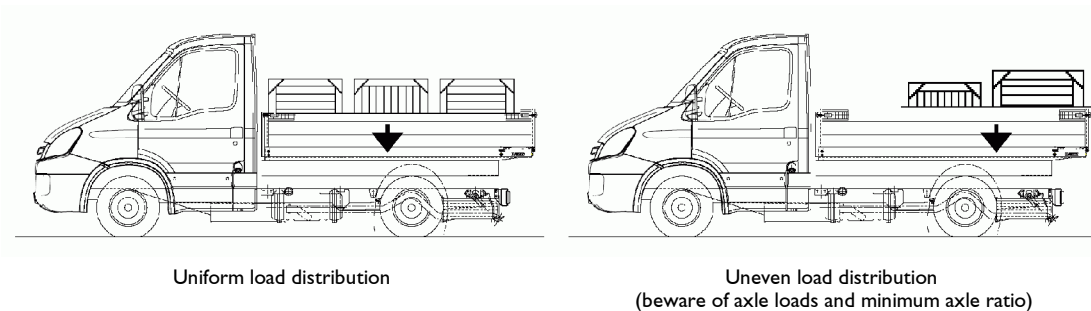


Figure I.3



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### Height of the centre of gravity

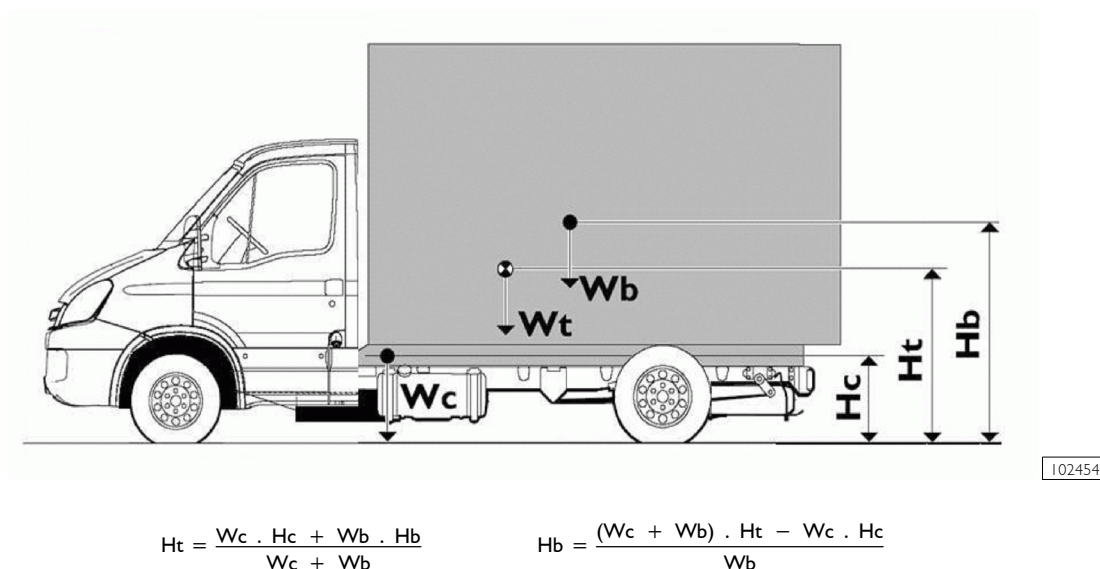
The height of the centre of gravity of the chassis cab is given in the technical documentation specific to each model (chassis drawing).

For testing the vehicle complete with superstructure, the bodybuilder must check that the height of the centre of gravity of the equipment including the payload, or of the entire vehicle when fully loaded, falls within the maximum permitted values.

These limits are defined in compliance with the national or international regulations (e.g. as amended by the current EC braking Directive) or requested by the Manufacturer to ensure good handling of the vehicle (e.g. transverse stability of the moving vehicle).

Figure I.4

Verification with full load:



$W_c$  = Chassis cab vehicle kerb weight

$H_c$  = Height of centre of gravity of chassis cab vehicle (laden condition)

$W_b$  = Body and payload

$H_b$  = Height of centre of gravity of body and payload in relation to ground

$W_t$  = Vehicle weight when fully loaded

$H_t$  = Height of centre of gravity of vehicle with full load

To check the vehicle with its body but no payload, use the above formula but for  $W_b$  use only the vehicle unladen weight (The position for  $H_v$  will depend on the load and deflection of the suspension).

The height of the centre of gravity indicated in Table 2.6 **represents values which are not to be exceeded for each given equipment level**. These values have been calculated only in terms of the transverse stability of the vehicle and are applicable to a mid wheelbase. Any other possible restrictive specification, e.g. braking regulation, should be taken into consideration.

The values given in Table 2.6 refer to the body with fixed payload. In versions where the payload tends to move sideways (e.g. suspended loads, fluid loads etc.) especially when turning, higher dynamic transverse forces is generated which makes the **vehicle less stable**. This must be taken into consideration when providing vehicle operating instructions or for possible reduction in the height of the centre of gravity.



## Using Stabiliser Bars

Supplementary stabilising or anti-roll bars, where available, spring reinforcements or the application of rubber components (in compliance with point 2.11) may increase the height of the centre of gravity of the payload which must be defined as each occasion arises. The modification must be carried out after careful consideration has been given to the specifications of the version, to the wheelbase and to the distribution of the cross-stresses acting on the suspension both at the front and at the rear of the vehicle. It must be borne in mind that it is often advisable to modify the rear axle only since a modified front axle would give the driver a false sense of stability making it more difficult to perceive the safety limits. Modification to the front axle may be made where the load is positioned behind the cab (e.g. crane) or where the superstructures are very rigid (e.g. van conversion).

### I.13.3 Observing the Permitted Weights

All the limits specified on the IVECO documents must be complied with. It is essential that **the maximum weight on the front axle is not exceeded**, under any load condition, so as to ensure the correct steering and braking characteristics regardless of the road surface conditions.

Particular attention must be taken with vehicles where the load is concentrated on the rear overhang (e.g. cranes, tail lifts, trailers) and to vehicles with short wheelbases and a very high centre of gravity.

Ensure transverse loads are properly distributed when positioning auxiliary components and superstructures. A +4% variation on the rated load (50% of load on the axle) is permissible for each wheel (for example: permissible load on axle 3000 kg; 1440 to 1560 kg allowed for each wheel side); in compliance with load allowed by tyres, without affecting braking properties and vehicle driving stability.

Apart from different specifications for specific vehicles, the following may be taken to be the minimum weights for the front axle: 30% of the total vehicle weight (with uniformly distributed loads and with loads concentrated on the rear overhang).

The rear overhang of the body must be built in strict observance of the permitted axle loads, the minimum load required on the front axle, the limitations in length, the positioning of any tow hook and of the rear under-run guard stipulated by the relevant National and EC regulations.

## Variations in the Permissible Weight

Special exceptions to the maximum permissible weights may be granted for particular applications for which, however, precise limitations regarding the use will be imposed in addition to possible vehicle reinforcements.

Such exemptions, if they exceed the limits imposed by law, must be authorised by the Government Administrative Authority.

The request for authorisation must include:

- vehicle type, wheelbase, identification number, designated use;
- unladen weight on the axles (e.g. vehicles equipped with crane) including positions for the centre of gravity of the payload;
- proposals concerning the reinforcement of the vehicle components where necessary.

The reduction in the permissible weight on the vehicle (derating) may involve changing various components such as suspension, brakes etc) and may require recalibration of the load sensing valve where one is fitted. In these circumstances necessary instructions may be provided.



Dimensions and masses

## **I.14 Instructions for the Correct Functioning of the Parts of the Vehicle and Accessibility for Maintenance**

As a rule, when modifying or installing any type of equipment, nothing must be altered which prevents the correct functioning of assemblies and parts of the vehicle under all operational conditions.

For example:

- Ready access to all parts requiring inspection or maintenance and periodic servicing must be provided. In the case of closed body types suitable opening doors must be provided.
- For tilting cabs, adequate space permitting tilting must be assured. In the case of structures which involve the space above the driver's cab, adequate space for the passage of intake air must be guaranteed.
- Service access to chassis/driveline components must be retained. For instance repairing the gearbox or clutch must be possible without necessitating the removal of major components of the added structure.
- The cooling system (radiator cowling, radiator, air passages, cooling circuit etc.), fuel supply (pump position, filters, pipe diameter, etc.) and the engine air intake must not be altered.
- The anti-noise panels must not be altered or moved in order to prevent changes in the approved noise levels of the vehicle. Should it be necessary to make openings (e.g. for the longitudinal runner of the body to pass through) these must be properly closed off using material with inflammability and soundproofing characteristics equivalent to those used originally.
- Adequate ventilation of the brakes and battery case (especially in the case of vans) must be guaranteed.
- When positioning the mudguards and wheel arches, the rear wheels must be free to rebound even when used with chains.
- When the vehicle has been set up, for safety reasons, headlight attitude must be checked and adjusted as necessary. Perform the adjustment according to the instructions provided in the use and maintenance manual.
- In the case of parts which are supplied loose (e.g. spare wheel, chocks) it will be the responsibility of the bodybuilder to position and secure them in an accessible and safe manner in compliance with possible national laws.



## **I.15 Quality System management**

For some time IVECO has been promoting Quality System development and training for bodybuilders.

This is a requirement due not only to compliance with domestic and international regulations on product liability, but also the growing demand for increasingly higher quality levels. The creation of new forms of organization in the various sectors and the quest for increasingly more advanced levels of efficiency.

IVECO believes it essential for bodybuilders to be equipped with an organization where the following are defined and available:

- Organization charts for functions and responsibilities.
- Quality system.
- Quality goals.
- Technical design documentation.
- Process and control phases with relevant resources.
- Product improvement plan, obtained also with corrective actions.
- After sales service.
- Staff training.
- Manufacturer liability documentation.

## **I.16 Vehicle maintenance**

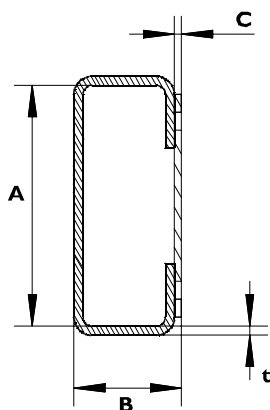
In addition to making the necessary checks on the outfit in keeping with customary working procedures, the bodybuilder shall perform the checks specified in the "IVECO pre-delivery inspection" list, which can be obtained from the IVECO network, for the aspects affected by the modifications performed.



## I.17 Conventions

In these bodybuilders instructions, the wheelbase is taken as the distance between the centreline of the first steering axle and the centreline of the first rear axle (driven or non-driven). This definition differs from the definition of wheelbase in the CE Directives. The rear overhang is taken as the distance between centreline of the last axle and the rear end of the chassis runner. For dimensions A, B and t of the frame and counterframe section please refer to the figure below.

Figure I.5



120360





## SECTION 2

### Chassis modifications

	Page
2.1 General instructions for chassis modifications	2-5
2.1.1 Specific Precautions	2-5
2.2 Protection against Rust and Painting	2-7
2.2.1 Original components	2-7
2.2.2 Added or modified painted parts	2-10
2.2.3 Precautions	2-11
2.2.4 Exceeding the Limits	2-12
2.3 Drilling the Chassis	2-13
2.3.1 Screws and nuts	2-13
2.3.2 Characteristics of the material to be used when modifying the chassis	2-13
2.3.3 Stresses on the chassis	2-14
2.3.4 Welding the Chassis	2-15
2.3.5 Closing of existing holes	2-16
2.4 Modifying the Wheelbase	2-17
2.4.1 General Specifications	2-17
2.4.2 Authorisation	2-17
2.4.3 Consequences for steering	2-17
2.4.4 Effect on Braking	2-17
2.5 Modifying the Rear Overhang	2-18
2.5.1 Authorisation	2-18
2.6 Installing a Towing Device	2-18
2.6.1 General Specifications	2-18
2.6.2 Traditional towing hooks	2-19
2.6.3 Hook types	2-22
2.6.4 Lowered Rear Cross Member	2-22
2.7 Installing a Supplementary Axle	2-24
2.8 Modifying the Drive Line	2-24
2.8.1 Permitted lengths	2-24



	Page
2.8.2 Determining Driveshaft Positions	2-27
2.9 Modifications of the engine air intake and exhaust system	2-29
2.9.1 Intake	2-29
2.9.2 Engine exhaust	2-29
2.10 Modification of the Engine Cooling System	2-30
2.11 Work on the Suspension	2-31
2.11.1 General Specifications	2-31
2.12 Heating/Air conditioning system modifications	2-32
2.12.1 Installation of a Supplementary Heating System	2-32
2.12.2 Installing an Air-Conditioning System	2-33
2.13 Cab Modifications	2-34
2.13.1 General Specifications	2-34
2.13.2 Roof Panel Modifications	2-35
2.13.3 Occupant protection	2-37
2.14 Changing the Size of the Tyres	2-38
2.15 Modifications to the Braking System	2-39
2.15.1 General remarks	2-39
2.15.2 Brake pipes	2-39
2.15.3 Fitting pipes on the vehicle	2-40
2.15.4 Instructions for adjusting the braking load proportioning valve	2-43
2.16 Electrical System: Modifications and Drawing-Off Power	2-48
2.16.1 Earth points	2-50
2.16.2 Electromagnetic compatibility	2-56
2.16.3 Additional equipment	2-63
2.16.4 Current drawing	2-66
2.16.5 Additional Circuits	2-74
2.16.6 Operations to adjust overhang	2-75
2.16.7 Provision for trailer	2-75
2.16.8 Side Marker Lights	2-78
2.17 Repositioning Parts and Mounting Auxiliary Assemblies and Equipment	2-80



2.18	Retarder Installation	2-82
2.19	Modifications to the Rear Underrun	2-82
2.20	Rear mudguards and wheel boxes	2-83
2.21	Mudflaps	2-83
2.22	Side Guards	2-83
2.23	Chocks	2-85





## 2.1 General instructions for chassis modifications

Particular attention must be given to the following points:

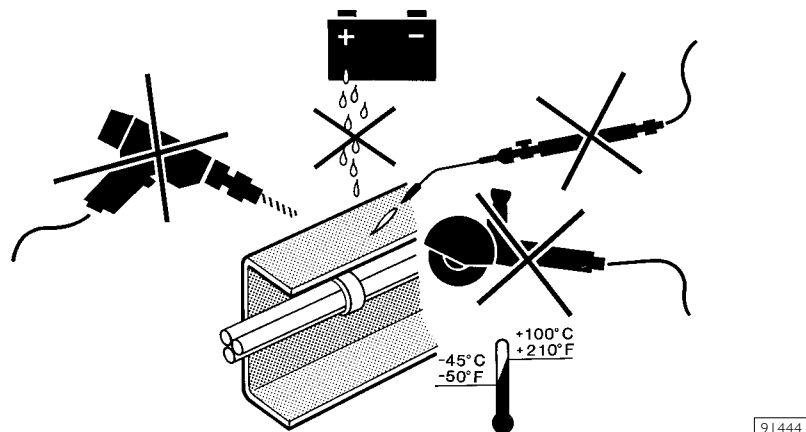
- **Welding to the bearing structures of the chassis is explicitly prohibited** (with the exception of the items described at points 2.3.4, 2.4 e 2.5);
- **Holes in the flanges of the side members are not permitted** (except for the items described at point 2.3.4);
- Where riveted connections exist and can be modified as explained below, these can be replaced by flanged-head screws and nuts of min. class 8.8 or by hex screws of the next greater diameter and self locking nuts. Screws greater than M12 must not be used (max. diameter of hole 13 mm) unless otherwise specified.
- In cases where the original joints were detached and rejoined with bolts it is forbidden to reuse the same bolts. In this event and when rivets are replaced with bolts, the bolt torque must be checked after the vehicle has been driven approximately 500 ÷ 1.000 kms.

### 2.1.1 Specific Precautions



**During the welding, drilling, grinding and cutting operations when working in the proximity of brake lines and particularly if these are of plastic material or electric wiring, care must be taken to ensure their protection. Where necessary they should be removed (comply with the provisions given at points 2.15 and 2.16).**

Figure 2.1



**Regarding the electrical equipment remember to:**

- a)** Take precautions concerning the alternator and the electrical/electronic components. In order to avoid damaging the diode rectifier, never disconnect the batteries (or open the isolator) when the engine is running.  
If the vehicle has to be tow started make certain that the batteries are connected. Should it be necessary to quick charge the batteries, disconnect them from the vehicle circuit.  
In order to run the engine with external means and in order to avoid current peaks which might damage the electric/electronic components, do not use the "start" function in conjunction with external charge devices if such devices are equipped with this function. Starting will have to be carried out only with the external battery trolley ensuring correct polarity.
- b)** Checking the earth connections.  
As a general rule the original earth connections of the vehicle must not be changed. If it is necessary to move these connections or to implement further earth points use the existing holes on the chassis as far as possible and:
- Remove, mechanically, and/or with an appropriate chemical product, the paint on the chassis side and on the terminal side creating a resting plane free from indentations or ridges.
  - Apply appropriate high conductivity paint between the cable terminal and the metal surface (e.g. galvanizing paint IVECO Part number 459622 by PPG).
  - Connect the earth cables within 5 minutes from the application of the paint.

Do not use the IVECO standardised M1 (battery earth connection) M2, M8 (earth connection for starter motor depending on the driving position) points for the earth connections for control switches (e.g. sensors or low absorption devices): See IVECO Workshop manuals.

With regard to the electronic devices, avoid linking earth connections between the devices; only use single wire earths with optimised lengths (as short as possible).

**c)** Electric wiring

For further information regarding the braking and electronic system, refer to point 2.15 and 2.16.



## 2.2 Protection against Rust and Painting

**NOTE** All components installed on chassis must be painted as per Sta Iveco I8-I600 Colour IC444RAL 702I brightness 70/80 shore.

### 2.2.1 Original components

In Table 2.1 details the operations for protecting and painting the components of the original vehicle (Table 2.3 for painted parts, Table 2.2 for non-painted or aluminium parts).

Table 2.1 - Protection category - STD I8 - I600 (Schedule I)

Class	Parts requirements	Specific examples affected
A	Parts in direct contact with atmospheric agents	Body - Door mirrors - Windscreen wipers - Aerodynamic kit metal structure - sun blind metal structure - Metal bumpers - Cab attachment lock - Door stopdevice - Body fasteners (screws,bolts, nuts, washers), etc.
B B2	Parts in direct contact with atmospheric agents.with mainly structural characteristicsin direct view.	Frame and parts, includingfasteners. Parts beneath grille (category B). Exterior cab steps.
B1		Only for rear axles and axles
C	Parts in direct contact with atmospheric agents.not in direct view.	Engine and parts
D	Parts not in direct contact with atmospheric agents.	Pedals - Seat reinforcements - Fasteners - etc., fitted inside cab.

**NOTE** Parts must be supplied only with cataphoretic coating or rustproofing (Schedule III). The enamel will be appliedduring the frame finishing stage.



Table 2.2 - Various unpainted and aluminium parts and components - STD I8 - I600 (Schedule IV)

Type of protection		IVECO standard	Class			
			A	B - B1 - B2	C	D
Stainless steel <span>1</span>		18-0506	yes	-	-	-
Dacromet (■)	DAC 320-8	18-1101	yes	-	-	-
	DAC 500-8				-	-
	DAC 320-5			-	-	
	DAC 500-5			-	-	
	DAC 500-5 PL		-	yes Category B1 wheel studs	-	-
Geomet (■■■)	GEO 321-8-PM	18-1101	yes	-	-	-
	GEO 321-5		-	yes		
	GEO 321-5-PM					
	GEO 321-5-PL					
Zinc coating (■)	Fe/Zn 12 III (yellow)	18-1102	-	-	yes	yes
	Fe/Zn 12 V (olive green)		-	yes	-	-
	Fe/Zn 25 V (olive green)		-		-	-
	Fe/Zn 12 III S (yellow)		-		-	-
	Fe/Zn 12 V S (olive green)		-		-	-
	Zinc coating (■■)		Fe/Zn 12 II	-	-	yes
Fe/Zn 12 IV S			-	yes	-	-
Aluminium	Anodic oxidation	18-1148	yes	yes	yes	yes
	Painting	See Schedule III	yes			

(■) Hexavalent chromium coatings.

(■■) Hexavalent chromium-free coatings.

(■■■) Chromium-free coatings.

<sup>[1]</sup> Matching with other metals must not generate battery effects.



Table 2.3 - Painted parts - STD I8 - I600 (Schedule III)

Description of the cycle phase		Classes					
		A	B [8]	BI [5]	B2	C	D
MECHANICAL CLEANING SUPERFICIAL [1]	Sanding/sandblasting	-	yes ★	-	yes ★	yes ★	yes ★
	Brushing						
	Sandpapering						
PRETREATMENT	Iron phosphatation (only for non-precoated ferrous materials)	-	yes ★	-	yes ★	yes ★	yes ★
	Zinc phosphatation ☆	yes					
CATAPHORESIS	High thickness (30-40 μm)	yes [2]	yes ★ [6]	-	yes ★ [6]	yes ★ [9]	yes •
	Medium thickness (20-30 μm)	yes [3]					
	Acrylic top coat (>35 μm)	-					
RUSTPROOFING	Bicomponent (30-40 μm)	-	yes [10]	-	yes [10]	yes ★ [9]	
	Monocomponent (30-40 μm)		-	yes	yes		
CHIP-RESISTANT PRIMER	Mono (130 °C) or bicomponent (30-40 μm)	yes [3]	-	-	-	-	-
ENAMEL	Mono (130 °C) or bicomponent (30-40 μm)	yes	yes ★	-	-	yes ★	yes ★ [7]
	Powders (40-110 μm)	yes [4]					
	Single component, low temperature (30-40 μm)	-	-	yes			

[1] = Carry out operation in presence of shearing burrs, oxidation, welding swarf, laser-cut surfaces.

[2] = Two-coat body cycle.

[3] = Three-coat body cycle.

[4] = As an alternative to single or dual component enamel only for body parts (windscreen wipers. Rear view mirrors etc.).

[5] = Only for rear axles and axles.

[6] = Excluding parts that cannot be submerged in pretreatment or paint baths because this would affect their operation (e.g.: mechanical parts).

[7] = Colour is specified on the drawing by means of an IC

[8] = For fuel tanks in ferrous sheet metal or precoated.

[9] = Only parts to be fitted on engine.

[10] = Parts that cannot be treated with cataphoresis (see [6]).

☆ = For galvanised or aluminium panels, use special phosphating treatments.

★ = Alternative products and cycles for the same class, as long as they are compatible with the part being treated.



## 2.2.2 Added or modified painted parts

All parts of the vehicle (cab, chassis, bodywork, etc.) which are added or subjected to modification must be protected from rust and corrosion.

There must be no unprotected areas on ferrous materials.

Table 2.4 (painted) and Table 2.5 (unpainted) show the minimum treatments required for modified or added components when it is not possible to provide the same protection as that used on IVECO original components. Different treatments are allowed on condition that the same level of protection against rust and corrosion is guaranteed.

Never use powder enamels directly after degreasing.

Parts in light alloy, brass and copper must not be protected.

Table 2.4 - Added or modified painted parts

Description of the cycle phase	Class
	A - B - D (1)
Mechanical surface cleaning (including the removal of burrs / rust and cleaning of modified parts)	Brushing/sanding/sand blasting
Pre-treatment	Degreasing
Anti-rust	Bicomponent (30-40µm) (2)
Paint	Bicomponent (30-40µm) (3)

(1) = Modifications to rear axles, front axles and engine (Classes B1 and C) are not allowed.

(2) = Preferably epoxy.

(3) = Preferably polyurethane.

Table 2.5 - Added or modified unpainted and/or aluminium parts

Type of protection	Class	
	A - B (1)	D
Stainless steel	yes	-
Dacromet (1)		-
Zinc treatment (1)	-	yes

(1) = Hexavalent chromium-free.



### 2.2.3 Precautions

Suitable precautions must be taken to protect those parts whose preservation and operation could be damaged by paints such as:

- rubber or plastic pipes for the air and hydraulic installations;
- gaskets, parts in rubber or plastic;
- flanges of the transmission shafts or power take-offs;
- radiators;
- shock absorber and hydraulic or air cylinder rods;
- drainage and bleeder valves (mechanical components, air tanks, cold starting heater plug pre-heating tanks etc.);
- fuel sediment filter;
- nameplates and logos.

With particular regard to the engine and its electric and electronic components, adequate precautions shall be taken to protect:

- on the whole engine and vehicle wiring, including earth contacts;
- on all connectors on sensor/actuator side and wiring side;
- on all sensors/actuators, on flywheel, on flywheel rev sensor bracket;
- on the whole diesel fuel system pipes (plastic and metallic);
- on complete diesel fuel filter base;
- on control unit and control unit base;
- on the whole soundproofing cover inner side (injectors, rail, pipes);
- on common rail pump including regulator;
- on vehicle electric pump;
- on tank;
- on front belt circuit and relevant pulleys;
- on power steering pump and relevant piping.

If the wheels are removed, protect the contact surfaces on the hubs, avoid increasing the thickness and especially avoid the build-up of paint on the connecting flanges of the wheel disks and resting points of the fixing nuts.

Ensure that the disc brakes are adequately protected.

The electronic components and modules must be removed.



**When the painting operation is to be completed by oven drying (max. temp. 80°C), all parts which may be damaged by exposure to heat, must be removed.**



### 2.2.4 Exceeding the Limits

In case of special transport with considerable high centre of gravity (e.g. special body versions, advertising vehicles, etc.), from a technical point the values shown in the table may be exceeded, provided the vehicle is driven carefully (e.g. low speed, gradual running direction changes, etc.).

Table 2.6 - Maximum heights in relation to the centre of gravity of the payload and cornering stability

Models	Max. height (approx.) of centre of gravity of payload (include. body and equipment) in relation to the ground (mm)
-	-



## 2.3 Drilling the Chassis

**The frame must not be drilled.**

When auxiliary units or components are to be applied to the frame, existing factory-made holes must be used and the following instructions must be applied.

### Positioning and sizes

If it is necessary to make holes in the frame, it is compulsory to ask IVECO for authorisation.

#### 2.3.1 Screws and nuts

In general, use connectors of the same type and class as those for similar fixings on the original vehicle (Table 2.7).

As a general rule, materials of class **8.8** are recommended. Class **8.8** and **10.9** screws must have been hardened and tempered. For applications of diameter  $\leq 6$ mm, stainless steel parts are recommended. Approved finishes are Dacromet and zinc coating, as detailed in Table 2.2. A Dacromet finish is not recommended if the screws are to be subjected to welding. If space allows, use screws and nuts with flanged heads. Use self-locking nuts. Nuts must be tightened using a torque wrench set to the correct torque setting for the fixing.

Table 2.7 - Classes of resistance for screws

Class of resistance	Usage	Tensile strength (N/mm <sup>2</sup> )	Yield point (N/mm <sup>2</sup> )
<b>4</b>	Non-load bearing screws	400	320
<b>5.8</b>	Low resistance screws	500	400
<b>8.8</b>	Medium resistance screws (cross members, cleat plates, brackets)	800	640
<b>10.9</b>	High resistance screws (spring supports, stabilizer bars and shock absorbers)	1000	900

#### 2.3.2 Characteristics of the material to be used when modifying the chassis

When modifying the chassis of the vehicle, and in applications which reinforce the side members directly, the material used must correspond in quality (Table 2.8) and thickness (Table 2.9) to that of the original chassis.

Should it not be possible to source materials of the thickness indicated, the next superior standard thickness may be used.

Table 2.8 - Materiale da utilizzare nelle modifiche del telaio Standard IVECO 15-2110 e 15-2812

Steel name		Tensile strength (N/mm <sup>2</sup> )	Yield point (N/mm <sup>2</sup> )	A5 elongation
IVECO	FEE490	610	490	23%
Europe	S355J0W			
Germany	QSTE500TM - S355J0W			
UK	S355J0W			



Drilling the Chassis

Table 2.9 - Daily: truck chassis dimensions, section and thickness

Class	Type	Wheelbase [mm]	Chassis rear overhang [mm]	A x B x t wheelbase area side member section [mm]	A x B x t rear overhang area side member section [mm]
35S18W - 55S18W	truck	3050	801	134 x 60 x 5	134 x 60 x 5
		3400	962		

### 2.3.3 Stresses on the chassis

Do not exceed the following stress values under static conditions:

Table 2.10

Range	Permitted static stress on the chassis (N/mm <sup>2</sup> ) $\sigma$ amm.
	<b>Off-road use</b>
Daily 4x4	100

When prescribed by national regulations, the bodybuilder must check that the stress limits are not exceeded.

Welding activity will cause a deterioration in the characteristics of the material. Therefore, when checking the stresses in thermally-modified zones, consider a reduction of approx. 15% of the resistance characteristics.



### 2.3.4 Welding the Chassis

**NOTE** All frame welding must be carried out after authorisation from IVECO. They must then be carried out scrupulously following the instructions given below.



**Welding operations must only be carried out by specialist, trained personnel, using suitable equipment and in a perfectly workmanlike manner (see norms EN 287). Any intervention on the system not carried out as per instructions provided by IVECO or carried out by unskilled staff, might severely damage the on-board systems, thus adversely affecting vehicle operation safety and efficiency and causing damages not covered by guarantee contract.**

In case of arc welding, strictly follow instructions below in order to protect electric units and ECUs:

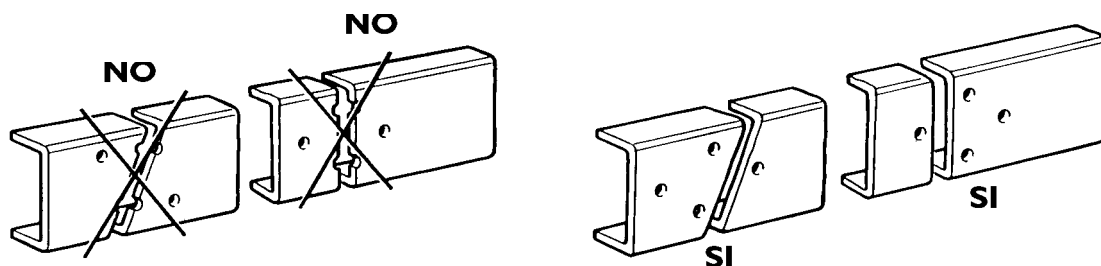
- before disconnecting power cables, check for no loads engaged;
- in case an electric switch is installed (main contactor) wait for cycle end;
- disconnect negative power pole;
- disconnect positive power pole without connecting it to ground and DO NOT short circuit it with negative pole;
- disconnect ECUs connectors, operate carefully and do not touch ECU connector pins;
- In case of welding next ECU, disconnect it from vehicle;
- connect welding machine ground directly on part to be welded;
- protect plastic material pipes against heat sources and disassemble, if required;
- in case of welding near leaf springs or air springs against welding spatters, carefully protect surfaces;
- avoid electrode or gun contact with spring leaves;

#### Operations for welding preparation

As part of the procedure it will be necessary to remove the paint and deoxidise the parts of the chassis that are affected by the welding operation as well as those parts which may have to be covered by possible reinforcements. When work has been completed the modified part must be protected with adequate rustproofing (see point 2.2.2).

- a)** Cut the side members with a diagonal or vertical cut. (We recommend that the diagonal cut be used particularly for the section between the wheelbase) Cuts are not permitted in areas in which the profile of the side member as well as the chassis width change or in those where there is a high concentration of stresses (e.g. spring brackets). The cuts must not be made through the holes present in the side member (see Figure 2.2).

Figure 2.2



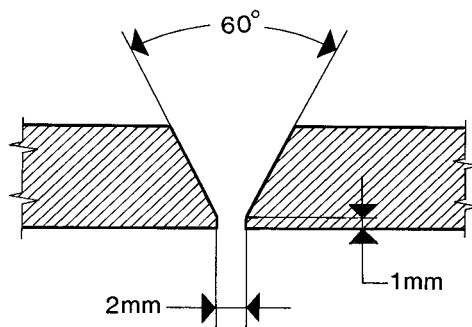
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Drilling the Chassis

- b)** On the inner side of the side member give the parts that are to be joined a V-shaped chamfer of  $60^\circ$  along the entire length to be welded (see Figure 2.3).

Figure 2.3



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- c)** Arc weld in stretches using carefully dried basic electrodes. The recommended electrodes are:  
 For S 500 MC (FeE490: QStE 500TM)  
 Diameter of the electrode is 2.5 mm, current intensity approx. 90A (max. 40A for each millimetre of diameter of the electrode).  
 Using MIG-MAG welding use a welding rod with the same characteristics as the material to be welded (diameter 1 to 1.2 mm).  
 Recommended welding rod: DIN 8559 - SG3 M2 5243  
 gas DIN 32526-M21 or DIN EN 439  
 If FeE490 is used at very low temperatures, we recommend:  
 PrEN 440 G7 AWS A 5.28 - ER 80S - Ni I  
 gas DIN EN439-M21  
 Avoid current overloading. Welding must be free from marginal cuts and waste material.
- d)** Repeat the operation on the reverse side by welding as detailed in point **c**).
- e)** Allow the side members to cool slowly and uniformly. Cooling by air, water or other means is not permitted.

### 2.3.5 Closing of existing holes

If, when making new holes, the existing holes are found to be too close these may be closed up by welding. To ensure the success of this operation the outer edge of the hole should be chamfered and copper plate used for the inner part.

For holes with a diameter of over 20 mm, chamfered plugs may be used, welded on both sides.





## **2.4 Modifying the Wheelbase**

### **2.4.1 General Specifications**

It is only possible to alter the wheelbase after obtaining specific approval from IVECO.

### **2.4.2 Authorisation**

Provided the chassis converter gives sufficient guarantees from the technological and control point of view (qualified personnel, adequate operating processes, etc.).

Conversion must be carried out performed in compliance with these instructions by making the necessary changes and adjustments and taking the appropriate precautions (e.g., determining whether ECU parameters need updating, rearranging the exhaust pipes, ensuring compliance with specific load limits on the rear axle, etc.), by taking into due account the requirements specified for the original wheelbase lengths.

### **2.4.3 Consequences for steering**

In general, changes to the wheelbase affect steering specifications. Each operation is directly linked to the authorisation requested from IVECO.

### **2.4.4 Effect on Braking**

In general, changes to the wheelbase affect braking specifications. Each operation is directly linked to the authorisation requested from IVECO.



## 2.5 Modifying the Rear Overhang

### 2.5.1 Authorisation

Rear frame lengthening, as well as shortening to the shortest standard value for each model, must be specifically authorised by IVECO.

## 2.6 Installing a Towing Device

### 2.6.1 General Specifications

Without prior authorisation, the installation of a tow-hook is permissible only on those cross members which are intended for that use and on those vehicles which IVECO has intended for towing a trailer.

The subsequent installation of a tow hook in vehicles for which the installation of a tow hook was not originally contemplated, must be authorised by IVECO.

In addition to the permissible towing weight, the authorisation will specify all other possible specifications that are to be adhered to such as the use of the vehicle, the transmission ratio, the type of braking system as well as possible specifications concerning reinforcements to be applied to the rear cross member or the necessity for employing specially intended cross members.

In trailers with one or more axles close together (centre axle trailers), considering the stress resulting in particular from the vertical dynamic load to which the rear cross member is subjected, the instructions given in point 2.6.2 must be taken into account.



**The tow hook must be appropriate for the permitted loads and of the type approved by national laws.**

**Since tow hooks are important to vehicle driving safety (in some countries they must be specifically certified) they must not be modified in any way.**

When mounting the tow hook to the cross member, the specifications of the hook manufacturer as well as the limitations imposed by current standards - such as minimum space required for the brake and electrical connections the maximum distance between the swivel hook axis and the rear edge of the body - must be respected.

The size of the hook attachment flange does not coincide with the holes on the vehicle rear beam, modification of the drilling on the beam may be authorised in specific cases after applying appropriate reinforcements.

The bodybuilder is obliged to construct and fit the superstructure to make the necessary manoeuvres and control of the attachment possible without impediment or hazards.

The trailer drawbar must be free to move.



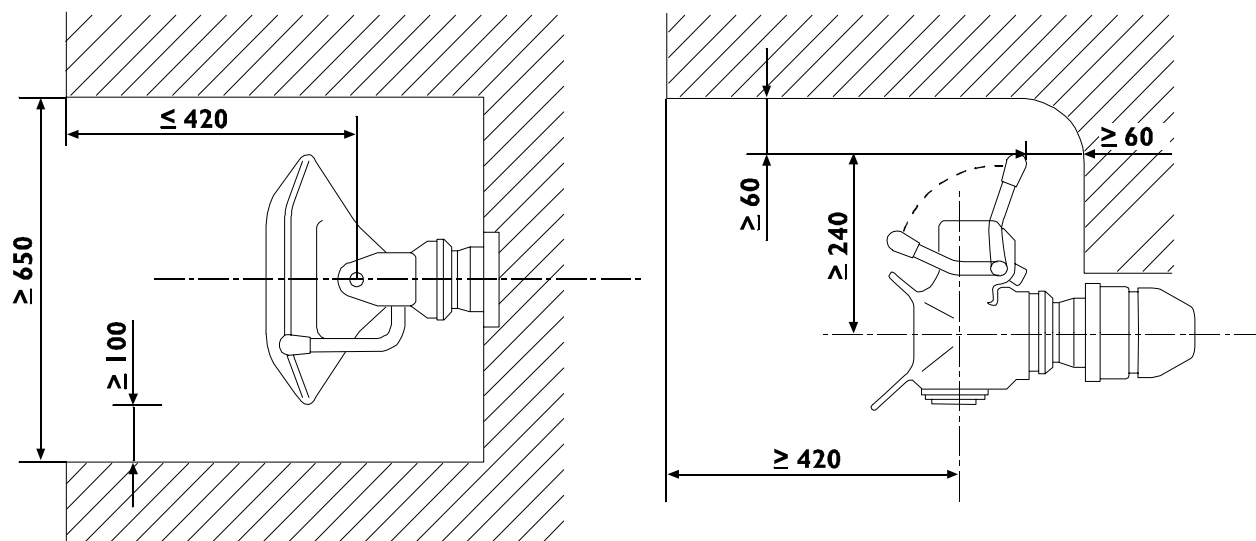
Modifying the Rear Overhang

## 2.6.2 Traditional towing hooks

### • Choice of hook for traditional trailers

The reference dimension for choosing the type of hook is defined by value D calculated as defined below.

Figure 2.4



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Free area for towing hooks

A towing hook may be fitted, without obtaining prior approval only on crossmembers provided for this purpose and to vehicles on which IVECO provides for a towing hook to be installed.

The installation of a towing hook on vehicles which IVECO does not provide a towing hook installation then authorisation from IVECO must be obtained before any installation is carried out.

The towing hook must be chosen on the basis of the following typical values:

$$D = 9.81 \times \frac{T \times R}{(T + R)}$$

D = Representative value of the hook class (kN).

T = Maximum mass of tractor, in t.

R = Maximum mass of trailer, in t.



### •) Towhook for mid-axled trailers

The use of central axle trailers implies the use of tow hooks suitable for this purpose.

The values of the trailer loads and of the permissible vertical loads are contained in the technical documentation of the manufacturer of the tow hook or on the production data plate (e.g. DIN 74051 and DIN 74052).

There are also tow hooks with special type approval, whose values are greater than the ones mentioned in the above standards. These hooks may in any case be subjected to restrictions depending on the trailers used (e.g. drawbar length). In addition this can imply that the rear cross member should be further reinforced and a subframe runner of larger size be fitted.

- mobile connection with the towing vehicles takes place via a towing device.
- The drawbar is not connected to the frame so that it is free to move and therefore able to transmit vertical torques.
- Depending on its construction, part of the overall weight will be borne by the towing vehicle.
- For mechanical attachment devices designed for mid-axled trailers, the  $D_c$ ,  $S$  and  $V$  values are defined by the following equations:

$$D_c = g \cdot \frac{(T \cdot C)}{(T + C)} = (\text{kN})$$

$$V = a \cdot \frac{X^2}{l^2} \cdot C (\text{kN})$$

- $D$  = representative value of the class of jaw (kN). This is defined as the technical reference force for the horizontal force between the towing vehicle and the trailer;
- $g$  = acceleration due to gravity ( $\text{m/s}^2$ );
- $T$  = maximum weight (in tonnes) of the towing vehicle;
- $T+S$  = maximum weight (in tonnes) of the towing vehicle + the vertical load of a trailer with a centre axle;
- $R$  = maximum weight (in tonnes) of the trailer;
- $S$  = value of the static vertical load (in tonnes) which, in static conditions, is transmitted to the point of attachment.  
 $S$  must be  $\leq 0,1 \cdot R \leq 1000\text{kg}$ ;
- $C$  = sum of the maximum axle loads (in tonnes) of the trailer with a centre axle at maximum load. It is equal to the maximum weight of the trailer with a centre axle less the static vertical load ( $C = R - S$ );
- $V$  = value  $V$  of the intensity of the theoretical dynamic vertical force;
- $a$  = for the equivalent acceleration at the point of attachment, as a function of the rear suspension of the towing unit, use the following values:
- $a = 1.8 \text{ m/s}^2$  for air suspension;
  - $a = 2.4 \text{ m/s}^2$  for other suspension types;
- $X$  = length of the load surfaces (m);
- $l$  = theoretical length of the drawbar (distance between the centre of the drawbar towing eye and the centre line of the trailer axle (m));
- $X^2/l^2 \geq 1$  if the result is less than 1, use the value 1.

#### Example for calculating the class of towing gear for trailers with a centre axle

Let us consider a 65C15 vehicle with maximum weight 6250 kg that is to be used to tow a mid-axled trailer weighing 3500kg with  $S = 250 \text{ kg}$ , load surface length of 5m and theoretical drawbar length of 4m.

