

STRALIS EURO 6

BODYBUILDERS INSTRUCTIONS

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IVECO

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UPDATE DATA

Section	Description	Page	Revision date

INTRODUCTION

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

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

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

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

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

Before performing any operation, it is necessary to:





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

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

Data and information contained in this publication may be outdated as a result of changes adopted by IVECO, at any time, for technical or commercial reasons or due to the need to adapt the vehicle to new legal requirements.

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

SYMBOLS - WARNINGS

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

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GENERAL INFORMATION

I.1 SCOPE OF THE GUIDELINES

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

These Guidelines also aim to indicate to Bodybuilders:

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

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

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

I.2 TECHNICAL DOCUMENTATION AVAILABLE ELECTRONICALLY

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

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

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

I.3 IVECO AUTHORISATION

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

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

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

I.4 AUTHORISATION REQUEST

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

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

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

I.5 RESPONSIBILITIES

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

The Bodybuilder is therefore responsible for:

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

I.6 LEGISLATIVE REQUIREMENTS

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

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

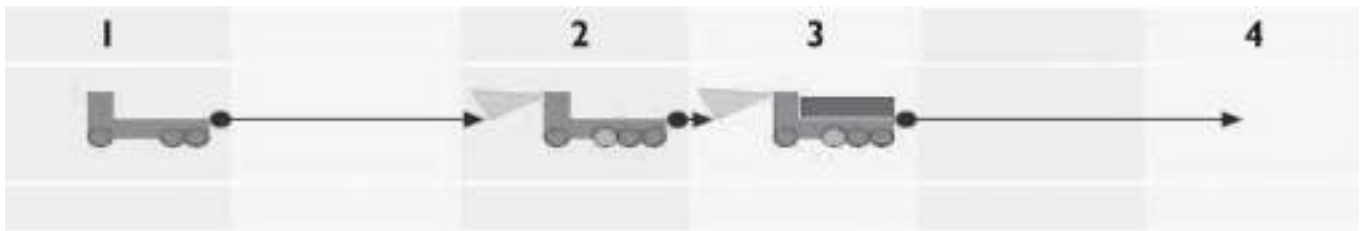
For this reason, IVECO shall not be held liable for any consequences due to errors caused by insufficient knowledge or incorrect interpretation of the legal provisions in force.

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

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

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

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



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Figure 1

- | | |
|-----------|----------------|
| 1. IVECO | 3. Bodybuilder |
| 2. Dealer | 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.

I.8 GUARANTEES

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

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

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

I.9 QUALITY SYSTEM MANAGEMENT

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

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

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

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

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

I.10 ACCIDENT PREVENTION

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

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



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

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

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



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

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

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

To this regard, please note that:

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



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

I.12 VEHICLE MANAGEMENT ON THE PART OF BODYBUILDER

Acceptance of chassis

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

Maintenance

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

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



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

Delivery of the vehicle to the final customer

Before delivering the vehicle, the Bodybuilder must:

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

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

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

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

I.13 VEHICLE NAMES

The commercial names (an example follows) of IVECO vehicles do not coincide with approval names.

Commercial 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	8x2x6 Cab vehicles
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)
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

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 P with air suspension on rear axle and 3rd liftable rigid axle
CM	Demountable Bodies
GV	Large Volumes
D	Timing system
HM	Heavy Mission
LT	Lowered tractor
CT	Lowered cab
RR	Rough Roads
HR	Double reduction rear axle
SL	Super Light

I.14 TRADEMARKS AND SYMBOLS

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

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

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

Instructions for additional units

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

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

I.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.

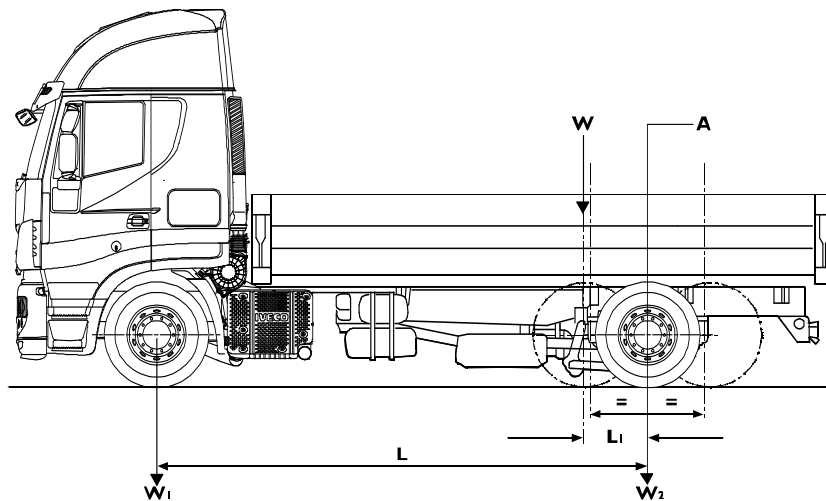
The positioning of lights and mirrors, normally set for widths of 2550 mm, is also suitable for special superstructures 2600 mm wide (e.g. mini-vans).

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

Positioning on the longitudinal plane

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

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



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

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

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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

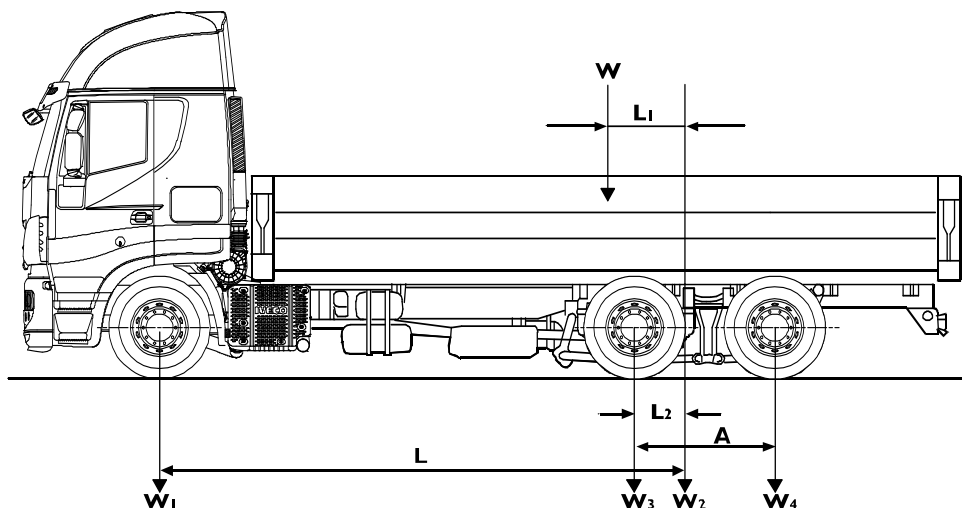
W = Payload plus superstructure

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



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

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

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

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

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

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

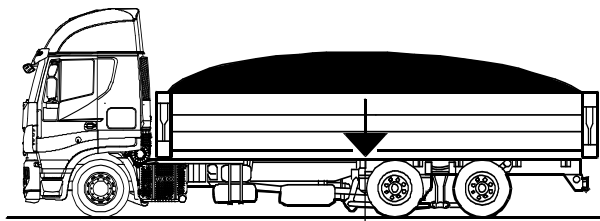
This way, in particular version fittings (e.g. cranes on the rear overhang), the correct positioning can be determined for the centre of gravity of the equipment and the payload, depending on the load carried (see Chapter 3.8).

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.

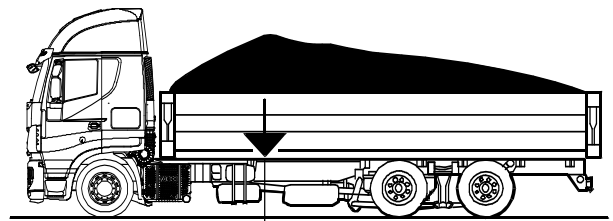
For equipment, the centre of gravity is obvious considered for its actual position.

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 axles, 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.



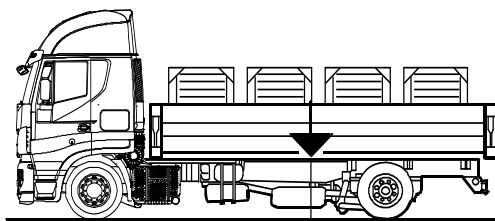
Even distribution of load



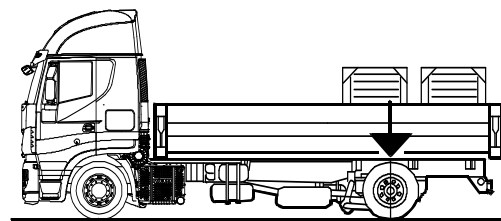
Uneven distribution of load

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Figure 4



Even distribution of load



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

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Figure 5

Height of centre of gravity

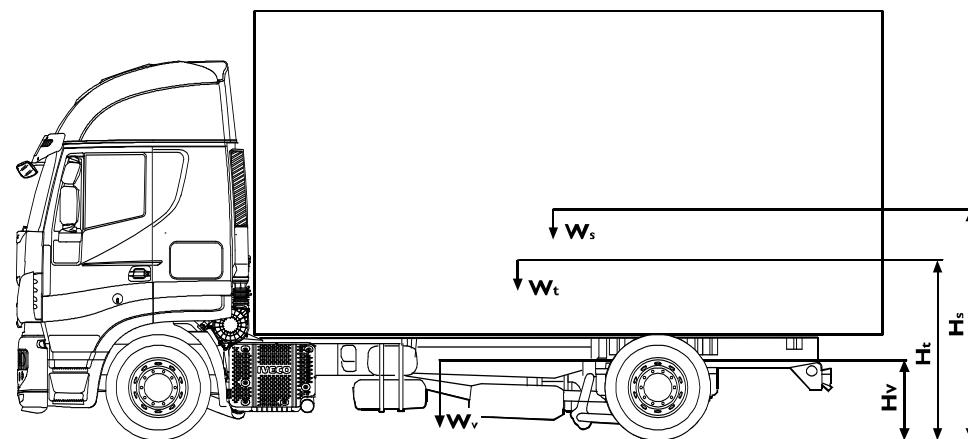
For the cab version and no-load vehicle, the value of the height of the centre of gravity is shown on the specific technical documentation for each model (cab version diagram).

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

The following cases should be distinguished:

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

1. Fixed loads



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

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

192340

Figure 6

Control at full load

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

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

Ht = Complete full-load vehicle centre of gravity height

Wv = Cab version vehicle tare weight

Ws = Payload plus superstructure tare weight

Wt = Complete vehicle ground at full load

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

2. Mobile loads

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

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

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

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

3. Loads that result in increased aerodynamic actions

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



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

Special attention must therefore be paid:

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

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

Adoption of stabiliser bars

The application of additional or reinforced stabiliser bars, where available, reinforcing the springs or rubber elastic elements (in accordance with the procedure outlined in Section 2.7), may allow higher values of the centre of gravity of the payload, to be determined from time to time. The operation must be carried out after a careful evaluation of the features of the fitting, the wheelbase and the subdivision of lateral forces on the suspension, and should generally concern both the front and the rear. However, it should be kept in mind that in many cases it is advisable to carry out the operation only on the rear axle; acting on the front axle would give the driver an incorrect sensation of greater stability, making it actually harder to perceive the safety limit. Interventions on the front axle can be made in the presence of concentrated loads behind the cab (e.g. cranes) or superstructures with high rigidity (e.g. vans).

Exceeding the limits

In the case of special transport with a high centre of gravity height (e.g., transport of machinery, indivisible loads, etc.), from a technical standpoint it is possible to exceed the values shown in the table, provided that the driving is adjusted appropriately (e.g. reduced speed, gradual variations of the trajectory of travel, etc.).

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.

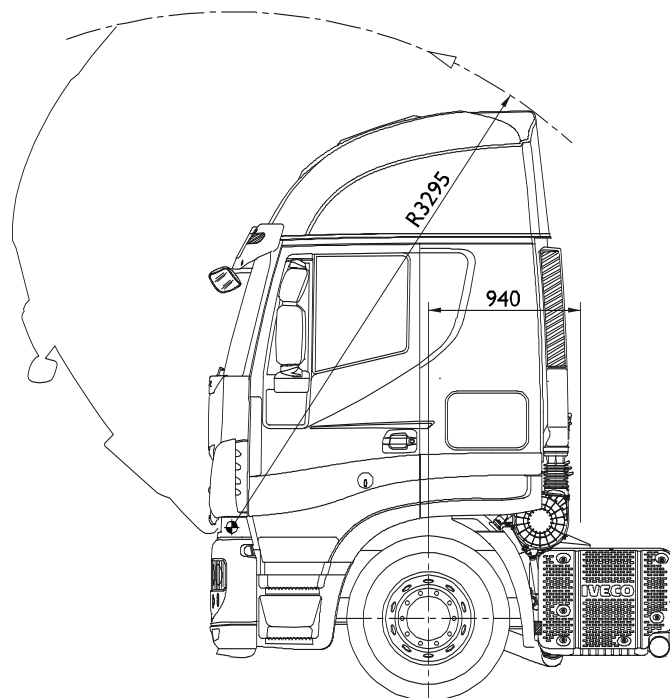
The permitted reduction of mass on vehicles (derating), can lead to interventions on some parts, such as suspensions and brakes, and may require a new calibration for the braking correction operation; in these cases the necessary indications may be provided.

