

NEW STRALIS MY 2016 DIESEL-NP

BODYBUILDERS
INSTRUCTIONS

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IVECO

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UPDATE DATA

Section	Chapter	Description	Revision date

INTRODUCTION

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

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

Any modification, transformation or fitting not described in this manual and not expressly authorized will relieve IVECO of any liability and the warranty, if present, will immediately be null and void.

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

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

Before performing any operation, it is necessary to:

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

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

Data and information contained in this publication may be outdated as a result of changes adopted by IVECO, at any time, for technical or commercial reasons or due to the need to adapt the vehicle to new legal requirements.

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

SYMBOLS - WARNINGS

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

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SECTION 1

GENERAL INFORMATION

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GENERAL INFORMATION

I.1 SCOPE OF THE GUIDELINES

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

These Guidelines also aim to indicate to Bodybuilders:

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

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

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

I.2 TECHNICAL DOCUMENTATION AVAILABLE ELECTRONICALLY

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

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

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

I.3 IVECO AUTHORISATION

Modifications or versions indicated in these Directives and carried out in full compliance of the instructions provided, do not require any specific authorisation.

If this is not the case, IVECO authorisation is required to carry out:

- particular changes to the wheelbase;
- work on the braking system;
- modifications to the steering system;
- modifications to the stabilizer bars and suspensions;
- modifications to the cab, cab mounts, locking and tilting devices;
- replacing the engine or the "driveline" with electric motor or hybrid systems;
- modifications to intake, engine exhaust and SCR components;
- applications of retarders;
- power take-off applications;
- tyre size variations;
- modifications to the coupling parts (hooks, articulations);
- any modification not included in these Directives.

I.4 AUTHORISATION REQUEST

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

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

Upon completion of the interventions the bodybuilder shall be responsible for attainment of definitive approval from the competent authority.

I.5 RESPONSIBILITIES

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

The Bodybuilder is therefore responsible for:

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

I.6 LEGISLATIVE REQUIREMENTS

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

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

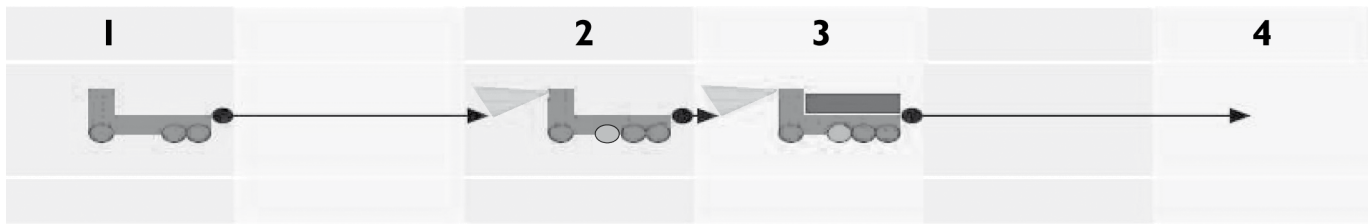
For this reason, IVECO shall not be held liable for any consequences due to errors caused by insufficient knowledge or incorrect interpretation of the legal provisions in force.

I.7 MULTI STAGE TYPE APPROVAL - COLLABORATION (only for vehicles registered in the EU, Switzerland and Turkey)

Annex XVII of Directive 2007/46/EC concerns *Multi-stage Type Approval*

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

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



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Figure 1

- | | |
|--|----------------|
| 1. IVECO | 3. Bodybuilder |
| 2. Authorised workshop upon Dealer order | 4. Customer |

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

Consequently:

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

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

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

1.8 WARRANTIES

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

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

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

I.9 QUALITY SYSTEM MANAGEMENT

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

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

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

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

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

I.10 ACCIDENT PREVENTION

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

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



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

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

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



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

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

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

To this regard, please note that:

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



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

I.12 VEHICLE MANAGEMENT ON THE PART OF BODYBUILDER

Acceptance of chassis

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

Maintenance

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

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



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

Delivery of the vehicle to the final customer

Before delivering the vehicle, the Bodybuilder must:

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

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

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

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

I.13 VEHICLE NAMES

The commercial name of IVECO vehicles (for example **STRALIS 480 E6**) does not match the type approval name. A complete example is provided below.

Type approval name

STRALIS HI-WAY 440 S 48 T/P

- **STRALIS** – Vehicle name
- **HI-WAY** – Cab type

HI-STREET	Short cab
HI-ROAD	Long cab
HI-WAY	Hi-Way Cab

- **440** – Total Ground - PTT Cab versions / PTC Tractors with semi-trailers (no./10 = weight in t)

190	4x2 trucks
260	Trucks 6x2 - 6x4
320	Trucks 8x2x6
440	Tractors 4x2 - 6x2- 6x4

- **S** – Stralis Range Code
- **48** – Engine power (no. x 10 = power in HP)
- **T** – Model

T	Tractor 4x2
TX	Tractor 6x2 C (added central axle)
TY	Tractor 6x2 C (added rear axle)
TZ	Tractor 6x4 (Tandem rear axle)
–	4x2 truck
X	Cab version 6x2 C - 8x2x6 C (added central axle)
Y	Cab version 6x2 P - 8x2x6 P (added rear axle)
Z	Cab 6x4 (tandem rear axle)

- **/ P** – Version

–	Cab version 4x2 with mechanical suspension
P	4x2 - 6x2 C - 6x4 with air suspension on rear axle - 6x2 P with 3rd liftable single-wheel rigid axle
PT	Only 6x2 P with air suspension on rear axle and 3rd twin wheel lifting rigid axle
PS	Only 6x2 P - 8x2x6 P with air suspension on rear axle and 3rd single wheel lifting rigid axle
FP	4x2 - 6x2 P - 6x2 C - 6x4 with front and rear air suspensions (ev. 3rd lifting rigid axle)
FS	6x2 P - 8x2x6 with front and rear air suspensions, 3rd single wheel lifting steering axle
TN	Only 6x2 with mechanical suspension on rear axle and 3rd liftable rigid axle
CM	Demountable Bodies
GV	Large Volumes
D	Timing system
HM	Heavy Mission
LT	Low Tractor (tractor with lowered chassis)
CT	Car Transporter (Truck with lowered chassis)

RR	Rough Roads
HR	Double reduction rear axle
SL	Super Light

I.14 TRADEMARKS AND SYMBOLS

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

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

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

I.15 DIMENSIONS AND GROUND

General information

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

Weighing of the chassis

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

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

Vehicle adaptability

The vehicle adaptability limits for each model are mainly defined as:

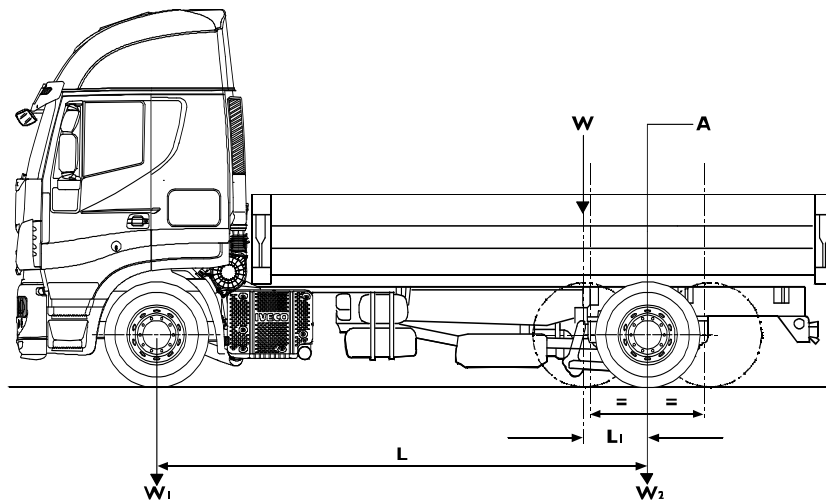
- distribution of mass on the axles;
- width of mirrors adopted;
- rear under-run protection device position.

The positioning of lights and mirrors, normally set for widths of 2550 mm, is also suitable for special superstructures 2600 mm wide (e.g. mini-vans).

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

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

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



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Figure 2

Example to determine the placement of the centre of gravity of the payload plus superstructure (Vehicle with 2 axles; vehicles with 3 axles having equal loads on two rear axles)

A = Front wheel axle or tandem centre line

W = Payload plus superstructure

W1 = Measurement of payload on front axle

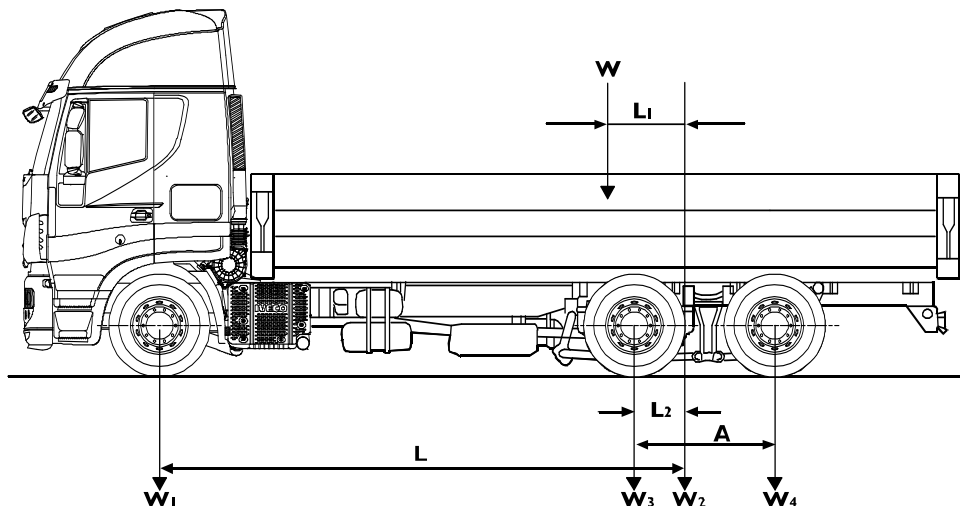
W2 = Measurement of payload on rear axle (or tandem)

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

L = Actual wheelbase

$$L_1 = \frac{W_1 \cdot L}{W}$$

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



192337

Figure 3

Example to verify compliance with the permitted axle masses (vehicles with 3 or more axles, with a constant ratio of weight distribution on the two rear axles, for which the "virtual" value of the wheelbase and the centre line between the axles, due to the weight distribution, are defined by the manufacturer)

W = Payload plus superstructure

W1 = Measurement of payload on front axle

W2 = Measurement of payload on rear axles

W3 = Measurement of payload on first rear axle

W4 = Measurement of payload on second rear axle

L = Calculated wheelbase (virtual)

L1 = Distance of centre of gravity relative to the calculated centre line

L2 = Calculated centre line (virtual)

A = Rear axles wheelbase

$$W_1 = \frac{W \times L_1}{L}$$

$$W_2 = W \times \frac{(L - L_1)}{L}$$

$$W_3 = W_2 \times \frac{(A - L_2)}{A}$$

$$W_4 = \frac{W_2 \times L_2}{A}$$

Note For vehicles with three or more axes, with variable ratio of the distribution of the masses on the two rear axes depending on the load, the "virtual" value of the wheelbase and the centre line between the axes must be determined for the respective load condition realized, using the instructions on the vehicle cab diagram.

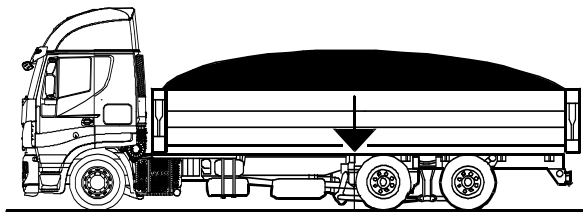
This way, in particular version fittings (e.g. cranes on the rear overhang), the correct positioning can be determined for the centre of gravity of the equipment and the payload, depending on the load carried (see Chapter 3.8).

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

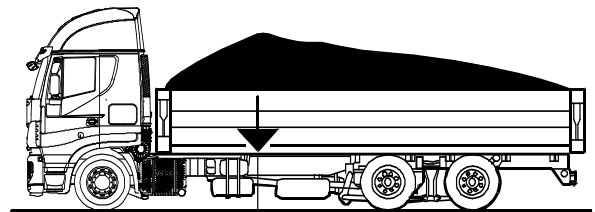
For equipment, the centre of gravity is obvious considered for its actual position.

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

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



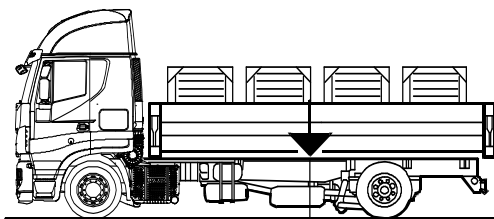
Even distribution of load



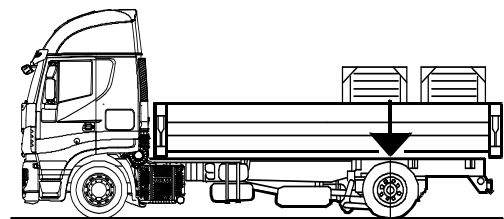
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Figure 4

Uneven distribution of load



Even distribution of load



192339

Figure 5

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

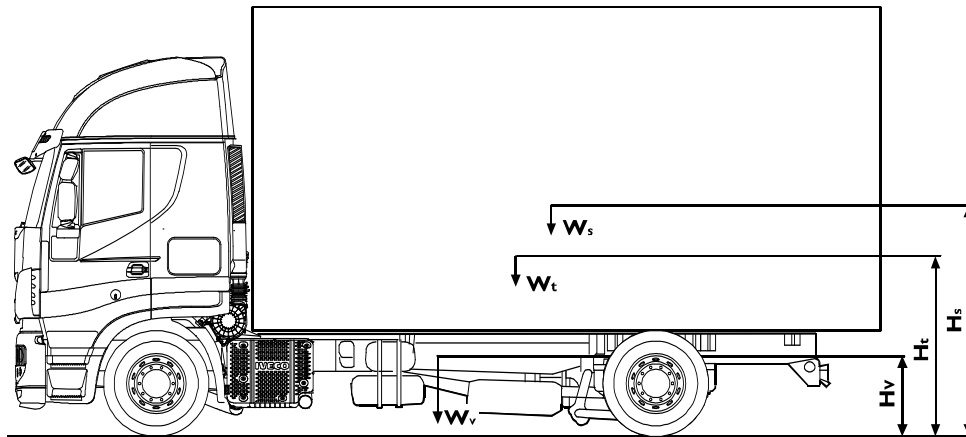
Height of centre of gravity

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

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

The following cases should be distinguished:

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

I. Fixed loads

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

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

192340

Figure 6**Control at full load**

H_v = Cab vehicle centre of gravity height (cab version)

H_s = Payload centre of gravity height plus superstructure relative to ground

H_t = Complete full-load vehicle centre of gravity height

W_v = Cab version vehicle tare weight

W_s = Payload plus superstructure tare weight

W_t = Complete vehicle ground at full load

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

2. Mobile loads

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

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

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

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

3. Loads that result in increased aerodynamic actions

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



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

Special attention must therefore be paid:

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

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

Adoption of stabiliser bars

The application of additional or reinforced stabiliser bars, reinforcing the springs or rubber elastic elements (in accordance with the procedure outlined in Section 2.7 - Paragraph "suspension" (► Page 36)) helps to compensate for any high values of the centre of gravity of the payload. However, it should be noted that the operation must be carried out on the rear axle, since acting on the front may give rise to an incorrect sensation of higher vehicle stability and higher safety limits. Interventions on the front axle can be carried out in the presence of concentrated loads behind the cab (for example, cranes) or of superstructures with high rigidity (for example, vans).

Respect of the permitted masses

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

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

In vehicles with an added lifting rear axle, it must be considered that, in the case of a lifted axle, the actual wheelbase is reduced while the rear overhang increases, so it is advisable not to place the centre of gravity of the superstructure and the payload behind the centre line of the engine axle. installation of the axle lifting system in the case of concentrated rear loads is also discouraged.

Note *In the positioning of the auxiliary bodies and superstructure, a proper load distribution in the transverse direction must be ensured. A variation on the nominal load may be permitted for each wheel (50% load on the corresponding axle) of $\pm 4\%$ (e.g.: load allowed on the axle 10,000 kg; allowed for each wheel side from 4,800 to 5,200 kg) in compliance with what is permitted by the tyres, without affecting the braking and driving stability characteristics of the vehicle.*

Unless otherwise specified individual vehicles, the minimum values of the mass on the front axle must be:

- 20% of the actual mass of the vehicle, if the load is evenly distributed,
- 25% of the actual mass of the vehicle, if the load is concentrated on the rear overhang.

Actual mass is meant to include any vertical load resulting from the trailer.

Variations on permitted masses

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

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

In the authorisation request, you must indicate:

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

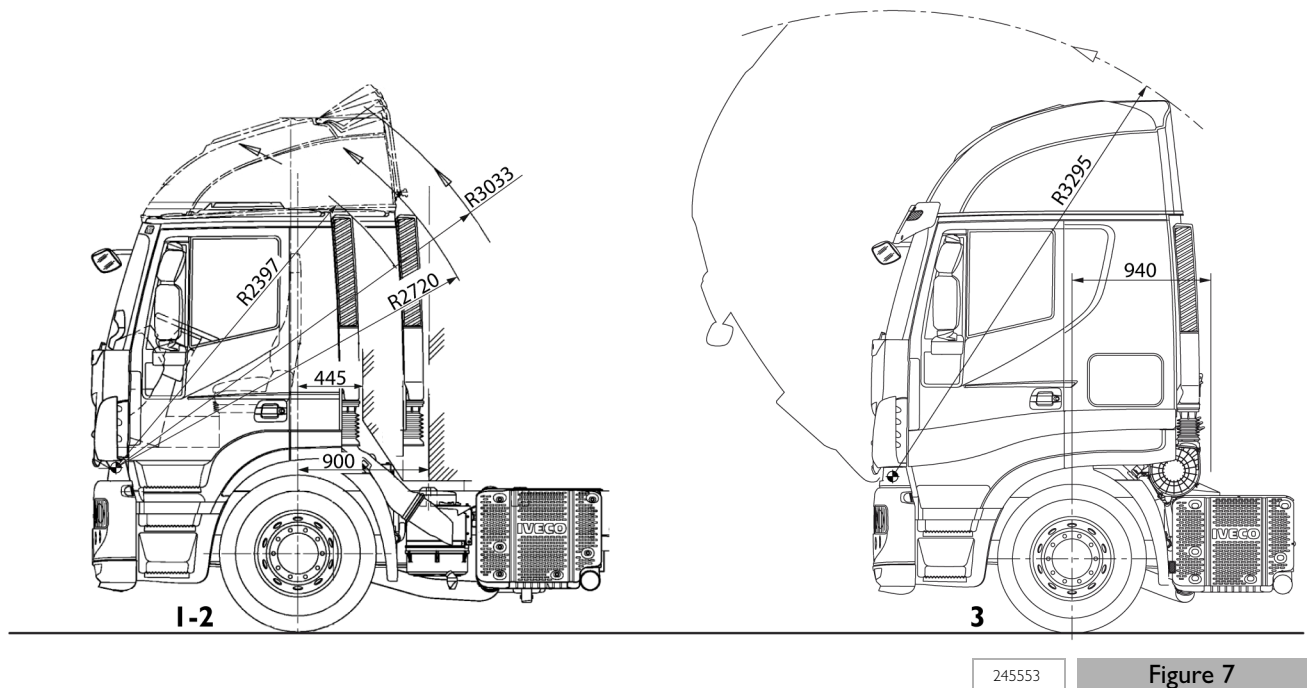
Reduction of the permitted mass on the vehicles (downgrading) can lead to interventions on the suspensions and brakes; in these cases the necessary indications may be provided.

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

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

For example:

- free access must be guaranteed to the places that need inspection, maintenance or periodic controls (e.g., battery replacement, access to the air suspension compressor) and, in the case of enclosed superstructures, special compartments and doors should be provided;
- cab tilting must be guaranteed. Figure 7 shows the maximum measurements of the longitudinal dimensions of the cab "D" between the centre line of the front axle and the body of the semi-trailer; "R" indicates the rotation radius of the cab;



245553

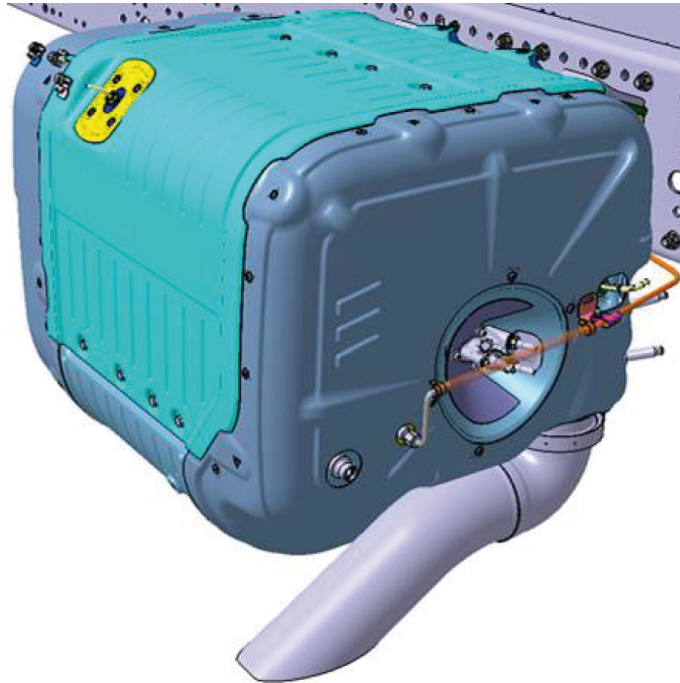
Figure 7

- | | | | | | | | |
|---|--------------------|----------------------------|-------------|---|-----------------|------------|-------------|
| 1 | STRALIS Hi-STREET: | D = 445 mm | R = 2397 mm | 3 | STRALIS Hi-WAY: | D = 940 mm | R = 3295 mm |
| 2 | STRALIS Hi-ROAD: | D = 900 mm | R = 2720 mm | | | | |
| | | (R = 3033 mm with spoiler) | | | | | |

- the possibility of disassembling the various groups for assistance operations must be maintained;
- in outfittings which include the tipping of the side boards, consider the size of the parts which protrude most from the vehicle, in order to avoid limitations to tipping or damage to the parts. These dimensions are shown on the diagrams for Bodybuilders available on the website www.ibb.iveco.com;
- conditions should not be affected regarding cooling (radiator grille, radiator, air passages, cooling etc.), fuel supply (pump positioning, filters, pipe diameter, etc.) and engine air intake;
- the soundproofing panels must not be altered or moved so as not to affect the approved sound emission limits. If any openings need to be made (e.g. for the passage of pipes or added sections), they must be thoroughly closed, using fireproof and soundproofing materials equivalent to the original materials used;
- sufficient ventilation of the brakes must be ensured along with sufficient airing of the battery casing and the DPF/muffler assembly;
- in the placement of fenders and wheel arches, free shaking of the rear wheels must be guaranteed, even under the conditions of use with chains. It must also be guaranteed enough space for the lifting axle tyres. Some models include steering of the 3rd axle also in the raised position: respect the spaces necessary for this function (see Chapter 2.21);
- adjustment of the vehicle's headlamps must be checked once construction is completed, to correct any changes in their structure; for adjustment, proceed according to the instructions given in the "Use and Maintenance Handbook";
- for any elements supplied loose (e.g. spare wheel, chocks), the Bodybuilder must position and fasten them in an accessible and secure way, in compliance to any national regulations.

Exhaust system accessibility (only diesel versions)

Each outfitting must ensure access to the exhaust gas post-treatment assembly (muffler) and, in particular, to the cover of the ceramic particulate filter housing.



245554

Figure 8

Above and around the muffler, the outfitting must be kept at a minimum distance of 80 mm to allow any vertical and transversal movements which may be required when removing the silencer.

Remember that the weight of the assembly is approximately 120 kg and that the temperature on the surface can reach 250 °C in certain conditions.

Distance from muffler



- **Assemblies or parts made using flammable material must never be fitted near the vehicle's exhaust system.**

Take into consideration that:

- synthetic materials must never be exposed to temperatures exceeding 70°C; adequate protections must be implemented if higher temperatures are expected (thermal shielding).
The factory mounted fuel tank is made from materials belonging to this class and therefore, if fitting in a position that is not original, particular attention must be exercised.
- the minimum distance between the muffler and the cab rear wall, gearbox and braking system components must be at least 50 mm.
- the minimum distance between the exhaust pipe and brake pipes, wiring, spare wheel must be at least 200 mm; this value may drop to 80 mm if using protections.

I.17 GENERAL REGULATION FOR THE PREVENTION OF FIRE RISK

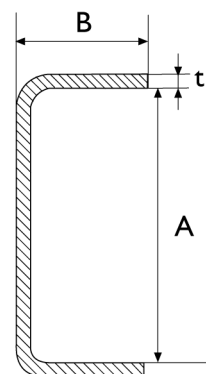
Particular attention must be paid to prevent the spillage of hydraulic fluids or inflammable liquids above components which may become hot or overheated.

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

I.18 CONVENTIONS

In these Guidelines the following conventions are adopted:

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



91473

Figure 9

SECTION 2

CHASSIS INTERVENTIONS

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CHASSIS INTERVENTIONS

2.1 GENERAL CHASSIS MODIFICATION STANDARDS

Keep in mind that:

- **weldings on the supporting structures of the chassis are absolutely forbidden** (except as prescribed in Paragraph "Weldings" (➡ Page 8) and in Chapters 2.4 (➡ Page 14), and 2.5 (➡ Page 17));
- **no holes may be drilled into the side members** (with exception to indications provided in Paragraphs "Weldings" (➡ Page 8) and "3.3 Choosing the type of connection" (➡ Page 12));
- for cases where modifications to nailed unions are allowed, the nails may be replaced with flanged head screws or with hex head screws classed 8.8 with the next higher class diameter and nuts fitted with an anti-unscrewing system. Screws larger than M12 may not be used (maximum hole diameter of 15,5 mm), unless otherwise specified;
- for cases where unions that require screws are restored, the suitability of these screws must be checked before being re-used, and they must be tightened to the appropriate torque;



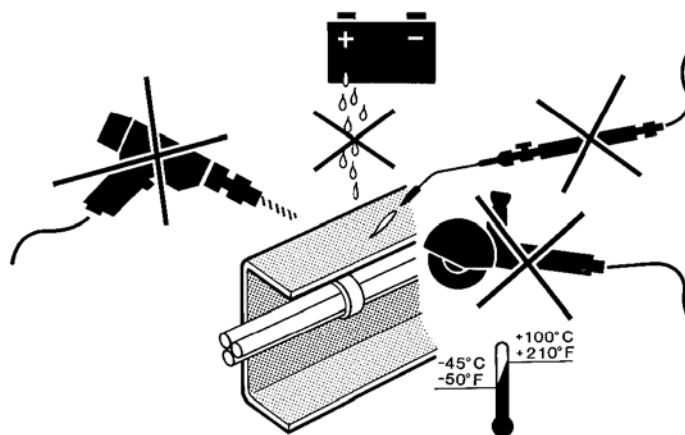
- ▶ **As regards remounting safety components, it is prohibited to re-use the same screws and tightening must be done at the specified torque (contact the Service Network for the value).**

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

Preventive measures



- ▶ **When welding, drilling, milling and cutting near brake hoses and electrical wires, be sure to adopt appropriate precautions for their protection; disconnect these parts if necessary (respect the prescriptions in Chapters 2.15 and 5.5).**



91444

Figure 1

Precautions for alternators and electric/electronic components

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

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

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

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

Earth connection

For further details on the connections to ground, see the Chapter 5.5 (► Page 35).

Braking and electrical systems

For additional details on the braking and electrical systems see Chapters 2.15 (► Page 49) and 5.5 (► Page 35).

Characteristics of the material used in chassis modifications

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

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

Table 2.1 - Material to be used in chassis modifications

Name of steel		Breaking strength [N/mm ²]	Yield stress [N/mm ²]	Elongation
IVECO	Fe E490	610	490	19%
Europe	S500MC			
Germany	QStE500TM			
IVECO	Fe 510D ⁽¹⁾	520	360	22%
Europe	S355J2G3 ⁽¹⁾			
Germany	QSt52-3N ⁽¹⁾			
U.K.	BS50D ⁽¹⁾			

⁽¹⁾ Alternatively, only by lengthening the rear overhang.

Table 2.2 - Dimensions of the chassis side member cross-section

Model	Wheelbase [mm]	Area of side member near wheelbase A x B x t [mm] (see Figure 6)
STRALIS I90	up to 6300	289 / 199 x 80 x 6.7
	6700	289 x 80 x 6.7
STRALIS 260 X/P*, X/F*		289 x 80 x 6.7
STRALIS 260 Y/P*, Y/F* (-CM, -D)	up to 5100	289 / 199 x 80 x 6.7
	5700 and on	289 x 80 x 7.7
STRALIS 260 Y/F*-GV		289 / 199 x 80 x 7.7
STRALIS 260 Z/*P-HM		289 x 80 x 7.7
STRALIS 320 X/*S, Y/*S		289 x 80 x 7.7

Model	Wheelbase [mm]	Area of side member near wheelbase A x B x t [mm] (see Figure 6)
STRALIS 440 T/*P (-LT), TX/P		289 x 80 x 6.7
STRALIS 440 T/P (-HR, -RR), TY/P, TY/PT, TZ/P-HM		289 x 80 x 7.7

Stresses on the chassis

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

Note static stress σ permitted on the chassis: **150 N/mm²**

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

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

2.2 DRILLS ON THE CHASSIS

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



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

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

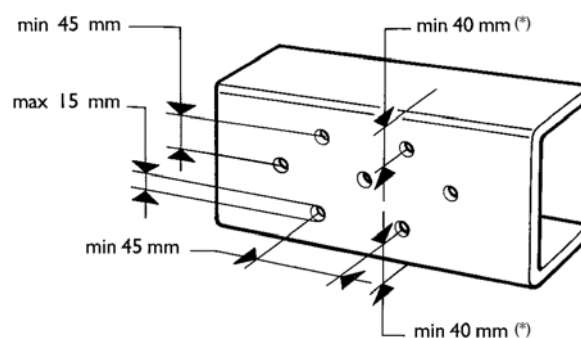
Hole position and size

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

Hole diameter must be suited to sheet metal thickness but cannot exceed 15 mm (unless otherwise stated). The distance of the axis of the holes from the internal edge of the side member must not be less than 30 mm; in the same way, the axes of holes must not be less than 45 mm from each other or from other existing holes.

The holes must be offset as in Figure 2.

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



192342

Figure 2

Screws and nuts

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

Table 2.3 - Screws resistance classes

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

The screws belonging to classes 8.8 and 10.9 must be well cleaned and, for applications with diameter ≤ 6 mm, protection FeZnNi 7 IV S is recommended; for diameters > 6 mm, protection GEO-8 is recommended.

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

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

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

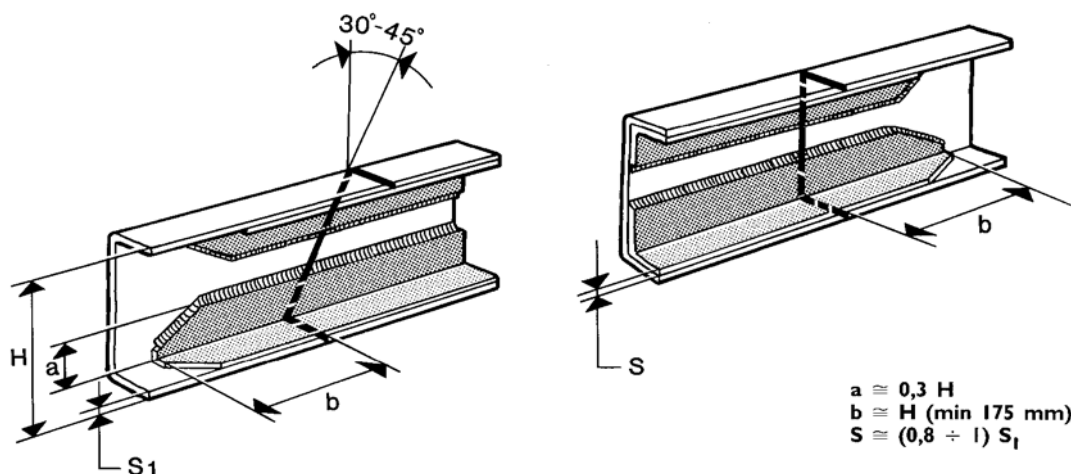
Welds



- **When welding, drilling, milling and cutting near brake hoses and electrical wires, be sure to adopt appropriate precautions for their protection; disconnect these parts if necessary (respect the prescriptions in Chapters 2.15 and 5.5).**

Welds are allowed:

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



91448

Figure 3

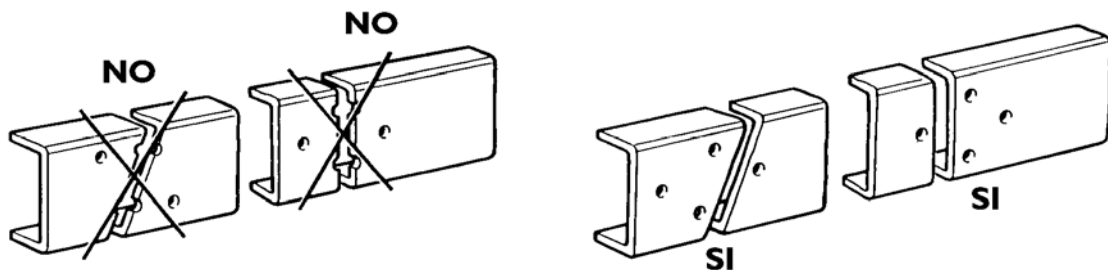
The following instructions must be respected when performing electric arc welding and in order to protect electrical components and ECUs:

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

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

Weld operations

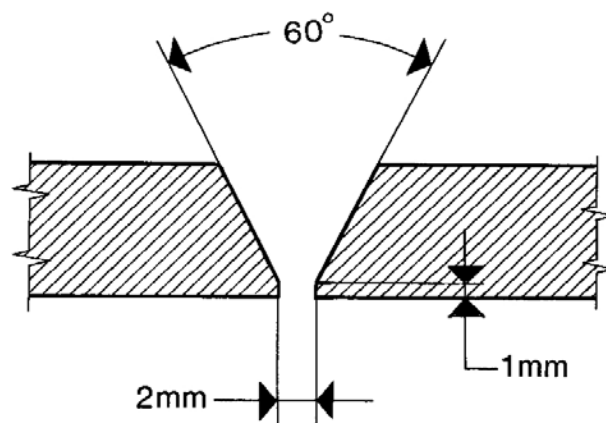
- Thoroughly remove paint and rust from the chassis where welds will be made, as well as all parts that will be covered by reinforcements.
- Cut the side members with a skewed or vertical cut. The side members must not be cut at the points where the chassis contour and width changes or where stress is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



91446

Figure 4

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



91447

Figure 5

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

- Grind off the excess material.
- Mount steel corner reinforcements that have the same characteristics as the chassis; the minimum indicative sizes are shown in Figure 3.
Reinforcement anchorage must regard only the vertical rib of the side member and can be realised with a weld bead, staples, bolts or nails (even Huck nails).
Area and length of the weld bead, number and distribution of staples, number of nails or bolts must be adequate to transmit the bending and shearing moments.
- Once work is complete, use anti-rust protection (see Paragraph "Added or Modified Parts" (➡ Page 12)).

Sealing holes by welding

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

Good results are obtained by:

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

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

2.3 RUST AND PAINT PROTECTION

Note All components mounted on the chassis must be painted in compliance with IVECO Standard I 8-I 600 Colour IC444 RAL 7021 - 70/80 gloss.

Original vehicle parts

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

Table 2.4 - Class of protection - IVECO Standard I 8 - I 600 (Prospectus I)

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

Table 2.5 - Unpainted aluminium parts - IVECO Standard 18 - I600 (Table IV)

Type of protection		IVECO standard	Classes			
			A	B - B1 - B2	C	D
Stainless steel ⁽¹⁾		18-0506	–	–	–	–
Geomet ⁽²⁾	GEO 321-8	18-1101	yes	–	–	–
	GEO 500-8					
	GEO 321-8 PM					
	GEO 321-8 PML					
	GEO 321-8 PL					
	GEO 500-8 PL					
	GEO 321-5		–	yes	–	–
	GEO 500-5					
	GEO 321-5 PM					
	GEO 321-5 PML			yes Class B1 wheel studs		
	GEO 321-5 PL					
	GEO 500-5 PL					
Zinc coating ⁽³⁾	Fe/Zn 12 II	18-1102	–	–	yes	yes
	Fe/Zn 7 IV		–	–	yes	yes
	Fe/Zn 12 IV					
	Fe/Zn 7 IV LUB		–	yes	yes	yes
	Fe/Zn 7 IV S					
	Fe/Zn 12 IV S					
Alloy Zn-Ni	Fe/Zn Ni 7 VII S	18 - 1103	–	yes	yes	yes
	Fe/Zn Ni 7 IV					
Aluminium	Anode oxidation	18-1148	yes	yes	yes	yes
	Painting	See Table III	yes			

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

⁽²⁾ Coatings free from chromium salts.

⁽³⁾ Coatings free of hexavalent chromium.

Table 2.6 - Painted parts - IVECO Standard 18 - I600 (Prospectus III)

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

Cycle phase description		Classes					
		A	B ⁽⁸⁾	BI ⁽⁵⁾	B2	C	D
RUST PREVENTER	Bi-component (30-40 µm)	–	yes	–	yes	yes ^(*)	yes ^(*)
	Single-component (30-40 µm)		–	yes	–	⁽⁹⁾	
ANTIROCK PRIMER	Single (130 °C) or bicomponent (30-40 µm)	yes ⁽³⁾	–	–	–	–	–
VARNISH	Single (130 °C) or bicomponent (30-40 µm)	yes	yes ^(*)	–	–	yes ^(*)	yes ^(*)
	Powders (40-110 µm)	yes ⁽⁴⁾					
	Low temperature single-component (30-40 µm)	–	–	yes			

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

⁽²⁾ Two-layer bodywork cycle.

⁽³⁾ Three-layer bodywork cycle.

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

⁽⁵⁾ Only rear/front axles.

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

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

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

⁽⁹⁾ Only parts to mount on the engine.

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

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

Added or modified parts

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

Areas free of protection on ferrous materials are not accepted.

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

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

Lightweight alloy, copper and brass parts must be protected.

Table 2.7 - Painted modified parts or add-ons

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

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

⁽²⁾ Preferably epoxy

⁽³⁾ Preferably polyurethane

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

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

⁽¹⁾ Free from hexavalent chromium

Precautions

a) On the vehicle

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

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

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

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

The electronic components and modules must be removed.

b) On engines and their electric and electronic components

Appropriate precautions must be taken to protect:

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

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

2.4 WHEELBASE MODIFICATION

General information

Note Any wheelbase modifications that regard the electric circuits and/or relocation of the electric/electronic components requires IVECO approval and must be carried out in compliance with chapter 5.5 instructions.

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

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

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

Authorisation

Wheelbase modification is allowed without IVECO authorisation only when:

- another length included in production for the vehicle model is to be made;
- number, type and position of the cross members, the existing circuits and systems on the standard chassis are replicated taken as reference.

For the 6x2, 6x4 and 8x2x6 versions, variation in the wheelbase is only allowed with specific authorisation.

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

Note The operations must be performed in compliance with these directives, taking into account the suitable adjustments and adaptations (for example, the need to reparameterize the control units), as well as all necessary precautions (arranging the exhaust pipe, observance of minimum tare weight on the rear axle, etc.) provided for on the corresponding original wheelbases.

Effects on steering

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

When required by legislation, do not exceed the limits prescribed for the path, steering wheel force and the relative time of ability to negotiate curves (e.g. Regulation ECE or EC Directive in force).

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

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

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

Table 2.9 - Wheelbase lengthening with standard steering system (*)

Models	Max load on front axle (respect the load capacity of the tyres) [kg]	Max wheelbase value between the steering axle and the engine axle [mm]	Offset radius [mm]	Steering wheel diameter [mm]
I90	7500	6300	120	470
I90P	7500	6700	120	470
I90 /FP-CM	7500	5700	120	470
I90 /FP -GV	7500	5500	120	470
260 Y/FS -GV	8000	5100	120	510

Models	Max load on front axle (respect the load capacity of the tyres) [kg]	Max wheelbase value between the steering axle and the engine axle [mm]	Offset radius [mm]	Steering wheel diameter [mm]
260 Y/PS, Y/FS -CM	8000	6050	120	510
260 X/P	8000	4500	120	470
320 Y/PS	8000	6050	120	470
440 TX/P	7500	4000	120	470

(*) The table does not take into account the fact that, as an option (only for certain wheelbases, with rear air suspensions and oversized front tyres), maximum loads of 8600 kg and 9000 kg are also possible on the front axle.

Effects on braking

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

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



- **Modifications to the wheelbase on vehicles equipped with electronic control systems for braking, where present, grip and stability, require as mandatory the updating of the setting parameters (datasets) of the relevant control units via IVECO teleservices.**



- **Wheelbases which can be technically realised depend on the vehicle type (model/version). For wheelbases which are longer or shorter than the standard wheelbases, availability of the ESP system setting parameters must be verified.**

Intervention procedure

Proceed as follows to obtain good results:

- position the vehicle so that the chassis is perfectly horizontal, use appropriate trestles;
- detach the drive shafts, braking system hoses, cables and all other equipment that may interfere with proper work execution;
- identify the reference points on the frame (e.g: guide holes, suspension supports);
- mark the reference points with a slight punch mark on the top flaps on both side members, after having verified that the conjunction line is at a perfect right angle with the longitudinal axle of the vehicle;
- if moving the suspension supports, identify the new position using the previously determined references;
- make sure that the new measurements are identical on both the right and left sides; the diagonal check, for lengths of at least 1500 mm must not yield deviations of over 2 mm;
- make the new holes using as jig - if any other tools are unavailable - the supports and gusset plates of the crossbars;
- secure the supports and crossbars using nails or screws; if using screws, bore the holes and use calibrated screws class 10.9 with anti-unscrewing nuts; if size allows, flanged head screws may be employed;
- if cutting the frame (to be carried out according to indications of the item in "Welding Operations" - Paragraph "Welding" (► Page 8)) mark a second line of reference points so that the work area is set between the two lines (plan for a distance of at least 1500 mm upon work completed). Carry over the points relative to the cutting area between the two lines; proceed as instructed in Paragraph "Welding" (► Page 8);
- before welding, check that the side members and any added parts are perfectly aligned and perform the check measurements on both sides and along the diagonal line, as previously indicated. Apply the reinforcements as in Paragraph "Welding" (► Page 8).

Additional information

- Protect the surfaces against oxidation as in Paragraph "Added or modified parts" (➡ Page 12).
- Restore the braking and electrical systems as according to Chapters 2.15 (➡ Page 49) and 5.5 (➡ Page 35).
- Follow the instructions in Chapter 2.8 (➡ Page 38) for interventions on the transmission.

Checking chassis stress

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

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

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

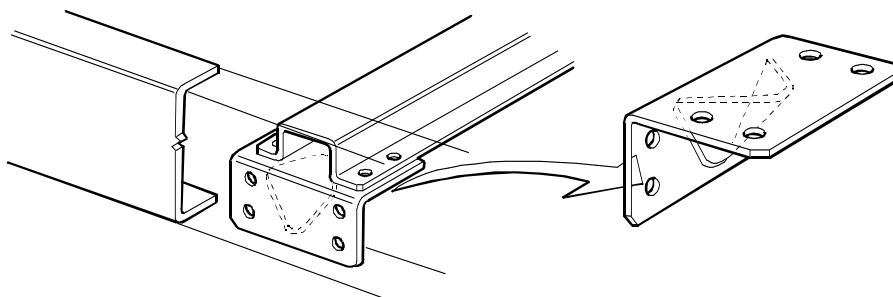
Cross members

The need to apply one or more crossbars is subject to the amount of elongation, the positioning of the gearbox, the welding area, the points of application of forces arising from the superstructure, and the conditions of use of the vehicle.

Any additional cross members must have the same characteristics of those already mounted on the frame (bending and torsion strength, material quality, connection to side members, etc.). Figure 6 shows an example. In any case an additional crossbar must be installed for elongations exceeding 600 mm.

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

The minimum distance between the cross members, especially for "heavy duty use" must not be less than 600 mm; this restriction excluded "lightweight" cross member that acts as transmission and suspension supports.



91449

Figure 6

Gearbox modifications

See Chapter 2.8 (► Page 38) for checks of modifications allowed.

2.5 REAR OVERHANG MODIFICATION**General information**

When modifying the rear overhang, the limits set by national standards must be respected. This is also the case for the maximum distances from the rear structural edge and distance from the ground, defined for the tow hook and under-run protection. The distance from the tip of the frame to the rear edge of the superstructure must, as a rule, not exceed $350 \div 400$ mm.

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

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

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

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

Authorisation

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

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

Chassis Shortening

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

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

Elongation

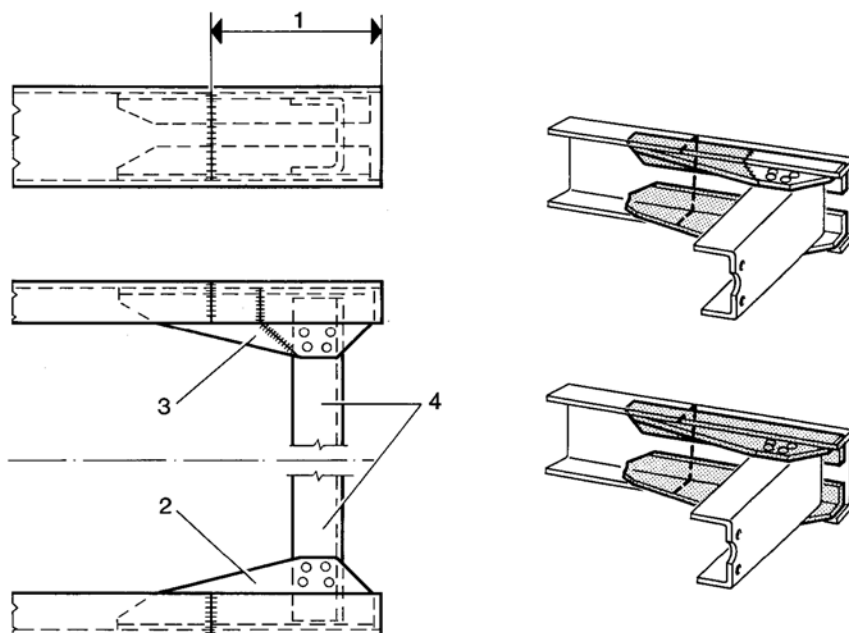
possible solutions concerning elongations are shown in Figures 7 and 8.

Cuts can be of straight type. The minimum dimensions of the reinforcements to apply in the area of modification are shown in Figure 3.

The solution for elongations greater than $300 \div 350$ mm is shown in Figure 7. In this case, the corner reinforcements, which also serve as junction between cross member and frame, must have the same width and thickness of the original gusset plate. The union between the cross member and plate, originally performed using nails, can be done with screws class 8.8 having the next largest scale diameter and anti-unscrewing nuts.

When the connection between the cross member and gusset plate is made by welding, the gusset plate can be connected to the reinforcement by welding (see Figure 7).

The solution for elongations exceeding 350 mm is shown in Figure 8.

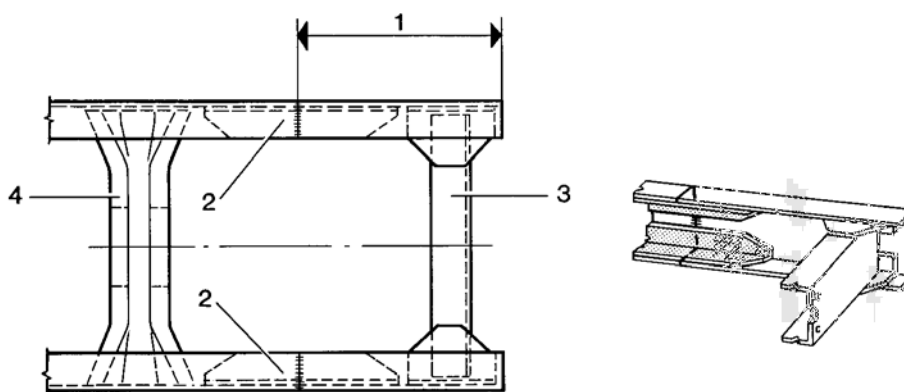


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Figure 7

- 1. Added part
- 2. Reinforcing profile

- 3. Reinforcing profile (alternative solution)
- 4. Original rear cross member



91455

Figure 8

- 1. Added part
- 2. Reinforcing profile

- 3. Original rear cross member
- 4. Any additional cross member

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

2.6 INSTALLING THE TOW HOOK

General information

The application of a tow hook is possible without authorization:

- on vehicles with the specifically prescribed crossbar (opt. 6151) for inertia trailers;
- on vehicles originally equipped with opt. 430 for adaptation to towing a trailer.

Authorisation is required for installation on vehicles where the tow hook was not originally envisaged.

For trailers with one or more close axles (centre axle trailers) and in consideration of the stresses to which the rear crossbar is subjected, particularly due to the dynamic vertical loads, observe the indications provided in the Paragraph "Tow hook for centre axle trailers" (➡ Page 21).

Precautions for Installation

The tow hook must be suitable for the permitted loads and must be of type approved by national legislation.



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

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

- clearances required for the coupling of the brakes and electrical system;
- distance between the hook pin axis and the rear edge of the superstructure (see Figure 9).

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

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

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

The trailer drawbar must be guaranteed freedom of movement.



Figure 9

- Printed 692.68.697 – 5 Ed. - Base 03/2019

Towing hooks for conventional trailers

According to Directive 94/20/CE, both for the choice of the hook and for the application of any reinforcements to the rear crossbar, it is important to take into account the action of the horizontal forces generated by the masses of the tractor and trailer, based on the following formula:

$$D = 9.81 (T \cdot R) / (T + R)$$

D = representative value of tow hook class [kN]

T = maximum mass of the tractor [t]

R = maximum mass of trailer with mobile vertical drawbar [t]

Tow hooks for centre axle trailers

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

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

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

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

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

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

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

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

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

g = acceleration of gravity [m/s²]

T = maximum weight of the towing vehicle [kg]

R = maximum weight of trailer at full load [kg]

S = vertical static load on the hook [kg], namely the mass part which in static conditions, is transmitted to the coupling point on the vehicle. $S \leq 0.1 \times R \leq 1000$ [kg]

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

V = value of the intensity of the theoretical dynamic vertical force between the vehicle and the trailer [kN]

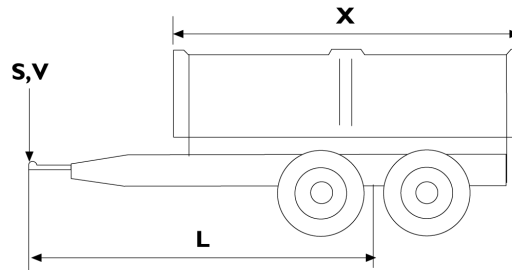
a = vertical acceleration in the area of the drawbar coupling/hook. in function of the rear tractor suspension, use the following values:

- **a** = 1.8 m/s² of air suspensions
- **a** = 2.4 m/s² for other types of suspensions

X = length of the load bed [m], (see Figure 10)

L = theoretical drawbar length, distance between the centre of the drawbar eye and the centre line of the trailer axles [m], (see Figure 10)

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



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Figure 10

X. Length of the trailer load bed

L. Theoretical drawbar length

If you wish to use the tow with a vehicle not originally designed (and in compliance with the limits established by IVECO for each model), only original rear cross members which have already been hole punched can be mounted. Towable masses and the bearable vertical loads can be defined based on the size of the hole.

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

Moreover, in the case of long rear overhangs and depending on the masses to be towed, it may be necessary to adopt sections of the subframe having a larger size than those normally provided.

Subframe for central-axle trailers

Table 2.10 is useful for sizing the subframe section destined only to tow a central-axle trailer.

However when, as in most cases, the vehicle is to be fitted with a standard superstructure (fixed body, crane), the table relating to this superstructure must be referred to (see Section 3) and choose the table which provides the higher values of the section modulus W_x .

In Table 2.10 the symbol "A" indicates that the section required for the trailer only, is less than that required by the superstructure.

Table 2.10 - Longitudinal sections of the subframe for centre axle trailers

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Road Hi-Street 190 4x2 - Rear axle 11.5 t 289/199 × 80 × 6.7	3800	970	–	–	–	–	–	–	–	–
	3800	1195	–	–	–	–	–	–	–	–
	3800	1825	–	–	–	–	–	–	–	–
	4200	970	–	–	–	–	–	–	–	–
	4200	1195	–	–	–	–	–	–	–	–
	4200	2050	–	–	–	–	46	46	46	46
	4500	1780	–	–	46	46	46	46	46	46

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Road Hi-Street 190 4x2 - Rear axle 11.5 t 289/199 x 80 x 6.7	4800	2455	–	46	46	46	46	46	46	46
	5100	1555	–	–	–	–	–	–	–	–
	5100	1960	–	–	–	46	46	46	46	46
	5100	2185	–	46	46	46	46	46	46	46
	5100	2365	46	46	46	46	46	46	46	46
	5500	2185	–	46	46	46	46	46	46	46
	5700	2185	46	46	46	46	46	46	46	46
	6300	2005	–	46	46	46	46	46	46	46
	6300	2365	46	46	46	46	46	46	57	57
	6300	2770	46	46	46	57	74	89	105	105
Hi-Road Hi-Street 190 4x2 - Rear axle 11.5 t 289 x 80 x 6.7	6700	3400	46	46	46	46	46	46	74	74
Hi-Road Hi-Street 190 4x2 - Rear axle 13 t 289/199 x 80 x 6.7	3800	970	–	–	–	–	–	–	–	–
	3800	1195	–	–	–	–	–	–	–	–
	3800	1825	–	–	46	46	46	46	46	46
	4200	970	–	–	–	–	–	–	–	–
	4200	1195	–	–	–	–	–	–	–	–
	4200	2050	46	46	46	46	46	46	46	46
	4500	1780	–	46	46	46	46	46	46	46
	4800	2455	46	46	57	57	74	89	89	105
	5100	1555	–	–	–	–	–	46	46	46
	5100	1960	46	46	46	46	46	46	46	46
	5100	2185	46	46	46	46	46	57	57	74
	5100	2365	46	46	46	57	74	89	89	105
	5500	2185	46	46	46	46	57	57	74	89
	5700	2185	46	46	46	46	57	57	74	89
	6300	2005	46	46	46	46	46	46	57	57
	6300	2365	46	57	57	74	89	89	105	105
	6300	2770	89	89	105	105	119	150	173	173
Hi-Road Hi-Street 190 4x2 - Rear axle 13 t 289 x 80 x 6.7	6700	3400	46	74	74	74	89	105	105	105
Hi-Way 190S /P /FP /FP- CM 4x2 - Rear axle 11.5 t 289/199 x 80 x 6.7	3800	1847	–	–	–	–	–	46	46	46
	4200	1217	–	–	–	–	–	–	–	–
	4200	2072	–	–	46	46	46	46	46	46
	4500	1307	–	–	–	–	–	–	–	–
	4500	1802	–	–	–	46	46	46	46	46
	4800	2477	46	46	46	46	46	46	46	57

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Way 190S /P /FP /FP- CM 4x2 - Rear axle 11.5 t 289/199 × 80 × 6.7	5100	1577	–	–	–	–	46	46	46	46
	5100	1982	–	46	46	46	46	46	46	46
	5100	2207	46	46	46	46	46	46	46	46
	5100	2387	46	46	46	46	46	46	46	57
	5500	2207	46	46	46	46	46	46	46	46
	5700	1982	46	46	46	46	46	46	46	46
	5700	2207	46	46	46	46	46	46	46	57
	6300	2207	46	46	46	46	46	46	46	46
	6300	2387	46	46	46	46	46	57	57	74
	6300	2792	46	46	57	57	74	89	105	105
Hi-Way 190S /P /FP /FP- CM 4x2 - Rear axle 11.5 t 289 × 80 × 6.7	6700	3422	46	46	46	46	46	46	57	74
Hi-Way 190S /P /FP /FP- CM 4x2 - Rear axle 13 t 289/199 × 80 × 6.7	3800	1847	46	46	46	46	46	46	46	46
	4200	1217	–	–	–	–	–	–	–	46
	4200	2072	46	46	46	46	46	46	57	57
	4500	1307	–	–	–	–	46	46	46	46
	4500	1802	46	46	46	46	46	46	46	46
	4800	2477	46	57	57	74	89	89	105	105
	5100	1577	46	46	46	46	46	46	46	46
	5100	1982	46	46	46	46	46	57	57	74
	5100	2207	46	46	46	57	74	74	89	89
	5100	2387	46	57	57	74	89	89	105	105
	5500	2207	46	46	57	57	74	89	89	105
	5700	1982	46	46	46	46	57	57	57	74
	5700	2207	46	46	57	57	74	89	89	105
	6300	2207	46	46	46	57	57	74	74	89
	6300	2387	57	74	89	89	105	105	105	119
	6300	2792	89	105	105	119	135	150	173	173
Hi-Way 190S /P /FP /FP- CM 4x2 - Rear axle 13 t 289 × 80 × 6.7	6700	3422	46	57	74	74	74	89	105	105
Hi-Way 260S Y/PT 6x2 - Rear axle 19 t 289/199 × 80 × 6.7	3805	1757	46	46	46	46	46	46	46	46
	4200	2117	46	46	46	46	57	57	74	89
	4500	2072	46	46	46	46	57	57	74	89
	4800	1712	46	46	46	46	46	46	46	57
	4800	2072	46	46	46	57	57	74	89	89

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Way 260S Y/PT 6x2 - Rear axle 19 t 289/199 x 80 x 6.7	5100	1802	46	46	46	46	46	46	74	74
Hi-Way 260S Y/PT 6x2 - Rear axle 19 t 289 x 80 x 7.7	5700	2432	46	74	74	74	74	89	105	105
	6050	2657	74	74	89	105	105	105	105	150
Hi-Way 260S Y/PT 6x2 - Rear axle 20 t 289/199 x 80 x 6.7	3805	1757	46	46	46	46	46	46	57	74
	4200	2117	46	57	57	74	89	89	105	105
	4500	2072	46	57	74	74	89	89	105	105
	4800	1712	46	46	46	57	74	74	74	74
	4800	2072	57	74	74	89	89	105	105	105
	5100	1802	46	57	74	74	74	74	74	89
Hi-Way 260S Y/PT 6x2 - Rear axle 20 t 289 x 80 x 7.7	5700	2432	74	89	105	105	105	135	150	150
	6050	2657	105	105	105	150	150	150	173	208
Hi-Way 260S Y/PT 6x2 - Rear axle 21 t 289/199 x 80 x 6.7	3805	1757	46	46	57	74	74	74	74	89
	4200	2117	74	89	89	105	105	105	105	119
	4500	2072	74	89	89	105	105	105	119	150
	4800	1712	74	74	74	74	89	89	105	105
	4800	2072	89	89	105	105	105	105	150	150
	5100	1802	74	74	89	89	105	105	105	105
Hi-Way 260S Y/PT 6x2 - Rear axle 21 t 289 x 80 x 7.7	5700	2432	105	105	150	150	150	173	208	208
	6050	2657	150	150	173	208	208	208	245	245
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP (1) 6x2 - Rear axle 19 t 289/199 x 80 x 6.7	3120	722	–	–	–	–	–	–	–	46
	3805	1757	46	57	57	74	89	89	105	105
	4200	1127	46	46	46	46	46	46	46	46
	4200	1622	46	57	57	74	89	89	89	105
	4200	2117	89	89	105	105	119	135	150	173
	4500	1217	46	46	46	46	46	46	57	57
	4500	1622	57	57	74	89	89	89	105	105
	4500	1802	57	89	89	89	105	105	105	119
	4500	2072	89	105	105	105	119	135	150	173
	4800	1487	46	57	57	74	74	89	89	105
	4800	1712	57	74	89	89	105	105	105	119
	4800	2072	105	105	105	119	135	150	173	173
	5100	1802	89	89	105	105	105	119	119	135

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP (1) 6x2 - Rear axle 19 t 289 x 80 x 7.7	5700	2432	46	74	74	74	74	89	105	105
	6050	2657	74	74	89	105	105	105	105	150
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP 6x2 - Rear axle 20 t 289/199 x 80 x 6.7	3120	722	–	–	–	46	46	46	46	46
	3805	1757	74	89	89	105	105	105	119	135
	4200	1127	46	46	46	46	46	46	57	57
	4200	1622	74	89	89	105	105	105	105	119
	4200	2117	105	119	135	150	173	173	173	173
	4500	1217	46	46	46	57	57	57	74	89
	4500	1622	89	89	105	105	105	105	119	135
	4500	1802	105	105	105	119	119	135	173	173
	4500	2072	105	135	150	173	173	173	173	173
	4800	1487	74	89	89	89	105	105	105	105
	4800	1712	89	105	105	105	119	135	150	173
	4800	2072	119	135	173	173	173	173	173	173
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP 6x2 - Rear axle 20 t 289 x 80 x 7.7	5700	2432	74	89	105	105	105	135	150	150
	6050	2657	105	105	105	150	150	150	173	208
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP (1) 6x2 - Rear axle 21 t 289/199 x 80 x 6.7	3120	722	46	46	46	46	46	46	46	46
	3805	1757	105	105	119	119	135	150	173	173
	4200	1127	46	46	57	57	57	74	74	89
	4200	1622	105	105	105	119	119	135	150	173
	4200	2117	173	173	173	173	173	208	245	245
	4500	1217	57	57	74	74	89	89	89	105
	4500	1622	105	105	119	119	135	150	173	173
	4500	1802	119	135	150	173	173	173	173	173
	4500	2072	173	173	173	173	173	208	245	245
	4800	1487	89	105	105	105	119	119	135	150
	4800	1712	105	119	135	150	173	173	173	173
	4800	2072	173	173	173	173	208	245	245	245
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP (1) 6x2 - Rear axle 21 t 289 x 80 x 7.7	5700	2432	105	105	150	150	150	173	208	208
	6050	2657	150	150	173	208	208	208	245	245

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Way Hi-Road Hi-Street 260S Y/FP-GV ⁽²⁾ 6x2 - Rear axle 19 t 289/199 x 80 x 7.7	4200	2117	–	–	–	–	74	74	89	105
	4500	2072	–	–	–	74	74	89	105	105
	4800	2072	–	–	–	74	89	105	105	105
	5100	1802	–	–	–	–	–	74	74	89
	5700	2432	89	105	105	105	150	150	173	173
Hi-Road Hi-Street 260S /TN 6x2 - Rear axle 19 t 289 x 80 x 6.7	3800	1785	46	46	46	46	46	46	46	46
	4200	1630	46	46	46	46	46	46	46	46
	4200	2125	46	46	46	57	74	74	74	74
	4500	1630	46	46	46	46	46	46	46	46
	4500	1810	46	46	46	46	46	46	57	74
	4500	2080	46	46	46	57	74	74	74	89
	4800	1495	46	46	46	46	46	46	46	46
	4800	1720	46	46	46	46	46	46	46	57
	4800	2080	46	46	57	74	74	74	74	89
	5100	1810	46	46	46	46	46	57	74	74
	5700	3025	105	150	150	173	208	208	208	245
	6050	2665	89	105	105	150	150	150	173	208
Hi-Road Hi-Street 260S /TN ⁽³⁾ 6x2 - Rear axle 20 t 289 x 80 x 6.7	3800	1785	46	46	46	46	46	57	74	74
	4200	1630	46	46	46	46	46	46	57	74
	4200	2125	57	74	74	74	89	89	105	105
	4500	1630	46	46	46	46	46	46	57	74
	4500	1810	46	46	46	57	74	74	74	74
	4500	2080	57	74	74	74	89	105	105	105
	4800	1495	46	46	46	46	46	46	46	46
	4800	1720	46	46	46	57	74	74	74	74
	4800	2080	74	74	74	89	89	105	105	105
	5100	1810	46	46	57	74	74	74	74	89
	5700	3025	150	208	208	245	245	245	286	286
	6050	2665	135	150	173	208	208	208	245	245
Hi-Road Hi-Street 260S /TN 6x2 - Rear axle 21 t 289 x 80 x 6.7	3800	1785	46	46	57	74	74	74	74	89
	4200	1630	46	46	46	57	74	74	74	74
	4200	2125	74	89	105	105	105	105	150	150
	4500	1630	46	46	57	74	74	74	74	74
	4500	1810	57	74	74	74	74	89	105	105
	4500	2080	74	89	105	105	105	105	150	150
	4800	1495	46	46	46	46	46	57	74	74
	4800	1720	57	74	74	74	74	74	89	105
	4800	2080	89	105	105	105	105	135	150	150
	5100	1810	74	74	74	74	89	105	105	105
	5700	3025	245	245	286	286	286	317	343	343

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Road Hi-Street 260S /TN 6x2 - Rear axle 21 t 289 x 80 x 6.7	6050	2665	208	208	208	245	245	245	286	286
Hi-Way 260S X/P 6x2 - Rear axle 19 t 289 x 80 x 6.7	2840	2072	–	–	–	–	46	46	46	46
	3140	1802	–	–	–	–	46	46	46	46
	3440	2477	46	46	46	46	46	46	46	46
	3740	2387	46	46	46	46	46	46	46	57
	4340	2207	46	46	46	46	46	46	57	74
	4690	2657	46	46	74	74	74	74	89	105
Hi-Way 260S X/P 6x2 - Rear axle 20 t 289 x 80 x 6.7	2840	2072	46	46	46	46	46	46	46	46
	3140	1802	46	46	46	46	46	46	46	46
	3440	2477	46	46	46	46	57	74	74	74
	3740	2387	46	46	46	74	74	74	74	89
	4340	2207	46	46	57	74	74	74	74	89
	4690	2657	74	74	89	105	105	105	105	150
Hi-Way 260S X/P 6x2 - Rear axle 21 t 289 x 80 x 6.7	2840	2072	46	46	46	46	46	46	57	74
	3140	1802	46	46	46	46	46	46	46	57
	3440	2477	57	74	74	74	89	105	105	105
	3740	2387	74	74	74	89	89	105	105	105
	4340	2207	74	74	74	89	105	105	105	105
	4690	2657	105	105	105	150	150	150	173	208
Hi-Way 260S Z/P-H/M 6x4 - Rear axle 19 t 289 x 80 x 7.7	3800	1487	–	–	–	46	46	46	46	46
	4200	1847	46	46	46	46	46	46	46	46
	4500	1982	46	46	46	46	46	46	46	46
Hi-Way 260S Z/P-H/M 6x4 - Rear axle 20t 289x80x7.7	3800	1487	46	46	46	46	46	46	46	46
	4200	1847	46	46	46	46	46	46	46	57
	4500	1982	46	46	46	46	46	57	74	74
Hi-Way 260S Z/P-H/M 6x4 - Rear axle 21 t 289x80x7.7	3800	1487	46	46	46	46	46	46	46	46
	4200	1847	46	46	46	57	74	74	74	74
	4500	1982	57	74	74	74	74	74	89	105
260 S... Y/P-CM 6x2 - Rear axle 19 t 289 x 80 x 7.7	3805	1758	A	A	A	A	A	46	46	46
	4200	1623	A	A	A	A	46	46	46	46
	4200	2118	A	46	46	46	46	46	46	46
	4500	1623	A	A	46	46	46	46	46	46
	4500	1803	A	46	46	46	46	46	46	46
	4500	2073	46	46	46	46	46	46	46	46
	4800	1713	A	46	46	46	46	46	46	46

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Towable mass (R) and static load (S) on the hook of the centre axle trailer [kg]							
			R≤9500 S≤ 950	R≤12000 S≤ 1000	R≤14000 S≤ 1000	R≤16000 S≤ 1000	R≤18000 S≤ 1000	R≤20000 S≤ 1000	R≤22000 S≤ 1000	R≤24000 S≤ 1000
			Section modulus W_x [cm ³] for longitudinal sections of the subframe with material with a yield limit of 360 [N/mm ²] (Fe 510)							
260 S... Y/P-CM 6x2 - Rear axle 19 t 289 x 80 x 7.7	4800	2073	46	46	46	46	46	46	46	46
	5100	1803	46	46	46	46	46	46	46	46
	5700	2433	46	46	46	46	46	57	74	74
	6050	2658	46	46	57	74	74	74	74	74
260 S... Y/P-CM 6x2 - Rear axle 20 t 289 x 80 x 7.7	3805	1758	46	46	46	46	46	46	46	46
	4200	1623	46	46	46	46	46	46	46	46
	4200	2118	46	46	46	46	46	46	46	46
	4500	1623	46	46	46	46	46	46	46	46
	4500	1803	46	46	46	46	46	46	46	46
	4500	2073	46	46	46	46	46	46	57	57
	4800	1713	46	46	46	46	46	46	46	46
	4800	2073	46	46	46	46	46	57	74	74
	5100	1803	46	46	46	46	46	46	57	74
	5700	2433	74	74	74	74	74	89	89	105
	6050	2658	74	74	89	89	105	105	135	135

⁽¹⁾ Not valid for versions /TN/PT, CT and GV

⁽²⁾ Only with CCM I 1954

⁽³⁾ 5050 or 6040

Note See Table 3.2 (profile dimensions).