Therefore, from the data

1.  $S = 0.25 \text{ t}$
2.  $C = R - S = 3.5 - 0.25 = 3.25 \text{ t}$
3.  $(T + S) = 6.25 + 0.25 = 6.5 \text{ t}$
4.  $X^2 / l^2 = 25 / 16 = 1.5$

we obtain:

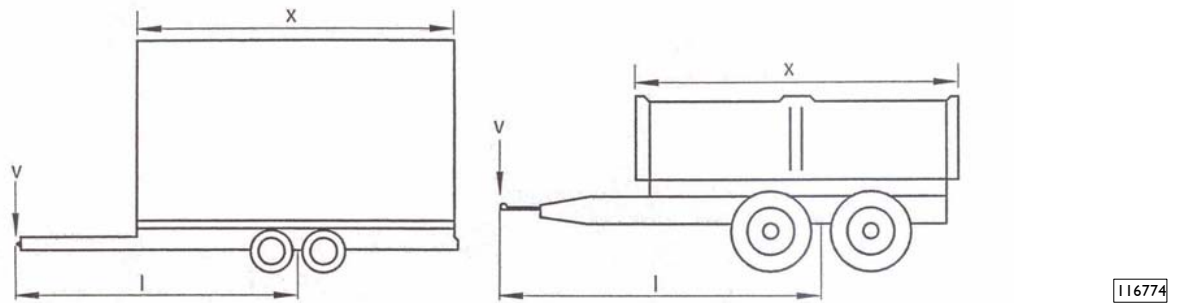
$$D_c = 9.81 \times (6.5 \times 3.25) / (6.5 + 3.25) = 21.3 \text{ kN}, \text{ and } V = 1.8 \times 1.5 \times 3.25 = 8.8 \text{ kN}$$



Towed vehicle equipped with a towing device that cannot move in a vertical direction (in relation to the trailer) and in which the axle or axles are arranged about the vehicle centre of gravity (under uniform load) so that only a small vertical load no greater than 10% of the maximum trailer load or than 1000 kg, if lower, is transmitted to the vehicle (lower value applies).

Mid-axled trailers are therefore subgroups of trailers with rigid drawbars.

Figure 2.5



Length of trailer work surface and theoretical length of crossbar

The use of trailers with centre axles (rigid tow bar trailers with single or tandem axles), with respect to articulated tow bar trailers, entails an increase in bending stress on the rear chassis overhang as well as an increased torsional stress of the rear towing cross member resulting from the vertical static and dynamic loads which the tow bar exerts on the hook (for example when braking or on bumpy roads).

On vehicles for which towing of a trailer is permitted and in accordance with values laid down by IVECO for each model, towable weights with mid-axled trailers and vertical loads on the drawbar may be defined on the basis of the size of the drilling flange present on the vehicle rear beam (see Table 2.11).

With long rear overhangs, it may be necessary to adopt larger subframe sections than normal depending on the towable weights.

Table 2.11 - Approved towing hooks available

Maker	Type	Class	D (kN)	D <sub>c</sub> (kN)	V (kN)	EC approval no.
Pommier	70-C/3	S	31	31	37.5	e 2*94/20*0062*00

The following table shows S maximum admitted value for original towing cross member when towing a central axle trailer.

Model	Maximum S (kN)
35S18W - 55S18W	100



### 2.6.3 Hook types

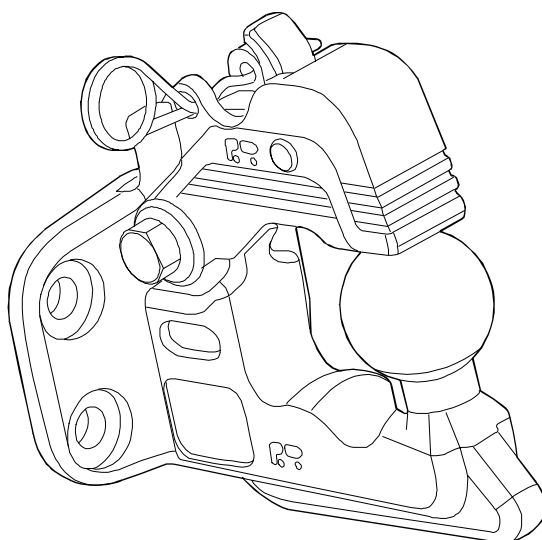
#### •) Ball hooks

In fitting the ball hook, in accordance with the manufacturer's instructions, it is necessary to observe the guidelines laid down by the national and international regulations (e.g., EC Directives).

If required, the installer will need to present the necessary documentation to comply with the requirements of the law.

The automatic hook for the truck version can also be fitted to the same crossmembers provided for the ball hook.

Figure 2.6



I2036I

#### •) Pin hooks (automatic)

These are to be fitted on the truck version, subject to using a suitable cross member. Unless supplied directly by IVECO, they will both need to have type approval in compliance with current standards. They must be installed according to the instructions provided by the respective manufacturers.

#### I3-Pole connector

If not already fitted by IVECO, it can be retro fitted following the instructions given in point 2.16.7.

### 2.6.4 Lowered Rear Cross Member

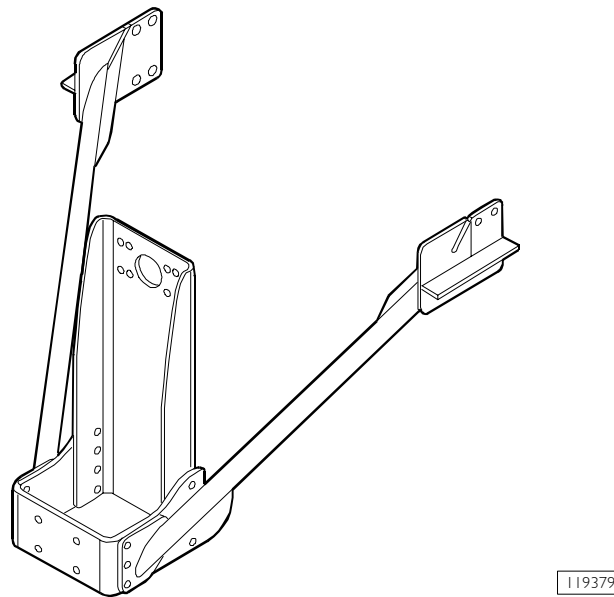
If the type of trailer used requires that the tow hook be positioned lower than originally intended, IVECO may issue authorisation for the original cross member to be lowered or for an additional cross member (of the original type) to be fitted in a lower position. Figure 2.7 shows an example.

The installation of the new cross member in its new position must be carried out in the same manner as before, using the same type (diameter and class) of bolt.



## Example of towing beam reinforcement

Figure 2.7



A device to prevent the bolts from loosening must be adopted for the joints.

### Remarks about the Payload

It is essential to check that the static load on the hook does not mean that the permitted load on the vehicle rear axle is exceeded and that the minimum weight adhering to the front axle is respected, as indicated under point 1.13.3.

### Increasing the Towable Mass

For those vehicles which IVECO regards as suitable for towing a trailer, a request may be submitted to evaluate the possibility of authorising a towable mass exceeding that which is normally permitted.

Such authorisation will include the conditions that must be complied with and, where necessary, specifications concerning modifications and work to be carried out on the vehicle.

These include possible reinforcements to the standard cross member (see Figure 2.7), the instructions for installing a reinforced cross member when available, and those on the brake system to be made.

The tow hook must be suitable for the new use. Its connecting flange must match that of the cross member.

To fasten the cross member to the chassis frame, preferably use flanged head nuts and bolts or hex head screws of minimum class 8.8. Use self-locking nuts.

### Rating plates

Some countries require a plate to be fitted, near the towing device, giving the maximum permitted towable weight and vertical load. If not already fitted, this must be done by the bodybuilder.

The body builder shall also take care that the above plate is properly fitted.



## 2.7 Installing a Supplementary Axle

Supplementary axles are not approved for use on the vehicle.

## 2.8 Modifying the Drive Line

Following the modification of the wheelbase, work on the transmission, as a general rule, is carried out on the basis of the transmission of a similar vehicle with approximately the same wheelbase. The maximum value of the inclinations of the propeller shafts used for standard production vehicles is to be retained. This rule must also be applied when any modifications to the suspension and rear drive axle is made.

An all cases, contact IVECO and send them a diagram showing lengths and angles of the new proposed suspension for the necessary authorisation.

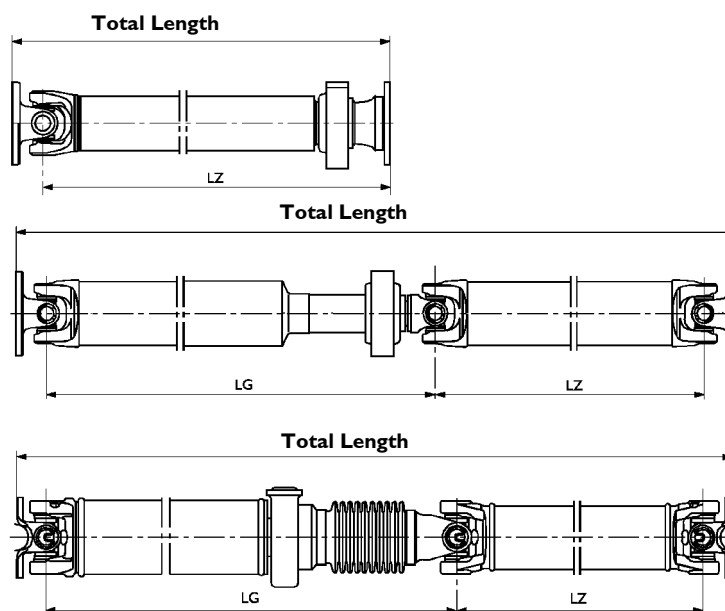
The purpose of the specifications contained in this manual is to ensure the proper functioning of the transmission, to limit its noise and to avoid the build-up of stress transmitted from the engine assembly. In no way does this diminish the responsibility of the bodybuilder for the work he has completed.

### 2.8.1 Permitted lengths

The maximum operating lengths obtainable for both the intermediate shaft sections and the sliding shafts "LG" or "LZ" (see Figure 2.8) can be determined according to the external diameter of the tube existing on the vehicle and the maximum operating rotational speed (see formula). These are specified in Table 2.14.

For the propeller shaft length specified in Table 2.14, when the tube diameter is not sufficient, a new shaft section with the same characteristics as the existing shafts must be used. As an alternative, in some cases transmission shaft with a larger diameter tube can be used. The tube diameter required can be determined in compliance with the required length and the maximum rotational speed, directly from Table 2.14.

Figure 2.8



91505

LZ Intermediate sections  
LG Sliding sections





As far as sliding shafts are concerned, length "LG" is measured between the universal joint centres, with the sliding stub in the intermediate position. Always check both sections LG and LZ.

The maximum working revs can be obtained using the formula below:

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

$n_G$  = maximum number of transmission shaft revs (r.p.m.)

$n_{\max}$  = maximum number of engine revs (r.p.m.), refer to Table 2.12

$i_G$  = gearbox ratio in the fastest gear, refer to Table 2.13

Table 2.12 - Maximum number of engine revs

Engine	Engine code (1)	$n_{\max}$
.18	FICE0481H*C	3500

(1) = Check the engine code on the engine rating plate

Table 2.13 - Gearbox ratio with the fastest gear

Gearbox	$i_G$
6S400 - 2840.6	0.8

#### Example of calculation of the maximum obtainable transmission length

Let us consider a 35C13 equipped with a ZF S5-200 gearbox. Let us assume you wish to use a propeller shaft LZ with an outer diameter of 76.2 mm.

From the data below:

1.  $n_{\max} = 3600$  rpm

2.  $i_G = 0.8$

the following will be obtained:

$$n_G = 3600 / (0.8) = 4500 \text{ rpm}$$

This value corresponds to a maximum obtainable length of 1.400 mm.

The universal joints on the same shaft should not be rotated.



The greater thickness of the tube depends on the class, i.e. on the torque that the original shaft has to transmit and on the design of the driveline (torque, ratios of kinematic chain, power axle load).

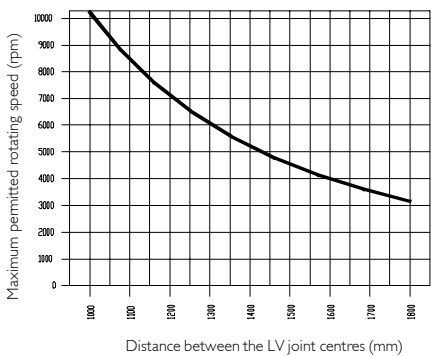
A reference value for the thickness of the tube of a general validity cannot be given. When, for example, a tube of a larger diameter is to be used, its thickness should theoretically be reduced until the torsional strength of the original tube is achieved. It should however be noted that, to determine the thickness of the tube, the following points are to be taken into account: the size of the male element of the universal joint, the possible necessity of adapters and the sizes of the tubes available.

Therefore the thickness of the tube should be agreed upon as each occasion arises with the workshops authorised by the manufacturers of the transmission shaft depending on its dimensions (i.e. size of the universal joint).

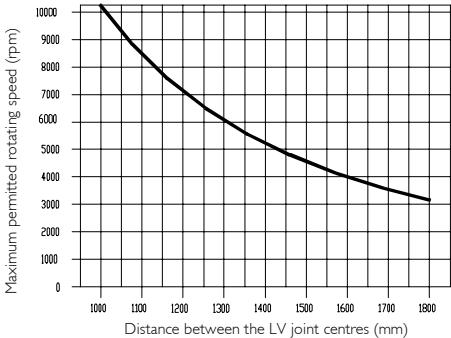
The minimum operating length (from flange to flange) must not fall below 600 mm for the sliding sections and 300 mm for the intermediate sections.

Table 2.14 - Obtainable propeller shaft characteristics

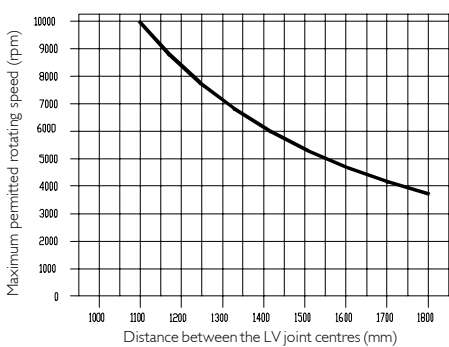
I410 CRITICAL TRANSMISSION SPEED - PIPE Ø 76,2 x 2,4 mm



I310 CRITICAL TRANSMISSION SPEED - PIPE Ø 76,2 x 2,11 mm



I310 CRITICAL TRANSMISSION SPEED - PIPE Ø 88,9 x 1,65 mm



117798



The above obtainable maximum lengths refer to the original shafts. Shorter shafts (-10%) shall be provided for the sections resulting from the conversion.

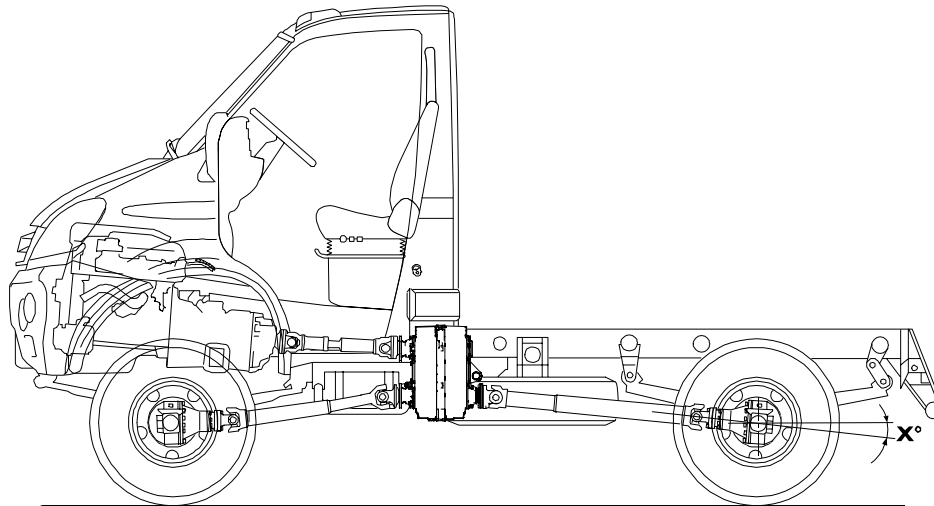


### 2.8.2 Determining Driveshaft Positions

In the case of a drive line consisting of several sections, each shaft must be approximately the same length. As a general rule, the difference in length between an intermediate and a sliding shaft (see Figure 2.9) must not exceed 600 mm; while between two intermediate shafts the difference must be no greater than 400 mm. For sliding shafts there must be a margin of at least 20 mm between the minimum working length and the fully closed length.

Complying with the useful travel, position the static arrangement in an area as central as possible.

Figure 2.9



120362

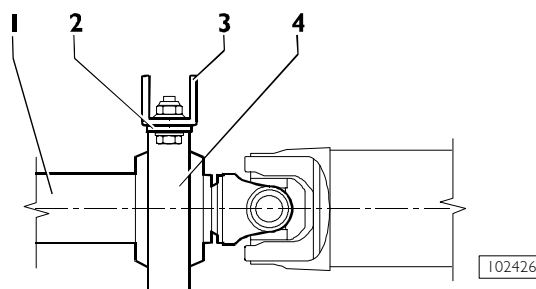
$X^\circ < 10^\circ$

If the wheelbase is lengthened considerably, it may be necessary to apply an extra propeller shaft between the reduction unit/transfer box and rear axle. In this case, the angle between the various propeller shafts must be constant and contained within the maximum limit envisaged in production (see Figure 2.9).

**NOTE** It is absolutely forbidden to move the transfer box.

The elastic supports must be fitted with supporting plates at least 5 mm thick (see Figure 2.10) joined to cross members with similar specifications to the IVECO specifications.

Figure 2.10



1. Intermediate shaft - 2. Support bracket - 3. Bearing plate - 4. Intermediate shaft support



The use of original drive line from IVECO is recommended for these modifications. Should this not be possible however, hardened steel tubes with a yield point of not less than  $420 \text{ N/mm}^2$  ( $42 \text{ kg/mm}^2$ ) may be used.

Modifications to the universal joints are not permitted.

Whenever the transmission or part thereof, is modified, each modified section must be subjected to careful dynamic balancing.



**Since transmission is important to vehicle driving safety, it should be borne in mind that any modification to it must bear maximum operational guarantees. Only very specialised and transmission manufacturer-certified companies should therefore be employed to carry out work of this kind.**



## 2.9 Modifications of the engine air intake and exhaust system

### 2.9.1 Intake

The specifications of the engine air intake and exhaust systems must not be altered without authorisation by Iveco. Operations carried out should not alter the vacuum levels (for the intake) and the original counterpressure levels (for the exhaust).

Table 2.15 - Maximum back-pressure permitted at the intake and exhaust, at the rated engine speed and full load

Engines	Engine Code	Back-pressure at the exhaust (kPa)	Minimum/maximum back-pressure at the intake (kPa)
I8	FICE0481H* <sup>C</sup>	30	1.6 - 8.5

Any work done on the exhaust system of the vehicle requires that the vehicle be homologated again with regard to noise and smoke wherever government regulations require it. The air intake must be positioned to avoid the intake of hot air from the engine and/or of dusty air or snow and rain. The apertures for the intake of air which may have to be made in the bodies of vans, must have a working surface of not less than two and a half times that of the master hose located upstream of the filter. These apertures (e.g. openings in the grill) must be of such a dimension that they do not become obstructed. It is prohibited to alter the air filter or replace the original filter with a lower air capacity unit. Modifications to the equipment (fuel injection pump, regulator, injectors etc.) are not permissible as this may alter the correct functioning of the engine and adversely affect the exhaust emissions.

### 2.9.2 Engine exhaust

Pipes must be laid as straight as possible, bend angles must not exceed 90° and radiuses must be at least 2.5 times the outer diameter. Avoid constrictions and use effective cross-sections no smaller than the originals. Leave a big enough gap between the exhaust piping and the electric system, plastic piping, spare wheel (minimum 150 mm), plastic fuel tank (minimum 100 mm), etc. Lower values (e.g. 80 mm) may be approved if steel guard panels are used. Further reductions require the use of heat insulation or the replacement of plastic pipes with steel pipes. Modifications to the silencer body are not permitted and neither is it permitted to make changes to equipment (injection pump, regulator, injectors, etc.) that could impair efficient engine operation and affect exhaust gas emissions.



## 2.10 Modification of the Engine Cooling System

The proper functioning of the original system, especially in connection with the radiator, the free surface of the radiator and hoses (dimensions and layout) must not be tampered with. In any case, whenever modifications must be made that entail work on the engine cooling system (e.g., modifications to the cab), the following points must be considered:

- the useful area for the passage of air for the cooling of the radiator must not be less than that which is available on vehicles with the standard cab. Maximum venting of air from the engine compartment must be ensured and care must be taken - possibly using shields or baffles - to avoid stagnant air pockets or back flow of air. The performance of the fan must not be altered;
- if it is necessary to re-position the hoses this must be done without affecting the complete filling of the system (which must occur at a continuous flow, without forming blockages at the mouth) or the normal flow of water. The maximum stabilising temperature of the water must not be altered even under the most severe operating conditions;
- hoses must be located so that air pockets are not formed (i.e avoiding air traps and providing appropriate bleeding points) that could hinder the circulation of water. So, it is necessary to check that the water pump primes immediately on starting the engine and later operates with the engine idling (accelerate a few times, if necessary) even when the circuit is not pressurized. In addition to this check that the delivery pressure of the water pump, when the engine is running under no load and at maximum RPM, is not lower than 1 bar;
- always reinstall the radiator anti-clogging protection after making alterations to the engine cooling system.



## 2.11 Work on the Suspension

### 2.11.1 General Specifications



**Company authorisation must be obtained to re-work the suspension systems and springs (e.g. additional spring leaves, different cambering etc.) since these are important components for the operation of the vehicle.**

As a general rule no modification of the parabolic springs is permitted. On vehicles equipped with these springs, installation of elastic rubber components may be authorised for special versions or operations in order to increase the stiffness of the suspension. In very specific cases, and for specific uses, the possibility of adding an extra leaf to the parabolic spring may be evaluated. This operation should be carried out only by specialised firms after approval from IVECO.

It is forbidden to fit a parabolic spring on one side and a semi-elliptic spring on the other side on the same axle.

On vehicles equipped with a load apportioning valve (LAV) for the braking system, modification of the rear suspension requires adjustment of this LAV valve (see point 2.15).

#### Modifications to the rear suspension

Changing the features of the rear spring (e.g., no. of leaves, spring rate etc.) requires adjusting the brake load apportioning valve so as not to alter the vehicle's braking performance. When work on the suspensions follows rather large changes in the permitted loads on the axle(s) or the total weight of the vehicle, it may be necessary to adapt the braking forces to permit compliance with the requirements for the brake regulations in force. The necessary instructions will be given on the documentation issued by IVECO. If the vehicle is equipped with the ABS system, no adjustment need be made.

If the modification of the specifications of the rear spring does not require changing loads on both axles and total weight, the brake load apportioning valve must be adjusted by an IVECO dealer. So as not to alter the vehicle's braking capacity, it is necessary to observe the ground load / brake pressure ratio (under various load conditions) given on the rating plate of the brake load apportioning valve.

In these cases, to adjust the brake load apportioning valve, follow the instructions given in point 2.15.4, applying a load on hole 9 corresponding to the stiffness of the new spring.

It will be necessary to check the ground load / brake pressure ratio is observed for all load conditions.

Should this not be, contact IVECO for a further check on compliance with the brake regulations.

Changing the data on the rating plate of the load apportioning valve requires it to be replaced with a new one giving the new data.



## 2.12 Heating/Air conditioning system modifications

### 2.12.1 Installation of a Supplementary Heating System

When the installation of a supplementary heating system is deemed necessary, it is advisable to use the types recommended by IVECO.

For vehicles on which IVECO has not anticipated the use of supplementary heaters, the installation should be carried out in compliance with the supplier's instructions (i.e. heater arrangement, piping, electrical system etc.) and following the directions given below.

All national rules and regulations relevant to the matter should be adhered to (i.e. inspections, particular installation for dangerous cargo transportation etc.). The supplementary heating system must not make use of the equipment that is specific to the vehicle which is subject to approval if the use is liable to impair or alter the performance of the equipment.

Furthermore:

- ensure correct operation of the vehicle components and equipment (i.e. cooling system);
  - check the electrical system to ensure that the battery capacity and alternator output is sufficient for the higher current requirements (see point 2.16). Provide the new circuitry with a protection fuse;
  - connect the intake of the newly added fuel system to the reservoir connected to the engine fuel return line. Direct feed from the vehicle fuel tank is permitted only if this is independent from the engine fuel system and the new circuit is perfectly leakproof;
  - trace pipe and cable paths, the location of brackets and hoses bearing in mind that the overall dimensions and heat affect the various units on the chassis. Avoid runs and arrangements that could lead to hazards when the vehicle is running. Use shields or armouring if necessary;
- a)** When installing a water heater, original vehicle heating and engine cooling circuits are involved (see point 2.10), it is advisable to follow the instructions listed below to ensure reliability of the heating system and safe operation of the original system:
- ☐ special care must be taken when defining the connections between the supplementary equipment and the main one; refer to IVECO, if necessary;
  - ☐ determine a rational arrangement for piping, avoid neckings and siphonings;
  - ☐ install proper venting valve (bleeding points) to ensure proper filling of the system;
  - ☐ ensure that the circuit may be fully drained by providing additional plugs if necessary;
  - ☐ proper insulation should be used to prevent heat dissipation.
- b)** When air heaters are used and when the installation is to be made directly in the cab, make sure that the engine exhaust system does not touch the added installation (to prevent combustion gas circulation inside the vehicle) and have the correct warm air distribution by avoiding direct air flows;
- the complete installation should be designed to ensure good accessibility for quick and easy servicing.



Modifications of the Engine Cooling System



### 2.12.2 Installing an Air-Conditioning System

When the installation of an air conditioning system is deemed necessary, it is advisable to use the types recommended by IVECO. If this procedure is not applicable, the installation must be carried out in accordance with the supplier's instructions and the following points:

- the installation must not interfere with the correct operation of the vehicle components and of equipment which may be connected with the installation;
- check the electrical system to ensure that the battery capacity and alternator output is sufficient for the higher current requirements (see point 2.16.3). Provide the new circuitry with a protection fuse;
- in liaison with IVECO, establish a method for installing the compressor; if it is fitted to the engine, use the original IVECO compressor;
- trace pipe and cable paths, the location of brackets and hoses bearing in mind that the overall dimensions and heat affect the various units on the chassis.  
Avoid runs and arrangements that could lead to hazards when the vehicle is running. Use shields or armouring if necessary;
- the complete installation should be designed to ensure good accessibility for quick and easy servicing. At vehicle delivery, the bodybuilder will supply all service and maintenance instructions which are deemed necessary.

Furthermore, according to the system operations:

#### Equipment installed inside the cab

- The condenser should not impair the original engine cooling system features (reduction in the radiating area of the engine radiator).
- The best arrangement is for the condenser not to be combined with the engine radiator but in a separate compartment, suitably ventilated.
- The arrangement of the evaporator-blower unit in the cab (if not anticipated by IVECO) should be designed to make sure that the accessibility control and operating equipment is not impaired.

#### Equipment fitted on the cab roof

- When the equipment (condenser, evaporator, blower) is fitted on the cab roof, make sure that its mass is not higher than that permitted for roof installation. Furthermore, the bodybuilder should provide for proper reinforcement to the roof frame if necessary, in relation to the mass of the unit and the extent of the modification introduced.
- For specific applications with compressors not supplied by IVECO (e.g. fridge box), contact the IVECO offices in charge.



## 2.13 Cab Modifications

### 2.13.1 General Specifications

Any work on the driver's cab must be authorised previously by IVECO.

Modifications must not prevent operation of the control devices located in the area affected by the modifications (e.g. pedals, linkages, switches, pipes etc) or alter the strength of the load-bearing elements (uprights, reinforcement sections etc.). Due care must be taken when carrying out work that may affect the cooling system and air inlet pipes of the engine.

When defining the position of payload, account shall be duly taken of the variation in cab weight, in order to ensure the correct distribution of the permitted loads on the axles (see point 1.13).

For operations that require the removal of sound deadening panels or internal protective elements (panelling, padding) restrict the removal to the absolute minimum, taking care to restore the protective elements to their original condition, ensuring the previous operating capability.

Controls and equipment (power take-off engagement control, external operating cylinder control etc.) may be fitted in the cab provided that:

- They are positioned, properly and are easily accessible to the driver.
- Safety, control and warning devices are fitted which meet the requirements of use and safety of the vehicle and its equipment as well as the requirements of national legislation.

Ensure that the pipes and wires are correctly positioned particularly when the cab is tilted. Use the necessary fixings taking care to observe the appropriate distances from the engine, heat sources and moving parts.

Provide the necessary protection from corrosion for all modifications to the structure (see point 2.2).

Ensure that the seals are fitted correctly and apply sealant to those areas which require it.

Ensure that a perfect seal is provided against the infiltration of water, dust and fumes.

The bodybuilder must check that after modification, the cab satisfies legal requirements regarding both the inside and outside of the vehicle.



### 2.13.2 Roof Panel Modifications

Installation and modification work to achieve specific refurbishments must be carried out with great care to safeguard the strength of the cab and ensure that its operation and protection are maintained.

When fitting assemblies or systems onto the roof (e.g., air-conditioning systems, spoilers), check that the weight of the appliance does not exceed that permitted for the cab. These limits will be provided upon request depending on the assembly or system to be fitted.

When making the opening, ensure that:

- the connection radii are not less than 50 mm;
- do not modify any ribs that may be present;
- do not change the curvature of the roof.

#### Fitting a spoiler

The various versions designed by IVECO can be obtained from the local IVECO dealership with relevant instructions for installation. It is recommended that these versions are used as they are specifically checked.

If fitting a spoiler other than the one designed by IVECO, follow the manufacturer's instructions for its installation.

Whenever national regulations require it, these installations must be inspected by the agencies responsible.

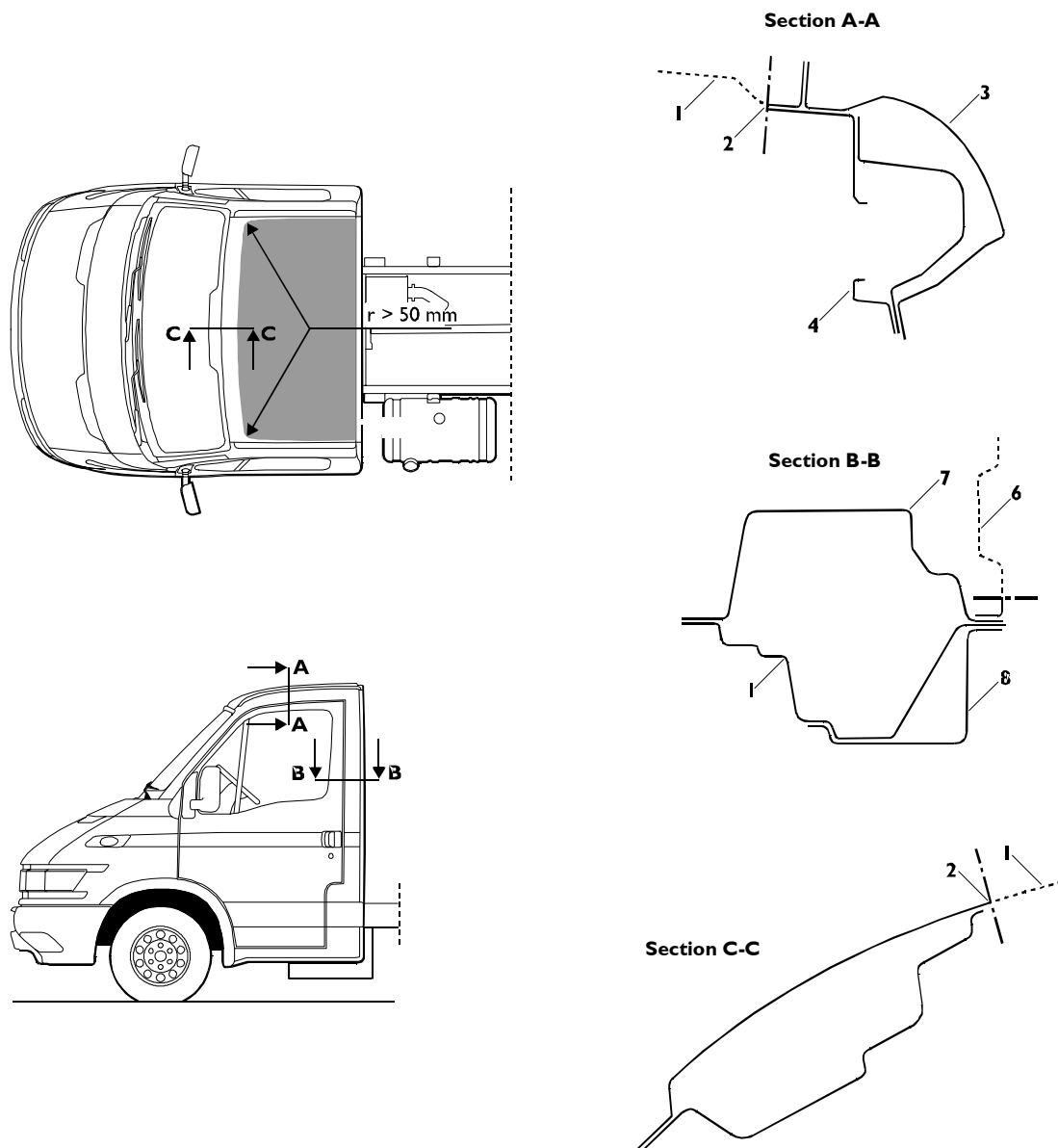
#### Modifications to the roof panel and the cab rear wall

In the event that the rear wall has to be fully removed - and the roof panel partially removed (e.g. motor caravans), the operation must be carried out in accordance with the instructions below:

- make the cut as illustrated in Figure 2.11, taking care to comply with the minimum joining radii indicated. Remove the structure for the rear cross member at the level of the roof assembly, In order for the upper mounts of the seat belts to remain effective, it is necessary to restore the resistance with a suitable structure capable of ensuring the pillars will not deform. For this a structure with compression strength of at least 800daN must be fitted;
- make the connection with the new structure by following the general instructions previously specified.



Figure 2.11



1. Roof panel - 2. Limit cutting area - 3. Roof panel side covering - 4. Doorway ring - 5. Internal rear crosspiece -  
6. Rear wall - 7. Doorway rear covering - 8. Side covering

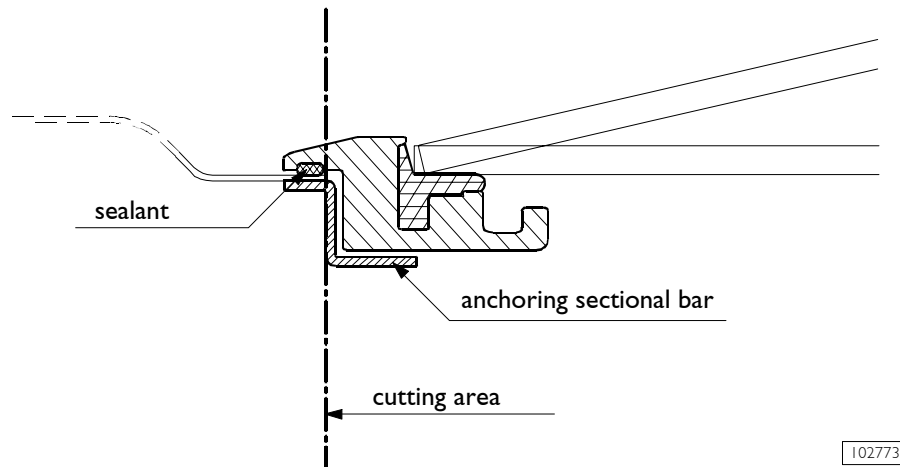


### Fitting a trap door

A hatch may be applied to the roof, provided that the operation does not affect the hoops and the construction guarantees the watertightness and strength of the modified part.

Figure 2.12 illustrates an example of installation.

Figure 2.12



### 2.13.3 Occupant protection

The airbags, seat belt fixing points (the positioning of the belt retractors and pre-tensioning devices), seat fixing, as outlined below, are an integral part of the overall safety of the occupants.

Any modification to these components may jeopardize the safety of the passengers and compliance with legal requirements.

#### Anchoring safety belts

Any work carried out in the areas of the seat belt fixing points may affect their compliance with EC certification.

The company carrying out the work must verify compliance with all legal requirements in force.

#### Seats

The seats have been fixed to the floor structure in compliance with legal requirements on locking systems.

Moving or fitting additional seats requires making suitable fixing areas in the structure under the floor, similar to the IVECO installation, in order to ensure compliance with the legal requirements.



## 2.14 Changing the Size of the Tyres

Replacing the tyres with others of different sizes or with a different loading capacity with respect to those considered at the time of vehicle type-approval must be approved by IVECO and it is also necessary to check for the need to reprogram the EBL or EBS system.

Changing the size of the tyres may involve replacing the wheels with others of a correspondingly greater loading capacity. In this case check whether the spare wheel carrier needs to be changed.

Mounting tyres of different sizes or types of construction on the same axle is prohibited.

Changing the size of the tyres may affect the ground clearance of the rear underrun guard, therefore the compliance with the national legal requirements must be verified. Its supporting brackets, where necessary, may be replaced with other appropriate, type-approved brackets. See point 2.19.

The use of larger tyres always necessitates verification of the safety margins for the mechanical parts, wheel arches etc., under all dynamic conditions of steering and bump travel. In certain cases the use of wider tyres may entail a check on the axles to assess the space required for the suspension components and the length of wheel studs etc.

Where there is local national legislation specifying overall widths (e.c. Jersey etc.) these must be complied with.

The use of tyres with a different outside diameter affects the performance of the vehicle in terms of speed, maximum gradability, pulling force, braking power etc. The tachograph must be recalibrated by an authorised workshop. The load capacity and the relative reference speed must always be compatible with the performance of the vehicle.

When the tyres with a load capacity or speed limit are chosen for a given vehicle, the permissible loads of the vehicle or its performance, must be reduced accordingly. On the other hand, the use of tyres with a greater load capacity does not automatically increase the maximum permissible mass on the axles.

The size and load capacity of the tyres are established on the basis of international and national norms (ETRTO, DIN, CUNA etc.) and are listed in the manuals of the respective tyre manufacturers.

Specific performance characteristics may be established by government regulations for special use in the case of fire-fighting vehicles, vehicles for winter duty, airport tankers, buses etc.. Whenever so required by government regulations the vehicle must be presented to the respective government agency for inspection of the parts that have been replaced and entry of the respective modifications in the vehicle documents.

**NOTE** Altering the tyre size may require replacement of the box mounting brackets.



## 2.15 Modifications to the Braking System

### 2.15.1 General remarks



**The braking system and components are very important for driving safety and vehicle use.**

**No changes may be made to the following parts: brake cylinders and callipers, adjustment units and valves, parking brake, brake control and auxiliary systems.**

**Any modification to the braking system requires authorisation from IVECO.**

It is recommended that when new units are fitted they should be the same makes as those fitted to the original vehicle. When required by national regulations, the vehicle must be submitted for testing to the respective authority.

### 2.15.2 Brake pipes



**Pipes must not be welded for any reason whatsoever.**

In the event that the vehicle wheelbase is modified, the brake pipes affected by the change must be replaced by new one-piece pipes. If this is not possible, fittings of the same type as the ones originally used on the vehicle must be used. When replacing pipes the minimum internal dimensions of the new pipes must not be less than that of the existing pipes.

The new pipes must have the same characteristics and be of the same material as those used originally on the vehicle. The installation must be carried out so that the piping is protected and the correct function of the system ensured.

For the supply and fitting of material we recommend that you contact our Service Centres or specialised workshops.

#### Metal pipes

For the hydraulic system pipes, any additions and replacements must be as follows:

- pipes (materials, dimensions, fittings): : ISO 4038 standard
- bending radii (referred to the pipe centre line = 4.76 mm): : min. 25 mm
- tightening torque:
  - rigid pipes, M10xI and M12xI fittings: : 12 ÷ 16 Nm
  - flexible pipes, M10xI male fittings: : 17 ÷ 20 Nm



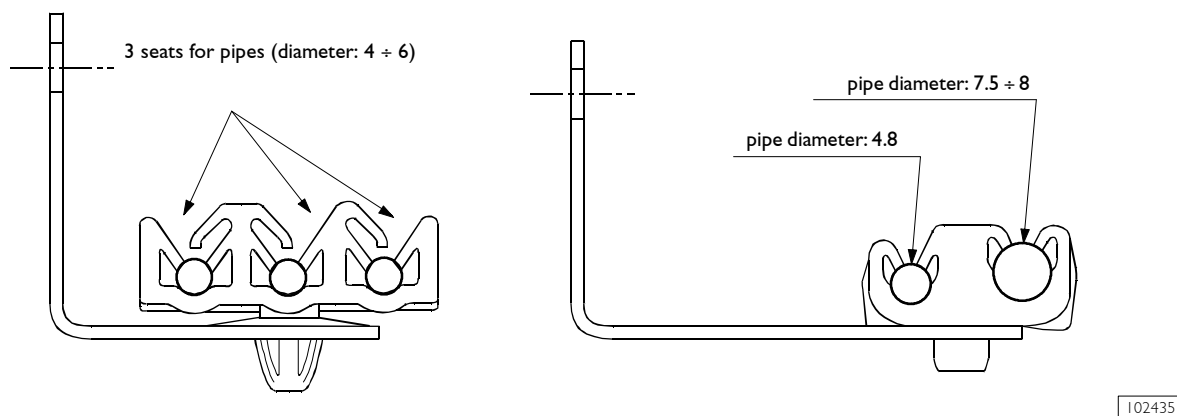
### 2.15.3 Fitting pipes on the vehicle

New pipes must be thoroughly cleaned inside before use (e.g. by blowing through with compressed air).

Pipes shall be secured into their correct positions and the fasteners must fully wrap the pipes: they may be made either of metal, with rubber/plastic protections, or plastic.

Figure 2.13 illustrates two examples of brackets complete with retaining clips, used to secure the brake pipes along the chassis.

Figure 2.13



When a pipe has to pass through the chassis frame (sidemember or cross members), appropriate precautions must be taken to avoid damage.

Observe adequate distances between the various fixing elements. As a rule the maximum distance of 500 mm should be considered.

For plastic pipes, in order to prevent distortion and tension on the connectors when fitting them, take the necessary precautions when arranging the pipe runs and fitting the fixing brackets or clips onto the chassis. Correct fitting of the fixing elements will ensure that the pipes do not rub against the fixed parts of the chassis.

Observe the necessary safety distances from moving parts and heat sources.



#### Important!

**After completing any work either on the system or on the equipment, the air must be bleed from the system correctly, following the instructions given below. The braking system must then be checked for correct operation and efficiency.**





### Manually bleeding air from the hydraulic brake system

There is one bleed screw on each brake calliper.