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

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

For example:

- free access must be guaranteed to the places that need inspection, maintenance or periodic controls (e.g., battery replacement, access to the air suspension compressor) and, in the case of enclosed superstructures, special compartments and doors should be provided;
- freedom of cab tilting must be provided; in Figure I-7, the quotas of maximum longitudinal dimension of the cab and radius of rotation are indicated;



195914

Figure 7

Note due to the new location of the air filter on the Stralis Hi-Way, the minimum distance between the centre line of the front axle and the body of the trailer is increased by 20 mm, from 920 to 940 mm.

The minimum distances on the Euro 6 versions are therefore:

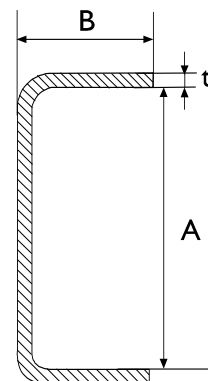
- Stralis Hi-Way: 940 mm (+ 20 mm compared to the Euro 5 version);
- Stralis Hi-Road: 900 mm (unchanged compared to the Euro 5 version);
- Stralis Hi-Street: 445 mm (unchanged compared to the Euro 5 version).

- The possibility of disassembling the various groups for assistance operations must be maintained. Any servicing on the transmission/clutch or controls (e.g. suspension bars) must be carried out without removing important parts of the added structure;
- 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;
- panels for noise emission levels must not be altered or moved so as not to vary the approved sound emission limits. If there are any openings (e.g. for the passage of the longitudinal sections of the chassis), they must be thoroughly closed, using fire-proof materials and soundproofing materials, equivalent to the original materials used;
- adequate ventilation must be maintained for the brakes and battery casing (particularly in the execution of truck bodies);
- in the placement of fenders and wheel arches, free shaking of the rear wheels must be guaranteed, even under the conditions of use with chains. It must also be guaranteed enough space for the lifting axle tyres. Some models include steering of the 3rd axle in the raised position as well: 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" manual;
- 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.

I.17 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 8

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 what is stated in Paragraphs "Weldings" (➔ Page 8) and "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;



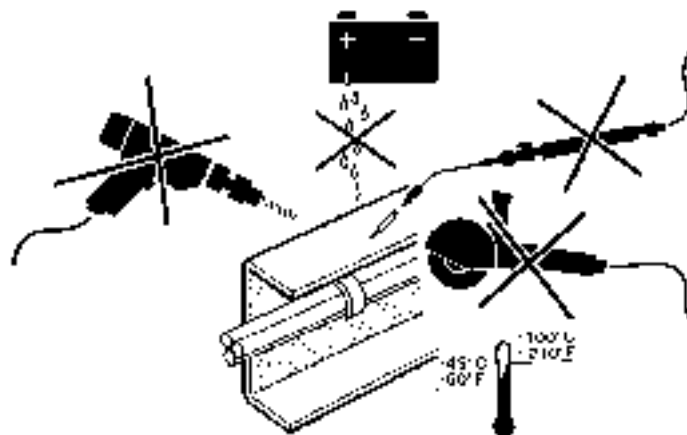
- ▶ **As regards remounting safety components, it is prohibited to re-use the same screws and tightening must be done at the specified torque (contact the Service Network for the value).**

- 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

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

- mechanically remove - either by filing and/or with a suitable chemical based solution - the paint on both the chassis and terminal side, thus creating a contact surface free of indentations and edges;
- paint the area between the terminal and metal surface with a high conductivity paint (e.g. zinc coating Part Number IVECO 459622 from PPG);
- connect to earth within 5 minutes after application of the paint.

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

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

Braking and electrical systems

For additional details on the braking and electrical systems see Chapters 2.15 (► Page 47) and 5.5 (► Page 30).

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]	A5 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 - Section dimension and chassis thickness

Model	Wheelbase [mm]	Area of side member near wheelbase A x B x t [mm] (see Figure 6)
STRALIS 190	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
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:

static stress σ allowed on 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.

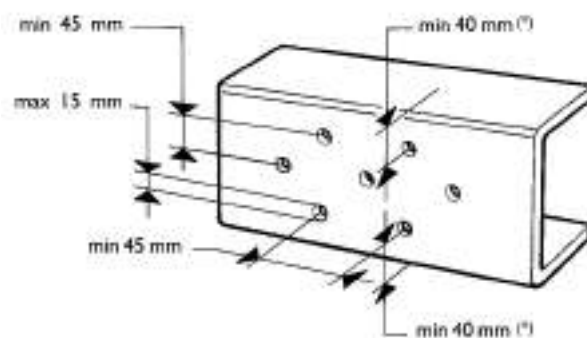
Hole position and size

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 hole axle from the edge of the side member must never fall below 40 mm (for chassis with thickness of 7.7 mm) or 39 mm (for chassis with thickness of 6.7 mm), likewise, the hole axes must not be at a distance of less than 45 mm from each other, or from the axes of existing holes.

The holes must be offset as in Figure 2.2.

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



192342

Figure 2

(*) valid with chassis thickness 7.7 mm, with chassis thickness 6.7 mm the measurement is equal to 39 mm.

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).

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

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

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

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

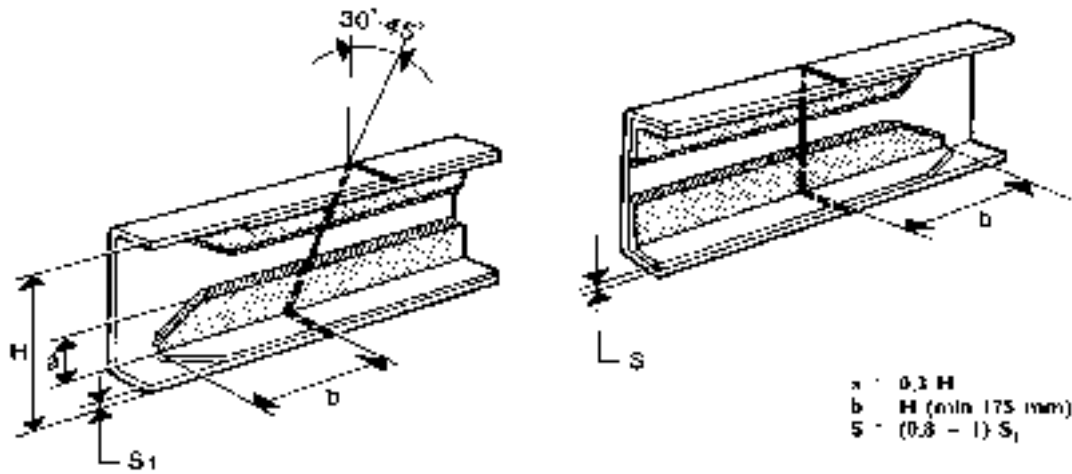
Welds



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

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 2.3).



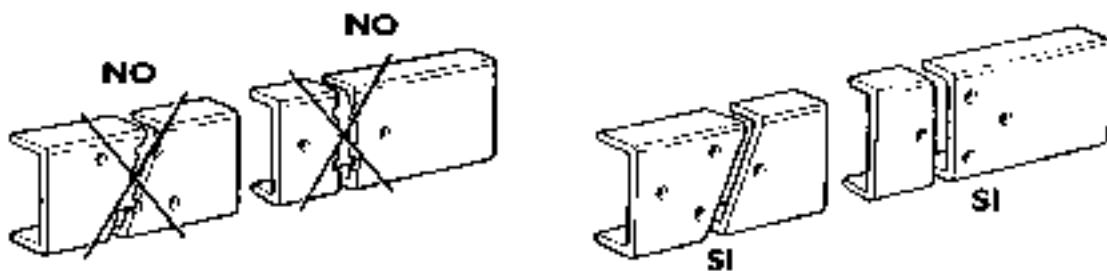
91448 **Figure 3**

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 leafs 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 2.4).



91446 **Figure 4**

- Make a 60 degree bevel cut on the internal part of the side member of the parts to join, for the entire length of the weld area (see Figure 2.5).

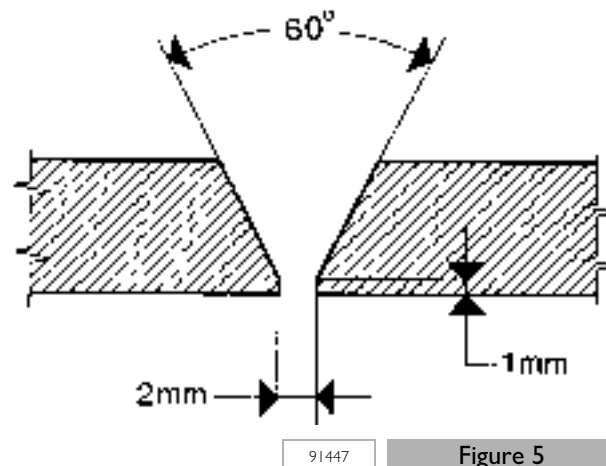


Figure 5

- 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 2.3.
Reinforcement anchorage must regard only the vertical rib of the side member and can be realised with a weld bead, staples, bolts or nails (even Huck nails).
Area and length of the weld bead, number and distribution of staples, number of nails or bolts must be adequate to transmit the bending and shearing moments.
- Once work is complete, use anti-rust protection (see Paragraph "Added or Modified Parts" (► Page 13)).

Sealing holes by welding

If new holes are located near old holes (see Figure 2.2), 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 8-1 600 Colour IC444 RAL 7021 - 70180 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 2.3 - Class of protection - IVECO Standard 18 - 1600 (Prospectus I)

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

Table 2.4 - Various parts and components not painted and in aluminium - IVECO Standard 18 - 1600 (Prospectus IV)

Type of protection		IVECO standard	Classes			
			A	B - B1 - B2	C	D
Stainless steel ⁽¹⁾		18-0506	-	-	-	-
Geomet ⁽²⁾	GEO 321-8	18-1101	yes	-	-	-
	GEO 500-8					
	GEO 321-8 PM					
	GEO 321-8 PML					
	GEO 321-8 PL					
	GEO 500-8 PL		-			
	GEO 321-5					
	GEO 500-5					
	GEO 321-5 PM			yes		
	GEO 321-5 PML					
	GEO 321-5 PL					
GEO 500-5 PL	yes Class B1 wheel studs					
Zinc coating ⁽³⁾	Fe/Zn 12 II	18-1102	-	-	yes	yes
	Fe/Zn 7 IV		-	-	yes	yes
	Fe/Zn 12 IV		-	-	yes	yes
	Fe/Zn 7 IV LUB		-	yes	yes	yes
	Fe/Zn 7 IV S		-	yes	yes	yes
	Fe/Zn 12 IV S		-	yes	yes	yes
Lega Zn-Ni	Fe/Zn Ni 7 VII S	FIAT 9.57409	-	yes	yes	yes
	Fe/Zn Ni 7 IV		-	yes	yes	yes
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 2.5 - Painted parts - IVECO Standard I8 - I600 (Prospectus III)

Cycle phase description		Classes					
		A	B ⁽⁸⁾	BI ⁽⁵⁾	B2	C	D
MECHANICAL SURFACE CLEANING ⁽¹⁾	Sand/shot blasting	–					
	Brushing	yes ^(*)	yes ^(*)	–	yes ^(*)	yes ^(*)	yes ^(*)
	Sandpapering						
PRE-TREATMENT	Iron phosphating (only for non-precoated ferrous materials)	–	yes ^(*)	–	yes ^(*)	yes ^(*)	yes ^(*)
	Zinc phosphating ^(**)	yes					
CATAPHORETIC PAINTING	High thickness (30-40 µm)	yes ⁽²⁾	yes ^(*) ⁽⁶⁾	–	yes ^(*) ⁽⁶⁾	yes ^(*) ⁽⁶⁾ ⁽⁹⁾	yes ^(*) ⁽⁶⁾
	Medium thickness (20-30 µm)	yes ⁽³⁾			–		
	Acrylic finishing (>35 µm)	–			–		
RUST PREVENTER	Bi-component (30-40 µm)	–	yes	–	yes	yes ^(*) ⁽⁹⁾	yes ^(*)
	Single-component (30-40 µm)		–	yes	–		
ANTIROCK PRIMER	Single (130 °C) or bicomponent (30-40 µm)	yes ⁽³⁾	–	–	–	–	–
VARNISH	Single (130 °C) or bicomponent (30-40 µm)	yes	yes ^(*)	–	–	yes ^(*)	yes ^(*) ⁽⁷⁾
	Powders (40-110 µm)	yes ⁽⁴⁾					
	Low temperature single-component (30-40 µm)	–					

(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 2.6 and 2.7 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 2.6 - 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 B1 and C) not allowed

⁽²⁾ Preferably epoxy

⁽³⁾ Preferably polyurethane

Table 2.7 - Unpainted or aluminium modified parts or add-ons

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

⁽¹⁾ Free from hexavalent chromium

Precautions

On the vehicle

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

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

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

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

The electronic components and modules must be removed.