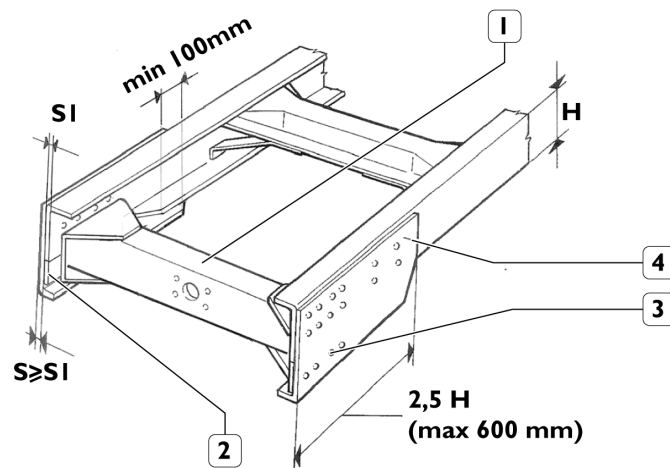
Rear crossbar in lowered position

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

Figures 11 and 12 show the respective realisation examples.

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

Anti-unscrewing systems must be used in the connections.



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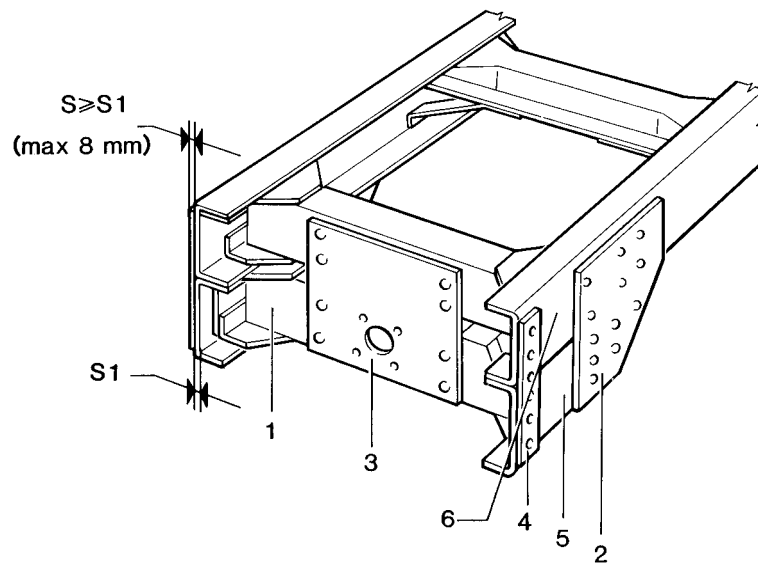
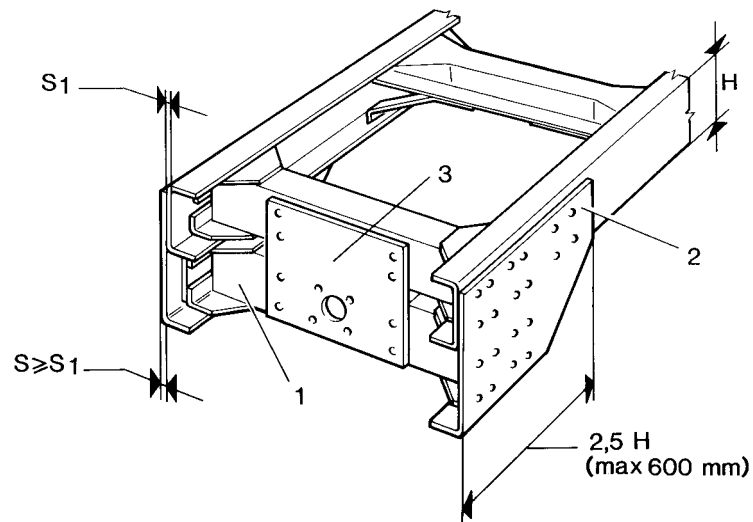
Figure 11

1. Original rear cross member.
2. Additional strap

3. M14 threaded hole - 10.9 (1110 kN)
4. Connecting corner

The outer corners should have a thickness of not less than that of the side members of the vehicle, they should extend in length for a distance of at least 2.5 times the height of the side member itself (max 600 mm) and should use a material with the minimum requirements set out in Chapter 3.3 - Paragraph "Choosing the type of connection" (➡ Page 12). The fastening to the vertical rib of the side members must be done with all the union screws of the crossbar to the chassis of the vehicle, integrating them with others whose number and positioning consider the greater time transmitted. In principle, in the lowerings equivalent to the height of the side member, an increase in the number of screws equal to about 40% is predicted.

In applying a supplementary crossbar (see Figure 12) a central coupling plate must be provided, of thickness suited to that of the crossbars.



192344

Figure 12

- 1. Lowered rear cross member
- 2. Connecting plate or angle
- 3. Coupling plate

- 4. Connecting plate
- 5. C-profile (same dimensions as chassis)
- 6. Space for rear spring retainer

The movements between the drawbar and the vehicle established by regulations in force must be ensured.

If the local legal regulations provide it, after construction the vehicle must be presented for the required checks.

Figure 12 shows an example of a lowered supplementary crossbar.

In cases where this solution is chosen on vehicles with short rear overhangs, the external connection angle must be made according to the solution proposed therein. If, after lowering the rear crossbar, the shelves of the guards need to be changed, there must be a method of fastening, resistance and rigidity equivalent to the original. Verify compliance with the standards for positioning the lights.

Tow beam in a lowered and forward position (close coupling) for centre axle trailers

Vehicles that, to tow centre axle trailers, must adopt a two beam in a lowered and forward position (close to the rear housings of the rear suspension or air springs), do not require special chassis reinforcement.

The bodybuilder must provide an adequate tow beam and use a suitable tow hook.

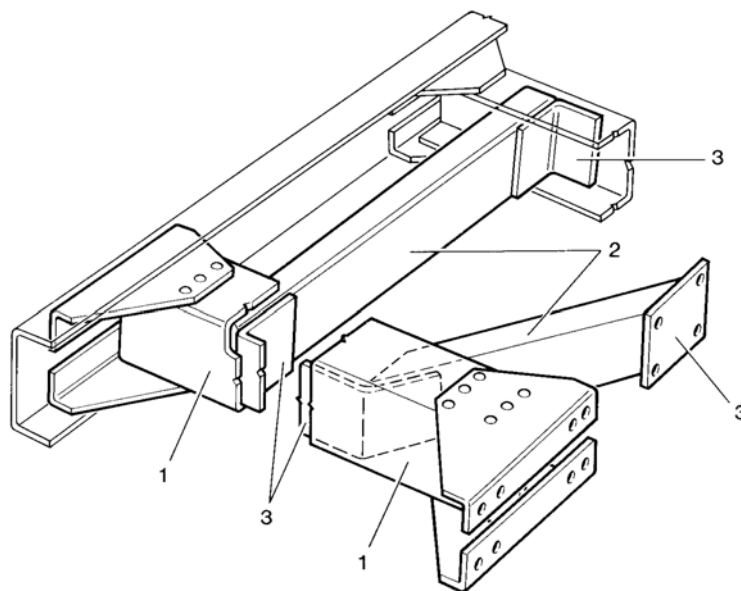
The positioning of the hook must be made in order to allow all relative movement between the tractor and the trailer drawbar in the various conditions of use, subject to the necessary safety margins and compliance with any regulations or legal requirements.

Since in these cases the normal version of the under-run protection bar can not be used, the Bodybuilder will be responsible for investigations on possible exceptions permitted or to be taken on the specific solutions (eg. tilting bumper beam).

Standard crossbar reinforcements

In cases where it is necessary to reinforce the standard crossbar and there are no originally reinforced crossbars, you will have to resort to the application of:

- C-profile within the crossbar an adequate reinforcement even of the connections of the same to the side members of the vehicle;
- C profile within the crossbar with connection to the vertical rib of the side member or to the next crossbar of the chassis if it is located in close proximity, according to Figure 13;



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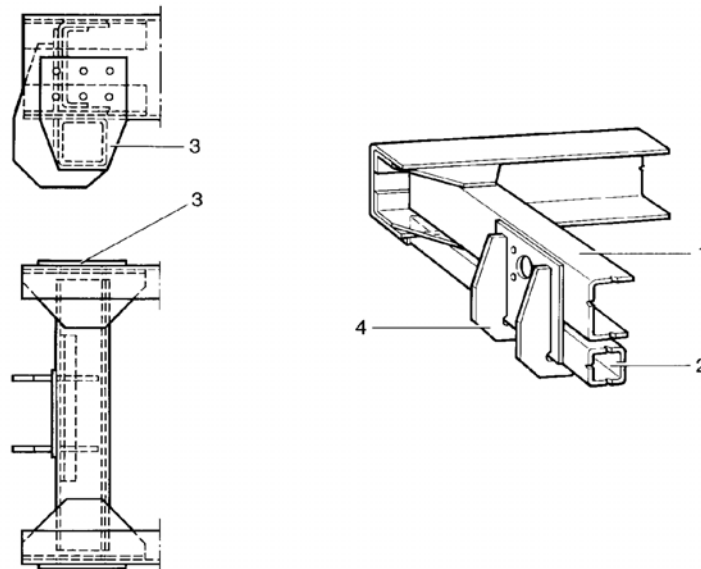
Figure 13

1. Original rear cross member.
2. Reinforcing profile

3. Connecting plates or angles

- suitably sized box-shaped crossbar, fastened on the ends to the vertical rib of the side members and connected to the crossbar in the central part, as shown in Figure 14. In vehicles with short rear overhang and in the presence of the subframe, the box profile can be inserted inside the profiles of the subframe, above the crossbar and connected to it by means of a front plate (as in Figure 12).

If in the mounting of the box profile it is necessary to operate on the brackets of the under-run protection bar, there must be a version equivalent to the original in terms of fastening, resistance and rigidity (respect any national legal requirements).



91460

Figure 14

1. Original rear cross member.
2. Box profile

3. Connecting plate
4. Coupling plate

Observations of payload

Static load on the drawbar coupling must not surpass the load allowed on the rear axle or axles of the vehicle. Furthermore, the minimum front axle load must be respected as indicated in Chapter 1.15 (► Page 11).

Increase of tow weight

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

These authorisations include the towing conditions and, when necessary, provide the instructions relevant to any vehicle modifications or work required: standard crossbar reinforcements (see Figure 12), or installation of a reinforced crossbar when available, or adjustments to the braking system.

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

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

Use anti-unscrewing systems.

Plates

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

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

2.7 ASSEMBLING AN ADDITIONAL AXLE



- ▶ **The installation of an additional axle includes the perfect integration with the braking system, pneumatic system, wiring and electronic systems: therefore approval by IVECO is necessary. The request of technical information at the axle manufacturer and suppliers of plants and systems involved in the transformation is the responsibility of the bodybuilder, as well as performing the functional and approval tests.**



- ▶ **The granting of the authorisation to install an additional axle and the passing of the approval tests do not exempt the Bodybuilder from full responsibility for processing.**



- ▶ **The addition of an additional axle on vehicles equipped with electronic control systems for braking, grip and stability, necessarily require the updating of the setting parameters of the relevant control units via IVECO teleservices.**

General information

On some models of the Stralis range, it may be possible to apply an additional axle and consequently increase gross vehicle mass.

For its implementation, the mass limits and conditions imposed by IVECO must be respected, as well as all other conditions requested by national laws and the necessity to ensure driving safety and proper vehicle function.

Any application diagrams sent to IVECO - Technical Application to be examined and authorised must show indications regarding connection of the axle to the chassis, as well as information on reinforcement and on changes to be made on the chassis; diagrams regarding modifications to systems must also be provided.

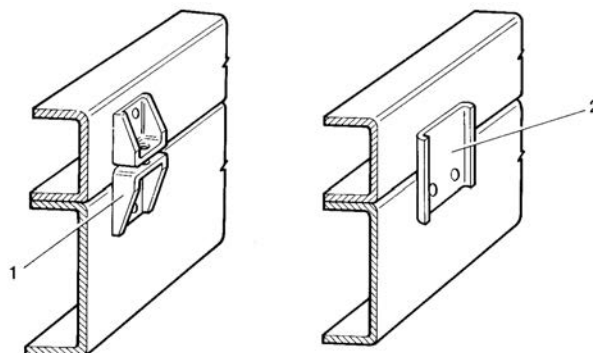
With regard to modifications to the chassis, in addition to complying with the indications in the previous paragraphs, it is necessary to consider the increase in stress due to the increase in the permitted load and the different conditions of operating dynamic stress.

The transformed frame must, in the corresponding sections, not be subjected to bending loads no greater than on the frame of the original vehicle.

Reinforcements on the chassis

Figure 15 shows several examples of possible solutions.

The reinforcements must concern the entire length of the chassis, up to the cab.



192346

Figure 15

1. Bracket

2. Plate

In the case of a subframe reinforcement, the anchors provided on the chassis may be used (if in existence), otherwise they should be made according to the indications in Chapter 3.1 - Paragraph "Sizing of profiles" (► Page 5) and subsequent paragraphs.

We recommend creating a cut-resistant joint in the area of the rear overhang and for about half of the wheelbase length (and always for lengths of at least 2 m from the front axle) (see Figure 15).

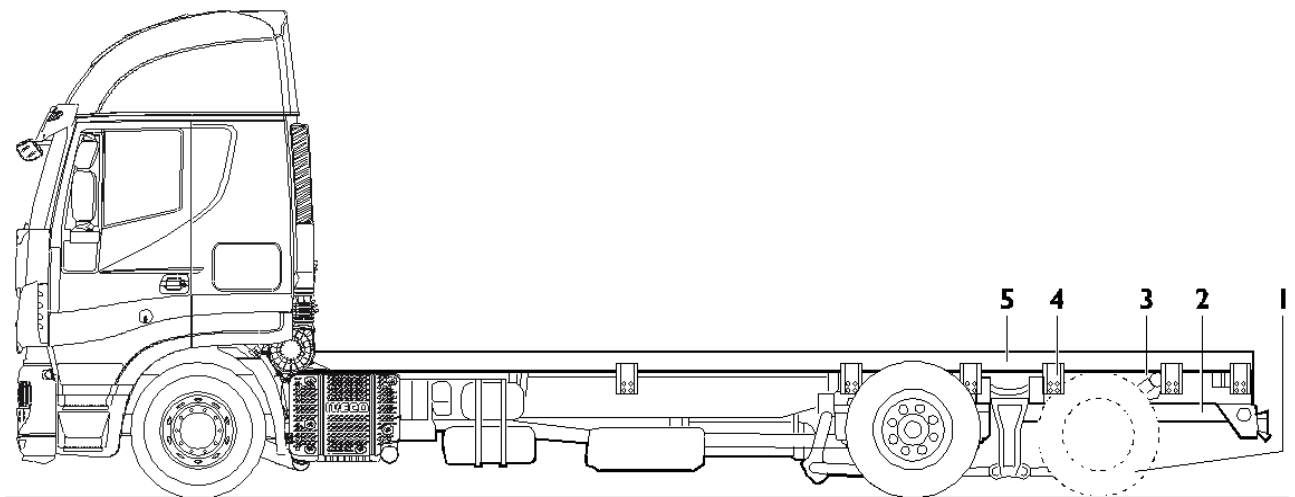
Note Reinforcement plates may not be mounted directly onto the side member flaps via holes filled with welding material; Negative effects on the strength of the original sections, due to incorrect welding, should be avoided.

Added axle

a) rear

The installation of an axle behind the engine axle generally results in the lengthening of the chassis overhang (see Figure 16) which is to be carried out according to the indications provided in the Paragraph "Lengthening" (► Page 17). This still requires the need for reinforcement as indicated in the Paragraph "Reinforcements on the chassis" (► Page 34).

For vehicles with a tapered frame, the adaptation of the section of the new overhang to the rest of the sections of the chassis can be a useful solution for containment of the stresses caused by transformation.



192347

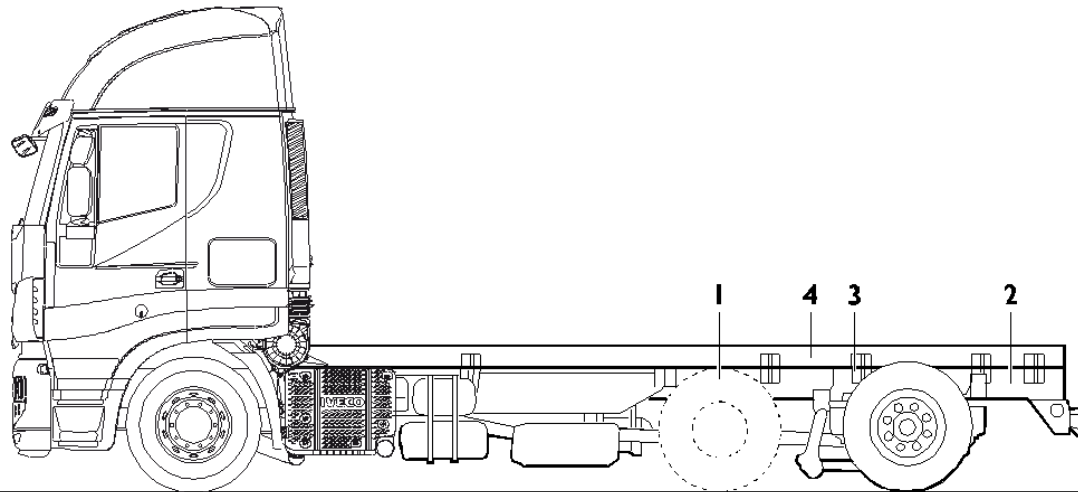
Figure 16

1. Added supplementary axle
2. Lengthening of the overhang

3. Reinforcements for modification of the chassis
4. Connections
5. Reinforcing profile

b) central

The installation of an axle in front of the engine axle may make it necessary to reduce the rear overhang (see Figure 17), to be realised according to the indications provided in the Paragraph "Shortening" (► Page 17) in order to respect the technically permissible load.



192348

Figure 17

1. Added supplementary axle
2. Shortening (if necessary) of the rear overhang

3. Connections
4. Reinforcing profile

Steering axles

Steering axles can be installed in both the centre position and the rear position and be either the self-steering or controlled steering type; they must be built and installed in order to ensure the necessary safety for functionality and driving.

- Self-steering axles must be equipped with a device that keeps them in place while reversing, which can be activated from the driver's seat.
- The application of a controlled steering axle, obtained through the original device of the vehicle's steering system, requires authorisation from IVECO upon presentation of the supplementary system diagram.

Suspension

The suspension of an additional axle may be mechanical spring or pneumatic, with the possibility of creating a mixed solution with the suspension of the engine axle.

The solution created should not adversely affect the dynamic behaviour of the vehicle, on the comfort and work angle of the transmission (with its space in the case of an added axle in front of the engine axle).

If there is a suspension independent of that of the engine axle, in principle rigidity characteristics can be adopted, proportional to those of the original rear suspension, in the ratio of the static loads on the two axles.

Parabolic suspensions

Interventions are generally not allowed on this type of suspension.

Exception is made for fittings or special uses for which, in order to increase suspension rigidity, the application of rubber elastic elements may be authorised.

In special cases and only after IVECO approval, the addition of supplemental sheets on the parabolic springs may be allowed; this must be carried out by a specialised spring manufacturer.

Stabiliser bars

In the case of an additional axle with air suspension, it might be necessary, depending on the solution adopted, to provide a stabiliser bar, particularly when there is a superstructure with high centre of gravity.

Similar stability measures should be adopted for mixed suspensions on added rear axles.

Attachments to the chassis

The connections for the added axle to the chassis must be able to react directly on all the longitudinal and transversal forces without transmitting them to the engine axle.

In the points of application of forces (spring supports, brackets for air springs, etc.), suitable crossbars or adequate reinforcements to the chassis must be provided.

It is important to remember to create the correct orthogonality and alignment of the added axle, respectively, with the longitudinal axle of the vehicle and with the drive wheel axle.

Check the special equipment available on the market.

Brake system



- **Considering the importance for the active safety of the vehicle, extreme care must be given to the braking system in both design and implementation.**

The same type of braking units, pipes and couplings as on the original vehicle must be used on the added axle; in particular, the braking unit must be of the type that equips the front axle.

For connection between the fixed parts (chassis) and the axle, it is advisable to use flexible pipes.

Direct connection is allowed between the braking section of the added axle and that of the engine axle.

Verify that the capacity of the air tank is suitable to the dimensions of the new added brake cylinders and, if necessary, mount an additional air tank.

We recommend activating the parking brake on the added axle as well.

Keeping in mind the different gross vehicle weight determined with the intervention, the braking torque must be adjusted to the new static and dynamic loads in order to achieve even distribution of braking among the axles.

The total braking capacity of the modified vehicle must be proportional to that of the original vehicle and the performance of the system (service, emergency and parking) must continue in any case to comply with national standards.

Note After processing, the vehicle must be presented to the competent authorities for approval verifications (an individual test or approval of that type).

The documentation on the braking to be presented to the approval body (e.g. curves of adhesion and compatibility, distribution, decelerations, heat behaviour, response time, etc.) must be provided by the person carrying out the work or the Manufacturer or the added axle.

Technical documentation with the features of the system and the braking capacities of the original vehicle is available on request.

Note For general indications on the braking system, follow what is set forth in Chapter 2.15.

Note With regard to the electrical system, follow the indications in Chapter 5.5.

Lifting device

The added axle may be equipped with a lifting device and may be used, in special cases and if national laws allow it, for the purpose of increasing grip of the engine axle in specific situations (starting on hills, slippery, snowy or icy roads).

For the device in question, the following conditions must exist:

- implementation depends on issuance by IVECO of the relative permit, on which the maximum permissible load on the overloaded axle is indicated;
- the use is limited to short sections of the route and the speed limit set in the specific authorisation.

Some national laws allow the use of the lifting device even in normal driving conditions, as long as the max approved load set for the engine axle and the allowed speed limit are not exceeded.

In this case it is a good idea to remember the indications in Chapter 1.15 (► Page 11) with regard to the positioning of the centre of gravity of the superstructure plus payload.

Note After processing, the vehicle must be presented to the competent authorities for approval verifications (an individual test or approval of that type).

For service and maintenance operations on the added groups, use operating modes and intervention times consistent with the provisions set for the original vehicle and shown on its documentation.

2.8 TRANSMISSION MODIFICATION

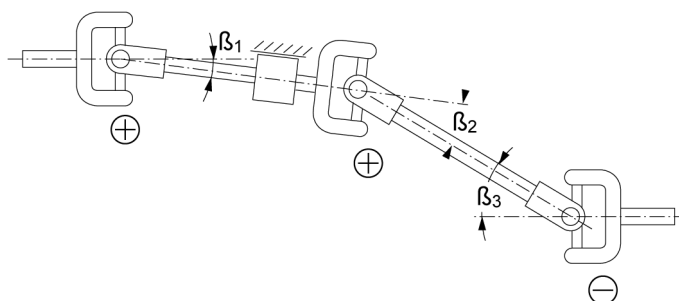
Gearbox adjustment, following wheelbase modification, must be performed using the gearbox diagram of an equivalent standard production vehicle with a similar wheelbase.

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

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

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

$$\beta_r = \sqrt{\pm \beta_1^2 \pm \beta_2^2 \pm \beta_3^2} \leq 3^\circ$$



196780

Figure 18

Maximum allowed angularity

n = engine speed

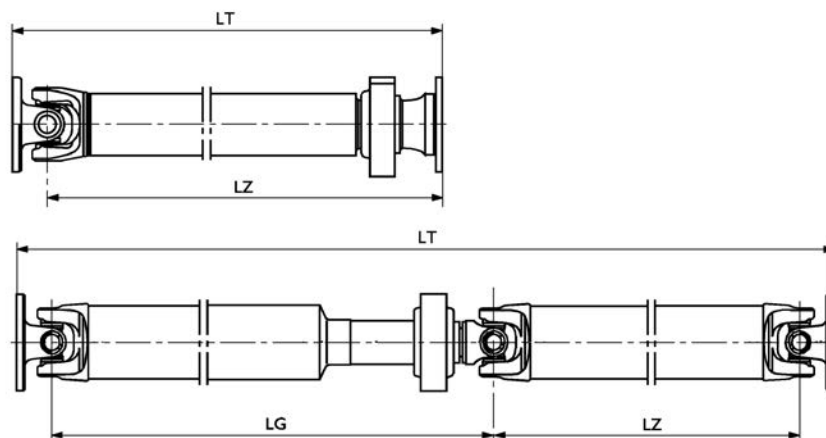
$\beta \cdot n < 20,000$ for classes 2040-2045-2050

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

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

Lengths allowed

1. The maximum possible operating lengths, both for "LG" sliding sections as well as for "LZ" intermediate ones (see Figure 19), may be determined based on the outer diameter of the vehicle's existing pipe and on the maximum number of operating revs. (see formula and Table 2.11).
If the shaft length calculated in this fashion is insufficient for the modification at hand, it is necessary to insert a new section with the same characteristics as those mounted.
2. In some cases, a propeller shaft with a larger diameter can be used and calculated (again, see Table 2.11) in relation to the length required and the maximum number of engine rpm.



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Figure 19

LG Length of sliding sections

LZ Length of intermediate sections

LT Total length

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

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

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

n_G	maximum engine speed [rpm]
$n_{\max}$	engine speed [rpm] at maximum output power, see Table 2-11
i_G	gear ratio at highest speed, see Table 2-12

Table 2.11 - Engine speed [rpm] at maximum output power

Engine Model	Engine code	Power [HP - kW]	$n_{\max}$
CURSOR 9	F2CFE611D*)	310 - 228	2200
	F2CFE611C*)	330 - 243	2200

Engine Model	Engine code	Power [HP - kW]	n _{max}
CURSOR 9	F2CFE611B*	360 - 265	2200
	F2CFE611A*	400 - 294	2200
CURSOR 11	F3GFE611F*	420 - 309	1900
	F3GFE611E*	460 - 338	1900
	F3GFE611D* (with EGR)	480 - 353	1900
	F3GFE611G* (with SCRT)	480 - 353	1900
CURSOR 13	F3HFE611G*	510 - 375	1900
	F3HFE611D* (with EGR)	570 - 419	1900
	F3HFE611F* (with SCRT)	570 - 419	1900

Table 2.12 - Gear ratio at highest speed

Gearbox	i _G
16 S 1620 TD	1.00
16 S 2220 TD	1.00
16 S 2320 TD	1.00
16 S 2220 TO	0.84
16 S 2520 TO	0.84
12 TX 1410 TD	1.00
12 TX 1810 TD	1.00
12 TX 2010 TD	1.00
12 TX 2210 TD	1.00
12 TX 2420 TD	1.00
12 TX 2620 TD	1.00
12 TX 1810 TO	0.77
12 TX 2010 TO	0.77
12 TX 2210 TO	0.77
12 TX 2410 TO	0.77
12 TX 2610 TO	0.77

Note Following the modification, the axle shaft crosspiece forks must not be turned from their original position.

Pipe thickness

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

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

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

Minimum operating length (from flange to flange) must be at least 800 mm for sliding shafts and 700 mm for intermediate shafts.

Table 2.13 - Maximum possible lengths

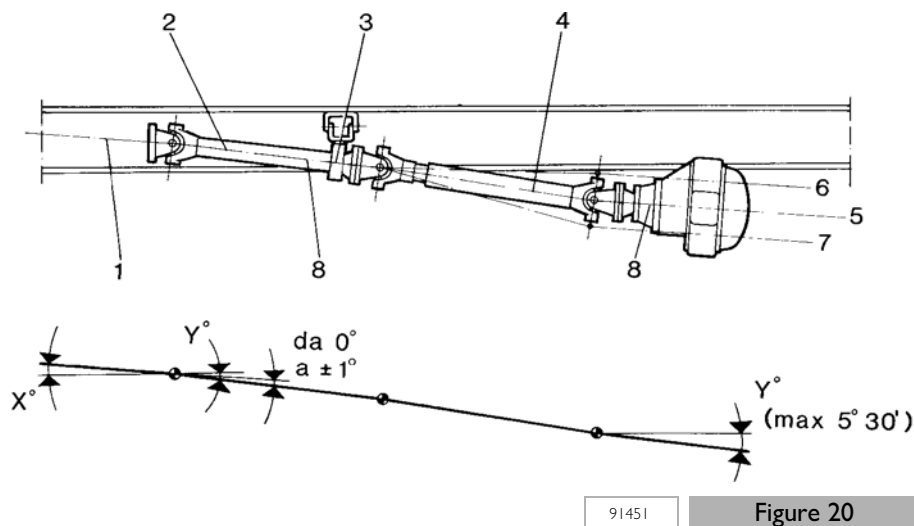
Joint dimensions	External diameter x thickness [mm]	Maximum possible lengths LG to LZ [mm]							
		1800	1900	2000	2100	2200	2300	2400	2500
		Maximum propeller shaft speed [rpm]							
2040	100 x 4.5	3400	3150	2900	2650	2450	2300	2100	1950
2040	120 x 3	4450	4100	3750	3400	3150	2900	2650	2450
2045	120 x 4	4450	4050	3700	3400	3100	2850	2650	2450
2055	120 x 6	4400	4000	3650	3350	3100	2850	2600	2400
2060	130 x 6	4650	4250	3900	3600	3300	3050	2800	2600
2065	142 x 6	5000	4600	4200	3900	3600	3300	3050	2850



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

Positioning the sections

The transmissions that comprise several sections, each axle must be of approximately the same length. In general, between an intermediate shaft and sliding shaft (see Figure 20) there must not be a difference in width greater than 600 mm, while between two intermediate shafts this difference must not be greater than 400 mm. As regards sliding shafts, there must be a minimum margin of 25 mm between minimum operating length and maximum sealing length; on opening, a covering must be guaranteed between the shaft and the sleeve of approx. twice the diameter of the spline shaft.



1. Drive shaft, clutch, gearbox
2. Intermediate shaft
3. Intermediate shaft bearing
4. Sliding shaft
5. Rear axle casing tilt (static load)

6. Rear axle casing tilt (max compression)
7. Rear axle casing tilt (no load)
8. Intermediate shaft, sliding articulated shaft and rear axle casing axis must have the same tilt.

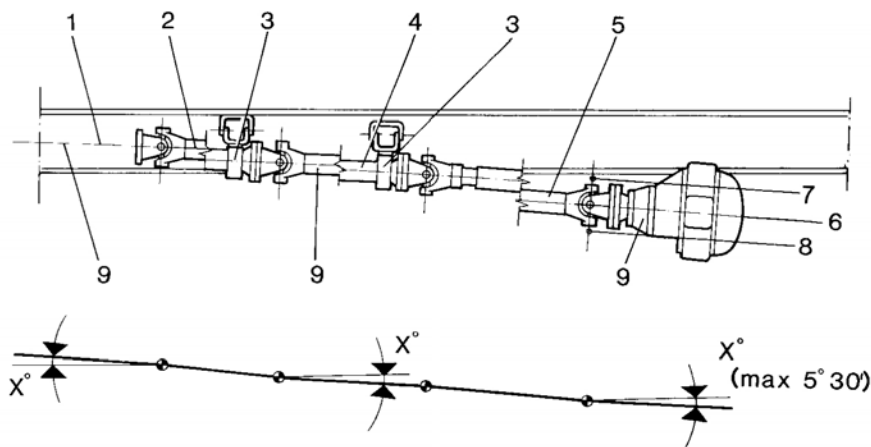
The intermediate shaft and the axle casing axle must be aligned.

Their tilt may vary up to 1° in regards to that of the engine-clutch-gearbox axle; which may be obtained by placing a wedge between the axle casing and the spring, or by means of adjusting the rear axle reaction bars.

The inclination of the axle casing should not be greater than 5.5° from the horizontal plane.

When in vehicle loading conditions, the flange of the rear axle is lower than that of the gearbox housing flange, it is necessary to make the inclination of the axle housing and the intermediate shaft greater than that of the engine-gearbox axle. Vice versa, when in vehicle loading conditions, if the flange of the rear axle is higher than that of the gearbox housing flange, it is necessary to make the incline of the axle housing and the intermediate shaft less than that of the engine-gearbox axle.

When wheelbase lengthening is substantial, it may be necessary to mount an additional intermediate section, as indicated in Figure 21. In this case, make sure that the engine-gearbox axle, the second intermediate shaft and the rear axle casing axis when in static load are all aligned with the same tilt.



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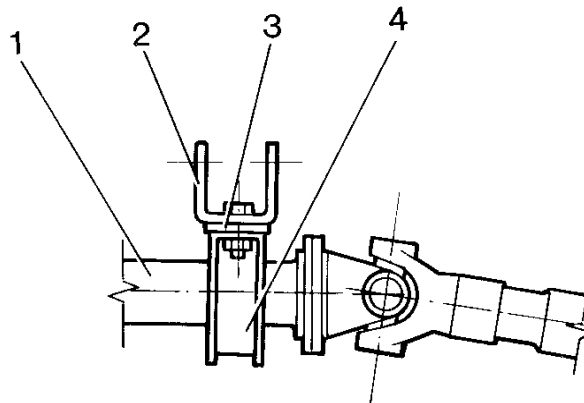
Figure 21

1. Drive shaft, clutch, gearbox
2. First intermediate shaft
3. Intermediate shaft bearing
4. Second intermediate shaft
5. Sliding shaft

6. Rear axle casing tilt (static load)
7. Rear axle casing tilt (max compression)
8. Rear axle casing tilt (no load)
9. Gearbox, second intermediate shaft, sliding articulated shaft and axle casing axis must have the same tilt.

The application of flexible supports must be done using support plates with a thickness of at least 5 mm (see Figure 22), connected to cross members with characteristics similar to those specified by IVECO.

In modifying the wheelbase, it is best to plan for disassembly of intermediate shafts when shaft length is less than approximately 800 mm.



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Figure 22

1. Intermediate shaft
2. Support plate

3. Rest plate
4. Intermediate shaft bearing

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

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

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

The universal joints may not be modified.

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



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

2.9 MODIFYING THE ENGINE AIR INTAKE AND EXHAUST SYSTEMS

Note Any interventions, if authorised by IVECO, must not vary the original intake vacuum and exhaust counter-pressure values.

Table 2.14 - Maximum permitted counterpressure at normal operating conditions and at full load

Engine Model	Engine code	Exhaust counter-pressure [kPa]	Intake vacuum [kPa]
CURSOR 9	F2CFE611D*	20	6.3
	F2CFE611C*	20	6.3
	F2CFE611B*	20	6.3
	F2CFE611A*	20	6.3
CURSOR 11	F3GFE611F*	37	6.3
	F3GFE611E*	37	6.3
	F3GFE611D*	37	6.3
	F3GFE611G*	30	6.3

Engine Model	Engine code	Exhaust counter-pressure [kPa]	Intake vacuum [kPa]
CURSOR 13	F3HFE611C*	37	6.3
	F3HFE611D*	37	6.3
	F3HFE611F*	37	6.3

Intake

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

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

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

The following are not allowed:

- alterations or replacement of the original air filter with one of lower capacity;
- modifications to the silencer body;
- interventions on equipment (injection pump, control valve, injectors, etc.) that may compromise good engine performance and affect exhaust gas emissions.

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

Exhaust

Given the complexity of the "Hi-e SCR" exhaust system (see Section 6 (► Page 5)) and the optimisation achieved by the layout of its components, no modifications of any kind are permitted on the engine exhaust pipes.

2.10 WORK ON THE ENGINE COOLING SYSTEM

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

If modifications must be made to the cab or full bodywork installed (buses, campers, mobile-shops, etc.) which require work to the cooling system, keep in mind that:

- the effective area for airflow towards the radiator must not be less than that expected for vehicles with standard cabs and must be protected via deflectors and/or conveyors installed in front of the radiator assembly;
- maximum outflow of hot air from the engine compartment must be guaranteed using appropriate deflectors and/or extractors;
- fan performance must not be modified;
- any modifications of the water piping must not compromise complete filling of the circuit (done with a steady flow and without any backflow from the intake until the circuit is filled) and regular water flow; in addition, these modifications must not alter maximum water stabilisation temperature, even in the most demanding conditions of use;
- pipe layout must be done so as to avoid the formation of air pockets (e.g. eliminating siphoning bends or installing required vents) that may make water circulation difficult;
- check that water pump activation at engine start-up and successive operation during idling is immediate (accelerate a few times), even when circuit is not pressurised. During checks make sure that the water pump supply pressure, with engine at top speed and no load, is less than 1 bar.

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

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

2.11 INSTALLING AN ADDITIONAL HEATING SYSTEM

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

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

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

In addition, be sure to:

- care for the proper operation of all other vehicle systems (e.g.: engine cooling system);
- check that the battery capacity and alternator power are sufficient for increased current draw (see Chapter 5.5 (► Page 35)) and install a protection fuse on the new circuit;
- connect - for the fuel supply - the supply system to a supplementary tank that is installed along the return pipe of the engine fuel. Direct connection to the vehicle tank is allowed under the condition that it occurs independently from the engine fuel supply, and the new circuit must be perfectly airtight;
- route piping and wiring layout (and installation of brackets and flexible fittings) in relation to the spaces available and the influence of heat on the chassis parts. Avoid any exposed parts that may be dangerous, and adopt suitable guards when necessary.

The system must allow easy access and prompt maintenance.

The Bodybuilder must provide all necessary maintenance instructions.

a) Water heaters

When the original vehicle heating and engine cooling circuits are involved (see Chapter 2.10 (► Page 44)), the following must be done to ensure good system operation and safety of the original system:

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

- allow complete circuit discharge, also by installing any additional plugs;
- adopt, when necessary, suitable protections to limit heat loss.

b) Air heaters

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

2.12 INSTALLING AN AIR CONDITIONING SYSTEM

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

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

- maintain good performance of the vehicle parts that may be involved in the intervention;
- check that the battery capacity and alternator power are sufficient for increased current draw (see Chapter 5.7 - Paragraphs "Additional batteries" (➡ Page 43) and "Additional alternators" (➡ Page 44)) and install a protection fuse on the new circuit;
- plan the compressor installation modes with IVECO, if installed on the engine;
- route piping and wiring layout (and installation of brackets and flexible fittings) in relation to the spaces available and the influence of heat on the chassis parts;
- avoid layouts and installations where exposure may be dangerous when the vehicle is moving; fit suitable guards when necessary;
- the system must allow easy access and ensure prompt maintenance.

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

In addition, in function of the type of system:

a) cab installed system:

- condenser installation must not cause negative effects on the engine cooling characteristics (reduction of exposed radiator-engine area);
- condenser installation must not be coupled with the engine radiator, but placed in its own specific compartment with proper ventilation;
- installation of the evaporator unit and of the bellow inside the cab (in cases where not provided directly from IVECO) must be planned as not to negatively impact control functions and access to equipment;

b) cab roof-installed systems :

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

Note From 1/1/2017:

a) if an additional climate control system is to be connected to the original system of the vehicle, the new total quantity of fluorinated greenhouse gases contained in the system (expressed in weight and in CO₂ equivalent) must be indicated by a data plate which replaces the original data plate;

b) if an additional independent system is to be added, the specific data plate indicating the fluorinated greenhouse gases must be positioned in line with the access points for the recharging operations.

In both cases, the data plate must be made according to the indications provided in Regulations 517/2014 (EU) and 2015/2068 (EU) in force in the European Union.

2.13 WORK ON THE CAB

General information

Note *All interventions on the driver's cab or on the roof must be authorised by IVECO in advance.*

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

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

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

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

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

Make sure that pipe and cable installation is performed properly also in function of cab tilting; adopt the necessary retainers and be sure to plan for appropriate distances from the engine, heat sources and moving parts.

Each structural modification must bear protection against corrosion (see Chapter 2.3 (► Page 10)).

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

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

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

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

Work on the roof

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

In any applications or units or equipment on the roof, make sure that the mass of the equipment does not exceed that permitted by the cab. These limits can be provided on request, depending on the version.

2.14 CHANGING TYRE SIZE

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

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

Mounting larger tyres:

- always requires a size check in relation to mechanical components, wheel arches, etc., in the various dynamic, steering and vehicle shaking conditions;
- may entail rim replacement with the consequential need to verify the spare tyre holder modification;
- may affect distance from ground of the rear under-run protection device and, in this case, a check on standard compliance is required; if necessary the support brackets must be replaced with appropriate and approved counterparts (see Chapter 2.20 (► Page 57));
- requires the need to check compliance of the limit transversal contour allowed in relation to the various standards.

Prescriptions

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



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

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

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

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

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



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

Table 2.15 - Wheel tightening torque according to IVECO STD 17-9219

CONNECTING ELEMENTS		Thread	TIGHTENING			
CODE	Name		CLASS	Torque [Nm]		FEATURES “S” (*)
				Min	Max	
1	Front and rear wheel mounting	Nut M18x1.5	II	335	410	“S”
2	Front and rear wheel mounting	Nut M20x1.5	II	540	440	“S”
3	Front and rear wheel mounting	Nut M22x1.5	—	580	650	“S”

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



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

2.15 WORK ON THE BRAKING SYSTEM

General information



- ▶ **No changes are allowed to the regulating unit, distributor, brake cylinders, valves, etc., since they are safety components.**



- ▶ **Any changes to the braking system (modification of pipes, installation of additional operating cylinders etc.) requires the authorisation of IVECO.**

Note For new units, it is advisable to prefer the same brands as those fitted to the original vehicle.

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

In the case of displacement of control valves, dryer, etc., restore the same type of installation originally provided, ensuring the correct functionality; interventions on the dryer must also not affect the conditions of cooling air coming from the compressor.

Brake pipes

Note In the case of changes to the wheelbase or the cantilever, the brake lines involved should preferably be replaced with new pipes and in one piece; if this is not possible, the couplings to be used must be of the same type as the original ones.



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

When replacing, it is necessary to comply with the minimum internal dimensions of the existing pipes.

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

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

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

Plastic pipes

In both the addition of new pipes and in the replacement of others, it should be noted that plastic material is not allowed:

- in areas where the internal/external temperature of the pipe may exceed 80 °C, (e.g. within 100 mm from the engine exhaust outlet or section of pipe at a distance of less than 3 mm from the compressor outlet);
- between the chassis and moving parts, where special flexible pipes should be used;
- on hydraulic lines.

Operations must provide:

- materials and dimensions: Standard DIN 74324 (IVECO STD I8-0400) Maximum operating pressure 12.5 bar
- radii of curvature (referring to the centre line of the pipe):
 - Φ 6 to 35 mm

- Φ 8 to 55 mm
- Φ 12 to 85 mm
- Φ 16 to 85 mm

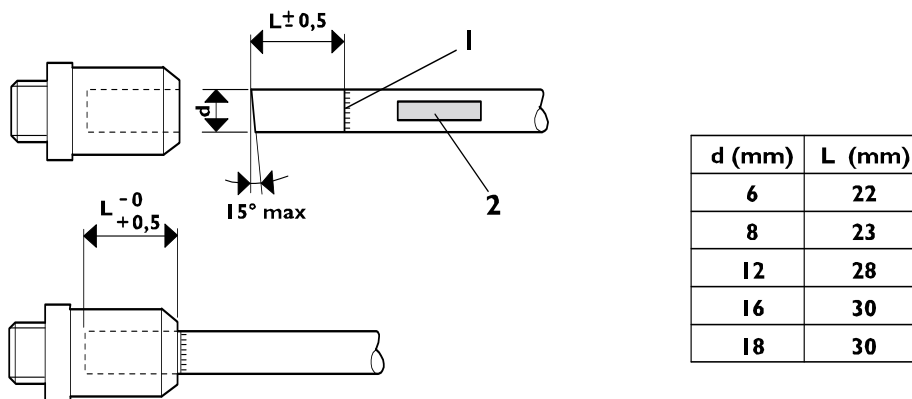
Preparation and assembly (IVECO STD 17-2403)

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

Permanently mark the section of pipe (dimension L in Figure 23) to be inserted into the coupling to ensure secure sealing.

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

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



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Figure 23

1. Identification of pipe limit

2. Marking

As much as possible, use quick-fit couplings.



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

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

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

Thread	Tightening torque [Nm $\pm$ 10%]
M12 $\times$ 1,5 mm	20
M14 $\times$ 1,5 mm	24
M16 $\times$ 1,5 mm	30
M22 $\times$ 1,5 mm	34

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

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

Vehicle pipe installation

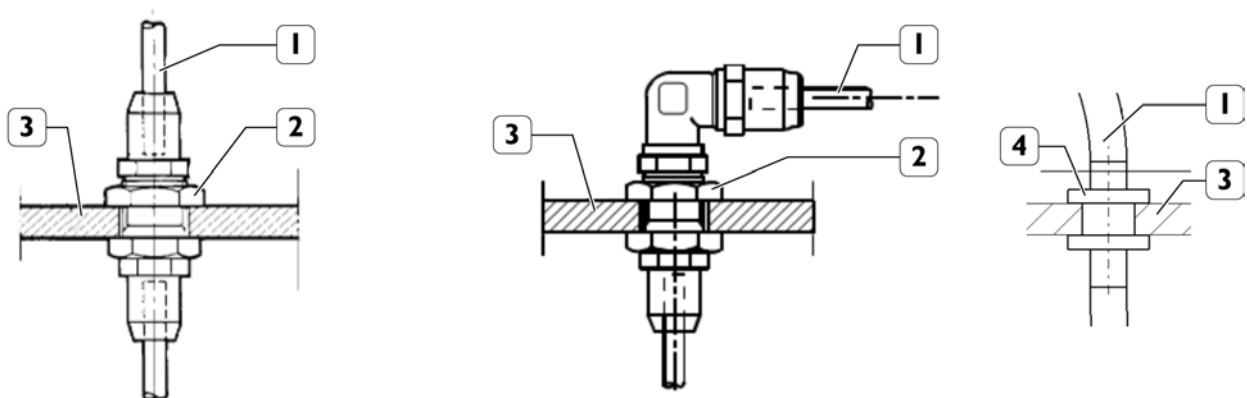
Before use, the new pipes must be thoroughly cleaned inside, for example by blowing air with a compressor.

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

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

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

In passing the pipes through the chassis (side members or crossbars), take precautions to avoid damage. One solution would be to use a coupling passing directly through or at an angle, or a rubber protective eyelet, as shown in Figure 24.



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Figure 24

1. Pipe
2. Through-coupling

3. Chassis
4. Rubber protection



► **After each intervention is on the system or equipment, brake efficiency should be checked.**



► **Bring the pressure to its maximum level on the air system. Check for leaks in the areas affected by the intervention.**

To ensure that the connections have been properly made, the air tank corresponding to an axle can be emptied; the pressure control on the in-vehicle indicator and the verification, by operating the brake pedal, on the remaining braking section(s), allow such verification.

Hydraulic circuits must have the normal air bleed operation.

ABS electronic brake control devices

In case of changes to the wheelbase, the original position for ABS modulators must be maintained relative to the axis rear wheels.

The wiring between the sensors on the rear axle and the control unit, as well as between the control unit and the modulators, must be adjusted using new cables or extension cables with appropriate connectors.

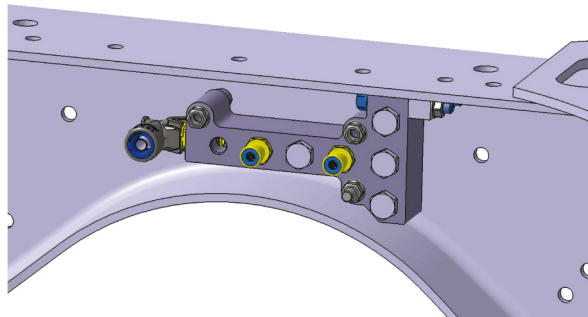
The brake piping upstream of the modulators must also be adequate.

Withdrawing compressed air from the auxiliary pneumatic circuit

In vehicles with a pneumatic braking system, it is possible to withdraw a small amount of air from the auxiliary pneumatic circuit.

To protect the auxiliary users (vehicle side), the connection is only possible with an additional overpressure valve (IVECO 8169974 EZ) without reflux and with an opening pressure of 6.7 - 7.0 bar.

Withdraw the air directly from the 4-way safety valve (outlet 24) of the braking system or from the distribution plate, if it is not otherwise occupied (see Figure 25).



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Figure 25

If you require larger quantities of air you have to assemble an additional tank.

In this case, however, it is necessary to ensure that the standard compressor is able to fill the tank within the specified time, otherwise you will need to install a higher capacity compressor.

Maximum allowed air consumption

The maximum allowed air consumption must be verified in extreme driving conditions, for example in stop-and-go traffic and / or with auxiliary pneumatic devices engaged. All devices which use air must be taken into account such as the braking system, air suspensions, trailer, gearbox, auxiliary devices, etc.

The maximum average operation of the compressor in one hour (duty-cycle) must not exceed 40%.

2.16 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

For information on work on the electrical system and the current draws, refer to indications provided in Section 5 - Chapter 5.6 (➡ Page 35) and 5.8 (➡ Page 46).

2.17 PART RELOCATION AND ANCHORAGE OF ADDITIONAL UNITS AND EQUIPMENT

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

- the functionality of the unit is not compromised;
- the original type of connection is restored;
- the new placement and distribution of mass is compatible with that originally established (see. Chapter 1.15 (➡ Page 11)).

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

Depending on the use of the vehicle, applications should always provide a sufficient margin in their height from the ground.

The holes to be drilled for the new arrangements should be made on the rib of the side member, according to the regulations given in Chapter 2.2 (➡ Page 7) and taking care to use the existing holes as much as possible.

Spare wheel holder

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

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

Additional fuel tank (only diesel vehicles)

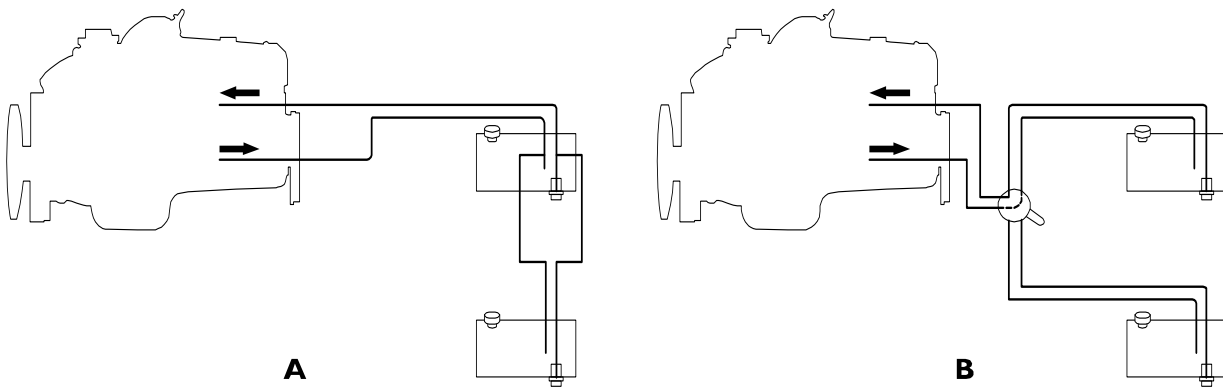
If filling the fuel tank is hindered by a superstructure, the tank support brackets can be placed lower down, with a displacement of a drilling module (45 mm).

When necessary to change the autonomy compared to the standard configuration, it is possible to:

- replace (both for capacity increase and decrease) the tank with another tank envisaged for the series;
- add an additional tank, chosen if possible from the standard ones and compatible with available space.

If the addition is made on the same side of the chassis, the two tanks can be connected with a flexible hose (at least in part) and fuel can always be drawn from the original tank (Fig. 26A).

When instead the additional tank is positioned on the opposite side of the chassis compared to the original, it is advisable to implement a scheme like the one in Figure 26 B, where the implementation of a diverter allows to alternatively use the two tanks.



196784

Figure 26

The chosen solution must be implemented in compliance with specific regulations.

The piping additions must ensure perfect sealing, have technical features and internal dimensions not less than those provided for in the original system and be properly clamped.

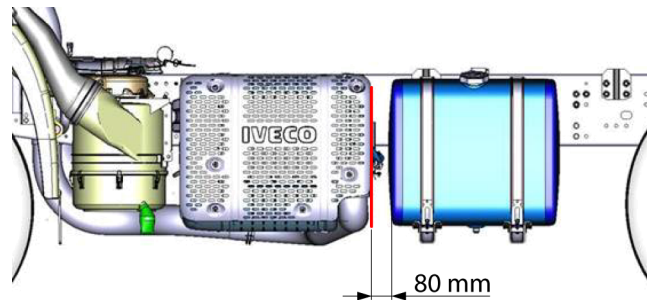
Note We highlight the need to:

- implement or realise a new measurement system that always provides correct information on the actual quantity of fuel in the tanks;
- use a specific indicator instrument and separate from the original.

Moving the fuel tank (only diesel vehicles)

1. Vertical movements are permitted as long as the absolute minimum pressure at the inlet of the LP/HP pump is 500 mbar.
2. With the exception of vehicles already fitted with the specific opt. 76755 "Retraction of mobile case assemblies", horizontal repositioning is possible when, compared to the original position, it involves a maximum extension of 500 mm of each return and delivery pipe.

For greater extensions, up to a maximum of 1000 mm, the standard fuel prefilter is to be replaced with a different type able to create a lower drop in pressure on the line.

Moving to the opposite side member (only diesel vehicles)

245556

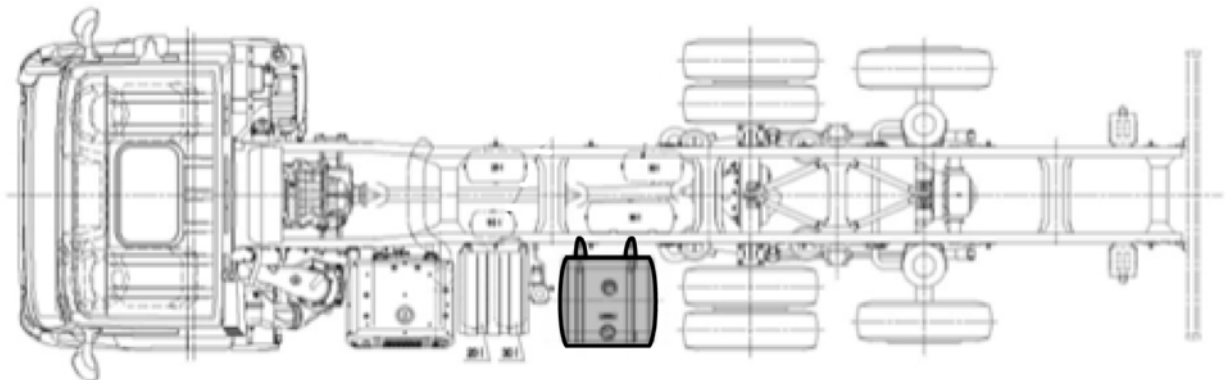
Figure 27

The fuel tank can be moved to the left side member providing a minimum distance of 200 mm from the DPF/muffler housing is maintained. This distance can only be reduced to 80 mm if appropriate heat shields (highlighted in red in figure 27) are used, which are of the same type as those used to protect the front section of the DPF/muffler.

Chassis with free right side (only diesel vehicles)

If the right side of the chassis, between the front mud guard and the rear wheels, must be free of all suspended assemblies, you may:

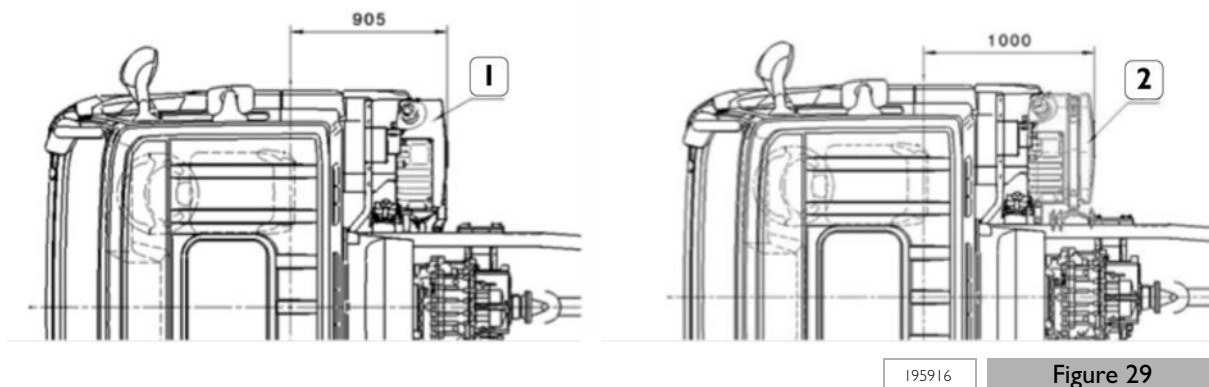
- Adopt optional fuel tanks for the left side;
- Reposition the urea tank on the basis of the possibilities stated in Chapter 6.4 (➡ Page 6), page. 7 and following.



195915

Figure 28

On Stralis Hi-Street / Hi-Road trucks with the fuel tank on the left (right side of the chassis free), the minimum space that cannot be used is 905 or 1000 mm (measured from the centre line of the front axle), respectively with a urea tank of 50 or 80 litres (see Figure 29).



1. 50 litre urea tank

2. 80 litre urea tank

Figure 29

2.18 TRANSPORT OF HAZARDOUS MATERIALS (ADR)

Each vehicle complies fully with the technical specifications of **Regulation 105 - Series 06 - attachment "B"** of the Agreement **ADR 2017 - Part 9 (Requirements relating to the construction and approval of vehicles)** with regards to the paragraphs:

- 9.2.2.2.1 (Cables)
- 9.2.2.2.2 (Additional protection)
- 9.2.2.4 (batteries)
- 9.2.2.5 (Lighting)
- 9.2.2.6 (Electrical connection)
- 9.2.4.3 (Fuel tanks)
- 9.2.4.4 (Engine)
- 9.2.4.5 (Exhaust gas device)
- 9.2.5 (Speed limiting device)
- 9.2.6 (Devices for hooking vehicles with engines and trailers)

Note Compliance with these requirements by the additional structures and their connections to "incomplete" vehicles, is the full responsibility of the bodybuilder.

2.19 INSTALLING A RETARDER

The application of a retarder brake in after-sales requires authorization from IVECO.

The possibility of adopting a different brake type from the original (for example, with electro-magnetic actuation) requires compatibility with the characteristics of the vehicle and what has already been approved by IVECO.

Please note that any unauthorised work on the original retarder will invalidate the vehicle warranty.

2.20 REAR UNDER-RUN PROTECTION (RUP)

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

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

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

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

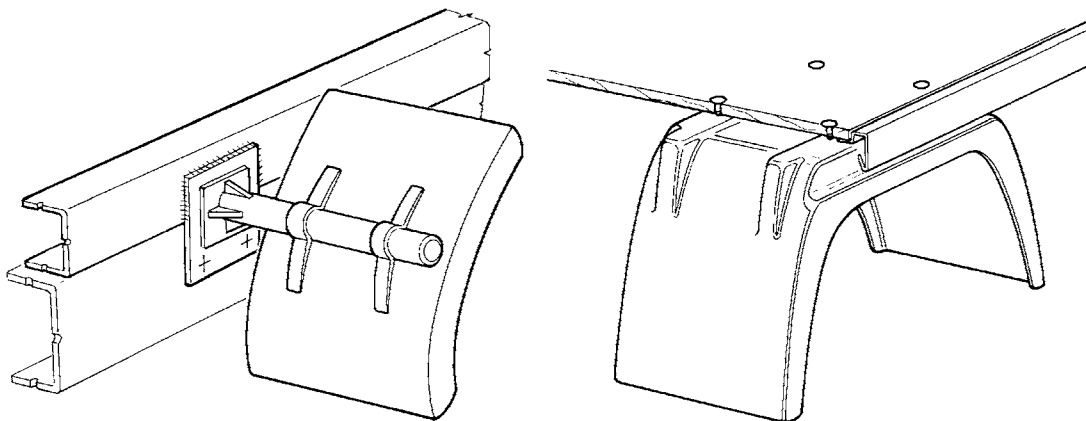
2.21 REAR MUD GUARDS AND WHEEL ARCHES

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

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

- the free shaking of the wheels must be ensured even in the conditions of use with chains; any indications on limit values can be requested via the Support Service;
- the width of the fender must be greater than the maximum dimensions occupied by the tyres, within the limits set by the regulations;
- the support structure of the fender must have adequate strength and be able to limit the vibrations;
- the connection can be made to the vertical rip of the side members of the vehicle or to the longitudinal sections of the sub-frame. In the first case the connection must be made exclusively by screws or directly below the superstructure (see Figure 30).