Carefully repeat the following operations on each of the callipers (the following sequence must be used - rear right, rear left, front left, front right):

- check the brake fluid level in the reservoir on the power brake, top up to the maximum level;
- clean the brake area surrounding the bleed screw;
- remove the rubber cap protecting the bleed screw;
- using a transparent flexible tube fix one end over the bleed screw and immerse the other end in a container part filled with brake fluid;
- loosen the bleed screw by one turn and press the brake pedal down to the floor;
- with the pedal held down on the floor tighten the bleed screw and then release the pedal;
- screw the bleeding screw.



**The fluid discharged from the hydraulic circuit during the bleed operation 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.**



**Bleed air from the hydraulic braking system using MODUS or E.A.S.Y. on vehicles with ABS/ABD/EBD**

On vehicles equipped with ABS/ABD/EBD systems, the traditional, manual bleeding operation described above may not be sufficient. The presence of air causes the brake pedal stroke to be longer, with possible uncharacteristic operation of the system. Manual operations must be carried out, which will be driven by the program in "MODUS" or "E.A.S.Y.".

This program makes it possible to perform full drain (primary circuit and secondary circuit of the modulator) under item "System filling / emptying".

An operator starts the repeated operation of the modulator solenoid valves and the pump and at the same time, by operating the brake pedal and releasing the drain screw on the calliper (according to the manual procedure) air bubbles still present in the concerned part of the system will be blown out.

Then follow the instructions that appear each time on the screen, taking care not to exceed the solenoid valve and pump operating time, so as to avoid component overheating.

If this occurs the system will be deactivated, and you will have to wait for the established time in order to let the system cool down before the operation can be started again.



**In the event that the modulator is replaced (the modulator is supplied by the Spare Parts Department already filled with the brake fluid) you only need to follow the manual drain procedure, taking care not to empty the unit and not cause its pump and solenoid valve to cycle prior to full charging.**

The ABS, ABD, EBD modulating devices, placed on the chassis in the engine compartment, must Not be moved.

When modifying the wheelbase, the electric cables between the rear axle sensors and the control unit must be adapted using new cables or extensions with the correct connectors. The brake piping downstream the modulator must be adapted too.

**Warning**

Great care must be taken, when carrying out the work, to make sure the correct connection of the pipes are made to each wheel. After every modification carry out the necessary checks and tests for correct operation at the Authorized Workshops equipped with the specific equipment.



Changing the Size of the Tyres

### 2.15.4 Instructions for adjusting the braking load proportioning valve

#### Load proportioning valve version

Two types of load proportioning valve are used: with torsion bar - pushrod for vehicles without ABS and with spring for vehicles with ABS.

The former are single circuit while the latter are double crossover circuit.

#### Load proportioning valve adjustment

This adjustment is made on each vehicle in the factory. It permits loading the vehicle or fitting standard bodies in compliance with the deceleration and road holding characteristic required by the relevant EC Directives.

The adjustment and control data are given on the appropriate rating plate, whose location on the vehicle is given in the specific literature.

Should it become necessary to adjust the braking load proportioning valve, this can be done following the instructions given below.

Table 2.16

Vehicle	Load proportioning valve	Leaf spring	Load on rear axle for adjustment	Weigh for adjustment	Clearance between bar and load proportioning valve pushrod for adjustment	Plate design
35SI8W	0.15 single	Dual leaf spring	1020		0.1	504276011
	0.15 single	Triple leaf spring	1000		0.1	504279857
	0.15 double (ABS)	Dual leaf spring	1500	5 kg		504276109
	0.15 double (ABS)	Triple leaf spring	1500	5 kg		504279856
55SI8W	0.15 double (ABS)	Triple leaf spring	1800	1 kg		504276010

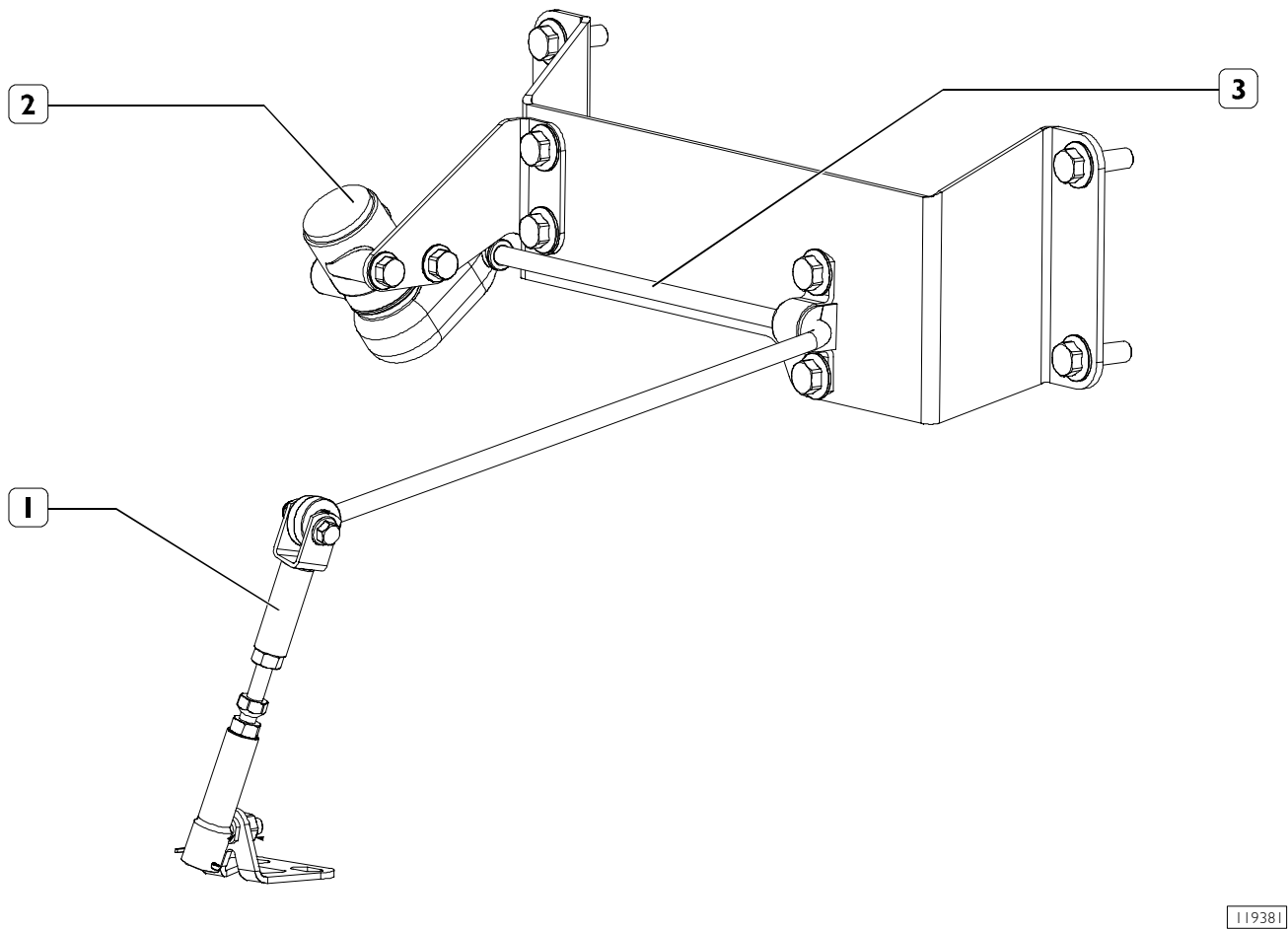
#### Single circuit bar load proportioning valve



**Never alter the length of the control link when the circuit is pressurised. Carry out checks with gradually increasing pressure.**



Figure 2.14

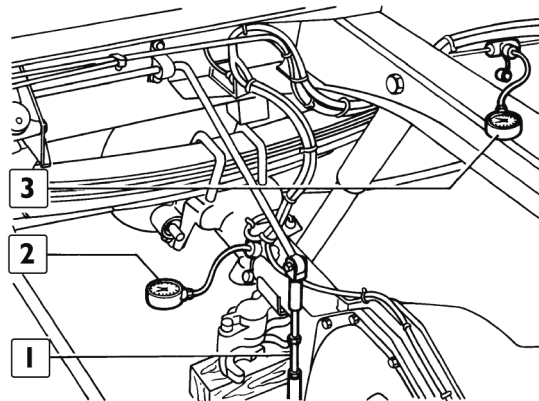


1. Control link - 2. Load proportioning valve - 3. Torsion bar

- Load the rear axle to the values shown in Table 2.16. The weight must not be less than the minimum value indicated by the manufacturer (Figure 2.16).
- Disconnect the control link (1) from the rear axle and raise through its travel. Ensure that the load proportioning valve pushrod slides properly in its seat and reconnect the link.
- Start the engine.
- Fully depress the brake pedal and use a feeler gauge to check that the adjustment clearance (0.1 mm) between the load proportioning valve pushrod and the bar is respected.



Figure 2.15 (Demonstration)



45025

- Connect pressure gauge (3) to the pressure point upstream of the load proportioning valve.
- Connect pressure gauge (2) to the pressure point downstream of the load proportioning valve.
- If the pressure gauges are not equipped with automatic bleed valves, bleed them manually by means of the rings on the pressure gauges.

Figure 2.16

[illegible]

119382

SINGLE CIRCUIT MECHANICAL LOAD PROPORTIONING VALVE PLATE (triple leaf spring)

- With the engine idling, gradually press the brake pedal to obtain a pressure of 100 bars on the pressure gauge (3, Figure 2.15) fitted upstream of the load proportioning valve. This pressure must be constant whether the vehicle is laden or unladen.
- Check that the pressure reading on the pressure gauge (2, Figure 2.15) fitted downstream of the load proportioning valve corresponds to the values on the plate (Figure 2.16). For example, with a load of 1000 kg on the rear axle, with an upstream pressure of 100 bars and pushrod-bar clearance of 0.1 mm, the downstream pressure must be 17.5 bars.
- If the pressure downstream of the load proportioning valve is different, adjust the control link (1, Figure 2.14) to restore it to the correct values.
- For more accurate adjustments, repeat the tests for several rear axle load values (Figure 2.16).



### Dual circuit spring load proportioning valve (ABS)

This adjustment is made on each vehicle in the factory. It permits loading the vehicle or fitting standard bodies in compliance with the deceleration and road holding characteristic required by the relevant EC Directives.

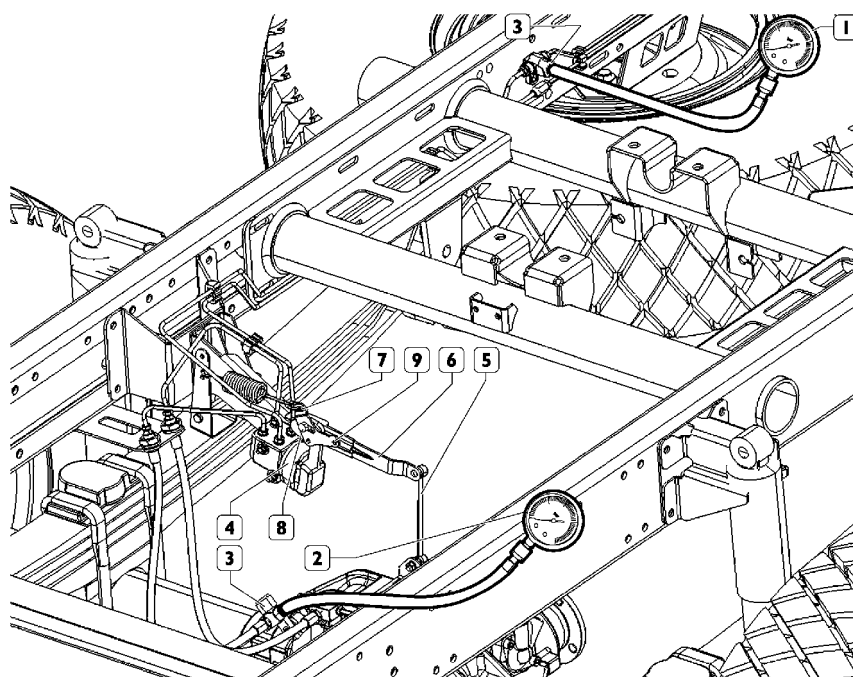
The adjustment and control data are given on the appropriate rating plate, whose location on the vehicle is given in the specific literature.

Should it become necessary to adjust the braking load proportioning valve, this can be done following the instructions given below (see Figure 2.17).

When replacement rear springs have been fitted it is necessary for the rear suspension to settle properly. To set the valve correctly the suspension must be settled in before making any adjustments to the valve. Load the vehicle partially (approximately 2/3 of its maximum weight) and make a few runs over a rough surface, braking a number of times while travelling forwards and while reversing.

- Connect the pressure gauges 1 and 2 to the pressure test points 3 upstream and downstream of the braking load proportioning valve.
- Loosen the clamping screw 8 of the proportioning valve adjustment lever 7.
- Apply adjustment load specific to each model to hole 9, after loading the engine axle to the specified reference value. Check the IVECO workshop manuals for the required values.

Figure 2.17



120363

The example shows the single-circuit braking load apportioning valve of the 35C model

1. Pressure gauge upstream of the load apportioning valve - 2. Pressure gauge downstream of the load apportioning valve - 3. Test points - 4. Braking load proportioning valve - 5. Connecting Rod - 6. Main lever - 7. Adjustment lever - 8. Clamping screw - 9. Hole for applying calibration load

- Tighten the clamping screw 8 to the prescribed torque of  $16 \div 19$  Nm.
- Press the brake pedal until the control pressure of 100 bar is obtained in the circuit upstream the corrector.
- Verify that the output pressure corresponds to the value shown on the load proportioning valve plate, corresponding to the weight at ground of the rear axle.



Changing the Size of the Tyres



## 2.16 Electrical System: Modifications and Drawing-Off Power

### General Information

The vehicles operate on a 12V electric system for normal requirements and the chassis is an earth return. This acts as a current return wire between relevant components, such as battery and alternator. All component negative terminals are connected through the chassis in the absence of an insulated return wire.

Installation of auxiliary equipment or circuits added by the bodybuilder must take into account the instructions given below. Depending on the complexity of the modification, suitable documentation (e.g. electrical diagram) must be provided for inclusion with that relating to the vehicle.

Use colours and/or codes for wires and connectors equal to those used on the original vehicle makes the installation more consistent and facilitates repair work.

**NOTE** For greater details on the vehicle's electrical system, see the specific Workshop Manual, publication no. 603.93.681 (Daily 4x4).

**This manual is available at the IVECO Service network and can be requested from the relevant Departments of the IVECO Sales Organisation.**

### Precautions

The vehicles are equipped with sophisticated electrical/electronic systems controlling their operation.

**Work on the system** (e.g. removing wiring harness, making additional circuits, replacing equipment, changing fuses, etc.) that is not done in conformity with IVECO instructions or is carried out by unskilled personnel can severely damage the systems (control units, wiring, sensors, etc.), jeopardizing safety and operation of the vehicle besides causing significant damage (e.g. short-circuiting with the risk of fire and destruction of the vehicle) that is not covered by warranty.

It is absolutely prohibited to make any changes or connections to the line linking the ECU's (CAN line), which cannot be tampered with, under any circumstances. Any fault diagnosis or maintenance work can only be done by authorized personnel with IVECO approved equipment.

- To avoid damaging the vehicle's electric system, carefully follow the cable manufacturer's instructions. The cable section and route shall be adequate to the type of load and the positioning of the same on the vehicle.
- Do NOT use a quick battery charger for emergency vehicle starting. Otherwise, the electronic systems - in particular, the control units that perform the lighting and power supplying functions - may be damaged.

Always disconnect the batteries before commencing any work on the electrical system. First disconnect the negative and then the positive power cable.

Use fuses with the required capacity for their specific function. Never use fuses of higher capacity. Change them only after eliminating the problem with keys and ancillaries disconnected.

Restore the original conditions of the wiring (routing, guards, and binding, preventing the cable at all costs from coming into contact with metal surfaces of the structure that may impair its integrity).

During **work on the chassis** frame, to safeguard the electrical system, disconnect the relevant components and the earth connections, follow the guides given in points 2.1.1 and 2.3.4.





When fitting additional equipment, where necessary, diodes must be fitted to provide protection against any induction current peaks. The earth signal originating from analogue sensors must only be wired to a specific receiver. Additional earth connections could result in false output signals being emitted from these sensors.

The wiring looms for the electronic components with low intensity signals must be arranged in parallel to the metal datum plane i.e. it must adhere to the chassis/cab structure in order to reduce the parasite capacity. It should be spaced from additional wiring looms as far as possible.

Additional equipment should be connected to the system earth with the utmost care (see point 2.1.1). The relative wiring must not be fitted alongside the existing electronic circuits in order to avoid electromagnetic interference.

The wiring of the electronic systems (length, conductor type, arrangement, clamping, connecting shield braids etc.) must follow the original IVECO standards. Carefully reset the original system after carrying out any work.

## Engine starting

Never start the vehicle by towing.

Do not start the engine without first disconnecting the batteries permanently.

If the batteries require charging, disconnect them from the vehicle circuit.

If starting using auxiliary methods, this must be carried out only using an external battery trolley in accordance with the following procedure:

- To prevent damage to the vehicle, it is important to ensure the tanks contain sufficient fuel during start-up. Attempting to start the engine with insufficient fuel could cause serious damage to the injection system.
- Observe all current accident prevention precautions (including the use of gloves).
- Use a battery trolley with specifications similar to those of the vehicle battery.
- Use an appropriate cable to connect the battery trolley positive terminal to the positive terminal of the CBA fitted on the vehicle battery positive terminal.
- Use a suitable cable to connect the negative terminal of the charged battery to the earth of the vehicle with the flat battery.
- When starting the engine on vehicles with a manual gearbox: turn the key ON and wait for all the engine warning lights on the instrument panel to go off. Start the vehicle engine. The starter motor must not be used for longer than 10 seconds. Do not depress the accelerator pedal during start-up.
- When starting the engine on vehicles with an automatic gearbox: turn the key ON and press the brake pedal. Wait for all the engine warning lights on the dashboard to go off and for a "Gearbox OK" message to appear on the display. Start the vehicle engine. The starter motor must not be used for longer than 10 seconds. Do not depress the accelerator pedal during start-up.
- Wait for the vehicle engine to reach idling speed.
- Do not turn on any vehicle electrical appliances, e.g. low beams, heater. This will prevent any current peaks and damage to electric control units when the battery trolley is disconnected.
- Firstly disconnect the vehicle negative terminal and then the battery trolley negative terminal.
- First disconnect the CBA cable fitted to the vehicle battery positive terminal and then the battery trolley positive terminal.



- The battery must in any case be recharged subsequently by disconnecting from the circuit using the correct slow, low current recharging procedure.
- Do not use other devices (battery charger) to start the engine. If in doubt, contact the IVECO service network.



**Any damage to electronic control units caused by failure to comply with procedure is not covered by the warranty.**

**See Chapter 5 for precautions to be adopted for installed control units.**

### 2.16.1 Earth points



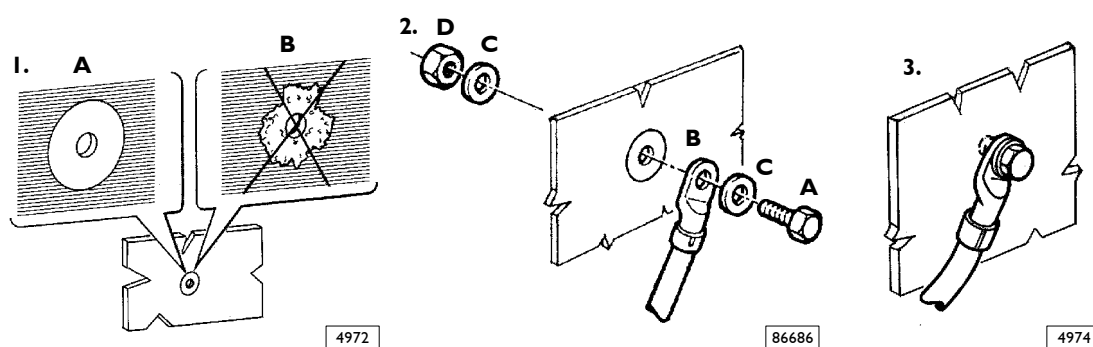
**The vehicle's original ground connections should not be modified in principle. In the event that such connections need be displaced or addition ground points need be realized, use the holes found on the chassis as much as possible, taking care to:**

- **remove by mechanical means, i.e. by using a file and/or a suitable chemical, the paint both on the chassis side and on the terminal, until the anaphoretic paint is fully taken off the chassis, thus obtaining a base surface free from nicks and steps;**
- **apply a suitable paint with high electric conductivity properties between the cable terminal and the metal surface;**
- **connect the ground not later than 5 minutes after applying the paint.**

As regards the signal-related ground connections (e.g. sensors or low-absorption devices), do not use the standardized points for engine ground connection and chassis ground connection.

The additional signal grounds shall be positioned at different points from the power grounds.

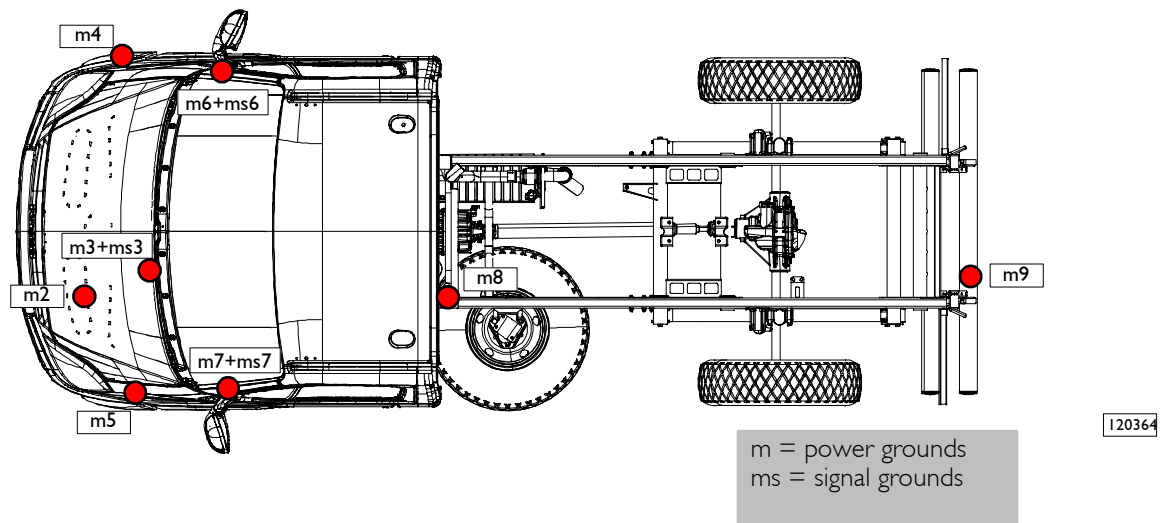
Figure 2.19



1. Ground connections: (A) in the first instance, connection is correct; (B) in the second instance, connection is incorrect -
2. Correct cable fastening to the ground point by using: (A) screw, (B) cable terminal, (C) washer, (D) nut -
3. Cable connected to the ground.



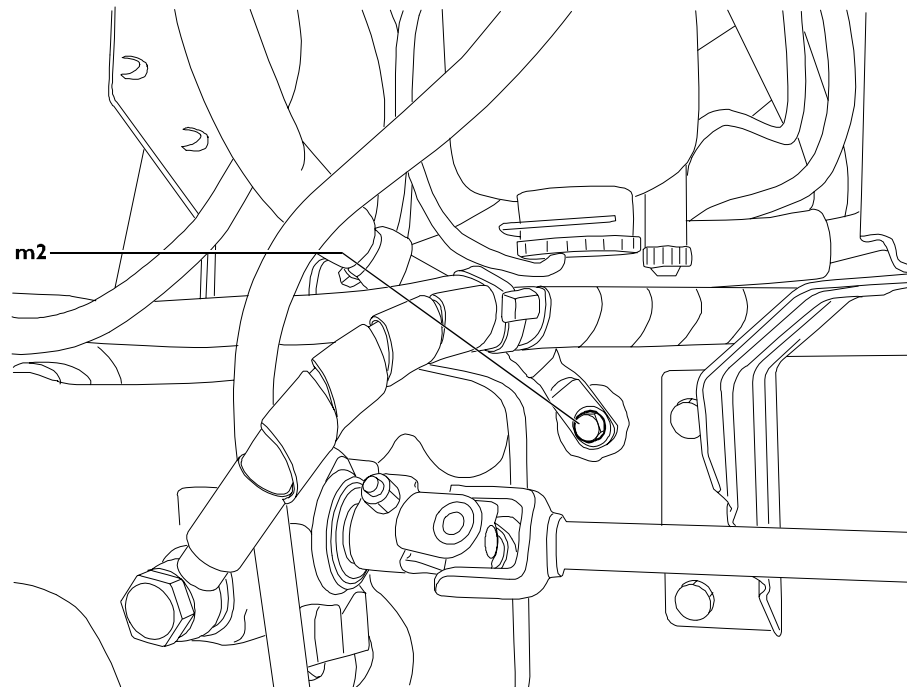
Figure 2.20



## GROUND POINTS AVAILABLE ON THE VEHICLE

m2. left chassis side member engine compartment ground - m3+ms3. engine compartment ground under the power brake  
 m4. engine compartment ground next to the front right headlamp - m5. engine compartment ground next to the left right headlamp - m6+ms6. right-side cab interior on the dashboard carrier - m7+ms7. left side cab interior on dashboard carrier  
 m8. Earth on frame behind cab - m9. Earth on left rear crossmember

Figure 2.21

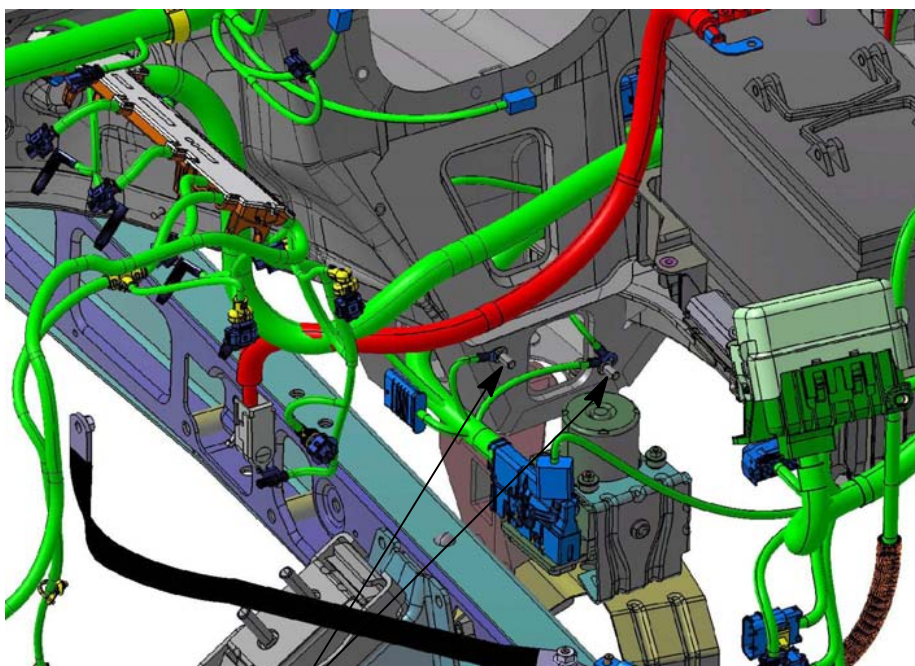


m2. Left frame rail engine compartment earth

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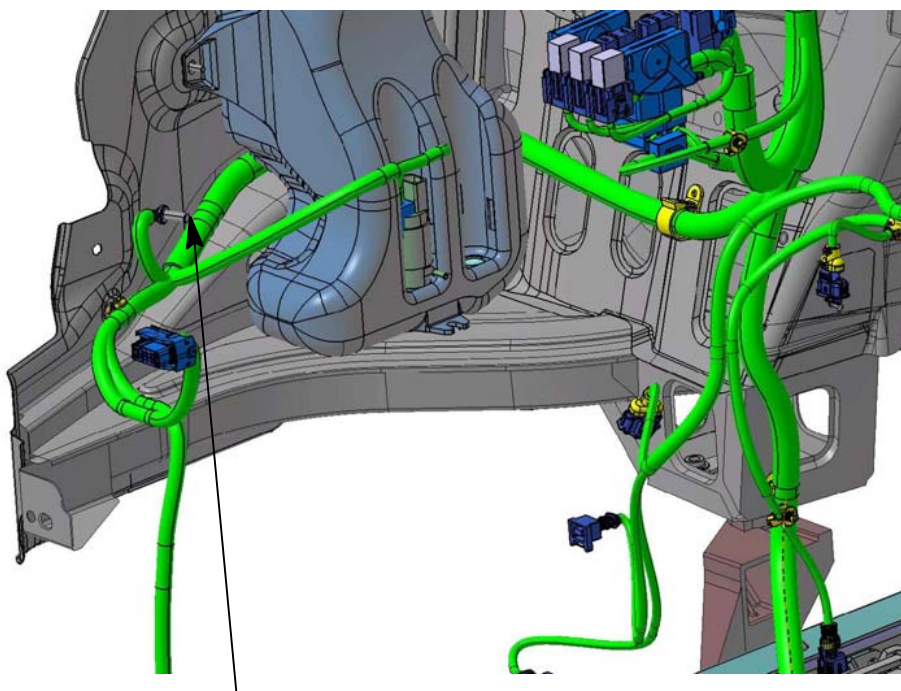
Figure 2.22



119372

m3 + ms3. Engine compartment earth beneath brake servo

Figure 2.23



119373

m4. Engine compartment earth near right front light





Figure 2.24

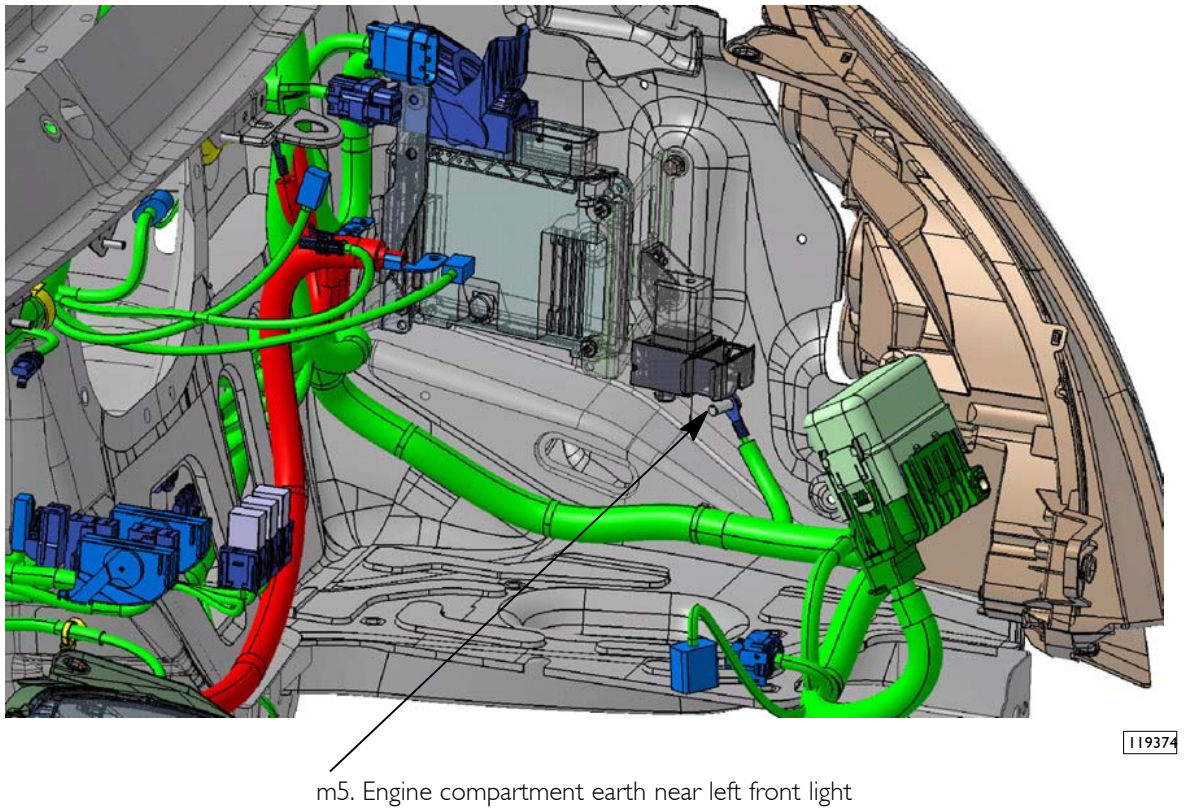
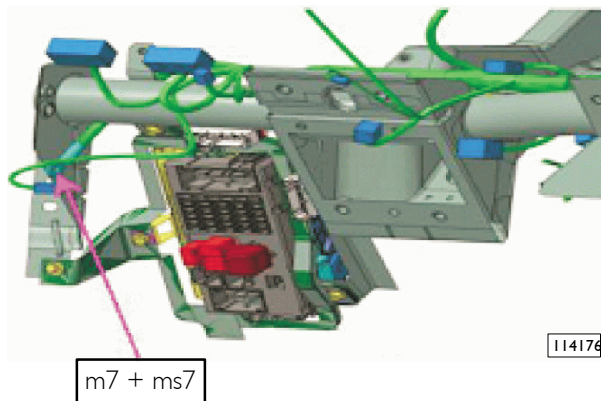
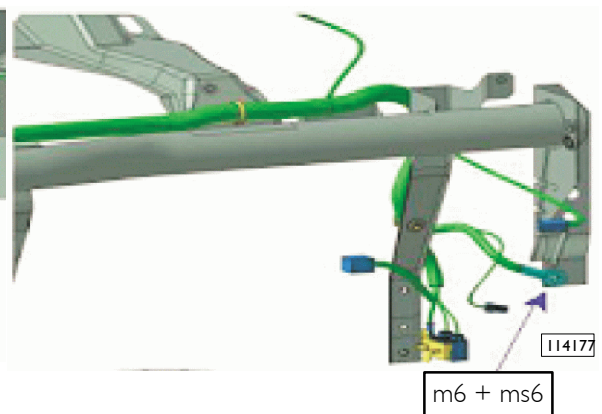


Figure 2.25



m7 + ms7. Left side cab interior earth on dashboard carrier

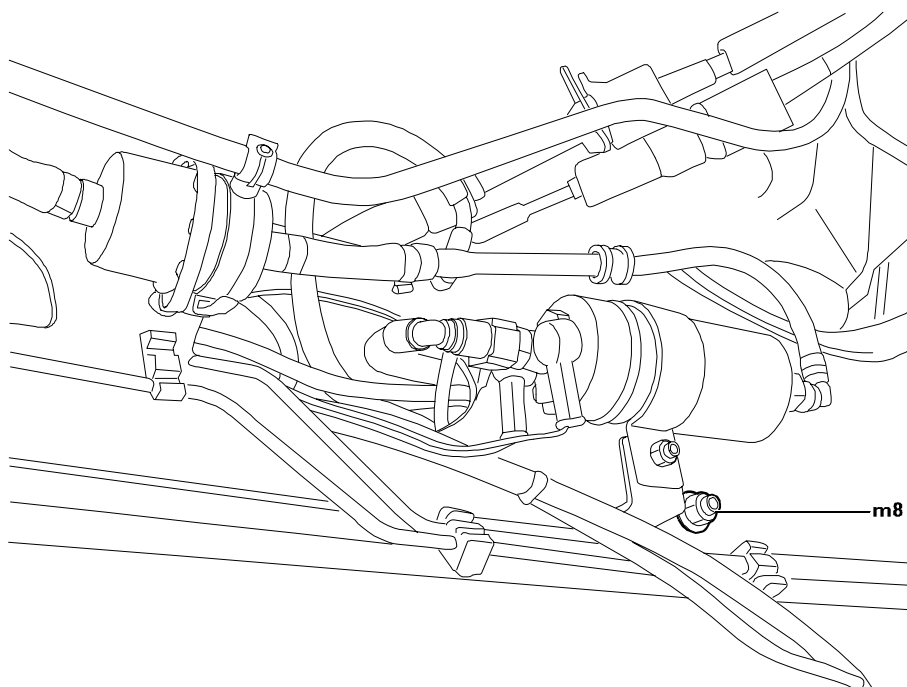
Figure 2.26



m6 + ms6. Right side cab interior earth on dashboard carrier



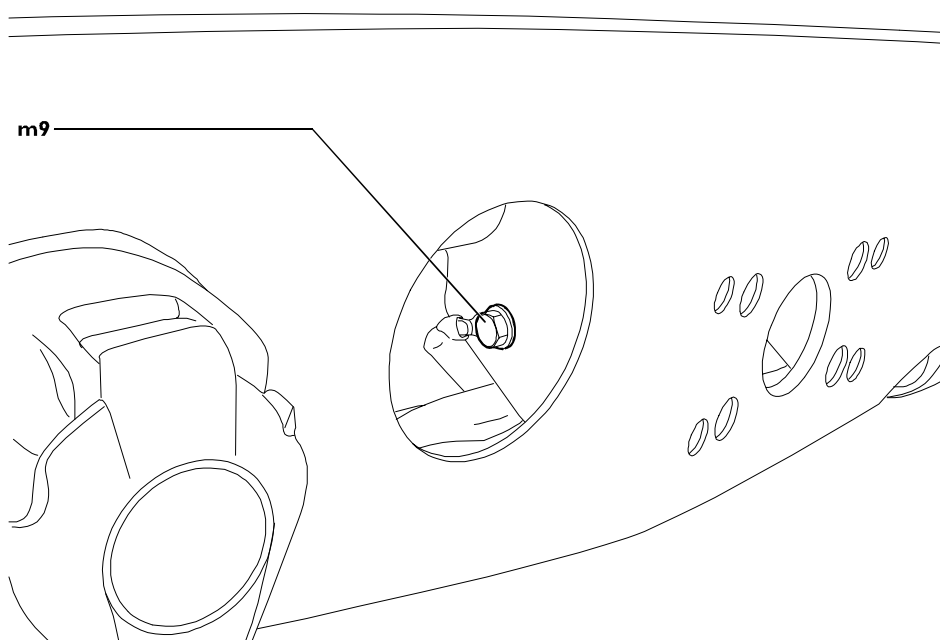
Figure 2.27



m8. Earth on frame behind cab

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Figure 2.28



m9. Earth on left rear crossmember

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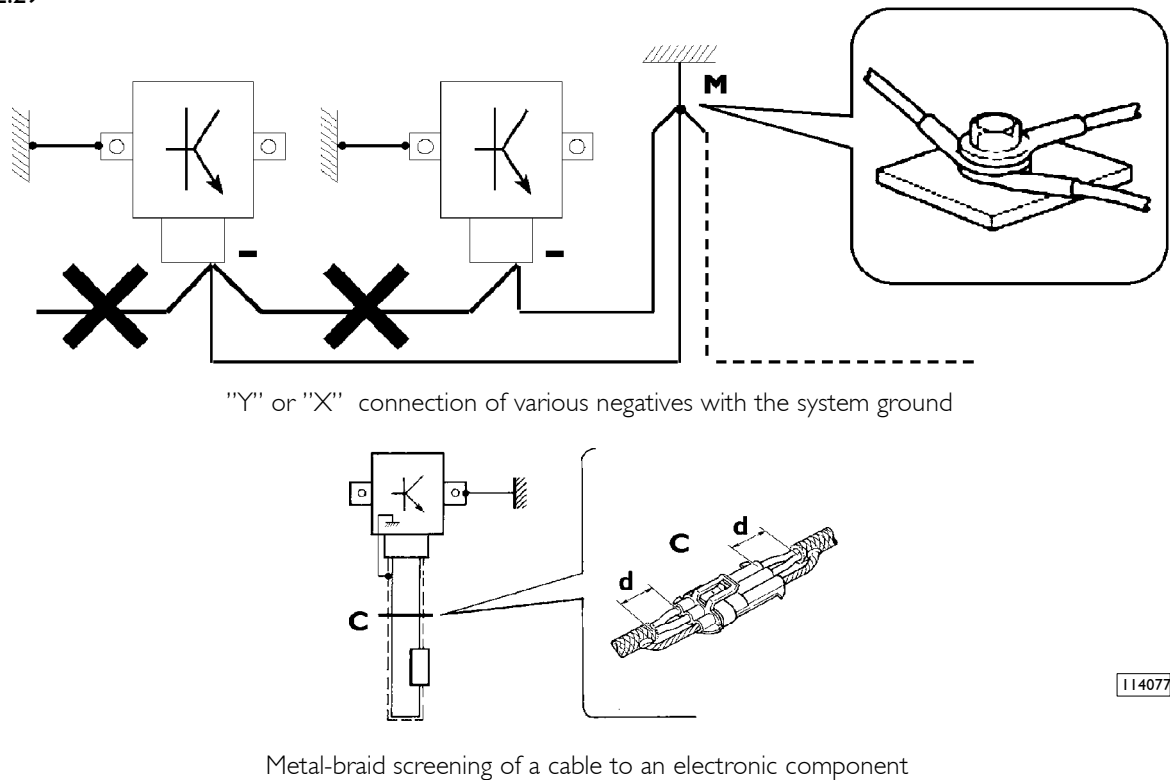


The negative leads connected to a system ground point shall be as short as possible and connected with one another according to a "Y" or "X" arrangements. Therefore, they shall be tightened as orderly and properly as possible.

As far as electronic components are concerned, the following instructions shall also be followed:

- The electronic control units shall be connected to the system ground when they are equipped with metal cases.
- The negative cables of the electronic control units shall be connected both to a system ground point and to the negative terminal of the battery.
- The analog grounds (sensor) shall feature very good conductivity, though they are not connected to the system ground/negative terminal of the battery. As a result, the greatest care shall be taken with the cable terminal stray resistance: oxidation, seaming defects, etc.
- The screened circuit metal braid shall come into electric contact only at the end facing the control unit into which the signal is fed.
- If junction connectors are available, the unscreened length "d" next to the same shall be as short as possible.
- The cables shall be laid in such a way that they are parallel to the reference plane, i.e. as near the chassis/body structure as possible.