Engines and their electric/electronic components

Appropriate precautions must be taken to protect:

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



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

2.4 WHEELBASE MODIFICATION

General information



- ▶ **Any wheelbase modifications that regard the electric circuits and/or relocation of the electric/electronic components requires IVECO approval and must be carried out in compliance with chapter 5.5 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:

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

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

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

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

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

Effects on steering

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

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

Table 2.8 lists the maximum wheelbase elongation values allowed for the vehicle with series steering, maximum load and tyres.

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

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

Table 2.8 - Maximum allowable wheelbase elongation, depending on the load on the front axle and the size of the tyres (Regulation ECE-R79/01 e EG/70/311)

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]	Caster trail [mm]	Steering wheel diameter [mm]
STRALIS 190	8000	6050	120	470
STRALIS 190 /FP-CM	8000	5700 6700	120	470 510
STRALIS 260 Y/P, Y/FP	8000	6050	120	470
STRALIS 260 Z/P -HM	8000	6050	120	470
STRALIS 260 Y/FP -CM	8000	4500 5100	120	470 510
STRALIS 260 Y/PS, Y/FS	7500 7500 8000	5700 6050 5700	120	470 510 470
STRALIS 260 XP	7500		120	470
STRALIS 320 YP	7500		120	470
STRALIS 320 XP	7500		120	470
STRALIS 440 TX/P	7500	3140	120	470

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

Effects on braking

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

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.



► **Vehicles mounting an ASR system require settings to be updated.**

Intervention procedure

Proceed as follows to obtain good results:

- position the vehicle so that the chassis is perfectly horizontal, use appropriate trestles;
- detach the drive shafts, braking system hoses, cables and all other equipment that may interfere with proper work execution;
- identify the reference points on the frame (e.g: guide holes, suspension supports);
- mark the reference points with a slight punch mark on the top flaps on both side members, after having verified that the conjunction line is at a perfect right angle with the longitudinal axle of the vehicle;
- if moving the suspension supports, identify the new position using the previously determined references;
- make sure that the new measurements are identical on both the right and left sides; the diagonal check, for lengths of at least 1500 mm must not yield deviations of over 2 mm;
- make the new holes using as jig - if any other tools are unavailable - the supports and gusset plates of the crossbars;
- secure the supports and crossbars using nails or screws; if using screws, bore the holes and use calibrated screws class 10.9 with anti-unscrewing nuts; if size allows, flanged head screws may be employed;
- if cutting the frame (to be carried out according to indications of the second item in "Welding Operations" - Paragraph "Welding" (► Page 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 13).
- Restore the braking and electrical systems as according to Chapters 2.15 (► Page 47) and 5.5.
- Follow the instructions in Chapter 2.8 (► Page 37) 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.

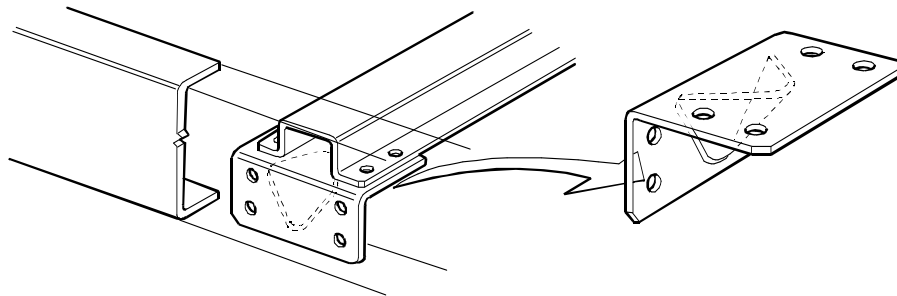
Cross members

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 2.6 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 37) for checks of modifications allowed.

2.5 REAR OVERHANG MODIFICATION

General information

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

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

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

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

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

Authorisation

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

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



- **If you need to adjust the length of the electrical circuits, see 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

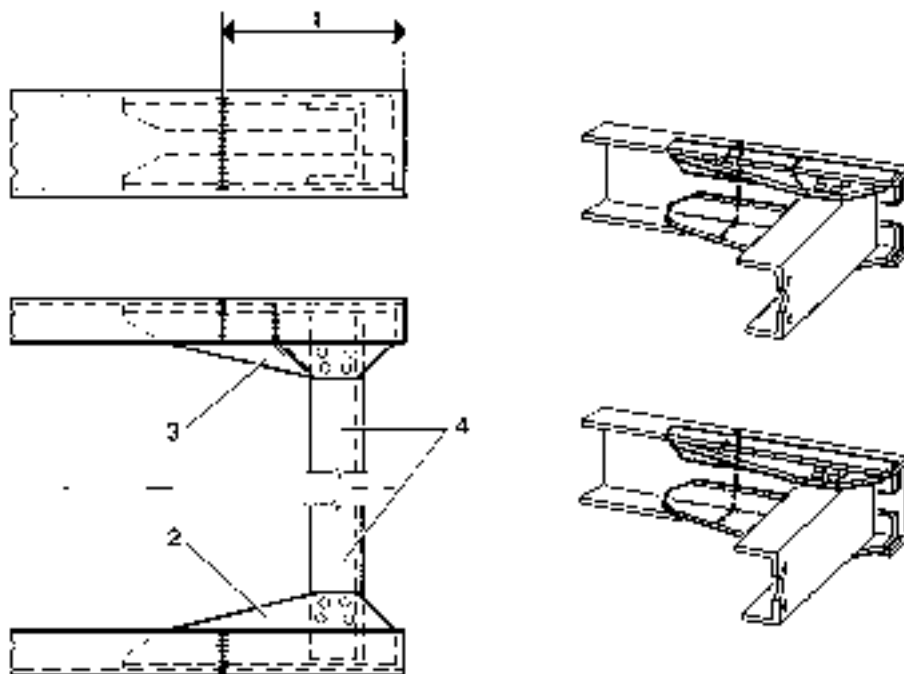
possible solutions concerning elongations are shown in Figures 2.7 and 2.8.

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

The solution for elongations greater than 300 ÷ 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 and the gusset plate is made by welding, it may be connected to the gusset plate reinforcement by welding (see Figure 2.7).

The solution for elongations greater than 350 mm is shown in Figure 2.8.

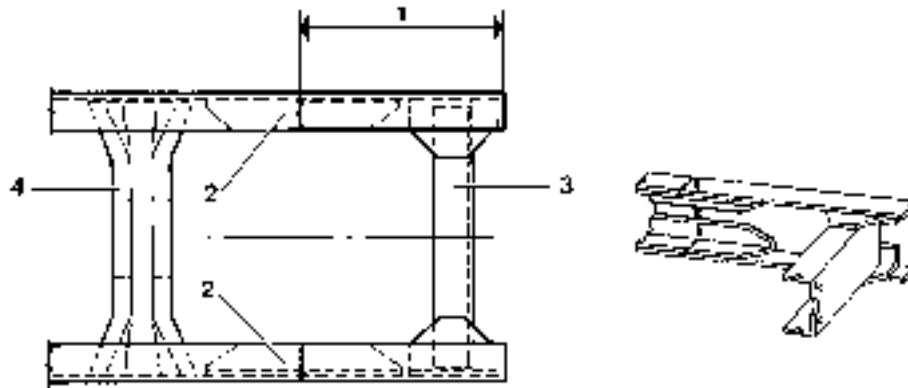


91454

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 towing hook is possible without authorisations:

- 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.

The installation on vehicles to which the drawbar coupling is not originally provided must be authorized by IVECO.

For trailers with one or more close axles (central axle trailers), taking into account the stresses to which the rear crossbar is subjected, particularly due to the dynamic vertical loads, keep in mind the precautions given in Paragraph "Towing hook for centre axle trailers" (► Page 20).

Precautions for Installation

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

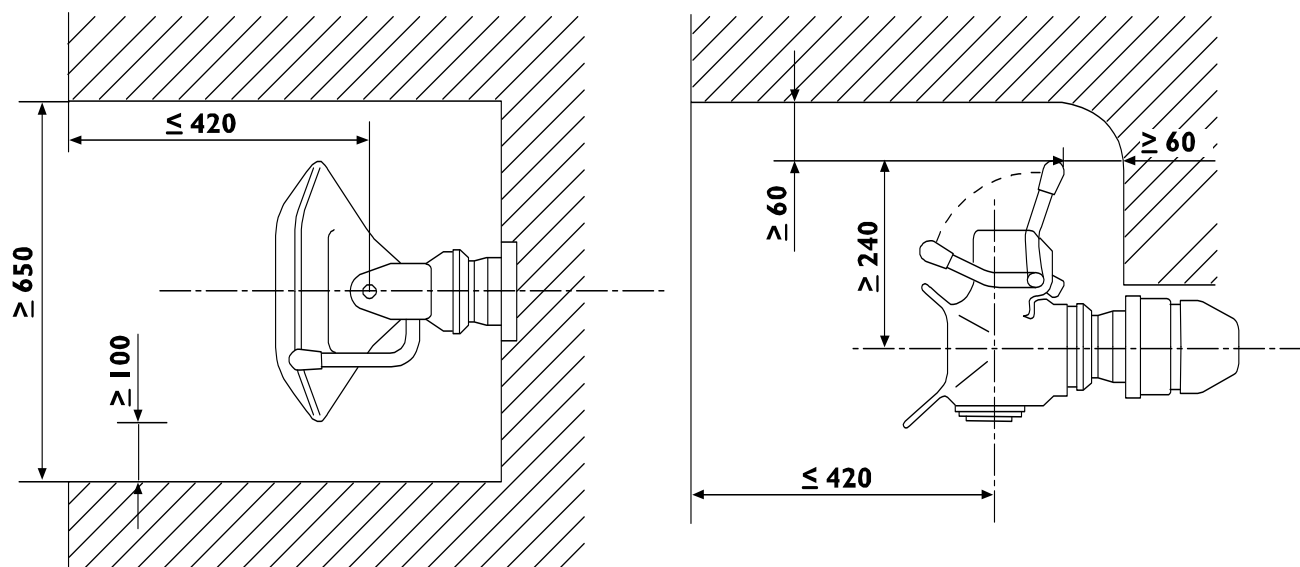


- **Given their importance related to safety, the drawbar couplings must not undergo modifications.**

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

- clearances required for the coupling of the brakes and electrical system;
- distance between the pivot axle of the hook and the rear edge of the superstructure (see Figure 2.9).

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.



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Figure 9

Free field for towing hooks

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.

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:

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

D = representative value of drawbar class [kN]

T = maximum mass of the tractor [t]

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

Drawbar couplings for centre axle trailers

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

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

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

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

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

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

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

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

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

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

T = maximum weight of tractor

R = maximum weight of trailer

S = value of vertical static load that, in static conditions, is transmitted to the coupling point. S must be $\leq 0,1 \times R \leq 1000$ kg of the trailer

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

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

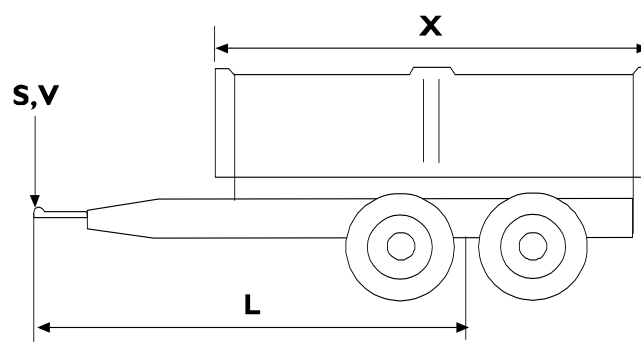
a = vertical acceleration in the area of the drawbar coupling/hook. in function of the rear tractor suspension, use the following values:

- $a = 1,8 m/s^2$ of air suspensions
- $a = 2,4 m/s^2$ for other types of suspensions

X = length of the load bed [m], (see Figure 2.10)

L = theoretical drawbar length, distance between the centre of the drawbar eye and the centre line of the trailer axles [m], (see Figure 2.10)

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



193864

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 counter chassis and, in particular, in the area that goes from the rear end of the overhang to the front support of the rear suspension, longitudinal and 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 counter chassis having a larger size than those normally provided.

Example of calculations for connection device class for centre axle trailers

We shall consider a vehicle with maximum weight of 18 t that must tow a centre axle trailer of 9 t with length of load bed 8 m and theoretical drawbar length of 7 m.