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

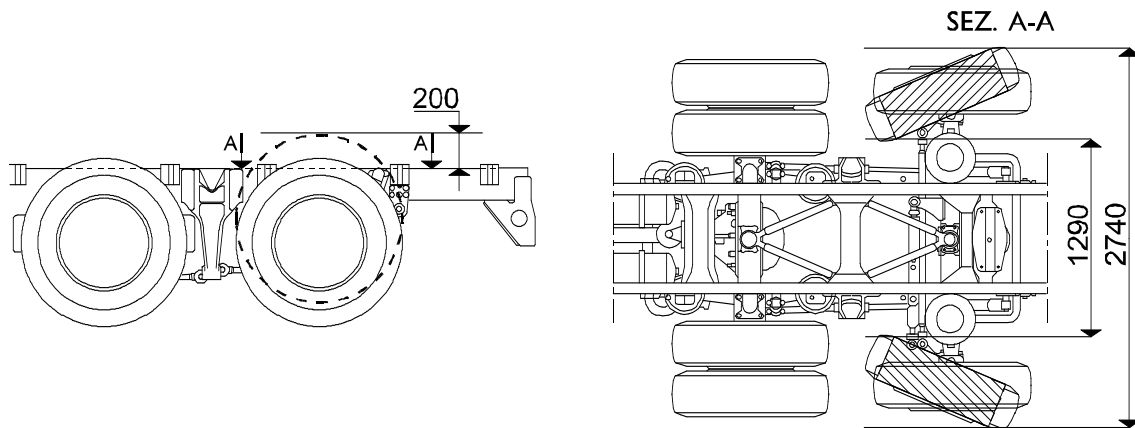


91472

Figure 30

Models 6x2 / PS and / FS have the steering of the third axle also in the raised position; it is therefore necessary to respect the space required for this function, following the indications of Figure 31.

In this figure, the dimensions refer to tyres 315/80 R 22.5; with the measurement 385/65 R 22.5 the dimensions in section A-A must be increased by 50 mm.



116725

Figure 31

2.22 RAIN FLAP

Once outfitting is complete, the mudflaps must be included in the vehicle equipment if and as indicated by the regulations in force.

2.23 SIDE PROTECTIONS

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

In permanently applied superstructures (e.g. fixed bodies, vans) side protection can be applied on the basis of their structure (e.g. backbone of the floor beams), while for mobile superstructures (e.g. tippers, interchangeable equipment, hook lifts) the connection can be made by means of suitable supports on the counter chassis or directly on the chassis. In the latter case, use the existing holes on the vertical rib of the side member as much as possible, in compliance with Chapter 2.2 (► Page 7).

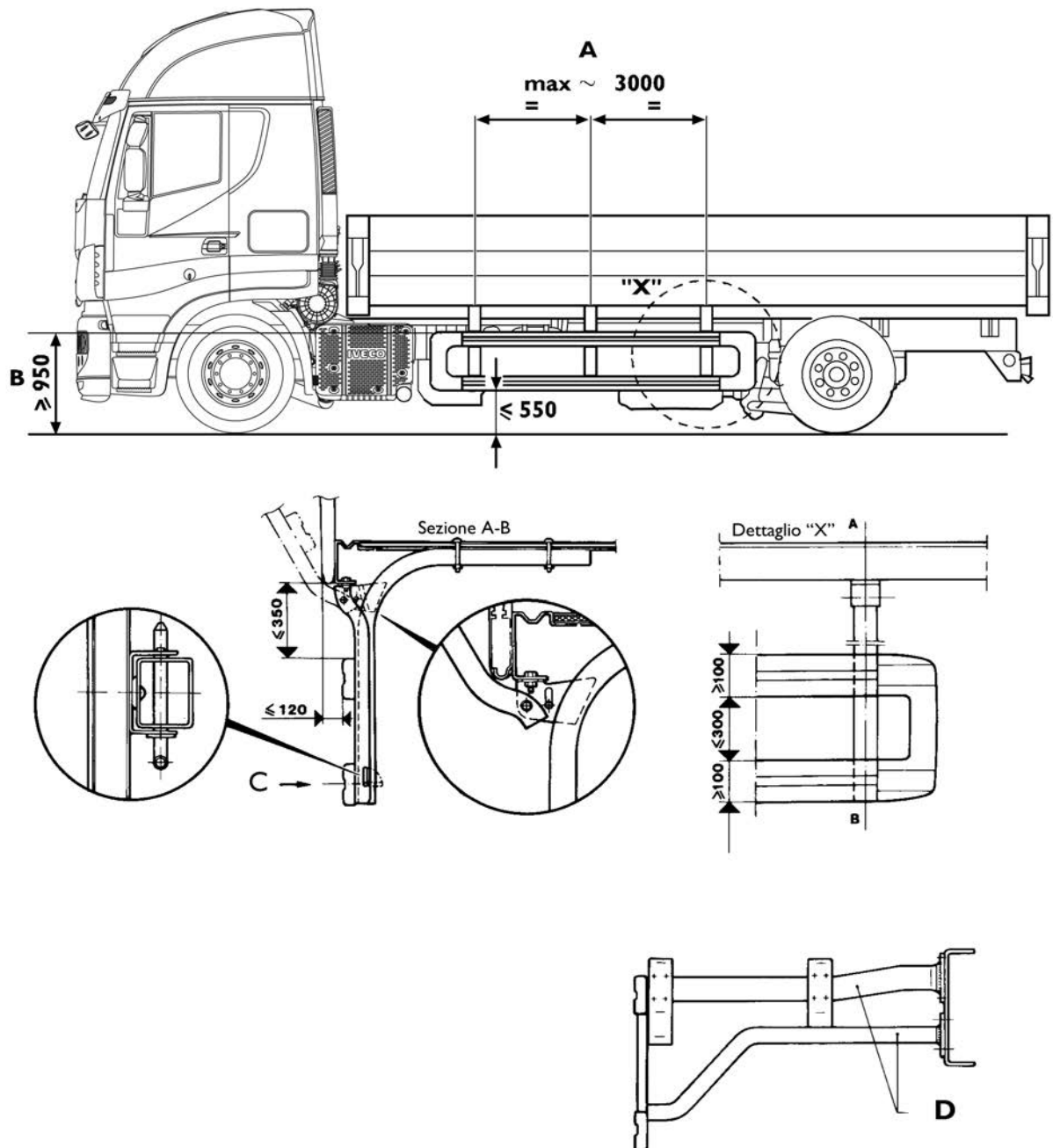
In implementing the outer protection, as required by the regulations (e.g. EC Directive), it is permitted to use either a single section with a surface extending in the vertical longitudinal sections, with pre-set dimensions and distances between them.

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

Special attention should be paid to ensure the distances established by the Regulations in relation to the various parts of the vehicle.

Figure 32 shows:

- a side protection solution in case of a fixed body, made in compliance with the relevant EC Directives,
- an example of a support for fixing the combined lateral protection and the mudguard for the rear wheels, suitable for mobile superstructures.



192349

Figure 32

- A For the IVECO profile
- B With the lower part of the superstructure over 1300 mm from the ground, or with the width of the superstructure below the external tyre dimension.
- C Test load 1 kN - Sagging allowed under the test load: ≤ 30 mm on the rear part, including the last 250 mm of the device; ≤ 150 mm on the remaining parts of the device
- D Support for fixing the combined lateral protection and the mudguard for the rear wheels

SECTION 3

**APPLICATIONS OF
SUPERSTRUCTURES**

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APPLICATIONS OF SUPERSTRUCTURES

3.1 CONSTRUCTION OF THE SUBFRAME

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

Material

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

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

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

Table 3.1 - Material to be used for the construction of superstructures Std IVECO I5-2110 and I5-2812

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

Sizing of profiles

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

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

Table 3.2 - Profile dimensions

Section modulus W_x [cm ³]	Recommended C profile [mm]		
$16 \leq W \leq 19$	80 X 50 X 4	80 X 60 X 4	80 X 50 X 5
$20 \leq W \leq 23$		80 X 60 X 5	
$24 \leq W \leq 26$		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

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

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

Aluminium subframe

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

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

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

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

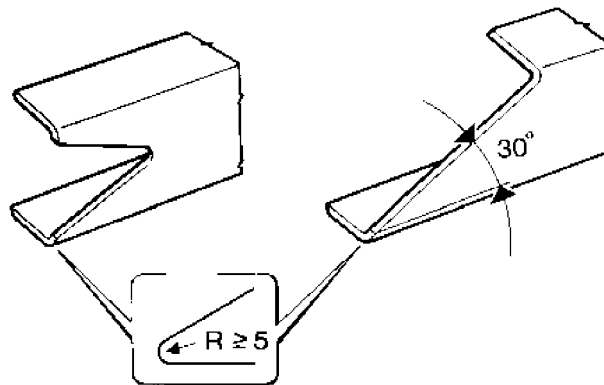
The collaboration requirement for aluminium means, in short, large and not very convenient dimensions.

3.2 ELEMENTS MAKING UP THE SUBFRAME

Longitudinal profiles

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

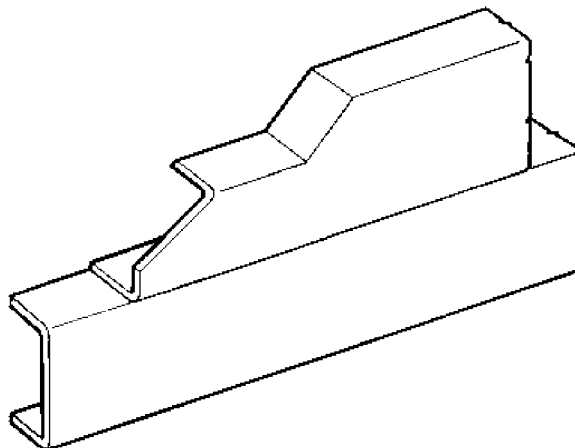
In order to achieve a gradual reduction of the resistant section, the front ends of the profile must be tapered in height with an angle not exceeding 30° , or another form of equivalent tapering (see Figure 1); the front end in contact with the chassis must be properly coupled, with min. radius of 5 mm.



91136

Figure 1

In cases in which the components of the cab rear suspension do not allow the passage of the profile in the entire section, this can be realised as in Figure 2. If, due to construction, there are high bending moments on the front of the chassis (e.g. in the case of a crane with the working range on the front of the vehicle), the profile of the subframe must be dimensioned to cope with such forces.



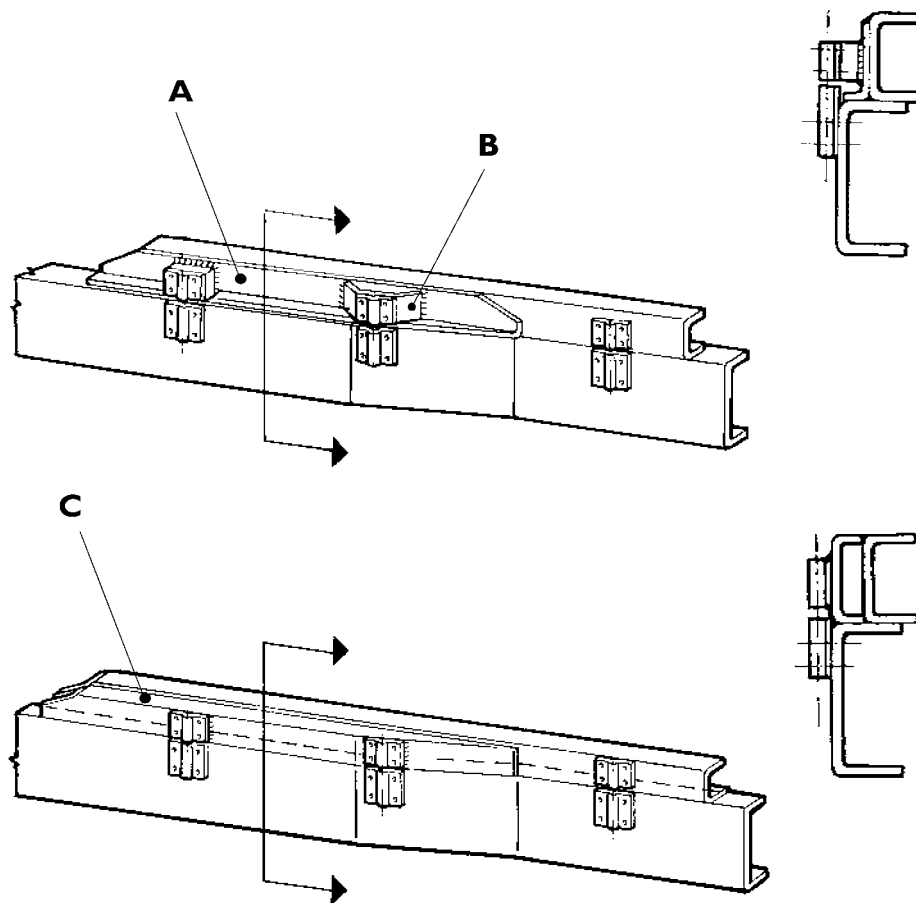
91137

Figure 2

The possibility of building a counter chassis with a different width from that of the vehicle chassis is permitted only in special cases (e.g. interchangeable equipment with sliding systems on rollers, where the mechanical or hydraulic devices are unified). In these

cases, precautions must be taken to achieve a correct transmission of forces between the structure of the counter chassis and the vertical rib of the chassis. This can be achieved by inserting an intermediate profile suitably adapted to the side member, or by applying an adequately stiffened connecting bracket.

The chassis side members are not parallel to each other and therefore the longitudinal sections of the subframe must follow the trend. If the front part of the subframe is narrower than the chassis, suitably adapted C-shaped profiles or L-shaped angular profiles with appropriate ribbing can be introduced on the outside of the chassis (see Figure 3).



91138

Figure 3

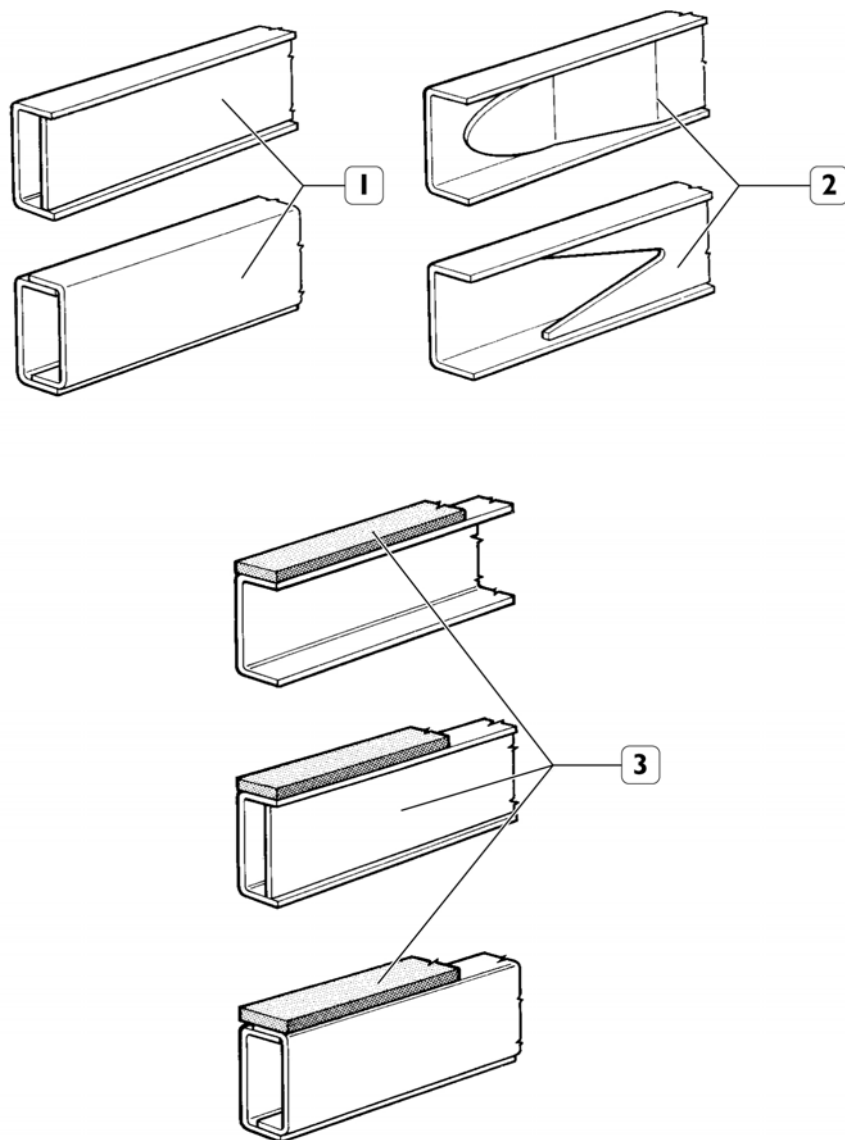
A. L profile

B. Alternative solution:

C. C Profile

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

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



193867

Figure 4

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

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

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

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

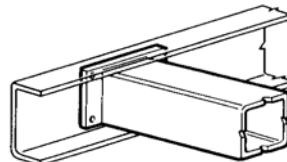
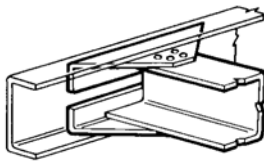
The dimensions prescribed for the side members of the various types of superstructures are the recommended minimum values and, as a rule, are valid for vehicles with wheelbases and rear overhangs provided as standard (see Tables 3.4, 3.5 and 3.7 to 3.11). In all cases similar profiles can be used, but with moments of inertia and resistance that are not lower. These values can be obtained from the technical documentation of the profile manufacturers.

Cross members

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

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

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



193868

Figure 5

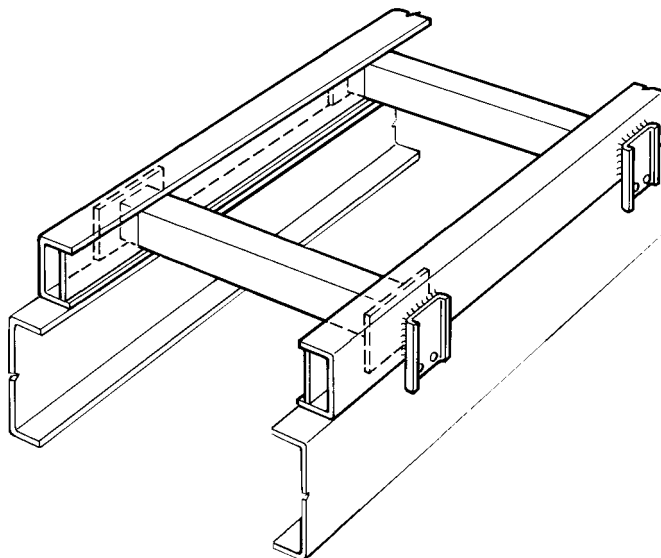
Stiffening of the subframe

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

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

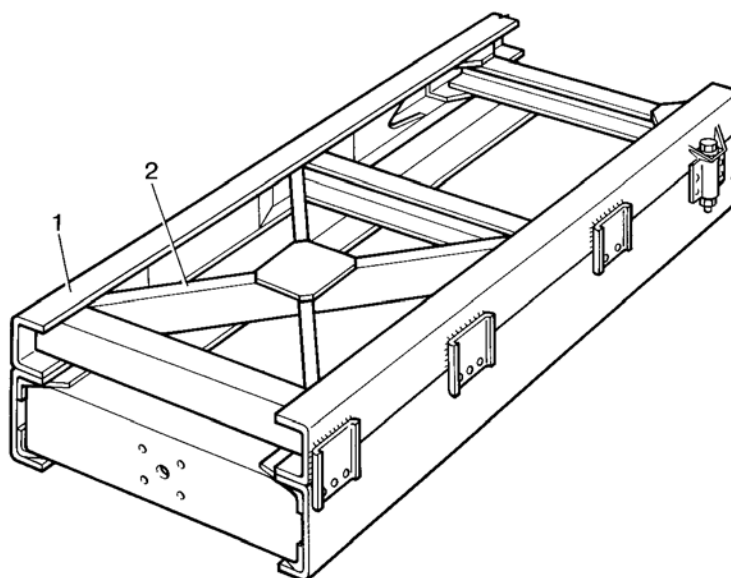
- boxing the longitudinal sections in the rear area;
- adopting closed section crossbars (see Figure 6);
- applying cross diagonals (see Figure 7);
- applying a torsion-resistant longitudinal element (see Figure 8).

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



166684

Figure 6

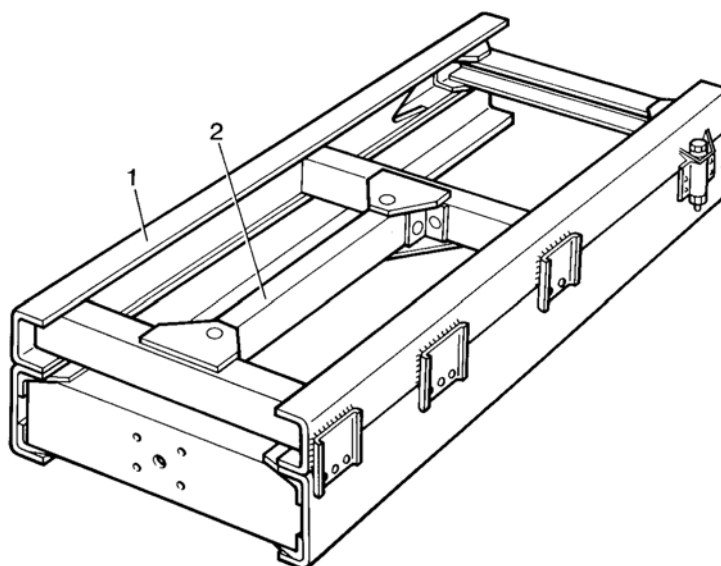


193869

Figure 7

1. Subframe

2. Diagonals



193870

Figure 8

1. Subframe

2. Box profile

Self-supporting superstructures with subframe functions

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

3.3 CONNECTION BETWEEN CHASSIS AND SUBFRAME**Choosing the type of connection**

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

It can be elastic (brackets or clamps) or rigid, resistant to shear stress (plates sealed longitudinally and transversally); the choice must be made according to the type of superstructure to be applied (see Chapters 3.4 to 3.9), evaluating the stresses that the added equipment transmits to the chassis, both in static and dynamic conditions. Number, size and construction of the anchors, reasonably allocated in the length of the counter chassis, must be such as to ensure a good connection between the chassis and the counter chassis.

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

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

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

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



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

Alternatively, use the connection in Figure 13, using the screws that connect the rear crossbar to the chassis.



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

Connection characteristics

Elastic connections (see Figures 10, 11 and 12) allow limited movement between the chassis and the subframe; These connections make it possible to consider parallel cooperation of the two resistant sections, where each assumes a share of the bending moment proportional to its moment of inertia.

In the rigid connections (see Figure 13), a single resistant section can be considered for the two profiles, on the condition that the number and distribution of the connections are such as to withstand the consequent cutting forces.

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

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

Subframe dimension

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

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

204635

Figure 9

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

M_c = part of the static bending moment M_f applied to the subframe [Nmm]

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

I_c = moment of inertia of the section of the subframe [mm⁴]

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

σ_c = maximum static stress applied to the subframe [N/mm²]

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

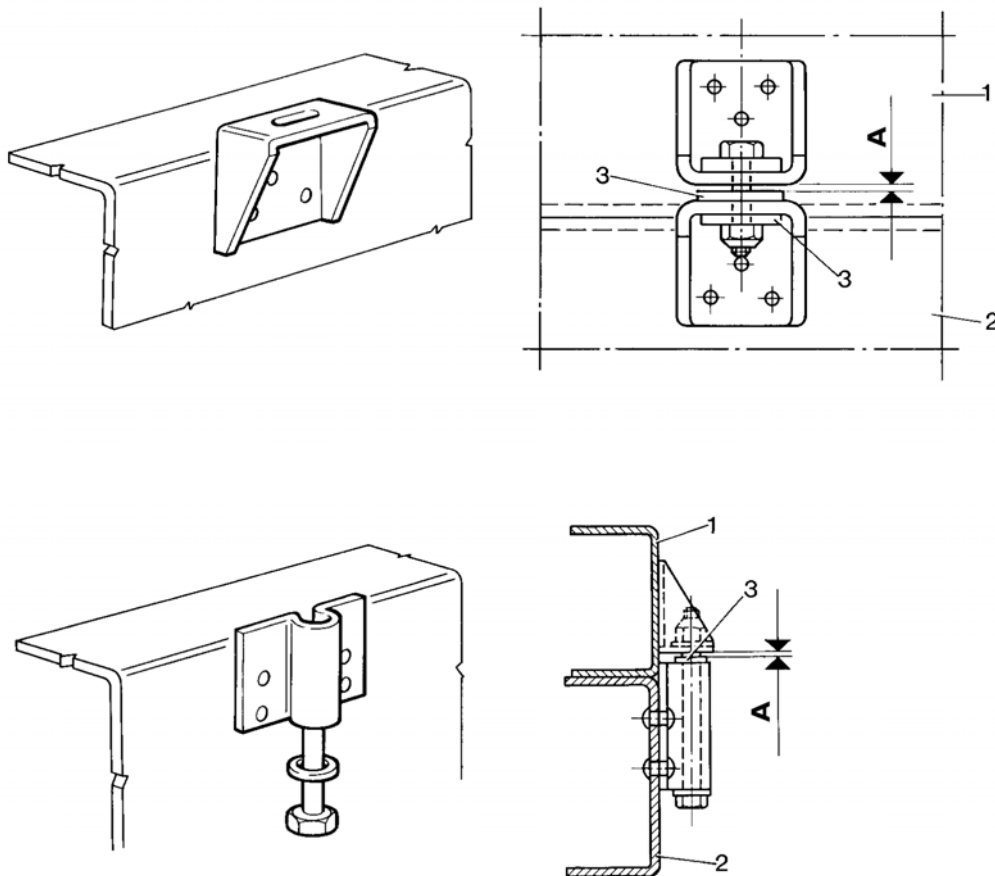
W_c = section modulus of the section of the subframe [mm³]

W_t = section modulus of the section of the chassis [mm³]

σ_{amm} = maximum static stress allowed on chassis [N/mm²] see chapter 2.1, Paragraph "Stresses on the chassis" (➡ Page 7)

Connection with brackets

Some examples of achievements of this type of connection, are shown in Figure 10.



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Figure 10

- 1. Subframe
- 2. Chassis
- 3. Shims

A. Leave $1 \div 2$ mm before the closure

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

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

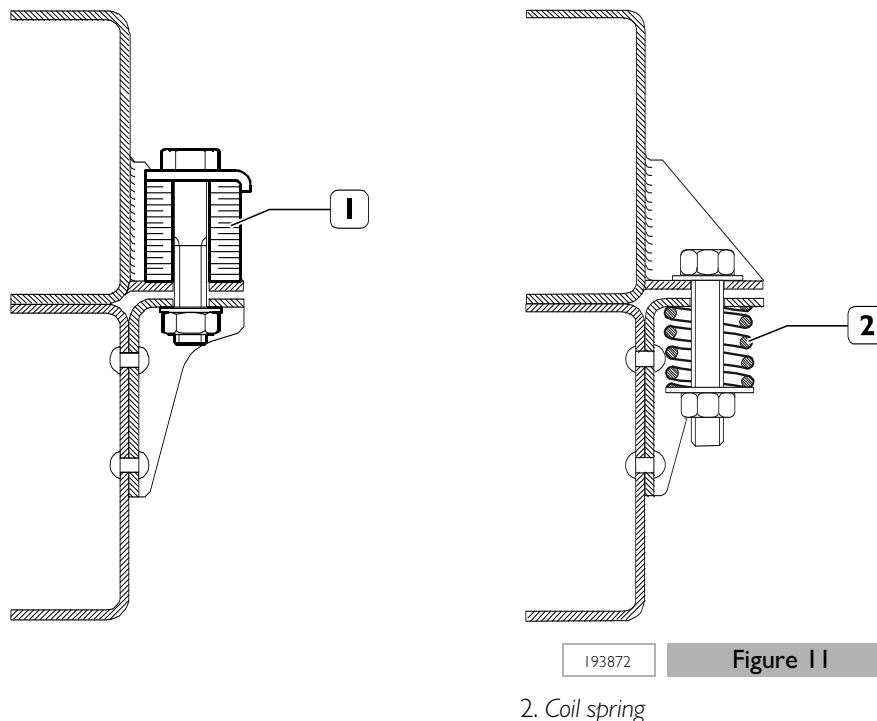
The brackets must be fixed to the rib of the side members of the vehicle by means of screws or nails.

In order to better contain the loads in the transverse direction, the brackets are normally applied so that there is a slight protrusion perpendicular to the upper edge of the chassis. If instead the brackets must be applied exactly to the wire, the side guide for the superstructure must be assured with other devices (e.g. using guide plates connected only to the subframe, or only to the vehicle chassis, see. Figure 13). When the front connection is elastic (see Figure 11), the lateral containment must be assured even in conditions of maximum torsion of the chassis (e.g. off-road applications).

In the event in which the vehicle chassis is already equipped with brackets for the attachment of a body of a type established by IVECO, these brackets must be used for this purpose. For the brackets applied to the subframe or to the superstructure, resistance characteristics not less than those originally mounted on the vehicle should be provided (see Table 2.1 and Table 3.1).

Connections with greater elasticity

When the connection needs greater flexibility (e.g. vehicles with high stiffness of the superstructure such as vans, tanks, etc., used on winding roads or in poor conditions, vehicles for special use, etc.), hardware of the type indicated in Figure 11 should be adopted in the area behind the driver's cab. Brackets accompanied by rubber plugs (1) or coil springs (2) should be used.



In the case of superstructures that generate high bending and twisting moments (e.g. a crane behind the cab), the subframe must be properly sized to support them.

The elastic element characteristics should be suited to the stiffness of the superstructure, the wheelbase and the type vehicle use (irregular road conditions).

Using rubber plugs, use materials that ensure good elasticity over time; provide adequate instructions for the periodic control and eventual restoration of the torque.

If necessary, the total capacity of the connection can be restored by installing cut-resistant hardware in the rear suspension area.

In versions where the vehicle is lifted by hydraulic stabilisers (e.g. cranes, aerial work platforms), limit the collapse of the elastic element (30 – 40 mm) to ensure sufficient cooperation of the subframe and avoid excessive bending moments on the original chassis.

Connections with clevis fasteners or clamps

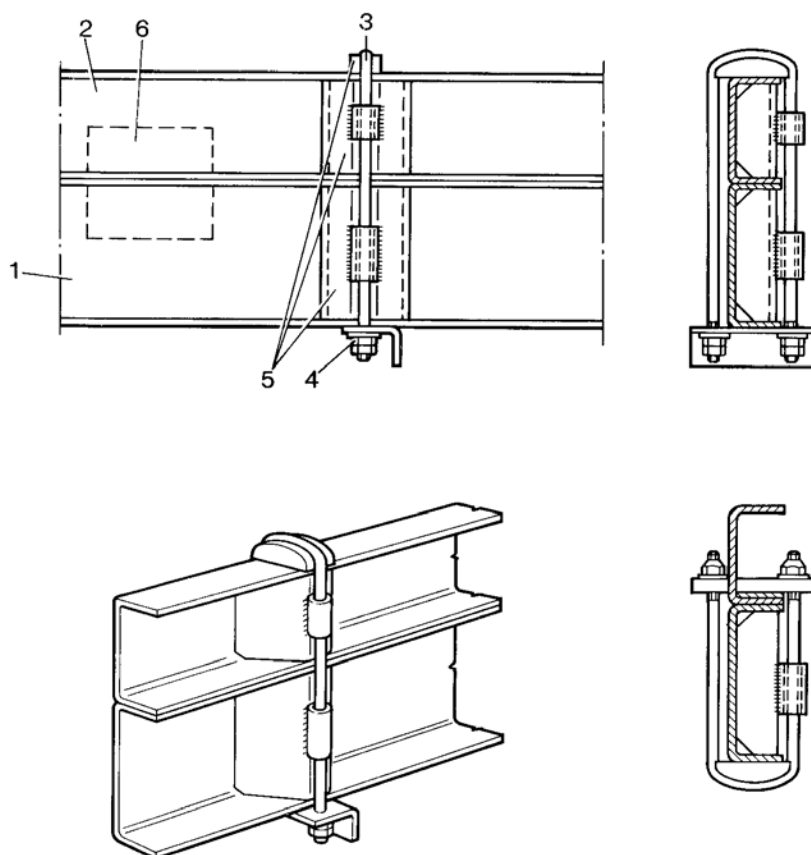
Figure 12 shows the main constructions of this type.

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

In order to drive and better contain the transverse direction of the structure added to the chassis, this type of fixing can be completed with the addition of plates welded to the subframe as shown in Figure 13.

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

For this purpose, it is also possible to use connections by means of screws at the rear end of the chassis as shown in Figure 14.



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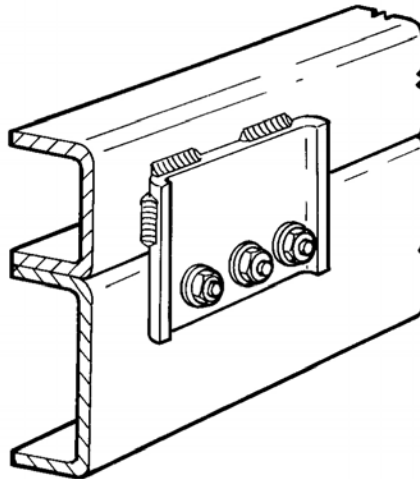
Figure 12

- 1. Chassis
- 2. Subframe
- 3. Clevis fasteners

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

Connection with longitudinal and transverse sealing plates (rigid junction)

The type of mounting shown in Figure 13, made with plates that are welded or bolted to the subframe and fixed with nails or screws to the vehicle chassis, ensures a good capacity for reacting to longitudinal and transverse thrusts and the greatest contribution to the stiffness of the assembly.



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Figure 13

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

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

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

Table 3.3

Chassis and subframe height/section ratio	Max. distance between the centre lines of the cut-resistant plates [mm] ⁽¹⁾	Minimum characteristics of the plates	
		Thickness [mm]	Dimensions of the screws ⁽²⁾ (min. 3 screws per plate)
≥ 1.0	500	8	M14

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

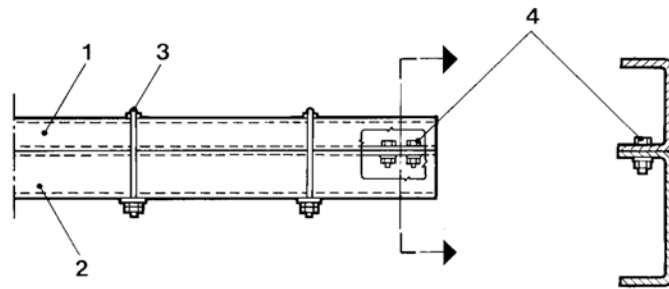
⁽²⁾ In the presence of contained thicknesses of the plates of the chassis and the subframe, it is advisable to connect by adopting spacer bushes, in order to use longer screws.

Mixed connection

Based on the indications in Chapter 3.1 (► Page 5) for realisation of the counter chassis and the considerations of Chapter 3.3 (► Page 12), the connection between the vehicle chassis and the reinforcing counter chassis may be of mixed type, i.e. obtained by rationally using the elastic connections (brackets, clevis fasteners) and rigid connections (longitudinal and transverse sealing plates).

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

For this purpose, it is also possible to use connections by means of screws at the rear end of the chassis as shown in Figure 14.



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Figure 14

1. Subframe
2. Chassis

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

3.4 CONTAINER APPLICATION

Dimensions and centres of gravity

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

Fixed bodies

The application on normal cab vehicles, valid only for road services, is normally made through a support structure consisting of longitudinal profiles and cross members. The minimum approximate dimensions of the longitudinal profiles are provided in the following table.

Table 3.4

Models	Maximum load front axle [kg]	Maximum load Rear axle [kg]	Maximum wheelbase (with reference to drive shaft in 3 axle vehicles with rear third axle) [mm]	Module for resistance W_x of the profile minimum reinforcement [cm ³]	Notes
190 (4x2)	7500	12000	4800	89	(2) e.g. 160 x 60 x 6 mm
190 (4x2)	8000	12000	5700	89	(1) (3)
190 (4x2)	8000	12000	6700	89	(1) With wheelbase 6700 mm, use longitudinal members with a thickness of 6.7 mm
190 (4x2)	9000	12000	4800	89	(1) (3)
190 (4x2)	9000	12000	6700	122	(1) (3) (4) e.g. 180 x 70 x 7 mm
260 (6x2)	7500	19000	6050	89	(1) (5) (6)
260 (6x2)	8000	19000	6050	89	(1) (6)
260 (6x2)	9000	19000	4800	89	(1) (6)
260 (6x2)	9000	19000	5500	122	(1) (6) e.g. 180 x 70 x 7 mm

Models	Maximum load front axle [kg]	Maximum load Rear axle [kg]	Maximum wheelbase (with reference to drive shaft in 3 axle vehicles with rear third axle) [mm]	Module for resistance W_x of the profile minimum reinforcement [cm ³]	Notes
260 (6x2)	9000	19000	6050	89	(1) (6) With wheelbase 5700/6700 mm, use longitudinal members with a thickness of 7.7 mm
260 (6x4)	9000	21000	4500	46	e.g. 120 x 60 x 6 mm
320 (8x2x6)	2 x 8000	20000	5100	46	
320 (8x2x6)	2 x 8000	20000	6050	89	

(1) With shear resistant plates, starting at approximately 1 000 mm before the engine axle centre line and up to the rear end of the chassis.

(2) 46 cm³ for vehicles with wheelbase up to 4800 mm and total rear protrusion (complete with the added structure) up to 2300 mm.

(3) Without shear resistant plates for vehicles with wheelbase up to 5700 mm and total rear protrusion (complete with the added structure) up to 2300 mm.

(4) Alternatively 89 cm³, using shear resistant plates for the entire length of the chassis and connections with brackets in the front area.

(5) 46 cm³ for vehicles with wheelbase up to 4800 mm and total rear protrusion (complete with the added structure) up to 1 800 mm.

(6) Without shear resistant plates for vehicles with total rear protrusion (complete with the added structure) up to 1 800 mm.

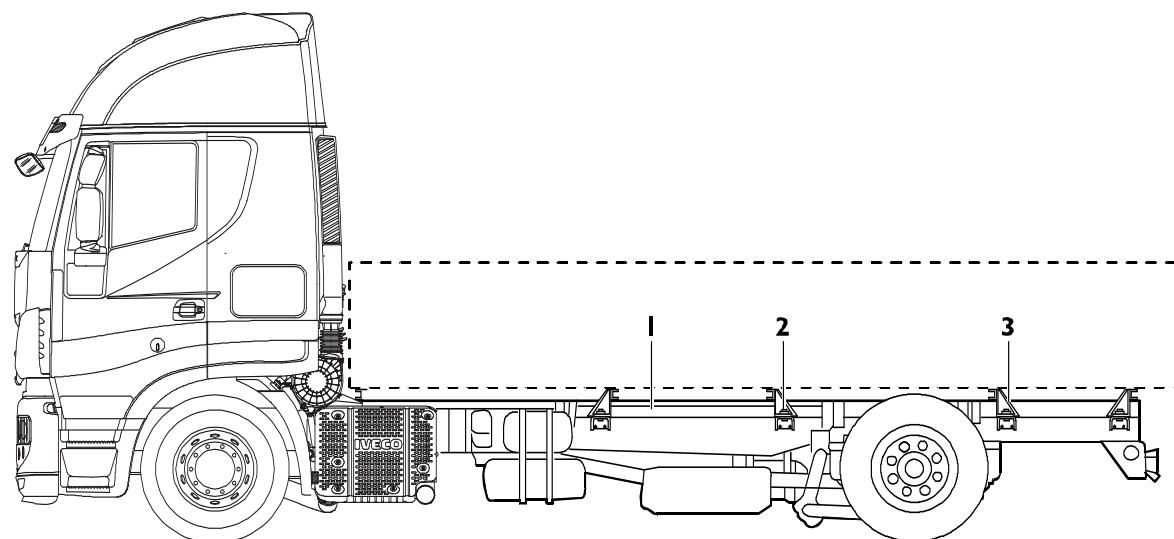
Note For the dimensions of the profiles see Table 3.2.

Fastening is achieved through specially crafted brackets along the vertical rib of the side members; if such connections have not already been specified by IVECO, they must be made according to the instructions in Paragraph "Connection with brackets" (► Page 13). To achieve adequate longitudinal containment, in the case of connections with brackets or clamps it is good practice to provide a rigid connection on the end of the rear overhang (one per side), obtained with screws or plates on the upper flange of the side member (see Figures 13 and 14).

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

In cases in which the body uses elevated supports above the subframe (e.g. crossbars), it is necessary to suitably stiffen such supports, to contain the longitudinal thrusts, as shown in Figure 15.

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



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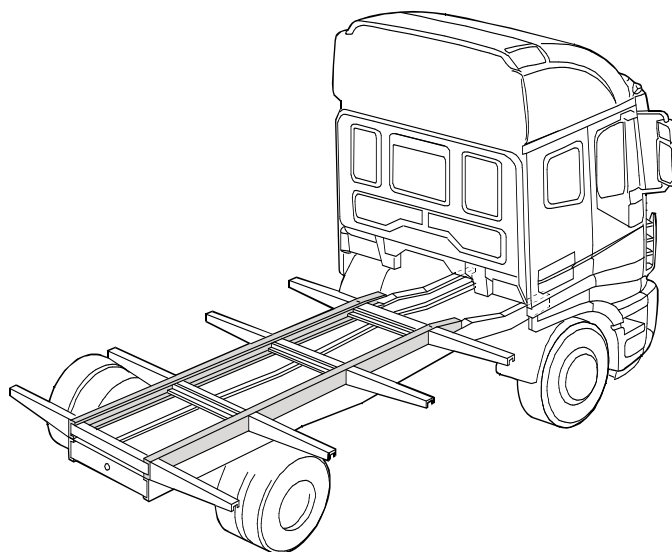
Figure 15

- 1. Counter chassis
- 2. Brackets

- 3. Containment elements

For special equipment where a reinforcing section of moderate height is needed, the structure of the subframe can be integrated by brackets for the anchorage of the bodywork so as to affect the height across the section of the reinforcing longitudinal profile (see Figure 16).

In these cases, the rear wheel arches can be inserted into the equipment crankcase.



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Figure 16

In the case of self-supporting superstructures having the support backbone with the function of the subframe, the application of the previously indicated reinforcing profiles can be omitted.

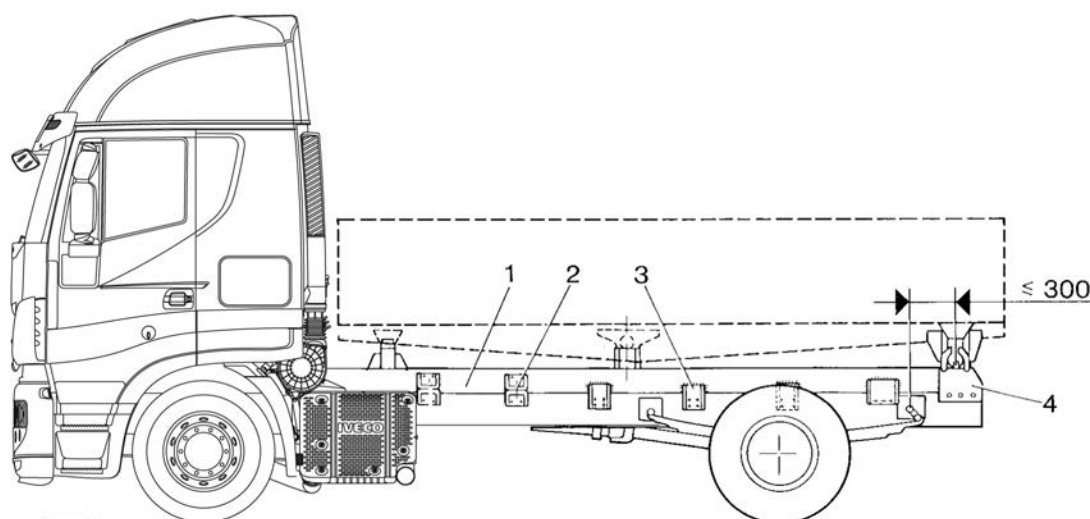
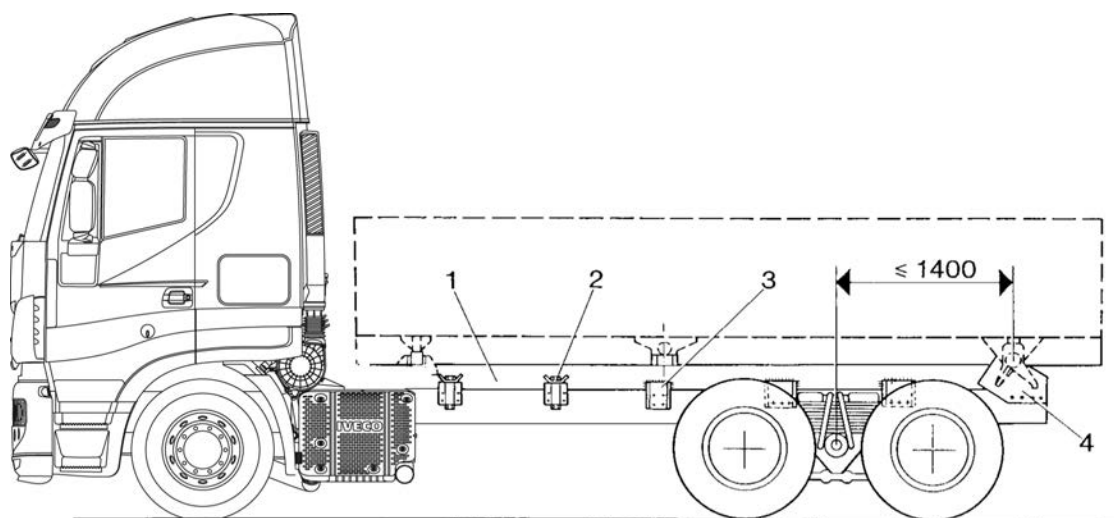
Tipper bodies

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

Therefore, please observe the following indications.

1. The use of a stabiliser bar on all IVECO models for which it is an optional, is recommended.
2. The counter chassis must be:
 - suitable for the type of vehicle and conditions of use,
 - with appropriately sized cross members and side members,
 - with the rear end stiffened with boxing and crossbraces (see Figure 6 and Figure 7). The connections to the chassis must be elastic (brackets or supports) at the front end, whereas the rear section requires stiff connections (cleat plates) (see Figure 13) to allow the additional structure to contribute more effectively towards the rigidity of the assembly. Omega shelves can be used on vehicles on where these are originally fitted.
3. The rear tipping hinge must be fitted on the subframe; its position must be as near as possible to the rear support of the rear suspension. In order not to impair stability of the vehicle during tipping operations and not to increase excessively stress on the chassis, it is recommended that in the case of leaf springs, the distances between the tipping hinge and the rear support or tandem centre line are observed as shown in Figure 17. In the case of pneumatic suspension, it is recommended that the distances between the tipping hinge and rear axle or tandem centre line are observed as shown in Figure 18. 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 stiffness of the rear end. Where long bodies are needed to transport large volumes, it is advisable to lengthen the wheelbase of the vehicle.
4. Great care must be given to the positioning of the lifting device both in terms of providing support of adequate strength and in order to correctly position the mountings. In any case, it is advisable to place the ram to the front of the centre of gravity of the body and payload so as to reduce the extent of the localized load.
5. In rear tipping it is recommended that a stabiliser is fitted to guide the container, particularly when the lifting cylinder is located behind the cab.
6. The lifting device hinge must be mounted on the counter chassis. The useful volume in the body must conform with the maximum permissible load on the axles, to the density of the material to be transported (a density mass of approximately 1600 kg/m³ is to be used for excavated material). In the case of transporting freight with a low density, the useful volume may be increased within the limits established for the maximum height of the centre of gravity of the payload (plus the fixtures).
7. The Bodybuilder must ensure the functioning and safety of all parts of the vehicle (e.g. the positioning of lights, towing hook etc.) and ensure that, following the addition of the structure, vehicle stability is guaranteed during tipping operations.

Note *To ensure stability on vehicles equipped with air suspensions, the air springs need to be fully discharged. See also Specification 01 in Chapter 5.2 (➡ Page 10).*

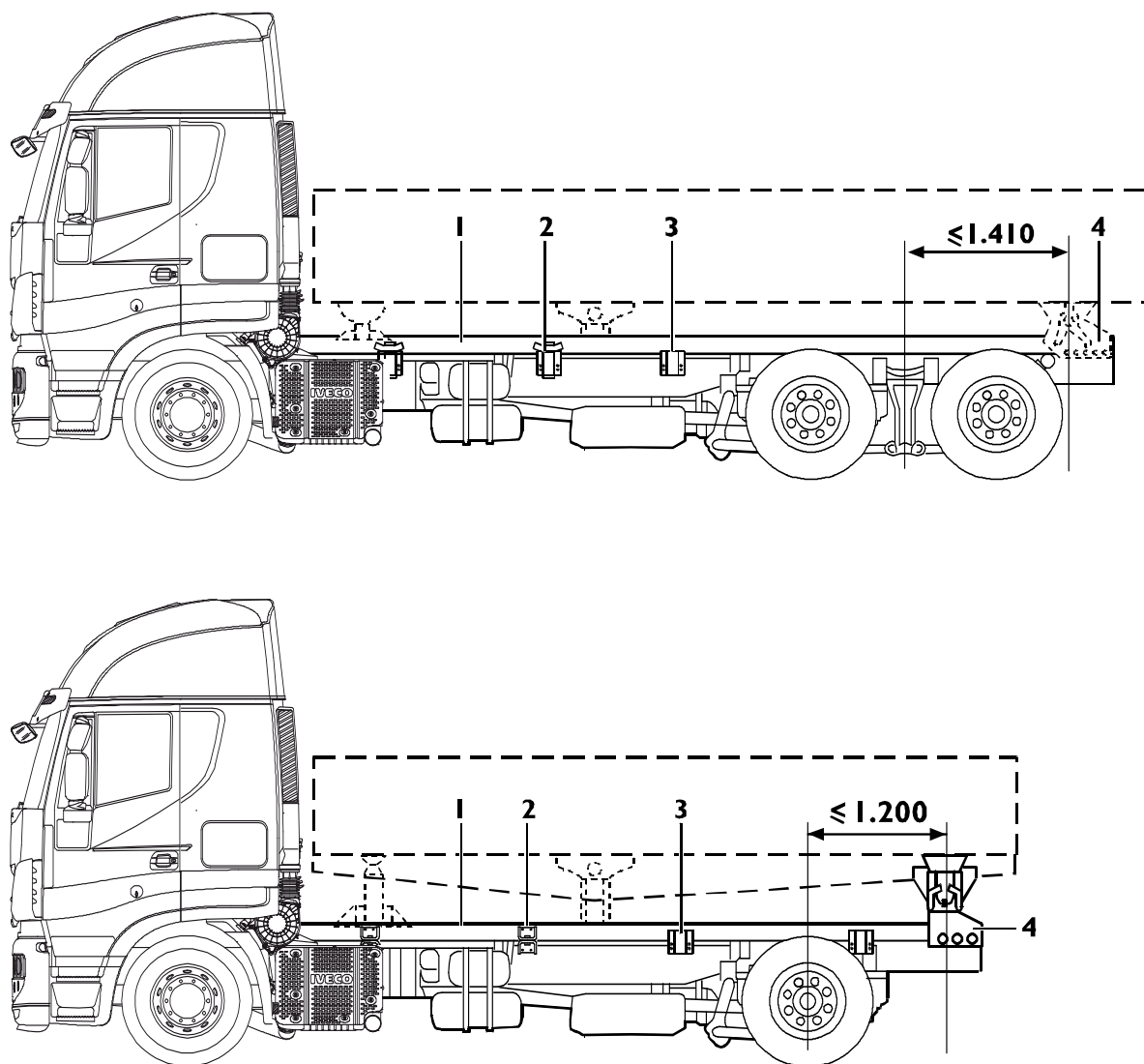


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Figure 17

- 1. Counter chassis
- 2. Brackets

- 3. Plates
- 4. Joint cover



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Figure 18

- 1. Counter chassis
- 2. Brackets

- 3. Plates
- 4. Joint cover

Heavy-duty services

Note Not applied on Stralis.

Light-duty services

For these applications, we recommend using models with short wheelbases. The sections to be used are given in Table 3.5. It is understood that the vehicle must be used for light duty on good roads, to transport freight with a low volume and a low friction coefficient.

In addition to the above general specification; in order to give the vehicles the required rigidity and stability, the following must be observed:

- carefully check the chassis specifications (suspension, frame, number of axles) so as to select a vehicle suitable for the body and its intended use;
- the rear end of the subframe must be stiffened using box-type sections, crossbraces, cleat plates etc.;
- the rear tipping hinge must be placed as near as possible to the rear brackets of the rear suspension;
- in cases of vehicles having wheelbases longer than the standard tipper wheelbase, in addition to the superstructure, specially stiffened rear tipping support anchoring should be used so as to contain sag and ensure good stability during operation; the rear tipping angle should be between 35° and 45° and the user should be informed that tipping should be done on as flat a surface as possible;
- use the most rigid rear suspension and rear stabilizer bar available; when parabolic rear springs are used, the stiffness can be increased using rubber elements which operate at static load;
- for vehicles with pneumatic rear suspension, discharge the air from the springs during tipping operation to allow the vehicle the greatest stability during tipping; It is important that this operation takes place automatically from the tipping control whereas the resetting can also be operated by the tipping control as the body is lowered;
- on vehicles with standard rear third axle or subsequently (6x2), a stabilizer bar may have to be fitted onto the third axle depending on the type of suspension to improve the transverse stability; In addition to the above instructions, hydraulic or mechanical stabilisers may have to be installed for operation depending on the location of the tipping supports in relation to the rear axles, suspension types and intended operation; the third axle must never lift when tipping.

Table 3.5

Model	Modulus of resistance W_x [cm ³] with ultimate tensile strength of the material equal to 360 N/mm ²	
	Open section	Box section ⁽¹⁾
STRALIS I90	46	56
	89 ⁽²⁾	110
STRALIS 260 /TN	89	110
STRALIS 260 /PT, Z/P-HM	89	110
STRALIS 260 /P, /PS, /FP, /FS (without -GV)	89	110

⁽¹⁾ A box-section with shear-resistant connections from 1 000 mm is required in front of the centre line of the drive shaft to the rear end of the frame

⁽²⁾ For payload on front axle of 8000 kg

Note For the dimensions of the profiles see Table 3.2.

Roll off containers

The roll-off body is a container which, by means of a specific tipping device on the vehicle, is moved through a sliding movement on the chassis and is subsequently deposited on the ground.

Since additional stresses are generated during loading and unloading operations compared to those which fixed body vehicles are subjected to, the subframe must have at least the dimensions envisaged for lightweight tipper trucks (see Paragraph "Light service" (► Page 24)).

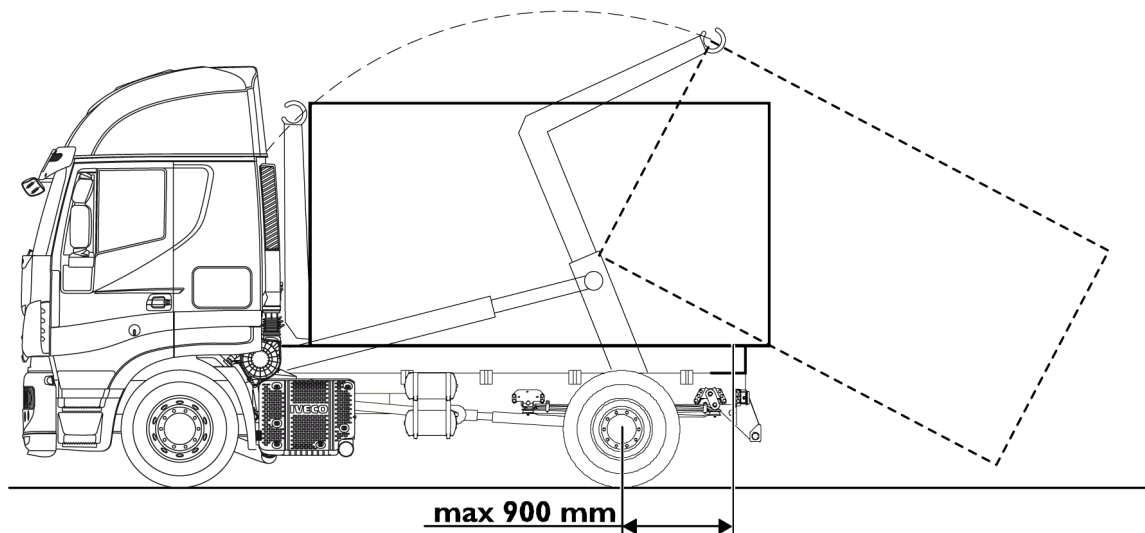
In the case of vehicles with long wheelbases or rear overhangs, it may be necessary to use subframe sections of larger dimensions. The interchangeable superstructure must rest on the vehicle chassis along its entire length or at least be in contact with an extensive area of the suspension coupling areas.

The movement device must be anchored to the subframe according to the indications provided in Chapter 3.8 .

Vehicle stability must be guaranteed in compliance with standard DIN 30722 during loading and unloading operations; it is therefore recommended that stabilizers are used at the rear end of the chassis. The stabilizers are strongly recommended when the rear axles have air or mixed suspension.

Note In order to guarantee the stability of vehicles equipped with air suspension during the offloading phase, it is necessary to fully discharge the air from the air springs and, in any case, follow the instructions in Paragraph "Lightweight services" (► Page 24).

It is important, with this type of vehicle, to adhere to the indications concerning the height of the centre of gravity (see Chapter 1.15 (► Page 11)); when containers for high payloads are used, use the most rigid rear suspension and rear stabilizer bar available if IVECO provides for this.



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Figure 19

The distance between the last rear axle and the sliding pivot must not exceed 900 mm.

3.5 TRACTOR FOR SEMI-TRAILER

Fifth wheel



- **The fifth wheel and the chassis fastening plate are safety devices and must be type-approved; therefore, modifications to their structure is not permitted.**

For installation of the aforementioned units, pay careful attention to the indications supplied by the Manufacturer.

Fifth wheel position

The position of the fifth wheel depends only on the load/maximum permitted mass on each axle for any axle configuration.

Always check that:

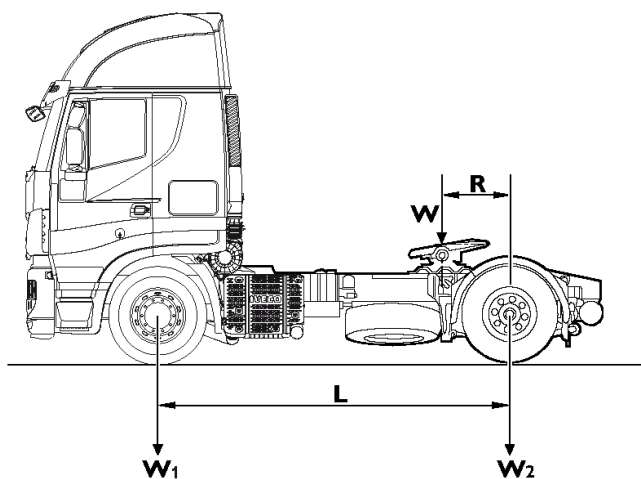
- the maximum permitted loads are not exceeded on each axle or axle assembly for any specific position of the fifth wheel and for the loads applied to it. If the original kerb weight indicated on the Certificate of Conformity changes due to outfitting and/or the changes made, reference must be made to the actual kerb weight of the tractor and with all the equipment (including fuel, tools, driver etc.);
- the maximum permitted length for the combination is not exceeded for each and any position of the fifth wheel and for each type of semi-trailer;
- all the geometric conditions ensure safe coupling of the semi-trailer, in accordance with current Regulations, particularly if the fifth wheel has been repositioned.

The position of the fifth wheel can be measured:

- from the centre of the rear axle for tractors 4x2 (Figure 20) and 6x2C (Figure 21);
- from the centre rear axles for tractors 6x2P (Figure 22);
- from the centre of the tandem axle for tractors 6x4 (Figure 23).

To calculate the furthest forward/furthest retracted position of the fifth wheel and the maximum theoretical mass at full load without exceeding the maximum permitted theoretical mass on the axles, the criteria indicated below can be used.

4x2 Vehicles



$$R_{\max} = L * W_1 / W$$

$$R_{\min} = L - (L * W_2 / W)$$

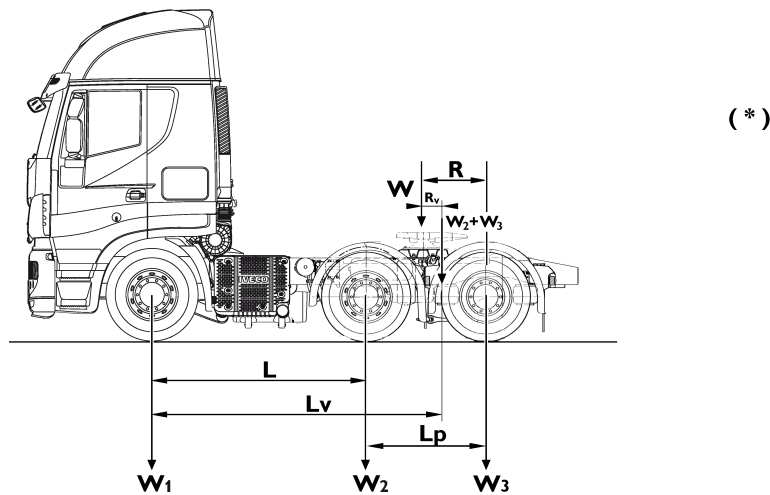
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Figure 20

W = Load on fifth wheel
W1 = Load on front axle
W2 = Load on rear axle

L = Wheelbase
R = Fifth wheel advancement

Vehicles 6x2C



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Figure 21

(*) Formulas: If necessary, contact IVECO Technical Application

W = Load on fifth wheel

W_1 = Load on front axle

W_2 = Load on first rear axle

W_3 = Load on second rear axle

L = Wheelbase

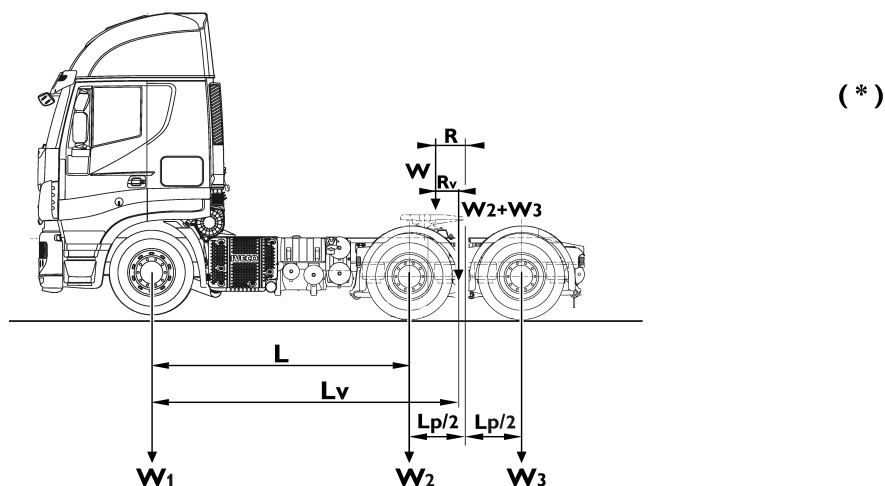
L_v = Virtual wheelbase

L_p = Rear axle centreline

R_v = Fifth wheel advance in relation to the virtual wheelbase

R = Fifth wheel advancement from rear axle

6x2P Vehicles



263075

Figure 22

(*) Formulas: If necessary, contact IVECO Technical Application

W = Load on fifth wheel

W_1 = Load on front axle

W_2 = Load on first rear axle

W_3 = Load on second rear axle

L = Wheelbase

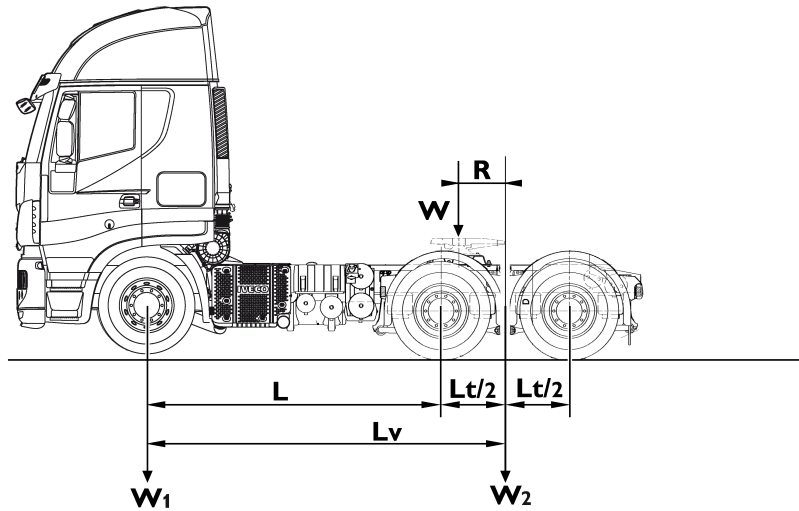
L_v = Virtual wheelbase

L_p = Rear axle centreline

R_v = Fifth wheel advance in relation to the virtual wheelbase

R = Fifth wheel advancement from rear axle centre line

6x4 vehicles



$$R_{\max} = L_v \cdot W_1 / W$$

$$R_{\min} = L_v - (L_v \cdot W_2 / W)$$

263076

Figure 23

W = Load on fifth wheel
 W_1 = Load on front axle
 W_2 = Load on rear tandem
 L = Wheelbase

L_v = Virtual wheelbase (from front axle to tandem centre line)
 L_t = Tandem length
 R = Fifth wheel advancement from tandem centre line

Example 1 - Furthest forward/furthest retracted position of the fifth wheel on a tractor 4x2

Maximum fully laden weight (in Europe)	18,000 kg
Maximum permitted mass on front axle 1	7,500 kg
Maximum permitted mass on rear axle 2	11,500 kg
Vehicle mass in running order	7,700 kg
Vehicle mass in running order weighing on the front axle 1	5,500 kg
Vehicle mass in running order weighing on rear axle 2	2,200 kg
Wheelbase (L)	3,790 mm

Check that the permitted limits do not exceed the theoretical limits.