Figure 2.29



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## 2.16.2 Electromagnetic compatibility

We recommend that electrical, electro-mechanical and electronic devices which comply with the following immunity requirements for electromagnetic emissions, both irradiated and conducted are used:

The level of electromagnetic immunity of the electronic devices equipping the vehicle, at a distance of 1 metre from the transmitting aerial must be:

- 50V/m immunity for devices performing secondary functions (not impacting on direct vehicle control), for frequencies varying from 20 MHz to 2 GHz.
- 100V/m immunity for devices performing main functions (not impacting on direct vehicle control), for frequencies varying from 20 MHz to 2 GHz.

The maximum admissible variation in transient voltage for units powered with 12V is +60V, as measured at the terminals of the artificial network (L.I.S.N.) during bench tests; otherwise, if the measurements are made on the vehicle, the variation must be determined at the most accessible point in the proximity of the device generating the disturbance.

**NOTE** The 12 V supplied devices must be free from immune from negative noises, such as -300V spikes, positive +100V spikes, +/-150V burst.

**They must operate correctly during voltage lowering phases to 5V for 40mS and to 0V for 2mS.**

**Moreover, they must resist the load dump phenomena up to 40V.**

Max levels measured on bench for radiated and driven emissions generated by 12V devices are shown in table below:

Table 2.17

Type of emission	Type of transducer	Type of disturbance	Type of detector	Frequency range and limits acceptable by noise in dBuV/m									Unit of measure
				150KHZ 300KHZ	530KHZ 2 MHz	5.9MHZ 6.2MHZ	30 -54 MHZ	68-87 MHz mobile services only	76-108 MHz broadcast only	142-175 MHZ	380-512 MHZ	820- 960 MHZ	
radiated	Aerial at a distance of 1 metre	Broad-band	Nearly peak	63	54	35	35	24	24	24	31	37	dBuV/m
radiated		Broad-band	Peak	76	67	48	48	37	37	37	44	50	
radiated		Narrow-band	Peak	41	34	34	34	24	30	24	31	37	
conducted	LISN 50 ohm/ 5 uH / 0,11 uF	Broad-band	Nearly peak	80	66	52	52	36	36	Not applicable			dBuV
conducted		Broad-band	Peak	93	79	65	65	49	49				
conducted		Narrow-band	Peak	70	50	45	40	30	36				

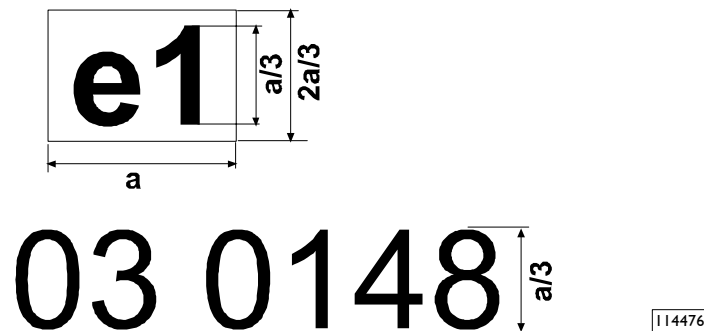
Use electrical/electronic equipment in compliance with the EC Directives on electromagnetic compatibility, i.e use suitable components for vehicle applications "e." marked (the EC marking is not sufficient). If in any doubt, call the IVECO Service Network.





Figure below an example of brand as required by the current European directive 2004/104/EC applicable for electromagnetic compatibility in the automotive sector:

Figure 2.30



$a \geq 6 \text{ mm}$

If in any doubt, call the IVECO Service Network.

These levels are granted only if the system comes from "IVECO Spare Parts" or it has been certified as per ISO, CISPR, VDE international regulations.

In case of systems which use the primary or secondary civil electric network (220V AC) as a supply source, the relevant characteristics have to comply with the IEC regulations.

### Two-way radio systems

The most frequent applications include:

- amateur receiver-transmitter units for CB and 2m bands.
- receiver-transmitter units for cellular telephones.
- GPS receiver and satellite navigation units.

The selection of the aerial to be installed is of remarkable importance to ensure max performance to receiver and transmitter equipment. It shall be of very good quality and installed with utmost care, even the mount position is of essential importance, as it determines the aerial efficiency, therefore its transmission range.

Therefore, the SWR (Stationary Wave Ratio), gain and generated electromagnetic field characteristics must be ensured within predefined limits, while impedance, efficient height, efficiency, orientability parameters are contained in manufacturer's technical card. The installation of 2m amateur CB sets, mobile phones (GSM) and satellite navigation systems (GPS) must use the power system already present on the vehicle. The connection is made directly to terminal 30 of connector ST40 (and I5, where necessary).

These units must be type-approved according to the applicable legal requirements and must be of the fixed type (non portable) type. The use of non type-approved receiver-transmitter units or supplementary amplifiers might affect the correct operation of standard on-board electrical/electronic devices, with adverse effects on vehicle and/or driver safety.



### Amateur equipment for CB and 2m band.

The installation of CB (27 MHz) and 2m (144 MHz) sets must use the power system provided on the vehicle. The connection is made to terminal 30 of connector ST40.

The systems must be legally type-approved and fixed (not portable). Install the transmitting part in a flat, dry area separate from the electronic components of the vehicle, away from humidity and vibrations.

The antenna must be installed outside the vehicle, possibly on a large metallic base as vertically as possible with the connection wire leading downwards. Follow the instructions and the manufacturer's warnings for assembly (see Figure 2.31).

- The SWR must be as close as possible to one. The recommended value is 1.5, while the maximum acceptable value must not in any case be greater than 2.
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient spatial uniformity, normally with deviations from the average value in the order of 1.5dB in the typical CB radio band (26.965-27.405 MHz).
- The **RADIATED CAB FIELD** value must be as low as possible. We suggest  $< 1 \text{ V/m}$  as a quality target. In any case, the value must not exceed limits imposed by current European guidelines.
- The aerial must therefore always be located outside the passenger compartment.

It is advisable to consider the following guidelines to ensure that the radio-cable-aerial is working effectively and assess whether the aerial is adjusted:

- 1) If the SWR is higher on low channels than high channels, extend the aerial.
- 2) If the SWR is higher on high channels than low channels, shorten the aerial.

After adjusting the aerial, it is advisable to re-check the SWR on all channels.

The best position to install the aerial is the centre of the roof because the earth plane is proportional in all directions, while installation on a side or any other part of the vehicle makes the earth plane proportional to the vehicle mass.

Cables involved in the installations should be connected and positioned taking care to:

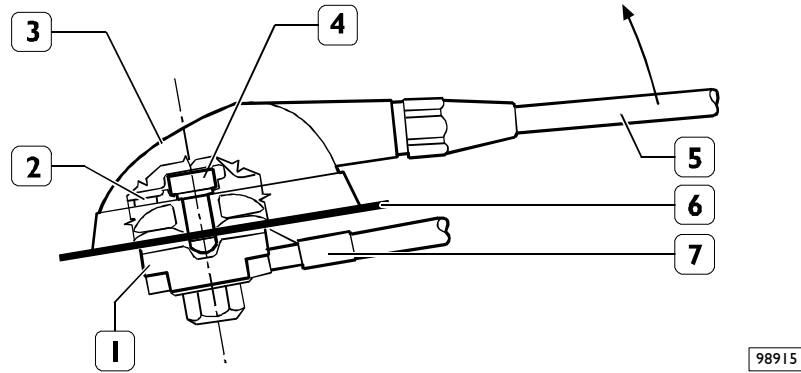
- Use a top-quality, low-loss coaxial antenna cable with the same impedance as the transmitter and the antenna. (see Figure 2.32).
- The coaxial cable run must be at a suitable distance (minimum 50 mm) from pre-existing wiring (TV, radio, telephone, amplifiers and other electronic devices) to prevent interference and malfunctioning. Ensure the minimum distance from the metallic structure of the cab. Cable installation on the left or right-hand side is preferable.
- Clean the lower part of the hole made in the body for installing the antenna in fixed position so that the antenna support is perfectly connected to the vehicle earth.
- The coaxial cable connecting the antenna to the radio must be fitted with the utmost care. Avoid curves or bends which can pinch or distort the cable. Avoid tangling. Shorten the wire as much as possible. Remember that any imperfections in the coaxial cable will cause severe interference for the radio transmitter.



- Use existing holes for routing the cable. Take all the necessary precautions for protecting the body if additional hole have to be drilled (use anti-rust paint, sheath, etc.).
- Ensure a good connection with the vehicle earth both at the base of the antenna and at the device fixing to ensure maximum power transfer.

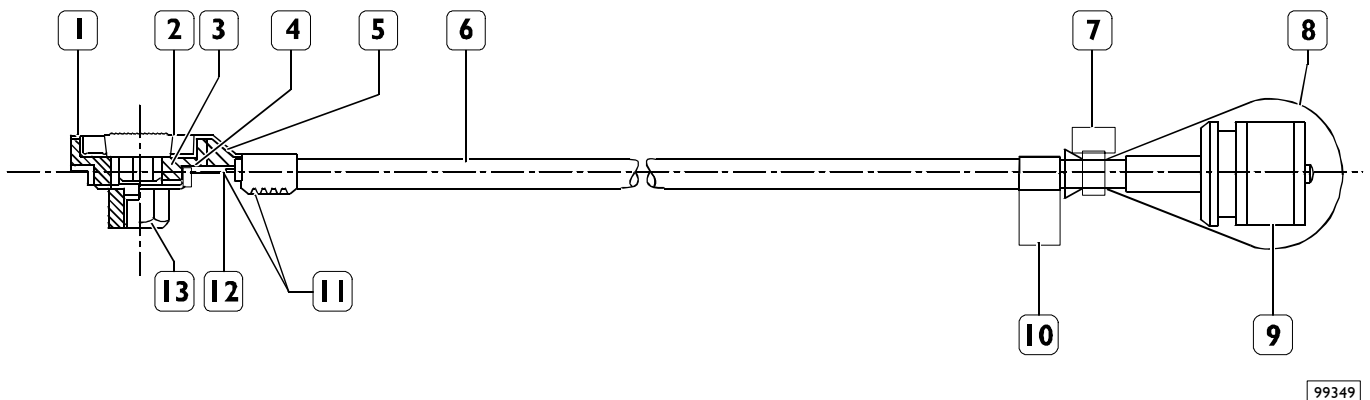
Radio transmitters are typically fitted on the dashboard in the gear lever area or in the header rail above the driver (see Figure 2.33).

Figure 2.31



1. Antenna support - 2. Gasket (P/N for spares 244614) - 3. Fixed joint cover (P/N for spares 217522) - 4. Fixing screw M6x8.5 (torque to 2 Nm) - 5. Antenna (spare P/N for complete rod 675120) - 6. Roof - 7. Antenna extension lead

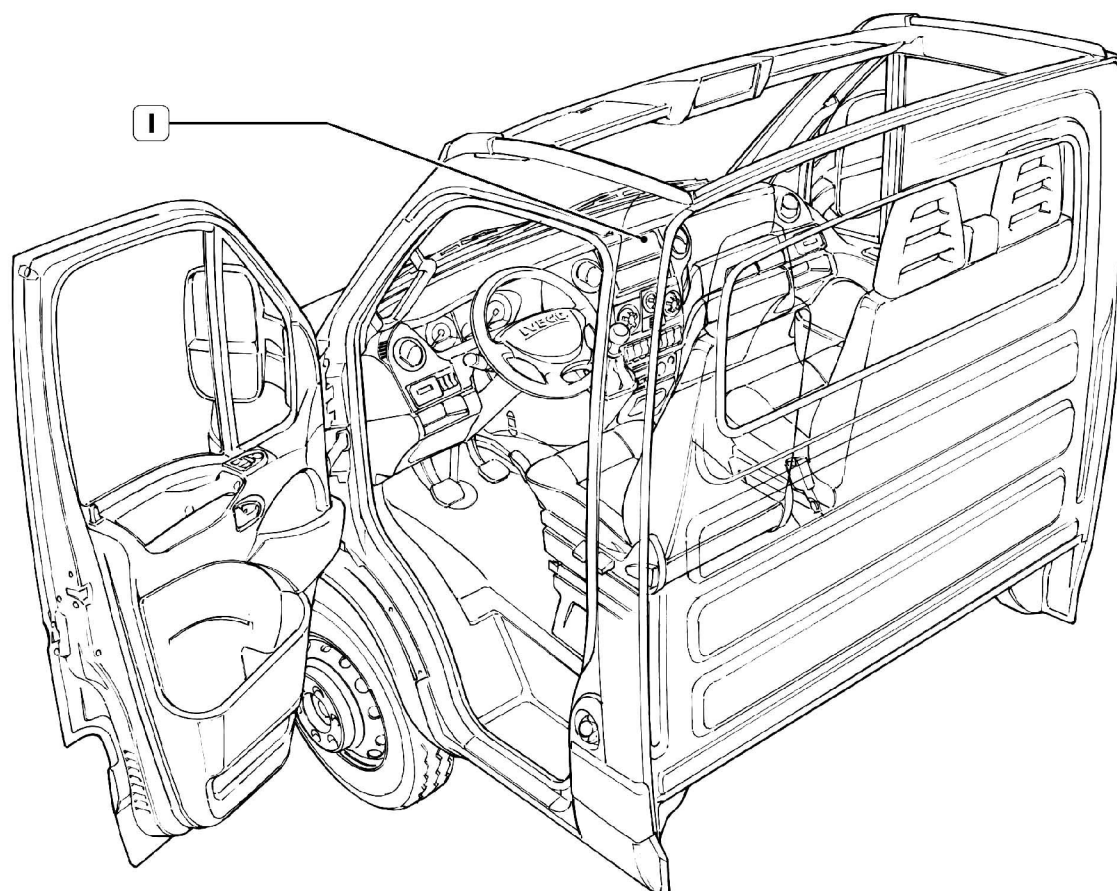
Figure 2.32



1. Antenna connector - 2. Ground wire - 3. Insulator - 4. Signal wire - 5. Capacitor (100pF) - 6. Cable RG 58 (characteristic impedance = 50  $\Omega$ ) - 7. Clamp - 8. Protective cap - 9. Connector (N.C. SO - 239) transceiver side - 10. Test executed sticker - 11. The 100pF capacitor must be soldered on the lower pin and crimped to the ground braid - 12. The lower pin must be soldered to the core conductor of the cable - 13. Nut



Figure 2.33



119358

I. Location of the CB transceiver unit (City Band)

### Two-way systems for GSM/PCS/UMTS mobile phones

Cellular telephone systems must be installed using the power system provided in the vehicle. Connect to terminal 30 via a supplementary fuse.

The devices must be legally type-approved and fixed (not portable). Install the transmitting part in a flat, dry area separate from the electronic components of the vehicle, away from humidity and vibrations.

- The SWR must be as close as possible to one. The recommended value is 1.5, while the maximum acceptable value must not in any case be greater than 2.
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient spatial uniformity, normally with deviations from the average value in the order of 1.5dB in the 870-960 MHz band and 2 dB in the 1710-1880MHz band.
- The **RADIATED CAB FIELD** value must be as low as possible. We suggest  $< 1 \text{ V/m}$  as a quality target. In any case, the value must not exceed limits imposed by current European guidelines.
- **For this reason**, the aerial must always be placed on the outside of the vehicle cab, if possible on a broad metal base fitted as upright as possible with the connection lead facing downwards, observing the Manufacturer's installation instructions and warnings.

The ideal location of the antenna is on the front of the cab roof at a distance no less than 30 cm from other antennas.



Follow the precautions below when connecting and arranging the wires:

- Use a top quality cable particularly as concerned to the protective shielding.
- The cable route must be at a suitable distance (minimum 50 mm) from pre-existing wiring. Ensure the minimum distance from the metallic structure of the cab. Avoid excessively pulling or pinching the cable. Installation on the left or right-hand side is preferable.
- Never shorten or extend the coaxial antenna cable.
- Use existing holes for routing the cable. Take all the necessary precautions for protecting the body if additional hole have to be drilled (use anti-rust paint, sheath, etc.).
- Ensure a good connection with the vehicle earth both on the base of the antenna and at the device fixing to ensure maximum power transfer.

Cellular telephones are typically fitted on the dashboard in gear lever area or in the header rail above the driver.

### GPS antenna cable and navigation system installation

Correct and careful assembly of GPS antennas in the vehicle is extremely important for correct operation and maximum performance.

The antennas should if possible be fitted in a concealed position where they cannot be seen.

Arranging the GPS antenna is a delicate matter. The power of the signal received from the satellite is very weak (approximately 136dBm), so any obstacle can effect quality and performance of the receiver.

- The **SWR** must be as close as possible to one. The recommended value is 1.5, while the maximum acceptable value must not in any case be greater than 2 in the GPS frequency range (1575.42 + 1.023 MHz).
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient spatial uniformity, normally with deviations from the average value in the order of 1.5dB in the 1575.42+1.023 MHz band.

The GPS antenna must be installed in a position ensuring maximum visibility of the sky.

The minimum angle of visibility must be 90°. Sky visibility must not be obscured by objects or metallic structures. The installation position must be horizontal.

The ideal location for the GPS antenna is under the plastic dashboard in the middle and at the base of the vehicle windscreen.

Do not install the antenna under any type of metallic structure in the cab.

Position the GPS antenna at a distance which is not less than 30 cm from another antenna.

Follow the precautions below when connecting and arranging the wires:

- use a top quality cable particularly concerning the protective shielding.
- The wire course must be at a suitable distance (minimum 50 mm) from pre-existing wiring. Ensure the minimum distance from the metallic structure of the cab. Avoid excessively pulling or pinching the cable. Installation on the left or right-hand side is preferable.
- Never shorted or extend the coaxial antenna cable.
- Use existing holes for routing the cable. Take all the necessary precautions for protecting the body if additional holes have to be drilled (use anti-rust paint, sheath, etc.).
- Ensure a good connection with the vehicle earth both on the base of the antenna and at the device fixing to ensure maximum power transfer.

Navigation systems must be installed using the power system provided in the vehicle. Connect to terminal 30 via a supplementary fuse.

The devices must be legally type-approved and fixed (not portable). Install the transmitting part in a flat, dry area separate from the electronic components of the vehicle, away from humidity and vibrations.



## Installation of IVECO original radio

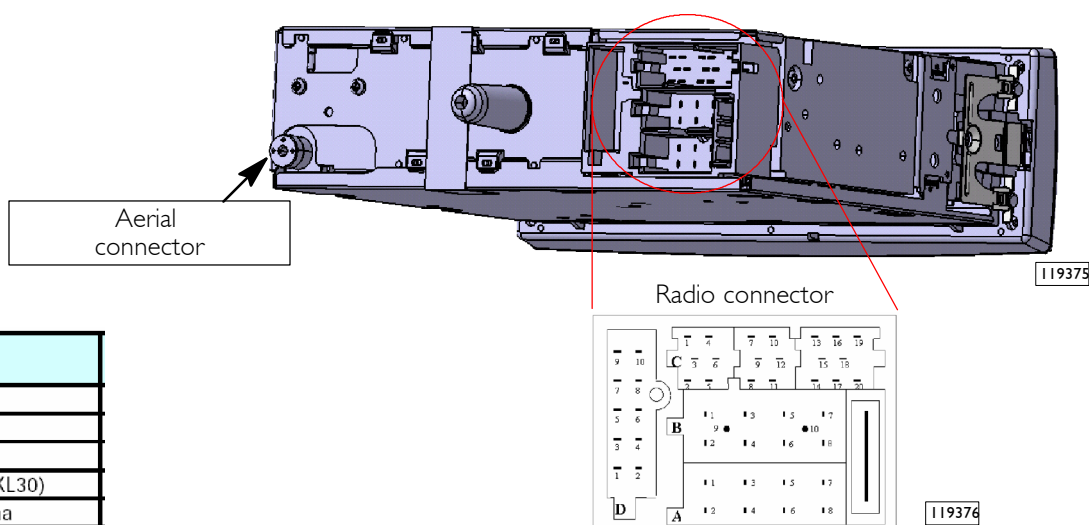
The radio comes in two configurations:

- Radio with CD player
- Radio with CD+MP3 player

The IVECO radio is built into the system on the CAN network and allows:

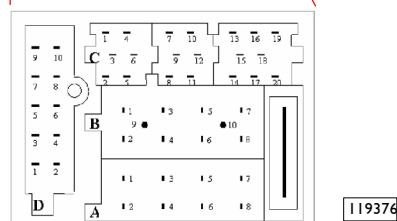
- Message repetition to comfort control panel
- Volume adjustment according to vehicle speed
- Integration with Convergence V2 system
- Recognition/antitheft system with body computer

If the original radio is not present, an aftermarket radio may be fitted.



Box Pin	Description
A 1	CAN-B (CAN-H)
A 2	NC
A 3	CAN-A (CAN-L)
A 4	Permanent 12V (KL30)
A 5	Automatic Antenna
A 6	NC
A 7	NC
A 8	GND (KL31)
B 1	LS RR +
B 2	LS RR -
B 3	LS RF +
B 4	LS RF -
B 5	LS LF +
B 6	LS LF -
B 7	LS LR +
B 8	LS LR -
B 9	MAUS Bus out
B 10	MAUS Bus in

119377



### 2.16.3 Additional equipment

Where the set power supply requires a voltage other than the system voltage, this must be obtained by means of an appropriate DC/DC 12-24V converter/inverter unless one is already fitted. The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.



**When installing devices that could interact with other electronic systems, namely: Retarders, Extra heaters, Power take-offs, Air conditioners, Automatic transmissions, Telematics and Speed limiters - contact IVECO to for efficient application.**

**NOTE** For the operations which might cause interference with the basic system, it is necessary to carry out diagnostic checks in order to make sure that the system has been properly fitted. These tests can be carried out using on-board diagnostic ECUs (Electronic Control Units) or IVECO service.

**IVECO reserves the right to void vehicle warranty if work is carried out in a way which does not comply with IVECO directives.**



**Using receiving-transmitting devices not approved or fitting auxiliary amplifiers may seriously affect correct operation of the electric/electronic units fitted to the vehicle, with adverse effects on the vehicle and/or driver safety.**



**Any damage to the system caused by the use of receiving-transmitting units not approved or the addition of auxiliary amplifiers shall not be covered by the warranty.**

The vehicles system is designed to provide the necessary power to all the standard equipment. Each piece of equipment has its own specific protection for its own function and the appropriate dimensions of the wires.

Fitting of additional equipment must include the provision of suitable protection and must not overload the vehicle's system.

The earth connections of the additional devices must be made with a cable of an adequate size. It should be as short as possible and permit movement of the apparatus in relation to the chassis of the vehicle.

If batteries of a greater capacity are used, due to the demand of the added loads, it is advisable to fit optional batteries or alternators with a greater capacity.

In any case we recommend that the increase in the capacity of the batteries should not exceed 20 to 30% of the maximum values provided as an optional extra by IVECO so as not to damage some components of the system (e.g. Starter motor). If greater capacities are required, use additional batteries making the necessary arrangements for recharging as described below.



## Supplementary batteries

The addition of an auxiliary battery to the vehicle circuit shall provide for a separate recharging system, which shall be integrated with the vehicle one. In this case, auxiliary batteries with the same capacity as the original ones (110 Ah) should be provided, to ensure correct recharging of all the batteries.

In the event that an auxiliary battery is to be installed:

- in the passenger compartment, the following batteries can be used:

- a) recombination batteries (AGM or gel)
- b) traditional batteries.

In both cases, the battery must be completely separated from the occupants in the vehicle. A suitable air tight container could be used in case of:

- vapour escape (e.g. in case of alternator voltage regulator failure);
- battery explosion;
- electrolyte leaks, even in case of vehicle overturning.

In the event that type "A" batteries are used:

- a vent to the passenger compartment exterior shall be provided.

In the event that type "B" batteries are installed, the batteries shall be equipped with:

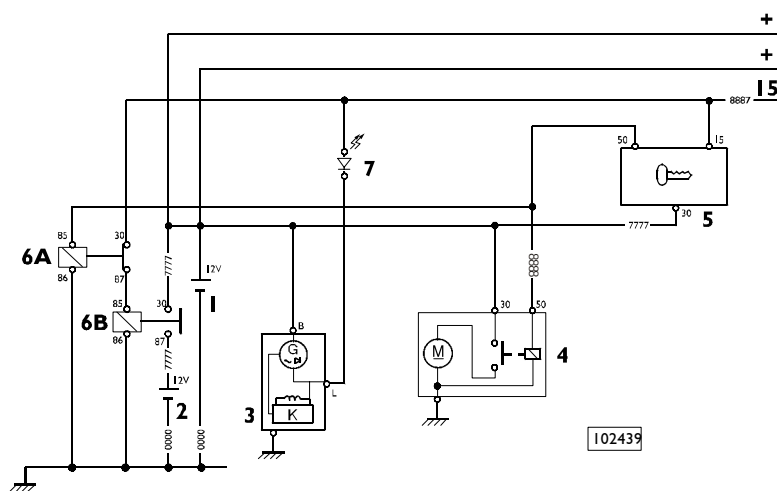
- a cover with a system for blowing the gas off to the outside, fitted with tube for conveying the acid spray to the outside;
- a flame anti-return system by means of a porous pellet (flame arrester).

Moreover, gas escape shall take place far from points liable to spark ignition as well as mechanic/electric/electronic members and parts. The exhaust shall be positioned in such a way that vacuum shall not be generated inside the battery.



**Ground connection of the added battery shall be made by using a cable of adequate section, as short as possible.**

Figure 2.34



**NOTE. THE DIAGRAM IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY**

1. Standard battery - 2. Auxiliary battery - 3. Alternator with built-in regulator - 4. Starting motor - 5. Ignition key - 6. Remote-control switches - 6B. Proper remote-control switch dimensioning based on only the loads powered by the auxiliary battery (2) - 7. No battery recharge warning light



**All the lines downstream all the batteries shall be adequately protected, under any possible fault condition. Failure to ensure adequate protection may pose a fire hazard and a danger to the persons.**





### Auxiliary alternators

The vehicle's electric system has been designed to supply the necessary power to the installed pieces of equipment. Both the specific protection and correct cable dimensioning are ensured for all the pieces of equipment, within the context of their own functions.

The addition of auxiliary pieces of equipment shall provide for suitable protections and shall not overload the vehicle system.

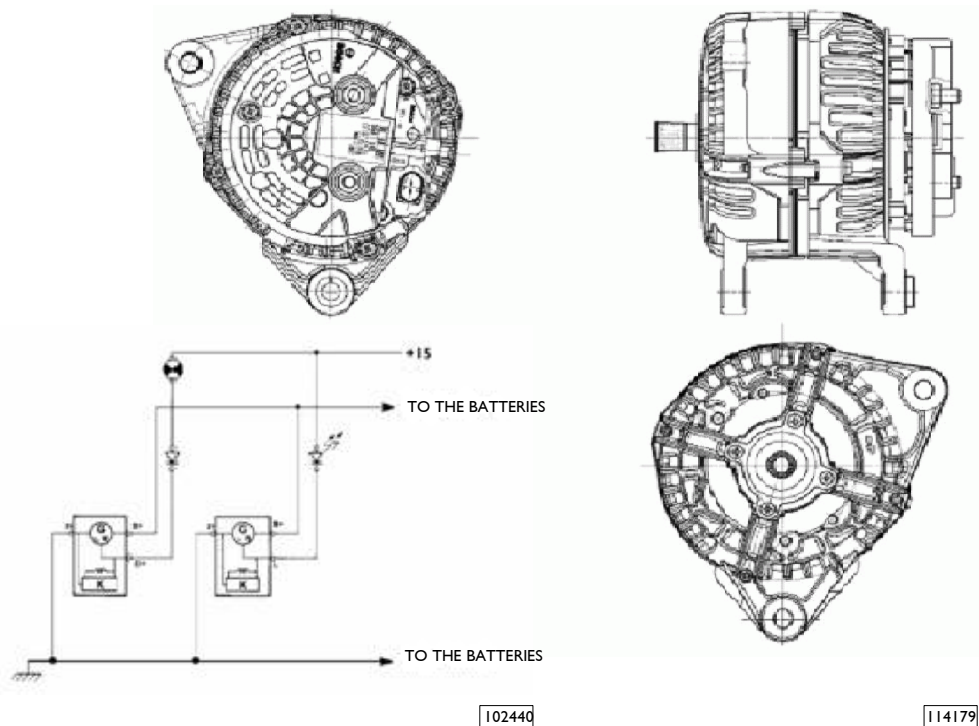
In the event that an extra battery has to be used in parallel to the standard one, it is recommended that a heavy duty alternator is used or an auxiliary alternator is fitted.

The auxiliary alternator shall be of the type equipped with Zener-diode rectifiers, to avoid possible damage to the installed electric/electronic pieces of equipment owing to accidental battery disconnection. Moreover, every single alternator shall feature a warning light or LED signalling failed battery recharge.

The auxiliary alternator shall feature the same characteristics as the standard one, and the cables shall be properly dimensioned.

In the event that modifications other than the ones described in this manual need be made to the system (e.g. adding several batteries in parallel), the operation shall be carried out together with the IVECO experts.

Figure 2.35



**NOTE.** THE DIAGRAM IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY

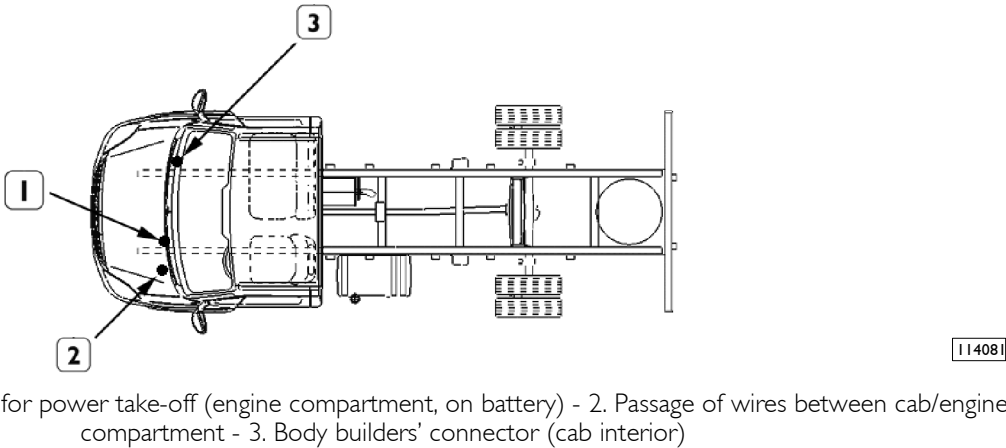


2.16.4 Current drawing

Precautions:

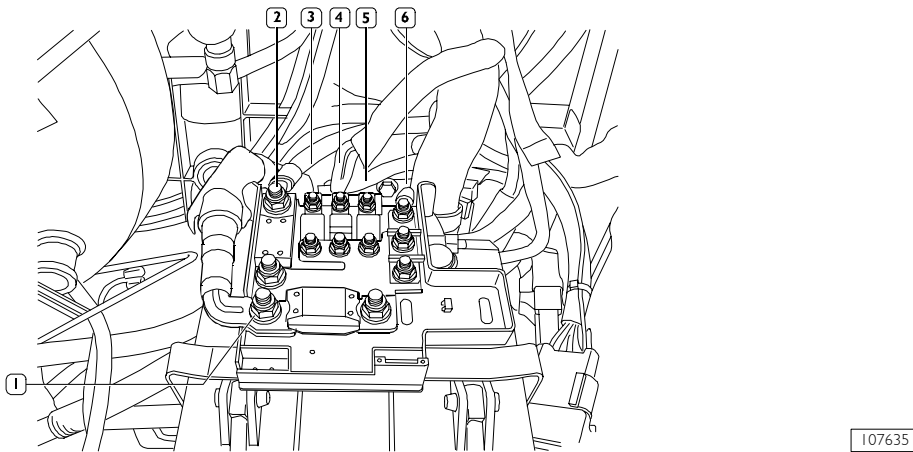
The points where current can be drawn and the instructions to be followed are described below.  
Protection fuses MUST be used and fitted next to the point where the power is taken.  
The added cables shall be protected by running them inside special sheathes or corrugated pipes. They shall be installed in accordance with the instructions given in paragraph 2.16.5.

Figure 2.36



CBA voltage supply (on battery)

Figure 2.37

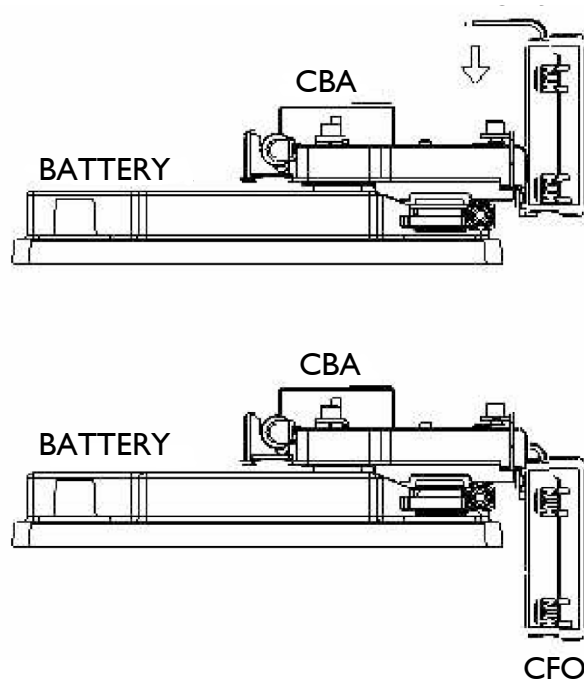


Ref.	Function	Fuse range	Sect.
1	Positive +30 for alternator motor	500	50
2	Positive for engine opening central unit "CVM"	150	35
3	Positive +30 for CPL - Dashboard control unit secondary loads	70	10
4	Positive +30 for CPL - Dashboard control unit primary loads	50	6
5	Positive +30 for box OPT	70	10
6	Positive +30 - Wiring for body builders' interface	-	-



A distribution and protection control unit ( CBA) is installed on the battery. This is fitted with a power take-off for body builders. The body builders' node is installed on stud no. 6 of the CBA.

Figure 2.38



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### Installation precautions

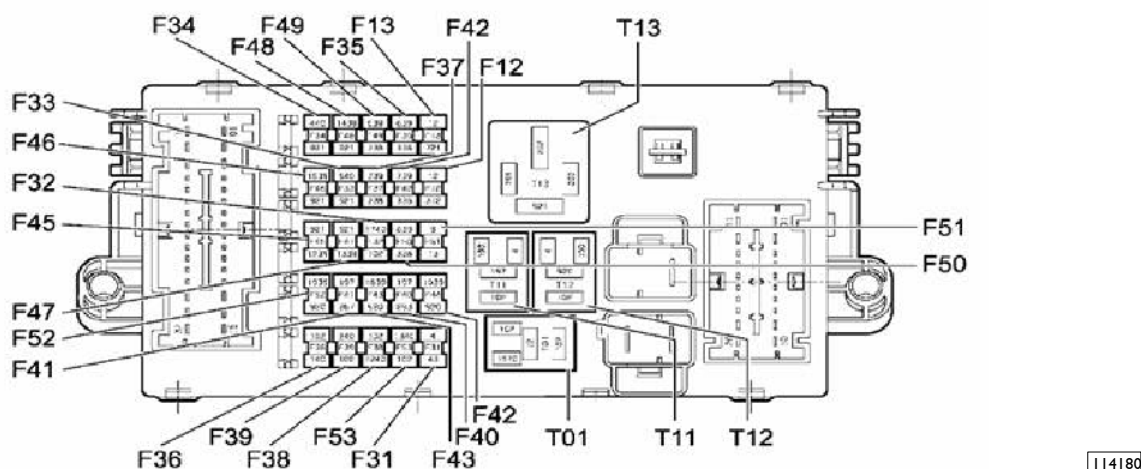
- 1) Do not lose any parts when overturning the component.
- 2) Fuses must not be removed from their position during installation.
- 3) Fit terminals on the studs and secure with nuts (M5 flanged nut, self-locking nut, etc.). Tighten the nuts to torque (4 min - 6 max Nm)
- 4) Then secure the CFO (Centralina Fusibile Opzionale - optional fuse unit) to the CBA control unit, taking care to fit the hole in the strip over the stud (M8 flanged nut, self-locking nut, etc.) of the battery terminal (built into the CBA) and tighten the nut to the required torque ( 8.8 min - 13.2 max Nm).



### Fuse and relay box under the dashboard

It is located in a special compartment, which can be closed by means of a snap-in drawer.

Figure 2.39



Only fuses of the prescribed type and rated current values shall be used - Danger of fire.

The fuses shall be replaced only after the cause of their actuation is eliminated. Cables shall be checked for integrity.

Table 2.18

Fuse	Utilization	Rated capacity
F-12	Right low-beam headlight	7.5 A
F-13	Left low-beam headlight - headlamp trim corrector	7.5 A
F-31	Relay T08-T17 in CVM and BC	3 A
F-32	Not used	15 A
F-33	Air heater/cigar lighter	15 A
F-34	Current draw	20 A
F-35	STANLEY solenoid	10 A
F-36	Central locking	20 A
F-37	Switch for brake lights and miscellaneous loads under 15	5 A
F-38	BC-ceiling light internal relay power supply	10 A
F-39	Car radio - tachograph	15 A
F-40	Not used	10 A
F-41	Not used	10 A
F-42	Reversing light switch	5 A
F-43	Windscreen wiper	20 A
F-44	Spare	-
F-45	DDC and CDDC	3 A
F-46	Spare	-
F-47	Driver window regulator	25 A
F-48	Passenger window regulator	25 A
F-49	Air conditioner/car radio/heated seat ECU	15 A
F-50	Not used	5 A
F-51	Tachograph	5 A
F-52	Spare	-
F-53	Main vehicle panel - rear fog light	7.5 A

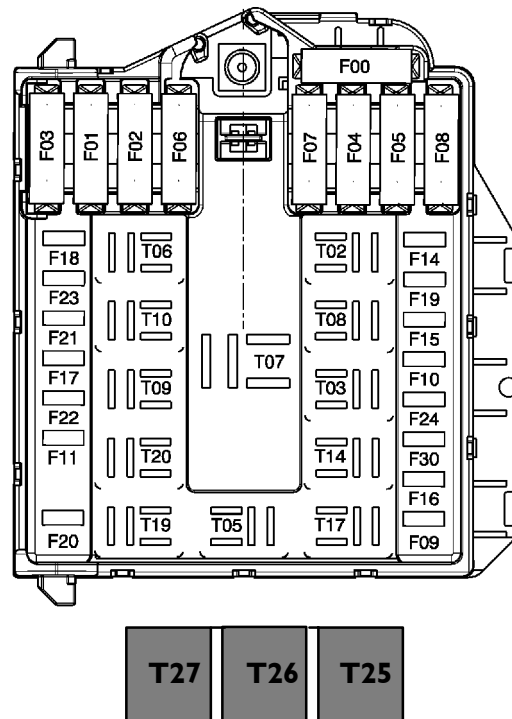
Table 2.19

Relay	Utilization	Rated output
T01	Right and left low-beam headlights	7.5 A
T11	Not used	7.5 A
T12	Cigar lighter/heater takeoff or air conditioner	3 A
T13	Power discharge from the key	15 A



### Fuse and relay box in the engine compartment (CVM)

Figure 2.40



114179

Table 2.20

Fuse	Utilization	Rated capacity
F-0	Ignition spark plugs	60 A
F-1	Not used	40 A
F-2	Not used	30 A
F-3	Not used	30 A
F-4	Siren	30 A
F-5	Ignition switch	30 A
F-6	Fan electromagnetic coupling (Baruffaldi)	20 A
F-7	Side lights	20 A
F-8	Heater or air conditioner fans	30 A
F-9	Windscreen washer	20 A
F-10	Warning horn	7.5 A
F-11	EDC I 6 (secondary loads)	10 A
F-14	Right high-beam headlight	7.5 A
F-15	Left high-beam headlight	7.5 A
F-16	EDC I 6, T02, T14 auxiliary heater	5 A
F-17	EDC I 6 (primary loads)	15 A
F-18	Not used	10 A
F-19	Fan electromagnetic coupling (Baruffaldi)	5 A
F-20	Fuel filter heater	25 A
F-21	Fuel pump	15 A
F-22	EDC I 6 (primary loads)	25 A
F-23	Auxiliary heater	10 A
F-24	PTO	15 A
F-30	Left and right fog light	15 A



Table 2.21

Relay	Utilization	Rated output
T02	Right and left high-beam headlights	20 A
T03	Warning horn	20 A
T05	Fan electromagnetic coupling power supply (Baruffaldi)	20 A
T06	Fan electromagnetic coupling power supply (Baruffaldi)	20 A
T07	Side lights	50 A
T08	Heater or air conditioner fans	20 A
T09	EDC 16 (main relay)	30 A
T10	Fuel pump	20 A
T14	Left and right fog lights	20 A
T17	Windscreen washer	20 A
T19	Fuel filter heater	20 A
T20	MODUS or E.A.S.Y. diagnosis	20 A

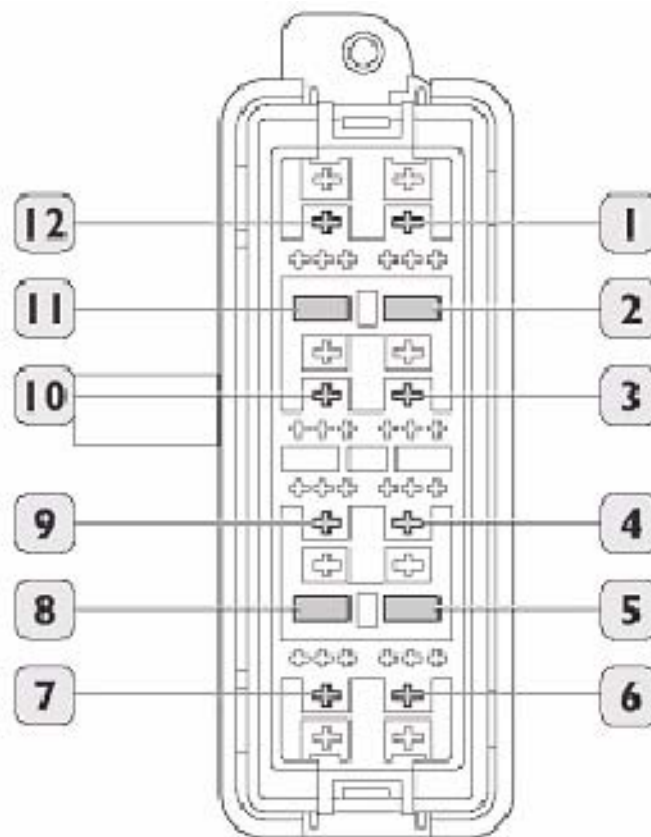
Table 2.22

Not incl. in control unit	Utilization	Rated output
T25	Windscreen wiper switch-on/switch-off	10/20 A
T26	Windscreen wiper speed 1 & 2	10/20 A
T27	Mirror/windscreen power supply	20 A



### Optional fuse box (engine compartment)

Figure 2.41



114080

Table 2.23

Relay	Drawing ref.	Utilization	Rated output
T04	1	Rotary lights	20 A
T16	12	Working lights	10 A
T15	3	Free	-
T22	4	Air conditioning compressor actuation	20 A
T18	6	Baruffali cut-out	20 A
T24	7	Power takeoff actuation enable	20 A
T23	9	Air conditioning compressor	20 A
T21	10	Compressor ON signal fro EDC 16	20 A

Table 2.24

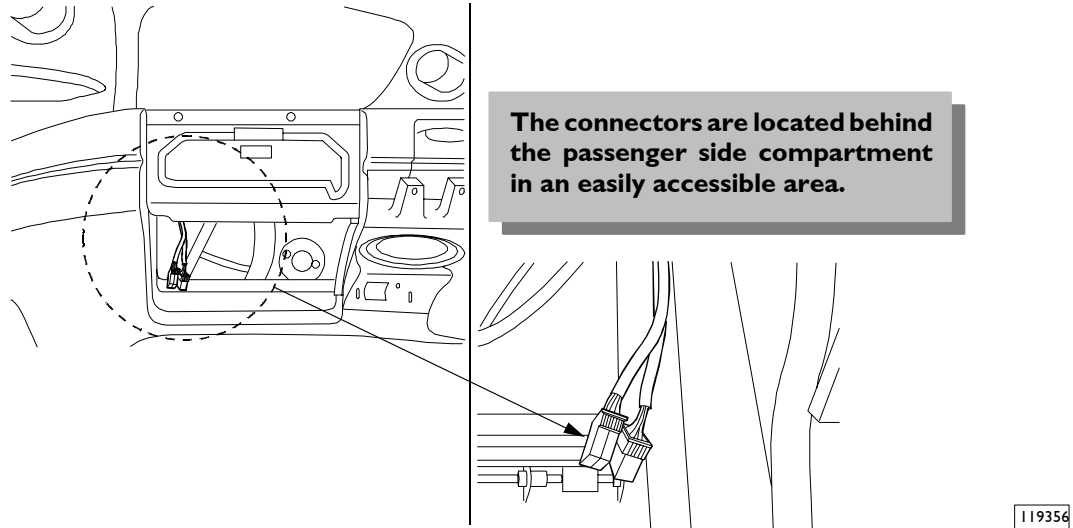
Not incl. in control unit	Drawing ref.	Utilization	Rated output
F-55	2	Rotary lights	10 A
F-25	5	Trailer connector	10 A
F-28	8	APU power supply	15 A
F-27	11	Working lights	10 A



### Body builders' connectors (cab interior)

The new Daily is fitted with two connectors to be used by body builders to interface with the vehicle electrical system.