The data at hand yields:

$$R = 9 \text{ t}$$

S equals 0.9 t, that is the least of the values $0.1 \times R = 0.9 \text{ t}$ and 1 t

$$X^2 / L^2 = 64 / 49 = 1.3$$

we obtain:

$$D_c = 9.81 [18 (9 - 0.9)] / [18 + (9 - 0.9)] = 9.81 (145.8 / 26.1) = 54.8 \text{ [kN]}$$

$$V = 1.8 (9 - 0.9) 1.3 = 18.95 \text{ [kN]}$$

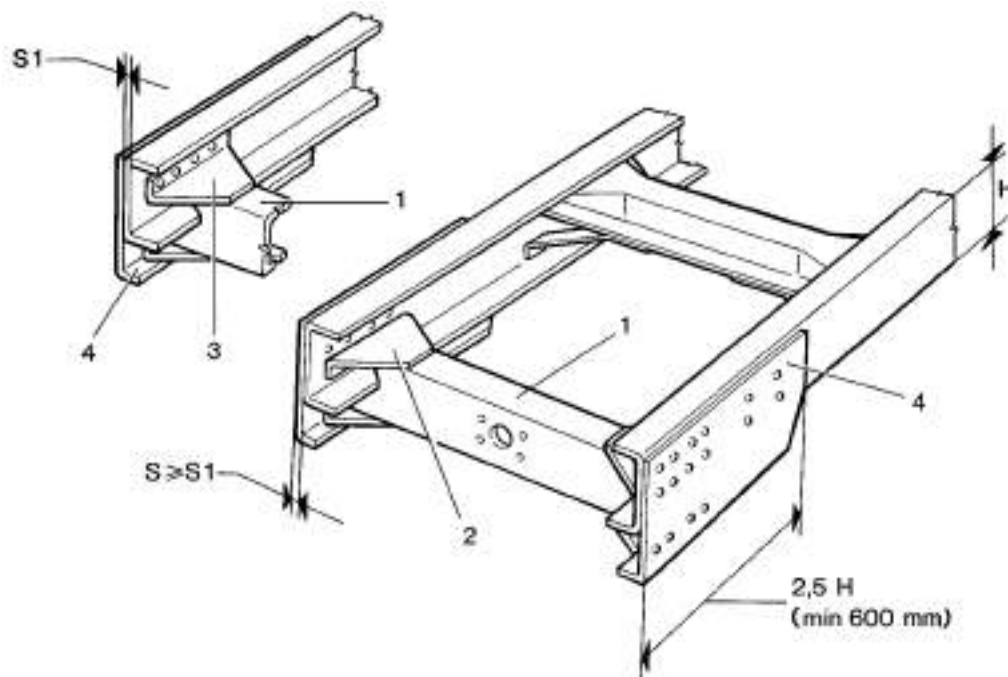
Rear crossbar in lowered position

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

Figures 2.11 and 2.12 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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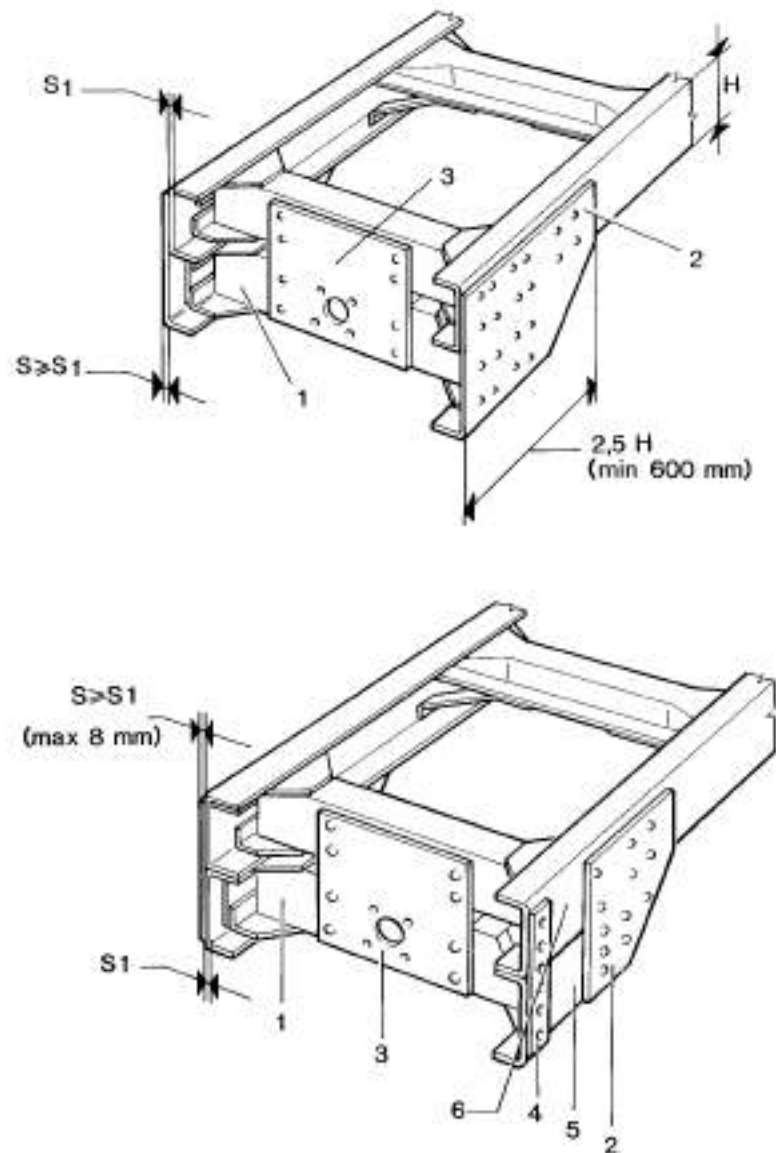
Figure 11

1. Original rear cross member.
2. Gusset plate

3. Overturned gusset plate
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 (min 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 2.12) a central coupling plate must be provided, of thickness suited to that of the crossbars.



192344

Figure 12

- 1. Original 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 2.12 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.

Table 2.9 - Longitudinal sections of the counter chassis for centre axle trailers

Models	Profile chassis [mm]	Wheel-base [mm]	Over-hang rear [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	
				Resistance modulus W_x [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)								
Hi-Road Hi-Street 190 Post 11.5 t	289/199x80x6.7	3800	970	-	-	-	-	-	-	-	-	-
		3800	1195	-	-	-	-	-	-	-	-	-
		3800	1825	-	-	-	-	-	-	-	-	-
		4200	970	-	-	-	-	-	-	-	-	-
		4200	1195	-	-	-	-	-	-	-	-	-
		4200	2050	-	-	-	-	46	46	46	46	46
		4500	1780	-	-	46	46	46	46	46	46	46
		4800	2455	-	46	46	46	46	46	46	46	46
		5100	1555	-	-	-	-	-	-	-	-	-
		5100	1960	-	-	-	46	46	46	46	46	46
	5100	2185	-	46	46	46	46	46	46	46	46	
	5100	2365	46	46	46	46	46	46	46	46	46	
	5500	2185	-	46	46	46	46	46	46	46	46	
	289x80x6.7	5700	2185	46	46	46	46	46	46	46	46	46
		6300	2005	-	46	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		
6700		3400	46	46	46	46	46	46	74	74		
Hi-Road Hi-Street 190 Post 13.0 t	289/199x80x6.7	3800	970	-	-	-	-	-	-	-	-	-
		3800	1195	-	-	-	-	-	-	-	-	-
		3800	1825	-	-	46	46	46	46	46	46	46
		4200	970	-	-	-	-	-	-	-	-	-
		4200	1195	-	-	-	-	-	-	-	-	-
		4200	2050	46	46	46	46	46	46	46	46	46
		4500	1780	-	46	46	46	46	46	46	46	46
		4800	2455	46	46	57	57	74	89	89	105	
		5100	1555	-	-	-	-	-	46	46	46	46
		5100	1960	46	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		
	289x80x6.7	5700	2185	46	46	46	46	57	57	74	89	

Models	Profile chassis [mm]	Wheel-base [mm]	Over-hang rear [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	
				Resistance modulus Wx [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)								
Hi-Road Hi-Street 190 Post 13.0 t	289x80x6.7	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	
		6700	3400	46	74	74	74	89	105	105	105	
Hi-Way 190S /P /FP /FP-CM Post 11.5 t	289/199x80x6.7	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	
		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		
	289x80x6.7	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	
		6700	3422	46	46	46	46	46	46	57	74	
	Hi-Way 190S /P /FP /FP-CM Post 13.0 t	289/199x80x6.7	3800	1847	46	46	46	46	46	46	46	46
			4200	1217	-	-	-	-	-	-	-	46
4200			2072	46	46	46	46	46	46	46	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		
289x80x6.7		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	

Models	Profile chassis [mm]	Wheel-base [mm]	Over-hang rear [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	
				Resistance modulus Wx [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)								
Hi-Way 190S /P /FP /FP-CM Post 13.0 t	289x80x6.7	6300	2792	89	105	105	119	135	150	173	173	
		6700	3422	46	57	74	74	74	89	105	105	
Hi-Way 260S Y/PT Post 19.0 t	289/199x80x6.7	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	46	57
		4800	2072	46	46	46	57	57	74	89	89	
		5100	1802	46	46	46	46	46	46	74	74	
	289x80x7.7	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 Post 20.0 t	289/199x80x6.7	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	
	289x80x7.7	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 Post 21.0 t	289/199x80x6.7	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	
	289x80x7.7	5700	2432	105	105	150	150	150	173	208	208	
		6050	2657	150	150	173	208	208	208	245	245	

Models	Profile chassis [mm]	Wheel-base [mm]	Over-hang rear [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	
				Resistance modulus Wx [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)								
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP Post 19.0 t (1)	289/199x80x6.7	3120	722	–	–	–	–	–	–	–	–	46
		3805	1757	46	57	57	74	89	89	105	105	105
		4200	1127	46	46	46	46	46	46	46	46	46
		4200	1622	46	57	57	74	89	89	89	89	105
		4200	2117	89	89	105	105	119	135	150	173	173
		4500	1217	46	46	46	46	46	46	57	57	57
		4500	1622	57	57	74	89	89	89	105	105	105
		4500	1802	57	89	89	89	105	105	105	105	119
		4500	2072	89	105	105	105	119	135	150	173	173
		4800	1487	46	57	57	74	74	89	89	89	105
		4800	1712	57	74	89	89	105	105	105	105	119
		4800	2072	105	105	105	119	135	150	173	173	173
	5100	1802	89	89	105	105	105	119	119	119	135	
	289x80x7.7	5700	2432	46	74	74	74	74	89	105	105	105
6050		2657	74	74	89	105	105	105	105	105	150	
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP Post 20.0 t	289/199x80x6.7	3120	722	–	–	–	46	46	46	46	46	46
		3805	1757	74	89	89	105	105	105	119	135	135
		4200	1127	46	46	46	46	46	46	57	57	57
		4200	1622	74	89	89	105	105	105	105	105	119
		4200	2117	105	119	135	150	173	173	173	173	173
		4500	1217	46	46	46	57	57	57	74	74	89
		4500	1622	89	89	105	105	105	105	119	135	135
		4500	1802	105	105	105	119	119	135	173	173	173
		4500	2072	105	135	150	173	173	173	173	173	173
		4800	1487	74	89	89	89	105	105	105	105	105
		4800	1712	89	105	105	105	119	135	150	173	173
		4800	2072	119	135	173	173	173	173	173	173	173
	5100	1802	105	105	119	135	150	173	173	173	173	
	289x80x7.7	5700	2432	74	89	105	105	105	135	150	150	150
6050		2657	105	105	105	150	150	150	173	173	208	

Models	Profile chassis [mm]	Wheel-base [mm]	Over-hang rear [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
				Resistance modulus Wx [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Way Hi-Road Hi-Street 260S Y/P Y/FP Post 21.0 t (1)	289/199x80x6.7	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
	5100	1802	135	150	173	173	173	173	173	173	
	289x80x7.7	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/FP-GV Post 19.0 t (2)	289/199x80x7.7	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 260 Post 19.0 t	289x80x6.7	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

Models	Profile chassis [mm]	Wheel-base [mm]	Over-hang rear [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	
				Resistance modulus Wx [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)								
Hi-Road Hi-Street 260S /TN Post 21.0 t (3)	289x80x6.7	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	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 Post 21.0 t	289x80x6.7	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	
6050	2665	208	208	208	245	245	245	286	286			
Hi-Way 260S X/P Post 19.0 t	289x80x6.7	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 Post 20.0 t	289x80x6.7	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	

Models	Profile chassis [mm]	Wheel-base [mm]	Overhang rear [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
				Resistance modulus Wx [cm ³] for longitudinal sections of the counter chassis with material with a yield limit of 360 [N/mm ²] (Fe 510)							
Hi-Way 260S X/P Post 2.1.0 t	289x80x6.7	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 Post 19.0 t	289x80x7.7	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 Post 20.0 t	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 Post 2.1.0 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

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

(2) Only with CCM 11954

(3) 5050 or 6040

Note See Table 3.2 (profile dimensions).

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 two beam and use a suitable drawbar coupling.