Maximum load on fifth wheel	(W)	= 18,000 - 7,700	= 10,300 kg
Maximum load on axle 1	(W_1)	= 7,500 (*) - 5,500	= 2,000 kg
Maximum load on axle 2	(W_2)	= 11,500 (*) - 2,200	= 9,300 kg
The furthest retracted position " $L_{\min}$ "	= $L - L \cdot W_2 / W$	= $3,790 - 3,790 \times 9,300 / 10,300$	= 368 mm
Furthest forward position " $L_{\max}$ "	= $L \cdot W_1 / W$	= $3,790 \times 2,000 / 10,300$	= 736 mm

(*) minimum between the permitted and theoretical limit

Example 2 - Maximum load on the fifth wheel of a tractor 4x2 and corresponding GVW for a given point (for example 700 mm)

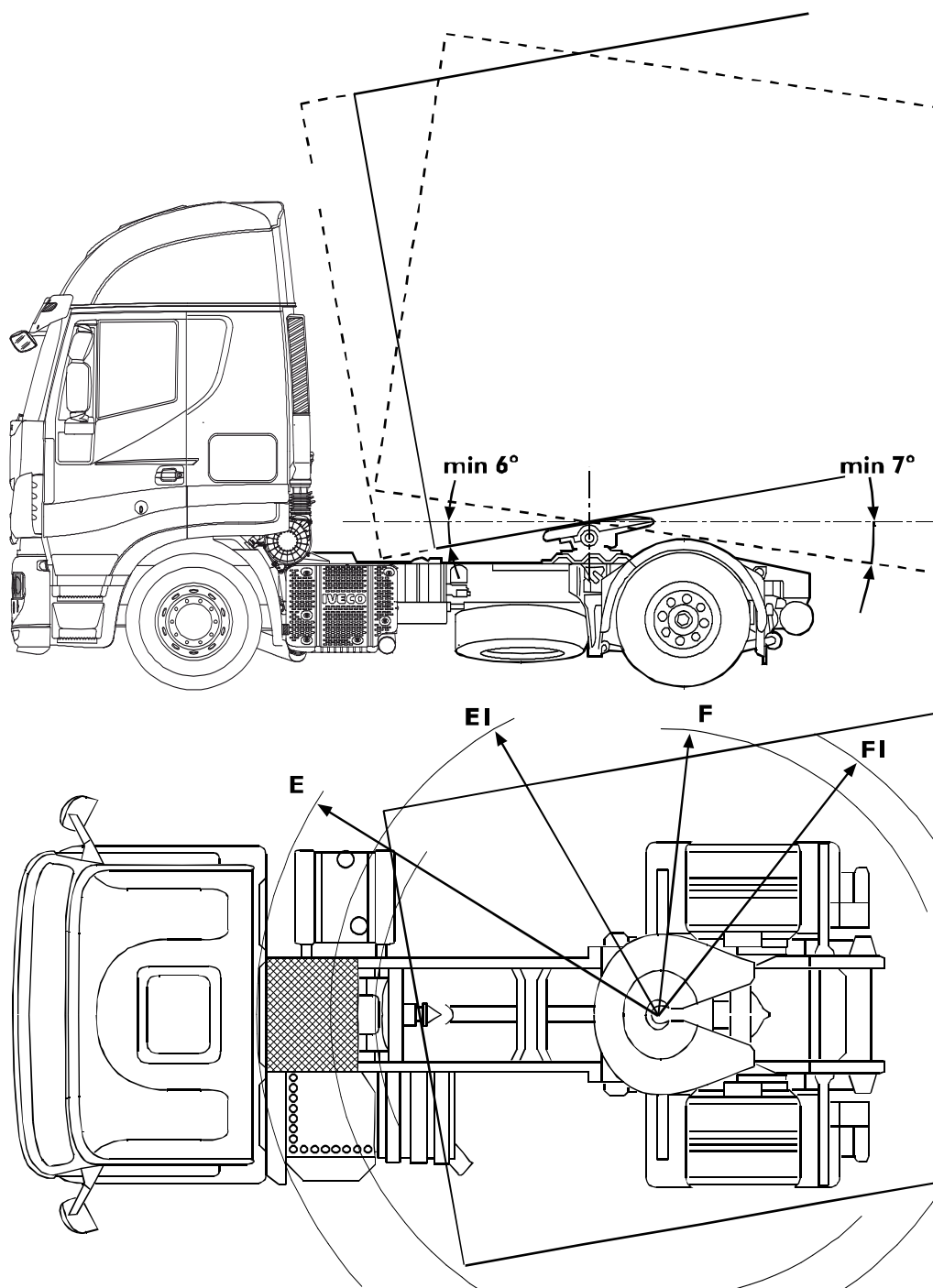
With the same previous start data:

Maximum load on fifth wheel so as not to exceed the limit on front axle 1	$(H) = L / W \cdot W_1$	$= 3,790 / 700 \times 2,000$	$= 10,829 \text{ kg}$
Maximum load on fifth wheel so as not to exceed the limit on rear axle 2	$(K) = L / (L - W) \cdot W_2$	$= 3,790 / (3,790 - 700) \times 9,300$	$= 11,407 \text{ kg}$
Maximum load on the fifth wheel so as not to exceed the limit on axles 1 and 2	$(Y) = \text{Min. value between (H) and (K)}$		$= 10,829 \text{ kg}$
Maximum load on fifth wheel	$= Y + \text{Vehicle running mass}$	$= 10,829 + 7,700$	$= 18,529 \text{ kg}$

Tractor and semi-trailer combination

The semi-trailers construction characteristics must be suitable to avoid negative effects on the articulated truck handling (e.g.: an over flexible frame, insufficient braking capacity etc..). In the tractor and semi-trailer combination, all movements must be verified in the various conditions of use, to ensure the necessary safety margins and observation of applicable laws and Standards (see Figure 24) is requested.

Consult the Standard ISO 1726 for details.



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Figure 24

- E. Tractor free front radius
- EI. Semi-trailer front clearance radius

- F. Tractor rear clearance radius
- FI. Semi-trailer rear free radius



► The axle load must always be checked on the basis of the fifth wheel position.



► **Always check the distance between the trailer and the cab.**

When required, check that the clearance area on bends respects the established limits.

Respect all other limits established by IVECO for defining fifth wheel heights.

Fifth wheel supporting structure

Follow the instructions below for making fifth wheel supporting structure for tractors supplied without one:

- the structure must be suitably dimensioned for vertical and horizontal loads which the fifth wheel transfers; refer to the information provided previously regarding its height.
- see the Paragraphs "Materials" (► Page 5) and "Section dimensions" (► Page 5) for the characteristics of the material of the structure;
- the upper and lower surfaces of the structure must be level so as to ensure a good contact on the chassis and the base of the fifth wheel;
- the structure components, when this is formed by several elements, must be welded and/or nailed to form a single assembly;
- fastening of the structure to the tractor (see Figures 25, 26, 27 and 28) must be carried out on the corner reinforcements, where present, unless otherwise specified.

Use class 8.8 screws or higher for correct anchoring of the semi-trailer to the fifth wheel (number and diameter suitable for tightening to a torque of no less than that for the fifth wheel fastening) with washers.

Do not weld or drill the side member wings when applying longitudinal stops.

Running guides maybe installed on to the frame; Consider the following for construction and application:

- adopt suitable dimensions for correct anchoring of the semi-trailer to the fifth wheel;
- securing to the chassis must be carried out without the use of welding and without drilling any holes into the side member flaps.

Application of simple plate structure

As a general rule, for tractors destined for use on normal roads and unless otherwise envisaged by IVECO, the structure for fitting the fifth wheel may be of the "ribbed plate" type, to be connected to the chassis via longitudinal sections and designated brackets or by direct assembly.

The plate is supplied with the vehicle and installed temporarily for transport; the final assembly must be carried out before assembly of the fifth wheel.



► **The plate represents a safety device subject to specific type-approval; therefore, it must not be modified and must be installed strictly following the indications provided by the manufacturer.**

Table 3.6 - Application of fifth wheel and plates

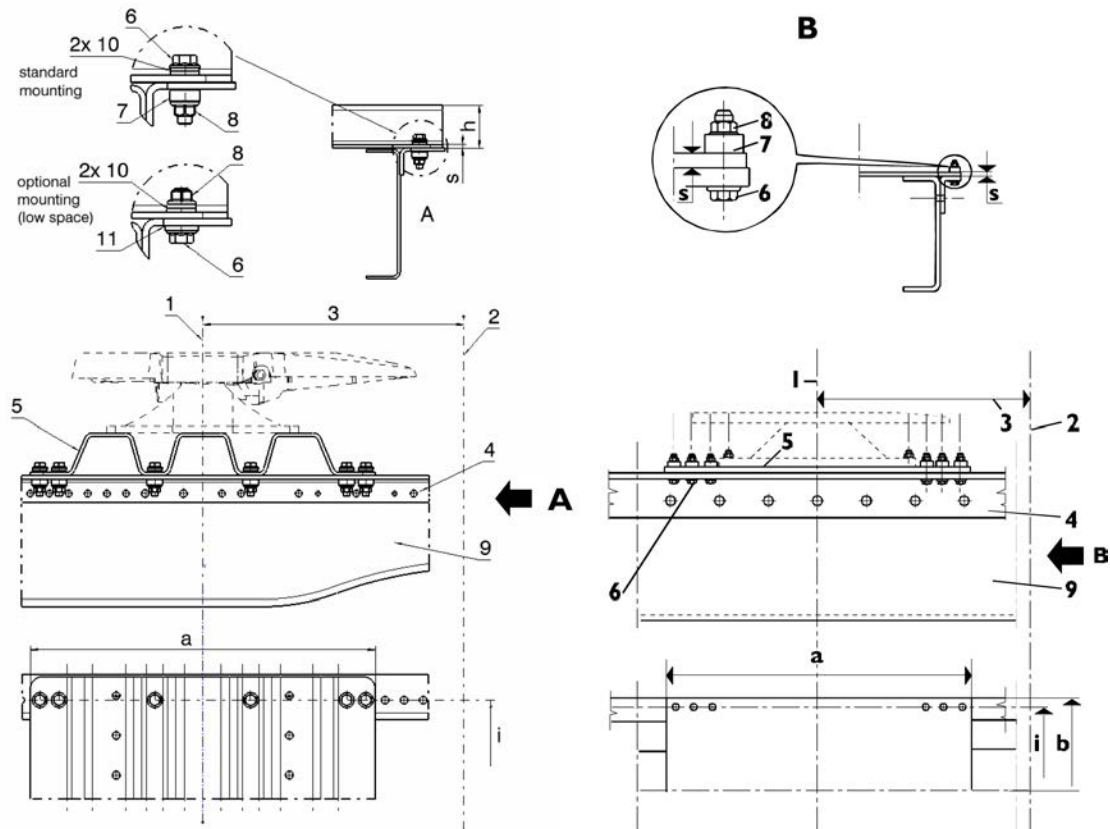
Fifth wheel support	4x2			6x2C	6x2P	6x4
	440 T/P	440 T/P SL	440 T/FP-LT 440 T/FP-CT	440 TX/P	440 TY/P	440 TZ/P-HM
Fifth wheel H = 128 mm + plate 12 mm	–	–	○	–	–	–

Fifth wheel support	4x2			6x2C	6x2P	6x4
	440 T/P	440 T/P SL	440 T/FP-LT 440 T/FP-CT	440 TX/P	440 TY/P	440 TZ/P-HM
Fifth wheel H = 140 mm - In-built plate	–	–	○	–	–	–
Fifth wheel H = 148 mm + plate 8 mm	○	–	○	–	–	–
Fifth wheel H = 150 mm + plate 12 mm	○	–	○	–	–	–
Fifth wheel H = 150 mm + plate 40 mm	–	–	–	○	–	–
Fifth wheel H = 150 mm + plate 50 mm	○	○	–	–	–	–
Fifth wheel H = 150 mm + plate 100 mm	○	–	–	○	○	○
Fifth wheel H = 185 mm + plate 40 mm	–	–	–	○	–	–
Fifth wheel H = 185 mm + plate 50 mm	○	○	–	–	–	–
Fifth wheel H = 185 mm + plate 100 mm	○	–	–	○	○	○
Fifth wheel without plate H = 190 mm	○	○	–	–	–	–
Fifth wheel without plate H = 225 mm	○	○	–	–	–	–
Fifth wheel Alu H = 180 mm	○	○	–	–	–	–
Fifth wheel Alu H = 245 mm	○	○	–	–	–	–
Variable fifth wheel H = 165-365 mm	–	–	○	–	–	–

S = Standard

O = Optional

Assembly instruction for 4X2 models: Stralis 440 S ... T/P and T/FP



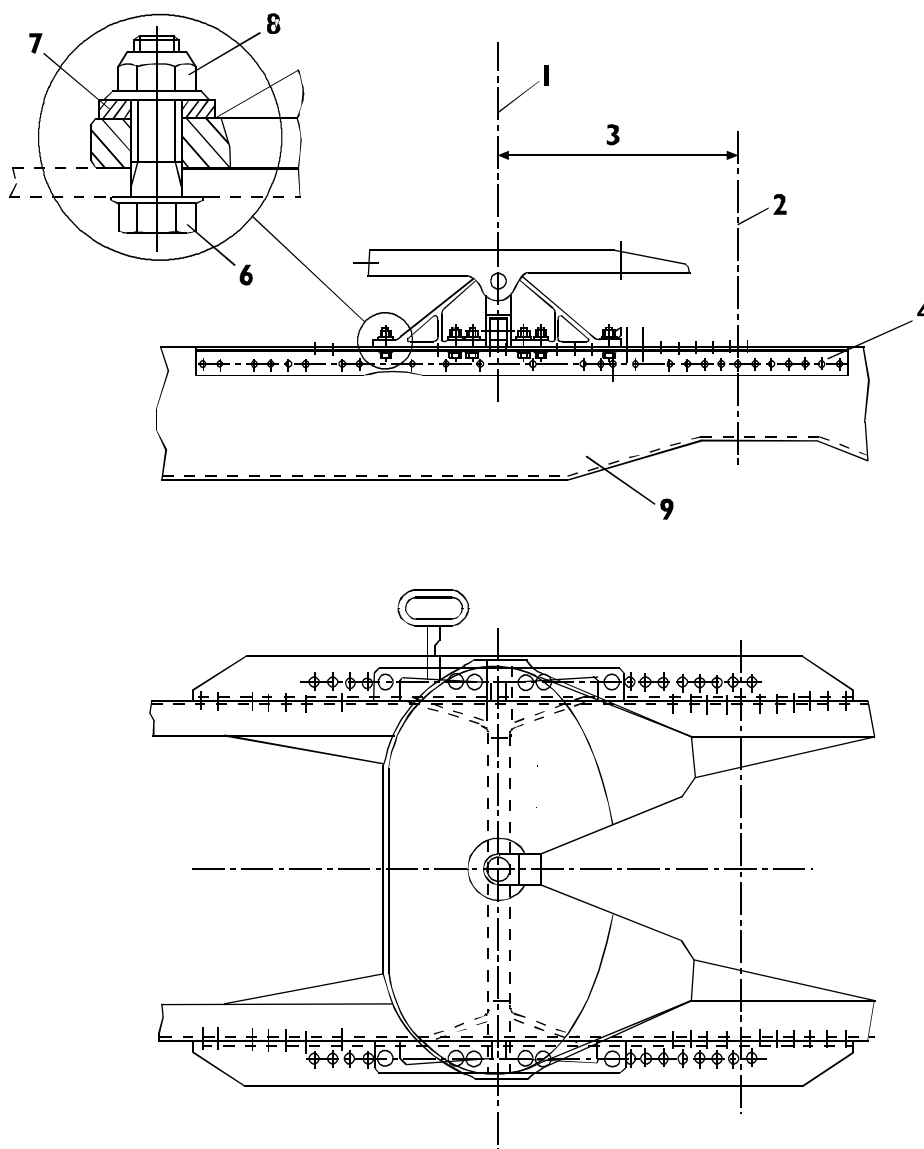
193890

Figure 25

1. Fifth wheel axis
2. Rear wheel axle
3. Fifth wheel advancement
4. Longitudinal profiles
5. Fifth wheel carrying plate
6. Screws with flange M16x1.5 - 10.9

7. Fastening spacer ($h = 15 \text{ mm}$)
8. Flanged head self-locking nuts
9. Chassis side members
10. Spring washer (16x34x4.4)
11. Fastening spacer ($h = 15 \text{ mm}$)

- After establishing fifth wheel advancement, secure the plate to the longitudinal section with screws (6), using appropriate spacers (7 or 11), washers (10) and self-locking nuts (8).
- Tighten the nuts (8) (tightening torque 277 - 355 Nm).

Assembly instruction for 4X2 models: Stralis 440 S ... T/P e T/FP - With cross member (Opt. 7727 - 7728)

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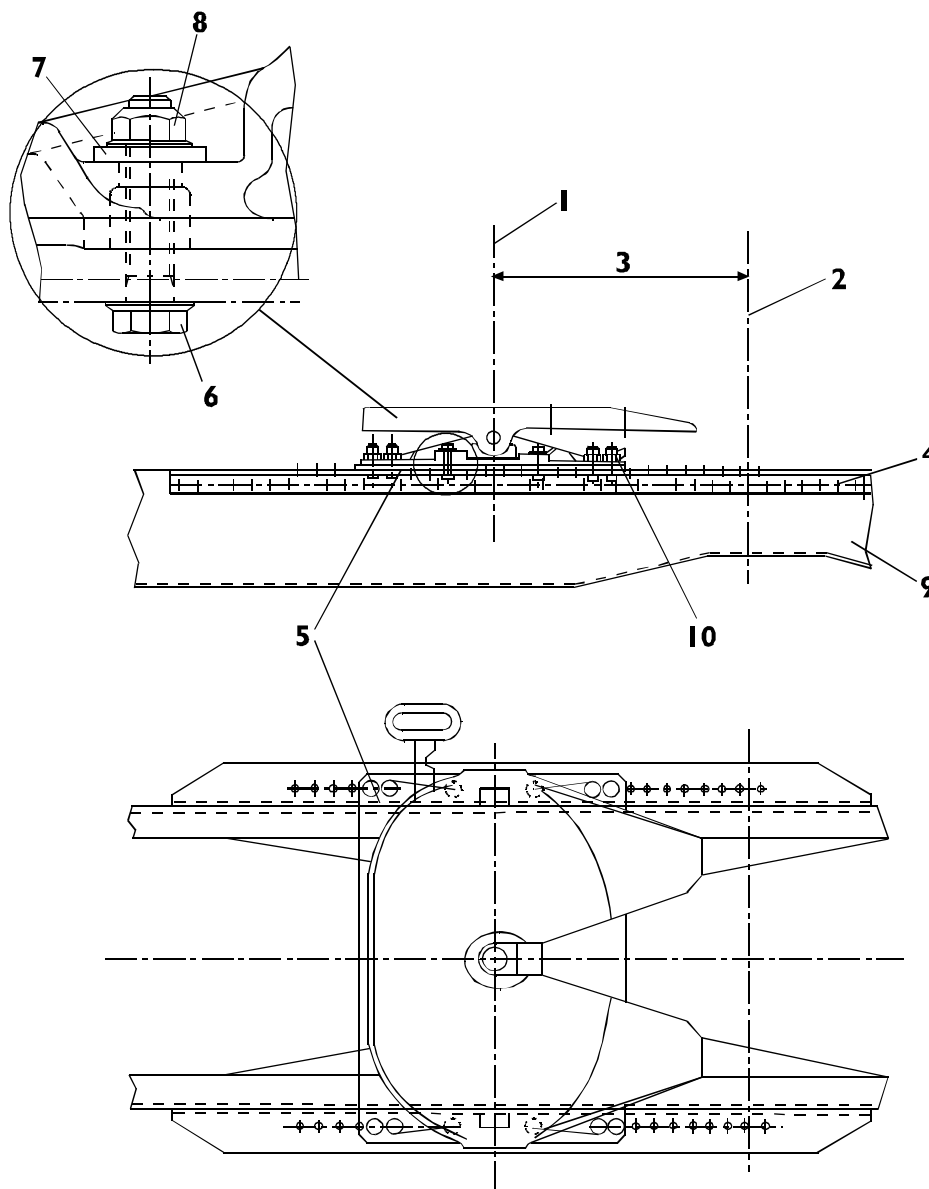
Figure 26

- 1. Fifth wheel axis
- 2. Rear wheel axle
- 3. Fifth wheel advancement
- 4. Longitudinal profiles

- 6. Screws with flange M16x1.5 - 10.9
- 7. Washer (h = 6 mm)
- 8. Flanged head self-locking nuts
- 9. Chassis side members

Tighten the nuts (8) (tightening torque 277 - 355 Nm).

Assembly instruction for 4X2 models: Stralis 440 S ... T/P e T/FP - Without cross member (Opt. 703)



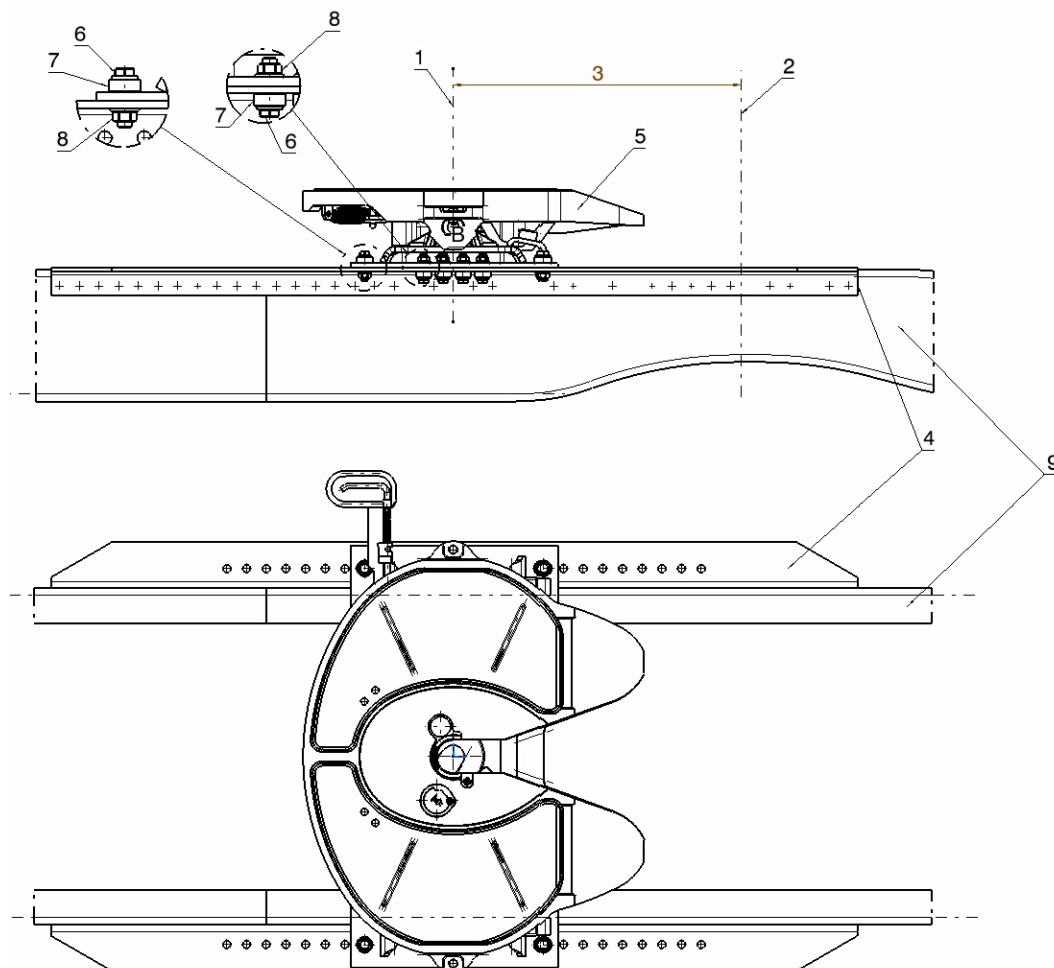
193892

Figure 27

- 1. Fifth wheel axis
- 2. Rear wheel axle
- 3. Fifth wheel advancement
- 4. Longitudinal profiles
- 5. Plate

- 6. Screws with flange M16x1.5 - 10.9
- 7. Washer (h = 6 mm)
- 8. Flanged head self-locking nuts
- 9. Chassis side members
- 10. Fastening spacer (h = 15 mm)

Tighten the nuts (8) (tightening torque 277 - 355 Nm).

Assembly instruction for 4X2 models: Stralis 440 S ... T/P e T/FP - Without cross member (Opt. 5704 and 5705)

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Figure 28

- 1. Fifth wheel axis
- 2. Rear wheel axle
- 3. Fifth wheel advancement
- 4. Longitudinal profiles
- 5. Fifth wheel

- 6. Screws with flange M16x1.5 - 10.9
- 7. Fastening spacer (h = 15 mm)
- 8. Flanged head self-locking nuts
- 9. Chassis side members

Tighten the nuts (8) (tightening torque 277 - 355 Nm).

Application of a collaborating structure to the vehicle chassis

The application of a suitable structure such as a subframe (see Figure 29) serves to ensure adequate torsional and bending contribution to the vehicle chassis, aside from distributing the load on the fifth wheel. This structure is required when the loads on the front axle exceed those shown consequent to high fifth wheel advancements and for particularly demanding use in some markets.

The typical application is that of Hi-Way 440TZ 6x4 vehicles with tandem axle.

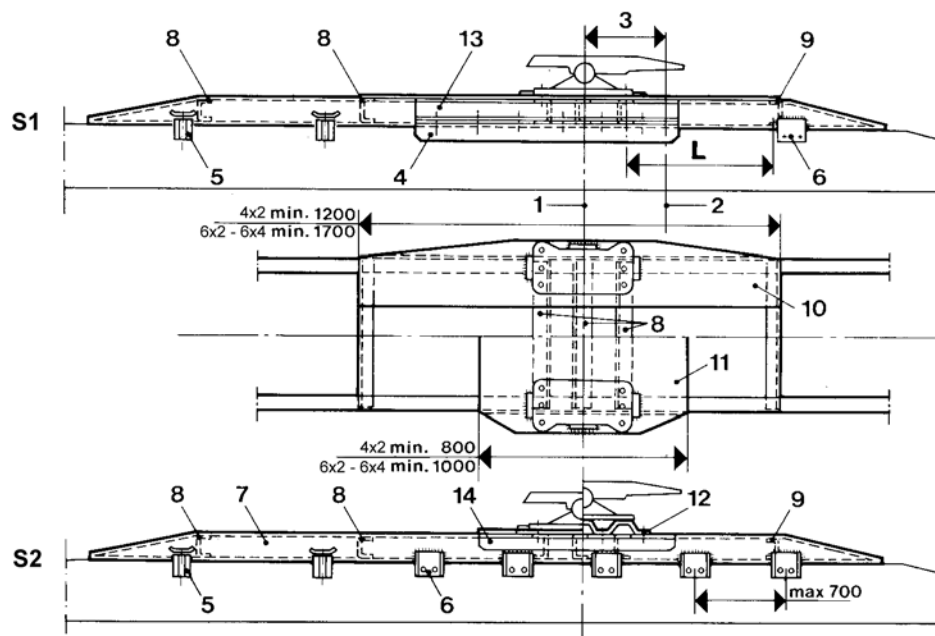
The longitudinal reinforcement sections must be connected by a suitable number of cross members arranged in correspondence with the fifth wheel supporting area and by other two cross members on the two ends of the structure.

The fifth wheel supporting surface may be made as follows:

- using a flat plate of suitable thickness (min. 10 mm), with length and width suited to fifth wheel supports or by means of two longer half plates (thickness min. 8 mm);
- using a ribbed plate provided by the fifth wheel supplier (height 30 or 40 mm) if there are no problems concerning fifth wheel surface height.

The plates forming the fifth wheel support must be connected stiffly to the basis chassis (longitudinal elements and cross members).

Use fastening elements already provided by IVECO (plates and/or brackets) for fastening the structure to the frame: a good connection requires the use of plates providing transverse and longitudinal resistance in the rear area and near the fifth wheel and brackets towards the front end (see Figure 29).



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Figure 29

S1. Solution 1

S2. Solution 2

1. Fifth wheel axis
2. Tandem axle centre line
3. Fifth wheel advancement
4. Corner reinforcements - Screws Φ 14 mm
5. Front shelves - Screws Φ 16 mm
6. Plates - Screws Φ 14 mm

7. Longitudinal reinforcement section
8. Stiffening cross member
9. Rear cross member (for $L = 400$ mm)
10. Semi-plate
11. Single plate
12. Ribbed plate
13. C shaped connecting section ref. Fig. 3.3
14. Fastening reinforcement corner

Adjustable height fifth wheel

IVECO also has variable height fifth wheels, to make the connection between lowered tractors (Low tractor) and the various types of semi-trailer possible.

This device can however also be used for other tractors:

- in the low position, with the exception of "quarries and work sites", and the tipping semi-trailer combination;
- in the high position, with the exception of combinations with outfitting with a high centre of gravity, silos, tanks, "quarries and work sites" and tippers.

The maximum authorized height, measured from the ground, is 1200 mm in accordance with the CEE certification indications relating to Braking.

3.6 TRANSPORT OF INSEPARABLE MATERIALS (TRAILER TRUCKS)

The carriage of oversize inseparable material is governed in various countries by specific standards.

The type of vehicle to be used must be verified directly with IVECO for transportation requiring particular force configurations due to concentrated vertical loads and dynamic braking forces.

A counter chassis must be used to support the load supporting structure, while other limitations may be specified on a case-by-case basis.

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

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

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

Table 3.7 - Installation of tanks

Model	Modulus of resistance W_x [cm ³] (Ultimate tensile strength of the material equal to 360 N/mm ²)
STRALIS 190	46 ⁽¹⁾ 89 ^{(1) (2)}
STRALIS 260	59 ⁽¹⁾ 89 ^{(1) (2)}
STRALIS 320	59 ^{(1) (3)}

⁽¹⁾ Stiffen the subframe in the tank and container resting area.

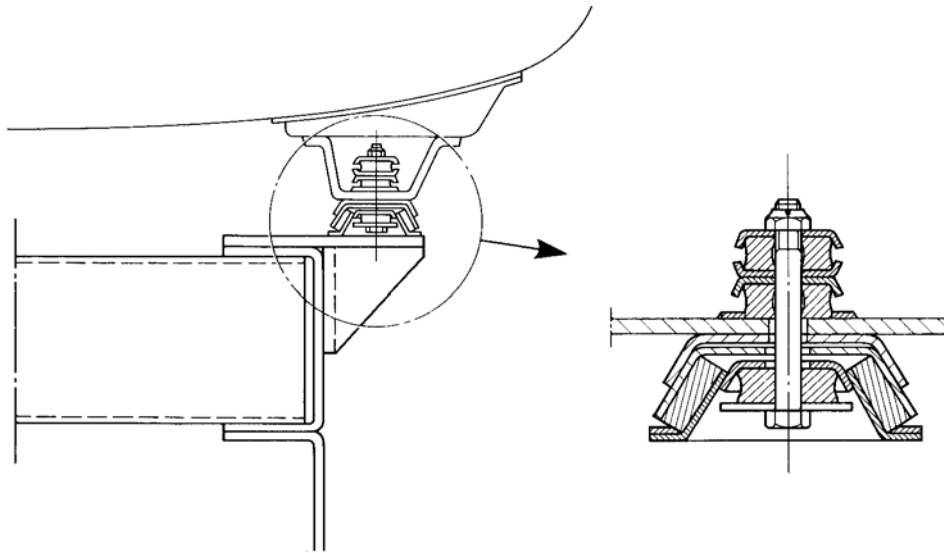
⁽²⁾ Maximum load on front axle 8,000 kg.

⁽³⁾ Arrange the front tank support in advanced position or near the second front axle rear spring mount. Use of a larger section and specific authorisation will be required otherwise.

Note For the dimensions of the profiles see Table 3.2.

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

The use of flexible parts is recommended for the connections between the cistern body and the subframe (see Figure 30) in the front part and rigid supports resistant to the longitudinal and transverse forces towards the rear part.



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Figure 30

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

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

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

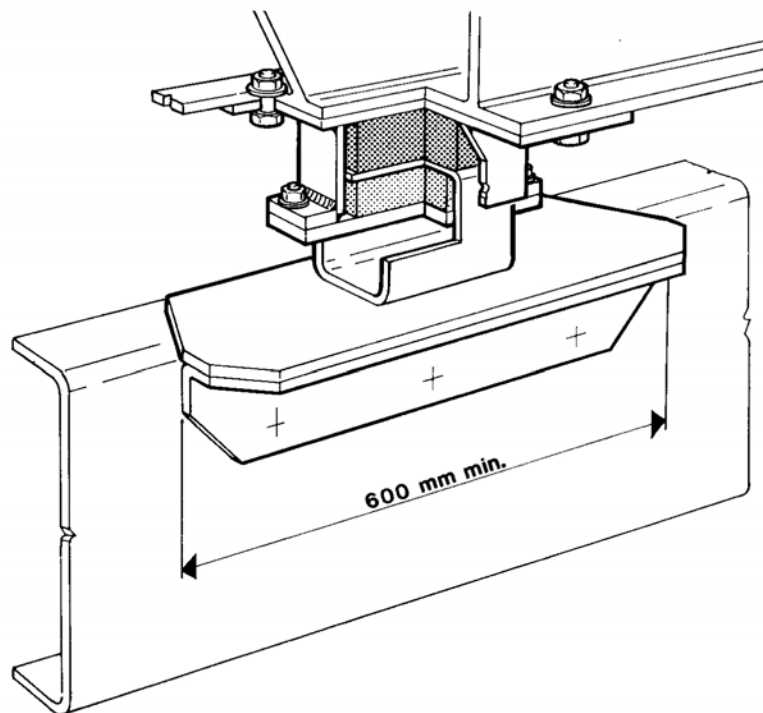
For road vehicles, it should be considered that the first front flexible connection must provide a detachment of approximately 10 mm between the subframe and the chassis during the torsional phase of the chassis.

b) Installation without a subframe

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

- the distance between the various rests must be established according to the load to be transmitted (approximately no more than 1 m);
- the rests must be made to uniformly distribute the load on a suitably wide surface (see Figure 31) and with bracing to contain longitudinal and transverse forces;
- anchorings must be of approximately 600 mm in length and be arranged near the suspension coupling points (maximum distance 400 mm).
The front anchoring must provide flexibility so as to permit the necessary torsional movements of the vehicle chassis;
- other anchoring solutions must be authorised by IVECO.

Self-supporting tanks can be arranged directly onto the vehicle chassis with adequate supports, positioned directly behind the cab and in the area of the rear axle(s). The amount and direction of these supports depend on the number of axles and the wheelbase, notwithstanding that a minimum of two supports is recommended on each side of vehicles with 2 axles and a short wheelbase and a minimum of three on 3 or 4-axle vehicles and a short wheelbase.



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Figure 3 I

A suitable subframe which ensures good distribution of load and suitable torsional stiffness for the chassis-subframe assembly must be ensured by means of shearing resistant connections when two or more separate containers are applied on the vehicle. A good solution consists in a stiff connection which joins the containers.

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

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

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

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

3.8 INSTALLING A CRANE

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

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



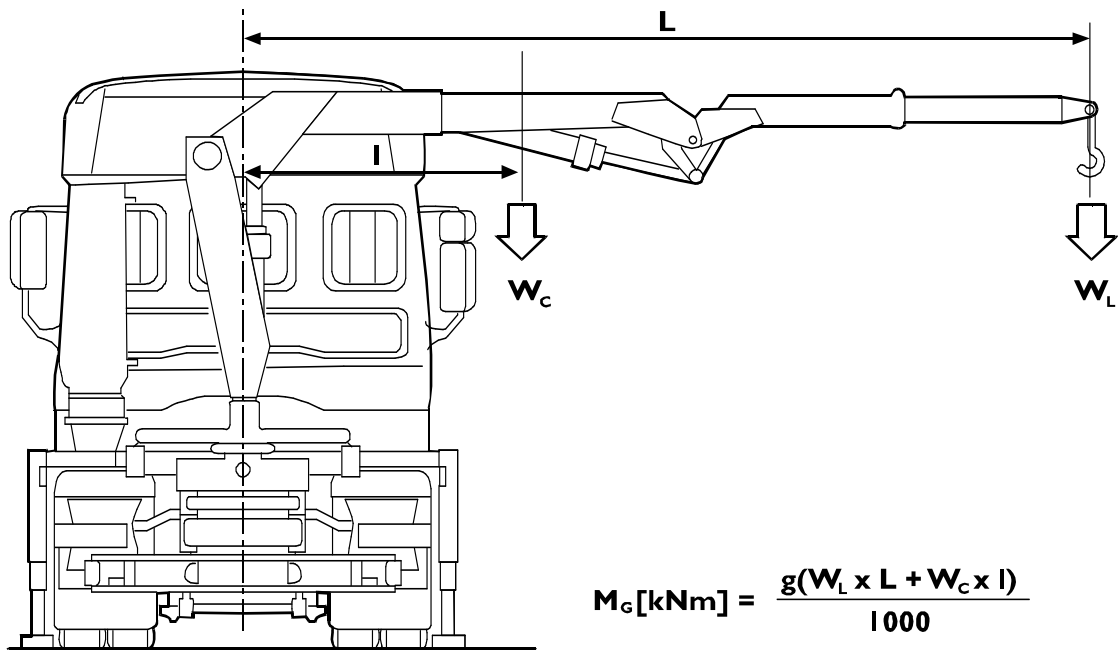
- **In order to ensure stability while the crane is operating, stabilizers must be used and must be in contact with the ground. On vehicles with air suspensions, the air springs must be discharged (see Specification 01 in Chapter 5.2).**

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

In those cases where no specific subframe is required (cases indicated with the letter A in the aforesaid tables) it is still necessary to provide a suitable mounting base for the crane on the chassis (the length of the sections must be at least 2.5 times the width of the base structure of the crane) in order to distribute the load and the stresses which develop during crane operation.

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

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



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Figure 32

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

W_L = mass applied to crane extremity [kg]

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

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

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



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

Crane behind cab

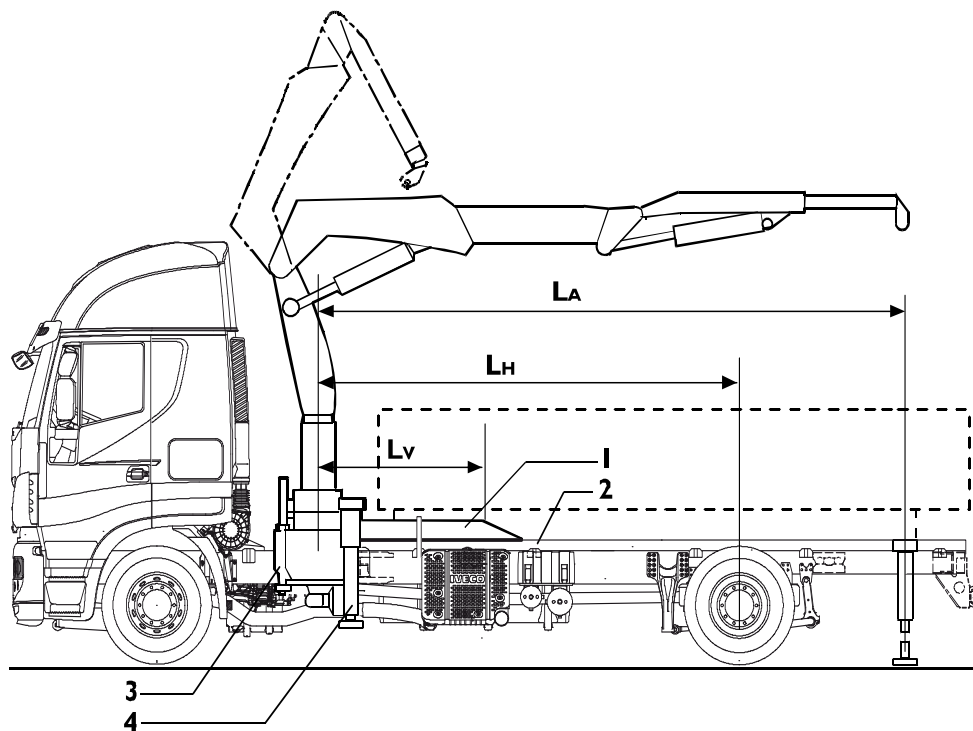
The fastening of the reinforcement sections to the chassis must be carried out using the standard brackets (see Figure 33), supplementing them, if necessary, with other fasteners of elastic type (brackets or clamps) in order to keep the flexural and torsional characteristics of the chassis as unchanged as possible.

The dimensions of the reinforcement sections to be used for this type of connection are shown in Table 3.8.

On vehicles for road use only, shearing resistant connections may be used for fastening the subframe to reduce the subframe section height (see Figure 34) is requested. The minimum reinforcement section dimensions for all these applications are given in Table 3.9.

The adoption of constant diameter sections for the entire length of the vehicle is recommended; section diameter reductions (always gradual) are possible in the areas in which the bending moment induced by the crane assumed values corresponding to the boxes marked "A" in Tables 3.8 and 3.9, as possible.

The section of the crane subframe (Figure 33) can be integrated towards the rear end with that envisaged for another possible superstructure; the length " L_v " must in no case be less than 35% of the wheelbase if the superstructure section diameter is smaller.



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Figure 33

- | | |
|------------------------|----------------------|
| 1. Reinforcing profile | 3. Crane connections |
| 2. Connections | 4. Stabilisers |

Table 3.8 - Crane behind cab (subframe secured with shelves or flanges)

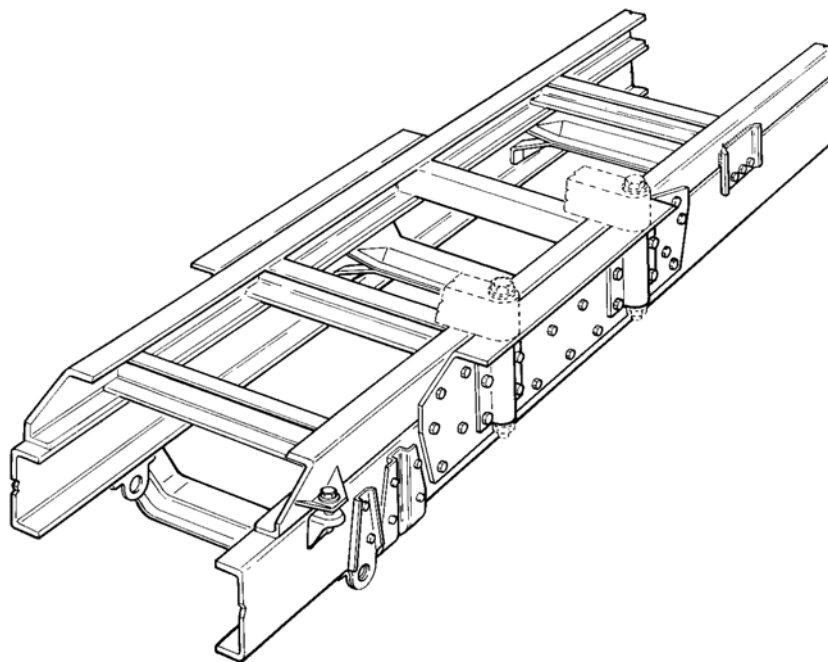
Models Frame section [mm]	Wheelbase [mm]	Ultimate tensile strength of counter chassis material [N/mm ²]	Total torque M _G max [kNm]																		
			20	30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	
			20	30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	300
			Minimum value of the modulus of resistance of the counter chassis section W _x [cm ³] ⁽¹⁾																		
190 260 289x80x6.7	<6300 <5100/1395	360 420	A A	A A	A A	A A	A A	A A	A A	A A	A A	21 ⁽¹⁾ 21 ⁽¹⁾	89 89	119 119	150 150	245 185	374 208	439 245	E 343	E 406	
260Y/P 260Z/P 320Y/PS 320X/PS 289x80x7.7	5700/1395 6050/1395 All All	360 420	A A	A A	A A	A A	A A	A A	A A	A A	A A	A A	21 ⁽¹⁾ 21 ⁽¹⁾	89 89	119 119	150 150	245 185	374 208	439 245	E 343	

A = The reinforcement section envisaged for the relative superstructure is sufficient (e.g. for normal bodies see Table 3.4). Close the reinforcement section in the crane assembly area. In the crane area, brace the reinforcement profile sections which have a thickness of less than 5 mm.

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

⁽¹⁾ When a higher section modulus is required for the superstructure (eg. container application) also use the latter for the crane.

Note For the dimensions of the profiles see Table 3.2.



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Figure 34

The application of cranes on off-road vehicles may require flexible connections on the front and middle parts between chassis and subframe (see Figure 11) so as not to excessively restrict torsional movement of the chassis. In these cases, the crane is practically connected to the subframe only, the dimensions of the longitudinal sections must therefore be suited to withstand the moment induced when the crane is used.

The vehicle elements arranged behind the cab (e.g.: the gearbox controls, air filter, cab tilt locking device etc.) must be arranged to ensure functionality; moving certain units such as battery boxes, fuel tanks etc. is allowed providing that the original connection type is restored.

The container or equipment must normally be retracted to arrange the crane behind the cab.

In the specific case of tipping equipment, particular attention must be paid to arranging the lifting device supports and the tipper rear hinges which must be as limited as possible.

Table 3.9 - Cranes mounted behind cab (subframe secured with shear resistant plates)

Models	Wheel- base [mm]	Ulti- mate tensile strength of counter chassis material [N/mm²]	Total torque M _G max [kNm]																			
			20	30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	300	
			Minimum value of the modulus of resistance of the counter chassis section W _x [cm³] ⁽¹⁾																			
190 260	<6300 <5100/1395	360	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	46	89	89	135	150	173	208	245	
289x80x6.7		420	A	A	A	A	A	A	A	A	A	A	A	31	36 ⁽¹⁾	89	89	105	135	150	173	
260Y/P 260Z/P 320 Y/PS 320 X/PS	5700/1395 6050/1395 All All	360	A	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	36 ⁽¹⁾	89	89	105	135	150	173	
		420	A	A	A	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	46	89	89	105	135	
289x80x7.7																						
Modulus of resistance W _x [cm³] necessary for the single section chassis plus counter chassis, with reference to the counter chassis and for each side of the vehicle			360	48	72	96	120	143	167	191	215	238	286	334	381	429	477	524	572	619	667	715
		420 ^(*)	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	520	560	600	
		490 ^(*)	34	50	67	84	100	117	134	150	167	200	234	267	300	334	367	400	434	467	500	

^(*) This is also valid for the chassis section (lower flap of the section assembly).

A = The reinforcement section envisaged for the relative superstructure is sufficient (e.g. for normal bodies see Table 3.4). Close the reinforcement section in the crane assembly area. In the crane area, brace the reinforcement profile sections which have a thickness of less than 5 mm.

⁽¹⁾ When a higher section modulus is required for the superstructure (eg. container application) also use the latter for the crane.

Note For the dimensions of the profiles see Table 3.2.

Cranes on rear overhang

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

Considering the particular distribution of weights on the vehicle (load concentrated on overhang) and to ensure the necessary torsional stiffness for good performance on the road and during the working phase of the crane, the subframe must be suitably stiffened in relation to the crane capacity. Therefore, the use of (see Chapter 3.2 (► Page 7)) box sections and cross bracings in line with the rear suspension and along the entire length L_v (see Figure 35) is requested.

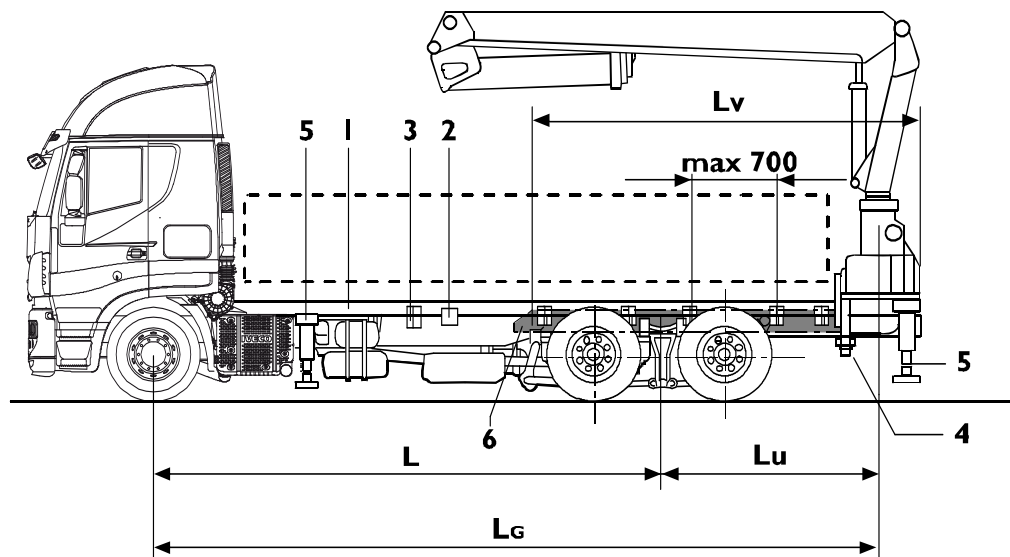
The passage between boxed sections and open sections must be well fitted as shown in Figure 3.4.

Shear resistant connections (a sufficient number of plates spaced at a maximum distance of 700 mm) must be used in the box section for fastening to the chassis, given that elastic fastenings are used on the front end. Check that the ratio between front axle and rear axle weight respects the limit defined for each vehicle under any load condition (see Chapter 1.15 (► Page 11)).

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

The rear overhang of the crane (measurement L_u see Figure 35) must be as limited as possible (never exceeding 50% of the wheelbase) to maintain good vehicle drive characteristics and acceptable stress regimes for the chassis.

For vehicles with additional liftable rear axle, the minimum load on the front axle must be tested with the rear axle raised (in countries where travelling with the vehicle in this condition is allowed) (see Chapter 1.15 (► Page 11)). The axle must be lowered while travelling if the minimum required value is not obtained.



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Figure 35

1. Subframe on the entire body length
2. Plates
3. Brackets

4. Crane connections
5. Stabilisers
6. Connecting corner

Table 3.10 - Crane on the rear overhang (subframe secured with shear resistant plates)

Models Frame section [mm]	Wheel-base [mm]	Ultimate tensile strength of counter chassis material [N/mm²]	Total torque M _G max [kNm]																			
				20	30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	
			20	30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	300	
			Minimum value of the modulus of resistance of the counter chassis section W _x [cm³] ⁽¹⁾																			
190/P 260/P, /PS, /FP, /FS 260/PT 289x80x6.7	<6300 <5100/1395 <5100/1395	360 420	A A	A A	A A	A A	A A	A A	A A	23 ⁽¹⁾ 23 ⁽¹⁾	32 ⁽¹⁾ 32 ⁽¹⁾	42 ⁽¹⁾ 32 ⁽¹⁾	71 42 ⁽¹⁾	110 71	135 110	173 135	222 173	222 173	246 222	E 246	E E	
260Y/P 260Z/P 320Y/PS 320X/PS 289x80x7.7	5700/1395 <5700/1380 <6050/1395 <6050/1380 All All	360 420	A A	A A	A A	A A	A A	A A	A A	A A	A A	A A	23 23	32 23	42 23	57 42	110 57	110 71	135 110	135 135	173 173	
Modulus of resistance W _x [cm³] necessary for the single section chassis plus counter chassis, with reference to the counter chassis and for each side of the vehicle		360 420 ^(*) 490 ^(*)	48 40 34	72 60 50	96 80 67	120 100 84	143 120 100	167 140 117	191 160 134	215 180 150	238 200 167	286 240 200	334 280 234	381 320 267	429 360 300	477 440 367	524 480 400	572 520 400	619 520 434	667 560 467	715 600 500	

(*) This is also valid for the chassis section (lower flap of the section assembly).

A = The reinforcement section envisaged for the relative superstructure is sufficient (e.g. for normal bodies see Table 3.4). Close the reinforcement section in the crane assembly area. In the crane area, brace the reinforcement profile sections which have a thickness of less than 5 mm.

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

(1) When a higher section modulus is required for the superstructure (eg. container application) also use the latter for the crane.

Note For the dimensions of the profiles see Table 3.2.

Removable cranes

The installation of removable cranes on the rear overhang may be carried out according to the specifications of the previous paragraph provided the type of fixing used between the crane and the subframe does not cause additional stress to the vehicle chassis. Since the vehicle may be used with or without the crane (where permitted), it is recommended that the position of the payload is marked on the superstructure.

If the possibility for the vehicle to tow a trailer is maintained, all the regulations for the correct coupling must be observed.

3.9 INSTALLATION OF TAIL LIFTS

Note The installation of tail lifts must be carried out with due regard for the maximum permissible weights on the rear axle (or rear axles) of the vehicle and of the minimum load established for the front axle (see Chapter 1.15 (► Page 11)). If this is not possible, the rear overhang will have to be reduced.

Installation of the tail lift must be performed either with a structure which enables adequate distribution of the forces, especially in the case of specific versions with no subframe.

To ensure the necessary strength and rigidity, the connection between the chassis and the subframe must be made using shear-resistant plates (spaced no further than 700 mm from one another) in the area of the rear overhang, and must continue up to the front support of the rear suspension (see Figure 36) is requested.

The dimensions of the sections to be used for the subframe can be defined using:

- Table 3.11, in the presence of trucks with rear overhangs as standard;
- using the specifications of Figure 36, with trucks with non-standard overhangs or specific tail lifts (for example, in aluminium) and noting that the flexing moments on the chassis, depending on the board capacities, must be calculated each time.

Table 3.11 can be used to size the section of a subframe intended to support only the tail lift.

However when, as in most cases, the vehicle is to be fitted with a standard superstructure (fixed body, crane), the table relating to this superstructure must be referred to, choosing the table which provides the higher values of the section modulus W_x .

Table 3.11 - Installation of tail lifts

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Max overhang superstructure [mm]	Tail lift capacity in kN (kg)							
				7.5 (750)	10 (1000)	12.5 (1250)	15 (1500)	17.5 (1750)	20 (2000)	25 (2500)	30 (3000)
				Minimum value of subframe section modulus of resistance W_x [cm ³] with ultimate tensile strength of the material equal to 360 N/mm ²							
190 S ... /P	3800	1848	2342	A	A	A	46	46	46	57	74
190 S ... /FP-CM	4200	2073	2567	A	A	46	46	46	46	74	89
190 S ... /FP-D	4500	1803	2297	A	A	46	46	46	46	46	74
rear axle 11.5 t	4800	2478	2972	A	46	46	46	46	57	89	135
	5100	2388	2882	A	46	46	46	46	46	74	135
	5500	2208	2702	A	46	46	46	46	46	74	105
	5700	2208	2702	A	46	46	46	46	46	74	105
289/199 x 80 x 6.7	6300	2793	3287	46	46	46	46	57	74	105	150
190 S ... /P	6700	3423	3917	A	A	46	46	46	46	74	89
190 S ... /FP-D											
rear axle 11.5 t											
289 x 80 x 6.7											

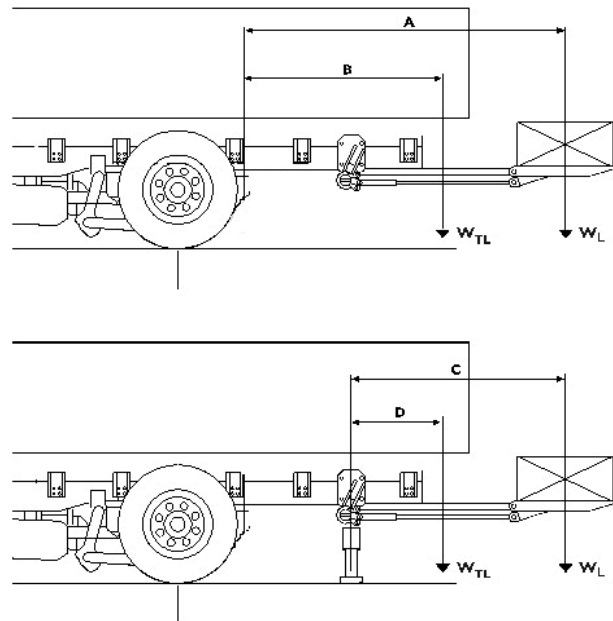
Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Max overhang superstructure [mm]	Tail lift capacity in kN (kg)							
				7.5 (750)	10 (1000)	12.5 (1250)	15 (1500)	17.5 (1750)	20 (2000)	25 (2500)	30 (3000)
				Minimum value of subframe section modulus of resistance W_x [cm ³] with ultimate tensile strength of the material equal to 360 N/mm ²							
260 S ... Y/P, Y/FP	3120	678	1172	A	A	A	A	A	46	46	46
260 S ... Y/PS, Y/FS	3805	1758	2252	46	46	46	46	46	46	74	105
260 S ... Y/FP-D	4200	1623	2117	46	46	46	46	46	46	74	105
rear axle 19 t	4200	2118	2612	46	46	46	46	57	74	105	135
	4500	1623	2117	46	46	46	46	46	57	74	105
	4500	1803	2297	46	46	46	46	57	74	74	119
	4500	2073	2567	46	46	46	46	74	74	105	135
	4800	1713	2207	46	46	46	46	46	74	74	105
	4800	2073	2567	46	46	46	57	74	74	105	135
289/199 x 80 x 6.7	5100	1803	2297	46	46	46	46	57	74	89	135
260 S ... Y/P, Y/FP	5700	2433	2927	A	A	46	46	46	46	46	74
260 S ... Y/PS, Y/FS				46	46	46	46	46	46	57	74
260 S ... Y/FP-D	6050	2658	3152	A	A	46	46	46	46	46	74
rear axle 19 t				46	46	46	46	46	46	57	74
289 x 80 x 7.7											
260 S ... Y/FP-CM	4200	1623	2117	A	A	A	A	A	46	46	46
rear axle 19 t	4200	2118	2612	A	A	A	46	46	46	46	46
	4500	1623	2117	A	A	A	A	46	46	46	46
	4500	1803	2297	A	A	A	A	46	46	46	46
289 x 80 x 6.7	4500	2073	2567	A	A	A	46	46	46	46	46
260 S ... Y/FP-CM	4800	1713	2207	A	A	A	A	A	A	46	46
rear axle 19 t	4800	2073	2567	A	A	A	A	46	46	46	46
	5100	1803	2297	A	A	A	A	A	46	46	46
	5700	2433	2927	A	A	46	46	46	46	46	74
289 x 80 x 7.7	6050	2658	3152	46	46	46	46	46	46	57	74
260 S ... Y/FP-CM	4200	1623	2117	A	A	A	A	46	46	46	46
rear axle 20 t	4200	2118	2612	A	46	46	46	46	46	46	57
	4500	1623	2117	A	A	A	A	46	46	46	46
	4500	1803	2297	A	A	A	46	46	46	46	46
289 x 80 x 6.7	4500	2073	2567	A	46	46	46	46	46	46	57
260 S ... Y/FP-CM	4800	1713	2207	A	A	A	A	A	46	46	46
rear axle 20 t	4800	2073	2567	A	A	A	46	46	46	46	46
	5100	1803	2297	A	A	A	A	A	46	46	46
	5700	2433	2927	A	46	46	46	46	46	46	74
289 x 80 x 7.7	6050	2658	3152	46	46	46	46	46	46	74	74
260 S ... Y/PT	3805	1758	2252	A	A	A	46	46	46	46	74
rear axle 19 t	4200	2118	2612	A	46	46	46	46	46	74	105
	4500	2073	2567	A	46	46	46	46	46	74	89
	4800	2073	2567	46	46	46	46	46	46	74	89
289/199 x 80 x 6.7	5100	1803	2297	A	46	46	46	46	46	57	74
260 S ... Y/PT	5700	2433	2927	A	A	A	A	A	46	46	46
320 S ... Y/S				A	A	A	A	46	46	46	46
rear axle 19 t	6050	2658	3152	A	A	A	A	46	46	46	46
289 x 80 x 7.7											

Models Frame section [mm]	Wheel- base [mm]	Over- hang chassis [mm]	Max overhang superstructure [mm]	Tail lift capacity in kN (kg)							
				7.5 (750)	10 (1000)	12.5 (1250)	15 (1500)	17.5 (1750)	20 (2000)	25 (2500)	30 (3000)
				Minimum value of subframe section modulus of resistance W_x [cm ³] with ultimate tensile strength of the material equal to 360 N/mm ²							
260 S ... Y/FP-GV	4200	2118	2813	A	A	A	A	46	46	46	46
260 S ... Y/FS-GV	4500	2073	2567	A	A	A	A	46	46	46	46
rear axle 19 t	4800	2073	2567	A	A	A	A	46	46	46	46
	5100	1803	2297	A	A	A	A	A	46	46	46
289/199 x 80 x 7.7	5700	2433	2927	A	46	46	46	46	46	46	74
260 S ... X/P, X/FP-D											
rear axle 19 t	4200	2073	2567	A	A	A	A	A	A	46	46
	4500	1803	2297	A	A	A	A	A	A	46	46
289 x 80 x 6.7											
260 S ... Z/P-HM											
rear axle 19 t	3820	1488	1982	A	A	A	A	A	A	A	A
	4200	1848	2342	A	A	A	A	A	A	A	46
289 x 80 x 7.7	4500	1938	2432	A	A	A	A	A	A	A	46
320 S ... Y/PS											
	4200	2118	2612	46	46	46	46	46	46	46	74
	4500	2073	2567	46	46	46	46	46	46	46	74
	4800	2073	2567	46	46	46	46	46	46	46	74
	5100	1803	2297	46	46	46	46	46	46	46	74
	5700	2433	2927	46	46	46	46	46	46	46	74
289 x 80 x 7.7	6050	2658	3152	46	46	46	46	46	46	57	74

A = The reinforcement section specified for the relevant superstructure on the chassis is sufficient (eg. Table 3.4 for normal bodies).

Note For the dimensions of the profiles see Table 3.2.

The possibility of using materials with superior mechanical characteristics requires verification of the total moment of resistance of the chassis plus subframe.

Procedure for calculating the bending moment on the chassis with overhangs not provided as standard

194753

Figure 36

 W_{TL} = Weight of tail lift W_L = Tail lift capacity

The bending moment on the chassis may be obtained using the following ratio:

$M [Nm] = W_L A + W_{TL} B$ for tail lifts without stabilisers

$M [Nm] = W_L C + W_{TL} D$ for tail lifts with stabilisers

To compensate for frame flexing, which is inevitable when the tail lift is in operation, the bodybuilder may use reinforcement sections with larger dimensions than those indicated in Table 3.11.

The stability of the vehicle in all tail lift operating conditions must be tested in compliance with applicable legislation.

Stabilizers

- **The Bodybuilder must carefully assess any variations in the stability and alignment of the vehicle caused by suspension compression and the chassis during all stages in the operation of the tail lift. Always evaluate whether using stabilisers is advisable even if their use is not rendered necessary by the stresses sustained by the chassis.**

Vehicles with liftable third axle, the use of a tail lift when the third axle is lifted is only allowed using stabilizers.

The stabilizers must be attached to the support structure of the tail lift, and should be preferably hydraulically operated.



- **The stabilisers must be put into operation in all tail lift loading conditions.**

When installing electro-hydraulic tail lifts, ensure that the capacity of the batteries and the power of the alternator are adequate (see Chapter 5.5 (► Page 35)).

The bodybuilder is also responsible for:

- any modifications to the under-run cross member or the arrangement of another new type (see Chapter 2.20);
- the observance of the visibility of the rear lights,
- the observance of the overhang angles,
- the positioning of the tow hook,

based on the various national legislation.

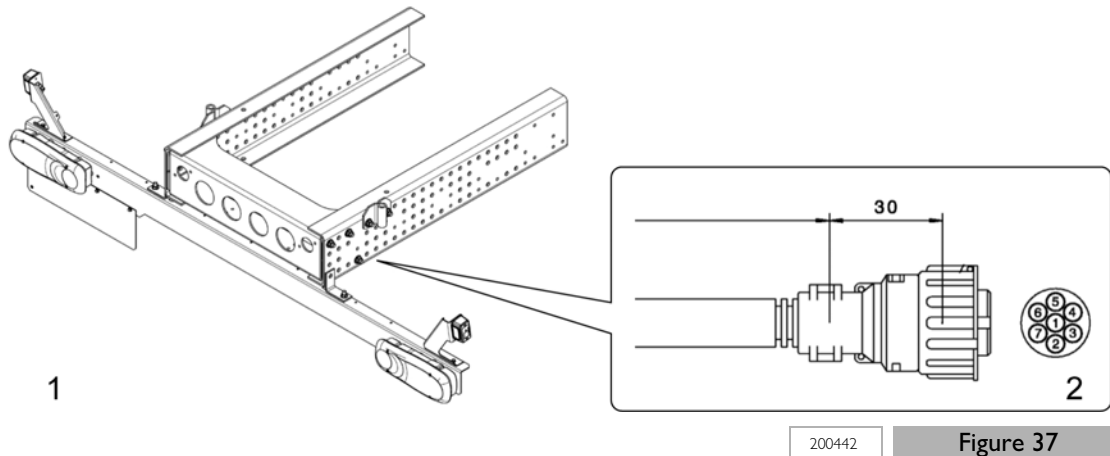
VEHH configuration for tail lifts

To allow compliance with the VEHH standard (Association of European producers of tail lift manufacturers), a designated pre-installation is available (opt. 75182) which prevents the Bodybuilder from having to act on the electrical system.