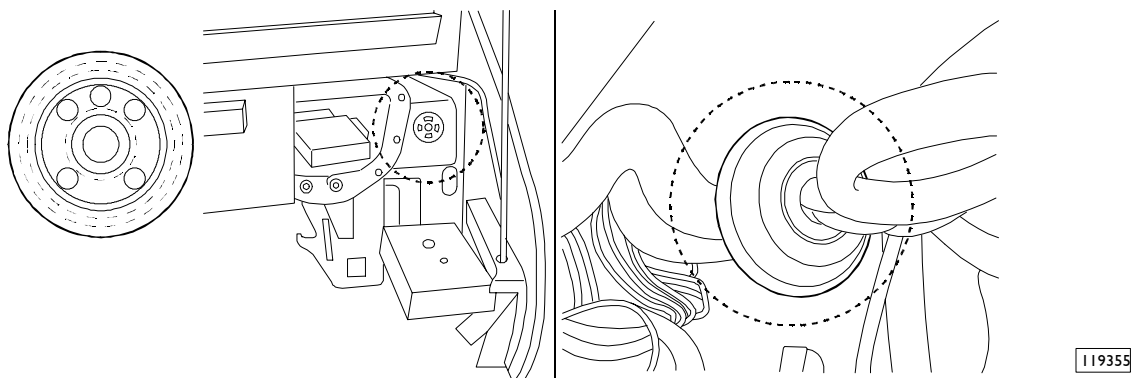
Figure 2.42



### Passing cables from inside the cab to outside

Electric cables may be passed from outside the cab to the engine compartment through five 10 mm diameter holes stamped in the bulkhead coupling near the brake servo. Seal the cable routing point to prevent fumes passing from the engine compartment to the cabin.

Figure 2.43



**Any damage caused by failure to comply with procedure is not covered by the warranty.**

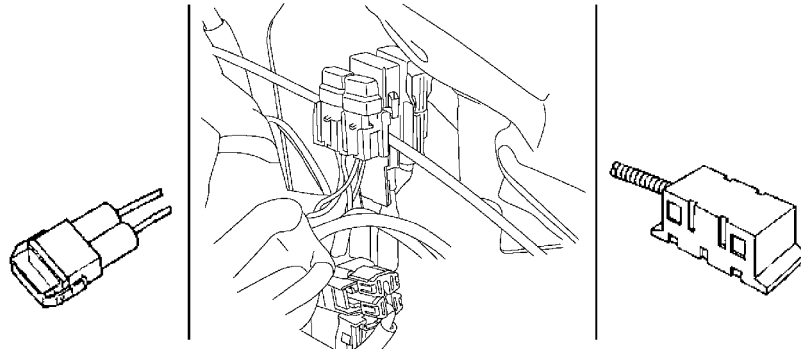




### Maxifuse and megafuse fuses

Fuse holder are available at the IVECO shops, to protect high-absorption current drawing. They shall be positioned (as near the battery drawing terminal as possible) by the body builder depending on the space available on the vehicle.

Figure 2.44



119357

Capacity	IVECO ref. no.	Cable section
KIT 40A	4104 0110 KZ	10 mm <sup>2</sup>
KIT 60A	4104 0111 KZ	10 mm <sup>2</sup>

Capacity	IVECO ref. no.	Cable section
KIT 100A	4104 0112 KZ	25 mm <sup>2</sup>
KIT 125A	4104 0113 KZ	35 mm <sup>2</sup>
KIT 150A	4104 0114 KZ	50 mm <sup>2</sup>

It should be pointed out that the current intensity shall, when grouping several cables, be reduced compared with the rated value of one single cable in order to compensate for smaller heat dispersion.

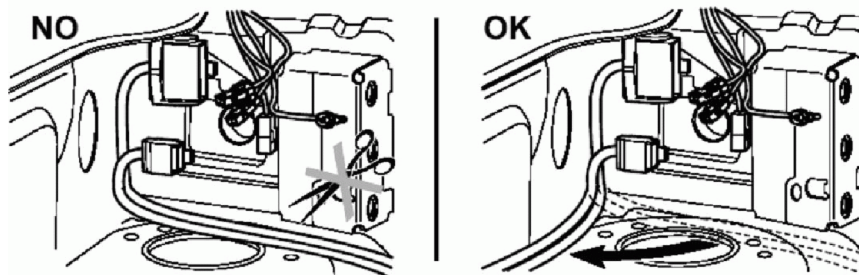
As regards the vehicles the engines of which are frequently started, in the presence of current drawing and short engine rotation time (e.g. vehicles equipped with refrigerating bodies), the battery shall be recharged at regular intervals in order to ensure efficiency of the same.

The connections with plugs and terminals shall be of the protected, weather-proof type. Components of the same type as the one originally fitted to the vehicle shall be used.

In the event that units and assemblies (various components, etc.) need be relocated due to special body building or vehicle conversion, such relocation shall be permitted providing:

In the event that a component has be installed just next to the route of a cable belonging to the original system, or a cable route needs be changed, the same can be relocated provided that its integrity is maintained (cuts shall not be made).

Figure 2.45



**Any damage caused by the failure to comply with the procedure shall not be covered by the warranty.**

**The airbag system components must not be displaced or tampered with for any reason whatsoever.**



### 2.16.5 Additional Circuits

These must be separated and protected by a fuse from the vehicle's main circuit.

The cables utilised must be of a size that is suitable for the relative functions and must be well insulated. They must also be suitable protected in sheaths (not PVC) or routed through flexible conduits in the case of a plurality of functions (we recommended the use of polyamide type 6 plastic for flexible conduits) and they must be correctly installed in a place where they are protected from impact and heat sources. Take care to avoid any chaffing with other components, particularly with live edges of the bodywork. The transit of these cables through structural components (cross members, profiles, etc.) must be executed using suitable cable glands or protections; firstly the cables must be secured separately with insulated cable clamps (e.g. made of nylon) at adequate intervals (approx. 200 mm).

In the case of external panels use a suitable sealant on both the cable and on the panel, to avoid the risk of infiltration of water, dust, or fumes.

Establish suitable distance between electrical wiring harnesses and other components as follows:

- 10 mm from static components;
- 50 mm from moving components (minimum distance = 20 mm);
- 150 mm from components that generate heat (e.g. engine exhaust).

Wherever possible it is good practice to follow a different cable route for signal cables interfering at high absorbed intensity (e.g. electric motors, solenoid valves) and signals that are susceptible to low absorbed intensities such as sensors, maintaining in any event a position as close as possible to the metal structure of the vehicle in both cases.

Plug and terminal connections must be protected, resistant to weathering, and executed using components of the same type as those utilised originally on the vehicle.

Use cables and fuses with the characteristics shown in the following table in accordance with the current draw:

Table 2.25

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

<sup>1)</sup> For uses of more than 30 seconds.

<sup>2)</sup> Depending on the position and hence the temperature that may be reached in the housing, choose fuses that can be loaded to up to 70% - 80% of their maximum capacity.



**The fuse must be connected as close as possible to the current take-off point.**

#### Precautions

- Incorrect installation of electrical accessories may affect occupant safety and cause severe damage to the vehicle. Contact IVECO if you have any questions.
- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).

It should be noted that when grouping several cables together, in order to compensate for the lower heat dispersal capacity current intensity must be reduced with respect to the nominal value of a single cable.

- In vehicles subject to frequent engine starts, in the presence of power draws with limited engine running times (e.g. vehicles with refrigerated bodies) periodic battery charges are required to maintain optimal efficiency.



### 2.16.6 Operations to adjust overhang

If the length of the wires on the chassis are modified to accommodate the new overhang, a watertight joint must be used with the same specifications as those used on the standard vehicle. Components used - such as wires, connectors, terminals, ducts etc. - must be the same type as those used originally and must be fitted correctly.

As far as electronic control device function is concerned, no joins are permitted: the cable must be replaced by a new cable with the same specifications as that used on the vehicle, and of appropriate length.

### 2.16.7 Provision for trailer

If the tail-lights are repeated on the trailer, fit the vehicle with a 13-pin trailer point.

It is not permitted to connect directly to the original equipment tail-light lights. Connection to the original vehicle tail-lights could cause current overloads that will be indicated by the on-board computer as operating faults.

If it is necessary to make changes to the system other than those described in this manual (e.g. inclusion of LED lights), the operation must be carried out in conjunction with Iveco.

#### a) Trailer connector added by the body builder

If the vehicle is not ordered with a trailer point, a set may be ordered from parts. This consists of:

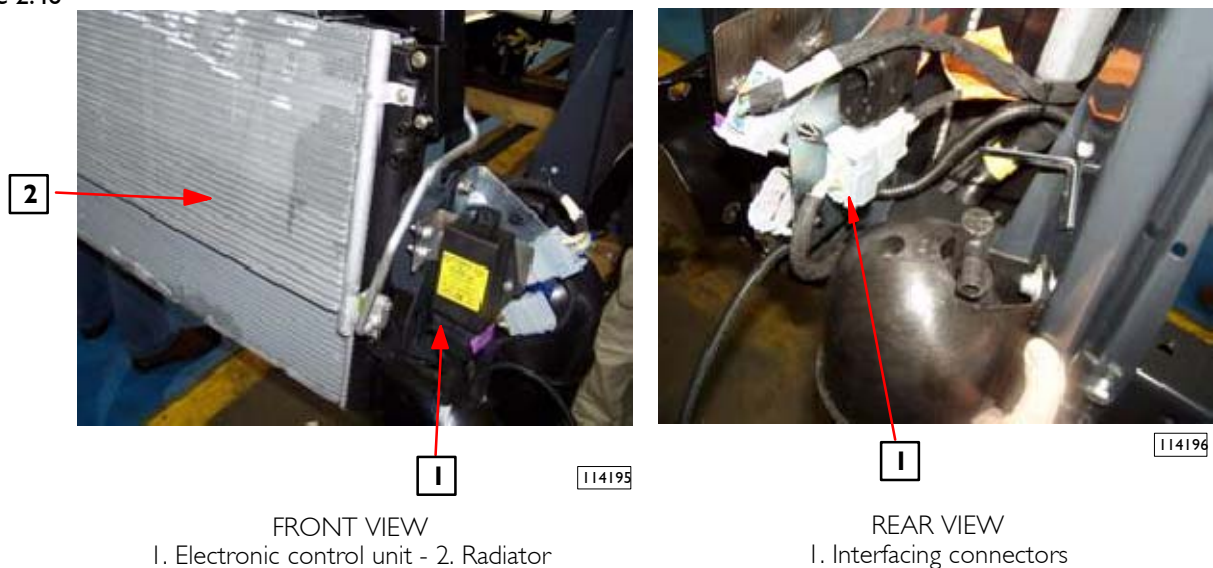
- electronic control unit;
- control unit fastening brackets;
- front bridle for connecting the control unit with the bonnet cable and chassis cable sectioning;
- chassis cable with 13-pole connector.

#### Installation

To ensure correct installation, the following instructions shall be followed:

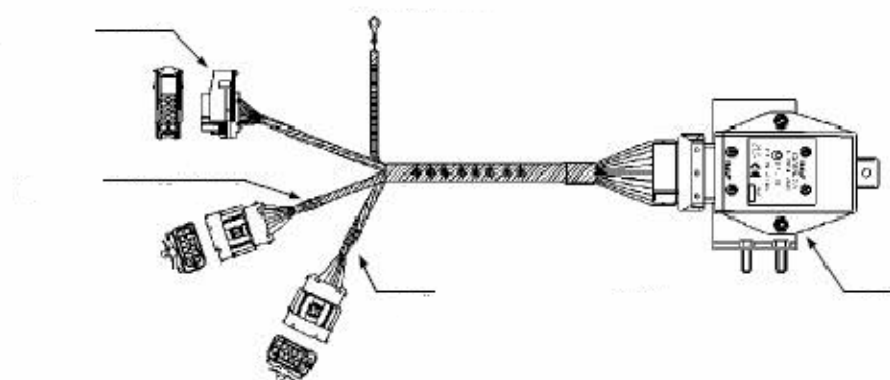
- fit the electronic control unit onto the bracket next to the radiator, as illustrated in the pictures.

Figure 2.46



- Disconnect the grey connector between the chassis cable and the cab cable. Connect the interfacing bridge between the electronic control unit and the connections available on the vehicle, as illustrated in the diagram.

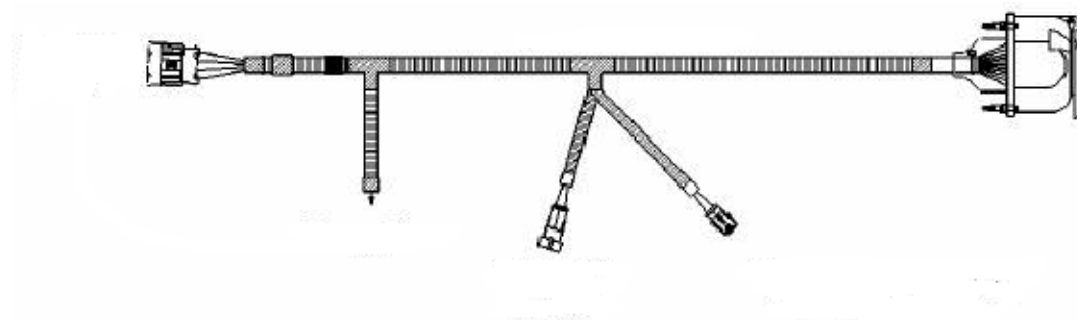
Figure 2.47



114197

1. Electronic control unit with bracket - 2. Red taping (connect to the added 13-pole chassis cable) - 3. Yellow taping (connect to the cab/bonnet cable) - 4. Connect to the chassis cable found on the vehicle - 5. Connect to the chassis ground

Figure 2.48



114198

1. To be connected to the chassis cable (from where the reversing gear sensor connection had come off) - 2. To be connected to the reversing gear sensor - 3. Connect to the chassis ground - 4. To be connected to the control unit connector - 5. Cable to be fitted onto the chassis

For more details on connections and assembling, ask IVECO for the wiring diagrams.



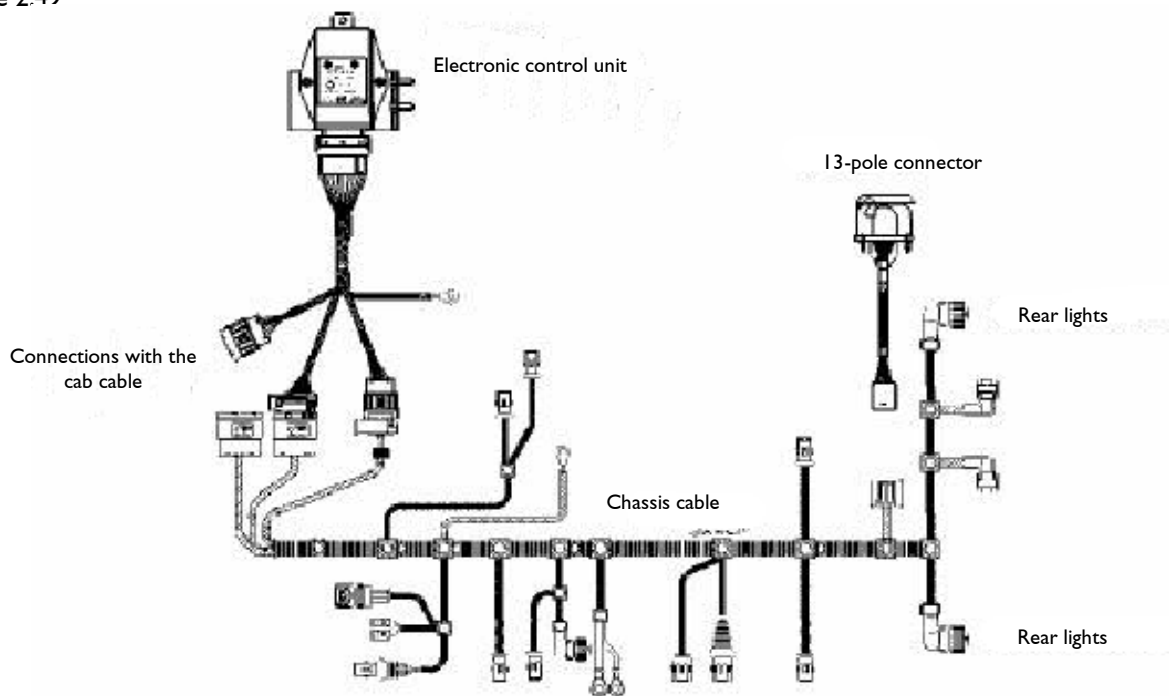
**Any damage to the lighting system caused by the failure to comply with the above procedure shall not be covered by the warranty.**



**b) Factory-installed trailer connector (optional item 06520)**

If the vehicle is ordered complete with the trailer connector, the full circuit will be delivered, which is made up of the electronic control unit (already fitted into place), the set chassis cable and the 13-pole connector.

**Figure 2.49**



114194

**NOTE** The diagram is shown for illustrative purposes only.

**Description of 13-pin interface**

**Table 2.26**

13-pole connector pin	Cable no.	Description	Remarks
1	1120	Rear left indicator bulb	1 bulb (21 W, 12 V)
2	2283	Rear fog light power supply	2 bulbs (21 W, 12 V)
3	0000	Ground	-
4	1125	Rear right indicator bulb	1 bulb (21 W, 12 V)
5	3335	Front left/rear right sidelights; left licence plate light; left clearance light	1 bulb (5 W, 12 V)
6	1175	Brake light power supply	2 bulbs (21 W, 12 V)
7	3334	Front right/rear left sidelights; right licence plate light; right clearance light	1 bulb (5 W, 12 V)
8	2268	Reversing light power supply	1 bulb (21 W, 12 V)
9	7777	After fuse F23 on the CVM	Battery positive
10	8879	After fuse F16 on the CVM	Ignition-operated positive
11	0000	Ground	-
12	6676	Trailer connection signal (ground)	Signal to be supplied if the parking sensors are available
13	0000	Ground	-



## 2.16.8 Side Marker Lights

The local or EC standards in force in some countries lay down that the vehicles specially manufactured by the body builders should be fitted with side marker lights on the overall length of the vehicle itself.

The Daily range vehicles are equipped with specific terminals to make the electric connection required to power the side marker lights.

The external body builders shall take care to make the connections and install the lights on the respective added structures (boxes, vans, etc.).

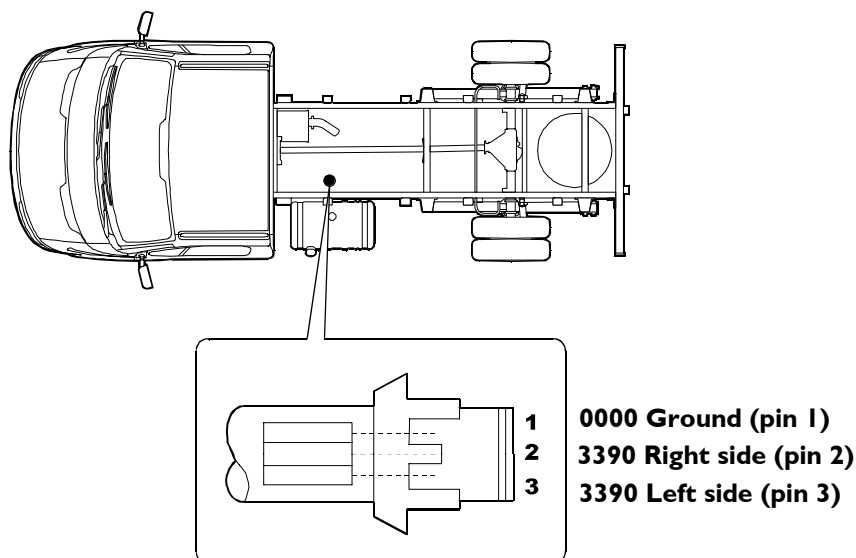
To ensure the electrical properties of the female connector contacts remain unchanged over time, leave the cap provided by IVECO in place.

Below is an illustration of the position for the above terminal on the chassis-cab.



**It is not possible to draw current from side parking lights.**

Figure 2.50



102448



Table 2.27

Connector on the vehicle	IVECO code	Interface to be used	Part number	Quantity
Male connector	98435341	Female connector	98435344	1
		Half shell		1
		Cable terminal		3
		Gasket (rubber piece)		3
		Cap		1

Connector pin-out:

Table 2.28

Pin	Cable code	Function	Cable section (mm <sup>2</sup> )	Max. current (A)
1	0000	Ground	1	10
2	3390	Vehicle right-side marker lights	1	10
3	3390	Vehicle left-side marker lights	1	10

As regards the vehicles on which the side dimmers are not compulsorily required, the respective connectors are in any case available. In the event that the side dimmers need be installed, the vehicle shall be delivered to an IVECO service centre, in order to have the body computer enabled.



## 2.17 Repositioning Parts and Mounting Auxiliary Assemblies and Equipment

Whenever, in the course of modifying the vehicle, it should become necessary to reposition assemblies such as the fuel tank, batteries or the spare wheel, such relocation is permitted provided that the functioning of these parts is not impaired and provided that the same type of connections as originally in use are re-employed. Their transversal location on the vehicle's chassis may not, when their weight requires it, be changed radically.

### Spare wheel carrier

In the case of chassis cabs not equipped with a spare wheel carrier, and vehicles in which the spare wheel carrier must be relocated, the spare wheel must be set on a support of suitable size that allows the wheel to be readily removed.

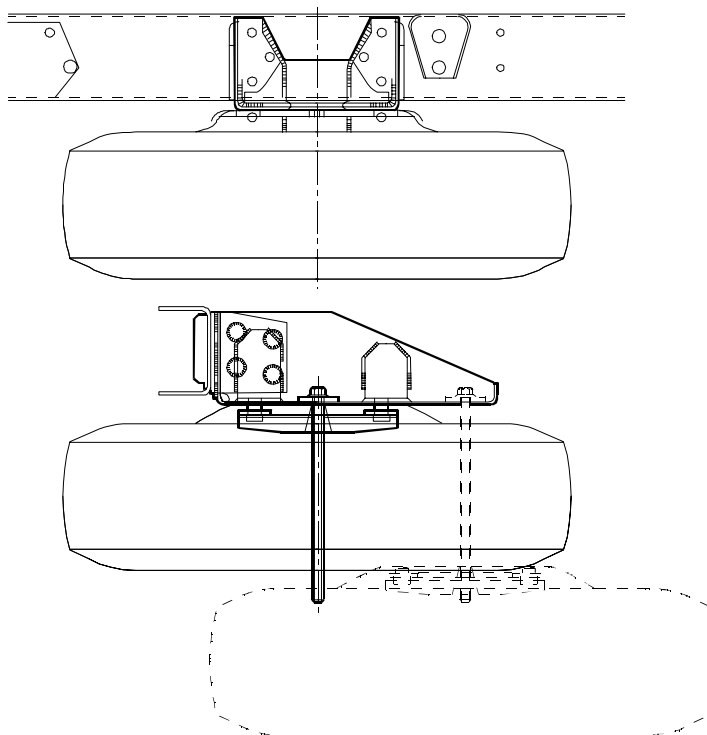
To secure the spare wheel to the side of the vehicle with a support attached to the web of the side member, it is advisable to use a local reinforcing plate on the inside or outside of the side member. The size of this plate must take into account both the weight of the wheel and the possible presence of other reinforcements on the side member.

In order to limit the torsional stresses on the vehicle chassis, we recommend that the plate be fitted where there is a cross member, particularly in the case of heavy units.

A similar procedure should be adopted when fitting additional units such as tanks, compressors etc. When positioning them, due consideration must be given to the distribution of the weights (see point 1.13). Adequate ground clearance must be ensured with due consideration given to the operation of the vehicle.

Any new holes that are necessary for the relocation must be made in the web of the sidemember in accordance with the specifications given in point 2.3 taking care to use existing holes as much as possible.

Figure 2.51



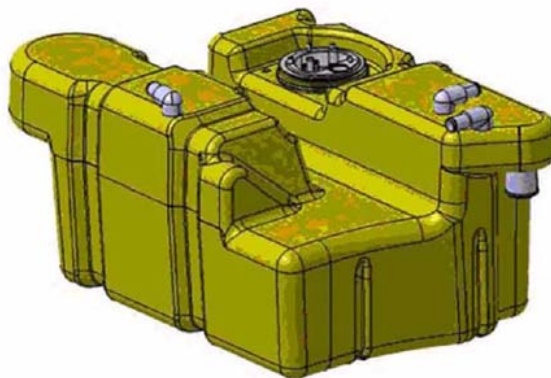
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## Fuel tank

Figure 2.52



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The use of fuel tanks other than the original tanks will lead to incorrect readings for fuel reserve, fuel consumption, range etc. on the control panel.

The new electrical systems architecture will process the fuel gauge level signals by associating the emptying concept as for the fuel tank original fitted.



**Fuel tanks are subjected to homologation.**



## 2.18 Retarder Installation

Not applicable to the vehicle.

## 2.19 Modifications to the Rear Underrun

Our vehicles are fitted with a rear underrun bar in accordance with EC Directives.

The maximum permitted distance from the bar to the rearmost part of the body is 400 mm, deducting the distortion found during approval tests (10 mm on average).

Whenever the chassis modifications affect the rear overhang, the underrun bar must be repositioned (in compliance with current regulations) keeping the same connection with the chassis as the original vehicle.

When modifying the vehicles or installing special equipment (e.g. tail lifts) it may be necessary to modify the structure of the underrun bar. Such modifications must not change the original resistance and stiffness specifications (so as to comply with local government regulations, if any). The company carrying out the modification / installation must where required, submit the necessary document demonstrating compliance with legislation in force at the time.

In the event that a different under run-bar has to be fitted, compliance with the standards and regulations in force must be checked. Test certificates and documentation must, where required, be submitted to the respective government agency.



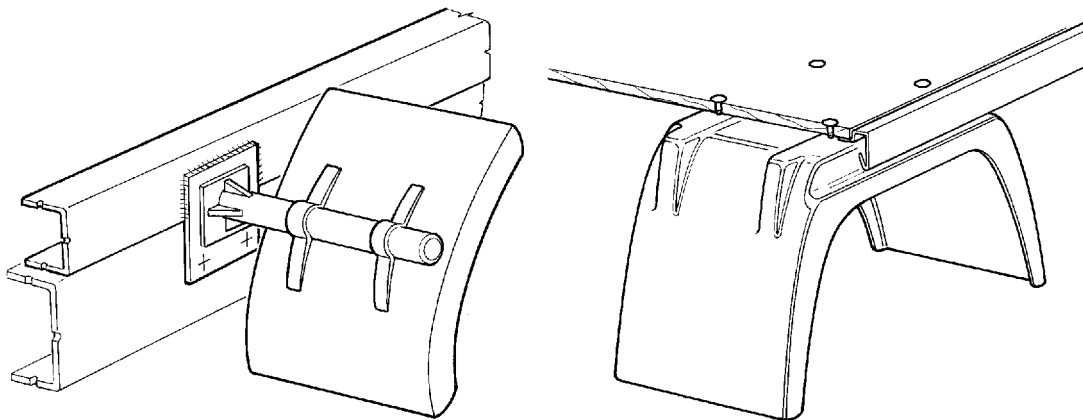
## 2.20 Rear mudguards and wheel boxes

When vehicles are supplied without mudguards, the bodybuilder must fit them using similar installations as used by IVECO on similar vehicles. In making the mudguards, wheel arches, as well as the shape of the body, bear in mind that:

- Ensure the wheels can turn even in the full bump condition with snow chains fitted, in compliance with the limits shown in the documentation supplied by IVECO.
- The maximum width of the vehicle over the tyres must comply with the legal limits.
- The supporting structure should be sufficiently strong enough, avoiding any sudden variation in section.
- The connection can be made to the vertical web of the vehicle's side members or to the longitudinal sections of the subframe. In the first case, the connection must be made solely with screws, or directly under the superstructure (e.g. body, van, etc.), (refer to Figure 2.53).

The instructions given in the first two steps shall also be followed when wheelboxes have to be executed.

Figure 2.53



91472

## 2.21 Mudflaps

If legally required, unless already fitted ex-factory, the bodybuilder must ensure that the complete vehicle is fitted with mud flaps. When fitting these all regulations (e.g. dimensional etc) must be complied with.



## 2.22 Side Guards

In some countries national or EC regulations require that the vehicle is fitted with side guards. The Bodybuilder who finishes off the vehicle must ensure compliance with the required regulations.

On permanently fitted structures such as fixed platform or box bodies etc, side guards can be fitted directly to their basic structure (floor frame, crossmembers). Whereas on mobile structures (such as tippers, demount bodies, removable containers) the side guards will be connected to the subframe by way of suitable brackets or installed directly to the chassis. In the latter case, we the Bodybuilder should, as far as possible, makes use of any holes already existing in the sidemembers vertical web in compliance with point 2.3.

In accordance with EC regulations, the external protection element can consist of either a single runner whose surface extends in the vertical direction or of several longitudinal sections with preset sizes and distances between them.

The side guards must be connected to its own supporting structures in order to allow quick removal or tilting should maintenance or repair work on assemblies or components located next to them be needed.

Operation of and access to the following parts must be ensured.

- Brake system equipment
- Fuel supply
- Suspension
- Spare wheel
- Engine exhaust.

The guards must be made of the appropriate materials (e.g. FeE420).

Particular care must be taken with the installation to ensure that the various requirements of the regulations are complied with (e.g. ground and body dimensions).

The body builder must take care when preparing and fitting the side guards which will depend on the type of body built, as it is not possible to give specific instructions that would apply to all body versions built.



## 2.23 Chocks

Usually these are fitted directly at the factory. Should this not be the case, or if it is necessary to change their original position, the Bodybuilder must work out a new arrangement in compliance with local regulations. The new position must ensure reliability and safety as well as easy access for operation by the user.



Chocks



Chocks

## SECTION 3

**Fitting supersctructures**

	Page
3.1 Construction of the Subframe	3-3
3.1.1 Material	3-3
3.1.2 Section bar dimensions	3-4
3.1.3 Aluminium Subframe	3-5
3.2 Elements making up the subframe	3-6
3.2.1 Longitudinal Runner Profiles	3-6
3.2.2 Cross Members	3-8
3.3 Connections between frame and counterframe	3-10
3.3.1 Choosing the Type of Body Mounting	3-10
3.3.2 Body Mounting Characteristics	3-10
3.3.3 Connection with Brackets (flexible type)	3-11
3.3.4 Elastic connections	3-12
3.3.5 Connection with U-bolts (clamps)	3-13
3.3.6 Rigid connection with longitudinal and transverse sealed plates	3-14
3.4 Fitting Box Bodies	3-15
3.4.1 Fixed boxes	3-15
3.4.2 Tipper boxes	3-18
3.5 Tractor for half-trailers	3-20
3.6 Transport of Indivisible Materials	3-20
3.7 Installation of Tanks and Containers for Bulk Materials	3-21
3.8 Installation of cranes	3-23
3.8.1 Crane Behind the Driver's Cab	3-24
3.9 Installation of Tail Lifts	3-26
3.10 Recovery Vehicles	3-28
3.11 Municipal, Fire-fighting and Special Services	3-28
3.12 Installation of front snowploughs	3-29



	Page
3.13 Winch Installation	3-29
3.14 Special body conversions	3-30
3.14.1 Chassis-cowls	3-30
3.14.2 Motor Homes	3-30
3.14.3 Installing an aerial platform	3-31





**NOTE** The following general instructions complement the general instructions given in the general regulations in Chapter I.

### 3.1 Construction of the Subframe

The purpose of an subframe (auxiliary frame) is to ensure a uniform distribution of the load on the vehicle's chassis and to increase the strength and rigidity of the main frame in relation to the particular use of the vehicle.

The following points are to be borne in mind when constructing a subframe:

#### 3.1.1 Material

Usually, provided the subframe is not to undergo great stress, the material used for its construction may be of a lower grade than that used for the vehicle chassis. It shall have good weldability characteristics and limits not lower than values (1) shown in Table 3.1.

Should the stress limits require it (e.g. crane applications), or if very high sections are to be avoided, material with better mechanical characteristics may be used. In this case it should be considered that a lower inertia moment of the reinforcing beam implies high bending stresses on the chassis frame.

The properties of certain materials that are considered in some of the applications indicated below are as follows.

Table 3.1 - Part to be used to construct IVECO Standard 15-2110 and 15-2812 superstructures

Steel name		Breaking load (N/mm <sup>2</sup> )	Yield point (N/mm <sup>2</sup> )	Elongation A5
IVECO	FE360D	360 (1)	235 (1)	25% (1)
EUROPE	S235JR			
GERMANY	S235JR			
UK	37/23CR			
IVECO	FEE420	530	420	21%
EUROPE	S420MC			
GERMANY	S420MC			
UK	S420MC			
IVECO	FE510D	520	360	22%
EUROPE	S355J2G3F			
GERMANY	S355J2G3F			
UK	50D			



### 3.1.2 Section bar dimensions

The table below illustrates the values for the bulk modulus  $W_x$  for C-section bars recommended by IVECO. The indicated  $W_x$  value refers to the real section and allows for the section bar coupling radii (it can be calculated with some approximation by multiplying by 0.95 the value obtained by considering the section made up of simple rectangles). Bars of different sections can be used as replacements for the indicated ones, provided that the bulk modulus  $W_x$  and the moment of inertia  $J_x$  of the new C-section do not features smaller values.

Table 3.2 - Profiles recommended by IVECO

Strength modulus $W_x$ (cm <sup>3</sup> )	Recommended C-section profile (mm)		
$16 \leq W \leq 19$	80 X 50 X 4	80 X 60 X 4	80 X 50 X 5
$20 \leq W \leq 23$		80 X 60 X 5	
$24 \leq W \leq 26$		80 X 60 X 6	
$27 \leq W \leq 30$		80 X 60 X 7	100 X 50 X 5
$31 \leq W \leq 33$		80 X 60 X 8	100 X 60 X 5
$34 \leq W \leq 36$		100 X 60 X 6	
$37 \leq W \leq 41$		100 X 60 X 7	
$42 \leq W \leq 45$	80 X 80 X 8	100 X 60 X 8	
$46 \leq W \leq 52$	120 X 60 X 6	120 X 60 X 7	
$53 \leq W \leq 58$		120 X 60 X 8	
$59 \leq W \leq 65$		140 X 60 X 7	120 X 70 X 7
$66 \leq W \leq 72$		140 X 60 X 8	120 X 80 X 8
$73 \leq W \leq 79$		160 X 60 X 7	
$80 \leq W \leq 88$		180 X 60 X 8	
$89 \leq W \leq 93$	160 X 70 X 7	180 X 60 X 7	140 X 80 X 8
$94 \leq W \leq 104$		180 X 60 X 8	
$105 \leq W \leq 122$	200 X 80 X 6	200 X 60 X 8	180 X 70 X 7
$123 \leq W \leq 126$		220 X 60 X 7	
$127 \leq W \leq 141$		220 X 60 X 8	
$142 \leq W \leq 160$	200 X 80 X 8	240 X 60 X 8	
$161 \leq W \leq 178$	220 X 80 X 8	240 X 70 X 8	
$179 \leq W \leq 201$	250 X 80 X 7	260 X 70 X 8	
$202 \leq W \leq 220$	250 X 80 X 8	260 X 80 X 8	
$221 \leq W \leq 224$	220 X 80 X 8	280 X 70 X 8	
$225 \leq W \leq 245$	250 X 100 X 8	280 X 80 X 8	
$246 \leq W \leq 286$	280 X 100 X 8		
$290 \leq W \leq 316$	300 X 80 X 8		
$316 \leq W \leq 380$	340 X 100 X 8		
440	380 X 100 X 8		
480	400 X 100 X 8		



### 3.1.3 Aluminium Subframe

In the case of materials, having different characteristics compared to steel, such as aluminium, both the dimensions and the structures of the subframe will have, as a rule, to be adapted accordingly.

When the subframe's main function is mainly to distribute the load more evenly while leaving the major loadbearing to the frame, aluminium longitudinal runners can be used having the same dimensions as stated for the steel. Some typical examples are: fixed bodies, vans, tanks with continuous and close spaced bearers or bearers mounted directly over the suspension hanger brackets. Exceptions are those cases where the high stresses on the vehicle's frame demand steel runners of a high dimension or shear-resistant connections.

When the subframe must contribute in terms of strength and stiffness (bodies having high concentrated loads, such as tippers, cranes, central axle trailers, etc.) aluminium is not recommended and has therefore to be authorised for each application.

It should be remembered that, when stating the minimum dimensions for the reinforcement runners, besides the admitted limit of stress for the aluminium, the different elastic modulus compared to steel (approx.  $7.000 \text{ kg/mm}^2$  as against  $21.000 \text{ kg/mm}^2$  for steel) will also have to be considered. This will result in larger dimensions for the runners.

Similarly, when the connection between frame and counterframe guarantees the transmission of shearing forces (connection via plates), a new neutral axis must be defined for the section based on the different elastic coefficients of both materials when checking the stresses at both ends of the single section.

The cooperation request for aluminium definitely means dimensions that are too large and not good value.

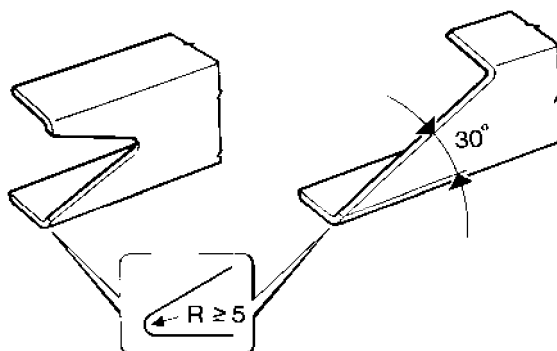


## 3.2 Elements making up the subframe

### 3.2.1 Longitudinal Runner Profiles

The side member of the added structure must be continuous, extending as far as possible forward to the front of the vehicle to include, if possible, the area of the rear support of the front spring, and rest on the chassis of the vehicle but not on the brackets. In order to achieve a gradual reduction in the resistant section, the front ends of the longitudinal runner must be tapered upwards at an angle of no more than  $30^\circ$ , or tapered in some other equivalent way (see Figure 3.1), ensuring that the front end in contact with the chassis is suitably connected, min radius 5 mm.

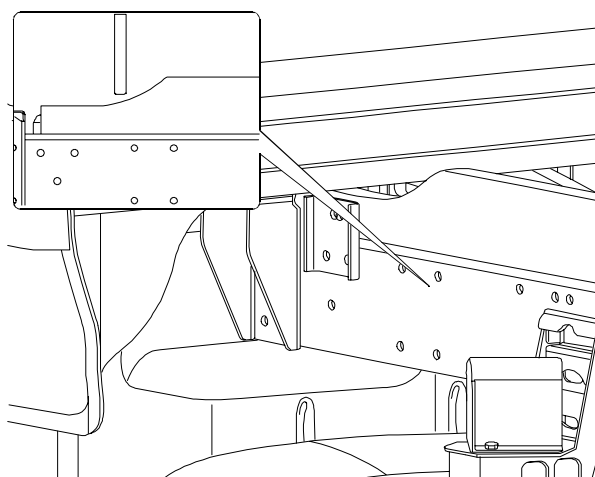
Figure 3.1



91136

If rear cab suspension components (e.g. with long cabs) do not allow the full section cross-section to pass through, proceed as shown in Figure 3.2. This could require the minimum resistant cross-section to be checked when high front bending moments are present (e.g. with a crane behind the cab that is operating towards the front of the vehicle) and the fastening should not be more than 250 mm away from the front end of the subframe if possible.