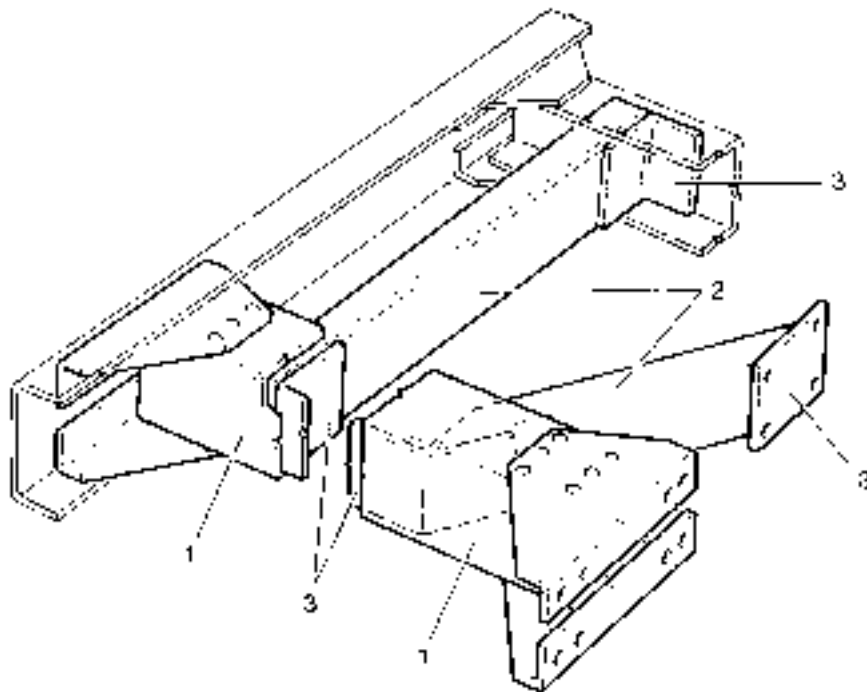
The positioning of the hook must be made in order to allow all relative movement between the tractor and the trailer drawbar in the various conditions of use, subject to the necessary safety margins and compliance with any regulations or legal requirements.

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 2.13;



91459

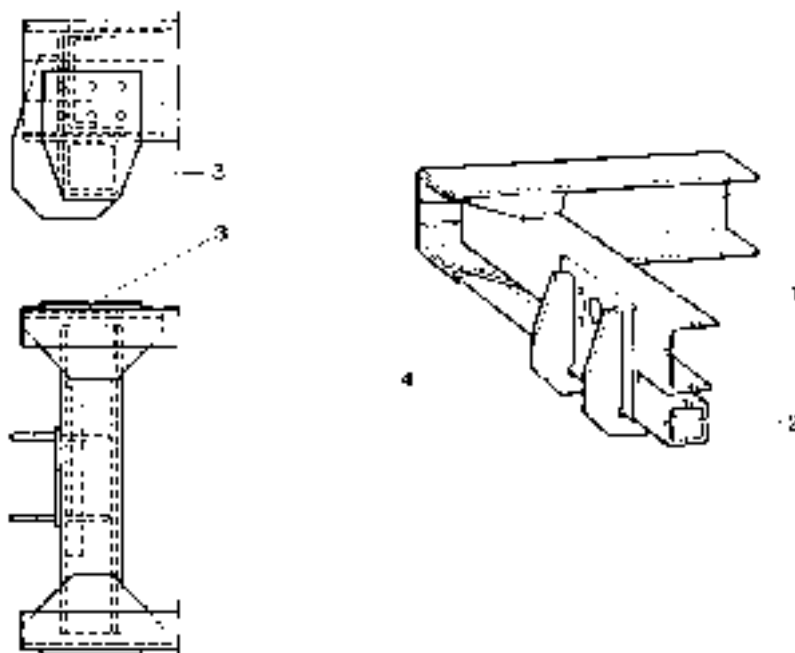
Figure 13

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 2.14. In vehicles with short rear overhang and in the presence of the subframe, the box profile can be inserted inside the profiles of the counter chassis, above the crossbar and connected to it by means of a front plate (as in Figure 2.12).

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 2.12), or installation of a reinforced crossbar when available, or adjustments to the braking system.

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

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

Use anti-unscrewing systems.

Plates

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

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

2.7 ASSEMBLING AN ADDITIONAL AXLE



- ▶ **Installation of an additional axle involves major impact on the braking system, pneumatic system, wiring and the MUX interconnection system: therefore approval by IVECO is necessary. The operation must be carried out in compliance with the instructions in Chapter 5 "Special instructions for electronic subsystems".**



- ▶ **The granting by IVECO 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.**

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.

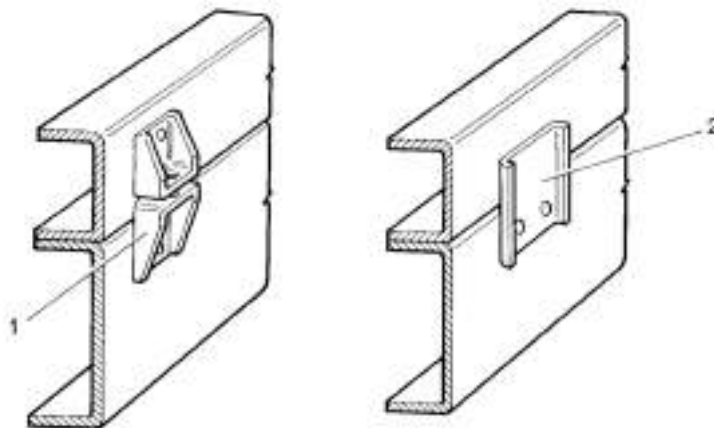
With regard to modifications to the chassis, in addition to complying with the indications in the previous paragraphs, it is necessary to consider the increase in stress due to the increase in the permitted load and the different conditions of operating dynamic stress.

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 2.15 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 counter chassis 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" 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 2.15).

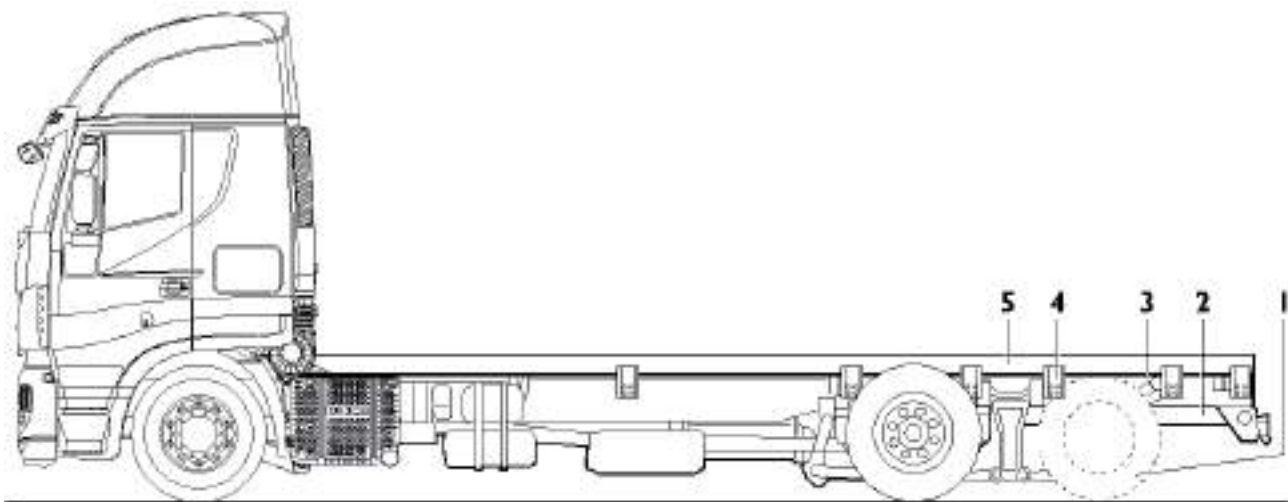
Note Reinforcement plates may not be mounted directly onto the side member flaps via holes filled with welding material; Negative effects on the strength of the original sections, due to incorrect welding, should be avoided.

Added axle

a) rear

The installation of an axle behind the engine axle generally results in the lengthening of the chassis overhang (see Figure 2.16), to be realised according to the indications in Paragraph "Lengthening" (► Page 18) and without prejudice to the need for reinforcements as referred to in Paragraph "Reinforcements on the chassis" (► Page 33).

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

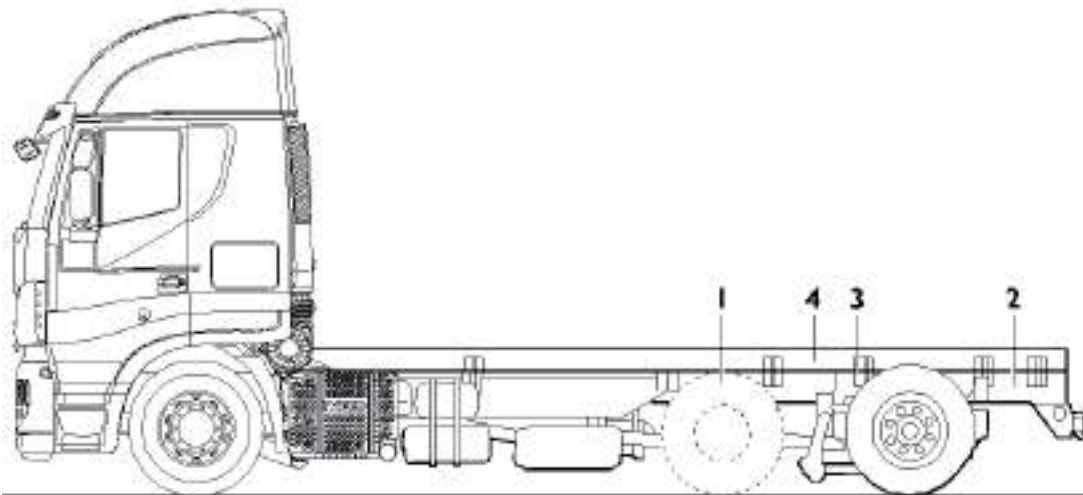
Figure 16

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 2.17), to be realised according to the indications in Paragraph "Shortening" (► Page 18) 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 mass 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.



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



- ▶ **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 over-loaded 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 GEARBOX MODIFICATION

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

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

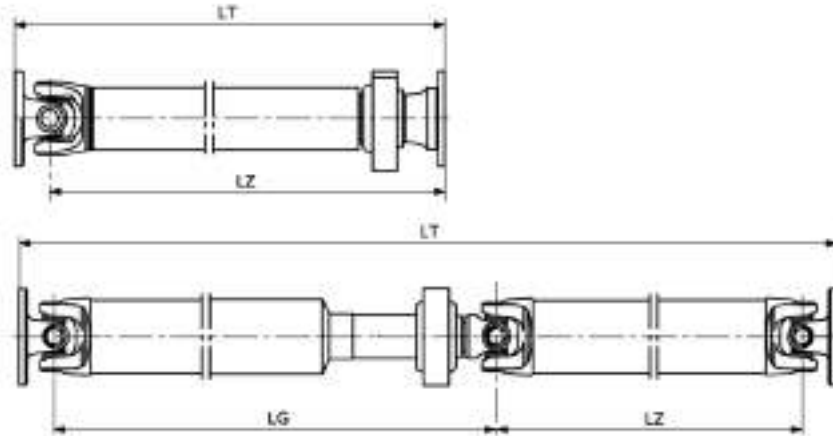
Contact the IVECO Technical Application for any difficulties; and send them a diagram with the length and tilt of the new transmission for a constant-velocity check.

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

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

Lengths allowed

1. The maximum work lengths that can be produced, both for the middle and sliding sections "LG" or "LZ" (see Figure 2.18), can be determined in relation to the external diameter of the existing vehicle pipe and the maximum running rpm (see formula and Table 2.10).
If the shaft length calculated in this fashion is insufficient for the modification at hand, it is necessary to insert a new section with the same characteristics as those mounted.
2. In some cases, a drive shaft with a larger diameter can be used and calculated (again, see Table 2.10) in relation to the length required and the maximum number of engine rpm.



192345

Figure 18

LG Length of intermediate sections

LZ Length of sliding sections

LT Total length

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

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

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

n_G	maximum engine speed [rpm]
n_{\max}	engine speed [rpm] at maximum output power, see Table 2-10
i_G	gear ratio at highest speed, see Table 2-11

Table 2.10 - Engine speed [rpm] at maximum output power

Engine Model	Engine code	Power [HP]	n_{\max}
CURSOR 9	F2CFE611D*C	310	2200
	F2CFE611C*C	330	2200
	F2CFE611B*C	360	2200
	F2CFE611A*C	400	2200
CURSOR 11	F3GFE611D*C	420	1900
	F3GFE611B*C	460	1900
	F3GFE611A*C	480	1900
CURSOR 13	F3HFE611B*C	500	1900
	F3HFE611A*C	560	1900

Table 2.11 - Gear ratio at highest speed

Gearbox	i_G
9 S 1310 TO	0.75
16 S 1620 TD	1.00
16 S 1920 TD	1.00
16 S 2220 TD	1.00

Gearbox	i_G
16 S 2320 TD	1.00
16 S 1820 TO	0.84
16 S 2220 TO	0.84
16 S 2520 TO	0.84
12 AS 1420 TD	1.00
12 AS 1930 TD	1.00
12 AS 2330 TD	1.00
12 AS 2330 TO	0.78
12 AS 2530 TO	0.78

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

Pipe thickness

Valid tube thickness is usually not possible.