The VEHH configuration consists of the following:

- temporary rear under-run bar. This is a simple bar with side marker lights, rear lights and a licence plate mount which the bodybuilder must remove and replace with a definitive under-run bar with its own fastening (see Figure 37);
- specific rear light wiring for connection to definitive under-run bar;
- specific wiring with 7-pin connector located on the right side member at the end of the rear overhang (see also Chapter 5.4 - Paragraph "TAIL LIFT" (➡ Page 30));
- specific switch on the dashboard for tail lift and warning light activation (see Figure 38) is requested.

Note The opt. 75182 is only available together with opt. 169 (Vehicle without rear under-run protection RUP).



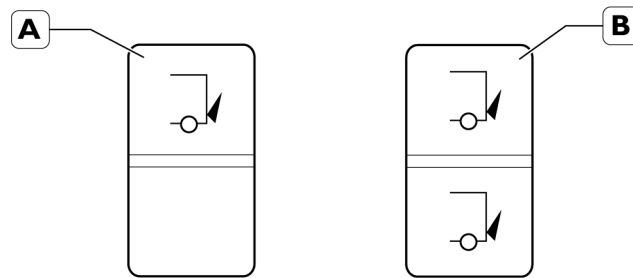
1. Temporary rear under-run bar

2. 7-pin connector 72096

Before operating the tail lift, press switch **(A)** on the central module of the dashboard.

When the green warning light **(B)** activates, this indicates that the control system is ON and that the engine is off; when the red warning light activates, this indicates that the tail lift is open.

Once the movement of the load has completed and after having correctly closed the platform, press the switch **(A)** again to deactivate the system and allow engine start-up.



245560

Figure 38

A. Switch

B. Red/green warning light

3.10 INTERCHANGEABLE OUTFITS

The interchangeable outfits can be separated from the vehicle and positioned on four supports while awaiting subsequent handling. As a rule this involves use of a subframe with longitudinal sections of dimensions based on Table 3.4.

Alternatively there are structures that already include the connection and lifting devices.

If the concentrated loads transmitted by the lifting systems produce great strains on the vehicle chassis, provision must be made for suitable reinforcement.

To ensure proper functionality, the various conditions of the vehicle alignment must be carefully checked according to the characteristics of the suspension. Models equipped with air suspension on the rear or integral axle, are particularly suited for this type of application.

In particular cases the lifting devices, as well as the subframe, may be anchored to the connection plates between the chassis and subframe, provided that they are of suitable dimensions.

For the superstructure connections, especially when rapid closing systems are used, verify that the longitudinal and transverse thrusts which occur under dynamic conditions are adequately withstood.

The possibility of doing without a subframe or a specific sub-structure can be allowed with IVECO authorization under the following conditions:

- the interchangeable superstructure must adhere all along the chassis or at least a large surface area of the suspension connection zone;
- the connection devices, of a suitable number, must be secured on the vertical rib of the side members;
- the lifting devices must be anchored so as to transmit limited stresses to the frame.

SECTION 4

POWER TAKE-OFFS

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POWER TAKE-OFFS

4.1 GENERAL SPECIFICATIONS

Different types of power take-offs (PTO) for motion withdrawal can be mounted for operating auxiliary units. Depending on the type of use and performance required, the application can be fitted to:

- the gearbox;
- the driveline;
- the front of the engine;
- the rear of the engine.

The characteristics and performances are given in the paragraphs which follow and in the relevant documentation which will be supplied upon request.

For the definition of the power necessary for the apparatus to be controlled, particularly when the values requested are high, the absorbed power should also be considered during the drive transmission phase (5 to 10% for the mechanical transmissions, belts and gears, and greater values for the hydraulic controls).

The choice of transmission ratio for the power take-off should be made so that the absorption of power occurs in a flexible engine operating range; low speeds (below 1000 rpm) must be avoided to prevent irregular running.

The available power can be calculated in relation to the power take-off speed and the established torque.

$$P \text{ [HP]} = M n i / 7023$$

$$P \text{ [kW]} = M n i / 9550$$

P = Available power

M = Torque permitted for the power take-off

n = Engine revolutions per minute

i = Transmission ratio = PT output rpm / engine rpm

Type of use

The maximum torque take-off values refer to continuous usage of up to 60 seconds.

Torque take-off values exceeding the maximum values indicated for occasional, limited usage (less than 30 s), must be approved on a case by case basis in relation to the type of application.

In the case of continuous usage exceeding 60 seconds, where the function is comparable to that of a stationary motor, the necessity of reducing torque take-off in relation to other, peripheral conditions (such as engine and transmission cooling necessities) must also be evaluated.

In the case of continuous usage which may lead to high oil temperatures, it is advisable to contact the PTO supplier to determine whether the installation of a dedicated external oil circuit kit is necessary.

The scheduled take-off values are also applicable for uses which do not involve large variations of torque either in frequency or magnitude.

In other cases, to avoid overloading (e.g. hydraulic pumps, compressors) it may be necessary to include the application of devices such as clutches or safety valves.



- ▶ **During prolonged use, the gearbox oil temperature must not exceed 110 °C and the water temperature must not exceed 100 °C.**



- ▶ **Not all types of power take-offs are suitable for continuous use; always follow the specific instructions for the power take-off during operation (working times, breaks etc.).**

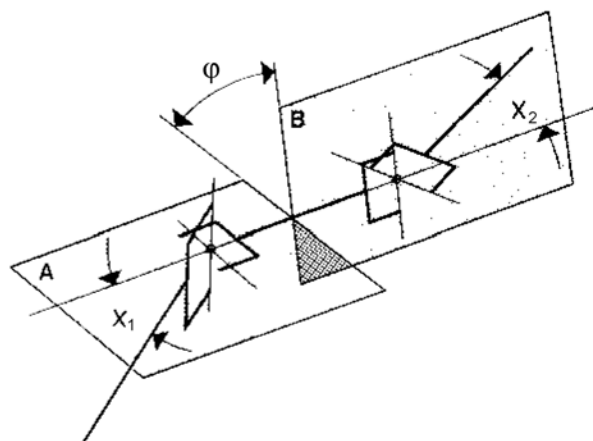
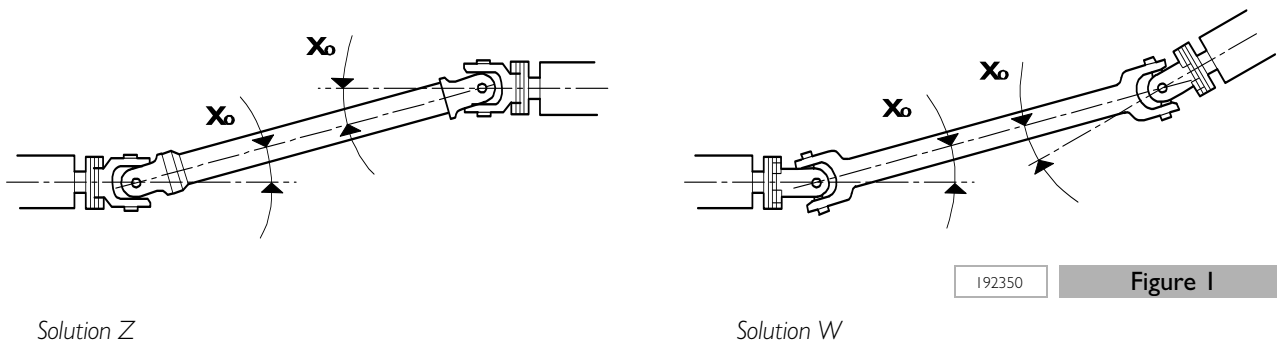
PTO transmission

In full compliance of the Manufacturer's transmission specifications, the kinematic forces from the power take-off to the relevant apparatus should be carefully considered (angles, rpm, moment) during the design phase as well as the dynamic behaviour in the installation phase.

This means that:

- the dimensions should take into consideration the forces which might occur under maximum power and torque conditions;
- to ensure effective kinetic forces, the shaft ends must be at the same angle (see Figure 1) and that this angle must not exceed 7°;
- solution Z is preferred to solution W due to the lower loads on the bearings of the power take-off and the equipment being driven. When it is necessary to obtain a different transmission line with spatial inclinations according to angle ϕ (as shown in Figure 2), it is important to remember that the kinetic forces of the assembly can only be ensured if the intermediate section has forks offset by the same angle ϕ and if equal conditions are respected between the angles at the extremities X_1 and X_2 .

For transmissions employing multiple sections, please refer to the indications provided in Chapter 2.8 (► Page 38).

**Electric system**

On Stralis Euro6 vehicle range all the PTO are managed exclusively by EM, also when PTO fitted in AfterSales. Therefore vehicle order shall contain related OPT 4572.

The VCM and EM electrical/electronic systems (see Figure 1 - Section 5) make available innovative methods and processes for the control of power take-offs able to significantly improve safety and reliability. Activation takes place by connecting the power take-off control switch to connector ST14A.

Pneumatic system

See the description in Chapter 2.15 (► Page 49).

4.2 PTO FROM GEARBOX

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

Table 4.1 shows available torque levels and the ratios between output rpm and engine rpm for the different types of IVECO optional gearbox/PTO combinations.

IVECO must authorize high torque take-offs for sporadic use, according to the type of use.

The PTO must normally be used with the vehicle at a standstill and must be engaged and released with the clutch disengaged so as to avoid excessive stress on synchronisers.

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

For gearboxes with a torque converter, the same power take-offs used on the manual gearboxes may be used. Note however, that when engine speed is lower than approximately 60% of the maximum value, the converter system is in the hydraulic operating phase and that during this phase, depending on the absorbed power the power take-off rpm may fluctuate even if engine rpm is constant.

Transmission PTO data

The following table shows the possible types of PTO.

The installation of a PTO post vehicle production requires the reprogramming of gearbox electronic control unit and the Expansion Module (EM), as well as interventions on the wiring system. Therefore, before proceeding, please carefully read Chapter 4.6 "PTO Management" (► Page 13).

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), providing the information regarding the specific PTO requirements.

Table 4.1 - PTOs available on gearbox

Gearbox	Option no.	PTO type	Assembly side	PTO ratio	Speed factor		Available torque (*) [Nm]
16 S 1620 TD 16 S 2220 TD 16 S 2320 TD					K1 (32/35) 0.91	K2 (30/39) 0.77	
	5202	NH/1b	central	1.00	0.91	0.77	1000
	5205	NH/1c	central	1.00	0.91	0.77	1000
	5209	NH/4b	right	1.28	1.17	0.98	430 (1)
	5210	NH/4c	right	1.28	1.17	0.98	430 (1)
	5258	N221/10b	above	1.48	1.35	1.14	730
	5260	N221/10b	above	1.91	1.75	1.47	560
	5264	N221/10b	above	2.19	2.00	1.68	470
	5255	N221/10c	above	1.23	1.13	0.95	870
16 S 2220 TO 16 S 2520 TO					K1 (35/32) 1.09	K2 (32/35) 0.91	
	5202	NH/1b	central	1.00	1.09	0.91	1000
	5205	NH/1c	central	1.00	1.09	0.91	1000
	5209	NH/4b	right	1.28	1.40	1.17	430 (1)
	5210	NH/4c	right	1.28	1.40	1.17	430 (1)

Gearbox	Option no.	PTO type	Assembly side	PTO ratio	Speed factor		Available torque ^(*) [Nm]
I6 S 2220 TO I6 S 2520 TO	5258	N221/I0b	above	1.48	1.62	1.35	730
	5260	N221/I0b	above	1.91	2.09	1.75	560
	5264	N221/I0b	above	2.19	2.40	2.00	470
	5255	N221/I0c	above	1.23	1.35	1.13	870
	5259	N221/I0c	above	1.48	1.62	1.35	730
I2 TX 1410 TD I2 TX 1810 TD I2 TX 2010 TD I2 TX 2210 TD I2 TX 2420 TD I2 TX 2620 TD					K (34/45) 0.76		
	5202	NH/Ib	central	1.00	0.76		1000
	5209	NH/4b	right	1.28	0.97		430 ⁽¹⁾
	5210	NH/4c	right	1.28	0.97		430 ⁽¹⁾
	78734	N TX/I0b flange	above /H	2.35	1.78		400
	78736	N TX/I0b flange	lower / H	2.35	1.78		400
	78742	N TX/I0c flange	lower / L	1.58	1.19		630
	78745	N TX / I0c+b double output	above/L/pump lower/H/flange	1.48	1.12		670
				2.35	1.78		400
	78485	N TX / I0c+b double output	above/L/pump lower/H/flange	1.23	0.93		690
				1.85	1.40		430
I2 TX 1810 TO I2 TX 2010 TO I2 TX 2210 TO I2 TX 2410 TO I2 TX 2610 TO					K1 (48/38) 1.26	K2 (40/41) 0.98	
	5202	NH/Ib	central	1.00	1.26	0.98	1000
	78732	NH/4b	right	0.90	1.14	0.88	430 ⁽¹⁾
	78733	NH/4c	right	0.90	1.14	0.88	430 ⁽¹⁾
	78735	N TX/I0b flange	above /H	1.59	2.01	—	490
	78737	N TX/I0b flange	lower / H	1.28	1.62	—	580
	78743	N TX/I0c Pump	lower / H	0.91	1.15	0.89	720
	78746	N TX / I0c+b double output	above/L/pump lower/H/flange	0.91	1.15	0.89	720
				1.28	1.62	—	580
Allison 3200	415	870	above	1.00	—	—	660

^(*) Available torque with PTO at 1500 rpm

⁽¹⁾ Sporadic operation < 1 hour of service

Direct application of pumps

When the application of pumps of other equipment is carried out directly from the power take-off, without the use of intermediate shafts and after checking that the size of the pump permits margins of safety with the chassis and engine unit, the static and dynamic torques exerted by the mass of the pump and by the power take-off should be checked for compatibility with the resistance of the walls of the gearbox.

The static moment due to the added masses must not exceed 90 Nm, measured on the pump coupling surface.

Furthermore, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine.



► **Observe values in Table 4.1 for torque take-offs**

4.3 POWER TAKE-OFF FROM TRANSFER BOX

Note *Not present on STRALIS.*

4.4 POWER TAKE-OFF FROM DRIVE LINE

The authorisation for the application of a power take-off on the drive line downstream of the gearbox is issued after examination of the complete documentation presented to the IVECO.

The power and torque values will be evaluated as each occasion arises on the basis of the conditions of use.

In general, the following should be noted:

- The PTO engagement /disengagement must be performed with the gearbox in neutral. During engagement and disengagement power absorption from BodyBuilder must be reduced to 0 Nm;
- the power take-off rpm is dependent on the gear selected;
- the power take-off must be located immediately downstream of the gearbox; for vehicles with the drive line in two or more sections, the power take-off may also be fitted at the flexible support between the first and second sections (respect the indications given in Chapter 2.8 (➡ Page 38));
- the angles of the drive line on the horizontal plane and vertical plane must be kept as close as possible to the original values;
- masses and rigidity added to the drive line must not provoke a loss of balance or abnormal vibrations or damage the transmission drive line (from engine to axle) either during vehicle movement or during operation with the power take-off;
- the power take-off must be fixed to the chassis with its own suspension.



- ▶ **The transmission is an important part for the safety of the vehicle, and as such any intervention on the transmission must only be carried out by specialist companies approved by the manufacturer.**



- ▶ **Any intervention on the driveshaft without prior authorisation from IVECO will immediately invalidate the warranty.**

4.5 POWER TAKE-OFF FROM ENGINE

In general the use of these power take-offs is planned for apparatus applications requiring a continuous power supply.

Torque take-off from the front of the engine

The low torque take-off, tending to be constant from the front part of the engine (only Cursor 9), is possible thanks to the belt transmission, while the use of drive shafts is generally reserved for more significant levels of take-off (e.g.: municipality uses).

In both cases, a specific pre-installation is required which can be requested at the origin (optional 5151) or created with major work carried out on the crankshaft, radiators, bumpers and chassis front cross member.

Particular attention must be paid to:

- to the system comprising additional masses and relative rigidity which must be flexibly disengaged from the crankshaft with regard to the torsional and flexural effects;
- to the additional mass values and relative moments of inertia and to the distance of the centre of gravity of the masses from the centre line of the crankshaft main bearing carrier which must be kept to a minimum;
- to avoiding a reduction in the radiator cooling capacity;
- to restoring the rigidity and resistance characteristics of the modified elements (cross member, bumper, etc.);

- to avoid exceeding, during extended use, temperatures of the engine cooling fluid of over 100°C and engine oil temperature (measured on the main duct of the pressure switch area) of 120 °C. A margin of approx. 10% should however be left. In other cases include supplementary heat exchangers.

Please contact IVECO for further information on the maximum values of the parameters relating to the torque take-off (moment of inertia, moment of bending, multiplication factor, angular position).

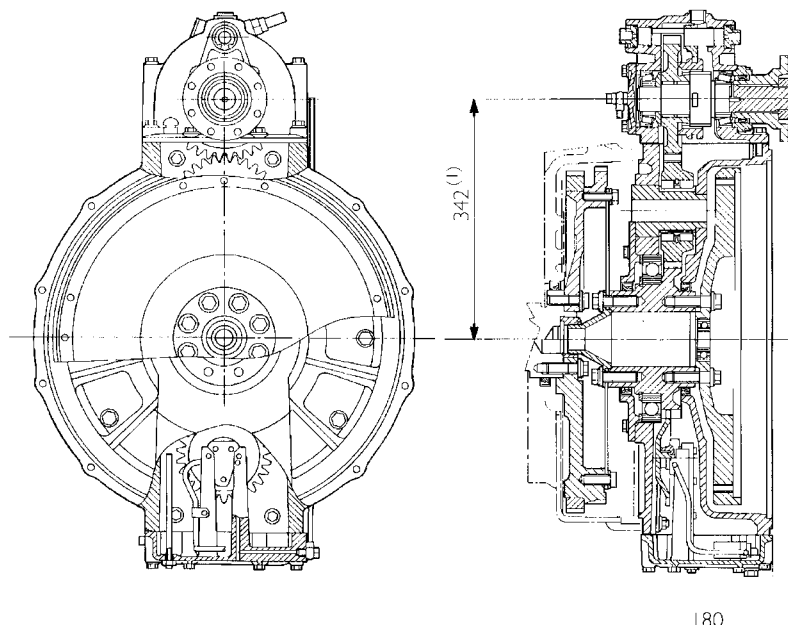
Multipower PTO on engine fly-wheel

Depending on the models in the range, it is possible to install an optional IVECO Multipower power take-off, designed to take off higher torques than other types of PTO. Mounted on the rear of the engine, it takes drive from the flywheel and is independent of the clutch control. It is suitable for use from stationary or with the vehicle moving (for example, municipal applications, concrete mixers etc.) and is combined with an oil cooling radiator fitted on the vehicle chassis.

Some precautions:

- the PTO must be engaged only with the engine at a standstill (the EM control unit (Expansion Module) has a configuration that prevents engagement while the engine is running);
- the unit may be disengaged with the engine running but only if not any power is absorbed by BB. The torque shall be 0 Nm.
- during engine start-up, torque taken must be zero.

Note To guarantee correct engagement, the static moment of connected units must not exceed 35 Nm.



91524

Figure 3

Table 4.2 - Technical specifications

Ratio revolutions - rpm	1.29
Max. torque available	900 Nm
Output flange	ISO 7646-120 x 8 x 10
Control	pneumatic
Direction of rotation	as engine
Installation on engines	Cursor 9-11-13

Weight	70 kg
Oil capacity	2 litres

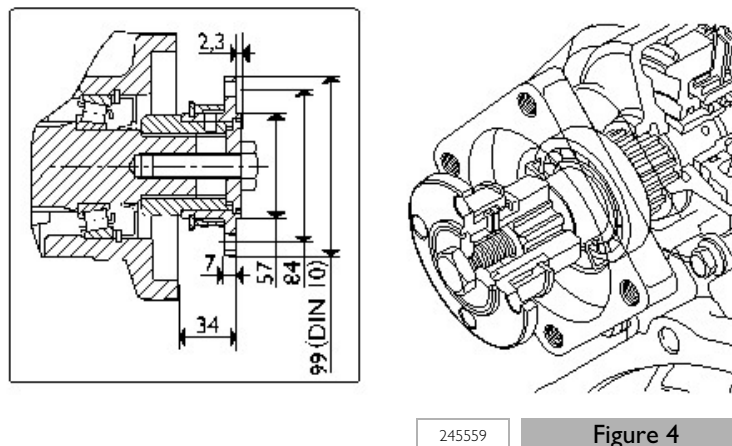
If PTO is engaged while driving, it must be remembered that depending on the gearing ratio of the power take-off (see Table 4.2), connected pumps may reach high rotating speeds (for example: an engine speed of 1800 rpm corresponds to a pump speed of 2400 rpm).

Power take-off on the camshaft

With the exception of tractors, vehicles can be fitted with a power take-off which drives a camshaft gear through clutch engagement; a DIN 10 flange (see Figure 4) allows connection of a drive shaft for the drive transmission to the user.

Engagement is only possible when the vehicle is stationary and with an engine speed of no more than 1000 rpm, while torque take-off can occur when the vehicle is moving and when it is stationary.

Note The installation of this power take-off must be requested when ordering the vehicle; retrofitting in After Sales would require the replacement of the whole engine.



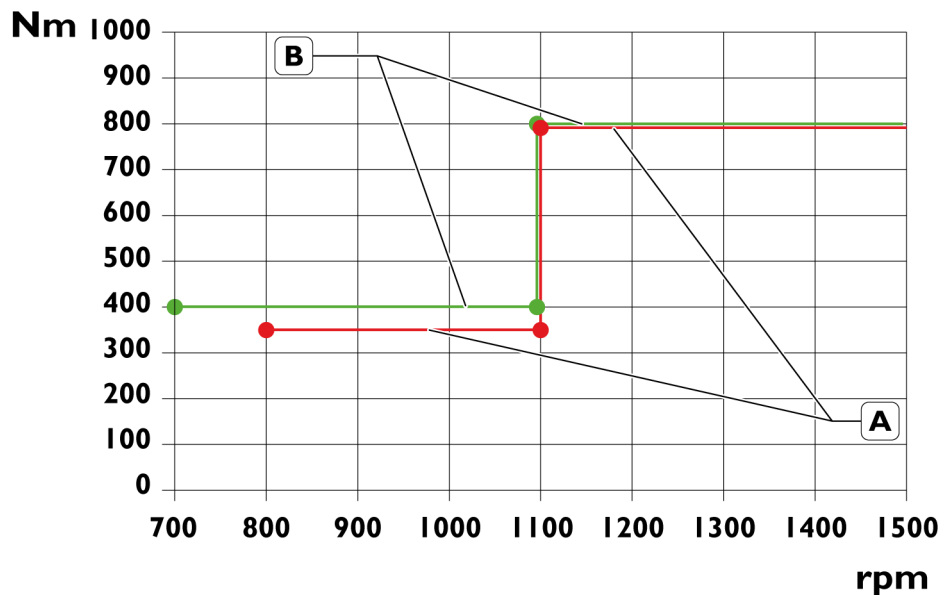
245559

Figure 4

Flange connection DIN 10 (optional 5367) on camshaft PTO

Table 4.3 - PTO specifications

Engine	Power take-off					
	Continuous maximum torque [Nm]	Engine / output speed ratio	Maximum speed [rpm]	Direction of rotation	Clutch engagement air pressure [bar]	Weight [kg]
CURSOR 9	800 (peak 820)	1.14	3200	Opposite to engine	8	13
CURSOR 11	800 (peak 1050)	1.12	3200	Opposite to engine	8	13
CURSOR 13	800 (peak 1050)	1.12	3200	Opposite to engine	8	13

Max. torque available depending on engine speed

245780

Figure 5

A. CURSOR 9

B. CURSOR 11/13

A) Vehicle stationary - PTO mode ON

- The maximum torque take-off is permitted at engine speeds exceeding 1100 rpm.

B) Vehicle running - PTO mode ON

- No torque limitation available in relation to rpm.
- The engine idle speed is set at 800 rpm (CURSOR 9) or at 700 rpm (CURSOR 11/13).
- The air supply system pressure for PTO clutch engagement must exceed 8.5 bar.

When the maximum permitted torque take-off is required, the moment of inertia of the connected rotating masses (including the drive shaft) must not exceed 0.03 kgm².

Once the maximum admissible value for the inertia has been exceeded, a flexible coupling needs to be applied the technical specifications of which are to be requested directly from IVECO.

4.6 PTO MANAGEMENT



- **Interventions that are carried out which do not comply with the following indications, may cause serious damage to the on-board systems (not covered by the contractual warranty) and could compromise the safety, reliability and correct functioning of the vehicle.**

General information

The PTOs are activated by means of solenoid valves and engagement is verified by the "PTO Detection" signal.

"PTO Management" includes safety and control functions and in particular, if the engagement has occurred correctly, carries out "Intermediate speed control".

The "PTO Mode" configuration (most advanced definition) requires programming of the Expansion Module (EM) and the Vehicle Control Module (VCM). The EM is able to drive up to three PTOs and controls their activation and deactivation individually.

The following two conditions must be met to permit activation of a PTO:

1. mechanical engagement
2. recall of a "PTO mode" to be paired

These actions, can be carried out with two separate commands and in sequence, or with a single command from the PTO switches on the central island console in the cab.



- **Only use the signals available on the Bodybuilder connectors (such as parking brake engaged signal, vehicle stopped signal, reverse not engaged signal) to ensure correct PTO management and prevent the risk of drive train damage.**

Definitions

Multiplex

Hi-MUX indicates the set of two control units: Body Computer module (BCM) and Frame Computer Module (FCM).

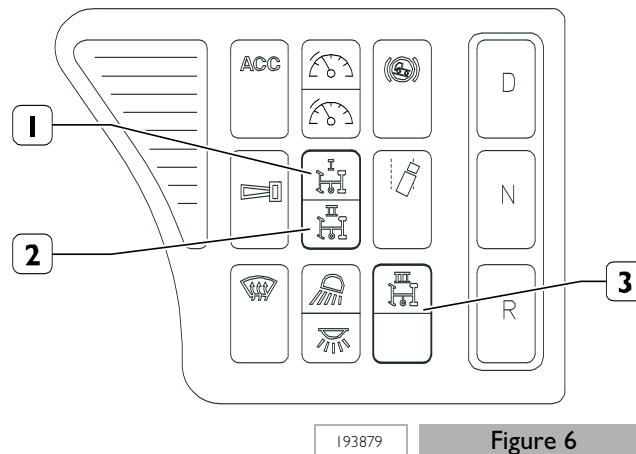
They are connected to the other electronic systems (EDC, VCM, ECAS etc.) in the vehicle.

Information and messages are exchanged by means of Bus CAN lines

PTO switch (PTOsw x, x = 1, 2, 3)

Located in the middle of the dashboard, this is used to request an action relating to a given PTO (for example, depending on EM programming, PTO engagement/disengagement, "Intermediate Speed Control" activation).

Since EM and VCM can control up to three PTOs, up to three switches may be fitted; each switch is connected to connector ST14A (respectively to pins 18, 19, 20).



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Figure 6

1. PTO 1 switch

2. PTO 2 switch

3. PTO 3 switch

Connector ST14A

More detailed information is given in Chapter 5.2 (➡ Page 9).

PTO Mode x ($x = 1, 2, 3$)

Following a request from a PTO switch on the dashboard resp. ST14 input, a PTO mode makes available a set of parameters that allow regular PTO operation.

A PTO mode offers:

- a physical PTO activation request. Possible selections: Yes/No (described below),
- an "Intermediate Speed Control" mode. Possible selections: Yes/No (option, described below).

It is possible to activate up to three PTO modes simultaneously.

Physical PTO Activation

The physical PTO activation is an integral part of a PTO Mode. This includes a set of parameters for mechanical engagement of a PTO. Various parameter sets are available for the different PTOs (depending on the engine and transmission). These guarantee PTO engagement is compliant with the specific requirements.

The PTO configuration may be customised by Iveco Service upon the specific customer request.

The physical activation of the PTO is stored in the EM.

"Intermediate Speed Control" mode x (x = 1, 2, 3)

This mode can be requested by the EM. If request is sent the VCM activates a set of parameters that defines the engine behaviour (activation of an intermediate speed, low idle rpm, high idle rpm, accelerator deactivation etc.). This configuration is stored in the Vehicle Control Module (VCM).

Note *Since the engine can only support one set of parameters at a time, a priority must be established regarding when multiple Intermediate Speed Control modes are required.*

Only management of the power take-offs through the EM control unit ensures comprehensive, reliable and safe PTO management. Only in this way is it possible to guarantee the integration with other vehicle functions.



- **Operating the power take-off without connection to the EM control unit may cause damage to the vehicle.**

Connection to the EM control unit presupposes activation and electrical control of the power take-offs (by means of electromagnetic valves). Air-activated power take-off and/or without connection to the EM control unit are not therefore not recommended by IVECO.

Configurations

Depending on the planned use of the vehicle, Bodybuilders are required to contact IVECO Service in order to carry out the necessary programming of the controls involved (EM, VCM, etc.) for operation of each individual power take-off.

EM - PTO 1, 2, 3 Programming

PTO programming includes the following function groups:

1. PTO switch function
2. PTO hardware
3. Conditions for the mechanical engagement of the PTO
4. Conditions for the mechanical activation of the PTO
5. Extended functions

Adjustments within the five function groups may be defined separately for each PTO mode x (x=1, 2, 3).

1) PTO switch function

The EM control unit controls the PTO modes and speeds by means of switches located on the dashboard and connected to the relevant pin of the connector ST14A.

Operating the switch may determine one of the following actions:

- Mechanical engagement of the PTO (in conjunction with a given PTO configuration)
- Activation of the "Intermediate speed Control" mode
- Mechanical engagement of the PTO (in conjunction with a specific PTO configuration) and activation of the "Intermediate speed control" mode after successful engagement
- No effect

Activation of a PTO by the EM is always connected to a switch operation. However, activating the switch should not necessarily lead to engagement of a PTO (see the list above).

Each switch may be allocated its own PTO configuration. If switch operation also activates "Intermediate speed control" mode, then when different switches are operated simultaneously a selection needs to be made. The following priority must be observed:

- PTO 3 configuration (PTOsw 3): maximum priority (PTOsw 1 and 2 status is ignored);
- PTO 2 configuration (PTOsw 2): medium priority (PTOsw 1 and status is ignored);
- PTO 1 configuration (PTOsw 1): minimum priority.

2) PTO hardware

Vehicles can be fitted with and simultaneously manage up to three of the PTOs described in Chapters 4.2 (➡ Page 7), 4.4 (➡ Page 9) and 4.5 (➡ Page 9).

3) Conditions for PTO engagement

The selection determines which conditions must be satisfied in order to engage the PTO mechanically (electrical activation by means of the electromagnetic valve).

All the configured conditions should be met within a certain time (20s standard). If this does not happen, the EM control unit generates a warning message on the IC display (Instrument Cluster) and stops the engagement procedure. PTO engagement must be requested again (deactivation and reactivation of the PTO switch).

Table 4.4 - Example of configuration

Parameter	Option 1	Option 2	Option 3
Operating brake	Operated	Not operated	Not controlled
Parking brake	Operated	Not operated	Not controlled
Clutch status output	Operated	Not operated	Not controlled
Clutch Timeout	S		
Connector ST91/92/93 3 Pin	Open	Earthed	Not controlled
Coolant temperature	40-100 °C		Not controlled
Clutch slip limit			Not controlled
Expansion module pressure switch (inactive)			
Min. rpm for engagement	650 rpm		Not controlled
Max. rpm for engagement	700 rpm		Not controlled
Min. vehicle speed	0 km/h		Not controlled
Max. vehicle speed	1 km/h		Not controlled
Lowest speed engaged			Not controlled
Highest speed engaged			Not controlled
Gear in neutral	In neutral	Gear engaged	Not controlled
Reverse gear	Operated	Not operated	Not controlled

4) Conditions for mechanical engagement of the PTO

The selection determines the conditions and the limit values which must not be exceeded or which must at least be reached.

With reference to Table 4.4, if any condition is violated, the PTO will be deactivated and a warning is displayed on the IC (Instrument Cluster).

5) Extended functions

a. Timing behaviour of PTO Mode request

The EM control unit expects that certain PTO engagement conditions are met within a certain time period (standard 20 seconds) after the PTO request. Once this period has elapsed, the PTO mode request is rejected and an error is displayed.

The time interval is programmable (0 - 25 seconds). The PTO switch must then be cycled (switched off and on again).

b. Timing behaviour of physical PTO engagement monitoring

Establishes the interval between PTO solenoid valve activation and physical PTO engagement, being checked by PTO feedback signal. If the set interval is exceeded, the request is rejected and an error is displayed.

c. Timing behaviour of PTO deactivation condition monitoring

If any of the defined deactivation conditions are not met for a period exceeding a specified time period (generally 10 seconds as the default setting) during the physical engagement of a PTO, the configured actions (physical deactivation of the PTO, sending of an ISC OFF command, sending of an ISC RESUME command) are initiated and an error is displayed. The time interval is programmable (0 - 10s).

d. Timing behaviour of physical PTO deactivation

Establishes the interval between PTO solenoid valve de-activation and physical PTO disengagement, being checked by PTO feedback signal. If the time interval is exceeded, an error message is displayed.

e. Timing behaviour between clutch activation and PTO engagement

Establishes a minimum time interval within which the clutch must be operated before PTO engagement is permitted and carried out (to be used only with manual non Single_H transmission).

f. Timing behaviour of error identification

Time that elapses before an error activates Degraded Mode.

Table 4.5

Parameter	Condition 1	Condition 2
Timeout at activation	1 - 10 s	Not controlled
Timeout at PTO activation conditions	1 - 10 s	Not controlled
Timeout at activation via switch	1 - 10 s	Not controlled
Timeout at PTO deactivation conditions	1 - 10 s	Not controlled
Timeout for error identification	1 - 10 s	Not controlled

Note Where possible, all the activation and deactivation and Timeout control condition parameters must be set to enable monitoring. When a failure tolerant approach is needed the selection of "is not controlled" is to be preferred.

PTO mode 0 (driving mode)

With a speed below 25 km/h, it is possible to activate intermediate engine rpm.

The intermediate rpm is set at 900 rpm and can be modified as follows:

1. activate the Resume function
2. adjust the speed to the required level using SET+ or SET-
3. activate Resume for at least 5 seconds.

The adjustment field with the gearbox in neutral is set at 100 rpm, but can be increased up to 200 rpm.

For safety reasons, it is not possible to modify the following settings:

Table 4.6

Parameter	Function
Resume/OFF	Activation/deactivation of intermediate speed
SET+ / SET-	Increase/reduction of intermediate speed
Conditions leading to intermediate speed deactivation	• Operation of the brake or clutch pedal • CCoff activation on control lever or on ST14A • Operation of engine brake/Intarder
Accelerator	Activated
Maximum engine speed set with SET+	NLL - 1800 rpm
Maximum speed achievable by means of the accelerator pedal	NLL - 2700 rpm (Cursor 9) NLL - 2340 rpm (Cursor 13)
Engine torque	Maximum torque according to engine

PTO modes 1, 2, 3 (configurable)

Through IVECO Service, three different and independent PTO maps can be set. Since the engine can only operate with one PTO mode at a time, the following priorities are assigned to the modes:

- speed mode 3: maximum priority (speed modes 1 and 2 are ignored);
- speed mode 2: average priority (speed mode 1 is ignored)
- speed mode 1: minimum priority.

Note The Bodybuilder must observe this order of priority when managing fitting and interface fitting. This is so as to avoid additional costs for subsequent modifications to the wiring or reprogramming.

The following table provides an overview of parameters which must be determined individually for each mode (programming by IVECO Service).

Table 4.7

Parameter	Option 1	Option 2
Engine speed adjustable by means of Set+ ⁽¹⁾	550 - 1800 rpm	
Engine speed adjustable by means of Set- ⁽²⁾		
Maximum torque ⁽³⁾	According to engine	
Theoretical speed in neutral ⁽⁴⁾		
Angular coefficient of torque curve Nm/rpm		
Speed threshold for PTO/CC activation (km/h) ⁽⁵⁾	1 km/h	
Speed deactivation with parking brake not engaged	Yes	No
Activation of parameter for maximum PTO speed ⁽⁶⁾	Yes, by selection	No
Maximum PTO speed (km/h) ⁽⁷⁾	1 km/h	
Speed deactivation by operating brake pedal ⁽⁸⁾	Yes	No
Speed deactivation by driver operating brake pedal ⁽⁸⁾	Yes	No
Speed deactivation by driver operating Intarder ⁽⁸⁾	Yes	No
Speed deactivation by operation of engine brake by means of CAN	Yes	No
Speed deactivation by operation of Intarder by means of CAN	Yes	No
Speed deactivation by operation of clutch ⁽⁸⁾	Yes	No
Speed deactivation if this is lower than minimum speed setting ⁽⁸⁾	Yes	No

Parameter	Option 1	Option 2
Speed deactivation if this is greater than maximum speed setting ⁽⁸⁾	Yes	No
Speed deactivation due to an error in the CC module ⁽⁸⁾	Yes	No
Speed deactivation in the event of service brake and parking brake switch error ⁽⁸⁾	Yes	No
Deactivation of accelerator pedal	Yes	No
Resume function on start-up	Yes	No
Maintaining other PTO operating modes via Resume function key ⁽⁹⁾	Yes	No
Speed deactivation in the event of speed sensor error ⁽⁸⁾	Yes	No
Speed deactivation in the event of exceeding coolant temperature ⁽⁸⁾	Yes, by selection	No
Coolant temperature (°C)	80 °C - 110 °C	
Speed deactivation with gear engaged ⁽¹⁰⁾	Yes	No
Speed deactivation with reverse gear engaged ⁽¹¹⁾	Yes	No
Activation for control of lowest speed for PTO engagement/disengagement ⁽¹¹⁾	Yes, by selection	No
Lower speed for speed activation/deactivation	1 st - 5 th gear	
Activation for control of the highest gear for PTO engagement/disengagement ⁽¹¹⁾	Yes, by selection	No
Highest speed for speed activation/deactivation	1 st - 5 th gear	
CC adjustment and Memo function ⁽¹²⁾	See description	See description
Engine speed via Memo ⁽¹³⁾	Final speed 550-LL	
Maximum speed via Set+ ⁽¹⁴⁾	1 km/h	
Temporary activation of engine speed increase by another control device ⁽¹⁵⁾	Yes	No
Temporary activation of speed increase by driver ⁽¹⁶⁾	Yes	No
Activation for a reserved speed	Yes, by selection	Not controlled
Value of reserved speed (km/h) ⁽¹⁷⁾		
Torque limitation according to engine speed (rpm)		
Torque limitation according to torque moment (Nm)		
Increase/reduction of speed with SET+ / SET- (rpm/min) activation ⁽¹⁸⁾		
Time required to reach selected speed ⁽¹⁹⁾		
Speed deactivation via external torque moment request (Nm)		

⁽¹⁾ Maximum rpm may not be exceeded using Set+.

⁽²⁾ Minimum rpm may not be exceeded using Set-.

⁽³⁾ To avoid damage to the PTO and transmission, engine torque should be adapted to the PTO.

⁽⁴⁾ Maximum variable rpm of engine with no load. Caution: this speed (rpm) differs from the PTO speed according to the PTO transmission ratio!

⁽⁵⁾ Up to this setting, the intermediate speed regulator is active in the following PTO modes (it regulates engine speed independently of the gear). If the set value is exceeded by pressing Set+ again, automatic switching takes place to CC mode (Cruise Control: speed is suggested independently of the gear).

⁽⁶⁾ If this value is exceeded, the intermediate speed will be deactivated and the speed will return to the value indicated in Note ⁽¹⁴⁾.

⁽⁷⁾ If the set speed is exceeded, the set intermediate speed will return to the value indicated in Note ⁽¹⁴⁾. Despite possible speed fluctuations, the value is always 5 km/h lower than the set value. If the value is changed, the value indicated in Note ⁽¹⁴⁾ is also automatically changed.

⁽⁸⁾ The intermediate speed is deactivated and returns to the value indicated in Note ⁽²⁾.

⁽⁹⁾ If the setting is on "Yes", the speed of the previously engaged mode is maintained, despite switching between the individual speed modes. If the setting is "No", the speed is adjusted to that of the corresponding selected mode (considering priority).

⁽¹⁰⁾ If the setting is "No", fields 20, 21 and 22 are activated. If the setting is "Yes", no input is possible in these fields.

⁽¹¹⁾ Becomes an unsatisfied condition. The intermediate speed setting returns to the value in Note ⁽²⁾.

(12) Three adjustment options are available in this case:

- Option 1: No possibility of calibration. The speed set at Note (10) is fixed and cannot be altered by the driver by means of SET+ / SET-;
- Option 2: calibrations possible. The speed set at Note (13) is fixed and may be adjusted by the driver using Set +/Set - on the basis of the adjustment range shown in Notes (1) and (2);
- Option 3: with calibration and possibility of storage. The speed set at Note (13) is fixed and may be adjusted by the driver using Set +/Set - on the basis of the adjustment range shown in Notes (1) and (2) and stored as a new speed.

(13) If a speed is already stored, this will be automatically activated at the time of engagement. This speed may be altered, as described under Note (16).

(14) Speed that may be achieved at maximum with SET+.

(15) Must be set to "No". With the programming on "YES" intermediate speed may be imposed by the EuroTronic transmission switching procedure. One consequence of this could be a PTO over speed.

(16) Must always be set to "No" to ensure that the Kickdown function is excluded. If set to "Yes", the driver could exceed the set speed limit by operating the kickdown function.

(17) If a power take-off is used on the propeller shaft (N90 - Omsi - etc.), it is possible to engage a speed higher than 90 km/h in this case in order to allow it to work in the highest gear with high engine rpm without the speed limit cutting in.

(18) Possibility of adjustments to modify rpm each time Set+/- is pressed.

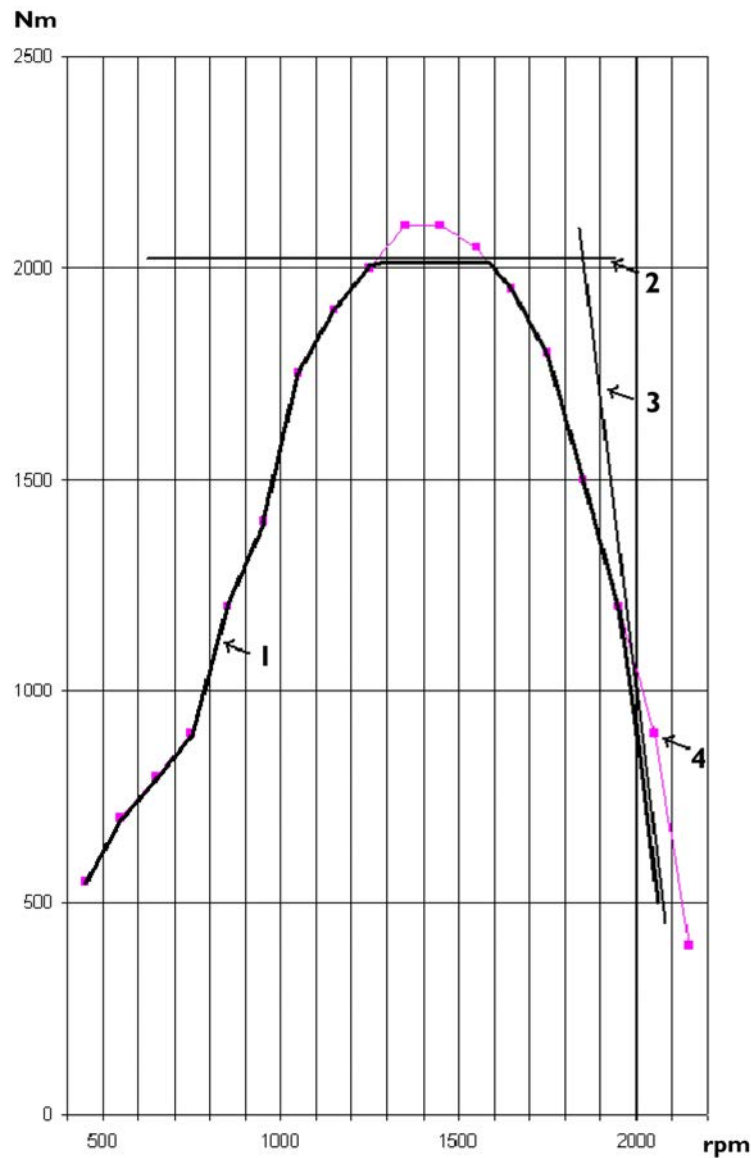
(19) The speed control activates after a correction time (time during which the modified signal remains uninterrupted in order to be accepted as valid) in the new selected speed mode (pin connector ST14 pins 18, 19, 20). This correction time may be shortened in relation to the factory setting (500 ms), down to 100 ms.

Modifications to the torque curve, maximum engine speed and slope of speed limiter of maximum engine speed

For mechanical power take-off protection, it is possible to limit:

1. engine torque delivery as a protection against overload;
2. engine rpm, as a protection against over-speed.

The diagram in Figure 7 shows this qualitatively by means of a torque/engine rpm curve (defined by 16 points), a horizontal section (representing torque limitation) and a sloping section (representing over-rev adjustment).



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Figure 7

- 1. Example of engine curve
- 2. Maximum torque straight limitation line

- 3. Over-revving adjustment
- 4. Engine curve point

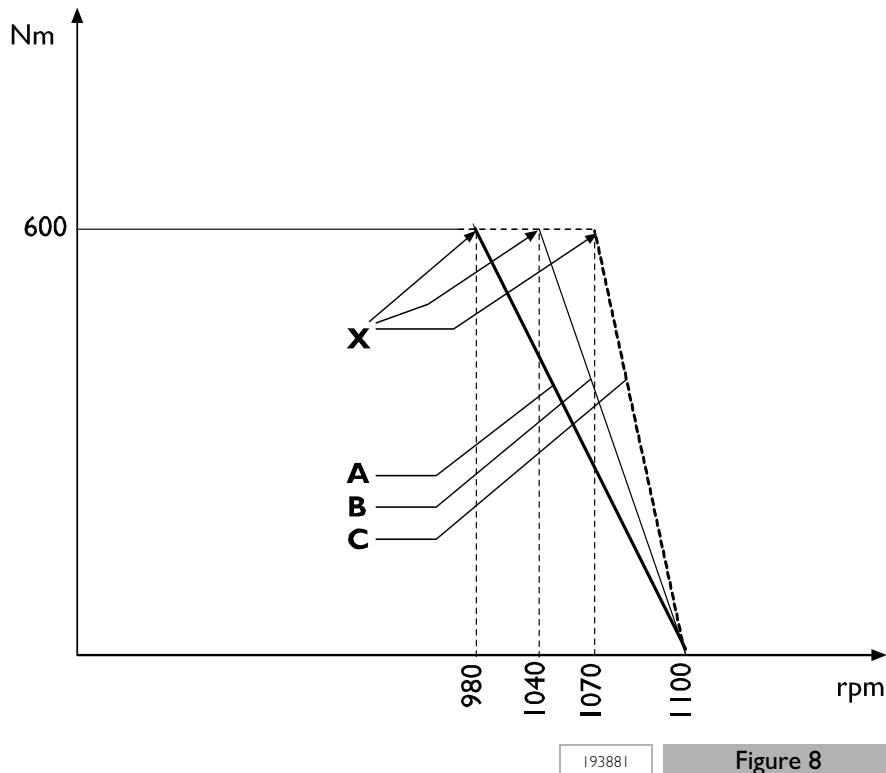
After setting a maximum for engine rpm and a variation mode (slope 3), we obtain a point of intersection X with the straight line of the set torque and therefore the maximum rpm compatible with this torque on the x-axis.

In other words: as the engine rpm increases, the control unit uses the lowest torque value between those on curve 1 and those on straight line 2 and then, for speeds greater than that determined by point X, causes the over-revving adjustment device to cut in and thus reduce the torque.

Please note that:

- the Bodybuilder chooses the engine speed up to which the selected torque must be available according to the intended use of the PTO;
- The speed referred to is that of the crankshaft and not the PTO, for which the rpm must be calculated taking into account the reduction ratio (see Table 4.3);

- the limitations (torque, intersection point and curve gradient) may be selected independently of one another; It is, however, advisable to set a combination;
- these parameters may only be activated by IVECO.



We will take a look at the example in Figure 8:

- max. engine torque 600 Nm;
- standard power take-off operation is specified at 900 rpm;
- engine rpm must not exceed 1100 rpm;
- rpm must be calculated for all over-revving rpm regulator gradients;
- variable over-revving rpm regulator curve gradient: 0 - 0.2 rpm/Nm.

The corresponding power at 1100 rpm and a torque of 600 Nm gives (see equations on page 4-3):

$$P = (600 \cdot 1100) / 9550 = 69 \text{ kW} = 94 \text{ HP}$$

The overrevving regulator curve (gradient) depends on the specific application.

With stationary operation, a steep overrevving rpm adjustment curve is therefore generally sufficient, while in driving mode this may give rise to rapid load changes (which could be a problem).

Therefore:

- with regulator at 0.05 rpm/Nm (curve C in figure), a torque of 600 Nm is available up to $1100 - (0.05 \times 600) = 1070$ rpm;
- with regulator at 0.1 rpm/Nm (curve B), the torque is available up to 1040 rpm;
- with regulator at 0.2 rpm/Nm (curve A), the torque is available up to 980 rpm.

4.7 STANDARD CONFIGURATIONS

Note The conditions described below can be modified by IVECO Customer Service.

No PTO installed or pre-installations

Only the engine speed programming is requested by the VCM.

The switches select the following three speed modes:

Table 4.8

PTO SW 1	PTO Mode 1	900 [tr/min]
PTO SW 2	PTO Mode 2	1100 [tr/min]
PTO SW 3	PTO Mode 3	1300 [tr/min]

PTO Multipower

Only the engine speed programming is requested by the VCM.

The switches select the three speed modes (see Table 4.8).

Activation conditions

Engine status	OFF
Pressure switch	ST91 - pin closed
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Deactivation conditions

Vehicle status	not stationary (PTO3)
Vehicle speed	> 25 [km/h]
Coolant temperature	> 120 [°C]

PTO 1,2 and manual gearbox

Activation conditions

Engine status	ON
Clutch status output	deactivated
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Deactivation conditions

Engine status	OFF
Vehicle status	not stationary (PTO3)
Vehicle speed	> 25 [km/h] (PTO1, PTO2)
Coolant temperature	> 120 [°C]

PTO 1,2 and gearbox 12TX**Activation conditions**

Gearbox status	consent
Engine status	ON
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Deactivation conditions

Vehicle status	OFF
Coolant temperature	> 120 [°C]

PTO 1,2 and automatic gearbox**Activation conditions**

Engine status	ON (500 < rpm < 900)
Gearbox status	neutral
Vehicle status	stationary or crawling speed (0 < v < 2 [km/h])
Coolant temperature	< 120 [°C]

Deactivation conditions

Engine status	OFF
Vehicle speed	> 20 [km/h]
Coolant temperature	> 120 [°C]

Engine PTO**Activation conditions**

Engine status	ON (engine speed < 1000 rpm)
Vehicle status	stationary
Coolant temperature	< 120 [°C]

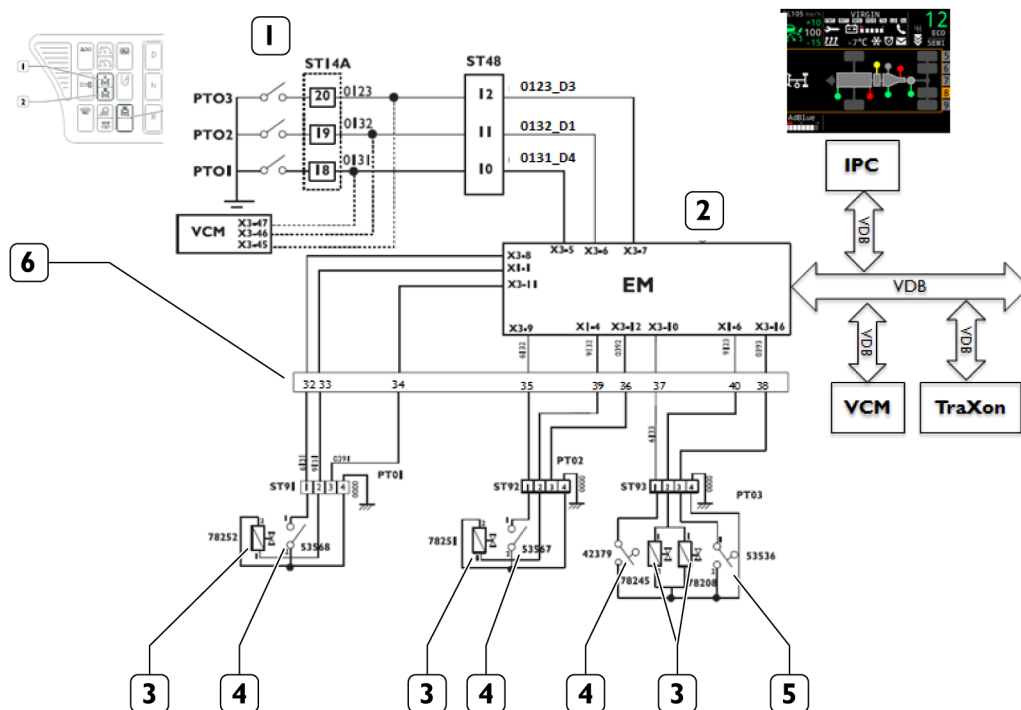
Deactivation conditions

Vehicle status	OFF
Coolant temperature	> 120 [°C]

4.8 EXPANSION MODULE (EM)

The EM control unit can be used for the electronic management of the PTO and for special applications (for example: waste collection); alternatively, the EM provides a CANOpen interface with special access points for Bodybuilder, in accordance with standard CiA 413 Truck Gateway.

Figure 9 shows the wiring diagram, while Figure 10 shows the block diagram of the hardware structure.

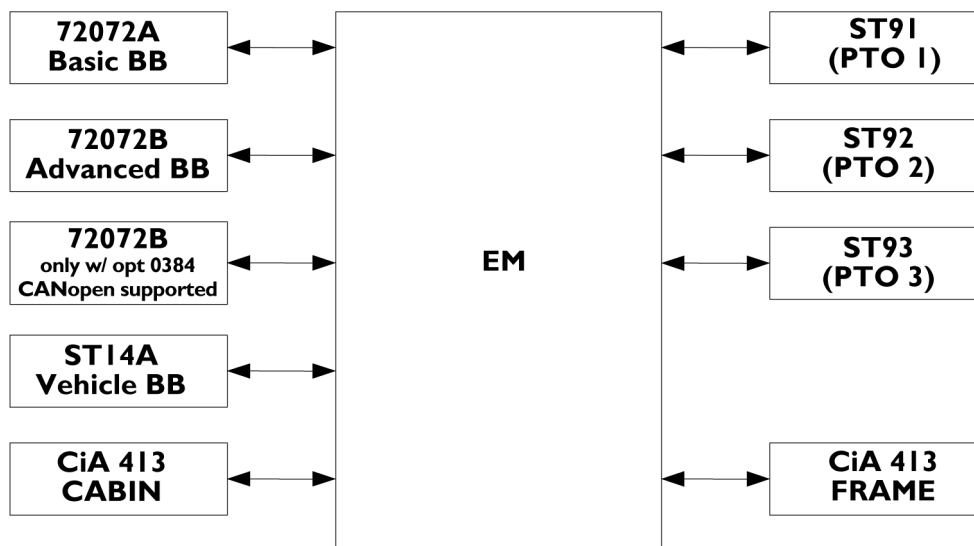


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Figure 9

1. PTO switches
2. EM control unit
3. PTO control solenoid valves
4. PTO return signal

5. PTO Pressure switch resp. Bodybuilder PTO3 engagement consent
6. Bulkhead connector "B"



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Figure 10

To ensure PTO activation and representation of this on the IC instrument panel, the connections on ST91, ST92 and ST93 (described in Chapter 5.2 - Paragraph "Connectors on the chassis" (➡ Page 24)) must be made as indicated in Figure 9; the Table below describes the functions available at the terminals of these connectors.

Table 4.9 - IN / OUT: ST91, ST92, ST93

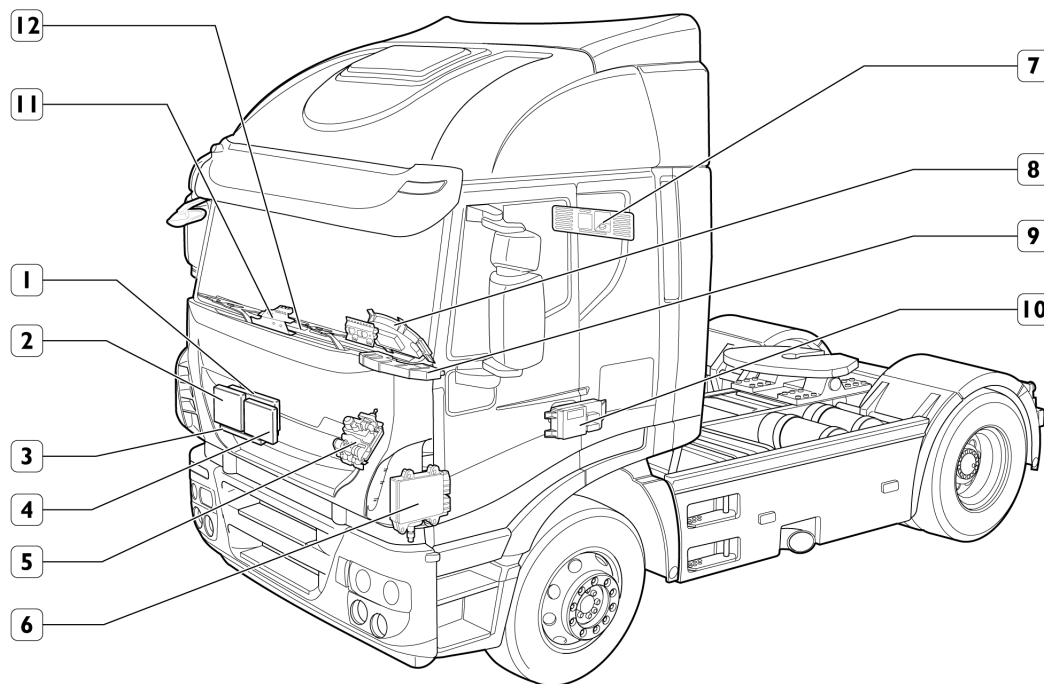
Pin 1	PTO feedback
Pin 2	PTO actuator (solenoid valve control)
Pin 3	pressure switch (PTO Multipower) or consent to PTO engagement external Bodybuilder
Pin 4	Ground

SECTION 5

**ELECTRONIC
SUB-SYSTEMS**

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Position of electronic control units

245782

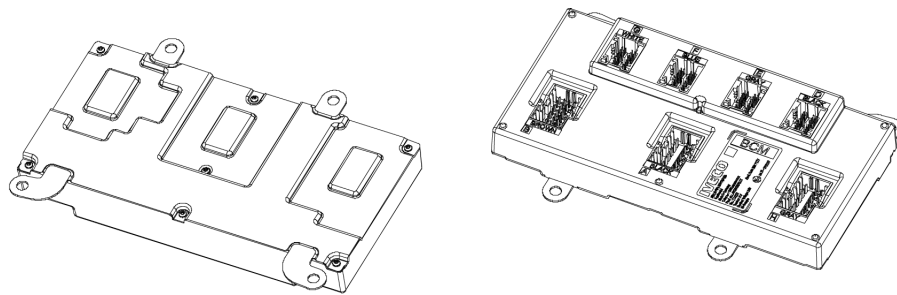
Figure 2

- | | |
|---|-------------------------------------|
| 1. BCM Body Computer Module | 7. BM Bed Module |
| 2. EM Expansion Module | 8. IC Instrument Cluster |
| 3. VCM Vehicle Control Module | 9. SWI Steering Wheel Interface |
| 4. ECAS Electronic Control Air Suspension | 10. FCM Frame Computer Module |
| 5. EBS Electronic Brake System | 11. MC Mirror controller (optional) |
| 6. EDC Engine Diesel Control | 12. CC Climate Control |

Body Computer Module (BCM)

The Body Computer Module is the vehicle's central control unit, in which important signals are processed for the interaction with individual systems.

Located in the cab, below the dashboard in front of the passenger, this module also controls various equipment (interior lights, switches on dashboard, door locking, windscreen wiper) and manages the front light assembly.



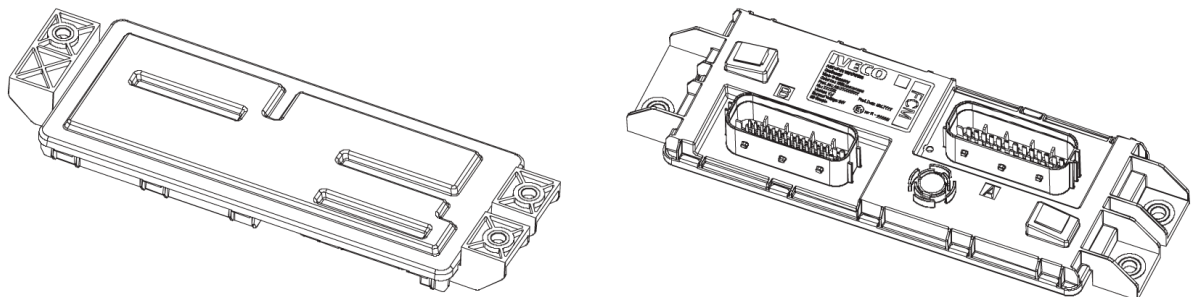
245784

Figure 3

Frame Computer Module (FCM)

The Frame Computer Module (FCM) processes information from the subsystems (rear light assembly, EC-APU, fuel tank...) and the Bodybuilder connectors located in the rear part of the chassis, as well as those coming from the trailer and semi-trailer. This information is then forwarded to the BCM.

Located inside the right side member, it is located behind the rear axle on trucks and near the fifth wheel coupling on tractors.



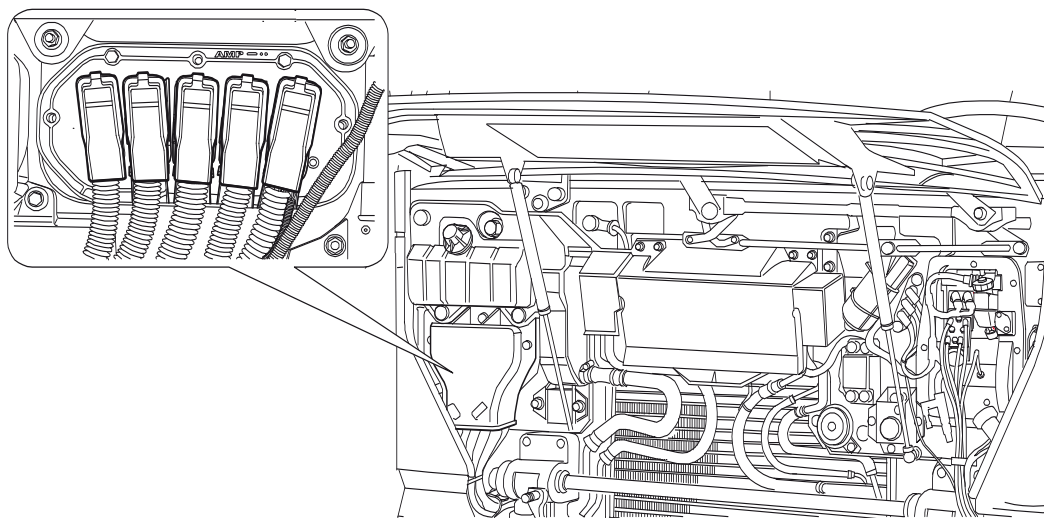
245785

Figure 4

Bulkhead coupling (passage of electrical wiring)

The subsystems fitted on the chassis are connected to the control units in the cab via the "bulkhead connector" which is the interface for the electric connectors.

The bulkhead connector is located under the hood.



190402

Figure 5

Expansion Module (EM)

The EM (Expansion Module) control unit, located in the cab control unit compartment (passenger side), controls the power take-offs and makes it possible to carry out complex applications such as:

- control of the transmission (gearbox) from external sources (TCI message);
- control of the engine from external sources such as engine speed requests and limits, vehicle speed limit, start up and engine stop;
- safety rules for waste collection applications;
- optimisation of the brake system for waste collection applications;
- control of additional lights;
- interface with CAN_open network.