Figure 3.2



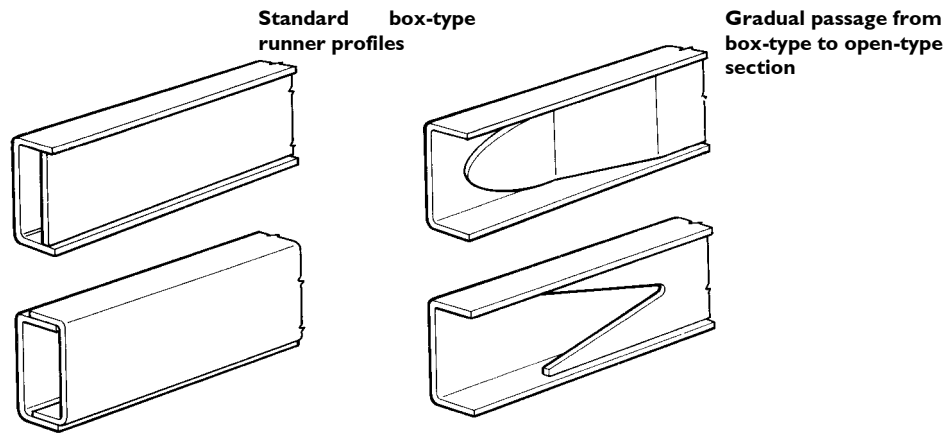
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The shape of the section of the runner is determined with due consideration to the function of the subframe and to the type of structure that is above it. It is advisable to use open C-sections if the subframe is supposed to adapt itself elastically to the chassis of the vehicle, and to use box-type sections when added rigidity is called for.

Proper care must be taken to ensure a gradual passing from the box- type section to the open kind. Some examples on how to achieve this are shown in Figure 3.3.

Figure 3.3



102456

There must be continuity between the longitudinal runners of the subframe and the vehicle. Where this is not possible, continuity may be restored by fitting cleat plate brackets.

If a rubber antifriction strip is inserted, specifications and thickness must be equal to those originally used by the IVECO in production (80 Shore hardness, thickness designed to guarantee minimum clearance after closure, see point 3.3.3). The application of antifriction material may prevent abrasive actions which can cause corrosion when materials with a different composition (e.g. aluminium and steel).

In all cases, it is possible to use similar sections whose moments of inertia and resistance are no lower. Such dimensions can be obtained from the technical literature supplied by the manufacturer of the runner profiles. It should be borne in mind that the moment of inertia, apart from being an important factor for the calculation of the share of bending moment to be applied, also represents the most adequate response to the degree of torsional stress required for the specific type of connecting section in use. Therefore, the moment of resistance is a determining factor as regards the stress exerted on the material.



### 3.2.2 Cross Members

An adequate number of cross members, which should be positioned if possible adjacent to the fastenings, are required to brace the two runners of the subframe.

The cross members may be of the open type (e.g. C-type) or, if greater rigidity is desired, of the closed type.

Suitable gusset plates must be employed at the points of the connection to confer sufficient strength to the connection (see Figure 3.4). In those cases, when greater rigidity is required for the connection, the work procedure may be carried out as illustrated in Figure 3.5.

Figure 3.4

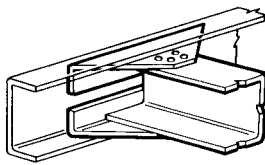
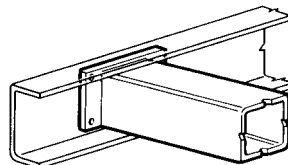


Figure 3.5



### Stiffening the Subframe

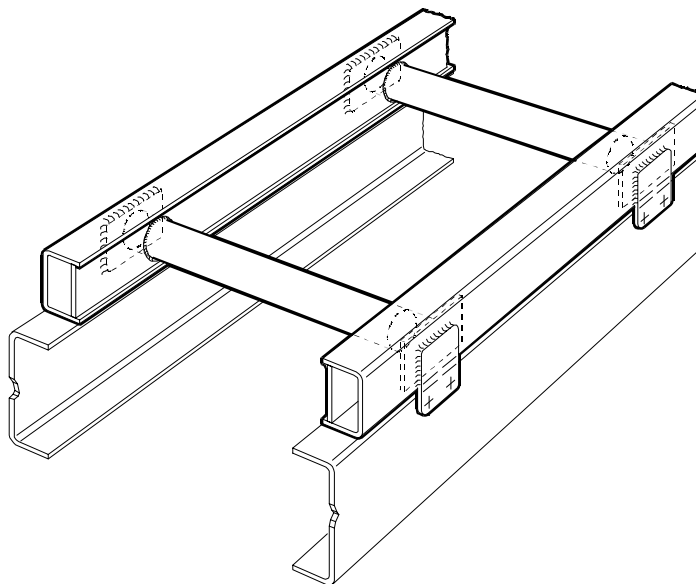
In the case of certain bodies, such as tippers, cement mixers, crane on rear overhang or bodies with a high centre of gravity, the subframe must be additionally stiffened at the rear end.

Depending on the degree of torsional stress, this must be done in one of the following manners:

- Joining the rear section of the longitudinal member by a box-frame construction.
- Box-frame construction, closed-section cross members (see Figure 3.6).
- Box-frame construction, crossties (see Figure 3.7)

As a general rule, the box-frame construction of the longitudinal runners should not be employed in the front end.

Figure 3.6

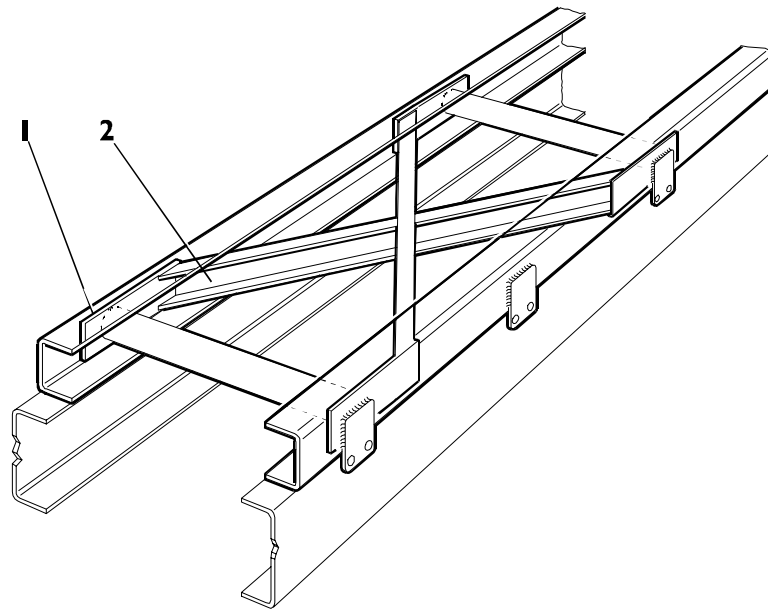


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Elements making up the subframe

Figure 3.7



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1. Subframe - 2. Cruciform

### Self-supporting Bodies as Subframes

A subframe (longitudinal runners and cross members) need not be fitted if self-supporting bodies are to be installed (e.g. rigid box body, tankers), or if the base of the structure to be fitted already serves the purpose of a subframe.



### 3.3 Connections between frame and counterframe

#### 3.3.1 Choosing the Type of Body Mounting

The selection of the type of connection to be used - if not provided initially by the Manufacturer - is very important in terms of the subframe providing strength and stiffness, for the appropriate body type.

The subframe connection may be flexible (brackets or clamps) or it may be rigid, resistant to shearing stress (longitudinal or transverse plates); the choice must be made based on the type of body that is to be mounted (see points 3.4 to 3.9) analysing the stress forces which the additional equipment that is added transmits to the chassis both under static and dynamic conditions. The number, size and type of securing devices properly subdivided over the length of the subframe, must be such as to ensure a good connection between the chassis of the vehicle and the subframe.

The screws and clamps must be of a strength class no lower than 8.8, the nuts must be equipped with devices that prevents them from working loose. The first fixing nut must be located, if possible, at a distance of approx. 250 to 350 mm from the front end of the subframe.

Any connecting points previously existing on the frame of the vehicle must be used first.

The compliance with the aforementioned distance for the first mounting must be ensured in cases where the body applies concentrated loads behind the cab and requires additional stability (e.g. cranes, front end tipping gears etc.) in order to prevent overstressing the chassis frame. If necessary, additional fixings must be fitted.

If the body to be installed has characteristics different from those permitted on the original chassis (e.g. tipper on a platform body chassis), the bodybuilder will provide the appropriate mountings (e.g. the replacement of brackets by cleat plates in the rear area of the chassis).



**When anchoring the body to the frame, no welding may be done on the frame of the vehicle, nor may holes be drilled on the flanges of the frame.**

#### 3.3.2 Body Mounting Characteristics

Flexible joints (see Figure 3.8, 3.9 and 3.10) permit limited movement between the frame and the subframe, and permit the use of two parallel working strong sections. Each bears a part of the bending moment in proportion to its moment of inertia.

For the rigid type of joint (see Figure 3.11) between subframe and chassis, a single strong section is obtained, provided that the number and position of the joints are adequate to support the resulting shearing stresses.

When using sheer resisting plates to secure the subframe to the sidemembers, a single strong section is formed which has a higher strength capacity when compared with the connections made using brackets or clamps. This has the following advantages:

- Lower height of the subframe profile under the same bending moment acting on the section.
- Higher bending moment under the same subframe profile dimensions.
- Further increase in the strength capacity, when the subframe is made up of high mechanical characteristic materials.



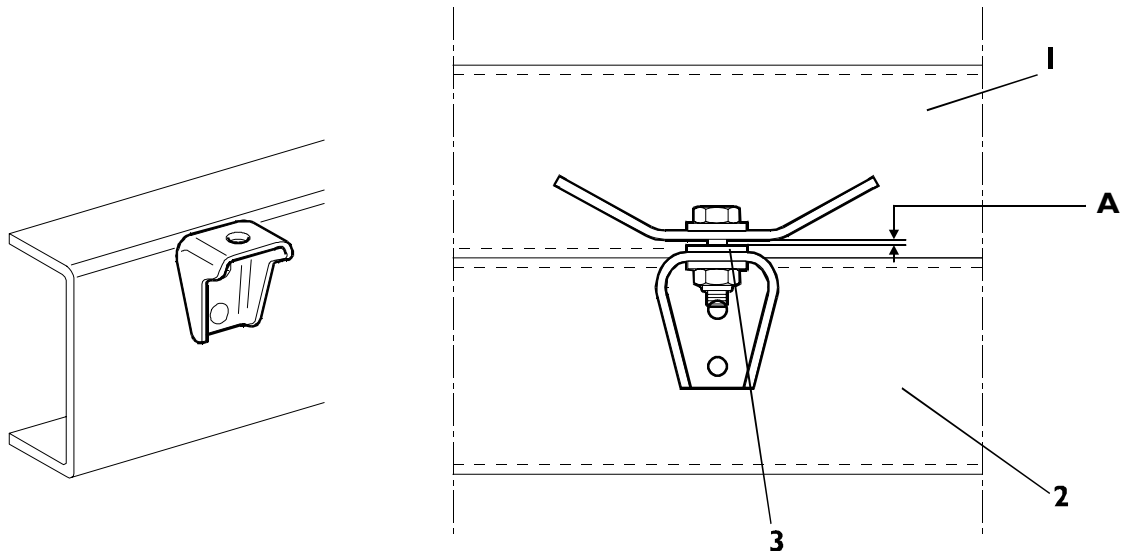
Connections between frame and counterframe



### 3.3.3 Connection with Brackets (flexible type)

A few examples of this type of connection (flexibility mounting), are shown in Figure 3.8 and 3.9.

Figure 3.8



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1. Subframe - 2. Frame - 3. Shims

In order to ensure a flexible joint there must be a gap of 1 to 2 mm between the brackets of the frame and those of the subframe before the securing bolts are tightened. Larger gaps are to be reduced by using suitable shims. Using bolts of proportional length improves the flexibility of the connection.

The brackets must be secured to the web of the vehicle's side member only by means of bolts or rivets.

In order to guide and better contain the loads transversally, a slight protrusion of the brackets above the chassis is recommended. When the brackets are fitted flush with the upper flange of the side member, the lateral movement of the body structure must be secured by other means (e.g. using guide plates the chassis connected - see Figure 3.10). When the front connection is of the elastic type (Figure 3.9), lengthwise securing must be ensured even in the conditions of maximum twisting of the chassis (e.g. off-road).

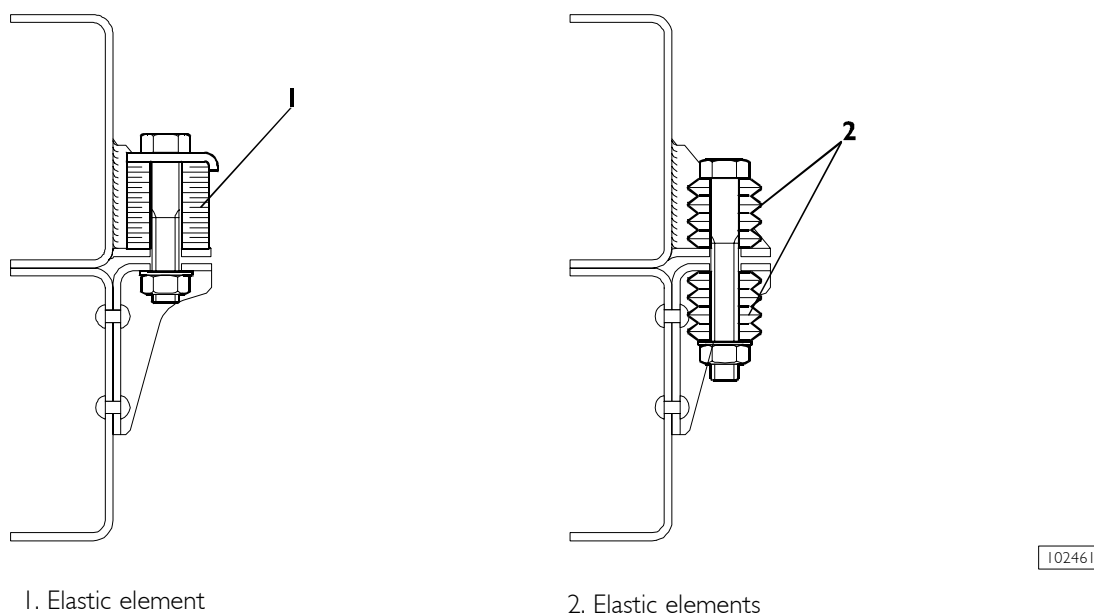
When the chassis already has factory fitted brackets for the installation of a box-type body, these brackets must be used for the installation of the structure. The brackets fitted to the subframe or to the body must have characteristics of strength not lower than those of the original brackets fitted to the vehicle.



### 3.3.4 Elastic connections

In the event that greater flexibility is required from a connection (e.g. vehicles with very rigid superstructures such as van body versions, tanks, etc. used on rough or winding roads, special vehicles, off-road vehicles, etc.), then elastic connections should be used as those illustrated in Figure 3.9 shall be used at the front behind the driver's cab.

Figure 3.9



In case of superstructures that generate very high bending and twisting moments (e.g. cranes located behind the cab), the subframe dimensions must be such as to adequately contain them.

The characteristics of the elastic element must be adequate to the superstructure stiffness, wheelbase and use intended for the vehicle (rough road conditions).

When using rubber mountings, materials that give the same characteristic to that of the spring type must be used. Relevant instructions for visual checking and torque setting must be provided.

The overall connection capability may, if necessary, be resumed by fitting shear-resistant plates in the area of the rear suspension.

On installations where the vehicle may be lifted by hydraulic stabilizers (e.g. cranes, overhead platforms), the yield of the elastic element must be reduced in order to ensure sufficient frame support and also avoid excessive bending moments on the vehicles chassis.



### 3.3.5 Connection with U-bolts (clamps)

The most important mounting of this type is illustrated in Figure 3.10.

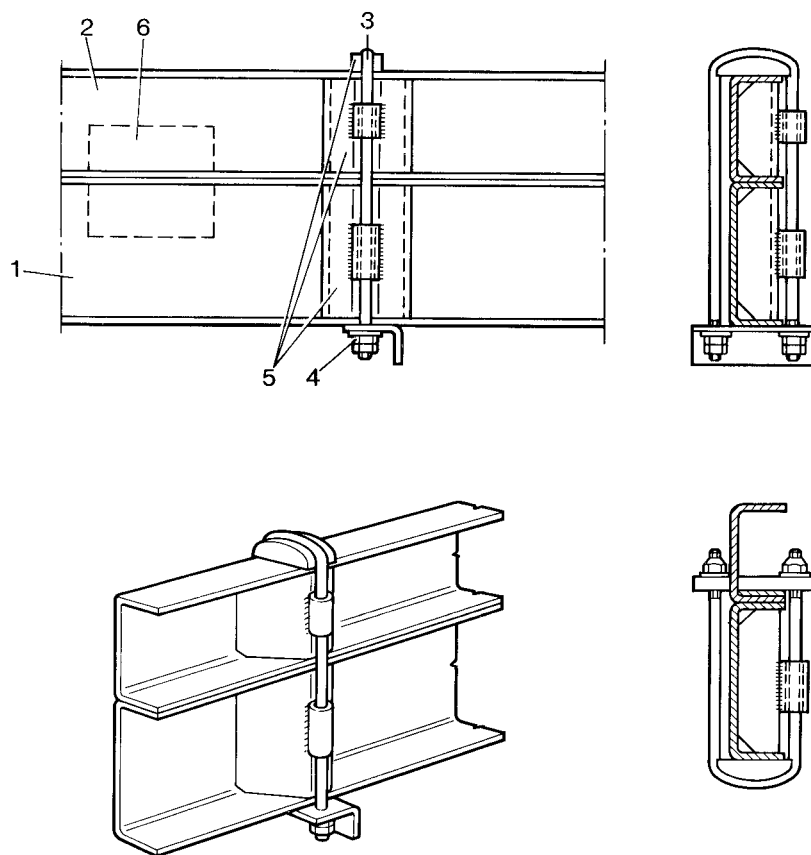
In this type of construction the bodybuilder must place a spacing piece, preferably made of metal, between the flanges of the two side members at the point where the U-bolts are located, in order to prevent the bending of the frames when the U-bolts are tightened.

In order to guide and to better contain transversally the structure that is attached to the vehicle's chassis, this type of joint must be complemented by the addition of plates that are attached to the subframe and chassis as shown in Figure 3.10.

Due to the nature of this type of mounting, its all-round use on the vehicle is not advisable. However, it is necessary - in order to keep the added structure from sliding, and to increase the rigidity - to provide positive attachment towards the rear with cleat plates to secure both longitudinally and transversally.

For this purpose it is also possible to use bolt-type connections at the rear end of the chassis as illustrated in Figure 3.11.

Figure 3.10



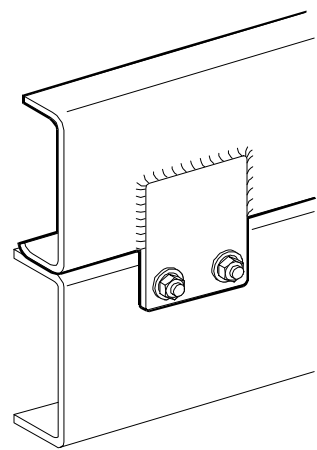
1. Frame - 2. Subframe - 3. U-bolts - 4. Locking with lock nut -  
5. Spacers - 6. Cleat plate (where necessary)



3.3.6 Rigid connection with longitudinal and transverse sealed plates

This type of fixing shown in Figure 3.11 is achieved by means of a plate that is welded or bolted to the subframe and is secured to the chassis by means of bolts or rivets. This ensures good reaction to longitudinal and transverse thrust and provides maximum rigidity between the vehicle chassis and the subframe.

Figure 3.11



102462

Assess the advisability of applying strengthening plates to the cut on each occasion.  
When this type of joint is used, the following must be observed:

- The plate must be attached to the vertical web of the main sidemembers. Before fixing ensure that the subframe is mounted correctly on the top flange with no gaps between the two mating surfaces.
- The use of cleat plates must only be fitted to the central and rear sections of the frame.
- The number of plates, thickness and number of securing bolts must be adequate to transmit the sections shear and bending moments between the chassis and the subframe.

When all the necessary elements are available these values can be determined accurately by calculation.

The height of the subframe has to be limited as much as possible (e.g., towing centre axle trailers, crane on rear overhang, tail lifts, etc.). Follow the instructions given in Table below:

Table 3.3

Chassis / subframe section height ratio	Max. distance between the centre line of the shear-resistant plate (mm) <sup>1)</sup>	Models 3)	Min. plate characteristics	
			Thickness (mm)	Screw size (min. 3 screws per plate) <sup>2)</sup>
≤1,0	500	35S18W; 55S18W	5	M 12 (2 screws per plate)

1) Increasing the number of bolts per plate enables a proportional increase in the distance between the plates (twice the number of bolts enables a greater distance between the plates). In the areas of high stress (e.g., supports of the rear spring, or of the rear air springs) provision must be made to fit the plates as close together as possible.

2) In the case of limited thickness of both the plates and the subframe, the connection should be carried out using spacers, so that longer bolts can be used.



Connections between frame and counterframe

### 3.4 Fitting Box Bodies

#### Dimensions and centres of gravity

Check that the weight is correctly distributed, particularly bearing in mind the instructions on the height of the centre of gravity mentioned in chapter 1, taking appropriate constructional precautions to ensure maximum stability of the transported load on the journey.

#### 3.4.1 Fixed boxes

See table in Chapter 1 to find out the volumetric masses required to determine the load distribution.

On standard cab vehicles, intended exclusively for road use, box- bodies are usually fitted on a subframe comprising longitudinal runners and cross members. The minimum dimensions of the longitudinal runners are specified in Table 3.4.

Table 3.4

Models	Minimum reinforcement sectional longitudinal	
	Wheelbase (mm)	Sectional modulus $W_x$ (cm <sup>3</sup> )
35S18W; 55S18W	3050; 3400	21

1) The body structure with its base should be made so that it can make an adequate torsion contribution to the chassis frame of the vehicle.

The attachment is carried out using the brackets arranged on the vertical web of the side members. If IVECO have not provided the brackets they must be installed according to the specifications given in point 3.3. In order to provide adequate longitudinal restraint when brackets or clamps are used, it is recommended that a rigid connection both sides on the rear overhang is made using either cleat plates or bolts through the upper flange of the side members (see Figures. 3.11 and 3.12).

Under no other circumstances may new holes be made in the flanges of the main side members.

If the box uses elevated supports above the subframe (e.g. crossmembers), stiffen the supports to withstand the longitudinal thrust. The front panel of the body must be strong enough to withstand the forces generated by the transported load, when braking sharply.



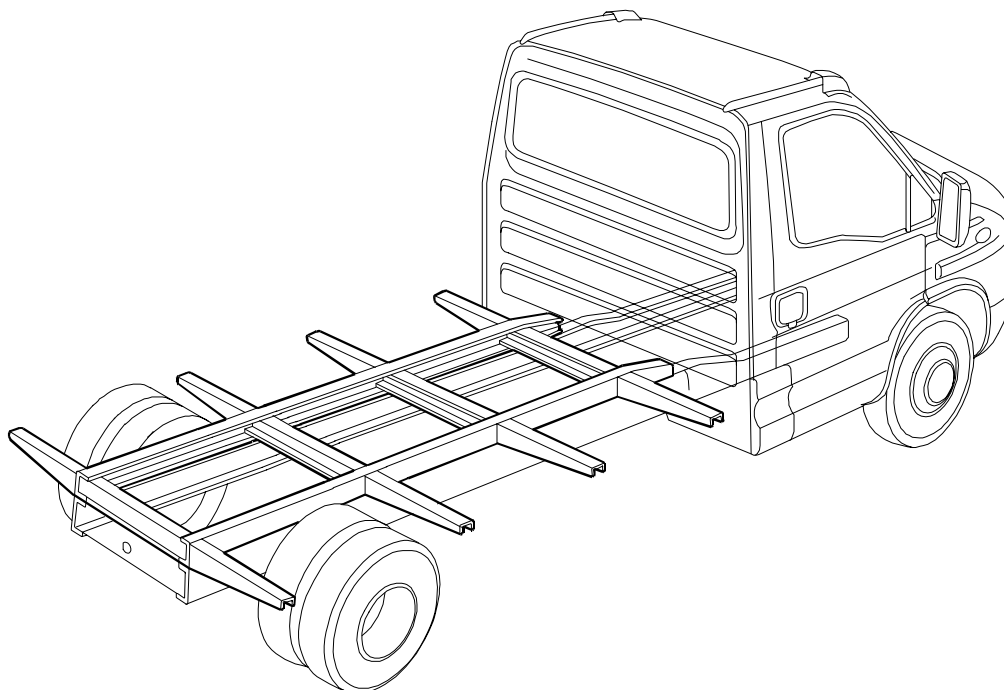
## Building Vans

For the connection of the body to the vehicle chassis, it is possible to make a framework composed of longitudinals and crossmembers, the minimum dimensions for the longitudinal sections are given in Table 3.4.

Figure 3.12 shows an example of a construction, where crossmembers and brackets have been added along the length of the longitudinal sections to keep down the height of the superstructure.

In this case, rear wheel boxes may have to be fitted in the floor of the van to allow the correct wheel movement.

Figure 3.12

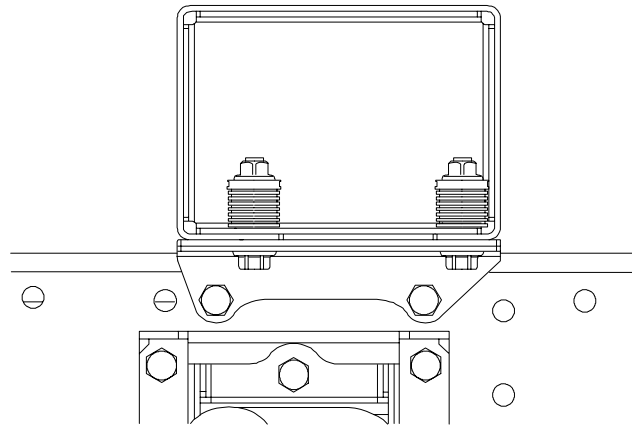


102465



If the floor is constructed using crossmembers arranged at a distance of less than 700 mm from one another and properly connected so as to provide a rigid self-supporting structure, the use of longitudinal runners may not be required (refer to Figure 3.13). To ensure the crossmembers have the necessary stability and to prevent vehicle chassis from becoming stiff towards the front, the instructions given in point 3.4.1 should be followed.

**Figure 3.13**



120371

When installing body structures with high torsional rigidity, to avoid the possibility of chassis frame deformation elastic connections should be used at the front body mountings of the structure. This is especially important if the vehicle is to be used either off road or semi off road conditions.

### **Front bulk-head**

This must be strong and sturdy enough to withstand the forces generated by the load during sharp braking.

### **Bodies integrated with the cab**

With this type of body the connection to the cab must be made so as not to transmit any stress to the cab itself.

Connecting the body to the cab:

- the structure must not be welded to the cab, only mechanical fixings must be used;
- the body structure must be self-supporting and must not be supported by the cab;
- all parts of the cab that have been modified in any way must be protected against oxidation and corrosion (see point 2.2).



### 3.4.2 Tipper boxes

The use of tipping bodies, whether end or three way, subjects the chassis to notable stress. For this reason it is most important to select the right vehicle from among those intended for this use. Therefore we list here the specifications that must be adhered to for this type of construction subdivided according to light or heavy duty. Table 3.5 gives the minimum runner dimensions for the subframe with which these vehicles must be equipped.

Furthermore any government regulations concerning these vehicles must also be abided by.

It is advisable to use a stabiliser bar for these applications on models where IVECO offers the feature as an option.

When the Manufacturer offers stabilising bars as optional equipment for certain models, their use is highly recommended.

The following points must be kept in mind:

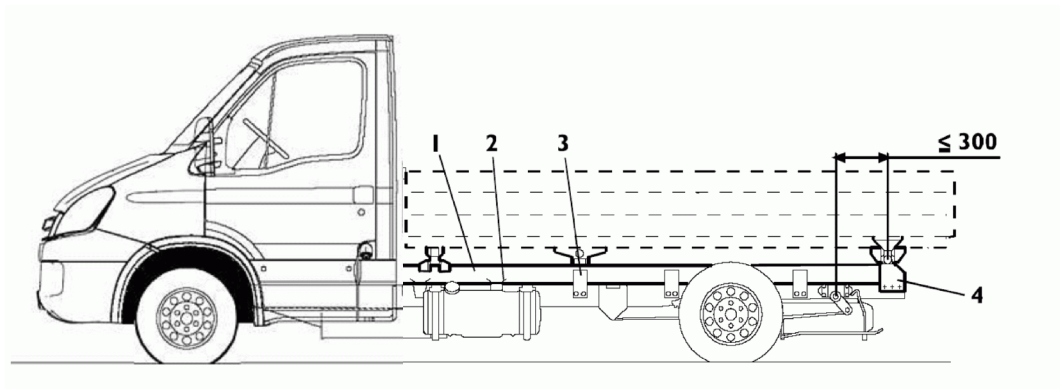
- The subframe must be (see Figure 3.6 and 3.7) suitable for the vehicle type and for the specific operating conditions. It must have adequately dimensioned side and cross members and be stiffened at the rear by box-type construction and crossbraces. Anchoring the subframe to the chassis, flexible joints brackets or shelves must be placed at the front end, whereas the rear section requires rigid-type joints (plates) to allow the added structure to contribute more to the rigidity of the whole. The "omega" brackets can be adopted on vehicles which are already equipped with them. It is possible to use brackets on vehicles that were equipped with brackets originally.
- The rear tipping hinge must be mounted on the subframe as near as possible to the rear support of the rear suspension. In order not to impair the stability of the vehicle during tilting operations and not to increase excessively the stress on the chassis, it is recommended that the distances between the tipping hinge and the rear spring support or tandem centreline be observed. If for technical reasons this cannot be achieved, small increases may be permitted provided a higher strength subframe is used, in order to increase the rigidity of the rear end. In the case of large volume transports requiring long bodies, it is advisable (in those cases where it is permissible) to lengthen the wheelbase of the vehicle.
- Great care must be given to the positioning of the lifting device both in terms of providing supports of adequate strength and in order to position the mountings precisely and conveniently. It is advisable in any case to place the device to the front of the centre of gravity of the body plus payload so as to reduce the extent of the localised load.
- For both under floor and front end tipping gear installations it is recommended that appropriate stabiliser acting as a guide for the stroke of the tipping body, are fitted.
- The hinge of the lifting unit must be mounted on the subframe.  
The useful volume on the body must conform - with the consideration of the maximum permissible mass on the axles - to the density of the material that is to be transported (a density mass of approx. 1600 kg/m<sup>3</sup> is to be used for excavated material). When freight having a low density is transported, 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.
- The bodybuilders must see to it that the functioning and safety of all parts of the vehicle (for instance, the positioning of lights, tow hook etc.) is safeguarded, in full compliance with the current safety regulations.



Connections between frame and counterframe



Figure 3.14



102467

1. Subframe - 2. Body mounting brackets - 3. Shear-resistant plates - 4. Tipping hinge side plates

Table 3.5

Models	Minimum reinforcing longitudinal	
	Sectional modulus $W$ (cm <sup>3</sup> )	Dimensions (mm)
35S18W; 55S18W	36	100×60×6



### 3.5 Tractor for half-trailers

No specific bodies for towing semi-trailers are made by IVECO.

However, it is possible to make the conversion, using the chassis-cab vehicle, with specific authorization issued by IVECO.

Contact IVECO for information on conversions.

### 3.6 Transport of Indivisible Materials

The transport of indivisible material and of freight whose dimensions exceed normal ones, is regulated in various countries by special legislation.

The particular configuration of these transports in which stress is created as a result of the concentrated vertical load and of the dynamic forces that may arise when braking, requires that the choice of vehicle to be used is cleared with the Manufacturer beforehand.

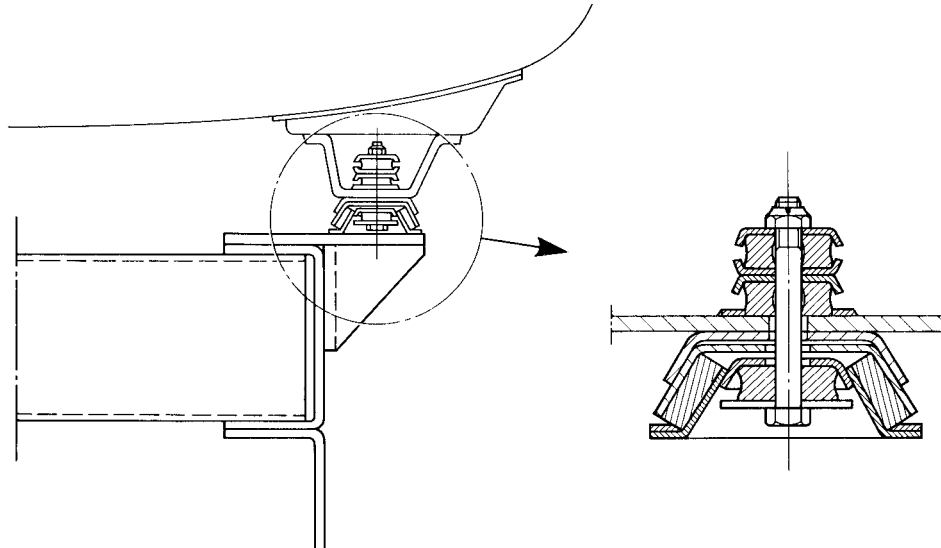
The structure that bears the weight on the tractor must be of the type that uses a subframe the other conditions that must be met to engage in this type of transport will be specified each time in our authorisations.



### 3.7 Installation of Tanks and Containers for Bulk Materials

As a general rule, the installation of tanks and containers on our vehicles requires the use of an appropriate auxiliary frame. Table 3.6 contains the guidelines for the dimensions of the longitudinal runners to be used for the auxiliary frame.

Figure 3.15



As was mentioned in the case of other applications, the positioning of the mountings through which the forces are discharged is similar here. The rigid mounts go in a position corresponding to the rear suspension supports and the flexible mounts as near as possible to the rear support of the front suspension.

When faced with a different situation, a possible solution could be that of reinforcing the structure by means of longitudinal runner profiles of larger dimensions in comparison with those given in Table 3.6.

In order to define the elastic connection, the rigidity characteristics of the vehicle chassis as well as the area where the connections are to be installed and the type of use for which it is intended must be taken into account.

Table 3.6 - Installing a tank

Models	Wheelbase (mm)	Minimum reinforcing longitudinals	
		Sectional modulus $W$ (cm <sup>3</sup> )	Dimensions (mm)
35S18W; 55S18W	3050 - 3400	21	80x60x5

Tankers, or more generally, structures which are torsionally very rigid, must be fitted so that the vehicle chassis retains sufficient and gradual torsional flexibility, by avoiding areas of high stress.



Tankers or more generally, structures which are torsionally very rigid must be fitted so that the vehicle chassis retains sufficient and gradual torsional flexibility by avoiding areas of high stress.

When installing a tank we recommend using elastic joints between the body of the tank and the subframe at the front and rigid supports that are capable of withstanding longitudinal and transverse forces at the rear.

As was mentioned in the case of other applications, the positioning of the mountings through which the forces are discharged is similar here. The rigid mounts go in a position corresponding to the rear suspension hangers and the flexible mounts as near as possible to the front spring's rear hanger brackets.

In order to define the elastic connection, the rigidity characteristics of the vehicle chassis as well as the area where the connections are to be installed and the operation for which it is intended must be taken into account.

IVECO must authorise the application of tanks directly onto the vehicle frame without the interposition of a subframe.

The installation of two or more separate containers or tanks on the vehicle requires the use of a subframe that permits good distribution of the load and an adequate torsional rigidity for the chassis/subframe using shear resistant connections. A good solution is to use a rigid connection which joins the containers to one another.

The installation of two or more separate containers or tanks on the vehicle requires the use of a subframe that permits good distribution of the load and an adequate torsional rigidity for the chassis/subframe using shear resistant connections. A good solution is to use a rigid connection which joins the containers to one another. So shall the minimum ratio of the front axle weight and the vehicle's overall weight when the vehicle is fully loaded (see point 1.13).

For this type of conversion, take particular care to keep the centre of gravity as low as possible to obtain good vehicle stability while in motion (see point 1.13).

It is necessary to provide special transverse and longitudinal bulkheads inside the tanks and containers in order to reduce the dynamic loads which the liquid transmits when the vehicle is in motion and the tanks are not filled to capacity. This may adversely affect the handling and resistance of the vehicle.

When building fuel tankers or containers for flammable liquids all the installation must comply with all safety requirements required for the safe operation of the vehicle as well as all current National / EC regulations.



Installation of Tanks and Containers for Bulk Materials

### 3.8 Installation of cranes

The selection of the crane must be made with due consideration to its characteristics (weight, maximum capacity) 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), depending on which of these is pertinent to the particular vehicle.

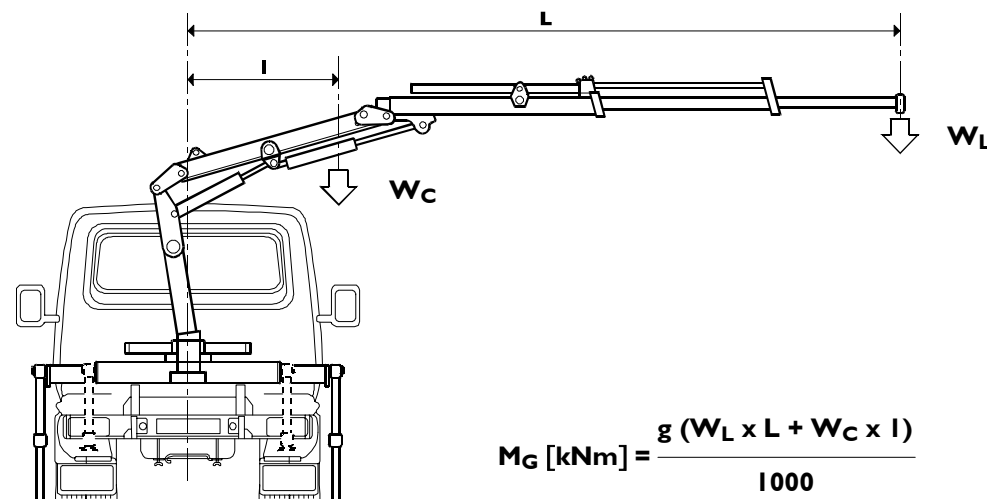
Stabilisers must be used during working stages using a crane. As a general guide, install the crane on a subframe. To construct the subframe, observe the general guidelines (see point 3.1) and also refer to Table 3.7 for the dimensions of subframe sections.

The longitudinal runners can also be determined by calculation, the dimensions refer to the total maximum static moment of the crane ( $M_G$ ) and is the moment of the crane + the moment of the load which is calculated on the basis of the equation given below in Figure 3.16.

If for instance a crane is to be fitted to a tipper which has its own subframe which has a greater section modulus ( $W_x$ ) than that required for the crane then the tipper subframe should be used. In all applications the structure or ancillary requiring the greater section modulus ( $W_x$ ) must be used.

Where the capacity of the crane ( $M_G$  value) falls within the area with a letter "E" (or for greater values) in the table, these must be checked each time by IVECO and authorisation given (by IVECO) before the installation is carried out.

Figure 3.16



102468

- $g$  = gravity acceleration, equal to  $9.81 \text{ m/s}^2$ .
- $W_L$  = weight applied to the end of the crane (kg);
- $L$  = horizontal distance between the point where load  $W_L$  is applied and the vehicle centre line [m];
- $W_c$  = crane's own weight applied to its centre of gravity [kg];
- $l$  = horizontal distance between the centre of gravity of the crane and the vehicle centre line [m].



**The body builder must verify each time the vehicle's stability and take all the necessary precautions to ensure correct operation. Both the crane manufacturer and the body builder are to define the type and number of stabilizers and make the subframe depending on the maximum static moment and the crane position.**



### 3.8.1 Crane Behind the Driver's Cab

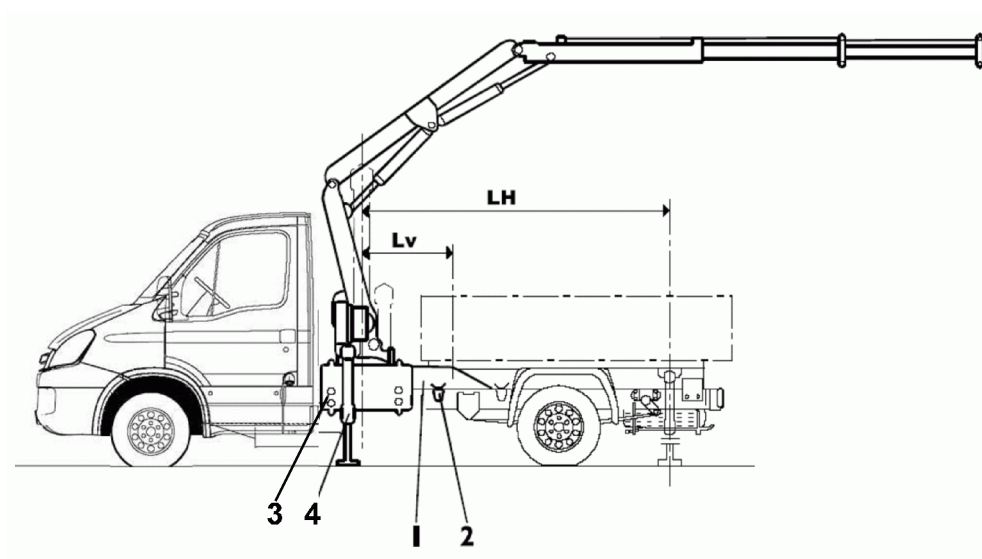
The mounting of the subframe onto the chassis frame will as a rule, be performed by using the standard brackets (see Figure 3.17) to which are added, if necessary, other flexible anchorages (brackets or clamps) so that the flexibility and torsional characteristics of the chassis frame remain unchanged.