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

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

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

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

Table 2.12 - Maximum possible lengths

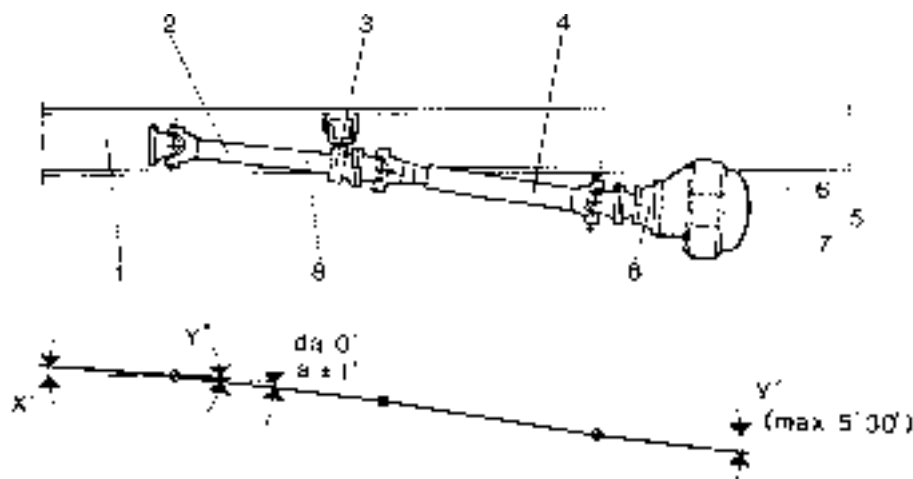
Joint dimensions	External diameter x thickness [mm]	Maximum possible lengths LG to LZ [mm]							
		1800	1900	2000	2100	2200	2300	2400	2500
		Maximum propeller shaft speed [rpm]							
2040	100 x 4.5	3400	3150	2900	2650	2450	2300	2100	1950
2040	120 x 3	4450	4100	3750	3400	3150	2900	2650	2450
2045	120 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. Generally speaking, the distance between an intermediate shaft and sliding shaft (see Figure 2.19) must be no greater than 600 mm, while between two intermediate shafts this difference must not be greater than 400 mm. As regards sliding shafts, there must be a minimum margin of 25 mm between minimum operating length and maximum sealing length; in opening, a covering must be guaranteed between the shaft and the sleeve of Ca. 2 times the diameter of the spline shaft.



91451

Figure 19

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.

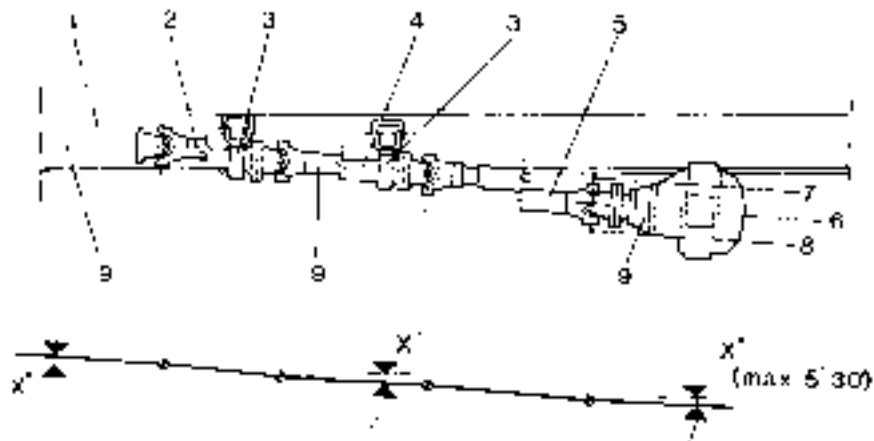
The intermediate shaft and the axle casing axle must be aligned.

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 2.20. In this case, make sure that the engine-gearbox axle, the second intermediate shaft and the axle casing axis when in static load are all aligned with the same tilt.



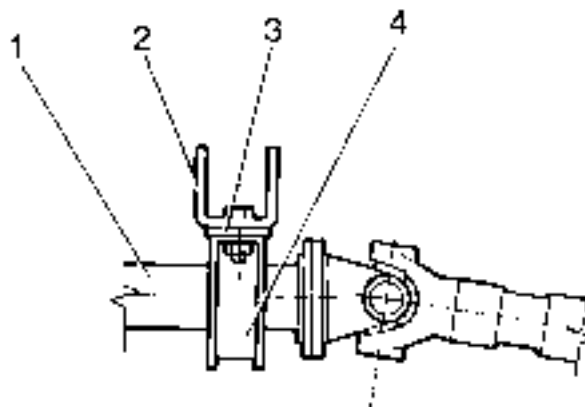
91452 **Figure 20**

- 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 elastic bearings must be done using support plates at least 5 mm thick (see Figure 2.21), 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.



91453 **Figure 21**

- 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

Intake

The characteristics of the engine air intake and exhaust systems must not be modified without IVECO authorisation. Modifications must not vary the original intake vacuum and exhaust counter-pressure values.

Table 2.13 - Maximum allowed counter-pressure at intake and exhaust under normal operating conditions and at full load

Engine Model	Engine code	Exhaust counter-pressure [kPa]	Intake vacuum [kPa]
CURSOR 9	F2CFE611D*C	20	6.3
	F2CFE611C*C	17	6.3
	F2CFE611B*C	16	6.3
	F2CFE611A*C	17	6.3
CURSOR 11	F3GFE611D*C	27	6.3
	F3GFE611B*C	27	6.3
	F3GFE611A*C	27	6.3
CURSOR 13	F3HFE611B*C	27	6.3
	F3HFE611A*C	27	6.3

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).

Engine exhaust

Note 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 allowed on the engine exhaust pipes.

2.10 MODIFYING THE ENGINE COOLING SYSTEM

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

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

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

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

- 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 30)) 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 43)), 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 5.5 - Paragraph "Additional equipment" (► Page 37)) 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 *Note that in relation to Directive 2006/40/EC on the emissions of air conditioning systems for motor vehicles, the use of fluorinated GHG with overall heating potential over 150 in comparison to CO₂ is prohibited.*

2.13 WORK ON THE CAB

General information

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

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

In relation to variation of cab weight, it is necessary to consider the position of the load in order to respect division of allowed axle loads (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

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

In any applications or units or equipment on the roof, 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 54));
- 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 2.14 - Wheel tightening torque according to IVECO STD 17-9219

CONNECTING ELEMENTS			TIGHTENING			
N.	Name	Thread	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. 19-0405).



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

2.15 WORK ON THE BRAKING SYSTEM

General information



- ▶ **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

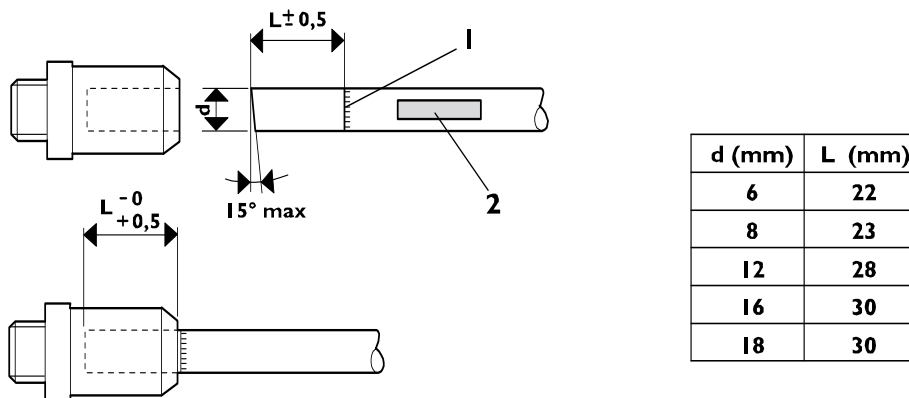
Preparation and assembly (IVECO STD I7-2403)

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 2.22) 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 22

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 ± 10%]
M12 x 1.5 mm	20
M14 x 1.5 mm	24
M16 x 1.5 mm	30
M22 x 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

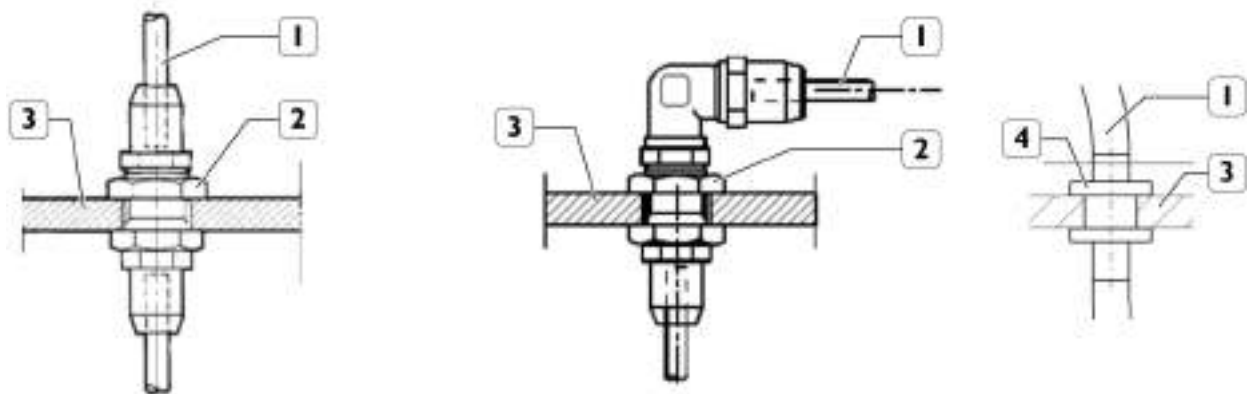
Before use, the new pipes must be thoroughly cleaned inside, for example by blowing air with a compressor.

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 2.23.



193866 **Figure 23**

1. Pipe
2. Through-coupling

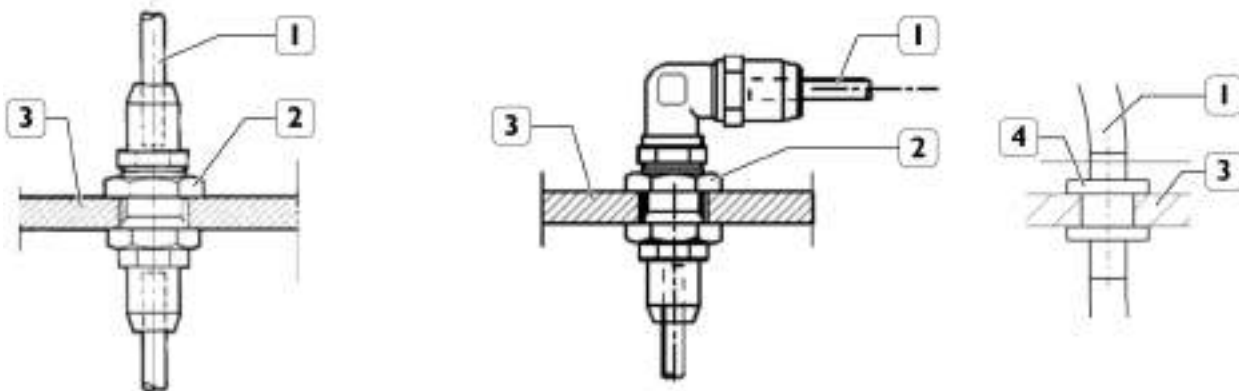
3. Chassis
4. Rubber protection



► **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.**



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Figure 23

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.

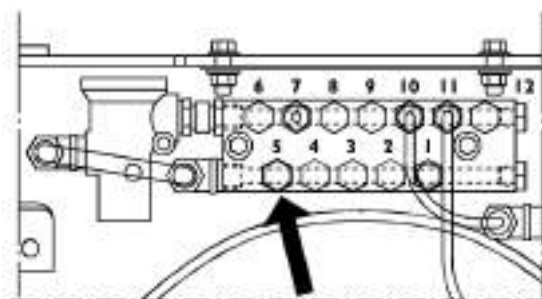
The wiring between the sensors on the rear axle and the control unit, as well as between the control unit and the modulators, must be adjusted using new cables or extension cables with appropriate connectors.

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

Withdrawing air from the cooling system

In vehicles with a pneumatic brake system it is possible to withdraw a small amount of air from the tank in the auxiliary circuit. This withdrawal should only occur through a limited return valve, which can avoid the lowering of the pressure below the threshold of 8.5 bar in the operating brake circuit and the auxiliary circuit.

Withdraw the air directly from the four-way safety valve (outlet 24) of the braking system or from the distribution plate (connection 5), if it is not otherwise occupied (see Figure 2.24).



116722

Figure 24

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.

If air is added to the air suspension tank (connection 25, Air Drying Unit), the APU regeneration volume must be controlled.

2.16 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

Note For information on work on the electrical system, refer to what is described in Section 5 - Chapter 5.5 (► Page 41).

2.17 PART RELOCATION AND ANCHORAGE OF ADDITIONAL UNITS AND EQUIPMENT

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

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

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 entry 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.

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

Similarly, it must act for the installation of tanks, compressors, etc.; the distribution of weight must also be taken into account for their placement (see Chapter 1.15 (► Page 11)). 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.