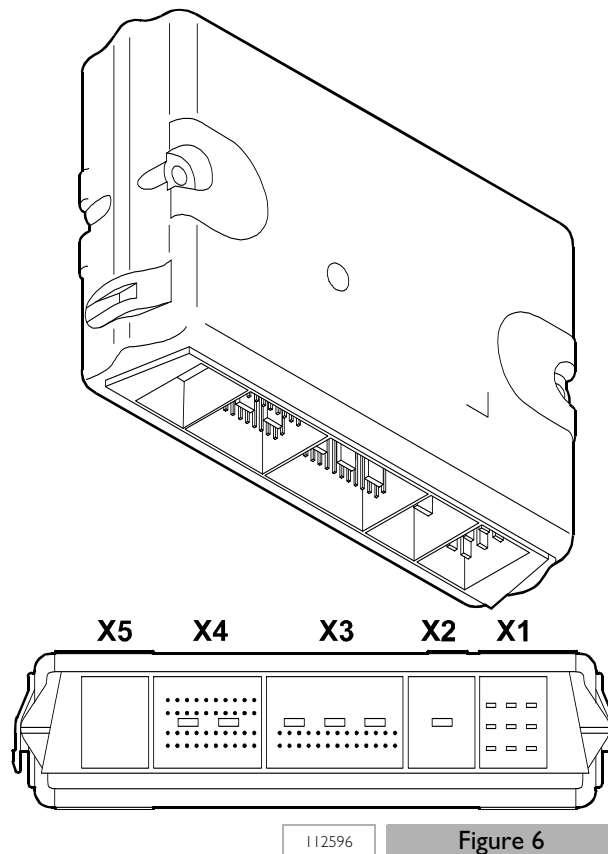


Figure 6

For a more in-depth analysis of the operating logic of the EM, it is possible to access the specific EM WP 2.2 Bodybuilder Manual, by making a request at www.ibb.iveco.com.

5.2 BODYBUILDER CONNECTORS

The standard vehicle outfitting requires connectors **ST14A, ST14B, ST52, ST64, ST77, ST78**.

Optional connectors are: **ST14C, ST40, 72072A, 72072B, 72072C, 72072D, ST91, ST92, ST93**.

Each is described below depending on its location in the cab (see Paragraph "Connectors in the cab" (► Page 10)) or on the chassis (see Paragraph "Connectors on the chassis" (► Page 24)).

In order to interface with the equipment, the Bodybuilder must have the counterpart (female) and must use contacts realized according to the following diagrams:

Table 5.1 - Connectors ST14A, ST14B, ST14C, ST40, 72072A, 72072C

Cable section	Contact code
0.35 mm ²	41200694 EZ
0.5 mm ² - 1.0 mm ²	41200695 EZ
1.0 mm ² - 2.5 mm ²	41200696 EZ
2.5 mm ² - 4.0 mm ²	41200697 EZ

Table 5.2 - Connector 72072B

Cable section	Contact code
0.35 mm ² - 0.5 mm ²	500314820 EZ
0.75 mm ² - 1.5 mm ²	500314821 EZ

Table 5.3 - Connectors ST52, ST64, ST77, ST78, ST91, ST92, ST93

Cable section	Contact code
0.35 mm ² - 0.5 mm ²	9845 7375 EZ
0.75 mm ² - 1.5 mm ²	9843 5370 EZ

A) Connectors in cab

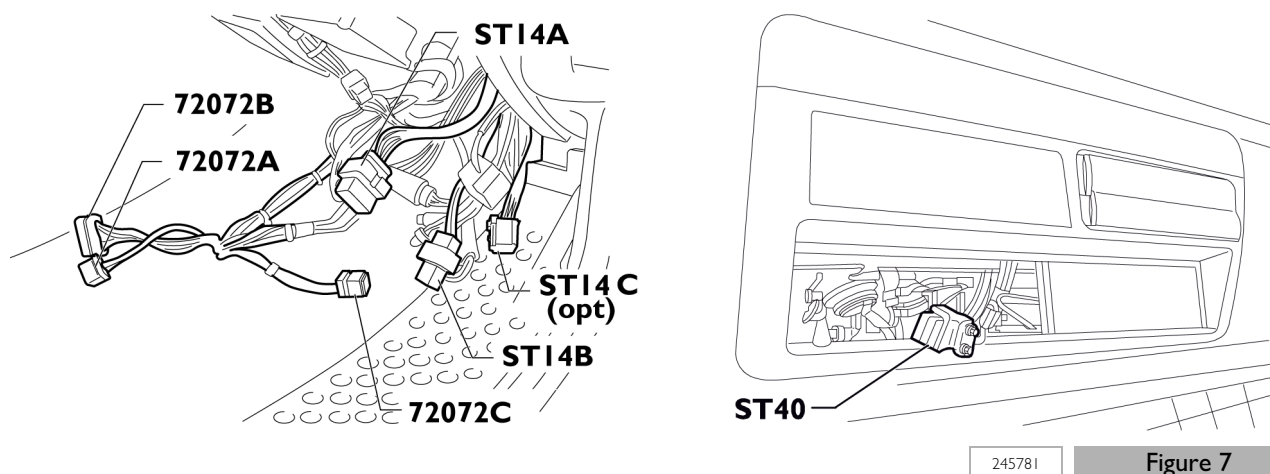
The following connectors are located inside the cab:

- ST14A (standard connector for Bodybuilder)
- ST14B (standard connector for Bodybuilder)
- ST14C (Allison automatic gearbox)
- ST40 (FMS)
- 72072A (EM)
- 72072B (EM)
- 72072C (EM)

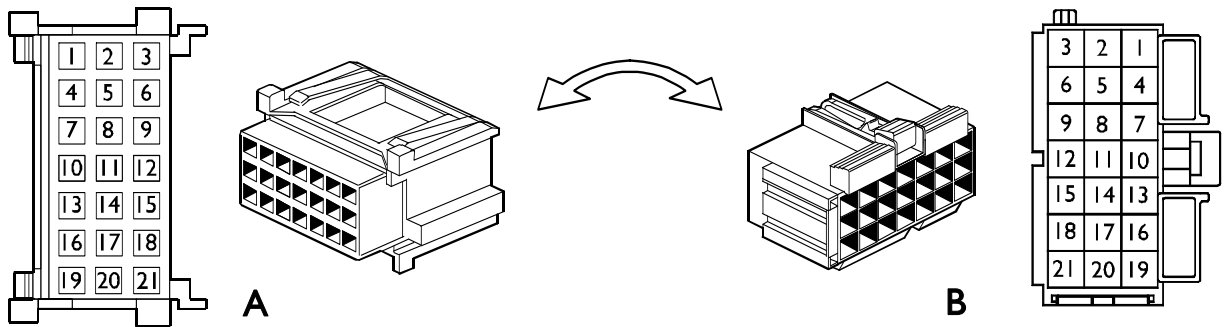
Location of connectors inside cab

The connectors in the cab are almost all housed behind a cover in the passenger side foot rest compartment.

The ST40 connector (FMS - Fleet Management System) is housed in one of the compartments in DIN format, located on a cross member above the driver's side sun visor.

**Figure 7**

a) Standard connector ST14A: 21 pin, blue



190411

Figure 8

A. 41118338 Counterpart to be coupled (female)

B. 41118319 Existing part on vehicle (male)

Table 5.4 - Basic functions of connector ST14A

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Engine Start	8892	Input 10 mA	VCM X3-27	Ground = start engine (the signal must be permanently active while the engine is turning) ⁽¹⁾ Open wire = no action
2	Engine stop	0151	Input 10 mA	VCM X3-26	Ground = stop engine (brief activation with V < 6 km/h, sufficient to stop the engine; with V > 6 km/h it does not work); Open wire = no action
3	Service brake	1165	Output 200 mA	VCM X1-13	0 V = service brake not pressed +24 V = service brake pressed
4	Vehicle standstill	5515	Output 200 mA	BCM G36	+24 V = vehicle stationary (V < 1 km/h) 0 V = vehicle moving (V > 5 km/h)
5	Parking brake	6656	Output 200 mA	VCM X1-10	0 V = not engaged +24V = engaged
6	Not connected				
7	Vehicle speed	5540	Output 10 mA	DTCO - B7	Pulse signal ⁽²⁾
8	Engine status	7778	Output 200 mA	BCM G06	0 V = engine stopped (< 50 rpm) +24 V = engine running (> 800 rpm)
9	Gearbox neutral	8050	Output 200 mA	VCM X1-07 EM X1-07	0 V = neutral not engaged +24 V = neutral engaged Signal controlled by EM, when installed; Else input driven by VCM
10	Reverse gear	2268	Output 200 mA	BCM G35	0 V = reverse gear not engaged +24 V = reverse gear engaged
11	K15	8871	Output 5 A	BCM H04	K15
12	CC Set+	8156	Input 10 mA	VCM X3-33	Input signal ⁽³⁾ Open wire = Set + not activated Ground = Set+ activated
13	CC Set-	8157	Input 10 mA	VCM X3-32	Input signal ⁽³⁾ Open wire = Set - not activated Ground = Set- activated

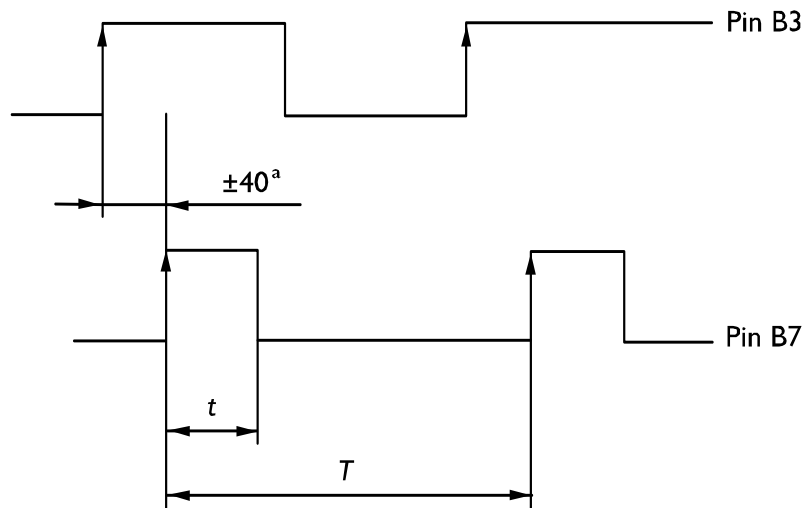
Pin	Description	Wire code	Max. Load	Connected to	Remarks
14	CC OFF	8154	Input 10 mA	VCM X3-30	Input signal ⁽³⁾ Open wire = Off not activated Ground = OFF activated
15	Cruise Control RES	8155	Input 10 mA	VCM X3-31	Input signal ⁽³⁾ Open wire = RES not activated Ground = RES activated
16	CC Driver/BB	0152	Input 10 mA	VCM X3-49	Selection of CC activation by driver or Bodybuilder (BB) Open wire = CC controlled by driver Ground = CC controlled by BB
17	Ground	0000	Output 10 A	Wiring	Ground
18	PTO 1 sw	0131	Input 10 mA	VCM X3-47 EM X3-05	Input signal ⁽⁴⁾ Open wire = PTO mode 1 not activated Ground = PTO mode 1 activated Signal controlled by EM, when installed; Else input driven by VCM
19	PTO 2 sw	0132	Input 10 mA	VCM X3-46 EM X3-06	Input signal ⁽⁴⁾ Open wire = PTO mode 2 not activated Ground = PTO mode 2 activated Signal controlled by EM, when installed; Else input driven by VCM
20	PTO 3 sw	0123	Input 10 mA	VCM X3-45 EM X3-07	Input signal ⁽⁴⁾ Open wire = PTO mode 3 not activated Ground = PTO mode 3 activated Signal controlled by EM, when installed; Else input driven by VCM
21	K30	7772	Output 10 A		K30 (downstream of fuse F52)

⁽¹⁾ The engine only starts when the key is turned in the Immobilizer block (K15 ON); otherwise the engine turns but will not start. When the engine is stopped by the Bodybuilder through the signal of pin 2 of connector ST14A, while driving at speeds exceeding the threshold of the VCM of 6 km/h, it is not possible to restart the engine by the Bodybuilder but the K15 cycle (off-on) must be repeated with the key.

⁽²⁾ Tachograph B7 Signal

Parameter	Min	Typ	Max	Unit	Remarks
Voltage U_{low}			1,5	V	$I = 1 \text{ mA}$
Voltage U_{high}	5,5			V	$I = -1 \text{ mA}$
Frequency			<1,6	kHz	Square wave
Pulse duration	0,64	2	4	ms	

The Tachograph B7 output provides the speed pulse according to ISO 16844-2.



191314

Figure 9

Speed pulse output signal (terminal B7) form + the timing diagram of the speed pulse output versus the motion sensor speed signal (terminal B3) mounted on gearbox resp. transfer box.

a: max. delay $40 \mu\text{s} \pm$ jitter $10 \mu\text{s}$

(3) Input monitored only when ST14A/pin 16 CC driver/bodybuilder connected to ground, else input ignored

(4) Cyclical passage between the int. inputs PTO_x must be not faster than 500ms. Switching faster may ignore the request. The input will activate physical PTO - when configured - and VCM intermediate Speed Control Mode 1,2,3. With simultaneous activations of PTO 1,2,3 inputs, the VCM intermediate Speed Control Mode is assigned by means of prioritization: PTO_3 - highest priority, PTO_2 - medium priority, PTO_1 - lowest priority

WARNING: The Deactivation of a physical PTO is only allowed in load-free conditions. Therefore the deactivation of a physical PTO device during driving operation and/or with a gear engaged is not permitted as the connection to the PTO is not load-free. If the PTO is nevertheless deactivated, this may result in malfunctions and the PTO and/or gearbox may be damaged.

Specification 01 - Vehicles with ECAS system (Electronically Controlled Air Suspension)



- **During working operations using stabilisers, the air springs on vehicles equipped with air suspensions must be discharged.**

On the rear axle with air suspensions, it is recommended that there is a residual pressure of no more than 0.5 bar to prevent dislodging of the air bellow rubber from the piston.

The residual pressure can be programmed with E.A.S.Y. on vehicles with a liftable axle or when equipped with opt. 7306 "Axle load indication".

Amendment (only 190/FP-CM, 260../FP IFS-CM)

If on fully air suspended vehicles type "-CM" the front axle is lifted with stabilizers, or when unloading a roller container, an overflow valve with backflow has to be mounted on the supply line of the front axle ECAS valve according to the IVECO diagram 5801691560. This will prevent dislodging of the air bellow rubber from the piston.

To lower the air suspension on all Stralis vehicles, the connector X1 pin 5 on the ECAS control unit has to be supplied with +24 V signal. This can be realised e.g. when the PTO is switched on a relay connected to ST14A will supply this +24 V signal to the pin.

As said ECU pin is fed by the "2nd driving height" or "ECAS reset" switch in the cabin, it is necessary to install a relay according the following circuit diagram:

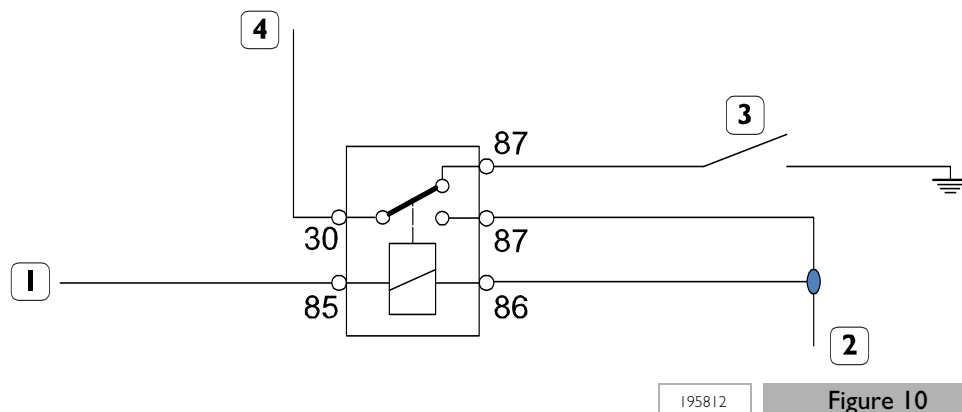


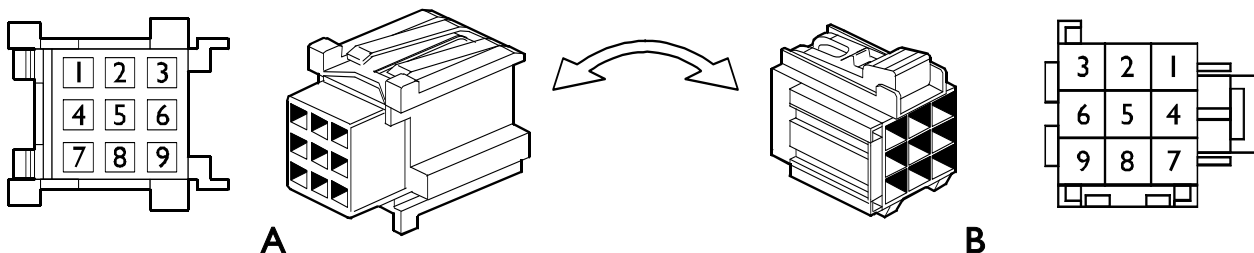
Figure 10

1. PTO request / STI4 pin 18
2. +15 / STI4 pin 11

3. 2 speed level / Reset ECAS
4. ECU ECAS / XI pin 5

Lowering the air suspension via connector XI pin 5 the "exhausted bellow function with high safety level" is activated. That means the vehicle will not react to changes of the level sensor signal.

b) Standard connector STI4B: 9 pin, blue



190412

Figure 11

A. 41118303 Counterpart to be coupled (female)

B. 41118302 Existing part on vehicle (male)

Table 5.5 - Basic functions of connector STI4B

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	2nd speed-limiter	8223	Input 10 mA	VCM X3-13	2nd speed limiter activation Open wire = not activated +24V = engaged
2	Reserved				
3	Clutch status output	9963	Output 200 mA	VCM XI-12	Clutch activated (switch 10%) Open circuit = clutch open Ground = clutch closed
4	PTS	5542	Output 200 mA	VCM XI-14	PTS = Programmable Threshold Speed ⁽¹⁾ Programmable threshold (rpm or vehicle speed) +24 V = PTS activated (speed > limit) 0 V = PTS not activated (speed ≤ limit)

Pin	Description	Wire code	Max. Load	Connected to	Remarks
5	Emergency lights	1113	Input 10 mA	BCM E19	Input signal ⁽²⁾ Open circuit = off Ground = on
6	Inhibition of TGC OFF	8879	Input 10 mA	BCM F-25	Input signal ⁽³⁾ Open circuit = Inhibition of TGC OFF not activated Ground = inhibition of TGC OFF activated Note The TGC does not disengage. If the TGC is disengaged, it opens at the end of the after-run.
7	Tail lift	0257	Input 10 mA	IC B04	Input signal (with Opt. 75182 installed) Open circuit = tail lift not activated Ground = tail lift open
8	Engine speed signal	5587	Output 10 mA	ECM I-34	Pulse signal ⁽⁴⁾
9	External lights	3333	Output 5 A	BCM A07	0 V = lights off +24 V = lights on (parking, low and high beam) Note The signal is not activated by flashing the high beam lights. The signal is also supported with K15 OFF. After an error, the signal remains deactivated until the next request.

⁽¹⁾ VCM default vehicle speed is 3 km/h. The value must not be modified in the case of certain Refurbishing Near Market requirements for RCV (please contact the IVECO market manager)

⁽²⁾ Vehicles with electrically activated main battery switch (OPT 2532)

⁽³⁾ The Service Network can change the signal to "K15 Remote Activation"

Open circuit = K15 Remote not activated

Ground = K15 Remote activated

Note The Bodybuilder must comply with the safety requirements.

WARNING: SAFETY REQUIREMENTS

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

For safety reasons, engine operation with K15 Remote control is therefore only to be activated in the following conditions:

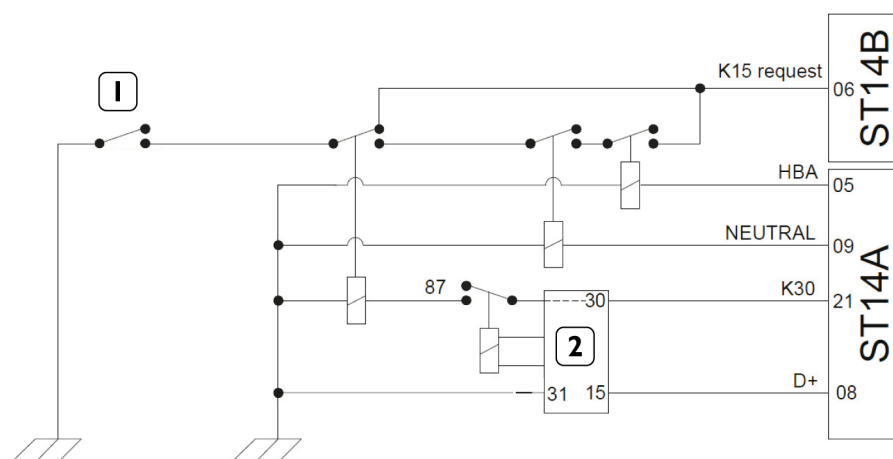
- **With the vehicle stationary and the parking brake engaged;**
- **With the gearbox in neutral.**

If even one of these conditions is not present, the K15 Remote control is automatically disabled.

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

One possible solution is shown in Figure 11 and must be implemented by the Bodybuilder to meet all the safety requirements.

Note that all the Bodybuilder controls must be disabled in a condition of K15. For this reason, a ShutOff relay with timed delay must be used.



248432

Figure 12

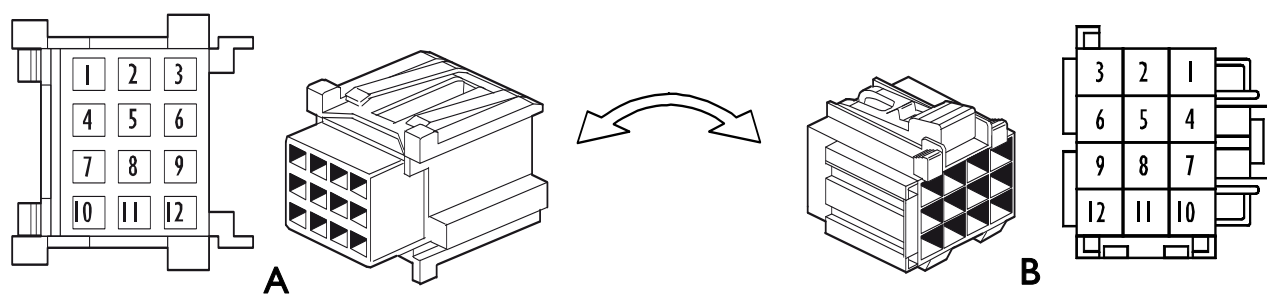
1. K15 activation request switch

2. ShutOff relay with timed delay of 5 s

All the safety aspects, as well as their implementation, are the direct responsibility of the Bodybuilder.

(4) Not available on Stralis CNG.

c) Optional connector ST14C: 12 pin, grey



190413

Figure 13

A. 41118329 Counterpart to be coupled (female)

B. 41118310 Existing part on vehicle (male)

Table 5.6 - Basic functions of connector ST14C (Allison Automatic gearbox)

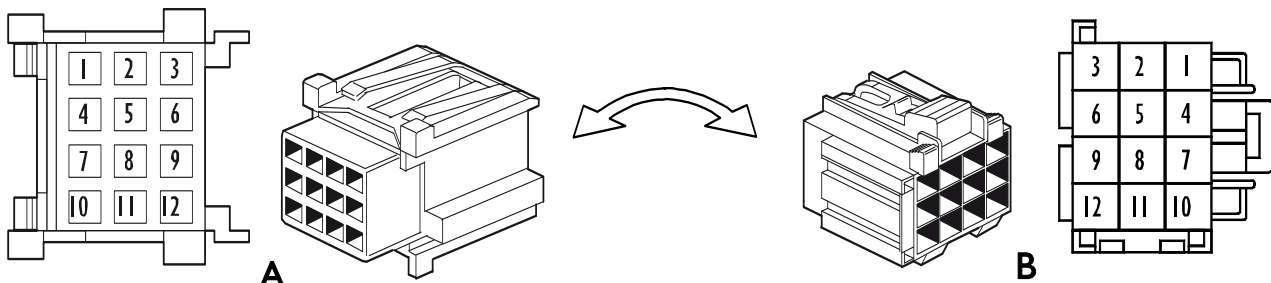
Pin	Description	Wire code	Max. Load	Connected to	Remarks
I	Neutral indicator for Extra PTO	5555	Output 500 mA	ALL 45	Gearbox in neutral. Ground for neutral engaged. This output function is activated by the TCM when Neutral is attained and a programmable combination of engine speed and transmission output speed has been detected.

Pin	Description	Wire code	Max. Load	Connected to	Remarks
2	Multi-state switch	I238888	Input 15 mA	ALL 23	Limitation 1st gear and inhibition reverse gear Open wire = function active +24V = function not engaged Ground = function active This function is normally enabled with an operator-controlled momentary switch. When the function is enabled, the transmission is limited to operation in only Neutral and (selectable*) low forward range(s). Operator requests to upshift beyond the maximum* gear range or to shift into Reverse are ignored by the TCM. If the function is enabled with Reverse selected on the shift selector, the transmission will shift to Neutral. If the function is enabled in a forward drive range higher than the maximum specified gear range*, the TCM will invoke preselect downshifts until the specified gear range is attained. The function is disabled when the enabling switch is released.
3	–	I422222		ALL 42	
4	PTO active	I431111	Input 15 mA	ALL 43	For special applications - Input from PTO switch . Open wire = inactive +24V = active Ground = inactive Enabling this function alerts the TCM that PTO operation has been requested by the operator. When the input function is enabled, the TCM disrupts the "modulated main pressure" feature in the transmission, resulting in transmission operation at full main pressure. When the function is enabled and all of the following conditions exist, the TCM activates Output Function G (PTO Enable Output). Required operating conditions for enabling of this function are: • accelerator position is "low"; • engine speed and output speed are within Customer Modifiable Constant limits.
5	PTO control	I302222	Output 500 mA	ALL 30	For special applications - 24V output to activate the PTO This output function is activated when use of the PTO has been requested and all operating conditions required to enable the PTO have been satisfied.
6	Reserved				
7	Reserved				
8	Double Automatic Neutral Input	I171111	Input 5 mA	ALL 17	For special applications - Logic mode "and" mode with pin 9 Open wire = function inactive +24 V = function active Ground = function active The TCM determines this function enable request to be valid only after receiving two separate input signals. When properly integrated into the vehicle system, the enabled function automatically commands the transmission to Neutral when a supplementary vehicle brake is engaged.

Pin	Description	Wire code	Max. Load	Connected to	Remarks
9	Double Automatic Neutral Input	1011111	Input 5 mA	ALL 1	For special applications - Logic mode "and" mode with pin 8 Open wire = function inactive +24 V = function inactive Value close to digital ground = function active The TCM determines this function enable request to be valid only after receiving two separate input signals. When properly integrated into the vehicle system, the enabled function automatically commands the transmission to Neutral when a supplementary vehicle brake is engaged.
10	Digital ground	1033333		ALL 3	It must be used as return for "closed on digital ground" inputs. Do not connect to the battery negative or to other grounds.
11	Range indicator	1132222	Output 500 mA	ALL 13	Gearbox: ground for neutral not engaged This output function is activated by the TCM when the specified gear (or gears) is being commanded by the TCM
12	"Almost" Neutral	1028049	Input 15 mA	ALL 23	Open wire = function inactive +24 V = function active Ground = function inactive When the transmission is in first range and this function is enabled, the TCM automatically commands transmission operation at a reduced load state which is similar to Neutral. Required conditions for enabling the function are: • Vehicle is stationary; • service brakes are applied; • throttle position is "low".

Contact Service Network for any modifications.

d) Optional connector ST40: 12 pin, blue



190413

Figure 14

A. 41118264 Counterpart to be coupled (female)

B. 41118266 Existing part on vehicle (male)

Table 5.7 - Basic functions of connector ST40

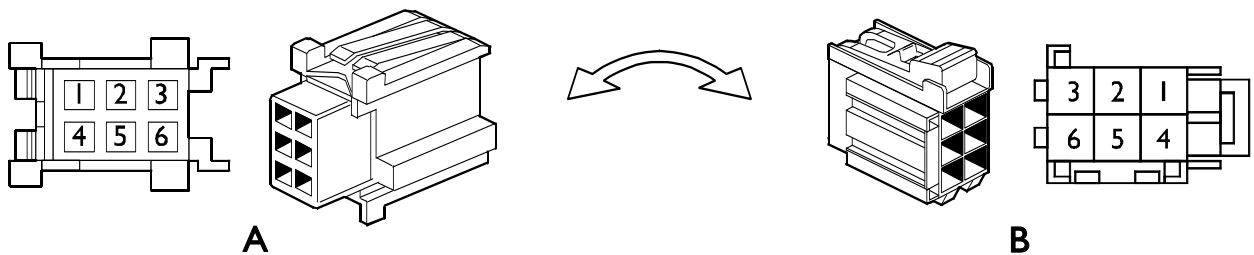
Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	K30	7772	Output 5 A	75000 / F31	Protected by fuse 20 A
2	K15	8871	Output 7.5 A	75000 / F19	Protected by fuse 10 A

Pin	Description	Wire code	Max. Load	Connected to	Remarks
3	Vehicle speed	5541	Output 10 mA	IC A/20	Instrument Cluster = Dashboard
4	+12 V	7712	Output 5 A	25770 / F04	Protected by fuse 5 A
5	CAN H		–	VCM X3-37	FMS CAN H
6	CAN L		–	VCM X3-38	FMS CAN L
7	Dashboard lights	4442	Output 1 A	BCM E01	
8	Reversing lights	2268	Output 200 mA	BCM G35	+24 V = reverse gear engaged
9	Ground	0000	Output 5 A		
10	K30	7972	Output 5 A	75000 / F76	Upstream of battery main switch
11	Reserved				
12	Reserved				

The FMS CAN line is enabled with OPT. I4569.

For further information please see Chapter 5.3 (➡ Page 29)

e) Optional connector 72072A: 6 pin, yellow



190414

Figure 15

A. 41118323 Counterpart to be coupled (female)

B. 41118304 Existing part on vehicle (male)

Only available with OPT 4572 (EM-light) or OPT 0384 (EM-full) installed.

Table 5.8 - Basic functions of connector 72072A

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Reserved				
2	Request gearbox in neutral Gearbox activation	6983	Output 500 mA	EM X4-05	Only with automatic gearbox Indicated that Driver requested Neutral gear & Neutral gear being physically engaged Ground = ON Open circuit = OFF

Pin	Description	Wire code	Max. Load	Connected to	Remarks
3	Bodybuilder Enable	0991	Input Load between 10 mA and 1 A ⁽¹⁾	EM X3-17	It must be activated by the Bodybuilder when the version is in operation, otherwise some of the Bodybuilder functions will not be supported: • Neutral shift for automatic gearboxes • Safe State activation by BB EMCY (ST14B/2) • CANOpen controls under Firewall monitoring • Extent of use of Bodybuilder power for vehicle systems Ground = active, low side switch
4	Vehicle CAN fully operational signal	9089	Output 10 A ⁽²⁾	Relay wiring: Activated via HS: EM X4-04 LS: VCM X1-07	Allows Bodybuilder the supervision of "Vehicle CAN fully operational" information ⁽³⁾ +24 V = ON, vehicle CAN systems are operational Ground = OFF at least one system is not operational
5	Reserved				
6	Reserved				

⁽¹⁾ During the K15 OFF phase, the input will not be activated to avoid an increase in the "sleep" current

⁽²⁾ Up to 10A can be used in combination with CiA cab connector 72072C / Pin 1

⁽³⁾ Allows the Bodybuilder to check the "Vehicle with CAN fully operational" information. It shows at the same time:

- IVN (In Vehicle Network) communication w/o timeouts and
- Bodybuilder interface application running

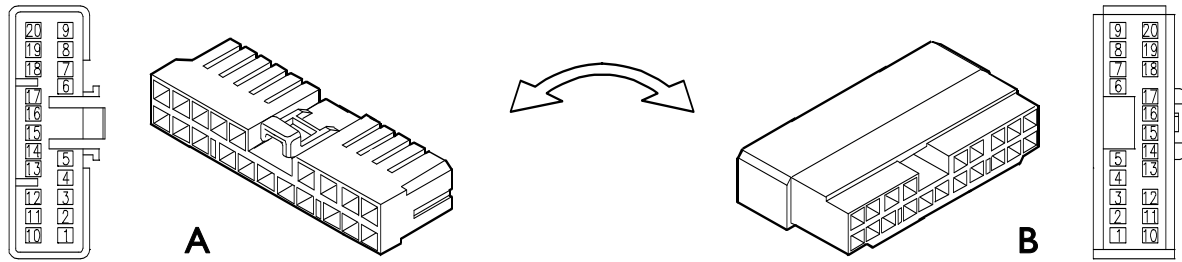
Output Signal is debounced by 1 sec in order to filter temporary disturbances. Output remains off for ~5 sec after K15 ON. The Bodybuilder must check this delay at each K15 ON cycle, otherwise wiring problems cannot be safely identified.

The IVN CAN communication of following systems are monitored via Timeout detection:

- Vehicle Control module
- Brake system
- ECAS (when installed)
- Automatic gearbox (when installed)
- Body Computer System
- Tachograph
- Instrument panel

Detailed information for each system are available via CANopen – see EMCY object 0x1014

f) Optional connector 72072B: 20 pin, black



190415

Figure 16

A. 500314809 Existing part on vehicle (male)

B. 500314816 Counterpart to be coupled (female)

Only available with OPT 4572 (EM-light) or OPT 0384 (EM-full) installed.

Table 5.9 - Basic functions of connector 72072B

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Request gearbox in neutral signal	0992	Input 10 mA ⁽¹⁾	EM X3-18	Only supported with opt 6821 (Std. EN 1501) and AutoGbx. Only if Bodybuilder Enable is also active (72072A/3). Signal change needed, earliest 1 second after K15 ON. Brings the gearbox to neutral just once. Ground = active, low side switch
2	Bodybuilder Emergency Signal	0993	Input 10 mA ⁽¹⁾	EM X3-19	Input to activate the Vehicle StoppedState values, only if Bodybuilder Enable is also active (72072A/2) List of configurable signals ⁽²⁾ Ground = active, low side switch
3	External stop brake request (EN1501)	0994	Input 10 mA ⁽¹⁾	EM X3-20	Only supported with 6821 (Std. EN 1501) ⁽³⁾ Input to activate the Stopping brake (V < 6 km/h) Ground = active, low side switch
4	Stop brake signal return (EN1501)	0995	Input 10 mA	EM X3-21	Reserved for IVECO exclusively Input to monitor the stop brake pressure Ground = active, low side switch
5	Stepper swt req. (EN1501)	0996	Input 10 mA ⁽¹⁾	EM X4-06	Only supported with 6821 (Std. EN 1501) ⁽⁴⁾ Input to activate the Refuse stepper switch Ground = active, low side switch Not available with ABS-HSA (opt 14861) installed
6	LMM (Light Management Module) Right direction light	6985	Output 1.5 A	EM X1-03	Right turn signal light 0 V = not engaged +24V = engaged
7	LMM (Light Management Module) Left direction light	6986	Output 1.5 A	EM X1-08	Left turn signal light 0 V = not engaged +24V = engaged
8	Reserved	—	1 A	EM X4-01	used on Euro IV/Euro V applications Only supported with OPT 6821 Output EN1501 Warning sound indicator 0 V = not engaged +24V = engaged
9	Reserved	6988	1 A	EM X4-02	For future IVECO applications Keep EM alive "output" 0 V = not engaged +24V = engaged

Pin	Description	Wire code	Max. Load	Connected to	Remarks
10	Brake lights EN1501	6989	Output 1 A	EM X4-03	Only supported w/ opt 6821 Output EN1501 Reverse protections brake active 0 V = not engaged +24V = engaged after K15 active for 2 sec (w/o brake activated) Not available with ABS-HSA (opt 14861) installed
11	Reserved	–	1 A	EM X4-21	used on Euro IV/Euro V applications Only supported with OPT 6821 Output EN1501 Solenoid valve Brake 0 V = not engaged +24V = engaged
12	Neutral gear request	6991	Output 1 A	EM X4-22	reserved for IVECO exclusively Please contact IVECO for further details ⁽⁵⁾ Supported with Automatic Gearbox 0 V = not engaged +24V = engaged
13	Chassis ready (acc. EN1501-1)	6992	Output 1 A	EM X4-23	Indicates Chassis Information ready (acc. EN1501-1) for adjustment contact the IVECO Technical Service 0 V = Off- Frame not ready +24 V = On - Frame ready
14	Low accelerator pedal idle switch	6993	Output 1 A	EM X4-31	Indicate that Accelerator pedal idle switch 0 V = OFF - low idle switch not active + 24 V = ON - low idle switch active
15	"At least one PTO is engaged"	6994	Output 1 A	EM X4-32	Indicates at least one PTO is engaged Signal based on PTO feedback signal/s 0 V = OFF - no PTO engaged + 24 V = ON - at least one PTO engaged
16	Bodybuilder fluid level	5981	Input 0-500 Ohm ⁽¹⁾	EM X4-14	Analogue input for IC display of Bodybuilder fluid level ⁽⁶⁾ n.d. with CANopen enabled 0x6167
17	Bodybuilder pressure	5982	Input 0-32 V ⁽¹⁾	EM X4-15	Analogue input for IC display of Bodybuilder pressure ⁽⁶⁾ n.d. with CANopen enabled 0x6167
18	Bodybuilder Thermal Temperature	5983	Input 0-500 Ohm ⁽¹⁾	EM X4-29	Analogue input for IC display of Bodybuilder temperature ⁽⁶⁾ n.d. with CANopen enabled 0x6167
19	EN1501-1 Reverse Roll external sensor	5991	Input 10 mA ⁽¹⁾	EM X4-16	For future IVECO applications
20	EN1501-1 Roll Protection	5992	Input 10 mA ⁽¹⁾	EM X4-38	For future IVECO applications

⁽¹⁾ During the K15 OFF phase, the input will not be activated so as to avoid an increase in the sleep current of "".

(2) Requirements for Functional Safety

- In case of an emergency during operation of the Bodybuilder application, the vehicle goes into the "Vehicle StoppedState" independently via activation of the Bodybuilder Emergency input (IVECO can offer pre-configured "StoppedState" settings). This feature is only available when the Bodybuilder application is in operation and not during vehicle movement; therefore, the Bodybuilder Enable input (72072A, pin 3) is simultaneously switched to ground.
- The "Vehicle Stopped State" values are transmitted via CAN to the other vehicle subsystems, therefore the output "Vehicle with full CAN operation" must be active. When this output is not active the application must not implement actions which rely on the EM nor

on the entire Bodybuilder interface functioning properly. The Bodybuilder is responsible for initiating measures to ensure that the "Safe State" of the application activates independently.

- If the application also requires a "recovery" strategy while the "Vehicle with full CAN operation" output is passive, contact IVECO.
- The 'Vehicle StoppedState' signal values will be transmitted directly after the Bodybuilder Emergency has been activated and will remain active until:
 - K15 is switched off or
 - the CANopen NMT 'Start Node' command is received or
 - the CANopen NMT 'Start all Nodes' command is received
 - the CANopen NMT 'Start via HW input' is configured and the signal is reactivated.

Note: During the 'StoppedState' phase, the relevant CANopen signals received on BB-CAN are ignored.

(3) The stop brake can only be activated with vehicle speed below 6 km/h. On EBS vehicles a new Stopping Brake request is serviced only when engine is running. When Stopping brake being active the engine could be stopped and Stopping brake remains engaged.

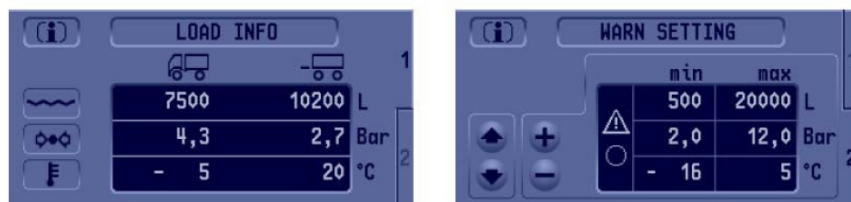
The Stopping brake is only supported during K15 ON phase, switching off K15 disable the function on ABS vehicles. On vehicles with EBS brake system the Bodybuilder automatically deactivates the stop brake request when K15 is switched off.

(4) An input on the waste compactor footboard (occupied footboard) activates the following actions on the actuated footboard switch, as described in Standard EN 1501-1 - Directives for occupied footboard:

- speed limiting
- reverse gear for rear loaded compactor. In the case of reverse gear engaged, protection by:
 - brakes activation;
 - torque limit set at 0% (only regulator at idle speed);
 - reverse gear is only prevented with automatic gearboxes if the input 72072A/03 is connected to ground by the Bodybuilder.

(5) The addition of a load on this output involves the addition of a diode, even if the output interacts with the Bodybuilder enable control on 72072/03. Alternatively, the relay module R2 25781 can be removed on mechanical gearboxes (relay for EM - Neutral 25626 - see Figure 37).

(6) It is possible to display information relating to the vehicle load on the Instrument Panel, but only for the comfort functions. To enable this function, contact the IVECO Assistance Service. If wiring is added to the input(s), the relative CANopen objects regarding vehicle load information are no longer available. On the Stralis EVO range the trailer load information via ISO 11992-3 is not supported on the Euro 6 range.

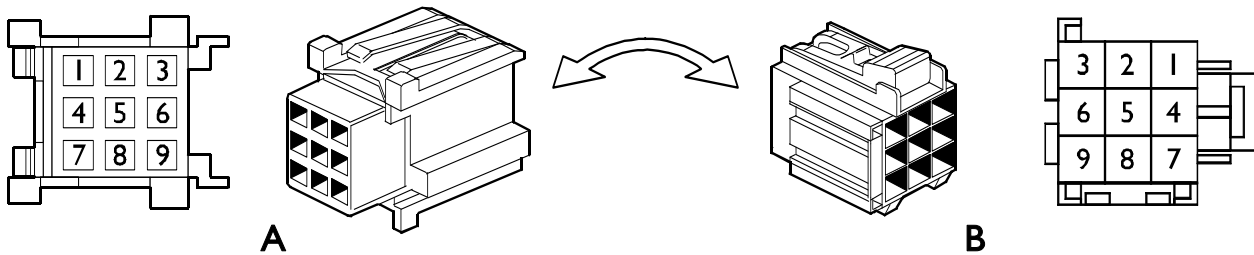


191315

Figure 17

(Pictures are by way of example only)

By using this function, alarm thresholds can be set for each type of load.

g) Optional connector 72072C: 9 pin, yellow

190412

Figure 18

A. 41200681 Counterpart to be coupled (female)

B. 504163547 Existing part on vehicle (male)

Only available with OPT 0384 (EM-full) installed.

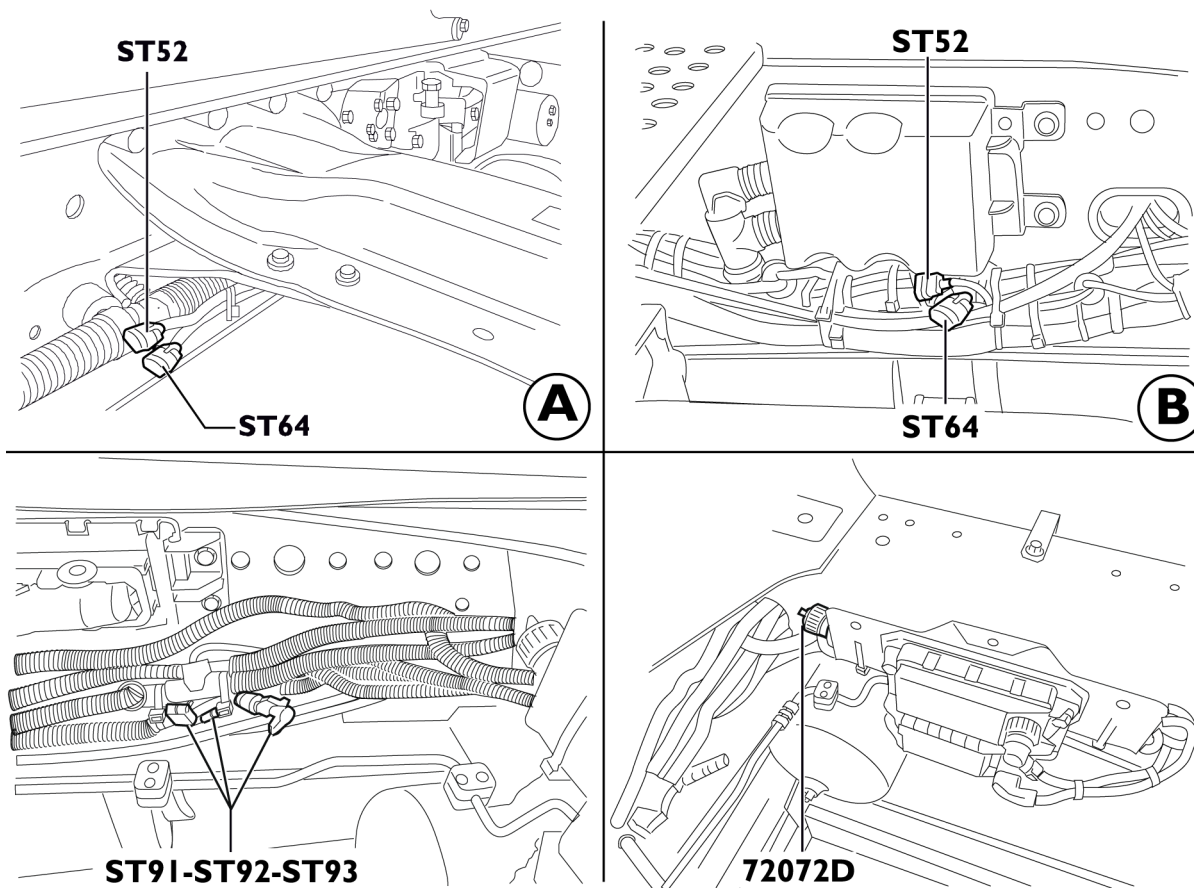
Table 5.10 - Basic functions of connector 72072C

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	K30	7796	Output 10 A ⁽¹⁾	K30	Protected by fuse 10 A
2	Ground	0000		Ground	
3	CO (CANopen) operational	0975	Output 0.5 A	EM X4-28	LSO (Low Side Output), activated in the case of CO initiated (typically ~3 seconds after K15 ON) For adjustment contact IVECO Technical Service Open circuit = CANopen not operational 0 V = CANopen operational
4	Bodybuilder CAN	CAN H		EM X4-17	CANopen Truckgateway
5	CAN Gnd	0999		EM X4-09	HF Ground (High Frequency), capacitive coupled
6	Bodybuilder CAN	CAN L		EM X4-19	CANopen Truckgateway
7	Reserved				
8	Reserved				
9	Reserved				

⁽¹⁾ 10A can be used in combination with the "Vehicle with full CAN operation" signal, connector 72072A pin 4.**B) Connectors on the chassis**

The following connectors (all black) are located on the frame:

- ST52 (for Bodybuilder specific solutions)
- ST64 (for Bodybuilder specific solutions)
- 72072D (EM)
- ST91 (PTO 1)
- ST92 (PTO 2)
- ST93 (PTO3)

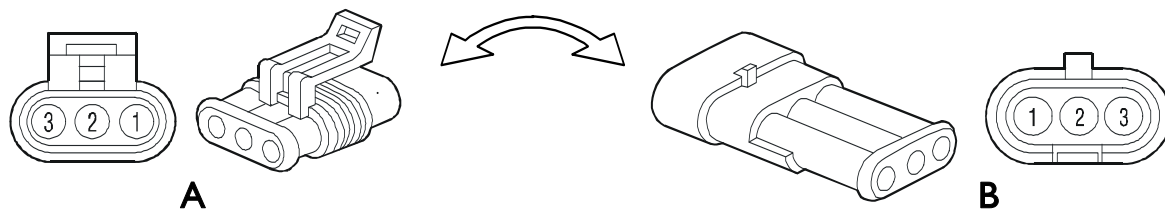
Location of chassis connectors

248436

Figure 19

A. Truck

B. Tractor

a) Connectors ST52 and ST64: 3 pin, black

190416

Figure 20

A. 98435344 Existing part on vehicle (male)

B. 98435331 Counterpart to be coupled (female)

Table 5.11 - Basic functions of connector ST52

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Positive +15 for fitters	8871	Output 10 A	FCM A24	Also connected to ST64-2
2	Ground	0000	Output 10 A	Wiring	Ground

Pin	Description	Wire code	Max. Load	Connected to	Remarks
3	Side lights	3333	Output 5 A	BCM A07	(1)

(1) +24 V when:

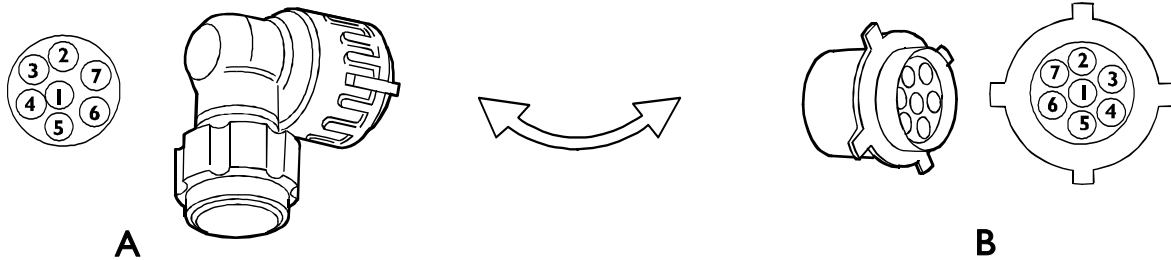
- K15 OFF and side lights on
- K15 ON and side lights on
- K15 ON and lights on (low and/or high beam)

Table 5.12 - Basic functions of connector ST64

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	15-pin trailer socket	8075		72010-11	Connection with 15-pin Trailer socket - Pin 11
2	Positive +15 for fitters	8075	Output 10 A	FCM A24	Also connected to ST52-1
3	15-pin trailer socket	6021		72010-10	Connection with 15-pin Trailer socket - Pin 10

For general use by Bodybuilder: allows the use of 3 terminals of the 15 pole connector for the trailer.

f) Optional connector 72072D: 7 pin, black



190417

Figure 21

A. 504111928 Counterpart to be coupled (female)

B. 41118387 Existing part on vehicle (male)

Only available with OPT 0384 (EM-full) installed.

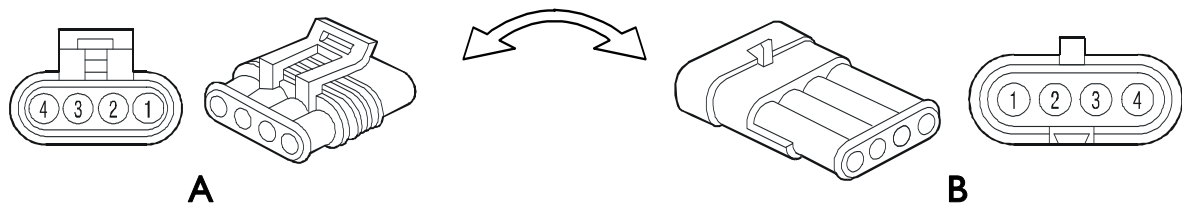
Table 5.13 - Basic functions of connector 72072D

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	K30	7795	Output 10 A	K30	Fused with 10 A F41 via ST48/1 (1)
2	Ground	0000		Ground	
3	CO enable (CANopen)	0975	Output 0.5 A	EM X4-28	LSO (Low Side Output), activated in the case of CO initiated (typically ~3 seconds after K15 ON) For adjustment contact the IVECO Technical Service Open circuit = CANopen not operational 0 V = CANopen operational
4	Bodybuilder CAN	CAN H		EM X4-17	CANopen Truckgateway

Pin	Description	Wire code	Max. Load	Connected to	Remarks
5	CAN line Ground	0999		EM X4-09	HF Ground (High Frequency),capacitive coupled
6	Bodybuilder CAN	CAN L		EM X4-19	CANopen Truckgateway
7	Reserved				

(1) I0A can be used in combination with K30 on connector ST14A pin 21

c) Optional connectors ST91, ST92, ST93: 4 pin, black



190418

Figure 22

A. 98435341 Existing part on vehicle (male)

B. 98435337 Counterpart to be coupled (female)

Only available with OPT 4572 (EM-light) or OPT 0384 (EM-full) installed.

Table 5.14 - Basic functions of connector ST91

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	PTOI feedback signal	6131	Input 10 mA (1)	EM X3-08	Connect to ground to read the PTO1 feedback
2	PTOI activation via electromagnetic valve	9131	Output 1.5 A	EM X1-01	OFF = 0V = valve not activated ON = +24V = valve activated
3	PTOI pressure switch	0391	Input 10 mA (1)	EM X3-11	Connected to ground if active Used for Multipower and engine PTO It could also be used to monitor the Bodybuilder consent
4	Ground	0000		Ground	

(1) During the K15 OFF phase, the input will not be activated so as to avoid an increase in the sleep current of "".

Table 5.15 - Basic functions of connector ST92

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	PTO2 feedback signal	6132	Input 10 mA (1)	EM X3-09	Connect to ground to read the PTO2 feedback
2	PTO2 activation via electromagnetic valve	9132	Output 1.5 A	EM X1-04	OFF = 0V = valve not activated ON = +24V = valve activated
3	PTO2 pressure switch	0392	Input 10 mA (1)	EM X3-12	Connected to ground if active Used for Multipower and engine PTO It could also be used to monitor the Bodybuilder consent
4	Ground	0000		Ground	

(1) During the K15 OFF phase, the input will not be activated so as to avoid an increase in the sleep current of "".

Table 5.16 - Basic functions of connector ST93

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	PTO3 feedback signal	6133	Input 10 mA (1)	EM X3-10	Connect to ground to read the PTO3 feedback
2	PTO3 activation via electromagnetic valve	9123	Output 1.5 A	EM X1-06	OFF= 0V =valve not activated ON = +24V = valve activated
3	PTO3 pressure switch	0393	Input 10 mA (1)	EM X3-16	Connected to ground if active Used for Multipower and engine PTO It could also be used to monitor the Bodybuilder consent
4	Ground	0000		Ground	

(1) During the K15 OFF phase, the input will not be activated so as to avoid an increase in the sleep current of "".

5.3 SPECIAL INSTRUCTIONS

a) Smart Auxiliaries

On C11 and C13 engine variants IVECO offers a highly sophisticated fuel saving package, making use of smart auxiliaries. These auxiliaries can be ordered via:

- CCP 78467 – Smart Auxiliaries
- CCP 78387 – Smart Auxiliaries + Smart EGR

Vehicles equipped with such an option reduce fuel consumption also by:

- **Regenerative braking** = recharging batteries using vehicle kinetic energy (charging voltage may reach 31V).
- **Passive boost** = suspending battery charging at high engine loads.
- **Steady state charging** = keeping StateOfCharge (SOC) in an optimum phase. SOC between 65% and 85%, instead of being always 100% charged.
- **Quick charge** = increased charging voltage 29V.

Please note that these smart functions may affect the electric/electronic components the BodyBuilder has designed or chosen.

- Supply voltage range is still within 32V limit, but Smart charging frequently reaches 31V. BodyBuilder systems must be compatible.
- Batteries StateOfCharge (SOC) might be reached only 65% during operation. some applications using battery power supply at engine standstill might be affected since available overall electric energy is being reduced.
- Special batteries are needed to guarantee lifetime also with the increased charges cycles of a smart alternator system; typically this is offered by carbon batteries, which are also used by IVECO.

IVECO is developing a programming at Customer Service, which converts Smart alternator to a conventional alternator. (28,3V max and always charge to 100%).

Please respect that this modification will partially reduce the smart auxiliaries fuel savings.

b) Operating supply voltage range

Electric/electronic components adopted by the BodyBuilder are designed for the following minimum and maximum supply voltage range.

Table 5.17 - Supply voltage range

Temperature range [°C]		Voltage supply range limits [V]		Notes
T _{min}	T _{max}	U _{s-min}	U _{s-max}	
-40	75	1.2	32	Devices operating during cranking
-40	80	16	32	Devices not operating during cranking
-40	85	22	32	Solenoids

It is the responsibility of the BodyBuilder to design his electric/electronic components to withstand the voltage supply range limits. Typical operation voltage is as follows:

Table 5.18 - Typical supply voltage

Engine status	Without Smart Auxiliary	With Smart Auxiliary
Engine off [max]	25 V	25 V
Engine running [max]	28.5 V	31 V

If components are not compatible, the BodyBuilder is to take appropriate measures (such as installing a voltage stabilizer / suppressor diode and/or Zener diodes) correctly dimensioned for the individual devices.

IVECO cannot accept any warranty for components, malfunctions or resulting damages.

c) Load dump protection

The BodyBuilder is to prevent battery disconnection while the engine is running. In particular, disconnecting a discharged battery while the alternator is generating charging current with other loads remaining may lead to load dumps.

It is the responsibility of the BodyBuilder to keep the vehicle owner / operators / workshops informed accordingly. IVECO cannot accept any warranty for components, malfunctions or resulting damages.

d) FMS (Fleet Management System)

For the management of a fleet it is necessary that each vehicle provides a set of information on its operation, the movements made and the driving style of the driver.

In the case of Stralis Euro VI the main information can be displayed directly on the radio screen, if this is the type designed for this purpose.

If the vehicle does not have such a solution, detailed information about:

- rpm, engine torque, water and oil temperature;
- mileage, type of route and driving times;
- consumption, speed and braking;
- loads on axles (if provided);

they can be acquired by means of an electronic device or personal computer connected to the CAN line.

The format of this information complies with the FMS standard on the Company website: www.fms-standard.com.

The connection to the CAN line is possible by means of the optional I 4569, which consists of:

- a green connector (FMS), housed in one of the DIN coating cases above the windshield;

- a bridge, which connects the connector to the ST40;
- a resistor which is used to terminate the CAN line.

To use the CAN FMS it is necessary to unplug the resistor and use the green connector; obviously the telematic device to be inserted must be compatible with the CAN FMS termination.

Note If the vehicle is not equipped with the optional 14569, it is mandatory that the necessary modifications to the electrical system and software upgrades are made at an authorised IVECO Service Centre.

Characteristics of the CAN line

Physical level	Unshielded twisted pair cable compliant with ISO std. 11898 (SAE J1929/11). Termination of internal bus to cable with 120 Ω resistor.
Data link level	CAN 2.0B, 250 Kbit/s Format identifier and multi-packet message management compliant with SAE J1929/21.
Application level	Messages and parameters compliant with SAE J1939/71.

The information that can be retrieved contains the message "FMS Standard Interface" and identifies the version that is supported. This message is not present if you have installed an interface that does not support this standard.

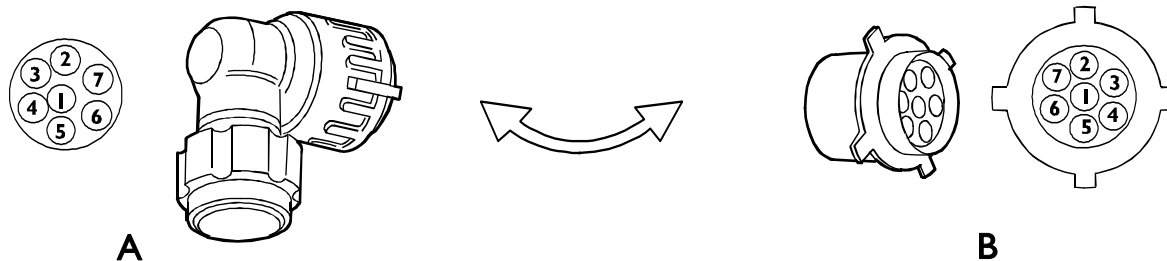
The telematic devices connected to the FMS connector, wanting to use the Remote Tachograph Download Data functionality must be set to use the "source address" F0; if you do not operate in this way, on the message "error 13", relative to problems on the CAN network, could appear on the tachograph.

5.4 TAIL LIFT

To attain compliance with the VEH standard (Association of European tail lift manufacturers), opt. 75182 is also available as described in Chapter 3.9 "VEH configuration for tail lifts" (► Page 51) for mechanical aspects.

Information regarding the connector and wiring diagrams is provided below.