For on-road vehicles only if the height of the subframe runner profile has to be reduced (e.g. to lower the total height of the vehicle) the mounting of the subframe may be carried out with shear resisting connections.

It is advisable to use sections with constant cross-section along the length of the vehicle. The cross section of the sections may be reduced (provided this is done gradually) at points where the bending moment induced by the crane assumes the values shown in Table 3.7.

The subframe for the crane may be integrated with the body longitudinal runner as shown in Figure 3.17 Length "Lv" must not be less than 35% of the wheelbase for vehicles with forward-control cab when the body runner has a smaller cross-section.

Figure 3.17



1. Subframe - 2. Connections - 3. Crane joints - 4. Stabilisers



When installing cranes on crew cab vehicles (e.g., 6+1), extend the subframe appropriately under the cab (see Figure 3.2), otherwise it may be necessary to limit crane rotation, depending on its capacity, so as not to exceed the bending moment allowed for the chassis.

The installation of cranes on vehicles used on rough roads may involve making elastic connections between the chassis and the frame in the front and central parts, so as not to excessively restrain the chassis torsion movement (refer to Figure 3.8). Since the crane is, in such cases, virtually connected only to the frame, the longitudinal runner dimensions must be suited to withstand the moments generated by the cranes operation.

The functioning of the equipment located behind the cab (e.g., fuel tank) must not be impaired. Relocating this equipment is permitted provided that the original type of connection is re-established.

Normally, when the crane is placed behind the cab, it is necessary to move the platform body or equipment towards the rear. In the specific case of tipping equipment, particular care must be given to the placement of the tipping gear and the rear tipping hinges which should be moved back as little as possible.

Table 3.7 - Cranes fitted behind the driver's cab (Subframe fixed by means of brackets)

Models		Crane capacity $M_G$ max (kNm)						
Chassis section at the centre line (mm)	Yield point of subframe material (N/mm <sup>2</sup> )	0-20	20-30	30-40	40-50	50-60	60-70	70-80
		Min. value of subframe section modulus $W_x$ (cm <sup>3</sup> ) <sup>1</sup>						
35S18W 55S18W	360	21	36	57	89	E	E	E



### 3.9 Installation of Tail Lifts

The dimensions of the longitudinal runners to be used when installing tail lifts can be assessed as follows:

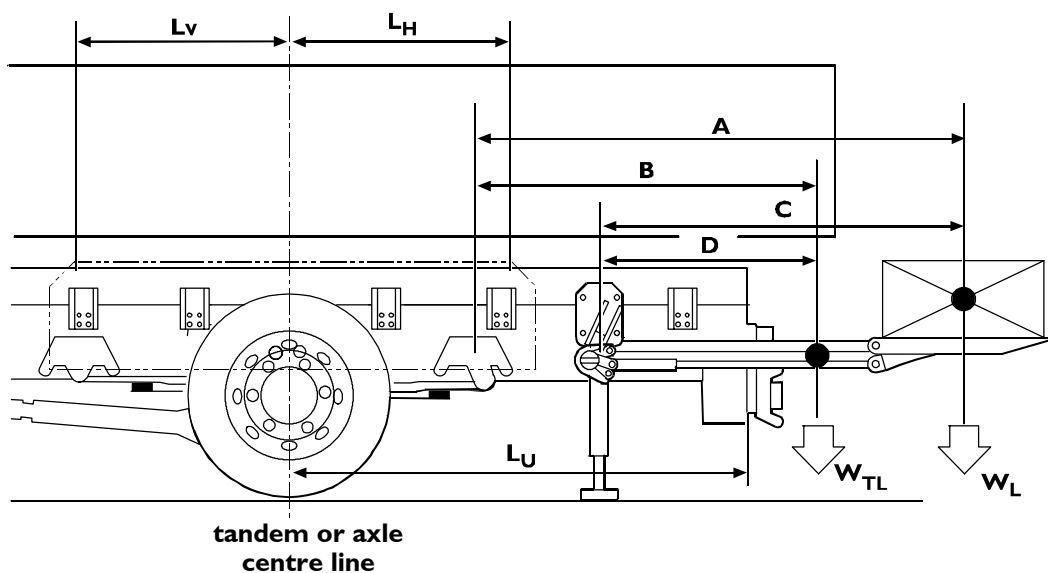
- by means of Table 3.8, with the standard rear overhangs and mean bending moments induced by tail lifts; depending on their capacity. In the table, the minimum capacity values are specified above which suitable stabilisers must be used;
- with different lengths of the rear overhang and with special tail lifts (e.g., of aluminium), the bending moments induced on the chassis frame can be defined with the information in Figure 3.18;

**The bodybuilder or the manufacturer of the tail lift will take care to ascertain operational stability and safety.**

In any event, particularly in those specific uses where there is no suitable subframe (as in the case with bodies for vans or box-type bodies built by means of cross members), the anchoring for the loading platform must be provided by a structure that enables the stress to be distributed over the chassis of the vehicle.

In addition, to provide the necessary strength and rigidity, the connection between the chassis and the subframe must be made, especially in overhangs of over 1200 mm, with shear resistant plates (no more than 400 mm apart) in the area of the rear overhang, as far as the front hanger of the rear suspension.

Figure 3.18



91538

$W_{TL}$  = Tail lifts weight

$W_L$  = Tail lift capacity

The bending moment on the chassis can be calculated using the formula below:

$$M \text{ [Nm]} = W_L \times A + W_{TL} \times B \text{ for tail lifts without stabilizers}$$

$$M \text{ [Nm]} = W_L \times C + W_{TL} \times D \text{ for tail lifts with stabilizers}$$



Construction of the Subframe

Base - May 2007

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The bodybuilder must consider each time the necessity of using stabilisers even in those cases where merely in terms of stress of the chassis their use may not appear to be necessary. When evaluating the need for stabilisers in relation to the capacity of the platform, the stability and attitude of the vehicle resulting from the deflection of the suspension during loading operations must also be considered.

The stabilisers must be attached to the platform's supporting structure should preferably be hydraulically operated and must be employed during all loading procedures with the platform.

To compensate for the elastic movement of the chassis, which is inevitable when the tail lift is in operation, the bodybuilder may make use of longitudinal runner profiles of larger size in comparison to the one indicated in Table 3.8.

The dimensions of the sections shown in Table 3.8 are for standard rear overhangs. For longer overhangs you need to check whether it is necessary to fit larger sections or stabilizers (see Figure 3.18).

**NOTE** The installation of tail lifts must be carried out with due regard for the maximum permissible weights on the rear axle or axles and of the minimum load established for the front axle (see point 1.13). if this should not be the case the rear overhang will have to be reduced.

When electro-hydraulic tail lifts are installed, it is necessary to check that the capacity of the batteries and the alternator is adequate (see point 2.16).

IVECO recommends fitting a switch to disconnect the electric circuit of the tail lift from the vehicle electric circuit when the tail lift is not working.

The bodybuilder is responsible for any modification to the rear underrun guard or for installing a different type (see point 2.19) and for maintaining the visibility of the rear lights. For the departure angles, for the installation of any tow hook and full compliance with all relevant National and EC regulations.

Table 3.8 - Installation of Tail Lifts (truck version)

Models		Tail lift capacity, kN (kg)			
	Wheelbase (mm)	3 (300)	5 (500)	7.5 (750)	10 (1000)
		Minimum value subframe section modulus $W_x$ (cm <sup>3</sup> ) depending on the material yield point (N/mm <sup>2</sup> )			
		360	360	360	360
35S18W; 55S18W	3450 ÷ 3750	2I	2I	26 + S	E

Notes.

E = To be checked on a single case basis (submit the technical documents including the stress and stability calculations).

S = Stabilizers must be fitted.

As far as the van versions are concerned, tail lifts with capacity of up to 3kN (300 kg) may be fitted, provided local reinforcements are fitted to the chassis frame. For higher capacities, the installation must be examined each time.



### 3.10 Recovery Vehicles

Installing breakdown equipment is generally done after choosing a specific subframe to ensure even load distribution and correct connections with the chassis of the component parts and assemblies to handle the vehicle to be recovered.

If the vehicle to be recovered has to be lifted and towed, the towing weights, vertical loads at the hook and the minimum ratio between the weights on the front and rear axle must be observed. (These are defined in the specific authorizations issued by IVECO).

The bodybuilders must use special plates / stickers to indicate the specific conditions for which transport is authorized (towing weight, load at hook, maximum speed, etc.).

### 3.11 Municipal, Fire-fighting and Special Services

Preparing municipal vehicles such as compactors, compressors or road sprinklers in many cases requires:

- building a subframe which is particularly strong at the rear or elastic mountings at the front of the vehicle;
- fitting a vertical exhaust behind the cab;
- application of a stiffer rear suspension system;
- rearranging the rear lights.



Construction of the Subframe

### 3.12 Installation of front snowploughs

The installation of snow removal equipment on the front of the vehicle, such as blades or plows, requires the use of suitable supporting structures and entails observance of the specifications contained in point 2.3 concerning the connection to the chassis. Furthermore, all government requirements and regulations governing the application of this type of equipment must be observed. The functional characters and possible use of the original items located at the vehicle front (e.g. towing hook) must not be affected. Otherwise the body builder must provide for similar items in accordance with the safety standards and regulations.

An increase of the maximum load permitted on the front axle may, on request, be approved for most of the IVECO models, when the latter are used as snowploughs and driven at moderate speed.

Compliance with the requested load must be documented and guaranteed by the bodybuilder that carries out the installation.

### 3.13 Winch Installation

The winch installation on the vehicle should be positioned on one of the following points:

- on the front of the frame (front installation);
- on vehicle chassis behind the cab;
- between vehicle side members, centre or displace on one side;
- on the end of the frame.

The installation should be performed so as not to interfere with operation of units and components of the vehicle and with respect to maximum loads allowed on the axles and following the company directions. Fixing the winch unit and relevant drive components must conform to the directions given at point 2.3 ensuring the reinforced areas are not locally limited to the mounting area (see point 2.17) taking into consideration the rope operations and in particular, its transverse component(s) when the winch is pulling sideways.

For the installation of the winch behind the cab a proper subframe must be designed to have dimensions and structure (stiffening cross members and braces) conforming to the winch capacity.

When specific requests are made for commercially available types of winch, we suggest choosing those equipped with hydraulic systems that can be operated through the hydraulic pumps already used for equipment previously installed on the vehicle (tipping bodies, crane etc.).

For worm screw type winches the power take-off system arrangement should take into account the low performance of such a drive system.

**All safety requirements, national and EC regulations must be complied with.**



### 3.14 Special body conversions

When the special body conversions (some examples listed below) are carried out, the general operating criteria previously detailed must be followed.

As referred to in paragraph 1.8, the vehicles manufactured by IVECO conform to the requirements set by the standards and regulations in force. The body builder must ensure and comply with these requirements as regards the operations carried out, especially in cases of body conversions that involve carrying people.

#### 3.14.1 Chassis-cowls

They are prepared especially for the installation of bodies or special body versions, such as mobile shops, motor homes, etc. Comply with the instructions and precautions specified in the technical documents (chassis diagram) that IVECO provide.

#### 3.14.2 Motor Homes

Particular attention must be given to ensure the total weight of the vehicle is observed and the individual axles are not over or under loaded. A sufficient load margin should be left to allow for the total number of people to be carried with essential items, such as:

- luggage, curtains, sports equipment;
- water tank capacity, toilet facilities food;
- gas bottles, etc.

Make sure the payload can be located in the specific compartments with the necessary margins, providing suitable guidelines for users so loading will be done correctly.

For any work to be carried out on the rear overhang, see the instructions given in point 2.5.

Special attention must be paid when making compartments for installing gas bottles. This must be done in compliance with all current regulations, taking all the necessary safety precautions.



### 3.14.3 Installing an aerial platform

The choice of aerial platform is determined by taking into account the specifications of the platform required to allow for vehicle performance.

The aerial basket and its payload must be positioned in accordance with permitted load limits.

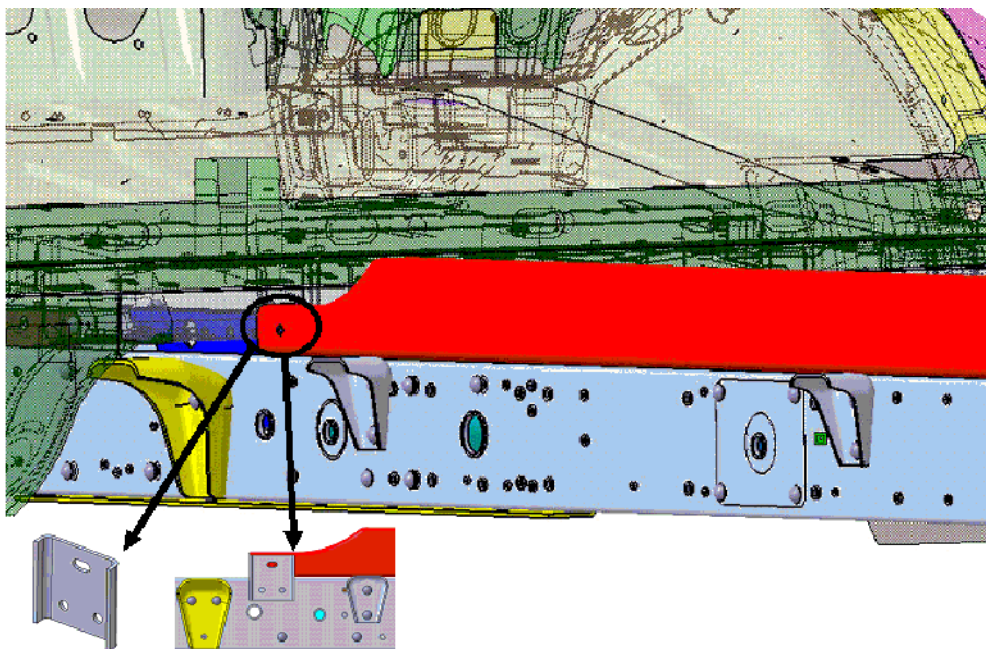
When applying the aerial basket, it will be necessary to comply with specific legal requirements, national regulations (e.g. CUNA, DIN) and international regulations (e.g. ISO, CEN), after checking which are required for the specific vehicle type.

Stabilisers must be used during working stages. The aerial basket must be fitted to the vehicle on a suitable subframe. To construct the subframe, comply with general requirements (see point 3.3), and also refer to tables 3.2 and 3.3 for section dimensions.

The bodybuilder must also:

- Be careful to construct the subframe in such a way as to avoid abrupt changes in cross-section, safeguard the frame against stress concentration points and minimise front overhang (see attached photo).

Figure 3.19



DETAIL OF FIRST SUBFRAME FASTENING

- Adjust vehicle lift/lower speed by modifying the hydraulic system to include flow modulating valves.
- Minimise lifting of the front axle off the ground in relation to the vehicle's horizontal attitude.

Specific cases must be checked each time. Request specific authorisation from IVECO.



**The bodybuilder must check vehicle stability each time and take all the necessary precautions for correct use. The crane manufacturer and the body builder are responsible for determining the type and number of stabilisers and for constructing a subframe suited to the maximum static moment and crane position.**

The minimum thickness of the straps must be 4 mm and they must be long enough to cover the frame longitudinal members in front of the cab block areas and to the rear of the subframe first fastening (see attached photo); the total length must be at least 1050 mm.





Construction of the Subframe

**SECTION 4****Power take-offs**

	Page
4.1 General Specifications	4-3
4.2 Power Take-off from Gearbox	4-5
4.3 Power Take-off from Transfer Box	4-8
4.4 Power Take-off from Drive line	4-10
4.5 Power Take-off from Engine	4-10
4.5.1 Torque drawing from engine front end	4-10
4.6 PTO management	4-11
4.6.1 Management of PTO on gearbox	4-11
4.6.2 Management of PTO on reduction unit	4-13
4.6.3 Engine speed control for power take-off	4-14







## 4.1 General Specifications

Different types of power takeoffs for motion withdrawal can be mounted to control of the ancillary control units. According to the type of use and the performances required, the application can be performed as follows:

- The gearbox.
- Transmission.
- The front 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 r.p.m. (below 1000 r.p.m.) must be avoided to prevent irregular running.

The power taken in relation to the number of revolutions of the power take-off at the required torque.

$$P(\text{CV}) = \frac{M \cdot n \cdot i}{7023} \quad P(\text{kW}) = \frac{M \cdot n \cdot i}{9550}$$

**P** = Useable power

**M** = Torque permitted for the power take-off (Nm)

**n** = power take-off r.p.m.

**i** = Transmission ratio = PTO output rpm/ engine rpm

### Type of use

Both occasional and continuous use should be considered.

For occasional use periods of under 30 minutes are considered.

The values for continuous use are those used for long periods (60'). Whenever this is comparable to that of a stationary engine, the suitability of reducing the scheduled values on the basis of the conditions of use (engine cooling, gearbox etc.) should be evaluated.

The scheduled take-off values are also applicable for uses which do not involve large variations of torque either in frequency or magnitude.

To avoid overloading, in some cases (e.g. hydraulic pumps, compressors) it may be necessary to include the application of devices like clutches or safety valves.



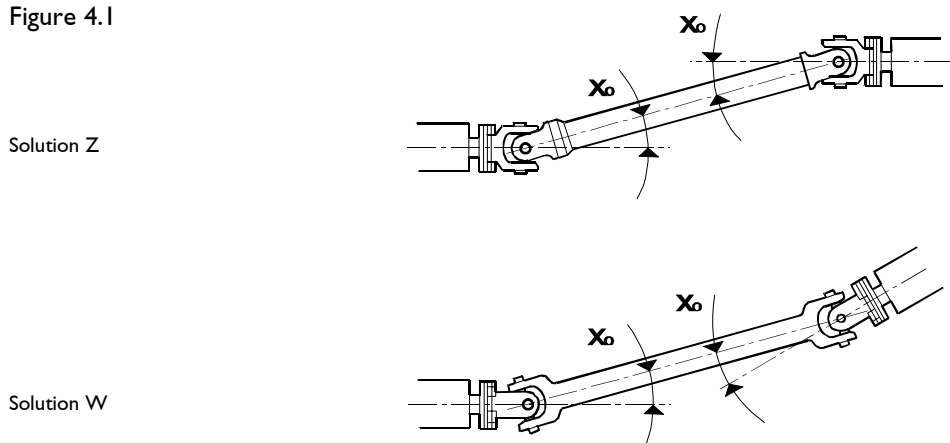
### PTO transmissions

The kinematic forces of the transmission from the power take-off to the relevant apparatus should be carefully considered (angles, r.p.m., moment) during the design phase and the dynamic behaviour during operation in compliance with the transmission Manufacturer's instructions should be respected. The dimensions should take into consideration the forces which might occur under maximum power and torque conditions.

To obtain a uniformity of kinetic forces angles of equal value, maximum of  $7^\circ$ , should be obtained at the extremities (Figure 4.1). 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 different spatial inclinations ( $\varphi$ ), the variations in r.p.m. should be compensated for with the arrangement of the forks shown in Figure 4.2.

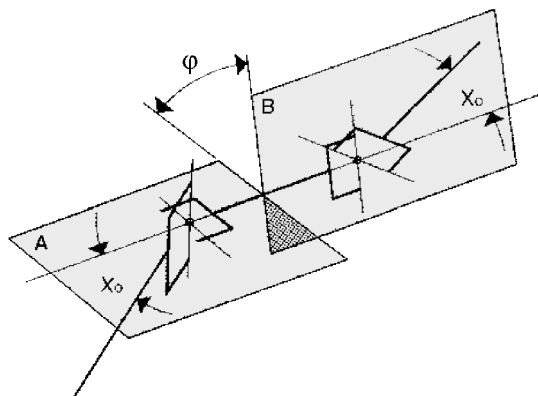
For transmissions employing multiple sections, the instructions given at point 2.8.2 should be followed.

Figure 4.1



91522

Figure 4.2



91523



## 4.2 Power Take-off from Gearbox

Depending on the type of gearbox power can be taken from the layshaft through the flanges or splining located on the rear, side or lower part of the gearbox.

The technical characteristics necessary are given in the documentation supplied upon request for the various gearboxes.

The types of power take-off and the torque values obtained with the ratio between the number of output revolutions and engine r.p.m. are shown in Table 4.1.

The values refer to the conditions indicated in the table.

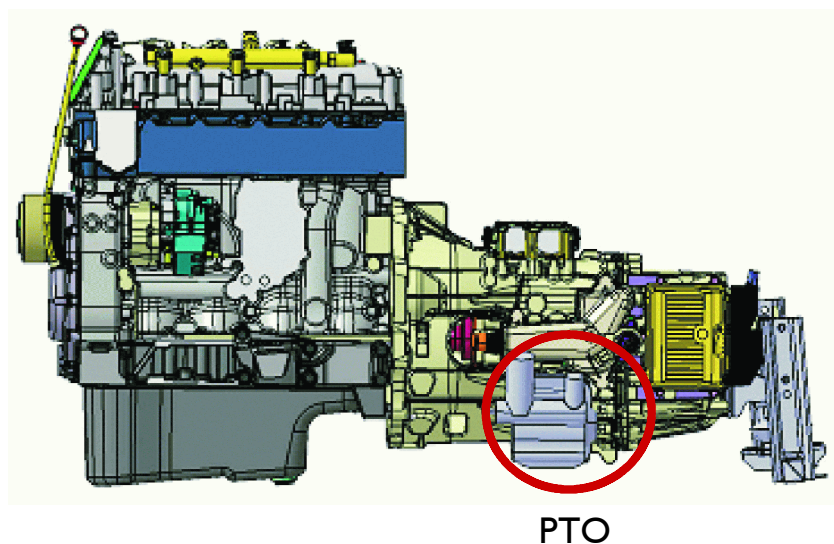
Higher values for occasional use must be agreed upon as each occasion arises depending on the type of use.

Check the vehicle to ascertain whether it is possible to fit a power take-off suitable to its size.

The power take-off applied to the gearbox must only be used when the vehicle is stationary and must be engaged and disengaged when the clutch is disengaged to avoid excessive stress on the synchronisers during gear change. For special situations when the power take-off is used and the vehicle is moving the gear must not be changed.

For gearboxes equipped with a torque converter, the same power take-offs used for normal gearboxes are, as a rule, used. It should be carefully noted that, when the engine r.p.m. is below 60% of the max. value the converter will be in the phase of hydraulic r.p.m.; in this phase, depending on the absorbed power, the r.p.m. of the power take-off is subject to oscillation despite the fact that the engine r.p.m. is constant.

Figure 4.3



### Transmission PTO data

The transmission ECU and the Body Computer (BC) will need to be reprogrammed when a PTO is applied after-market. Interventions on the electrical and pneumatic system are required. Read paragraph 4.6 "PTO management" carefully before applying a PTO.

Re-programming of the electronic control units 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), furnishing the information concerning the specific P.T.O. utilized.

Table 4.1

Gearbox	PTO opt	PTO	Assembling position	Output	Direction of rotation (1)	Flange	Max. torque C <sub>max</sub> (Nm) (2)	Total PTO ratio
6S400	06365	23Z2	Sideways	Rear	Clockwise	Pump	180	1.04

(1) When viewing the P.T.O. output from the front.

(2) The maximum torque that can be taken refers to an engine speed of 1,500 r.p.m. output from the P.T.O. For higher speeds, the value for the torque that can be taken must be reduced proportionally.



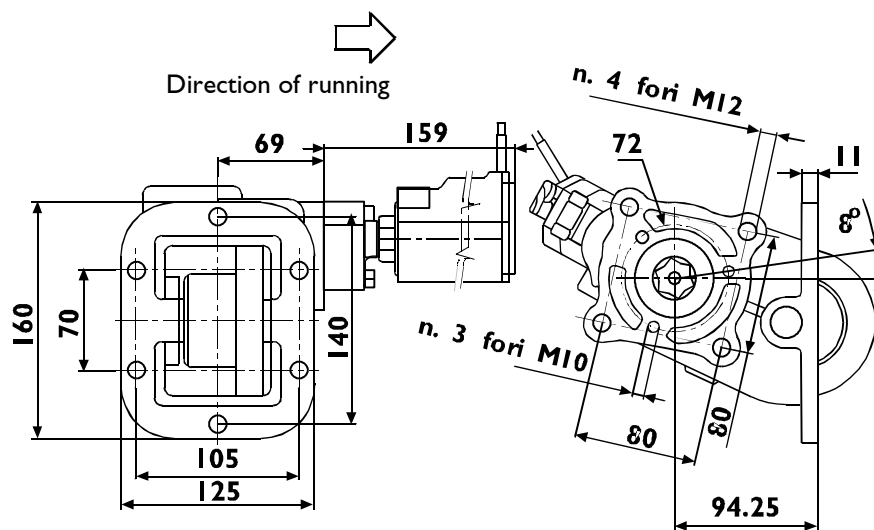
**For torque drawing, keep values defined in Table 4.1.**

**Transmission oil temperature must not exceed 110°C during prolonged use. Coolant temperature must not exceed 100°C. Not all types of power take-off available on the market are suitable for continuous use. When in use the specifications (working periods, pauses etc.) specific to the power take-off in question should be respected.**



**Fitting the gearbox with a power take-off other than the ones shown in the table will cause the gearbox warranty to immediately become null and void.**

Figure 4.4



P.T.O. TYPE 20Z1 AND 20Z2

102472



### Direct application of pumps to PTO - gearbox

When the application of pumps of other equipment (e.g. for the control of tipping apparatus or cranes) 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 chassis and engine unit (cross member, transmission shaft etc.), 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; by way of an example, the moment due to the additional masses must not adopt values of over 3% approx. of the maximum engine torque. In cases where the gearbox is applied in a single unit with the engine, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine r.p.m.

The power take-offs feature a flange for direct pump assembly with 4-hole UNI coupling. The output consists of a 21 ISO 14 splined shaft (Figure 4.4).



Power Take-off from Gearbox

### 4.3 Power Take-off from Transfer Box

It is possible to fit a power take-off behind the reduction unit. Iveco requires the application of the specific options, shown in Table 4.2.

The power take-off rpm to the reduction unit depends on the gearbox speed engaged.

Refer to the following table for PTO installation and associated power take-off options.

Table 4.2

OPT	Type	Figure	Coupling flange	Drive transmission	Max possible take-off level Cmax (Nm) Pmax (bhp) (l)	Gearbox speed	Transmission ratio
8693	2 right	4.5	Unit 2	Splined hole DIN 5482 B35x3l	Cmax 150 Pmax 40	1	5.375
8694	3 right	4.6	Unit 3	Splined hole DIN 5482 B35x3l		2	3.154
8695	ISO	4.7	ISO 4 hole	Splined hole DIN ISO 14 5482 B35x3l		3	2.04l
						4	1.365
						5	l
8696	Flange	4.8	-	SAE 1400 4XM12	6	0.79l	
						RM	4.838

(1) the maximum take-off values refer to an engine speed of 1900 rpm in fifth gear. For different speeds or gears, check that the maximum stated torque and power levels are not exceeded.

The power take-off on the reduction unit may be used both with the vehicle stationary and in motion.

#### Direct application of pumps to the PTO - reduction unit

When pumps or other user devices are applied direction to the power take-off without intermediate shafts, check that the pump dimensions allow safety margins with the frame and power unit (crossmembers, propeller shaft etc.) and then ensure that the static and dynamic torques exercised by the pump and power take-off masses are compatible with the strength of the reduction unit casing wall.

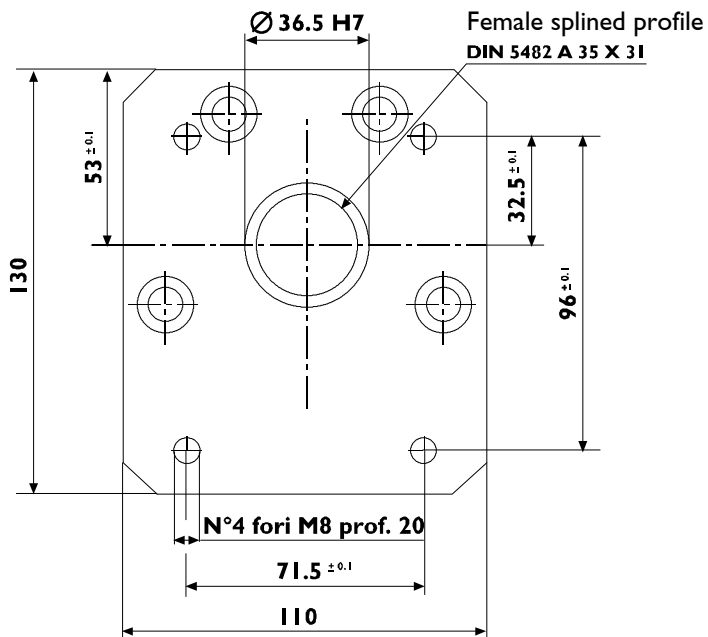
The inertia effect of the additional masses must also be checked so that resonance effects are not set up in the power unit within the engine operating speed range.



**For continuous power take-off operation, check that the reduction unit fluid temperature does not exceed 110°C and the engine water temperature does not exceed 100°C.**



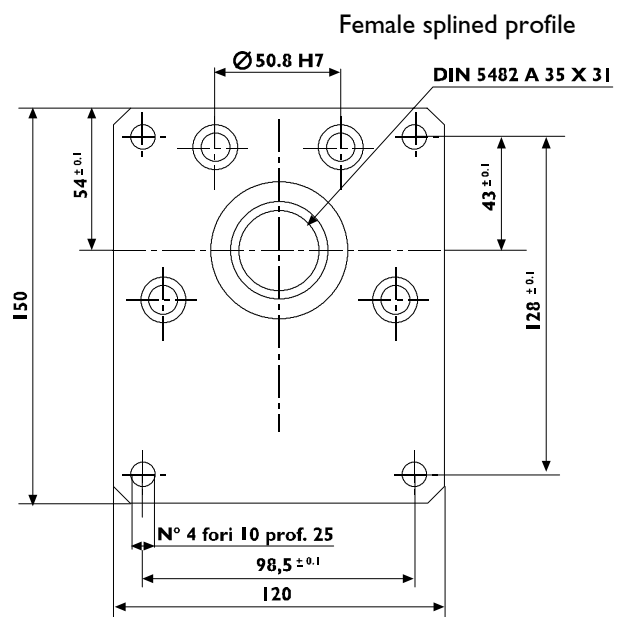
Figure 4.5



Power take-off Unit 2

119385

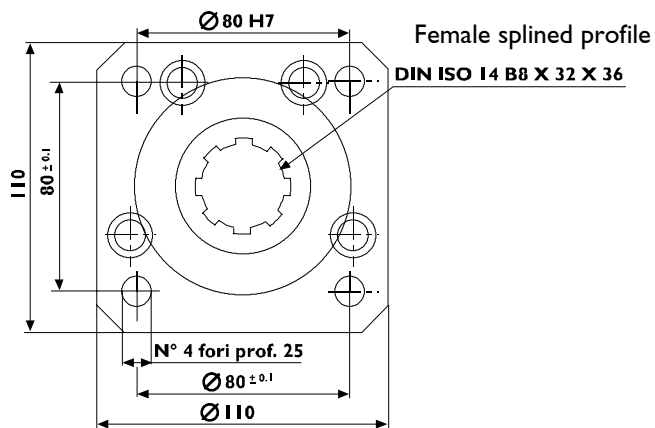
Figure 4.6



Power take-off Unit 3

119386

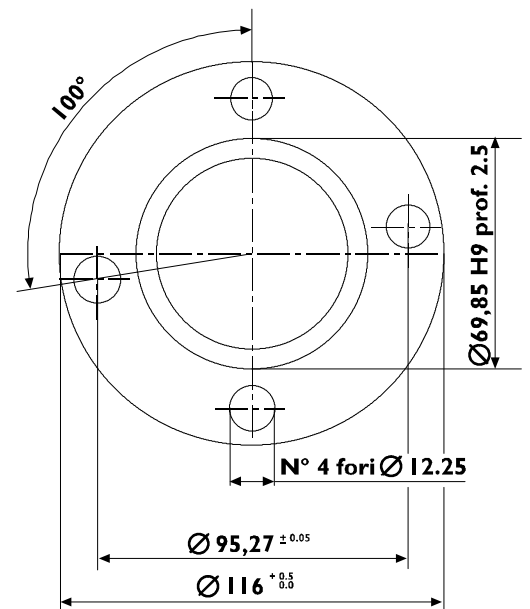
Figure 4.7



Power take-off ISO 4 holes

119387

Figure 4.8



SAE flange type

119388

The power take-off is turned on and off by opening a solenoid that delivers oil to a single-acting actuator. An activation button on the dashboard controls the power take-off activation and deactivation functions.



#### 4.4 Power Take-off from Drive line

**NOTE** Not present on Daily 4x4 Euro 4.

#### 4.5 Power Take-off from Engine

In general the use of these power take-offs is planned for apparatus requiring a continuous power supply.

#### 4.5.1 Torque drawing from engine front end

Power is taken from the front part of the crankshaft via belt-driven transmissions where the torque requirement is limited (e.g. air conditioning unit drives).

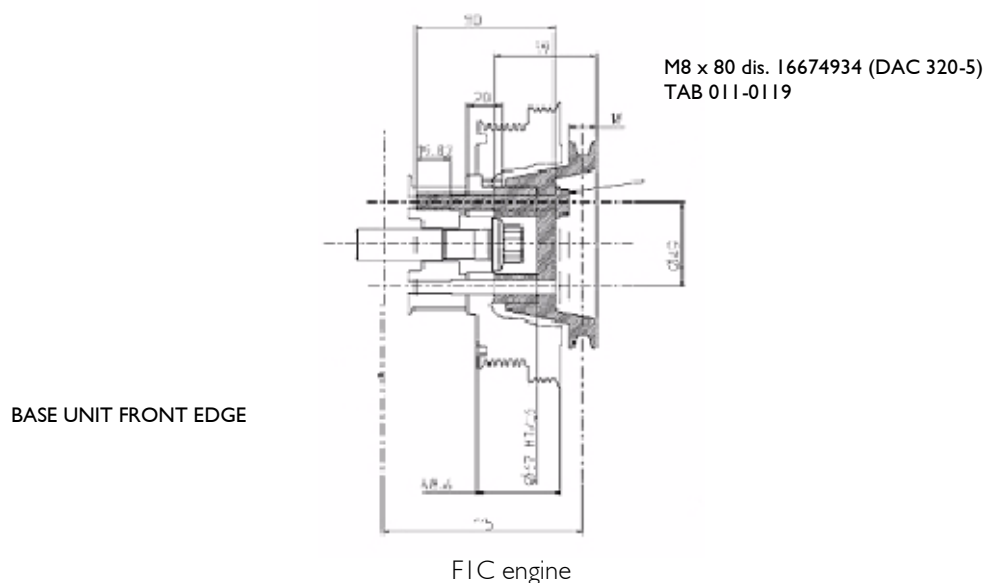
The data shown in the table refer to a drawing made with a special pulley made according to the construction examples shown in Figure 4.9.

### Table 4.3 - Power take-off from the front of the engine

Engine	Engine code (1)	n <sub>max</sub> (rpm) (2)	Max. take-off values			
			Max. no-load speed (r.p.m.)	Max. torque that can be taken (Nm)	Max. inertia moment (kgm <sup>2</sup> )	Max. bending moment (Nm) (3)
.18	FICE048TH* C	3500	4200	35	0,005	42

- (1) Verify engine code on engine plate
- (2) Maximum revs corresponding to the maximum rating
- (3) With respect to the base front edge

Figure 4.9





## 4.6 PTO management



Operations which do not comply with the instructions specified by IVECO or made by non qualified personnel can cause severe damage to on-board systems, effect driving safety and good operation of the vehicle and cause considerable damage which is not covered by warranty.

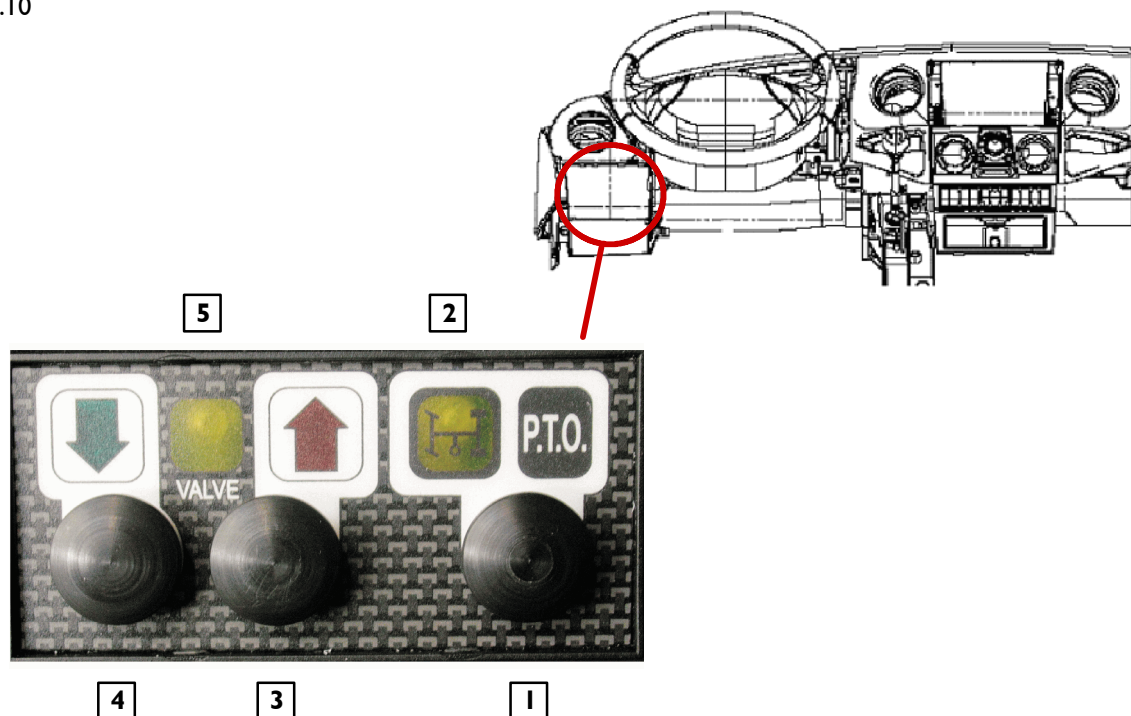
### 4.6.1 Management of PTO on gearbox

Inside the driver's cab is a control panel for power take-off activation and deactivation (Figure 4.10). The panel is divided into two separate sections referred to as "PTO" and "VALVE".

- **The "PTO" section** (button ref. 1 and warning light in ref. 2) controls power take-off engagement and disengagement, a warning light (2) signals the power take-off status.
- **The "VALVE" section** (buttons ref. 3, 4 and warning light ref. 5) controls the tipping operation, a warning light indicates the body condition e.g. raising or lowering. Both buttons interact with a hydraulic control valve in the tipping system.

The "VALVE" section is only designed for tipping vehicles and is not active on non tipping vehicles.

Figure 4.10



POWER TAKE-OFF CONTROL ON THE DASHBOARD

In general the use of these power take-offs is planned for apparatus requiring a continuous power supply. The push-button pad makes it possible to control the power take-off functions.



**Manual gearbox PTO mode****- PTO engagement**

The power take-off can be engaged and disengaged by means of a linear-acting actuator.

The push-button pad makes it possible to control the power take-off functions.

Procedure for Power Take-Off Engagement:

- a)** stop the vehicle;
- b)** engage neutral gear, if the specific body version is to be operated with the vehicle stationary, or engage the gear with which the equipment is to operate;
- c)** press the clutch pedal to the floor;
- d)** Press and release the button (1) (found on the power take-off panel) that controls power take-off engagement.
- e)** The power take-off actuation warning light will start blinking slowly until it remains ON steadily. The power take-off will be engaged when the warning light (2) comes ON steadily.
- f)** Released the clutch pedal, the power take-off has been engaged correctly.

**- PTO disengagement**

- a)** Stop the operation of the equipment.
- b)** Press the clutch pedal to the floor and then button (1) controlling the operation of the power take-off.
- c)** The power take-off operating warning light (2) will go out: the power take-off has been disengaged.
- d)** release the clutch pedal.



**Disengage the power take-off when it is not being.**



### 4.6.2 Management of PTO on reduction unit

The cab contains a power take-off control console that controls engagement and release functions. The power take-off is engaged and released by means of a solenoid.

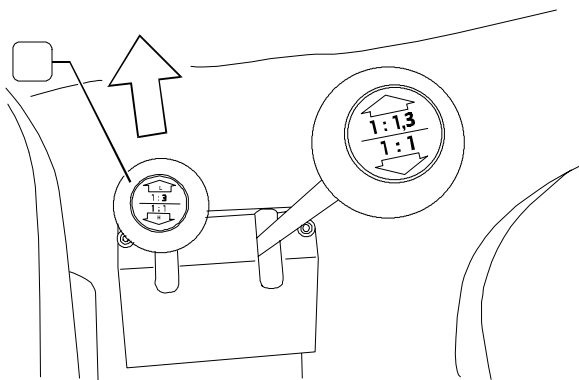
- Engagement of power take-off on reduction unit

The purpose of these actions is to prepare the equipment for operation.

The correct procedure for engaging the power take-off on the reduction unit is:

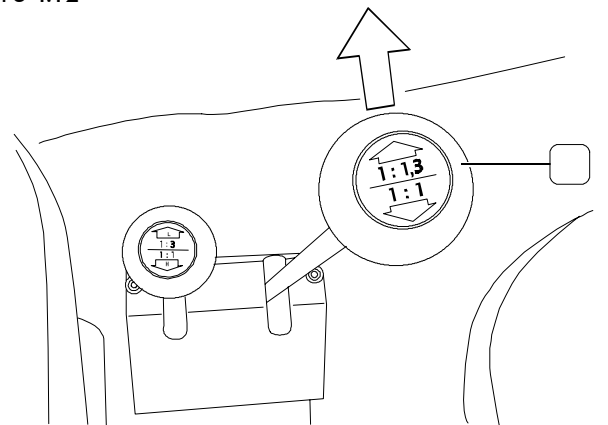
- stop the vehicle and leave the engine idling.
- Check that the reduction unit 1/2 gear and gearbox gear lever is in neutral and that the handbrake is engaged.