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

Fuel tank

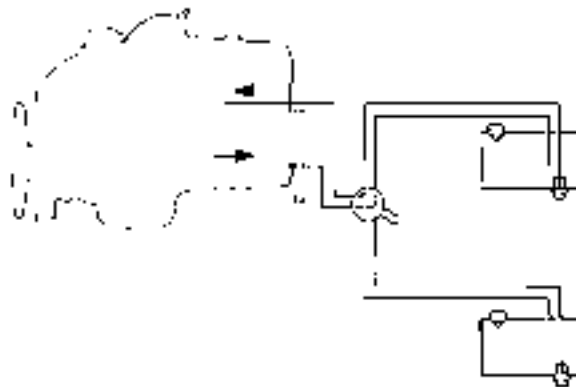
Depending on the type of vehicle (truck or tractor), the cab length and the engine power, the product range provides various types of fuel tanks, with a capacity of between 200 and 790 litres.

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

- replace the tank with another of greater capacity, choosing from those provided in 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.

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 2.25, where the adoption of a diverter allows to alternatively use the two tanks.



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Figure 25

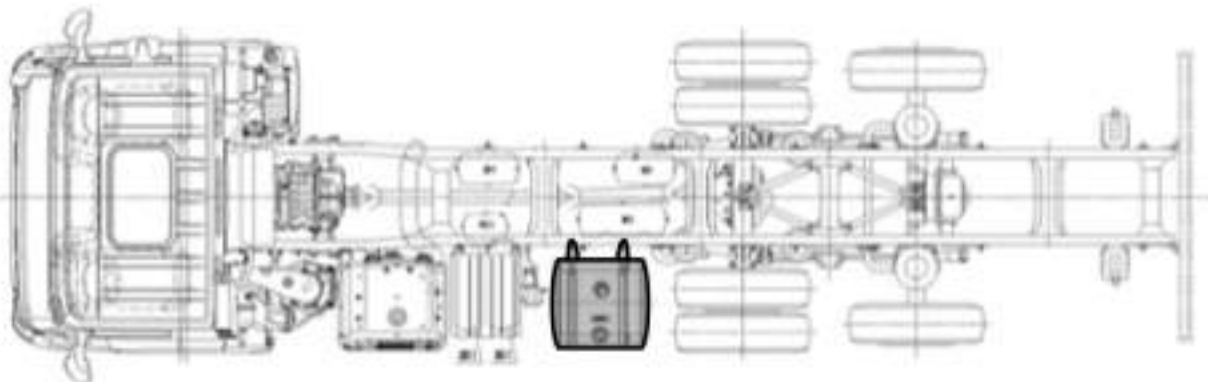
The chosen solution must be implemented in compliance with specific regulations.

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.

Finally, we would like to underline the need to adopt or implement a system that will always give correct information on the actual amount of existing fuel in the tanks.

Chassis with free right hand side

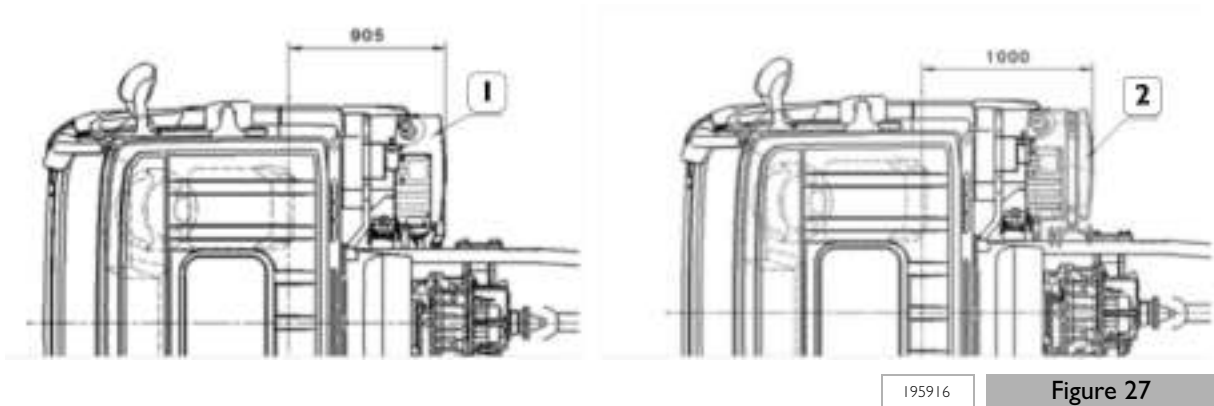
In cases where it is necessary that the right side of the chassis, between the front fender and the rear wheels, is free from any suspended assembly, it is possible to adopt specific fuel tanks for the left side (see Figure 2.26). This criterion does not concern the urea tank that, not having to be moved for any reason, should stay positioned right behind the right front fender.



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Figure 26

On Stralis Hi-Street/Hi-Road Trucks with the fuel tank on the left (right side of chassis free) the minimum space that can not be used is equal to 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 2.27).



1. 50 litre urea tank

2. 80 litre urea tank

195916

Figure 27

2.18 TRANSPORT OF HAZARDOUS MATERIALS (ADR)

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

IVECO does not provide versions fully prepared for the ADR, although production vehicles do already comply for some electrical parts, mechanical components and materials inside the cab.

The Bodybuilder, upon request, is given a declaration containing details of the sections in the document that have already been complied with.

A higher level of compliance can be obtained through the optional 2342 (ADR) in combination with the optional 8818 (digital tachograph for ADR).

The optional 2342 consists of:

- a special electric isolator positioned on the frame
- isolator control switch in the cab
- emergency switch
- protected electrical connections
- wiring protected with polyamide conduit
- ADR approval plate
- instructions on functioning

It should be noted that in the presence of such an option central door locking is not available.

Note As required by specific legislation, on ADR (hazardous materials) vehicles the connection of telematic devices to the connector FMS (Fleet Management System, see Chapter 5.3 (► Page 28)) must always be installed only in the cab. It is forbidden to maintain active connections on the chassis when the ADR button is pressed.

Anything still missing for the full adjustment of the vehicle to the specific type of goods to be transported is the responsibility of the Bodybuilder, who also has overall responsibility for implementation.

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

By way of example, below are some points of the Regulation ECE/TRANS/WP.15/213 on the topic.

- **Electrical system.**

Conductors suitably insulated and protected in ducts, protected from shock, stones, heat, etc.

Circuits protected from overvoltage with appropriate connections for use in hazardous environments, with fuses or automatic circuit breakers.

Main power switch (excluding the tachograph, powered directly from the battery with suitable safety devices) placed near the batteries, with direct or remote control in the cab and outside.

- **Braking.**

Compliance with specific EC Directives.

Obligation of the anti-lock system (ABS) and a device for slowing down, in the cases provided by law.

- **Cab protection.**

Use of fire-resistant materials, according to ISO 3795, with a burn rate not exceeding 100 mm/min; otherwise adoption of a protective wall between the cab compartment and transport.

- **Exhaust system.**

Suitable insulation for the components that reach temperatures above 200° C and cannot be moved in front of the protective wall.

Exhaust outlet facing towards the outer side; in the event of transport of explosives, the ends must be equipped with a spark arrester device.

- **Fuel tank.**

Location protected from shocks; in case of spills or leaks, the fluid should flow directly on the ground.

- **Independent heater.**

Safe with regard to protection against the fire; placed in front of the rear cab panel, at least 80 cm from the ground, with protection of the heated parts.

- **Speed limiter.**

Compliant with the ECE Directives in force.

- **Equipment.**

At least two fire extinguishers and two portable lamps, independent from the vehicle's electrical system, whose operation can not cause the combustion of the transported goods.

- **3rd axle.**

Electric lifting device arranged outside of the chassis, in a waterproof box.

2.19 INSTALLING A RETARDER

The application of a brake retarder in "aftermarket" is subject to the issuance of IVECO clearance.

While advising against the adoption of a retarder that is not like the one available on the price list, we do not exclude the option of selecting one of a different type (e.g. electrically operated) that is compatible 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 MODIFYING THE UNDER-RUN PROTECTION BAR

The vehicles are equipped with a under-run protection device in compliance with ec directives in force.

The maximum distance between the device and the rear-most point of the superstructure is 400 mm, less the deformation observed in the approval phase (on average 10 mm).

When the changes to the chassis require the adjustment of the rear overhang, the under-run protection device must be repositioned (in compliance with applicable regulations), making the same connection to the frame as provided in the original version.

In the transformation of the vehicles 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 operation must not affect the strength and hardness of the original (observe the national regulations). The Bodybuilder is required to submit the necessary documentation for compliance to the required characteristics.

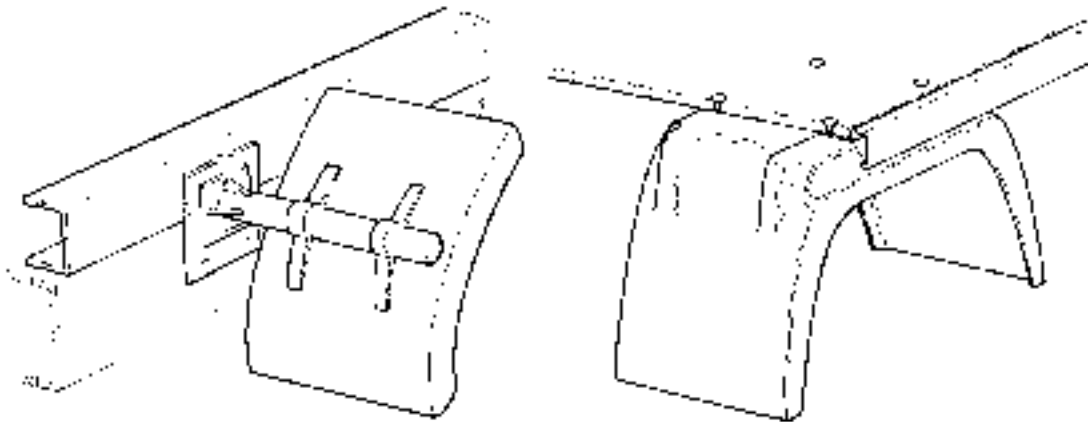
If you need to mount another under-run, it must be checked for compliance with regulations in force. The documents or test certificates should be submitted on request to the competent authorities.

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 counter chassis. In the first case, the connection should be made exclusively by means of screws or directly beneath the superstructure (see Figure 2.28).

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

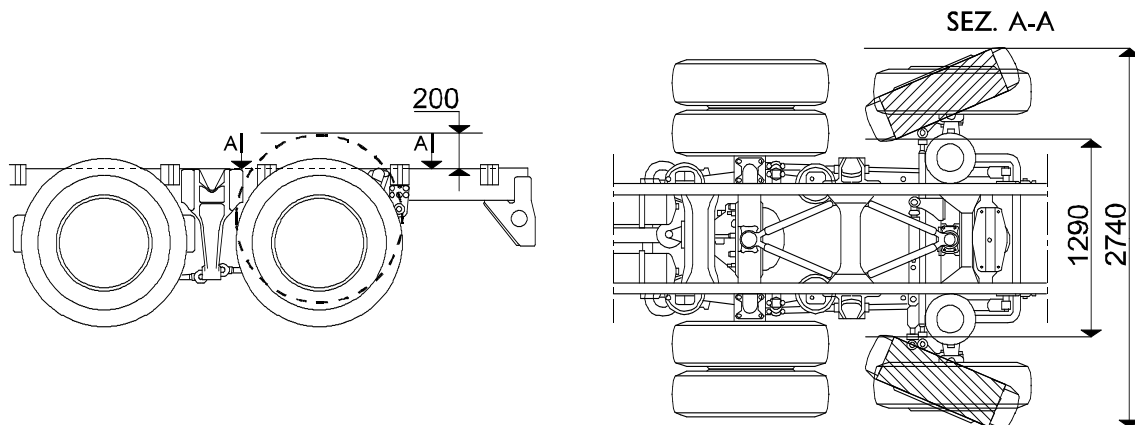


91472

Figure 28

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 2.29.

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 29

2.22 RAIN FLAP

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

2.23 SIDE PROTECTIONS

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

In permanently applied superstructures (e.g. fixed bodies, vans) side protection can be applied on the basis of their structure (e.g. 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).