Optional connector 72096: 7 pin, black



190417

Figure 23

A. 504111928 Counterpart to be coupled (female)

B. 41118387 Existing part on vehicle (male)

Table 5.19 - Basic functions of connector 72096

Pin	Description	Cable code	Max. Load	Connected to	Remarks
1	Tail lift activation from dashboard switch	6881	Output	Wiring	U_{bat} = tail lift activated 0 V = tail lift not activated Note Also prevents engine start-up. Requires the signal U_{bat} on pin 7

Pin	Description	Cable code	Max. Load	Connected to	Remarks
2	Tail lift indication on instrument panel	0258	Input	IC X-xx	If pin 6 = NOT Ground AND pin 5 = NOT U_{bat} , then: Ground = no indication on the instrument panel Open circuit = no indication on the instrument panel If pin 6 = Ground AND pin 5 = U_{bat} , then: Ground = indication on the instrument panel of tail lift open Open circuit = no indication on the instrument panel
3	Tail lift indication on instrument panel	0259	Input	IC X-xx	If pin 6 = NOT Ground AND pin 5 = NOT U_{bat} , then: Ground = indication on the instrument panel of tail lift activated Open circuit = no indication on the instrument panel If pin 6 = Ground AND pin 5 = U_{bat} , then: Ground = no indication on the instrument panel Open circuit = no indication on the instrument panel
4	K15 for tail lift	8871	Output 10 A	75000 / F20	
5	Tail lift control "open"	8135	Input		Main power supply U_{bat} when the tail lift is open
6	Tail lift control "activated"	0395	Input		Connected to ground when the tail lift is activated
7	U_{bat} signal from tail lift	9841	Input		Tail lift activation U_{bat} = tail lift activated Open circuit = tail lift not activated

Tail lift for STRALIS Hi-Way

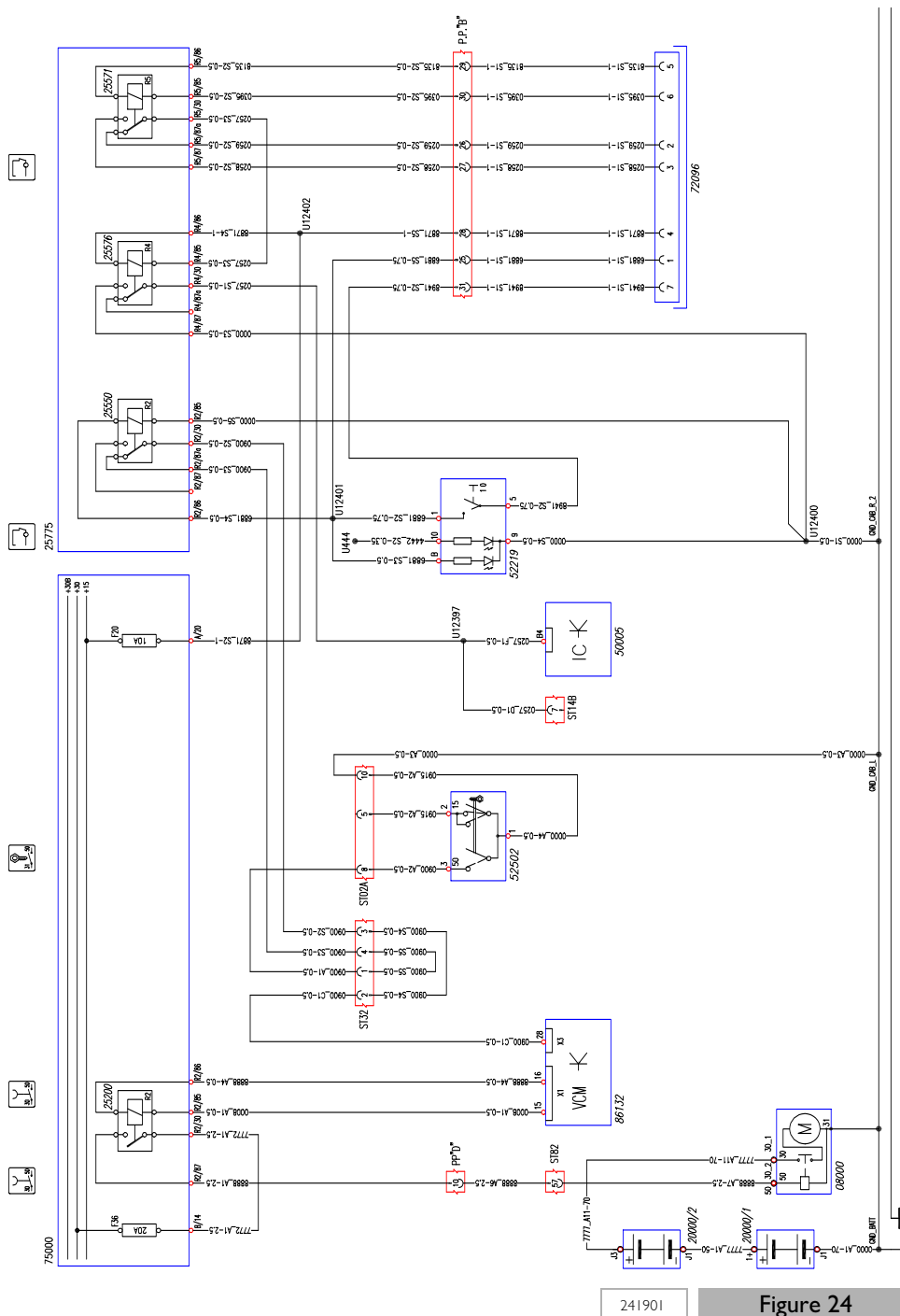
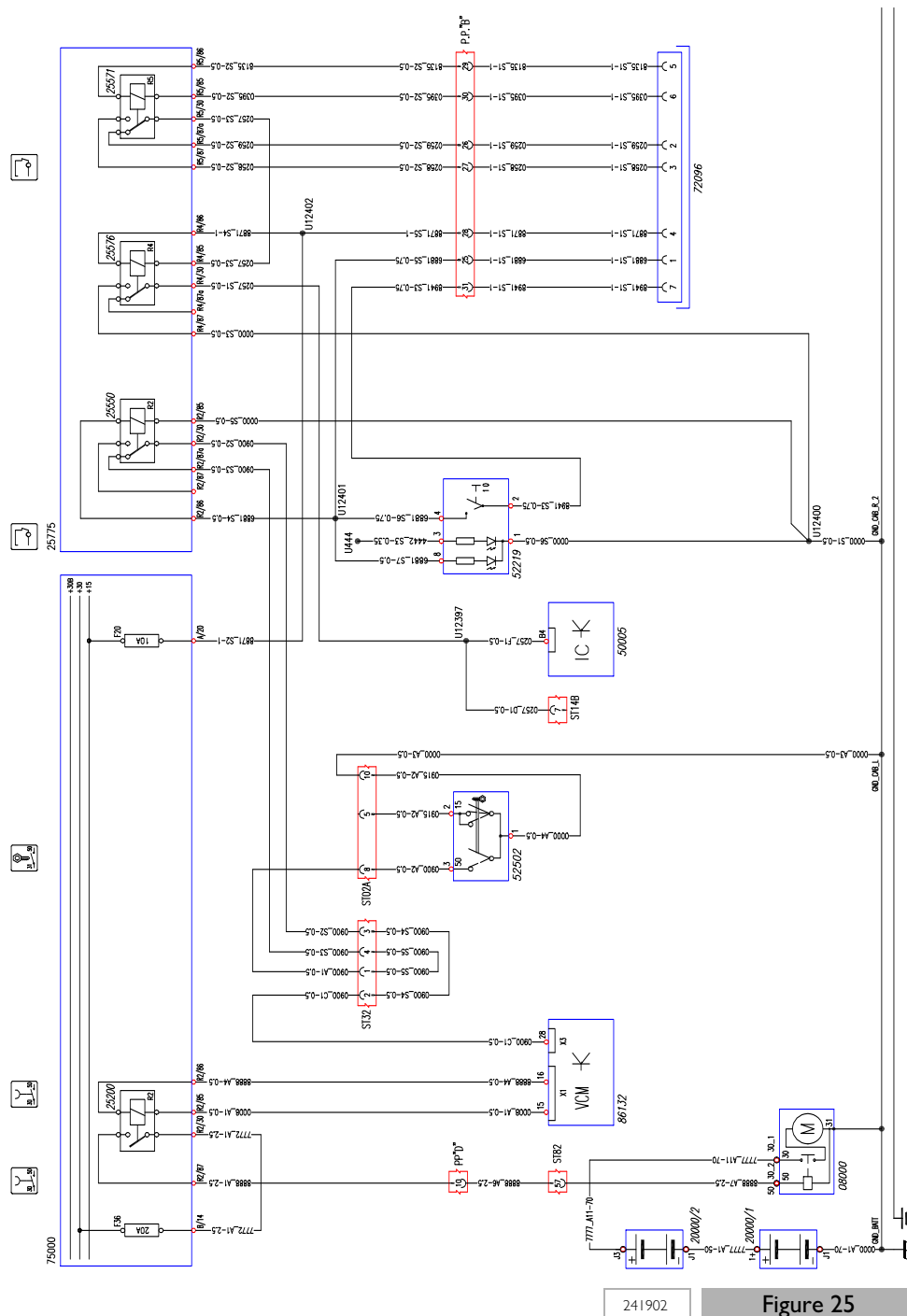


Figure 24

8000 Starter motor
 20000 Starter battery
 25200 Ignition contactor
 25550 Contactor for preventing tail lift start-up engaged
 25571 Contactor for VEH tail lift control
 25576 Contactor for tail lift warning light
 25775 Contactor and fuse holders (module 6)

50005 Switch with built-in warning light for heated rear-view mirrors
 52219 Switch for activating tail lift
 52502 Key switch for services with start-up
 72096 7-pole junction for tail lift connection
 75000 Interconnection control unit
 86132 VCM (Vehicle Control Module) control unit

Tail lift for STRALIS Hi-Road / Hi-Street



241902

Figure 25

- 8000 Starter motor
- 20000 Starter battery
- 25200 Ignition contactor
- 25550 Contactor for preventing tail lift start-up engaged
- 25571 Contactor for VEH tail lift control
- 25576 Contactor for tail lift warning light
- 25775 Contactor and fuse holders (module 6)

- 50005 Switch with built-in warning light for heated rear-view mirrors
- 52219 Switch for activating tail lift
- 52502 Key switch for services with start-up
- 72096 7-pole junction for tail lift connection
- 75000 Interconnection control unit
- 86132 VCM (Vehicle Control Module) control unit

5.5 ELECTRONIC CONTROL UNITS



► **CAN line wires and electric/electronic devices must not be modified.**



► **Any modifications on the electrical system will reduce quality and safety characteristics.**

Wiring harness length

The CAN line and the electrical wires form a single wiring, therefore it is not possible to replace only the CAN line or the electric cables where the electrical system consists of both.

When repositioning the Hi-MUX system electronic control units, it may be necessary to modify the wire length.

1. If the length is excessive, some bends are possible (avoid the coils, the cause of undesirable electromagnetic effects), unless the rigidity prevents it shorter length wiring needs to be adopted;
2. If the length is insufficient, it must be replaced.



► **It is strictly forbidden to carry out any modifications or connections to the CAN lines, which are to be considered unalterable. Diagnostic and maintenance operations can only be carried out by authorised personnel and with IVECO approved equipment.**

Note For any exception to mounting instructions, IVECO's written authorisation is necessary.

Lack of observance of above described prescriptions involves guarantee lapse.

Disconnecting electronic control units

Follow the instructions below carefully before disconnecting an electronic control unit:

- turn the ignition key to OFF and remove it;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light of the corresponding key will go out);
- open the DGC (Main Current Switch, see Chapter 5.9 (► Page 46));
- isolate the battery by disconnecting the battery cables: disconnect the negative terminal first followed by the positive terminal;
- disconnect the control unit.

Repositioning electronic control units

IVECO recommends avoiding modifications which entail the repositioning of the electronic control units. However, if repositioning is unavoidable, follow the instructions below:

- the electronic control units must be positioned on the chassis or in the cab and secured with a fastening similar to the original one (i.e. bracket);
- in order to avoid any malfunctions the electronic control units must not be turned in relation to the chassis and must maintain the original orientation (e.g. to avoid water ingress).
- electronic control units must not be fitted on the subframe;
- the cover must always be refitted;
- avoid subjecting electronic control units to knocks from debris and stones from the road when travelling.

5.6 ELECTRICAL SYSTEM

General information

Vehicles are set to function normally with a 24 V electrical system.

The chassis represents the grounding (it acts as a current return conductor between the components located on it and the battery power source/alternator) and it is connected to the negative pole of the battery and components, if an isolated return is not provided for this.

When installing additional equipment or additional circuits, the following indications must be taken into account and, depending on the complexity of the operation, there must be proper documentation (e.g. wiring diagram) to match that of the vehicle.

The use of cables and connections with colours/codes identical to those used on the original vehicle makes installation correct and facilitates any repair work.

Note For more detailed information on the vehicle's electrical system, refer to the specific Repair Manual, print 692.68.512 (STRALIS Hi-Way) and print 692.68.498 (STRALIS Hi-Road and Hi-Street).

These are available through the Service Network and can also be requested from sales bodies.

Precautions for work on the system



- ▶ **Electrical work (e.g. removing cables, adding circuits, replacing equipment or fuses, etc.), performed in a manner inconsistent with the IVECO instructions or by unqualified personnel, can cause serious damage to electronic control units and compromise driving safety.**



- ▶ **Any electrical work which does not comply with regulations may cause significant damage (e.g. short circuits with the possibility of fire and destruction of the vehicle) and authorises IVECO to annul the warranty.**

Before removing any electrical/electronic equipment, disconnect the ground cable from the battery negative terminal.

Note Whenever an electrical connection is opened, the two counterparts must be protected (for example, with sticky paper) to avoid infiltration of water or dirt.

To prevent damage to the vehicle's electrical system, follow the instructions of the cable manufacturer.

- The cables must have suitable sectioning for the type of load and the position of the load in the vehicle.
- The power cables (+ direct) must be:
 - individually intubated in conduits (of suitable diameter) and not together with cables which differ in the signal and negative;
 - placed at a distance of at least 100 mm (reference value = 150 mm) from high heat sources (turbine, engine, exhaust manifold, etc.);
 - placed at least 50 mm from containers of chemical agents (batteries, etc.);
 - placed at least 50 mm from moving parts.
- The path of the cables must be defined with dedicated and reconciled brackets and clamps, to avoid hanging parts and to allow the installation to be restored after repairs or interventions.
- The passage of cables through holes and on the edges of metal sheets must be protected by cable gaskets in addition to the corrugated tube. It is not possible to specially drill the chassis to allow the cables path.
- The corrugated tubing must completely protect the entire cable and be connected (with heat shrinking or taping) to the rubber caps on the terminals.
- All the positive terminals and cable terminals must be protected by rubber caps (air-tight in areas exposed to weathering or with possible stagnation of water).

- The fastening of the cable housings to the terminals (also negative), should be secured to prevent unscrewing, applying a torque where possible and placing them "radially" in the case of multiple connections (to be avoided if possible).



- **Use only fuses with the features prescribed for the specific function. NEVER USE FUSES WITH A CAPACITY HIGHER THAN THE PRESCRIBED. Replace using only keys and disconnected users.**

When the operations have been completed, restore the original conditions of the wiring (paths, protections, strips), making sure that the cables are not in contact with metallic surfaces which could affect their integrity.

Precautions for work on the chassis

For work on the chassis, to protect the electrical system, its equipment and ground connections, respect the precautions shown in Chapter 2.1 - Paragraph "Special Precautions" (► Page 5) and Chapter 2.3 - Paragraph "Welding" (► Page 8).

If required by the application of additional devices, diodes must be fitted to protect against any inductive current peaks.

The ground signal from the analogue sensors must only be wired on the specific receiver; additional ground connections may distort the output signal from this sensor.

The cable bundles for low signal intensity electronic components must be arranged parallel to the reference metal plane, namely adherent to the chassis / cab structure, in order to minimise parasitic capacities; space the path of the cable bundle added to the existing one as much as possible.

The added systems must be connected to the ground of the system with the utmost care (see Paragraph "Ground Points" (► Page 36)); the related wiring harnesses should not be coupled to the electronic circuits that already exist on the vehicle in order to avoid electromagnetic interference.

Ensure that the wiring of the electronic devices (length, type of conductor, position, strips, cable shielding connection, etc.) comply with indications provided by IVECO.

Carefully restore the original system after any operations.

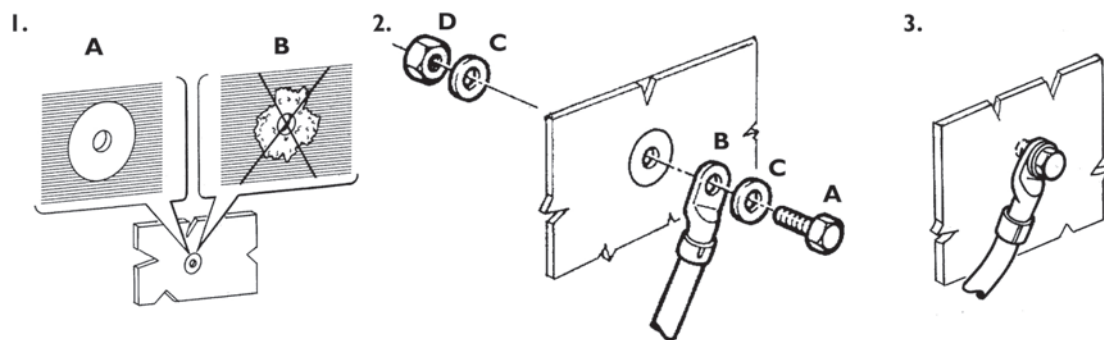
Ground points

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

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

As regards the signal related ground connections (e.g. sensors or low-absorption devices), do not use the standardized points. Under no circumstances use standardized points for engine ground connection and chassis ground connection.

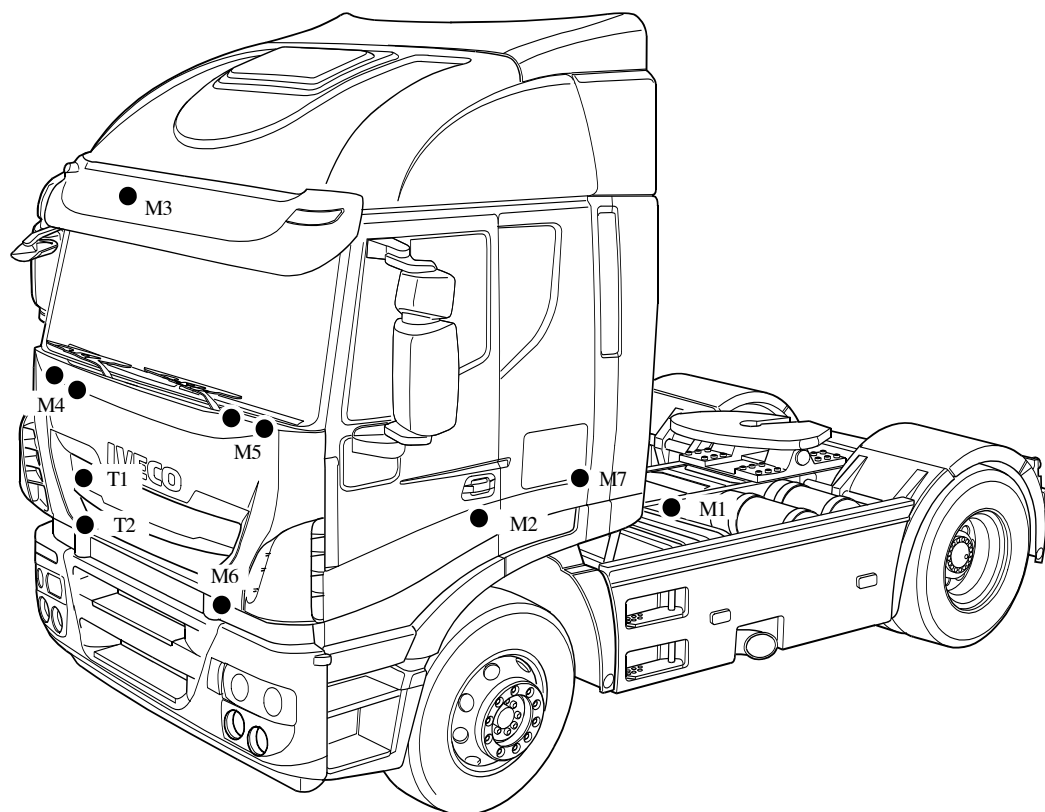
Additional signal grounds must be positioned at different points from the power ground.



191316

Figure 26

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



176018

Figure 27

M1 Battery ground
M2 Starter motor ground
M3 Upper cab ground
M4 Right inner cab ground

M5 Left inner cab ground
M6 Front right chassis ground
M7 Engine ground
T1 Equipotential braid
T2 Equipotential braid

The negative leads connected to a ground point in the system must be as short as possible and must be connected to each other in a "star" formation, while tightening must be done in an orderly and adequate manner.

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

- electronic control units must be connected to the system ground when equipped with metal housings
- the negative cables of the electronic control units are to be connected to a system ground point, connected to the negative terminal of the battery;
- the analogue grounds (sensors), while not being connected to the system ground/negative terminal of the battery, are to have good conductivity. Consequently, particular care should be given to terminal parasitic resistances: oxidation, scratches, etc.;
- the metal braid of the shielded circuits must be in electrical contact only at the control unit side to which the signal is to be sent
- With junction connectors (Figure 29) the unshielded sections "d" must be short as possible;
- The cables must be routed in such a way as to be parallel to the reference plane, as close as possible to the chassis/body.

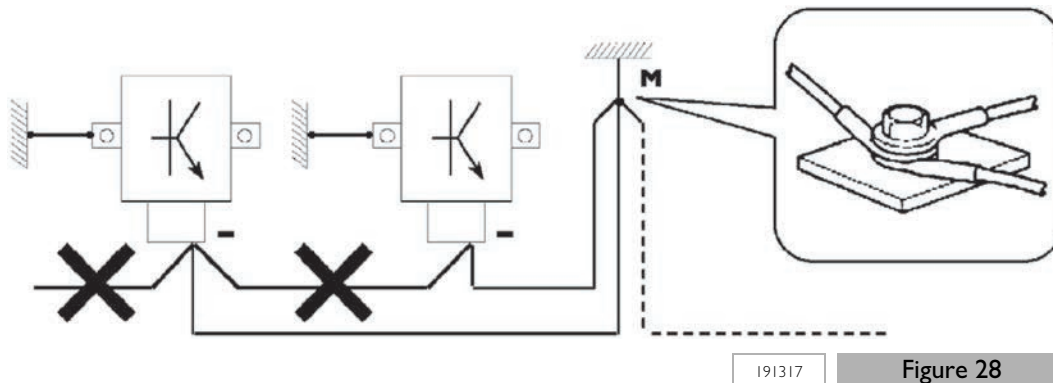
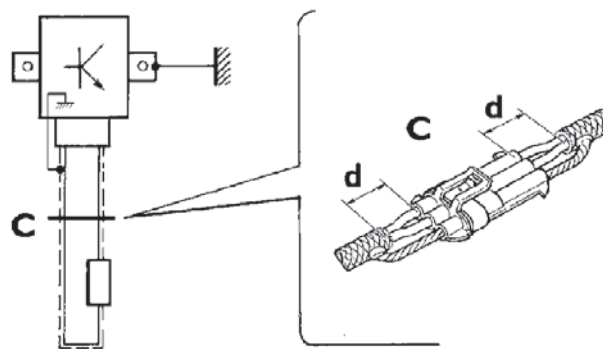


Figure 28

"STELLA" connections of various negatives with the system ground



191318

Figure 29

Shielding by means of a metal braid of a cable leading to an electronic component

Electromagnetic comparability

It is recommended that electrical, electro-mechanical and electronic devices which comply with the following immunity requirements for electromagnetic emissions, (both irradiated and conducted) are used.

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

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

The maximum excursion allowed for transition voltage with equipment powered by 24 V is +80 V measured on the terminals of the artificial network (L.I.S.N.) if tested on the bench. Alternatively, if tested on the vehicle, the excursion must be read at the most accessible point near to the conflicting device.

Note Devices powered by 24V must:

- be immune to interferences such as -600 V negative spikes, +100 V positive spikes, bursts of ± 200 V;
- operate correctly during the phase when voltage drops to 8 V for 40 ms and to 0 V for 2 ms;
- resist the load dump phenomena up to 58 V.

The maximum radiated emission levels measured at the bench and the levels of conducted emissions generated by devices and also by 24 V power supplies are given in the following table:

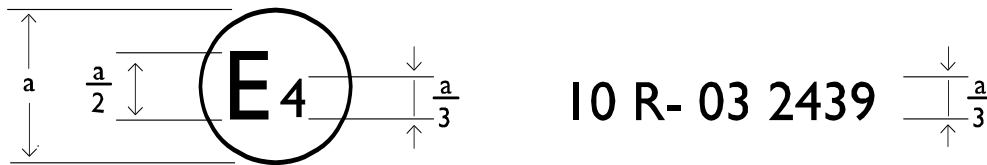
Table 5.20 - Electromagnetic emission levels

Type of emission	Type of transducer	Type of disturbance	Type of detector	Frequency range and limits acceptable in dB μ V/m									Unit of measurement
				150-300 kHz	0.53-2 MHz	5.9-6.2 MHz	30-54 MHz	68-87 MHz mobile services only	76-108 MHz broadcast only	142-175 MHz	380-512 MHz	820-960 MHz	
radiated	Aerial at a distance of 1 metre	Broad-band	almost peak	63	54	35	35	24	24	24	31	37	dB μ V/m
radiated		Broad-band	peak	76	67	48	48	37	37	37	44	50	
radiated		Narrow band	peak	41	34	34	34	24	30	24	31	37	
conduit	LISN 50 Ω 5 μ H 0.11 μ F	Broad-band	almost peak	80	66	52	52	36	36	Not applicable			dB μ V
conduit		Broad-band	peak	93	79	65	65	49	49				
conduit		Narrow band	peak	70	50	45	40	30	36				

Use electrical/electronic equipment in compliance with the UNECE directive on electromagnetic compatibility.

Only components with certified approval and with mark "e" are allowed: the "CE" marking is not sufficient.

By way of example, the mark prescribed by the current UNECE 10R3 on electromagnetic compatibility in the automotive field is shown below:



191312

Figure 30

 $a \geq 6 \text{ mm}$

The values in the table are only to be considered respected if the device comes from "IVECO Spare Parts" or it has been certified as per the international standards ISO, CISPR, VDE etc.

Whenever equipment is used which runs on mains power (220 V AC) for its primary or secondary source of power, it must be checked to ensure that its characteristics are in line with IEC regulations.

5.7 RECEIVER-TRANSMISSION SYSTEMS

The most frequent applications include:

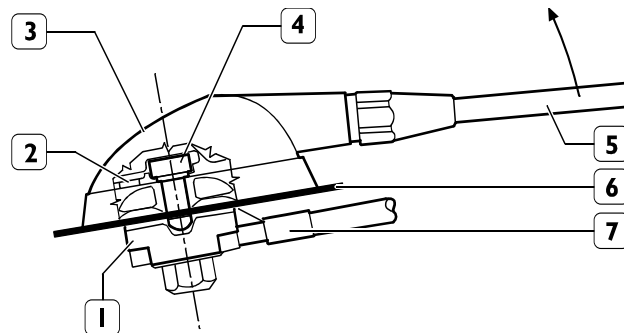
- amateur receiver-transmitter units for CB (City Band) and 2 m bands;
- receiver-transmitter units for cellular telephones and TETRA/TETRAPOL;
- GPS receiver and satellite navigation units.



- **If devices are fitted which could interact with the electronic systems already present (retarders, additional heaters, power take-offs, air conditioners, automatic gearboxes, telematics and speed limiters) contact IVECO to optimize the application.**

General instructions

1. The equipment must be approved according to the law and be of a fixed nature (not portable).
The use of non approved transmitters or supplementary amplifiers could seriously impede the correct functioning of the electrical/electronic devices normally supplied, with negative effects for the safety of the vehicle and/or the driver.
2. The system already provided on the vehicle must be used to power the transmitters and they must be connected to terminal K30 of the connector ST40 (and K15 where necessary) via a supplementary fuse.
Any additional power lines must be created respecting the correct sizing of cables and protection.
3. The coaxial antenna cable must be positioned taking care to:
 - use a low loss, top quality product with the same impedance as the transmitter and the antenna (see Figure 32);
 - in order to avoid interference and malfunctioning, create a path (the shortest possible) which maintains a suitable distance (min. 50 mm) from pre-existing cabling or from other cables (radio, amplifiers and other electronic equipment), keeping the minimum distance from the metal structure of the cab and using existing holes in the sheet metal;
 - do not shorten or lengthen; avoid unnecessary tangles, tension, folds and crushing.
4. Outside the cab, the antenna must be installed on the vehicle on a metal base with a wide surface; it must also be fitted as vertically as possible with the connection cable pointing downwards and therefore following the Manufacturer's fitting instructions and warnings (see Figure 31).
Installation on the centre of the roof is to be considered the best by far, as the grounding is proportional in all directions.
5. The quality of the antenna, the mounting position and a perfect connection to the vehicle structure (ground) are factors of fundamental importance to guarantee the best performance of the transmitter equipment.

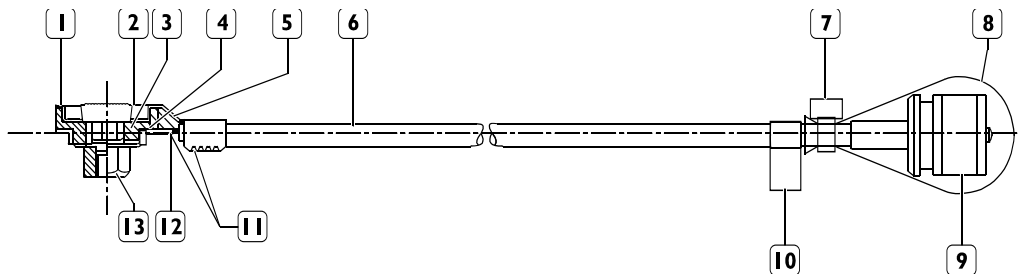


98915

Figure 31

- 1. Antenna support
- 2. Gasket
- 3. Fixed joint cover

- 4. Fastening screw M6x8.5 (tighten to a tightening torque of 2 Nm)
- 5. Antenna
- 6. Roof panel
- 7. Antenna extension cable



99349

Figure 32

- 1. Antenna connector
- 2. Ground wire
- 3. Insulator
- 4. Signal wire
- 5. Condenser (100 pF)
- 6. Cable RG 58 (characteristic impedance = 50 Ω)
- 7. Clamp
- 8. Protection cap

- 9. Connector (N.C. SO - 239) transreceiver side
- 10. Test executed sticker
- 11. The 100 pF condenser must be soldered on the lower pin and crimped to the ground braid
- 12. The lower pin must be soldered to the core conductor of the cable
- 13. Nut

Power for the equipment, when the voltage required is different to that for the system, must be obtained using a suitable DC/DC 12-24V converter if not already provided. The power cables must be as short as possible, avoiding any twists (coils) and maintaining the minimum distance from the reference plane.

In addition to indications provided in this Use and Maintenance Manual (Section: Controls and devices), below are some specific indications for each type of equipment.

Amateur equipment for CB (27 MHz) and 2 m band (144 MHz)

The transmitter part must be installed in a separate area from the vehicle's electrical components; if the transmission is impulsive it must be at a distance of least 1 meter away from other devices.

- The ROS value (Stationary Wave Ratio) must be as close as possible to the unit (the recommended value is 1.5), while the maximum acceptable value must never be greater than 2.
- The ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the typical CB band (26.965-27.405 MHz).
- The IRRADIATED FIELD in cab value must be as low as possible, and however $< 1 \text{ V/m}$.
In any case, limits set by the applicable European legislation must never be exceeded.

To determine whether the system is functioning well and to check that the antenna is calibrated, it is suggested that the following information is taken into account:

1. if the ROS (Stationary Wave Ratio) is higher on the lower channels than on the higher ones, the antenna should be lengthened;
2. if the ROS (Stationary Wave Ratio) is higher on the higher channels than on the lower ones, the antenna should be shortened;

After having calibrated the antenna, it is advisable to re-check the ROS (Stationary Wave Ratio) value on all the channels.

Equipment for GSM/PCS/UMTS cellular phones and TETRA/TETRAPOL

Install the transmitting part in a flat, dry area, separate from the electronic components of the vehicle, away from humidity and vibrations if the transmission is impulsive it must be at a distance of least 1 meter away from other devices.

- The ROS value (Stationary Wave Ratio) must be as close as possible to the unit (the recommended value is 1.5), while the maximum acceptable value must never be greater than 2.
- The ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the 380-460 MHz band and 870-960 MHz and 2 dB in the 1710-2000 MHz band.
- The IRRADIATED FIELD in cab value must be as low as possible, and however $< 1 \text{ V/m}$.
In any case, limits set by the applicable European legislation must never be exceeded.

The optimal position of the aerial is at the front of the cab roof, at a distance of 30 cm from other aerials.

GPS reception and satellite navigation equipment

Install the transmitting part in a flat, dry area, separate from the electronic components of the vehicle, away from humidity and vibrations. If the transmission is impulsive it must be at a distance of at least 1 meter away from other devices. The GPS antenna must be installed so as to have the maximum visibility possible of the sky.

In fact, as the signals received from the satellite are at very low power (approximately 136 dBm), almost any obstacle can influence the quality and performance of the receiver. The following should therefore be guaranteed:

- an absolute minimum angle of vision of the sky of 90° ;
- a distance no less than 30 cm from any other antenna;
- a horizontal position and never underneath any metal which makes up part of the cab structure.

Moreover:

- the ROS value (Stationary Wave Ratio) must be as close as possible to the unit (the recommended value is 1.5), while the maximum must never be greater than 2 in the GPS frequency range ($1575.42 \pm 1.023 \text{ MHz}$).
- the ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the $1575.42 \pm 1.023 \text{ MHz}$ band.

5.8 ADDITIONAL EQUIPMENT

The vehicle system is set up to supply the necessary power to the equipment provided, for each of which, as part of their function, the specific protection is assured as well as the correct sizing of cables.

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

The connection of the added users to ground must be made with an adequately sectioned cable, as short as possible and made to allow for any movements of the added equipment with respect to the chassis of the vehicle.

Having the need for higher capacity batteries, due to added loads, it is appropriate to request the optional with increased batteries and alternators.

In any case, when increasing battery capacity, it is advisable not to exceed 20-30% of the maximum values provided as optional by IVECO, so as not to damage some of the components (e.g. starter motor). When higher capacities are necessary, use additional batteries, making the necessary provisions for recharging as indicated below.

Additional batteries

The installation of too much additional electrical equipment or high absorption equipment (e.g. engines operated frequently or used for long periods with heat engine off, as in the case of tail lifts), could require power that the basic vehicle system cannot provide. In these cases, additional batteries of suitable capacity must be adopted.

The insertion of additional batteries in the vehicle circuit should include an adequate recharge system, using an alternator with more power or adopting an additional alternator with a separate recharge system, integrated with that of the vehicle. In this case it is necessary to provide additional batteries with a capacity equal to those originally fitted (170 Ah / opt. 220 Ah) for correct charging of all the batteries.

In case of installation of additional batteries, it is possible to use:

1. recombination batteries (AGM or gel);
2. traditional batteries.

In both cases it is necessary to adequately separate the batteries from the environment of the vehicle occupants by means of an appropriate container that ensures sealing in case of:

- emission of vapours (for example, in the event of a fault in the alternator voltage regulator);
- explosion of the battery;
- Leakage of liquid electrolyte, even in case of tilting.

If type 1 batteries are used, it is necessary to place a breather towards the outside of the housing compartment.

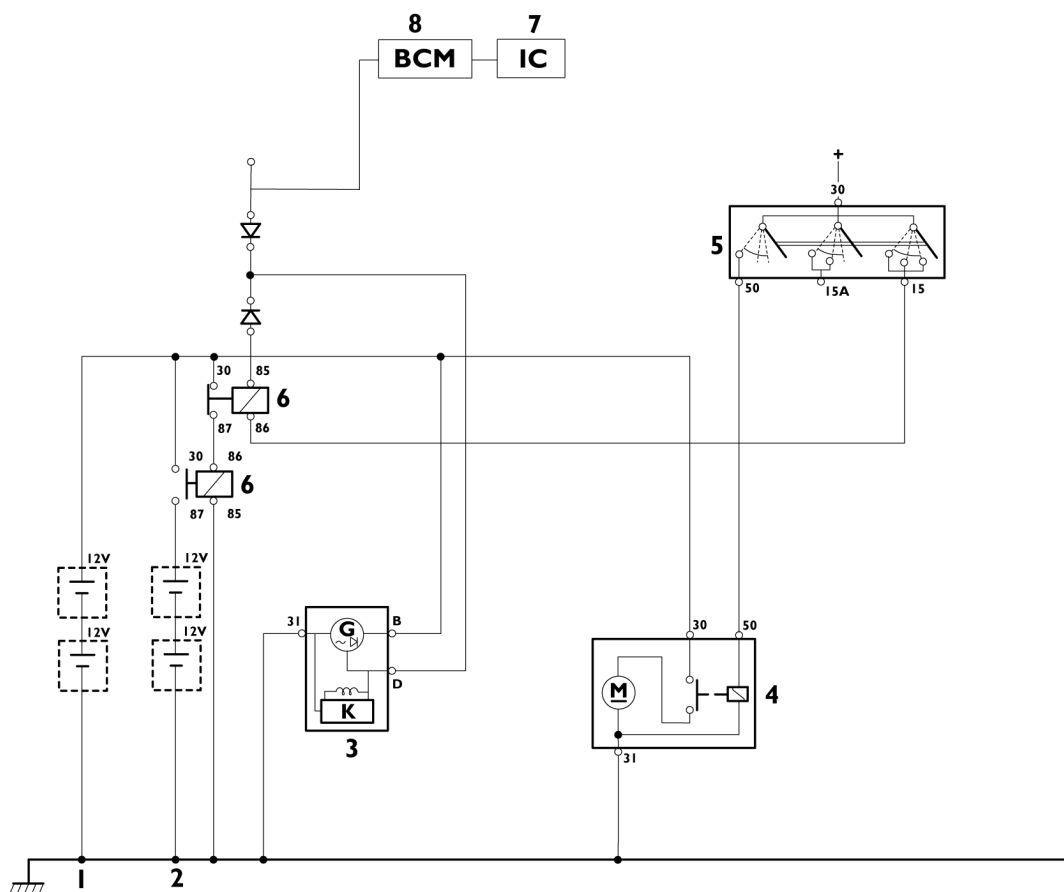
If type 2 batteries are used, it is necessary to use batteries equipped with:

- cover with a system that emits gas towards the outside, equipped with a tube for spraying acid spray outwards;
- flame arrestor system by means of porous pad.

It is also necessary to ensure that the evacuation of gas is located far from possible spark trigger points, from mechanical/electric/electronic parts, placing the exhaust outlet so as to avoid generating vacuum inside the battery housing compartment.



- **Ground connection of the additional battery must be made using a cable (the shortest possible) of adequate section.**



246282

Figure 33

- 1. Standard batteries
- 2. Additional batteries
- 3. Alternator with built-in regulator
- 4. Starter motor

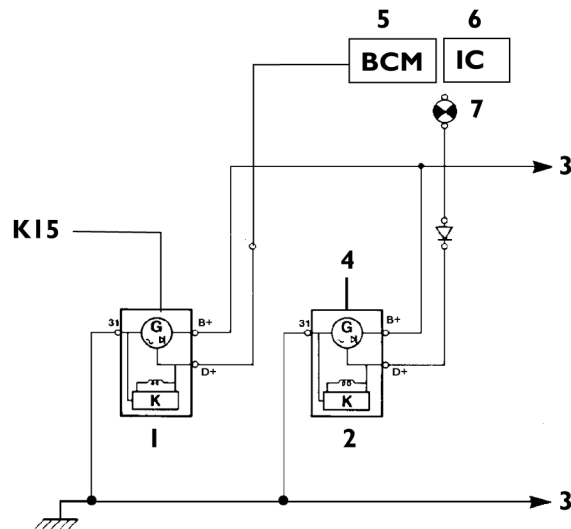
- 5. Ignition switch
- 6. Contactor switches
- 7. Instrument panel
- 8. BCM



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

Additional alternators

The installation of additional batteries involves the verification of the ability of the alternator to charge. If the results of this verification are negative, an alternator with more power must be used, or an additional alternator must be adopted; in this case, connection must be made as indicated in the following Figure.



246283

Figure 34

1. Standard alternator
2. Supplementary alternator
3. To the batteries
4. Signal K15 from connector ST14A/pin 11

5. BCM
6. Instrument panel
7. No battery charging warning light or led

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

The additional alternators must be the type with Zener diode rectifiers to avoid damaging electric/electronic equipment due to accidental battery disengagement. Each alternator must also have a light or LED indicating low battery charge.

The additional alternator must have electrical features identical to those of the standard alternator and the cables must be correctly sized.

If you need to modify the system in a way other than described in this manual (for example, adding batteries in parallel), it is necessary to share the operation with IVECO.

Additional electrical units

Particular attention must be paid when installing cooling units that use a second alternator, mounted on the engine (additional generator), as a power source.

These generators provide, depending on the number of turns, a voltage of the order of $270 \div 540$ V which goes through the wiring to the cooling unit installed on the vehicle.

There is a clear danger of any crosstalk (electromagnetic interference between adjacent cables) that can be generated between the aforementioned cable and the wiring already present on the vehicle.

In these cases it is necessary to use cables with high insulation, adopting a preferential path, though not in the vicinity of the standard vehicle wiring.

For these units, respect the electromagnetic emissions levels mentioned above.

In case of a standard alternator malfunction (e.g. low voltage, no signal) on the control panel, an error message will be reported.

A possible additional alternator cannot be connected to the MUX and therefore in case of malfunction, the MUX is not able to detect which alternator is not operating properly.

5.9 CURRENT DRAWS



- **It is not permitted to connect additional electrical systems directly to the positive pole of the battery assembly, as this is reserved for cables directed to the fuse holder. The fuse holder must not be changed or moved.**



- **It is not permitted to draw current from the bulkhead connector below the front grille, nor to disconnect or modify the terminals used.**

Current draws are possible from the main current switch DGC (standard equipment) or the TGC main current contactor (if fitted), or (under certain conditions) the PDU unit.

A) Main current switch (DGC)

It is generally located on the battery casing and functions automatically. It is a two-pole switch that disconnects the battery from the chassis, allowing the operation of the tachograph, body computer, cooling unit, bed module and instrument panel.

For special modifications (e.g. transport of fuel, transport of dangerous substances) it may be necessary to use a safety switch that isolates the batteries and the alternator from the rest of the system.

Note *Parallel connection is permitted with the output of the switch, provided that the current draw does not exceed 150A, suitable fuses are used and the necessary precautions are taken. If other draws are in progress, an additional strong one may generate difficulties.*

Specific solutions must be authorised by IVECO.

B) Main current contactor (TGC)

When the vehicle is equipped with the TGC optional, the draw may be made on the appropriate pin.

In this case you need to remove the protective plastic from the free pin and connect the draw terminal directly to the threaded screw (positive pole), locking it with a suitable nut; the chassis constitutes the return.

To make two or more current draws, interpose a suitable spacer between the draw terminals.

Always protect the cables with a special corrugated pipe and always replace the protective plastic.

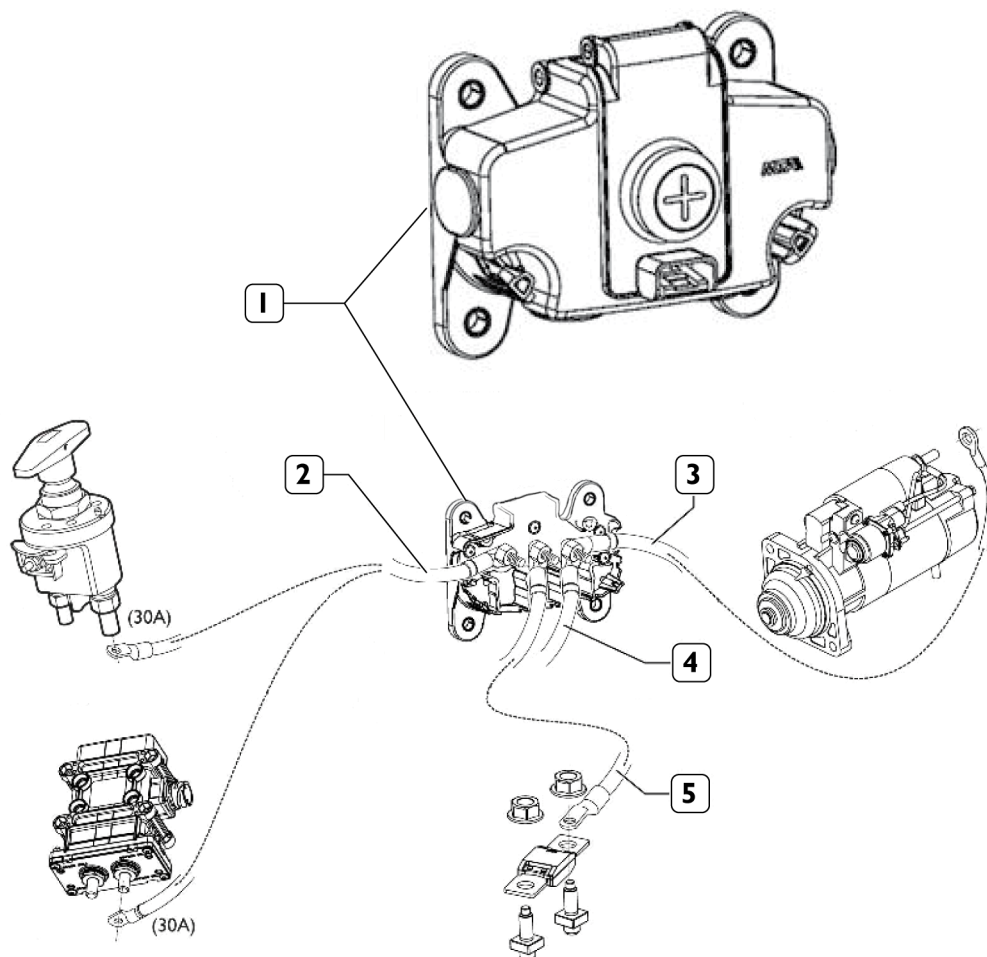
c) Power distribution unit (PDU)

The PDU is a junction box which, on the vehicle wiring diagram, is inserted between the DGC and the starter motor (see Fig. 35).

If it is combined with a 150A fuse ("megafuse"), this constitutes a safe point for drawing current.

The PDU combined with a fuse, is part of the standard equipment of trucks with right-hand drive (due to technical constraints), while it is available as an optional on trucks with left-hand drive (no. 78388).

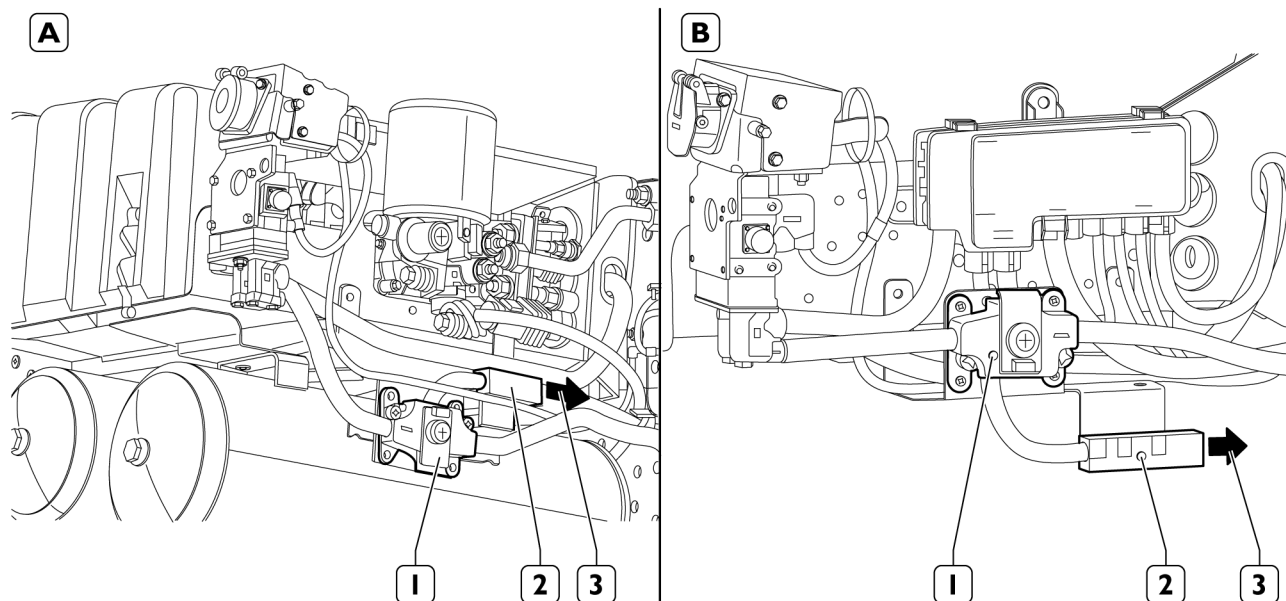
For tractors, it is possible to adopt just the PDU.



248433

Figure 35

1. PDU Control unit
2. Positive cable from the battery cutoff switch to the PDU control unit **70 mm²**
3. Cable from the PDU to the starter motor **70 mm²**
4. Cable from the PDU to the fusebox on the roof (RH drive vehicles only) **50 mm²**
5. Cable from the PDU to the 150A fuse (if fitted) **50 mm²**



259169

Figure 36

A. Application on trucks

B. Solution for low floors (Car Transporter)

1. PDU Control unit

2. Maxifuse 150A

3. Power supply for Bodybuilders

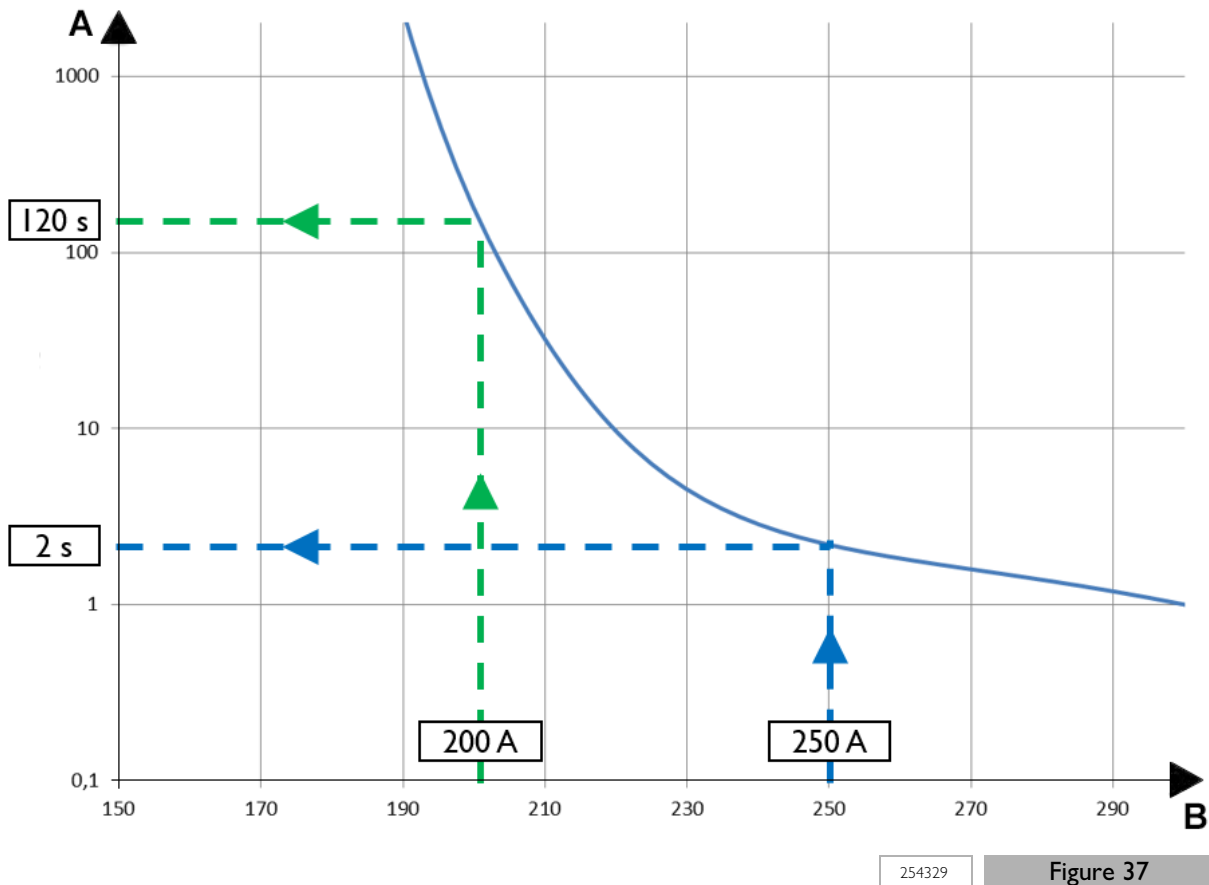
Current cut-off for currents exceeding 150 A

Currents exceeding 250 A are not permitted.

Electric currents exceeding 150 A are permitted with a 150 A fuse if the time interval is less than the value indicated on the graph below (the time scale is logarithmic).

Example

- The current cut-off of 200 A is possible for a time of 120 s
- The current cut-off of 250 A is possible for a time of 2 s.

Time-current characteristic curve for the 150 A fuse @ 23 °C - Basic: ISO Standard 8820

A Time [s]

B Electric current [A]

Voltage reducer

The electrical system of the vehicle is prepared for the power supply of 12V devices. Connection with a voltage reducer (from 24V to 12V) is possible in the cab.

Do not power the unit directly by taking 12 V voltage from a single battery.



- **The voltage reducer is arranged for a maximum current absorption of 20 A at a temperature of 30°C (measured in the device compartment on the upper cross member). Therefore, it must not be used if other devices indicate higher absorption.**

5.10 MISCELLANEOUS

a) Additional circuits

They must be separated and protected from the vehicle main circuit by means of a specific fuse.

The cables used must be 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 (the use of polyamide type 6 plastic is recommended) 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 passage of these cables through structural components (cross members, profiles, etc.) must be executed using suitable cable glands or protections; they must be secured separately with insulated cable clamps (e.g. made of nylon) at adequate intervals (approx. 200 mm). Do not make any holes in the chassis and/or bodywork for the passage of cables.

In case of external panels, use a specific sealant both on the cable and on the panel to prevent water, dust and fumes from infiltrating.

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 which 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 5.21- Use of cables and fuses according to the current drawn

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

⁽¹⁾ For uses of more than 30 seconds.

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



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

Precautions

- Incorrect installation of electrical accessories may affect occupant safety and cause severe damage to the vehicle. Contact IVECO if you have any questions.
- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).
It should be noted that when grouping several cables together, in order to compensate for the lower heat dispersal capacity current intensity must be reduced with respect to the nominal value of a single cable.
- In vehicles with frequent engine start-ups, with limited current drawn and engine rotations (e.g. vehicles with refrigeration chambers), provide for periodic battery charging to maintain efficiency.
- Plug and terminal connections must be protected, resistant to weathering, and executed using components of the same type as those utilised originally on the vehicle.
- In the event that a component has to be installed just next to the route of a cable belonging to the original system, make sure that its remains integral and avoid any cuts.



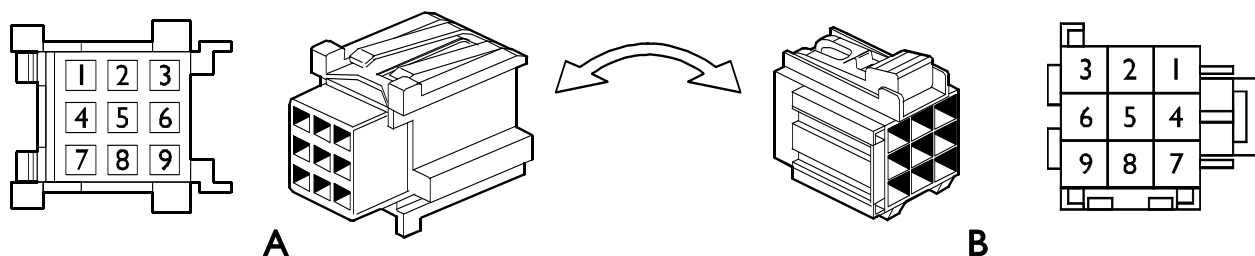
► **Any damage caused by failure to comply with procedure is not covered by warranty.**

b) Interventions for modifying the wheelbase and overhang

Should it be necessary to lengthen the wires on the chassis owing to the new dimensions of wheelbase and overhang, a watertight junction box must be used which has the same characteristics as those used on the standard vehicle. The electrical components used such as wires, connectors, terminal blocks, conduits etc. must be of the same type as those used originally and must be correctly fitted.

c) Connector ST14E

Connector ST14E may be present on New Stralis in the case of applications in which opt. 6821 (EN 1501) is fitted by the Service Assistance after the vehicle has been purchased.



190412

Figure 38

OPT 6821 is incompatible with OPT 14861 (HillHolder)..

Please contact the IVECO Service Assistance to have the control units reprogrammed (EM, EBS, IC, ...).

Table 5.22 - Basic functions of connector ST14E

Pin	Description	cable code	Max. Load	Connected to	Remarks
1	Ground	0000	–	EM X1-05	

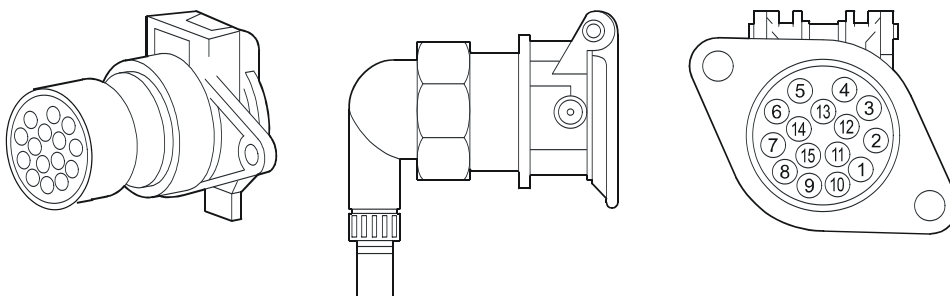
Pin	Description	cable code	Max. Load	Connected to	Remarks
2	Brake solenoid valve	6990	1 A	EM X4-21	used on Euro IV/Euro V applications Output EN1501 Solenoid valve Brake 0 V = not engaged +24V = engaged
3	EN1501 Brake lights	6989	1 A	EM X4-03	Output EN1501 Reverse protections brake active 0 V = not engaged +24V = engaged after K15 active for 2 sec (w/o brake activated)
4		0266			
5	External stop brake request (EN1501)	0994	10 mA	EM X3-20	Input signal to activate the Stopping brake (V<2km/h) Ground = active, low side switch
6	EN1501 Brake diagnostics warning light	6989	1 A	EM X4-03	Output EN1501 Reverse protections brake active 0 V = not engaged +24V = engaged after K15 active for 2 sec (w/o brake activated)
7	K30	7795	10 A	K30	Protected by 10A fuse F41 via ST48/I ()
8	Ramp switch request (EN1501)	0996	10 mA	EM X4-06	Input to activate the Refuse stepper switch Ground = active, low side switch
9	Buzzer (EN1501)	6987	1 A	EM X4-01	reserved for IVECO exclusively Output EN1501 Warning sound indicator 0 V = not engaged +24V = engaged

d) Trailer connectors

Two connectors are provided for connecting the trailer:

- 15-pin for general electrical devices (72010), located on the left;
- 7-pin for vehicles with EBS (72006), located on the right.

These are on the rear wall of the cab (tractors) or on the rear cross member of the chassis (trucks).

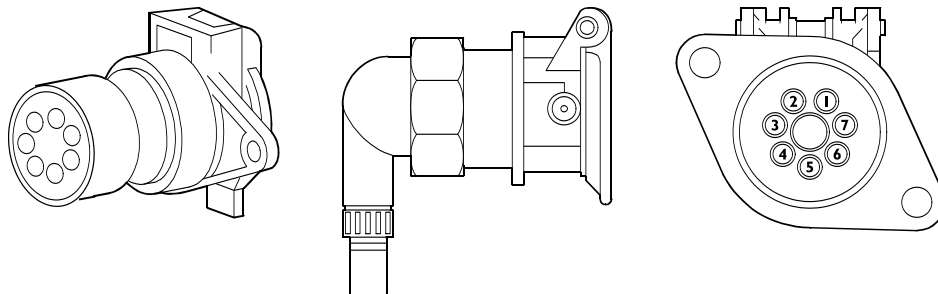


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Figure 39

Table 5.23 - Basic functions of the 15-pole connector (72010) for the trailer

Pin	Description	Cable code	Max. Load	Connected to	Remarks
1	Left trailer indicator	1180	2.3 A	FCM A01	The FCM control unit is able to manage current peaks of up to 4.5 A for a limited time; beyond this threshold, output is disabled.
2	Right trailer indicator	1185	2.3 A	FCM A33	The FCM control unit is able to manage current peaks of up to 4.5 A for a limited time; beyond this threshold, output is disabled.
3	Trailer rear fog light	2283	4.6 A	FCM A07	The FCM control unit is able to manage current peaks of up to 6 A for a limited time; beyond this threshold, output is disabled.
4	Ground	0000	11 A	Ground	
5	Trailer left side marker/side lights	3339	6 A	FCM A09	Beyond the value indicated, the FCM control unit will disable the relative output.
6	Trailer right side marker lights/side lights	3330	6 A	FCM A28	Beyond the value indicated, the FCM control unit will disable the relative output.
7	Trailer stop lights	1179	4.6 A	FCM A13	The FCM control unit is able to manage current peaks of up to 6 A for a limited time; beyond this threshold, output is disabled.
8	Trailer reverse light	2226	4.6 A	FCM A19	The FCM control unit is able to manage current peaks of up to 6 A for a limited time; beyond this threshold, output is disabled.
9	Power supply for trailer socket after fuse for T.M.P. users	7790	10 A	25770 / F8	
10	15-pole socket power supply	6021	10 A	ST64-3 (FCM A24)	The FCM control unit is able to manage current peaks of up to 11 A for a limited time; beyond this threshold, output is disabled.
11	Power supply for trailer interlocking positive +15	8075		ST64-1 (FCM A24)	
12	Trailer axle in raised position signal	6442	5 A	75000 A12 / F12	
13	Ground	0000	11 A	Ground	
14	Spare				
15	Spare				



113252

Figure 40**Table 5.24 - Basic functions of the 7-pin connector (72006) for the trailer**

Pin	Description	Cable code	Max. Load	Connected to	Remarks
1	Battery positive connected to fuse for trailer EBS	7772	30 A	75000-B25 / F47	

Pin	Description	Cable code	Max. Load	Connected to	Remarks
2	Key activated positive connected to fuse for EBS / speed limiter	8847	10 A	75000-A8 / F8	
3	Ground	0000	10 A	Ground	
4	Ground	0000	30 A	Ground	
5	Trailer EBS fault signal	667I		BCM E22	Inlet of the BCM control unit with dry current of the 10 mA contact.
6	CAN H line	WS/Bi		EBS X3-2	Connected to EBS control unit
7	CAN L line	GN/Ve		EBS X3-4	Connected to EBS control unit

e) Side marker light installation (Side Marker Lamps)

EC regulations require that vehicles are provided with side and clearance lights when the total length exceeds 6 m.

Installation of the side lights must be carried out on the additional structures (containers, vans, etc.), while the electric power supply is obtained by the specific connectors ST77 and ST78 on the chassis (trucks only).

Below is an illustration of the position for these terminals.

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

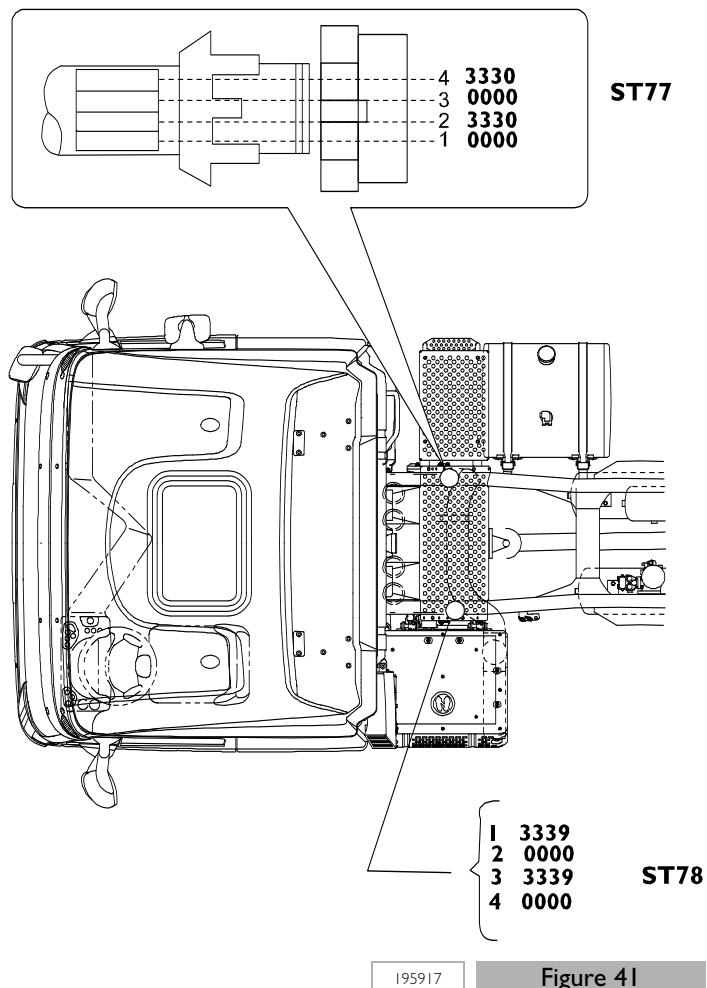


Figure 41

Table 5.25 - Basic functions of connector ST77

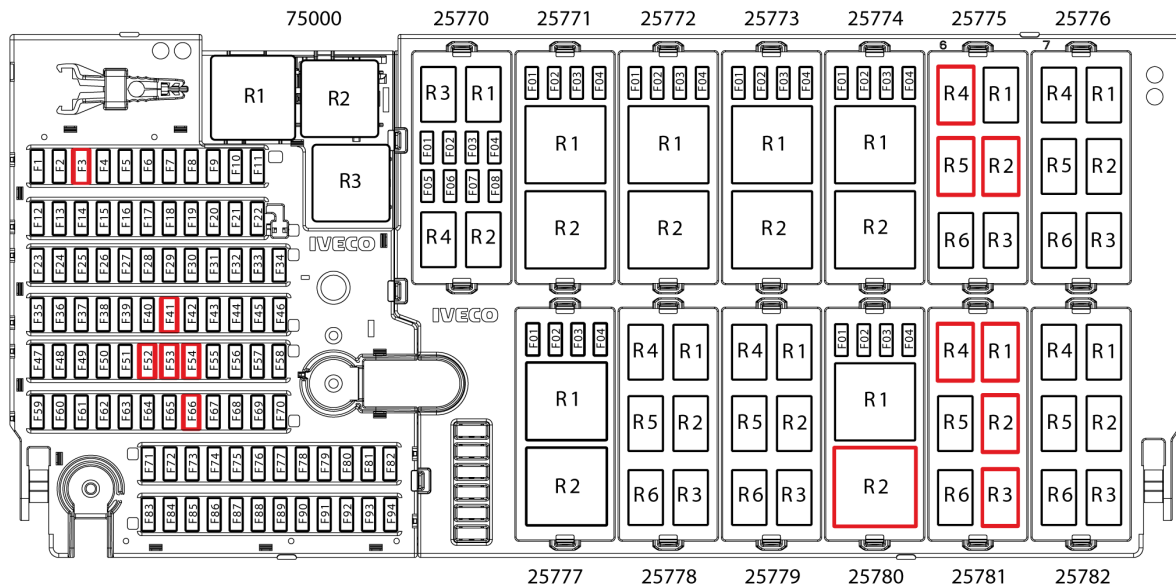
Pin	Description	cable code	Max. Load	Connected to	Remarks
1	Sidelights	3330	6 A	FCM A28	Common with 15-pin Trailer socket - Pin 6
2	Ground	0000	5 A	Wiring	
3	Sidelights	3330	6 A	FCM A28	Common with 15-pin Trailer socket - Pin 6
4	Ground	0000	5 A	Wiring	

Table 5.26 - Basic functions of connector ST78

Pin	Description	cable code	Max. Load	Connected to	Remarks
1	Sidelights	3339	6 A	FCM A09	Common with 15-pin Trailer socket - Pin 5
2	Ground	0000	5 A	Wiring	
3	Sidelights	3339	6 A	FCM A09	Common with 15-pin Trailer socket - Pin 5
4	Ground	0000	5 A	Wiring	

f) Fuses and relays

Special fuses are reserved for use by the bodybuilder; their position is shown in the following figure.