Figure 4.11



A - CRAWLER GEAR LEVER

Figure 4.12



B - HALF-GEAR LEVER

- Fully depress brake pedal.
- Press and release the button in the control console, which controls reduction unit PTO engagement.
- The indicator light begins to flash. The reduction unit PTO is engaged when the warning light comes on with a fixed light and an audible signal lasting approximately 1 second is heard.
- Now engage the gearbox speed selected for the application and release the clutch slowly.
- Releasing the power take-off on the reduction unit
  - Stop the equipment.
  - Press the brake pedal.
  - Put the gearbox in neutral.
  - Press the button that controls power take-off engagement.
  - The power take-off engagement warning light goes off. The PTO is released.
  - Now the clutch pedal may be released.



**Disengage the power take-off when it is not being.**



PTO management

### 4.6.3 Engine speed control for power take-off

#### FIC engines

FIC engines incorporate an engine management control unit with built-in power take-off (P.T.O.) function, which makes it possible to achieve isochronous engine speed control. The vehicle is fitted with a Cruise Control option: engine speed can be adjusted in 50 rpm steps, curves display a regulator deviation of < 1% until the maximum torque curve is reached.

Engine speed adjustment options with the use of Cruise Control are given below:



**Engine speed may be adjusted only with the vehicle stationary, gearbox in neutral and handbrake on.**

#### Cruise Control in RESUME position (Cruise Control activated)

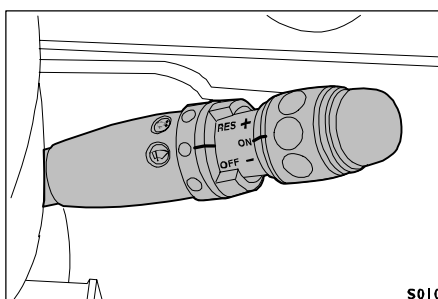
The system will go to the last speed stored in the control unit.

This speed may be adjusted by operating the +/- selector on the steering wheel interface (Figure 4.13) to increase/decrease the rpm number in 50 rpm steps.

Table 4.4

Position selected	Engine rpm adjustment
ON+	Engine rpm increase
ON-	Engine rpm decrease
RESUME	Select last rpm stored
OFF	Delete setting

Figure 4.13



**NOTE** With Cruise Control on, it is possible to return to engine idling status (adjustment cancelled) by positioning the Figure 4.13 Figure selector to OFF or by pressing the brake or clutch pedal.



## SECTION 5

### Specific information and instructions

	Page
5.1 Electronic system	5-3
5.2 Bodybuilder connectors	5-4
5.2.1 Inside the cab	5-4
5.2.2 Conector instaladores (61071) 20 pin	5-5
5.2.3 12 pin bodybuilders connector (72068)	5-8
5.2.4 12 pin connector for Minibus	5-10
5.3 Electronic control units	5-17
5.3.1 Precautions to be taken with the installed electronic control units	5-17
5.3.2 Modificación de la posición de las centralitas electrónicas	5-20
5.3.3 Desconexión de las centralitas electrónicas	5-20





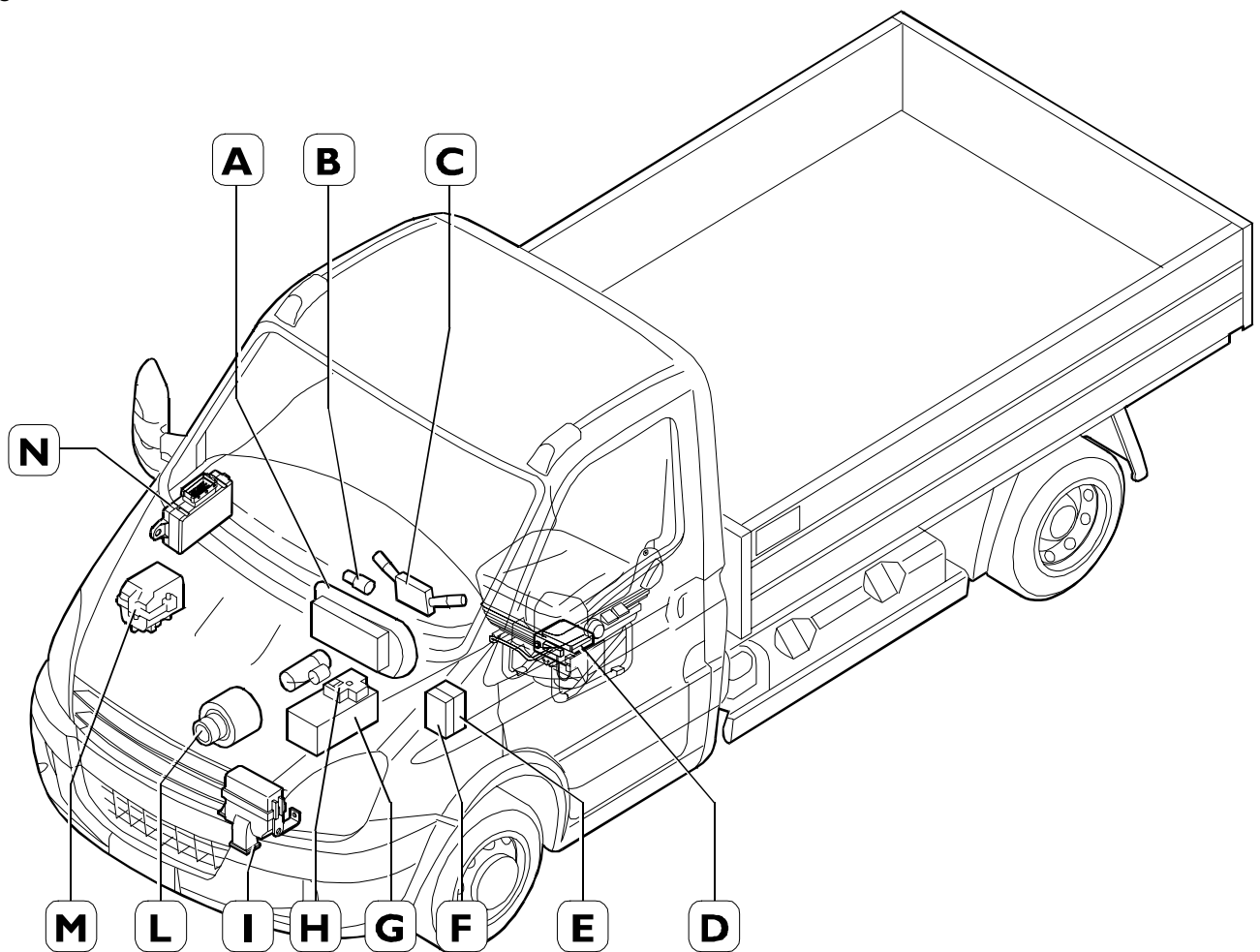
## 5.1 Electronic system

The following shows the location of the electronic control units and connectors that can be installed on the vehicle.



**Devices or electrical circuits must not be connected directly to the control units described below. It is only possible to use the connectors listed in the following paragraphs.**

Figure 5.1



120379

A. Instrument panel - B. Ignition key - C. Steering wheel interface - D. Door Management differential and PTO - E. CPL interconnection control unit - F. Body Computer - G. Battery - H. Positive distribution control unit CBA (+30) - I. Fuse box OPT - L. Alternator - M. Interconnection control unit (engine) CVM - N. CGP (Door Management Unit).



General Specifications

## 5.2 Bodybuilder connectors

The various connectors that can be used by the fitter are described in detail in the following paragraphs. To use the fitter connectors, you must request spare part kit comprising the female connectors, cable terminals and protective pads.



**Any interface between the body building and the vehicle shall take place through diodes and relays (clean contacts), unless otherwise specified in the manual.**

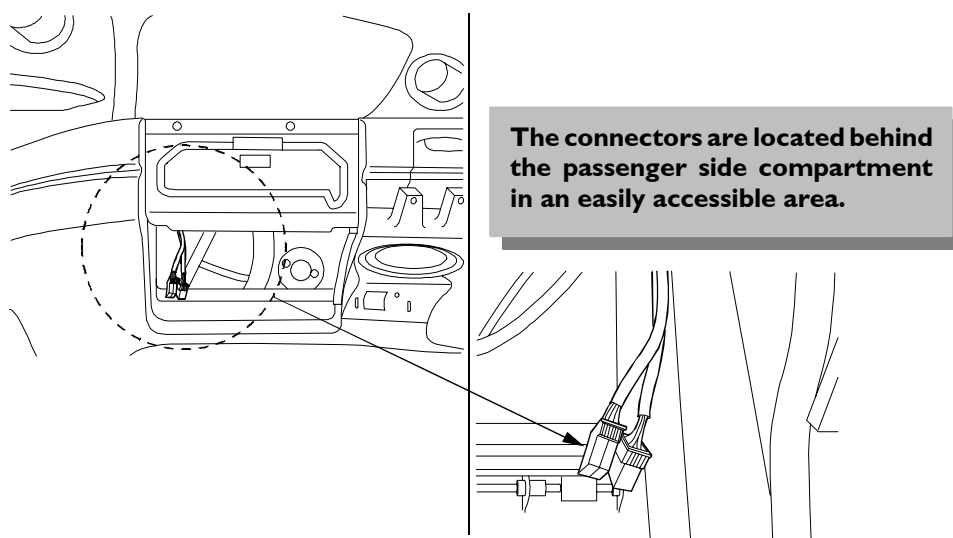


**DIRECT CONNECTION TO THE BODY BUILDER CONNECTOR IS STRICTLY PROHIBITED. FAILURE TO COMPLY WITH THIS PRESCRIPTION WILL CAUSE THE WARRANTY TO IMMEDIATELY BECOME NULL AND VOID.**

### 5.2.1 Inside the cab

The new Daily is fitted with two connectors to be used by body builders to interface with the vehicle electrical system.

Figure 5.2



119356





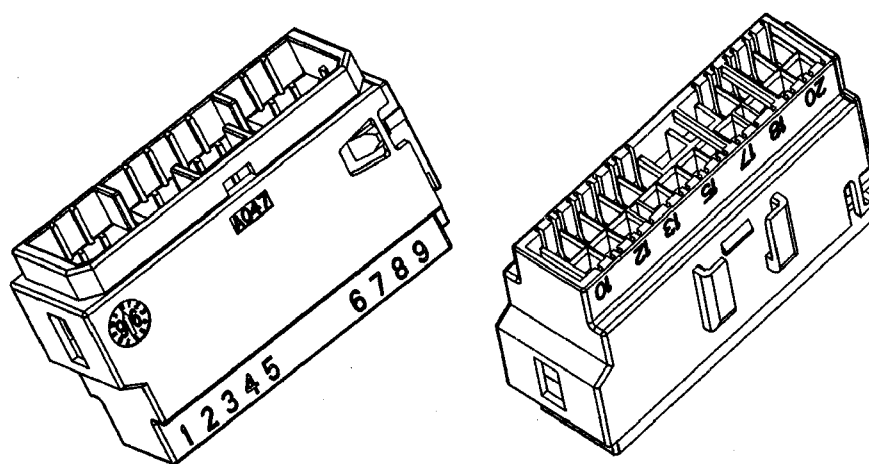
### 5.2.2 Conector instaladores (61071) 20 pin

To allow body builders to achieve an effective, accurate interface with the system on DAILY range vehicles, IVECO have provided for specific connection points to be used with the auxiliary systems.

Such provision is necessary to avoid tampering with and interfering in the basic system, in order to guarantee functional intactness and, therefore, the validity of the contractual warranty itself.

#### 20-way connector

Figure 5.3



114082

Counterpart to be coupled onto the vehicle

Table 5.1

Code number	Description
500314817	20-way male holder joint
500314820	Male contact for 0.3 to 0.5 mm <sup>2</sup> cable
500314821	Male contact for 1 to 1.5 mm <sup>2</sup> cable



Table 5.2 - Basic functions of 20 pin connector

Pin conn.	Description	Signal	Remarks
1	Engine start-up	Input Max. 20 A	When an ignition-operated positive is supplied, the starter motor is powered and starts the vehicle engine. Operation takes place only when the panel key is turned. When starting the vehicle, NO SAFETY CHECKS OF ANY TYPE ARE CARRIED OUT e.g. gear engaged etc. +12V = engine start signal Open circuit = no action
2	Engine shut-down	Input Max. 10 mA	When a pulse is sent to the pin, the vehicle engine is shut down +12V = Engine shut-down Open circuit = no action
3	Service brake	Max Output 500 mA (interface with uncoupling diode)	When the brake pedal is pressed, a positive signal is generated. +12V = Service brake active Open circuit = Service brake inactive
4	Vehicle stationary	Output Max. 500 mA	When the vehicle is off, an earth signal is supplied Earth = vehicle shut down Open circuit = vehicle in motion
5	Handbrake	Max Output 500 mA (interface with uncoupling diode)	When the handbrake is operated, an earth signal is present Earth = handbrake engaged Open circuit = service brake released
6	Battery positive	Output Max. 15 A	Positive protected by fuse present on dashboard node F32.
7	Exterior lights	Output Max. 500 mA	A positive signal is supplied if the vehicle side lights are on Open circuit = exterior lights off +12V = exterior lights on
8	Alternator in operation	Max Output 500 mA (interface with uncoupling diode)	A signal is supplied when the vehicle alternator is in operation. Earth = Battery not charged +12V = Battery charged
9	Clutch pedal	Max Output 500 mA (interface with uncoupling diode)	When the clutch pedal is pressed, the circuit is open. Open circuit = pedal pressed +12V = pedal released
10	Reverse	Max Output 500 mA (interface with uncoupling diode)	When reverse is engaged, a positive signal is present Open circuit = Reverse not engaged +12V = reverse engaged



Table 5.2 - (continues) Basic functions of 20 pin connector

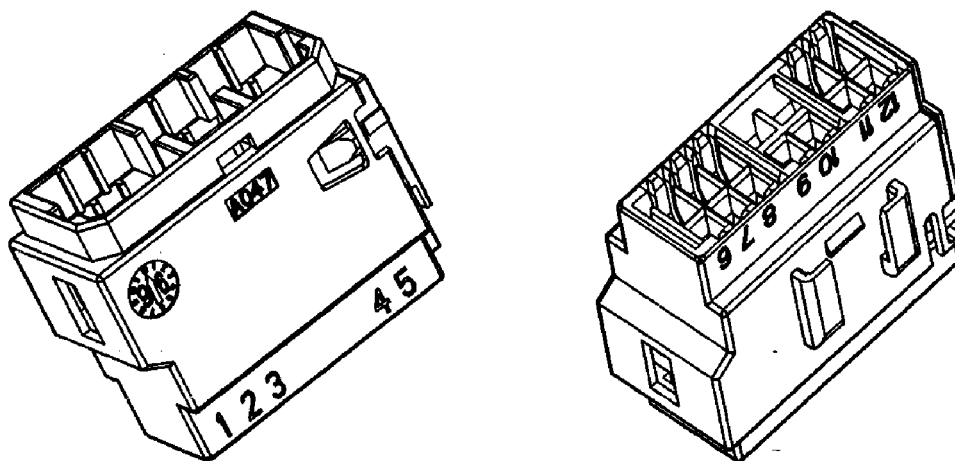
Pin conn.	Description	Signal	Remarks
11	Key-controlled positive	Max Output 5 A	Ignition-operated positive protected by fuse present on dashboard node F49.
12	Cruise control set +	Max input 10 mA	With the vehicle stationary, the engine rpm number is increased at each pulse (50 engine rpm per pulse). When the vehicle is travelling faster than 30 km/h, the vehicle speed can be adjusted. Wire open = Set + is inactive +12V = Set + active
13	Cruise control set -	Max input 10 mA	With the vehicle stationary, the engine rpm number is decreased at each pulse (50 engine rpm per pulse). When the vehicle is travelling faster than 30 km/h, the vehicle speed can be adjusted. Wire open = Set - is inactive +12V = Set - active
14	Cruise Control OFF (enable by connecting to teleservices)	Max input 10 mA	Only for vehicles without Cruise Control on the steering wheel interface. As soon as the key has been moved to the first position, a positive signal must be given to simulate the presence of the Cruise Control and then the remote controls may be used. When the positive signal is removed, the Cruise Control OFF operation is carried out. Once the OFF control has been used, the pulse must be supplied twice to re-enable the control. (first pulse Cruise Control ON, second pulse control). Wire open = Cruise control inactive +12V = Cruise Control active
15	Cruise control RESUME	Max input 10 mA	With the vehicle stationary, the positive signal adjusts the rpm to the stored number When the vehicle is travelling faster than 30 km/h, the vehicle speed can be adjusted to the stored speed. Wire open = Res is inactive +12V = Res active
16	Not connected		
17	EARTH	Max Output 15 A	
18	Not connected		
19	Not connected		
20	Not connected		



### 5.2.3 12 pin bodybuilders connector (72068)

12-way connector

Figure 5.4



114083

Counterpart to be coupled onto the vehicle

Table 5.3

Code number	Description
500314815	12-way male holder joint
500314820	Male contact for 0.3 to 0.5 mm <sup>2</sup> cable
500314821	Male contact for 1 to 1.5 mm <sup>2</sup> cable



Table 5.4 - Basic functions of 12 pin connector

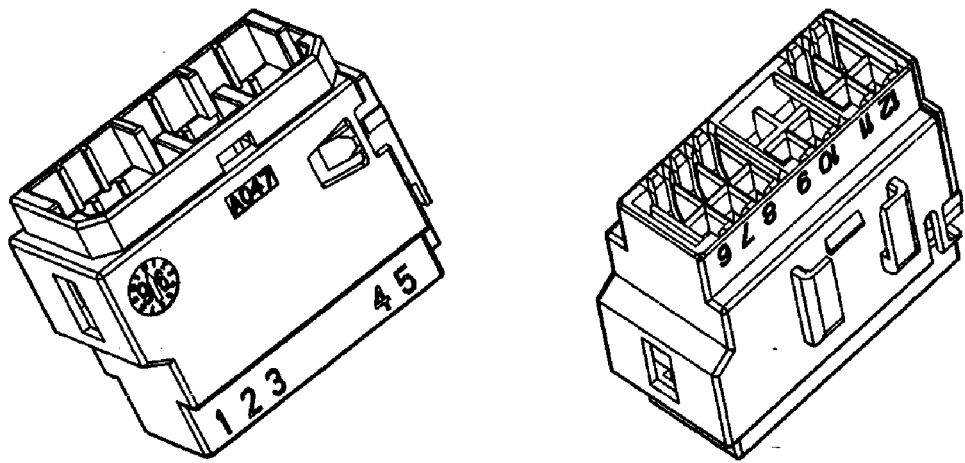
Pin conn.	Description	Signal	Remarks
1	Speed limiter	Input Max. 10 mA	The vehicle speed will be limited to 30 k.p.h. when a ground is supplied.
			Open circuit = speed limiter OFF. Ground = speed limiter ON.
2	Programmable speed limiter	Input Max. 10 mA	Limitation to the current speed will be turned ON/OFF when a ground is supplied.
			Open circuit = no action. Ground = speed limiter ON/OFF.
3	Multiple switch	See Specification 1 - Chapter 4 - Power take-off	
4	Speed signal (B7)	See Specification 2	
5	Automatic key	Input Max. 500 mA	Positive signal supplied to simulate initial key rotation (key ON position). Only the main loads are powered, the vehicle cannot be started from outside: vehicle key is not recognised.
			+12V = key ON. Open circuit = key OFF.
6	Power take-off engaged	Output Max. 500 mA	When the power take-off is engaged, an earth signal is present
			Open circuit = no action Earth = power take-off engaged
7	Warning horn	Output Max. 10 mA	Additional horns (to be interfaced with the relay).
			Ground = warning horn ON. Open circuit = warning horn OFF.
8	Multiple switch	See Specification 1 - Chapter 4 - Power take-off	
9	Not connected		
10	Engine revs (r.p.m.)	See Specification 3	
11	Not connected		
12	Not connected		



5.2.4 12 pin connector for Minibus

On Minibus vehicles, the 12-way connector shall be connected as follows.

Figure 5.5



Counterpart to be coupled onto the vehicle

Table 5.5

Code number	Description
500314815	12-way male holder joint
500314820	Male contact for 0.3 to 0.5 mm <sup>2</sup> cable
500314821	Male contact for 1 to 1.5 mm <sup>2</sup> cable



Table 5.6 - Basic functions of 12 pin connector for Minibus

Pin conn.	Description	Signal	Remarks
1	Emergency lights	Output Max. 500 mA	Positive to the intermittence device with the four indicators (LED power supply).
2	Speed limiter programmer	Input Max. 10 mA	Limitation to the current speed will be turned ON/OFF when a ground is supplied. Max. Open circuit = no action. Ground = speed limiter ON/OFF.
3	Out swinging door open	Max Output 10 mA (interface with uncoupling diode)	It signals when the door is closed. Ground = door closed. Open circuit = door open.
4	Speed signal (B7)	See Specification 2	
5	Door status LED (doors locked or unlocked)	Output Max. 500 mA	It signals the door status, with central locking. +12V = doors closed. Open circuit = doors open.
6	Not connected		
7	Warning horn	Output Max. 10 mA	Additional horns (to be interfaced with the relay). Ground = warning horn ON. Open circuit = warning horn OFF.
8	Emergency handle locked	Max Output 10 mA (interface with uncoupling diode)	It signals that the external emergency handle is locked. Ground = handle locked. Open circuit = handle open.
9	Out swinging door failure	Max Output 10 mA (interface with uncoupling diode)	It signals out swinging door operation anomalies. Ground = door closing failed. Open circuit = normal condition.
10	Engine revs (r.p.m.)	See Specification 3	
11	Not used		
12	Not used		

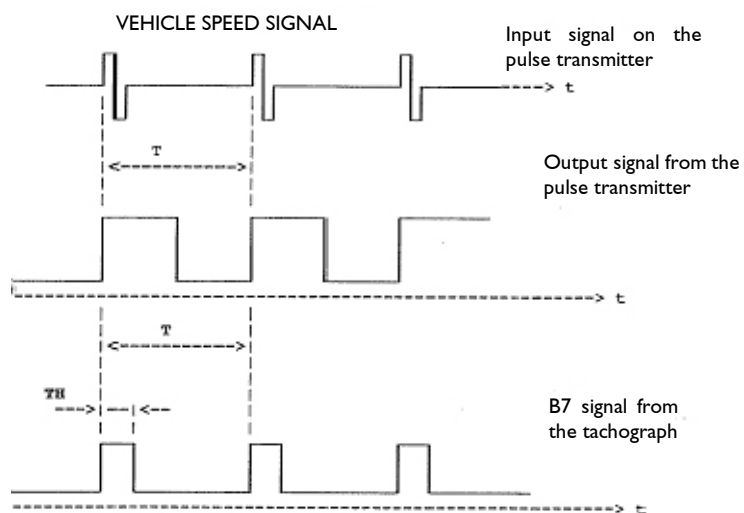


## **Specification 2**

### **Vehicle speed signal**

B7 is a square-wave signal having the same frequency as the input signal (from the pulse generator) and a variable duty-cycle, due to the vehicle's tachometric constant.

Figure 5.6



114186

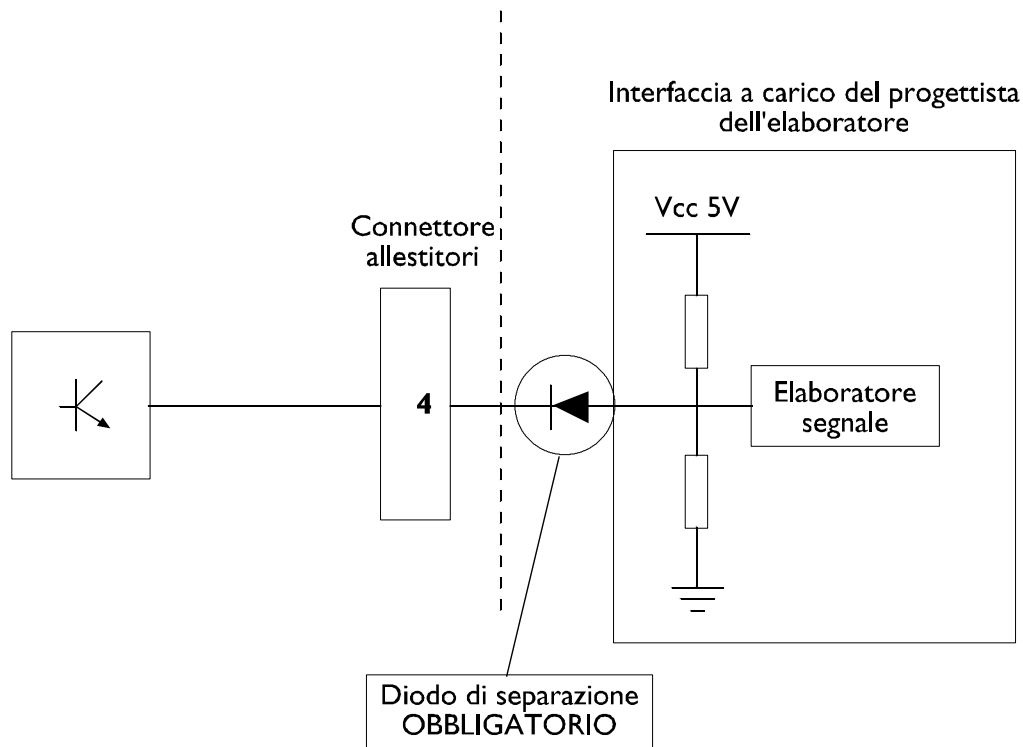
Below are the electric features of the signal:

- Minimum voltage level	< 1.5 V
- Maximum voltage level	> 5.5 V
- Max. frequency	1.5 KHz
- Pulse duration (Thi)	0.67 ÷ 6.7 ms
- Pulse duration tolerance	1%
- Load impedance minimum value	5.5 K $\Omega$
- Load impedance typical value	15 K $\Omega$





Figure 5.7



120377

The body builder must fit a separation diode so that the VON voltage is not lowered.

The signal processing designer must ensure an input interface equal to that shown with a max Vdc of 5 volts and pull-up/pull-down in order not to lower the VON voltage and increase the response time set by the vehicle interface.

Speed calculation, following signal B7 reading, involves controlling both the frequency and the duty-cycle of the signal itself, since the frequency is a function of the vehicle whereas the duty-cycle is a function of the tachometric constant.

Below is the formula used to calculate the vehicle speed from signal B7:

$$Vehicle\_speed - 225 \cdot \frac{T_{hi}}{T}$$

where the speed is expressed in km/h and Thi and T are in thousandths of a second.



Specification 3

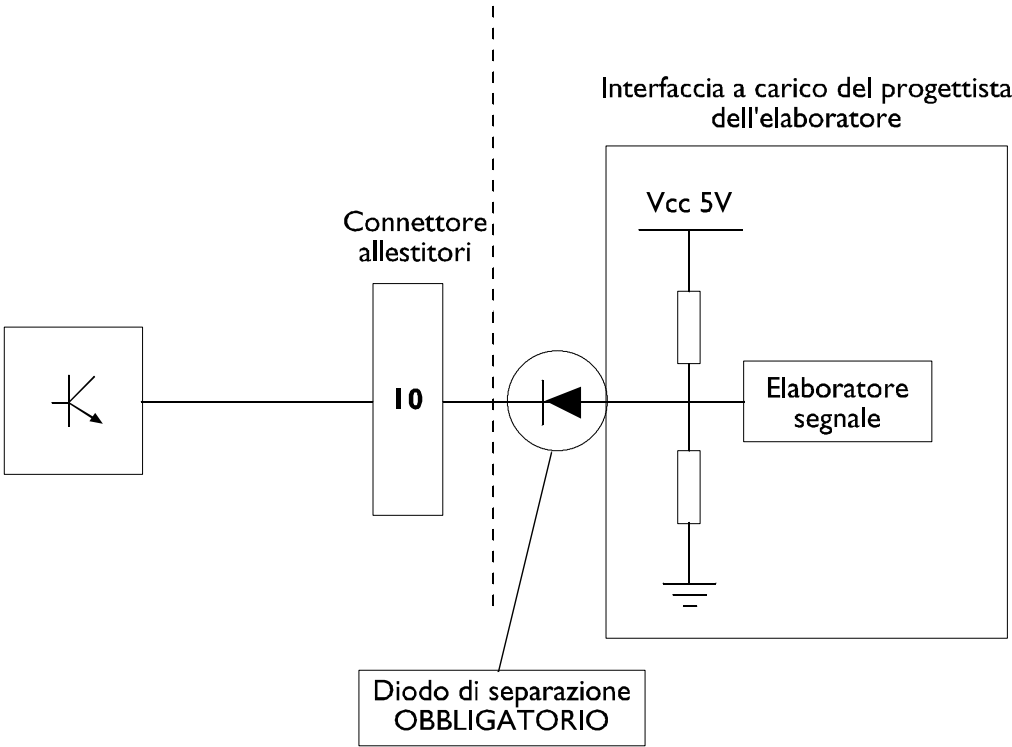
Engine revs signal

The engine revs signal is represented by a square wave.  
Below are the features of the engine revs signal:

Table 5.7

Features	Condition	Minimum	Typical	Maximum	Unit
C_IO	To case / UBat-	1.2		1.85	nF
R_IO	To UBat+	2.57		2.65	kΩ
I_Out				50	mA
t_Rise	Signal rise time of 10% to 90%			10.5	μs
R_ON	Iout < 0,05A			33.8	Ω
VI		5.4	13.5	15.7	V
Pulses per rev (r.p.m.)			4		

Figure 5.8



120378

The body builder must fit a separation diode so that the VON voltage is not lowered.

The signal processing designer must ensure an input interface equal to that shown with a max Vdc of 5 volts and pull-up/pull-down in order not to lower the VON voltage and increase the response time set by the vehicle interface.



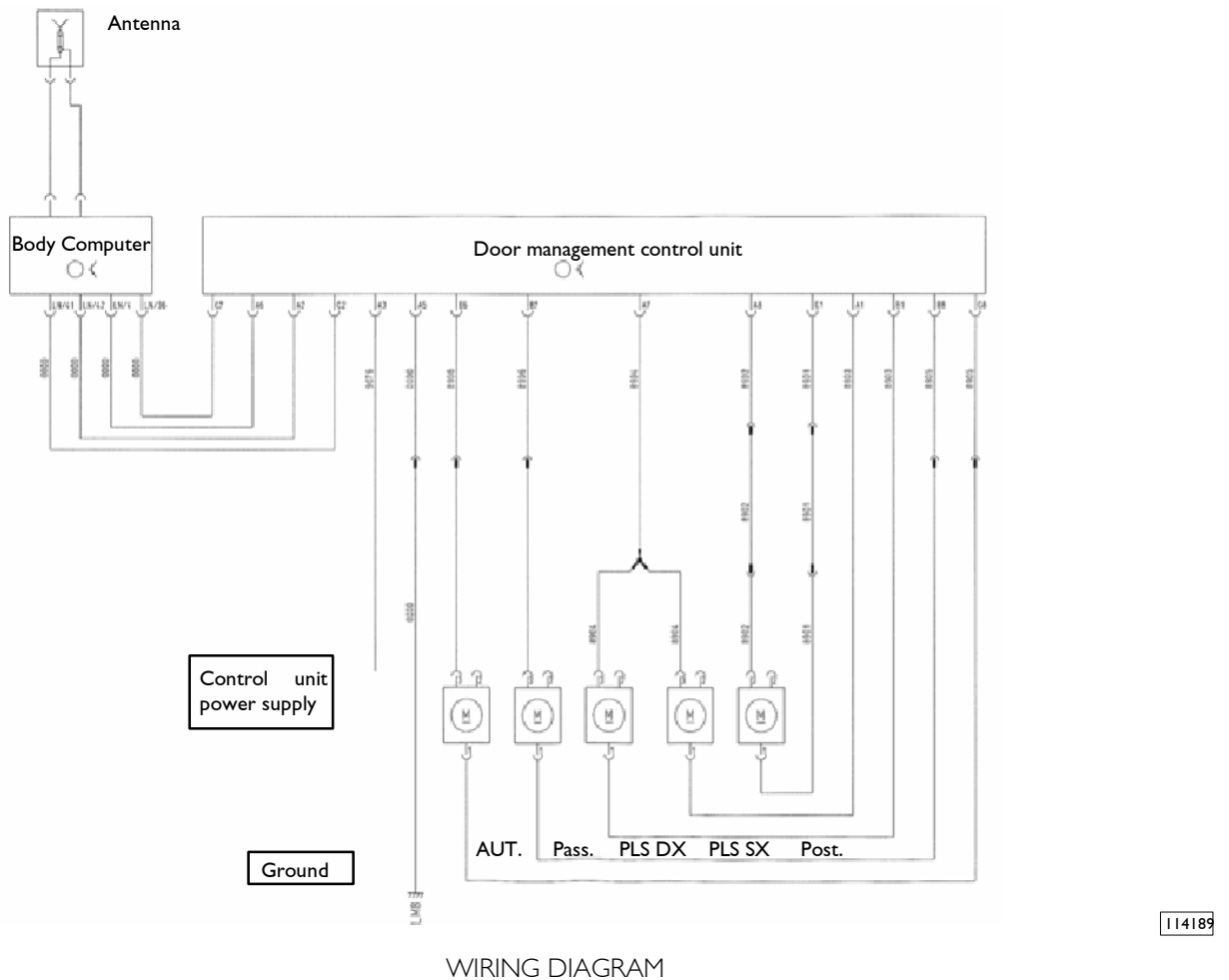
### Central locking control unit connections (optional item)

The door management control unit is an electromechanic component used to drive door opening and closing under the control of the body computer, when the vehicle is equipped with central locking.

The component is made up of four exchange relays used to drive the front doors, rear door and **PLS** (Sliding side doors).

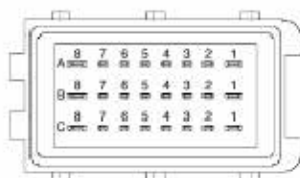
The control unit is installed in the cab left-side panel, by making use of a special fastening bracket.

**Figure 5.9**



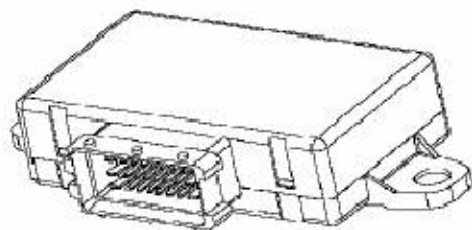
114189

**Figure 5.10**



114190

CONNECTOR DETAIL



114191

DOOR MANAGEMENT CONTROL UNIT



Operation with 2-button key. Briefly press button 1 built into the key: the indicator lights will blink once to indicate that all the front door locks have been locked. To unlock the door locks, press button 2, by pointing the key towards the vehicle all the time: the indicator lights will blink twice to indicate that all the front door locks have been unlocked.

- Central locking can be actuated only by means of the remote control.
- Opening or closing the doors by means of the key will not involve central locking actuation.
- If the vehicle is equipped with central locking with electronic alarm, overall vehicle monitoring will be implemented, which will signal whether the engine bonnet or any vehicle door is opened.

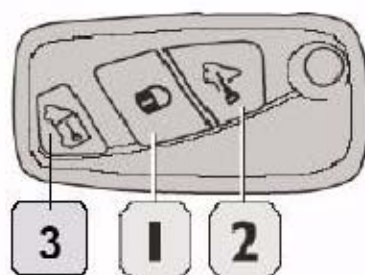
When the system is turned ON, the electronic alarm will be triggered when either the bonnet or any of the doors is opened. A microswitch placed on each of the vehicle doors as well as on the engine bonnet signals whether any of the same is opened.

Operation with 3-button key. Briefly press button 1 built into the key: the indicator lights will blink once to indicate that all the front door locks have been locked. To unlock the front door locks, press button 2, by pointing the key towards the vehicle all the time: the indicator lights will blink twice to indicate that all the front door locks have been unlocked. To unlock the rear door locks, press button 3, by pointing the key towards the vehicle all the time: the indicator lights will blink twice to indicate that all the rear and side door locks have been unlocked (PLS).

- Central locking can be actuated only by means of the remote control.
- Opening or closing the doors by means of the key will not involve central locking actuation.
- If the vehicle is equipped with central locking with electronic alarm, overall vehicle monitoring will be implemented, which will signal whether the engine bonnet, the rear or side doors, or any vehicle door is opened.

When the system is turned ON, the electronic alarm will be triggered when either the bonnet or the rear and side door(s) or any of the doors is opened. A microswitch placed on each of the vehicle doors as well as on the engine bonnet signals whether any of the same is opened.

Figure 5.11



114192



**If the vehicle is built as a truck, the body computer is not designed to manage the rear doors.**

**To control the rear doors, the wiring shall be laid as illustrated in the diagram. Moreover, the vehicle shall be delivered to an IVECO workshop in order to have its operation enabled.**



## 5.3 Electronic control units

### 5.3.1 Precautions to be taken with the installed electronic control units

To avoid carrying out wrong operations that may somehow permanently damage or deteriorate the operation of the control units fitted to the vehicle, the following instructions should be observed.

- In case of actions to be taken on the chassis, which require electric arc welding, the following shall be done: disconnect the cable from the positive terminal of the battery and connect the same to the chassis ground; remove the connector from the control units; remove the control unit from the chassis (in case of welds made quite near the control unit); make the welds by using direct current; ground the welding machine as near the welding point as possible; do not lay the battery cables parallel to the vehicle's electric cables.
- Do not remove and/or connect the connectors from the control units when the engine is running or the control units are powered.
- Remove the electronic control units if temperatures higher than 80 °C are reached when carrying out special operations.
- Make sure, after carrying out any maintenance operation requiring battery disconnection, that the terminals are properly connected to the poles when the battery is connected again.
- Do not disconnect the battery when the engine is running.
- Do not use a battery charger to start the engine.
- Disconnect the battery from the vehicle's on-board network if the battery needs charging.
- The batteries contain very harmful substances to the environment. To replace the batteries, it is recommended that you contact the IVECO dealer service, which will dispose of used batteries in compliance with the law regulations and the environment protection standards.
- Wrong assembly of electric accessories may affect the occupant's safety and also cause serious damage to the vehicle. In case of doubt, contact IVECO.
- The fluid contained in the batteries is poisonous and corrosive. Avoid contact with the skin and eyes. The operations shall be carried out in a well-ventilated place, far from naked flames or possible spark sources (e.g. cigarettes) - Danger of explosion and fire!
- Any battery kept at a charge state of less than 50% will be damaged due to sulphating. It also affects the vehicle starting capability and suitability and is more liable to possible freezing (which, in such case, may occur as low as -10 °C).
- To avoid damaging the vehicle's electric system, carefully follow the cable manufacturer's instructions. (The cable section and route shall be adequate to the type of load and the positioning of the same on the vehicle.)
- Do NOT use a quick battery charger for emergency vehicle starting. Otherwise, the electronic systems - in particular, the control units that perform the lighting and power supplying functions - may be damaged.



## Warnings

When installing devices such as the ones listed below (which may interact with the other electronic system originally fitted to the vehicle, i.e. ABS, EDC, etc.), contact IVECO in order to optimize the applications:

- Retarders
- Auxiliary heaters
- Power take-offs
- Air conditioners
- Automatic gearboxes
- Speed limiters
- Anti-theft systems
- Mobile phone systems, etc.
- Compressors for refrigerating systems.

## Note

As regards all the operations that may cause interactions with the basic system, it is recommended that diagnostic checks are carried out, in order to verify correct execution of the system.

Please be reminded that IVECO reserve the right to have its own vehicle warranty forfeited in the event that operations not consistent with the IVECO directives and instructions are carried out on the vehicle.

Refer to the specific workshop manuals for more information on the vehicle's electric system.

The vehicles are equipped with sophisticated electric/electronic systems that manage the vehicle operation.



**Any operation carried out on the electric system (e.g. removing the cable harnesses, making additional circuits, replacing pieces of equipment, fuses, etc.) by following procedures not conforming to the IVECO directives and instructions or performed by unskilled operators may cause serious damage to the vehicle's on-board systems (e.g. electronic control units, wiring, sensors), thus affecting driving safety. Carrying out wrong operations on the vehicle's electric system will cause major damage (e.g. short-circuits with possible fire and vehicle destruction) that is not covered by the contractual warranty.**



**Do NOT make any modification or connection to the CAN lines, which must not be tampered with for any reason whatsoever. Any diagnostic and maintenance operations shall be carried out only by qualified operators and by making use of IVECO-certified equipment.**



Electronic control units

The battery shall always be disconnected prior to carrying out any operation on the vehicle's electric system. To ensure correct battery disconnection, the negative pole shall be removed first, then the CBA shall.

Use only fuses featuring the characteristics specified for the function at issue; never use oversized fuses; replacement shall be made only after the trouble is eliminated and both the keys and the auxiliary devices are turned OFF.



**NEVER USE FUSES WITH HIGHER CAPACITY THEN THE PRESCRIBED ONE.**

Once the operations have been completed on the vehicle, resume (in the event that operations have been carried out on the electric system) the original conditions of cables (routes, protections, clamps). The cables **must not** come into contact with metal surfaces of the structure which may affect its intactness.

**NOTE Any deviation from the assembling directives shall require written authorization from IVECO. Failure to comply with the above prescriptions will cause the warranty to become null and void.**



### 5.3.2 Repositioning ECUs

IVECO recommends to avoid modifications which entails moving ECUs. Follow the instructions below if repositioning ECUs is unavoidable:

- ECUs must be positioned on the chassis or in the cab and secured with a fastening similar to the original one (i.e. bracket). To avoid malfunctions, the ECU in the chassis must not be turned (e.g. to avoid water ingress). Consequently, the original orientation must be preserved.
- las centralitas no deben montarse en el contra bastidor;
- the cover must always be refitted;
- avoid subjecting ECUs to knocks from debris and stones from the road when travelling.

### 5.3.3 Disconnecting ECUs



**Operations which do not comply with the instructions specified by IVECO or made by non qualified personnel can cause severe damage to on-board systems, effect driving safety and correct operation of the vehicle and cause considerable damage which is not covered by warranty.**

Follow the instructions below carefully before disconnecting an ECU:

- turn the ignition key to off, if it is inserted;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light in the button will go out);
- turn on the map reading lights located in the middle of the header rail;
- open the TGC (master switch), where fitted, with the switch arranged in the cab. The map reading lights will go out when the circuit breaker is open;
- isolate the battery by disconnecting the battery cables: disconnect the negative terminal first followed by the positive terminal;
- disconnect the ECU.



Electronic control units