245783

Figure 42

Table 5.27- Fuses

Connector	Pin	Maximum load	Locking	Location	Description
ST48	6	5 A	75000	F3	K15 (24 V) - for EM X3-I3
72072D	I	10 A	75000	F4I	Battery (24 V) - After TGC (Main Current Contactor)
ST48	13				
ST14A	2I	10 A	75000	F52	K30 (24 V) - After TGC (Main Current Contactor)
72072C	I	10 A	75000	F53	Battery (24 V) - After TGC (Main Current Contactor)
ST48	4	15 A	75000	F54	K30 (24 V) - for EM X1-02
ST48	5	15 A	75000	F66	K30 (24 V) - for EM X1-09
ST14A	II	3 A	75000		K15 (24 V) from BCM H04

Table 5.28 - Relays

Module	Relay	Description
25775	R2	Ignition cut-out relay for tail lift
25775	R4	Relay for tail lift warning light
25775	R5	Relay for tail lift control
25780	R2	Acoustic indicator for ramp control EN 1501
25781	R1	Relay for EM - Safety
25781	R2	Relay for EM - Neutral
25781	R3	Relay for EM - EN1501
25781	R4	Diode for EM - EN1501

5.11 SAFETY ELECTRONIC DEVICES

Note *It is recommended that the following information is integrated with information provided in the Use and Maintenance in terms of the detail of the features of the systems described, the operating modes and restrictions.*

Radar sensor

The radar sensor is installed on the front bumper. It takes various measurements and integrates the data with the following safety systems of the vehicle:

- AEBS emergency braking (Advanced Emergency Braking System)
- ACC speed control system (Adaptive Cruise Control)

The main function of the radar sensor is to perform ensure constant monitoring of the following:

- the distance from the vehicle in front, according to the value set by the driver
- detection of obstacles on the road for the activation of a gradual alarm which notifies the driver, then activates a partial braking and then requests complete braking



- **Since the device carries out processing operations which are fundamental for safety, installation and calibration procedures are required which can only be carried out by IVECO during the first equipment: After-sales installation is not permitted.**

For compliance with the safety specifications and functional levels of the vehicle, the following key points must be considered before additional parts are positioned in the front part of the vehicle (for example, mount for additional lights, etc.).

- additional parts must be designed as additional components of the original bumper
- accessories or signs must not be installed on the "main radiation cone" of the radar (red area in Figure 43), the dimensions of which are provided in the following table

Table 5.29

Distance [mm]	Width [mm]	Height [mm]
10	113	61
20	117	63
30	121	66
40	125	68
50	130	71
60	142	73
70	154	76
80	166	78
90	178	81
100	190	83

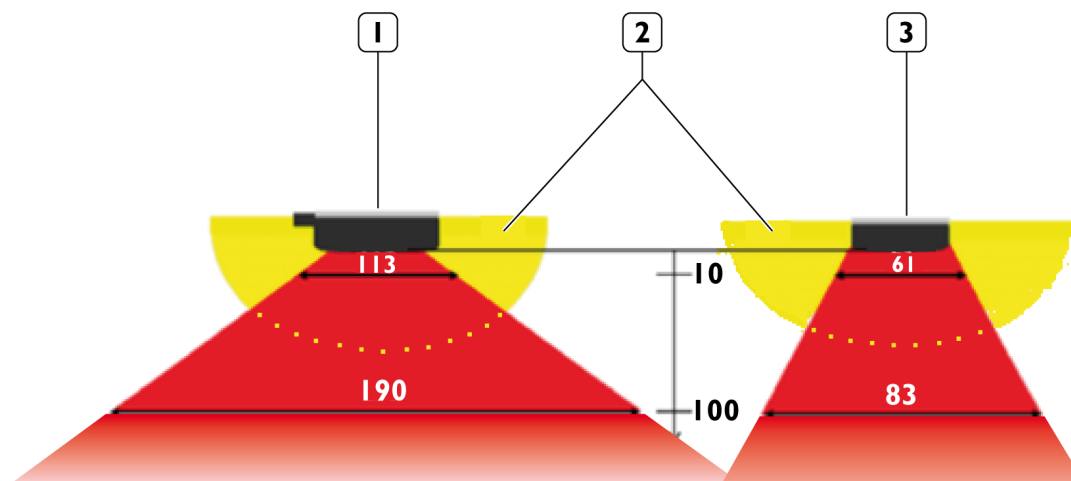


Figure 43

1. Width (Azimuth)
 2. Spherical zone
 3. Height (Elevation)

- do not modify, replace or tamper with the radar, the radar support bracket or any of the relative fixing points of the radar and the bracket
- do not modify, replace or tamper with the cover of the original radar "fitted in the factory"; furthermore, it is not permitted to paint to it or affix decals
- additional parts must ensure that the "main radiation cone" is kept free of any object as indicated below in Figure 44
- do not have additional components, electrical devices or wiring in the radius sphere of 300 mm, centred on the back of the radar

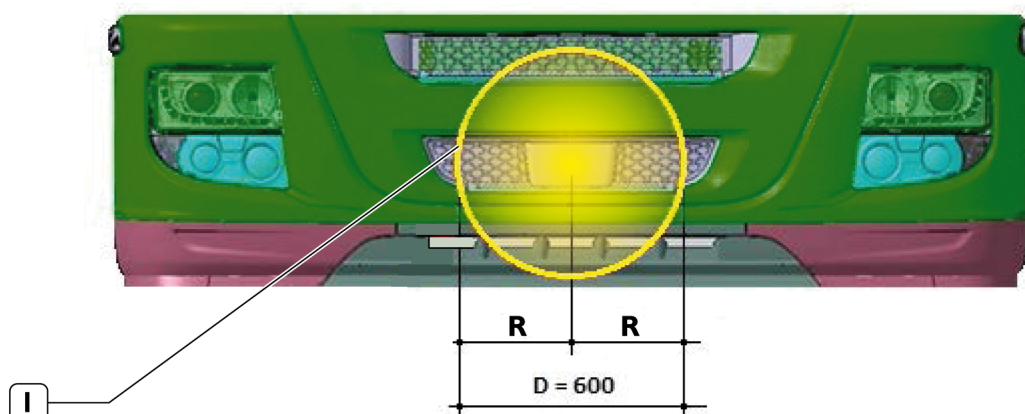


Figure 44

Note Changes to one or more than one of these parameters requires specific authorisation from IVECO as well as new deliberation and calibration of the device; any financial cost will be charged to the Bodybuilder.



- **The radar must be recalibrated each time it is removed from the bracket on the chassis.**

Note Recalibration can only be carried out by the IVECO Service Network.

Notes for additional components

- a) Free accessibility to the components below the front hatch must be ensured . The opening angle should allow the angle of the cab with the front hatch open
- b) The additional components must not limit the bumper cooling area or the front hatch



- **To prevent unintentional activation the brake pedal, the AEBS system must be deactivated when the area in front of the radar sensor is not completely free of any obstacles (tests on roller bench, towing vehicles, snow ploughs, front balers, etc.).**



- **Permanent or automatic disabling of the system is not permitted. The interruption can only be temporary password and will be cancelled after each start (refer to the Use and Maintenance Handbook for further details).**



- **Each time the radar wiring is disconnected, the wiring and radar connections must be protected to prevent the introduction of any dirt or water. Before refitting, the connector, radar connections and wiring must be inspected to check for any foreign bodies in order to guarantee their integrity.**

5.12 OPTIMISED TRACTION ON VEHICLES 6X2

In addition to the lifting function of the 3rd axle, the ECAS (Electronically Controlled Air Suspension) system automatically controls the level of the rear air suspension established for the specific use.

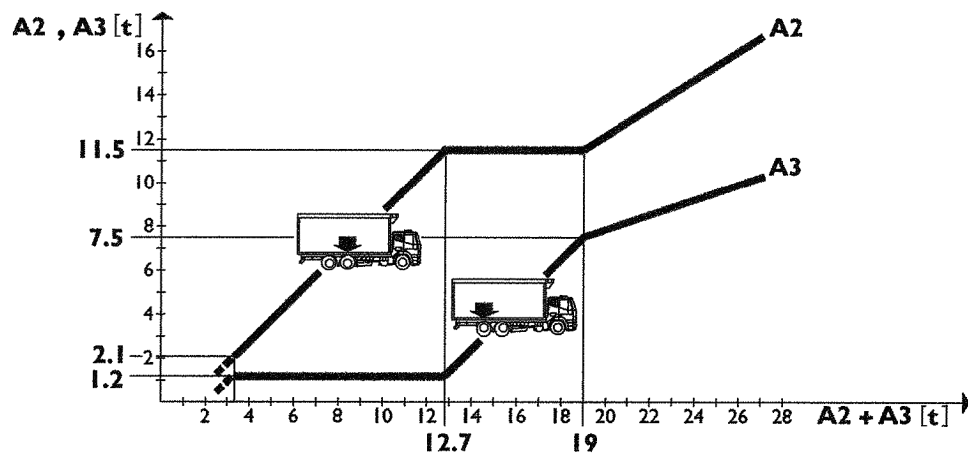
When required by the operating and road grip conditions, the system automatically distributes the load installed (equipment plus payload) giving priority to the drive axle, with the aim of obtaining better traction conditions (optimised traction).

The diagram in Figure 45 shows the distribution of the load between the drive axle and the third axle as a function of the overall increase (in the version 11.5 t + 7.5 t).

Table 30 shows the maximum values of the possible loads depending on the version of the vehicle / suspension or the optional installed.

The braking forces are automatically adjusted for the load on the ground.

Fittings with load distribution mainly on the rear axles (for example, waste collection vehicles with rear loading, cranes on rear overhang, etc.), it is possible to vary the load distribution on the rear axles originally provided using Modus.



261215

Figure 45

A2. Drive axle

A3. 3rd axle

Table 5.30 - Available versions

Models	Axes	Max. loads [kg]	Distribution stages of the loads [kg]			
Models P / PS / FS Unsprung masses 1,300 / 700 kg	drive axle	11,500 / 12,000	800	10,200	10,200	10,700
	3rd axle	6,300 / 6,500	500	500	5,600	5,800
	drive axle	11,500 / 12,000	800	10,200	10,200	10,700
	3rd axle	6,500 / 6,700	500	500	5,800	6,000
	drive axle	11,500 / 12,000	800	10,200	10,200	10,700
	3rd axle	6,700 / 7,100	500	500	6,000	6,400
	drive axle	11,500 / 12,000	800	10,200	10,200	10,700
	3rd axle	7,100 / 7,500	500	500	6,400	6,800
	drive axle	11,500 / 12,000	800	10,200	10,200	10,700
	3rd axle	7,500 / 8,000	500	500	6,800	7,300
Models PT / FT Unsprung masses 1300 / 1200 kg	drive axle	10,500	800	9,200	9,200	
	3rd axle	10,500	500	500	9,300	
	drive axle	11,500 / 12,000	800	10,200	10,200	10,700
	3rd axle	7,500 / 8,000	500	500	9,300	6,800

SECTION 6

**ADBLUE AND
SCRT SYSTEM**

Contents

6.1	GENERAL INFORMATION	5
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6.3	INSTRUCTIONS	6
	AdBlue tank	6
6.4	MOVING ADBLUE SYSTEM COMPONENTS	6
	Moving the tank	7
	Moving the muffler	8
	Interventions on the wiring and AdBlue and water pipes	9

ADBLUE AND SCRT SYSTEM

6.1 GENERAL INFORMATION

To comply with Euro VI requirements on engine gas emissions, IVECO has developed the "Hi-e SCR" system (High-efficiency Selective Catalytic Reduction), consisting of the combined action of a diesel particulate filter (DPF) and post-treatment of exhaust gases (SCR).

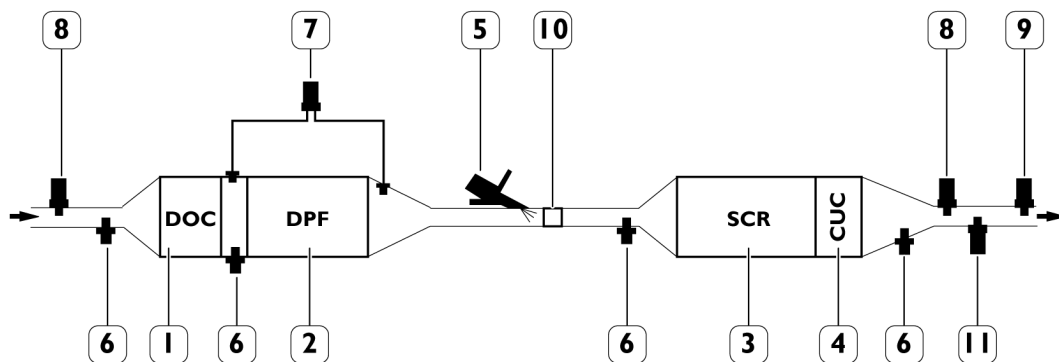
This post-treatment requires the use of an additive, commercially known as AdBlue (urea solution+water).

6.2 THE NITROGEN OXIDE CATALYTIC REDUCTION PRINCIPLE

The additive AdBlue, is sent from a dedicated tank by means of a SM (Supply Module) to a DM (Dosing Module) which injects AdBlue into the exhaust pipe. The mixture of exhaust gas and additive is then fed to the catalytic converter and chemically transforms NO_x into nitrogen and water, harmless to the environment.

In order to comply with Euro VI, new assemblies (DOC, passive DPF, CUC) and sensors are used which act as parameter control functions.

Main components of SCRT system



245557

Figure 1

1. Diesel Oxidation Catalyst
2. Diesel Particulate Filter
3. Selective Catalytic Reduction
4. Clean Up Catalyst
5. Dosing Module
6. Temperature sensors

7. DPF Δp sensors
8. NO_x sensors
9. NH_3 Sensor
10. Mixer
11. PM sensor

DOC (Diesel Oxidation Catalyst): to oxidise the exhaust gas components through the use of oxygen

DPF (Diesel Particulate Filter): to eliminate the particulate before the SCR through passive regeneration.

SCR (Selective Catalytic Reduction): to reduce the NO_x through the injection of AdBlue.

CUC (Clean Up Catalyst): to eliminate the ammonia residue (NH_3) so as to satisfy legal requirements.

6.3 INSTRUCTIONS

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

If changes are made to the chassis which also involve the AdBlue system, the following criteria must be observed:

- all post-treatment components must be installed under extremely clean conditions;
- the protection caps of the SM, DM and the AdBlue pipe bundle may only be removed just before assembly;
- the SM and DM fittings must be handled with care;
- the SM and DM fastening screws must be tightened to the torque specified in the relevant assembly diagrams;
- the seal of the DM flange on the ATS side must be replaced each time the DM is disassembled (the seal may only be used once);
- the "after-run" phase must not be interrupted using the battery manual switch or the ADR switch (the AdBlue pipes must always be emptied to prevent any crystallization or damage from freezing);

AdBlue tank

50, 60, 80 and 145 litres tanks are available depending on the required capacity.

Since the AdBlue solution may be corrosive for ferrous steels, any specifically shaped tanks must be made out of polyethylene or stainless steel (code 1,4571 - 1,4541 - 1,4112 - 1,4310 - standard DIN 17440).

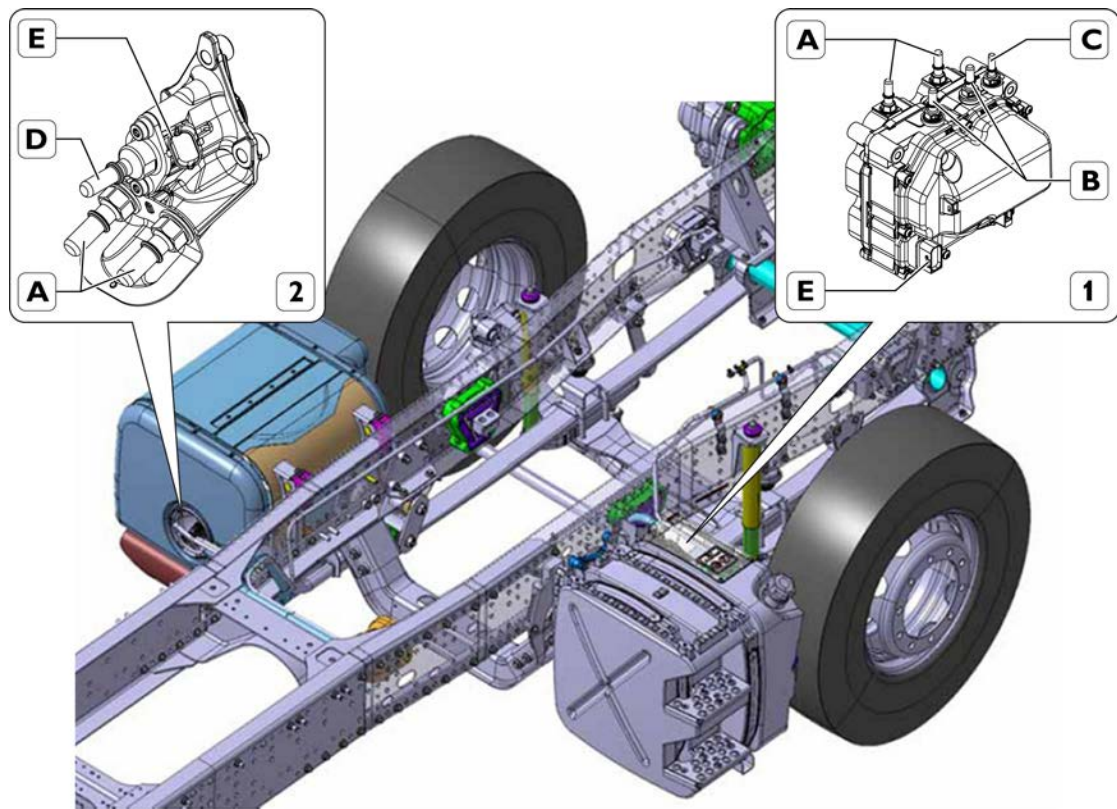
At the end of any operations which involve the AdBlue tank, make sure that:

- the tank ventilation pipe is not closed;
- AdBlue is present in 10% of the volume;
- the AdBlue does not exceed the maximum volume indicated by the level sensor, even if additional volume is anticipated due to the expansion of the solution in the case of freezing.

6.4 MOVING ADBLUE SYSTEM COMPONENTS

In order to comply with Euro VI requirements, the positioning of the main components of the AdBlue system has been optimised.

In particular, the SM pump module and the DM dosing module have been introduced into the AdBlue tank and silencer respectively (see Figure 2), providing benefits in terms of space and reduced length of pipes (better pressure stability).



I89105

Figure 2

1. Pumping module (SM)
2. Dosing module (DM)

- A. Water inlet/outlet fittings
- B. AdBlue intake and return coupling
- C. AdBlue pressure line fitting to DM
- D. AdBlue delivery union
- E. Electrical connector

All modifications must be studied and authorised by IVECO.

Moving the tank

- **vertically:**

The AdBlue tank can be moved provided that the new height of the SM module, to which it is secured, continues to comply with the conditions outlined in Figure 3.

The position of the DM module is subject to that of the silencer/muffler assembly.

- **horizontally:**

The AdBlue tank can be moved provided that the pipe between the SM and DM does not exceed 5035 mm in length.

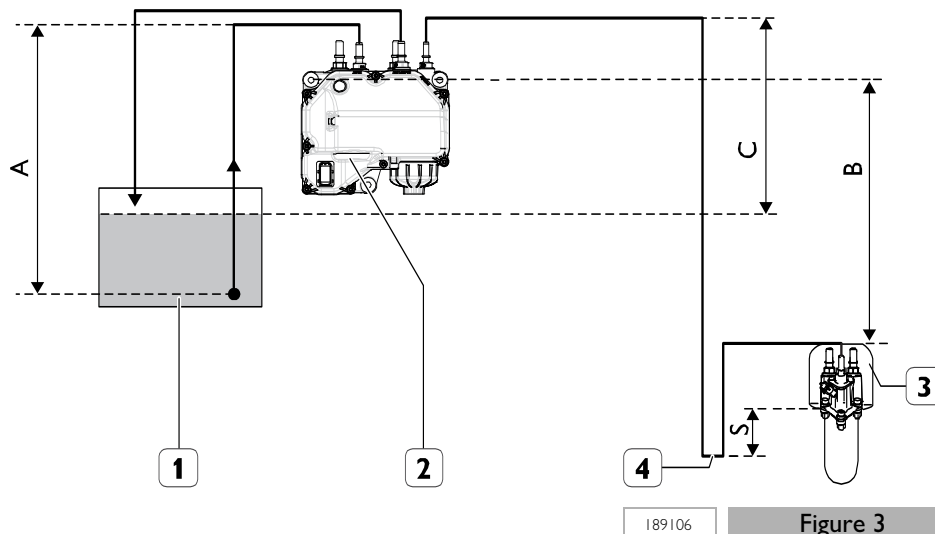


Figure 3

1. AdBlue tank
2. Pumping module (SM)
3. Dosing module (DM)
4. Siphon

- $A < 1000 \text{ mm}$
 $B < 1000 \text{ mm}$
 $C > 0$
 $S \geq 10 \text{ mm}$

Note Distance (A) is to be considered as fixed since the SM is integrated into the AdBlue tank.

In the diagram shown in the Figure 3, it can be seen that the pipes provide an adequate siphoning system in order to prevent any damage due to possible AdBlue freezing.

The siphon should have an internal collection volume of 12 cm³ and is to be located below the reference distance of the DM (for example S = 10 mm).

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

Moving the muffler

- **vertically:**

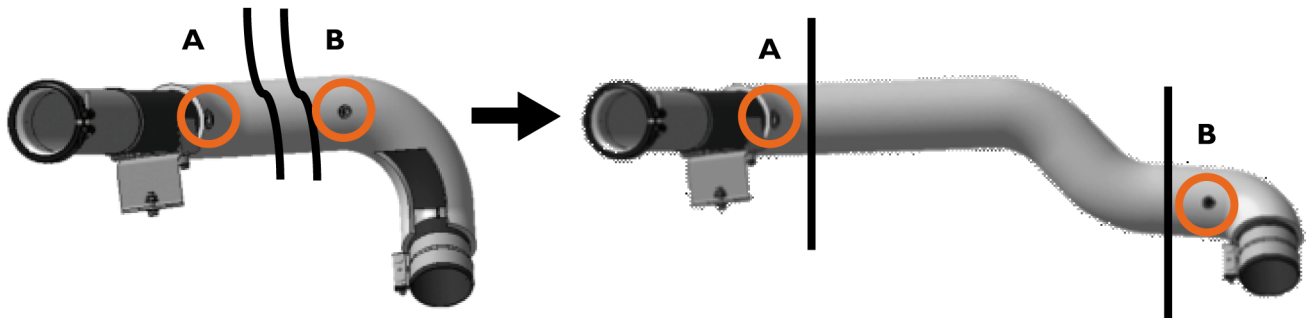
Height increases of up to 100 mm are permitted compared to the original installation distance.

Since sufficient air circulation around the muffler must be ensured, there must be a distance of at least 80 mm between its upper surface and the superstructure.

- **horizontally:**

Retractions are permitted which do not involve changes in the original trend of the exhaust gas temperature in the pipes connecting to the engine.

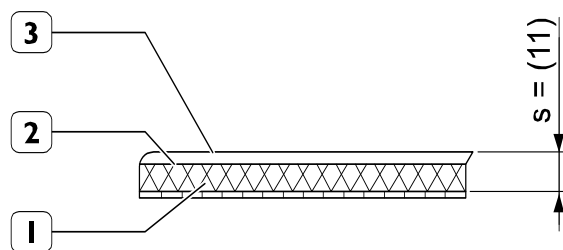
The subsequent lengthening of this pipe must be carried out at the centre so as not to change the position of sensors A and B in relation to the end of the pipe (see Figure 4).



245558

Figure 4

The new pipe must be installed so that between each end there is no loss of gas temperature greater than 15°C (relating to ambient $T = 25^{\circ}\text{C}$, engine speed = 1200 rpm and engine with full load). There must also be suitable cladding since the better the insulation, the greater possibility there is for muffler retraction.



218901

Figure 5

1. material in HTS fibre glass
2. ceramic fibre

3. external covering
- S. total thickness of insulating material [mm]

Figure 5 shows the structure of the material to be used for insulation. The essential features of this are:

- stability at temperature: 550°C
- heat conductivity at 500°C: 0.125 W/mK

Interventions on the wiring and AdBlue and water pipes

a) With regards to the electrical wiring please note that:

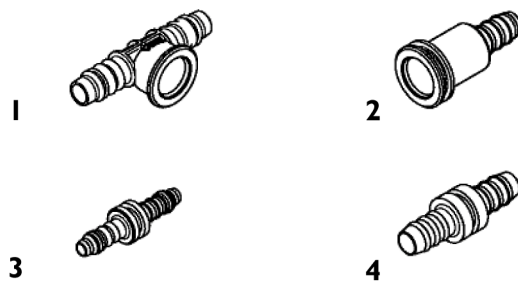
- it is only possible to lengthen cables relating to the temperature, AdBlue heater and AdBlue level sensors
- it is not permitted to alter the length of the NOx sensor cable. (If it is absolutely impossible to keep these cables unchanged, IVECO must be contacted and the indications provided must be followed).

b) With regards to the pipes for the AdBlue and heating water:

the adoption of flexible materials allows not only interventions for lengthening or shortening but also interventions for bending.

Note In order to limit the loss of load, only one lengthened stretch is allowed per pipe.

Note The pipes may be modified using specific equipment and couplings; to select and obtain these parts, contact the IVECO Service Assistance.



247862

Figure 6

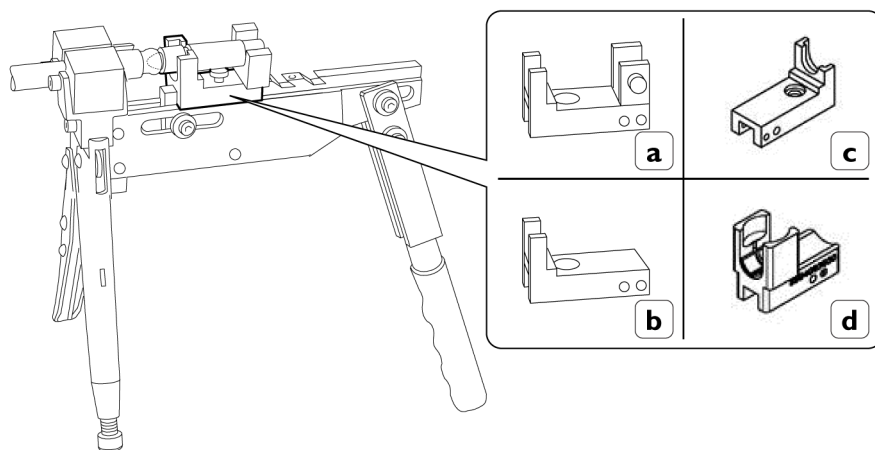
- | | | | |
|----|---------------------------------------|----|-------------------------------------|
| 1. | <i>T fitting for water pipes</i> | 3. | <i>Fitting NS6 for AdBlue pipes</i> |
| 2. | <i>Female fitting for water pipes</i> | 4. | <i>Fitting NS10 for water pipes</i> |

To change the length of the pipes (type 8x1 - PA for AdBlue and corrugated NS 10 for water):

- ensure that the fittings indicated in Figure 6 are available;
- mark the delivery and return pipes before separating them to ensure there is no confusion during subsequent reassembly;
- cut the pipes with the appropriate pipe cutting clippers in order to ensure an accurate cutting area;
- insert the aforementioned fittings in the sections obtained from the cut, using the designated tools indicated in Figure 7.



► **It is compulsory to work in a completely dust-free environment to prevent dust from reaching the injectors and subsequently clogging them.**



247863

Figure 7

- | | | | |
|----|---|----|---|
| a. | <i>Supports for fittings NS6 for AdBlue pipes</i> | c. | <i>Tool for inserting the T fitting</i> |
| b. | <i>Supports for fittings NS10 for water pipes</i> | d. | <i>Tool for inserting the female fittings</i> |

APPENDIX A

**STRALIS NP -
CURSOR CNG-LNG**

Contents

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STRALIS NP - CURSOR CNG-LNG

A.1 GENERAL INFORMATION

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

Any additional information must be requested from the IVECO Service Assistance.

Natural gas is a mixture consisting mainly of methane (main component), ethane, propane, carbon dioxide and nitrogen.

To be used as fuel for vehicles, it is compressed or liquefied, hence the vehicle designations CNG (Compressed Natural Gas / 200 bar operating pressure) or LNG (Liquefied Natural Gas / operating pressure 8-10 bar). These versions differ from others powered by diesel for the specific solutions applied to the engine, particularly for the electronic management and the presence of the cryogenic tanks and/or cylinders.

The increased level of technical complexity must therefore be taken into consideration when studying the conversion to be made to the vehicle and when implementing the relevant changes.

Note *Interventions on the engine power supply system which:*

a) use components other than original parts (even if type-approved as Separate Technical Unit) or

b) modify the original architecture (movements or addition to cylinders, retainer types, etc.)

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

To this case, the designated Authority may require the complete documentation (calculations, diagrams, test reports) certifying compliance with the requirements of Regulation UNECE 110 for all the modifications made to the original system.

Vehicle type-approval is the full responsibility of the Bodybuilder.

Note *IVECO only authorises CNG and LNG type-approved vehicles for ADR use according to Regulation UNECE 105 and produced in plants with the required equipment.*

If required, type-approval of the specific vehicle is indicated in the Certificate of Conformity.

A.2 SAFETY REGULATIONS

Please carefully read the same chapter in the Use and Maintenance Manual provided with the vehicle

A.3 MAIN COMPONENTS

a) Cylinders / Tanks

The NP STRALIS supply system consists of a series of cylinders (CNG vehicles) or tanks (LNG vehicles) or a combination of these assemblies, as well as valves and rigid pipes.

The table below shows the units that can be used to create the standard vehicles as required for the STRALIS NP range.

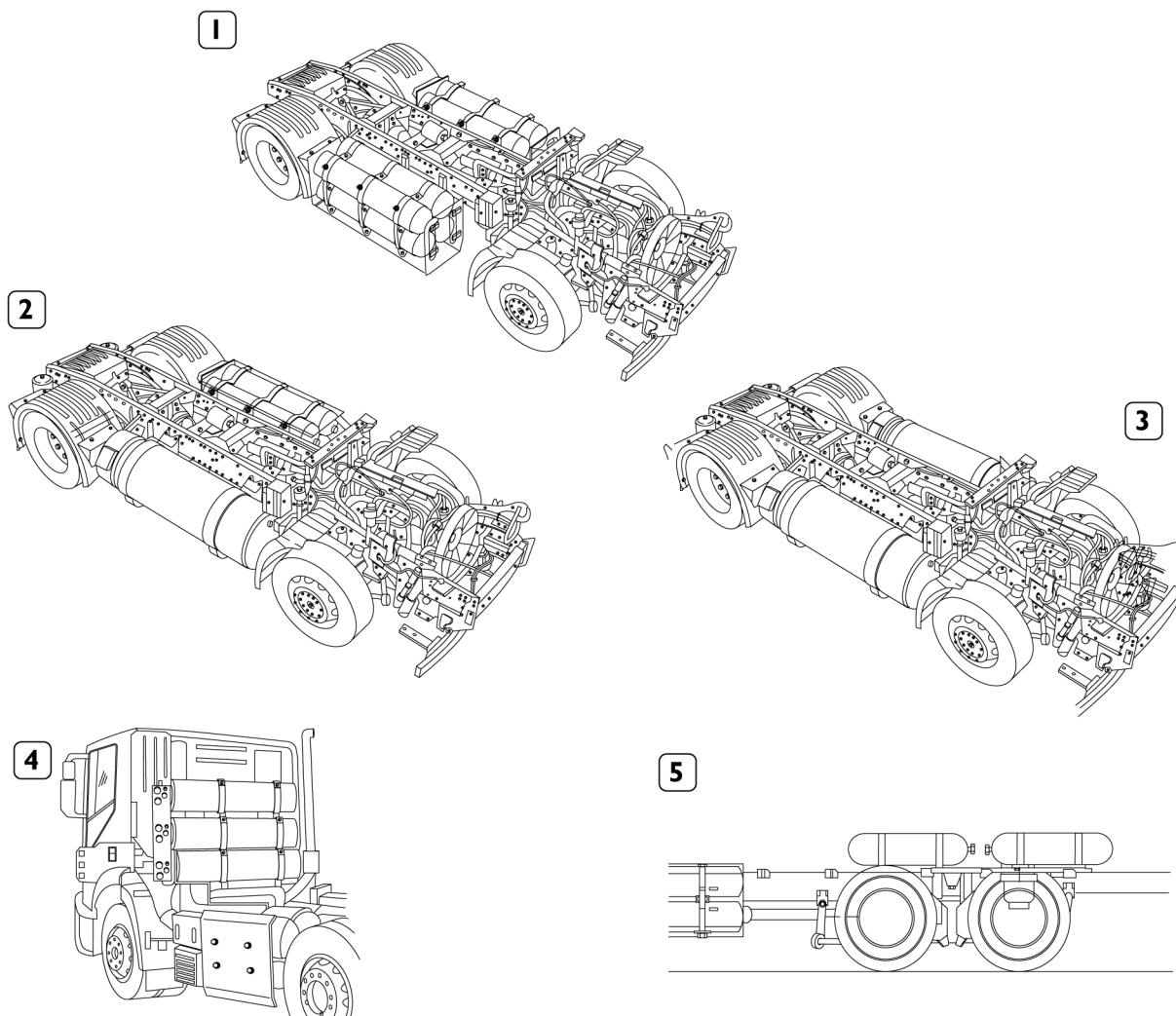
Table A.1 - Configurations of CNG cylinders - LNG tanks

Location	type fuel	No. of LNG tanks or No. of CNG cylinders x capacity [l]	Capacity net [l]	Net capacity for calculation of autonomy range [kg]
Right side or left side of chassis	CNG	4 x 70	280	42
		4 x 80	320	48
		4 x 115	460	70
		2 x 80 + 2 x 140	440	66
		2 x 115 + 2 x 148	526	80
		2 x (2 x 115 + 2 x 148)	1052	160
	LNG	1 (cross-section 26")	250	90
		1 (cross-section 24")	400	140
		1 (cross-section 26")	410	145
		1 (cross-section 26", only C8 NP)	510	185
		1 (cross-section 26")	540	195
Behind cab (AD cab only)	CNG	3 x 80	240	36
		3 x 140	420	63
		3 x 148	444	67
Above chassis (rigid only)	CNG	2 x 80	160	24
		4 x 80	320	48
		6 x 80	480	72

Note The net capacity in kg used to calculate the range in km takes into account the real mass of fuel which can be used. For example, methane cylinders work in the standard pressure range of 20 at 200 bar. This means that 10% of the load cannot be used and therefore it must not be in used in the calculation.

The following combinations are therefore available (see the following Figure):

1. only CNG with cylinders on the sides of the chassis
2. CNG + LNG mixed with cylinders and tanks fitted on the sides of the chassis
3. LNG only with tanks fitted on the sides of the chassis
4. CNG only with cylinders on the sides of the chassis and behind the cab
5. CNG only with cylinders on the sides and on the chassis



269947

Figure 1

b) Ventilation valve

Downstream of the CNG cylinder packs or LNG tanks, there is a manual cock for maintenance operations if partial or full emptying of the high pressure system section is required.

c) Disconnection valve

Upstream of the pressure gauge some versions have a manual valve which must be closed before carrying out any kind of maintenance operation on the components downstream.

d) Safety solenoid valve (CNG)

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

- Manual closure for maintenance and shut-off;
- One-way solenoid valve served by the ignition key which interrupts the flow entering the cylinder: thus the cylinders must be charged when the solenoid valves are not powered.
- the flow relief valve intervenes in the event of a sudden change in pressure, significantly limiting the outward flow of gas from the cylinders (for example if a pipe breaks);
- the fusible plug (T-PRD) which in the event of a fire melts at 103 ± 10 °C and allows the gas to exit directly into the external environment, preventing the cylinder from exploding
- the safety valve to control the pressure (P-PRD), with an opening threshold of 340 bar.

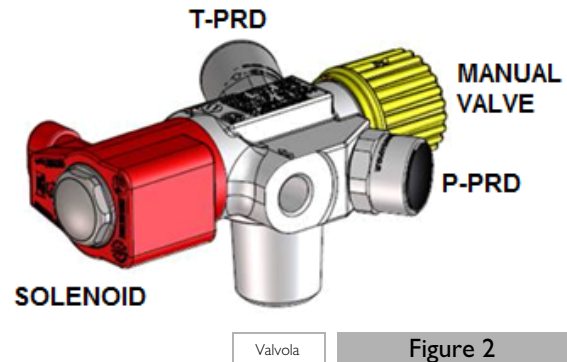


Figure 2

Note Safety valves are not interchangeable and the respective orientation must not be modified.

A.4 REQUIREMENTS**General instructions**

Note If extending or shortening the wheelbase length from a type-approved length to a type-approved length, authorisation from IVECO is not necessary if the gas system remains unchanged in terms of layout and position on the chassis.

If changing the configuration or layout, authorisation is required even if one of the possible type-approved alternatives is to be used.

The modifications must only be made by specialised personnel, working in authorised and certified workshops.

- Before any intervention, fully discharge the gas present in the pipes. This is possible by implementing the "Partial emptying" procedure (see Chapter A.5).
- Parts must be kept perfectly clean, and care must be taken to ensure that no sediment or foreign bodies can enter during handling operations.
- Pay particular attention to the direction of installation of all electrical connections.
- All threaded connections must be tightened to the torque specified for special components for the first equipment.
- Washers, conical washers, self-locking nuts and gaskets are of a designated type and deform to contribute to the tightening efficiency; therefore, before reassembly, these parts must be replaced.



► **Regardless of the reason for the disassembly, the power supply system components (in particular, the valves on the cylinders) must be replaced.**

- For reasons of safety, both when outfitting and during maintenance, it is strictly prohibited to use the gas pipes as a support for other pipes.
- In some situations of limited space, it is permitted to secure some electric cables (using collars) to the gas pipes, provided they serve only as a guide and not as a support.
- During these operations, pay careful attention to ensure that the pipes are not damaged in the process and remain free of any scratches, markings or deformation. Protect the pipes if necessary.
- When a gas pipe passes through the chassis side member, make sure that the rubber bulkhead connector is not dislodged in any way and is perfectly coaxial with the hole on the chassis.



- ▶ **After any intervention on the high pressure section of the CNG system, a TEST must be carried out to ensure there are no GAS LEAKS at 260 bar. The test can only be carried out at a Centre specifically enabled for this task. A Test Certificate is issued following a positive result.**



- ▶ **Check if local Regulations and the competent Authorities allow vehicles running on CNG and LNG to be parked in closed areas (for example, workshops) and that these areas are certified and authorised.**

Breather pipe

When the pressure inside the LNG tank exceeds the nominal calibration of the primary safety valve (16 bar), the system discharges the amount of gas needed through the vertical pipe behind the cab to reduce the pressure and bring it to below 14.5 bars.

The LNG tank is designed to ensure pressure is kept below the pressure set for the primary safety valve for at least 5 days with a full tank at standard operating pressure (approx. 9 bar), the vehicle stationary and ambient temperature of 20 ± 5 °C.

In the same conditions, if it is left to vent, a full tank will empty in approximately 6 weeks.

The time required by the tank before it begins to vent depends on the initial internal pressure (the lower, the better) and the percentage of gas in the tank (the higher, the better). For example, if a vehicle is left stationary with 30% of the maximum capacity of the tank, it will empty after just 3 days.

It is therefore recommended that the smallest possible amount of gas is left in the tank in the event of maintenance operations on the LNG tanks or long periods of inactivity. This is to prevent the natural gas venting into the atmosphere.

Change in the chemical composition of the LNG

If the vehicle remains stationary for long periods (> 20 days), especially when the tanks are almost empty, the chemical composition of the natural gas changes progressively and it may no longer meet the specifications required for proper engine operation. To prevent damage, the vehicle must be driven slowly without a load (without a semi-trailer, trailer and / or load) to the nearest LNG refuelling stations and refuelled before resuming normal service.

Indications for parts

a) Repainting the outfitted chassis

Note As well as the indications provided in Chapter 2.3 PROTECTION AGAINST RUST AND PAINTING (► Page 10) and especially page 13 of that Chapter, please note that it is also necessary to follow the indications provided by Regulation ECE R110 and any additional regulations of the individual country/market.

The following must be protected from paint:

- the stainless steel pipes of the gas supply system
- the pipe connection fittings
- the hose from the pressure reducer to the rail on the engine
- the solenoid valves and the relative coils on the gas cylinders
- the gas system pressure reducer
- the identification plates

Note The CNG tanks and LNG must be emptied; they must also be cleaned with nitrogen if the temperature in the painting booth exceeds 40 °C (maximum permitted temperature 60 °C).

b) Engine control unit protection

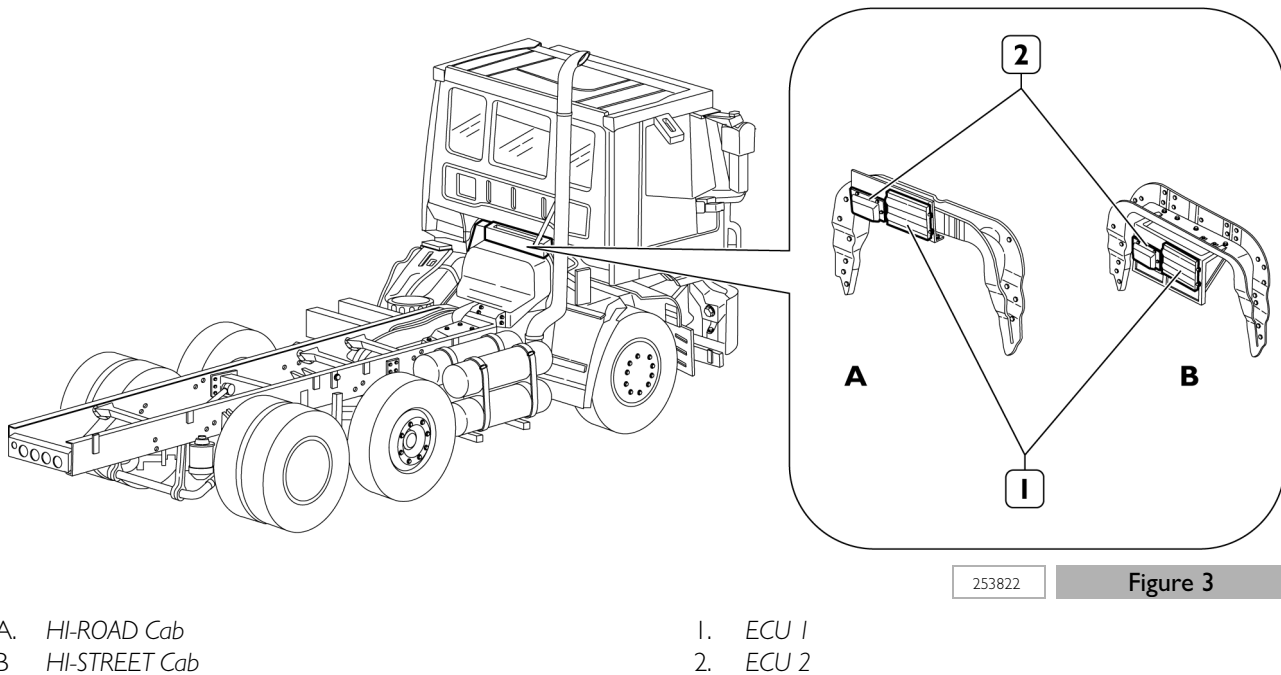


Figure 3

The engine control units are located in the suspension cross-member behind the cab in a central position.

If the vehicle conversion vehicle requires the engine exhaust gas pipe to be positioned vertically behind the cab, consideration must be given to the fact that the temperatures of the gas may exceed 800 °C and therefore this pipe must be kept at a distance of at least 50 mm from the ECU control units.



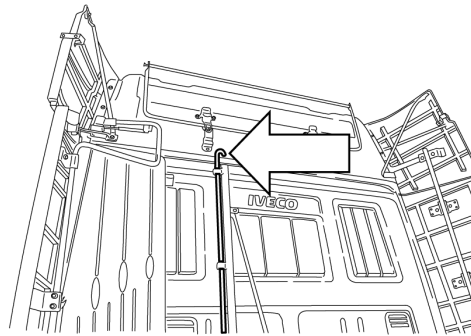
- Use suitable heat guard screens if high temperatures are anticipated (> 70 °C) with the subsequent risk for pipes, electrical cables, synthetic materials, etc.

c) Cylinders

Always keep a safe distance between the outfitting and the solenoid valves to allow the solenoid valves to open/close correctly and to allow for maintenance operations to be carried out: the minimum recommended distance is 200 mm.

With specific reference to LNG vehicles, please note the need to leave sufficient space:

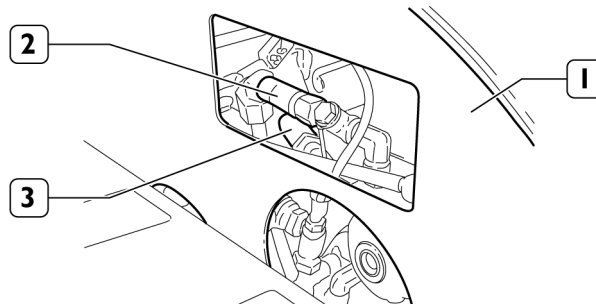
- around the vertical breather pipe (indicated by the arrow) on the rear wall of the cab, connected to the primary safety valve



253823

Figure 4

- around the tank head cover plate (1) to allow:
 - actuation of the manually-operated valve (red) of the liquid phase and the manually-operated valve (grey) of the vapour phase
 - inspection of the red plug (3) on the secondary breather valve



253824

Figure 5



- **The gas tank must be at a minimum height of 200 mm from the ground to ensure compliance with Regulation ECE R110.**



- **Use suitable heat guard screens if high temperatures are anticipated (> 70 °C) with the subsequent risk for pipes, electrical cables, synthetic materials, etc.**



- **The breather valves are essential for the safe operation of the system and therefore must always be accessible. Please read the Use and Maintenance Manual carefully for all indications in this regard.**

d) ATS system (After Treatment System)

The insulators and the heat shields must remain in their original position. Any modification must receive prior authorisation from IVECO.

e) Gas pipes

Any modification of the pipes must be compliant with Standard ECE R110 and all the components must be type-approved according to ECE R110.

Lengthening the pipes may have a negative impact on performance due to reduced injection pressure (especially for the LNG version).

Do not reposition components of the gas system such as the regulator, sensor or filter without having received explicit authorisation and approval from IVECO.



- **It is strictly prohibited to modify the diameter of the gas pipes.**

A.5 EMPTYING THE CNG SYSTEM

Note *Contact the IVECO Service Network before carrying out any intervention.*



- **Before any welding operations on the vehicle or maintenance operations on the engine, the fuel system must be fully "ventilated", i.e., it must be emptied of gas.**

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

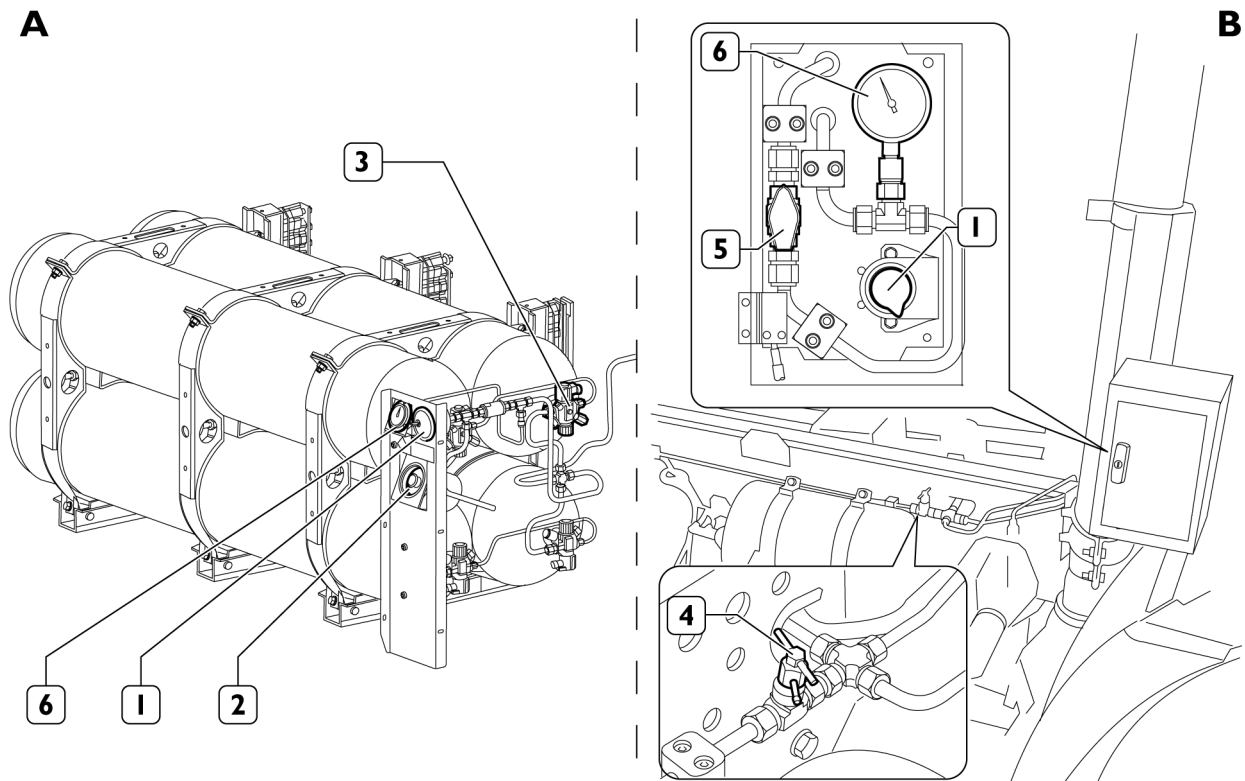


- **The emptying operations must be carried out while the engine is OFF and in an environment with suitable air exchange (a forced air exchange is preferable).**



- **To limit the release of uncombusted gas as much as possible, keep the engine running until the pressure of the gas drops to the minimum value of 20 bar.**

Note *Consumption of the gas at a residual pressure of 20 bar is a procedure which is less harmful to the environment than releasing the gas directly into the atmosphere.*



269946

Figure 6

A. Truck C8 or C9 NP 400 / C13 NP460

B. Articulated truck C8 or C9 NP 400

1. NVG1 valve

2. NVG2 valve

3. Safety solenoid valve on cylinder

4. Ventilation valve

5. Shut-off valve (if present)

6. Pressure gauge

a) Partial emptying

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

- Prepare a rubber hose which is compatible with the gas and is of a suitable diameter for coupling with the filler on the ventilation valve (4, Figure 6).
- Leave one end of the rubber hose at least 5 m from the cylinders and from any possible sources of flame; position the other end close to the ventilation valve.
- Cut off power supply by turning off the main current contactor.
- Disconnect the battery cables and electrically ground the vehicle.
- Check that the cocks of the solenoid valves on all the cylinders are closed.
- Correctly position the hose (compatible with the gas) on the ventilation valve filler (4, Figure 6) leaving the other end of the pipe at a distance of at least 5 metres from the cylinders and from any possible sources of flame.
- Slowly open the ventilation valve (4, Figure 6) to prevent the sudden decompression of the gas and the corresponding effects (freezing).
- After a few minutes, check that the pressure in the system is null.

b) Emptying fully

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

Before performing this operation:

- Perform the partial emptying operations described in the previous paragraph.
- Close the ventilation valve (4, Figure 6).
- Check that all the cocks of the solenoid valves (3, Figure 6) on the cylinders are closed.

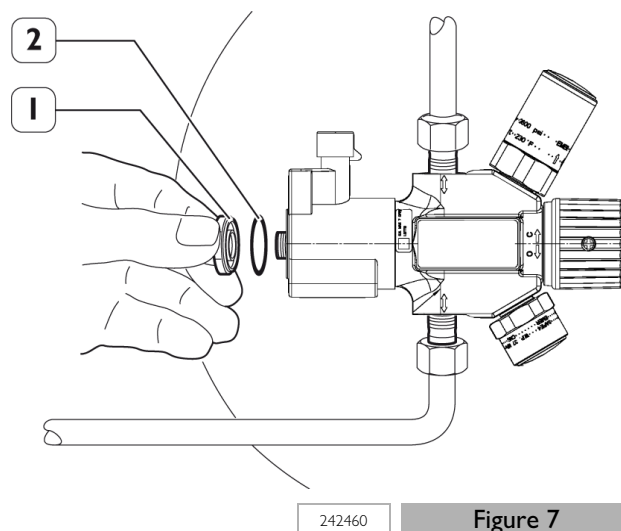


Figure 7

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

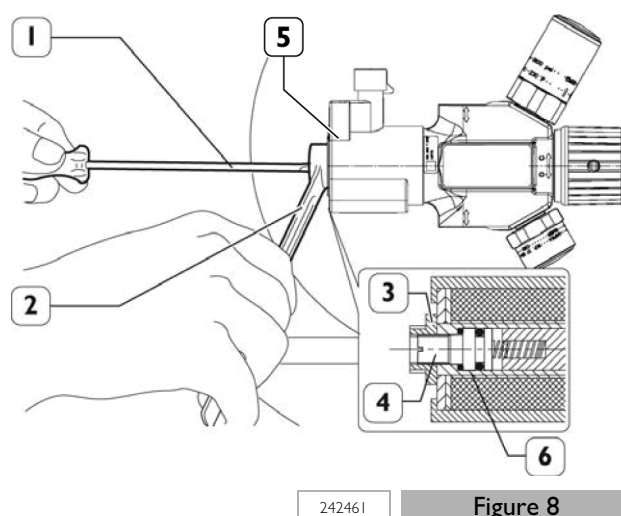
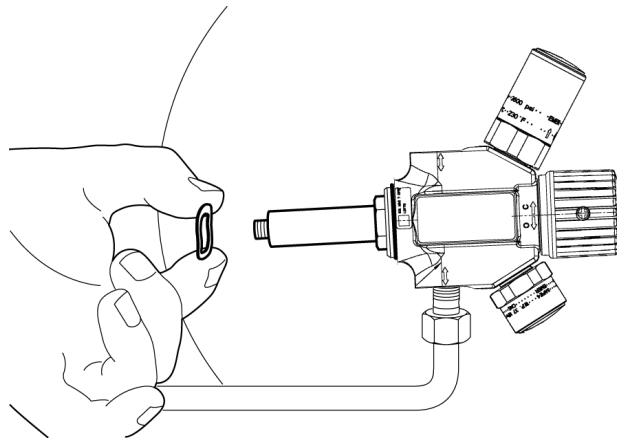


Figure 8

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



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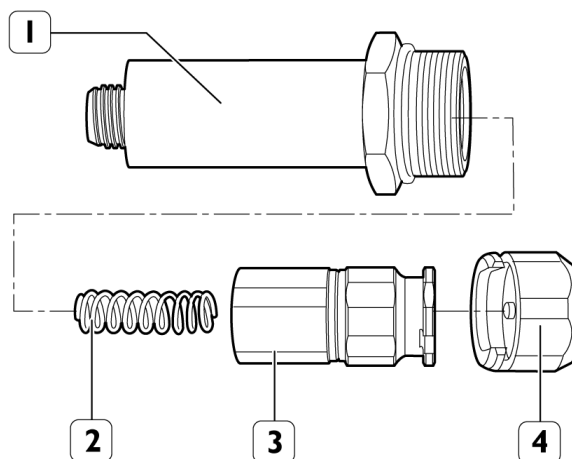
Figure 9

- Extract the spring washer.



- **The valve still contains a small amount of highly pressurised gas. To reduce this pressure, slowly unscrew the ring nut (2) of the coil shaft (1).**

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



143851

Figure 10

- Remove the piston (3) with the shutter (4) and the spring (2) from the coil shaft (1).
- Screw the empty coil shaft back in with its O-Ring and tighten the ring nut.
- Repeat the previous operations for all the shut-off valves of the cylinders.
- Partially open the cocks of the valves (3) on the cylinders (see Figure 6).



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

- Slowly open the ventilation valve (4, Figure 6).

After emptying, ensure that the engine cannot be started.

Restore the fittings after having disconnected / replaced a pipe

- Check intactness of unions and sealing caps.
- Insert the end of the pipe into the union seat. To avoid pre-tensioning, always check the alignment of the end of the pipe with the union.
- Fit and manually screw in the nut of the union until the two sealing caps are packed. Mark the position of the nut with respect to the union body in this point.
- Tighten with the wrenches, turning the nut by half turn. This wedges the second sealing cap under the first cap, tensioning the sealing assembly.
- Fit the fixing brackets, making sure not to stress the pipe.



► **Before restoring system operation, the HYDRAULIC SEAL TEST must be carried out at a specialised Centre.**

A.6 BODYBUILDER CONNECTORS

Note The basic functions of the Bodybuilder connectors are the same as those described in Section 5 - Chapter 5.2 (➡ Page 9) for vehicles with diesel engines.

A.7 POWER TAKE-OFF

The PTO described below are the same as those used on vehicles with diesel engines.

PTO operation is only possible in manual mode and can only be activated in Neutral.

Only gear I, III, V and Reverse RL can be used and gear shifting is only possible when the vehicle is stationary.

Note The power take-offs are available from IVECO, but the SW calibration SW must be implemented in a specific manner for all applications.

Only the Carrier module application has been explicitly tested and released by IVECO.

a) Cursor 8 NP**Power take-off from the gearbox****Table A.2 - PTOs available on gearbox**

Gearbox	Opt. No.	PTO type	Fitting position	Connection type	Transmission ratios	Torque [Nm] ^(*)
16 S 1621 TD	5202	NH/1b	central	Flange	0.91 / 0.77	1000
	5205	NH/1c	central	Pump	0.91 / 0.77	1000
	5209	NH/4b	right	Flange	1.17 / 0.98	430 ⁽¹⁾
	5210	NH/4c	right	Pump	1.17 / 0.98	430 ⁽¹⁾
	5258	N221/10b	above	Flange	1.35 / 1.14	730
	5260	N221/10b	above	Flange	1.75 / 1.47	560
	5264	N221/10b	above	Flange	2.00 / 1.68	470

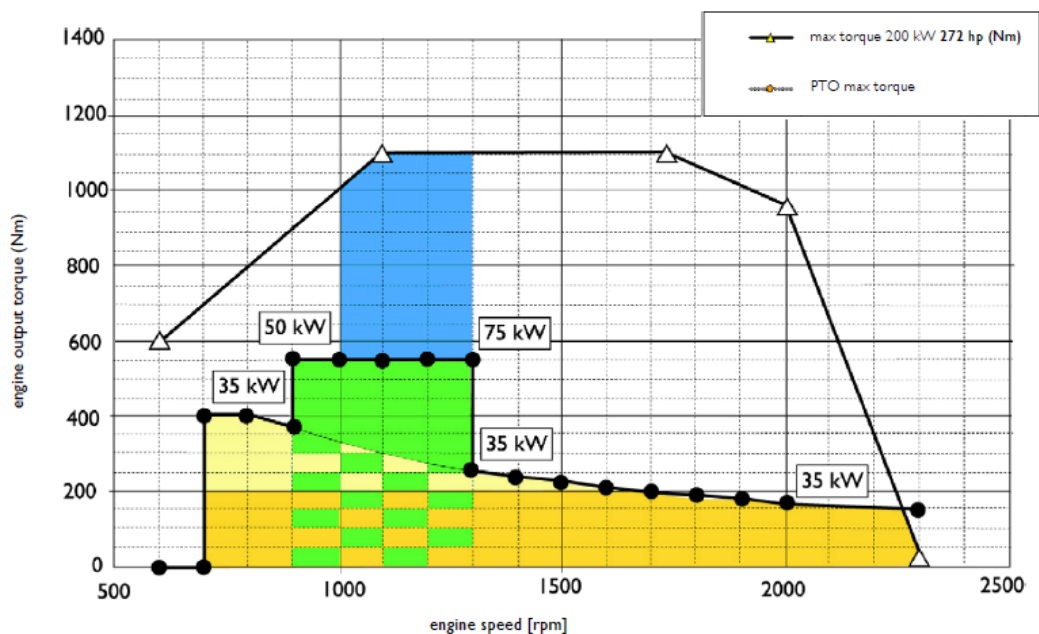
Gearbox	Opt. No.	PTO type	Fitting position	Connection type	Transmission ratios	Torque [Nm] ^(*)
I6 S 1621 TD	5255	N221/I0c	above	Pump	1.13 / 0.95	870
	5259	N221/I0c	above	Pump	1.35 / 1.14	730
Allison 3500R	32	I7A1	right	Pump	0.93	600
	413	870 XDFJP	Left	Flange	0.99	660
	415	870 XAFJP	above	Pump	1.00	660

(*) Available torque with PTO at 1500 rpm

(†) Sporadic operation < 1 hour of service

Engine speed and torque limitations

Normally the engine torque operating with PTO must not exceed the engine speed that the same engine is able to provide without being supercharged. This ensures that the engine is able to react rapidly to the need for changes in torque.



142794

Figure 11

Therefore, three operating areas with PTO are defined for CNG engines (see below).

Note that the torque and the rotation speed (dealt with in this chapter) refer to the clutch / output side of the engine.

If the PTO installed has its own transmission ratio (as is generally the case), the torque at PTO can be calculated by multiplying the engine output torque values by the transmission ratio. Similarly, the rotation speed at PTO can be calculated by dividing the engine output values by the transmission ratio.

1) Normal operation (green area)

From 1150 rpm to 1600 rpm

From 0 Nm to 375 Nm of PTO torque

The engine is in "configurable rpm 1, 2 or 3" mode with speed set between 1150 rpm and 1600 rpm.

The vehicle is stopped, the gearbox is in neutral, driving is not possible, the accelerator pedal is deactivated.

The PTO load is the only load that is applied to the engine.

The PTO load can be applied immediately after the first 0.7 seconds following activation of the configurable engine speed set point.

2) Operation at full load (blue area)

From 1250 rpm to 1600 rpm

From 375 Nm to 650 Nm

The engine is in "configurable rpm 1, 2 or 3" mode with speed set between 1250 rpm and 1600 rpm.

The vehicle is stopped, the gearbox is in neutral, driving is not possible, the accelerator pedal is deactivated.

The PTO load is the only load applied to the engine

The PTO load can be applied after the first 0.9 seconds following activation of the configurable engine speed set point.

If these limits are exceeded, engine malfunction and overheating of the catalytic converter lead to the risk of fire. IVECO cannot be held liable for any damage caused by insufficient PTO torque in "PTO Operation at full load (blue area).

3) Operation while driving (orange / yellow load)

From 780 rpm to 2900 rpm

From 0 Nm to 300 Nm of PTO torque

From 0 kW to 35 kW of PTO power

The engine operates in "PTO Mode 1, 2 or 3" without a set speed other than the engine idling speed of between 780 and 850 rpm.

An engine speed limit can be applied, but not less than 2000 rpm.

The vehicle can also be driven with the PTO engaged, the accelerator pedal is activated.

The PTO load is applied in addition to the normal engine load.

The PTO load can be applied 0.7 seconds after reaching the engine idling speed.

With a torque request exceeding 150 Nm, a "soft start" function is required (in addition to all the conditions indicated above) to prevent the engine stalling. The outfitting must not increase the PTO torque more quickly than 50 Nm/s.

Power take-off from the front of the engine (opt. 5151)

For the powertrains "270 HP – without air conditioning" only, it is possible to request preparation to install a PTO on the front of the engine. Installation of the PTO is the responsibility of the Bodybuilder.

Following the some type-approval Standards and Regulations, certain exemptions and authorisation must be requested from the local Authorities.

Table A.3- PTO Technical specifications

Engine	Power take-off				
	Max. torque available [Nm] constant / peak	Engine / output speed ratio	Maximum speed [rpm]	Direction of rotation	Clutch engagement air pressure [bar]
CURSOR 8 NP	600 / 820	1.14	3200	Opposite to engine	8

Note This PTO is not available on tractors, it cannot be combined with the automatic gearbox and cannot be installed as a "retrofit" on engines which were produced without a PTO.

b) Cursor 9 NP**Power take-off from the gearbox****Table A.4 - PTOs available on gearbox**

Gearbox	Option no.	PTO type	Assembly side	Connection type	PTO ratio	Speed factor	Available torque (*) [Nm]
12 AS 1931 TD						K1 0.82	
	5202	NH/1b	central	Flange	1.00	0.82	1000
	5209	NH/4b	right	Flange	1.28	1.05	430 ⁽¹⁾
	5210	NH/4c	right	Pump	1.28	1.05	430 ⁽¹⁾
	5260	N AS/10b	above	Flange	2.35	1.92	400
	6420	N AS/10c+b Double-output	above below	Pump Flange	1.48 2.35	1.21 1.92	670 400

(*) Available torque with PTO at 1500 rpm

⁽¹⁾ Sporadic operation < 1 hour of service**Power take-off from the rear part of the engine (opt. 5367)**

A PTO with a flange connection is only available for "truck" vehicles. It can be only be installed on the production line as first equipment.

c) Cursor 13 NP**Power take-off from the gearbox****Table A.5 - PTOs available on gearbox**

Gearbox	Option no.	PTO type	Assembly side	Connection type	PTO ratio	Speed factor	Available torque (*) [Nm]
12 TX 2011 TO						K1 (48/38) 1.26	
	5202	NH/1b	central	Flange	1.00	1.26	1000
	78732	NH/4b	right	Flange	0.90	1.14	430 ⁽¹⁾
	78733	NH/4c	right	Pump	0.90	1.14	430 ⁽¹⁾
	78735	NTX/10b	above	Flange	1.59	2.01	490
	78737	NTX/10b	below	Flange	1.28	1.62	580
	78743	NTX/10c	below	Pump	0.91	1.15	720
	78746	NTX/10c+b Double-output	above below	Pump Flange	0.91 1.28	1.15 1.62	720 ⁽²⁾ 580 ⁽²⁾

(*) Available torque with PTO at 1500 rpm

⁽¹⁾ Sporadic operation < 1 hour of service⁽²⁾ These values refer to just one PTO engaged