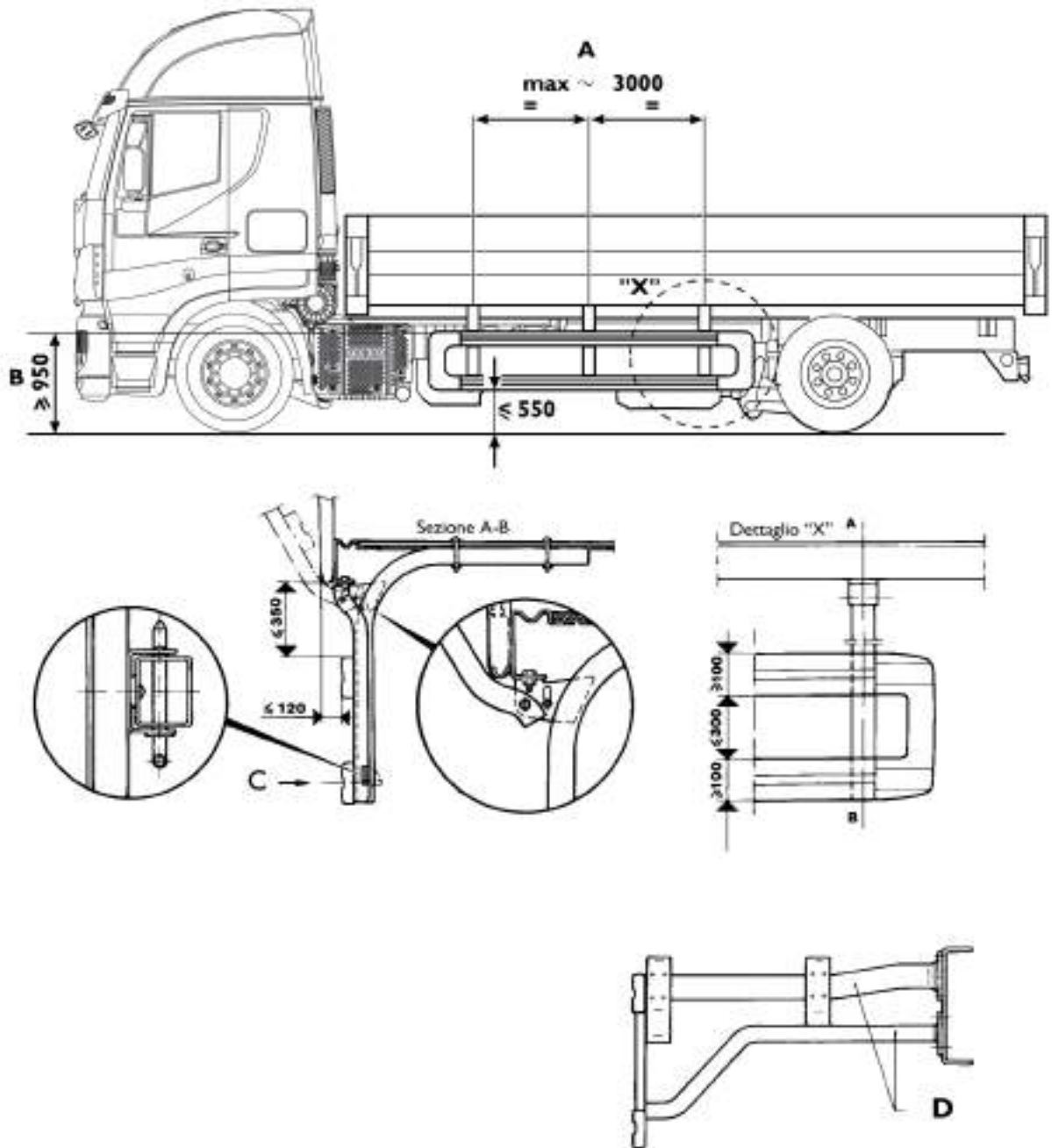
In implementing the outer protection, as required by the regulations (e.g. EC Directive), it is permitted to use either a single section with a surface extending in the vertical longitudinal sections, with pre-set dimensions and distances between them.

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 2.30 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 30**

- 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

2.24 WHEEL CHOCKS

Installation normally takes place directly in production. In cases where it is not so, or if the originally planned position needs to be changed, the Bodybuilder must find a new placement in accordance with local regulations.

The new placement must have characteristics of reliability and safety, and be easy to access.

SECTION 3

**APPLICATIONS OF
SUPERSTRUCTURES**

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APPLICATIONS OF SUPERSTRUCTURES

NOTE The specific instructions below are integrated into the requirements stated in Section 1 "GENERAL INFORMATION" in the general rules.

3.1 CONSTRUCTION OF THE COUNTER CHASSIS

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

Material

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

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

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

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

Name of steel		Breaking strength [N/mm ²]	Yield stress [N/mm ²]	A5 elongation
IVECO	Fe 360D	360 (I)	235 (I)	25% (I)
EUROPE	S235J2G3			
GERMANY	ST37-3N			
U.K.	40D			
IVECO	Fe E420	530	420	21%
EUROPE	S420MC			
GERMANY	QSTE420TM			
U.K.	50F45			
IVECO	Fe 510D	520	360	22%
EUROPE	S355J2G3			
GERMANY	ST52-3N			
U.K.	50D			

Sizing of profiles

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

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

Table 3.2 - Profile dimensions

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

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

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

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

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

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

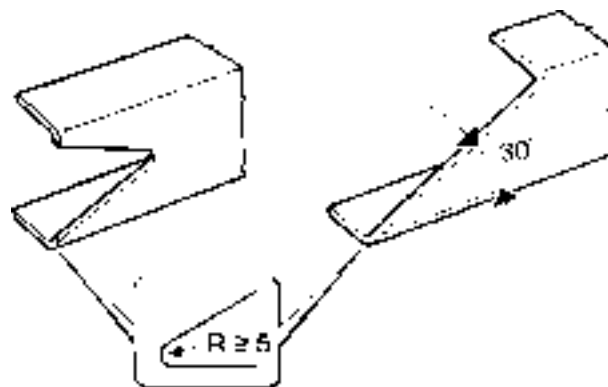
The collaboration requirement for aluminium means, in short, large and not very convenient dimensions.

3.2 ELEMENTS MAKING UP THE COUNTER CHASSIS

Longitudinal profiles

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

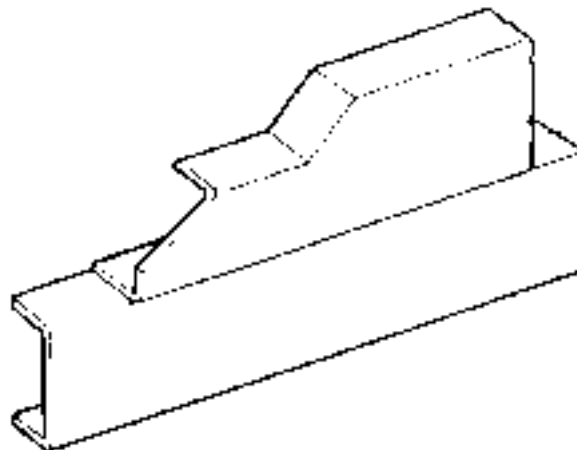
In order to achieve a gradual reduction of the resistant section, the front ends of the profile must be tapered in height with an angle not exceeding 30°, or another form of equivalent tapering (see Figure 3.1); the front end in contact with the chassis must be properly coupled, with min. radius of 5 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 3.2. 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 counter chassis must be dimensioned to cope with such forces.

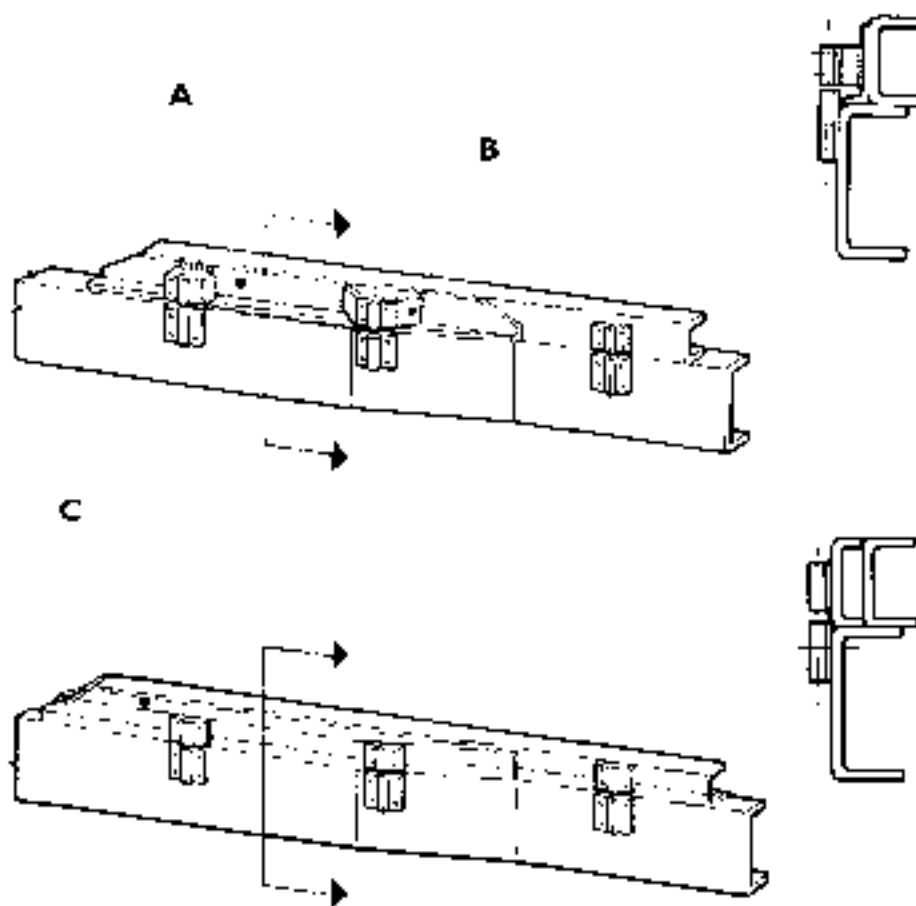


91137

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 counter chassis must follow the trend. If the front part of the counter chassis is narrower than the chassis, some suitably adapted C-profiles can be inserted outside the counter chassis, or angular L profiles with appropriate ribbing (see Figure 3.3).



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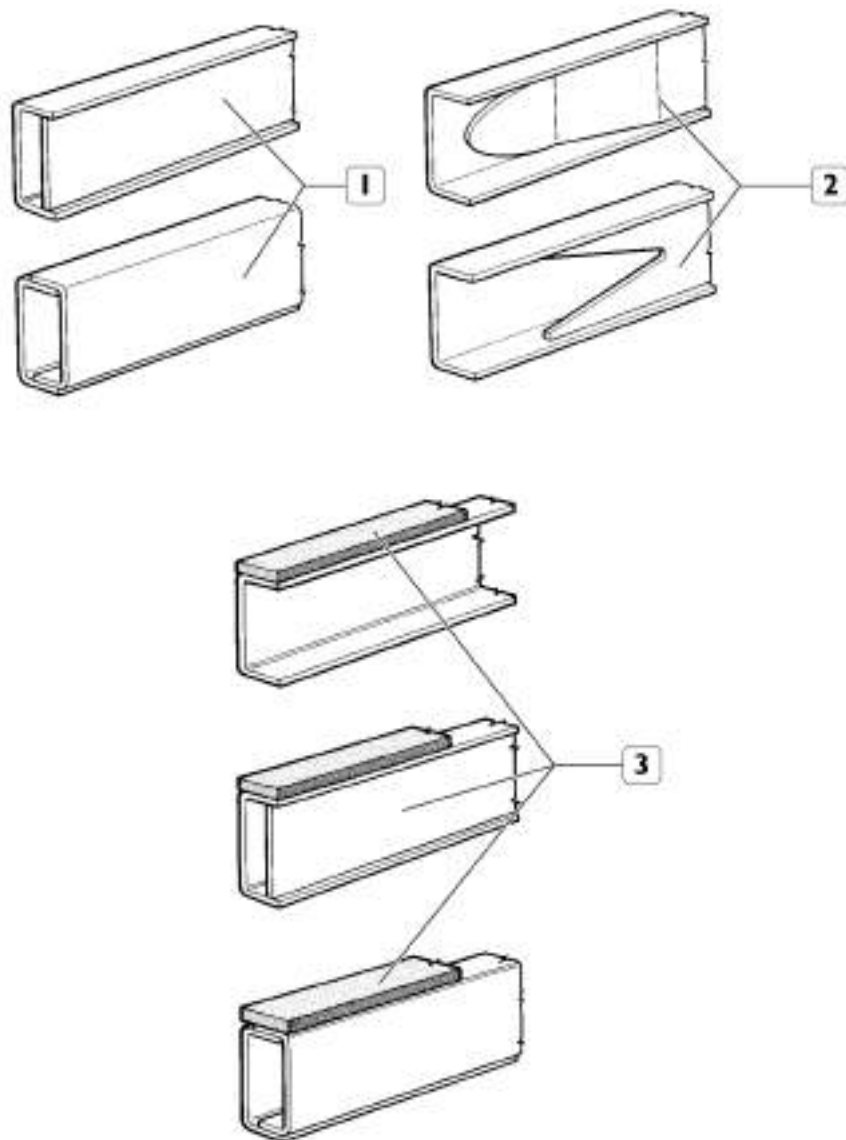
Figure 3

- 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 3.4.



193867

Figure 4

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

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

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

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

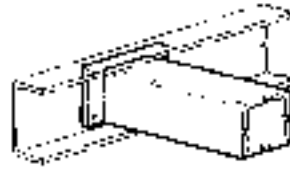
The sizing prescribed for the side members of the various types of superstructures are the recommended minimum values and, as a rule, are valid for vehicles with wheelbases and rear overhangs provided as standard (see Tables 3.4, 3.5 and from 3.9 to 3.13). In all cases similar profiles can be used, but with moments of inertia and resistance that are not lower. These values can be obtained from the technical documentation of the profile manufacturers.

Cross members

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

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

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



193868

Figure 5

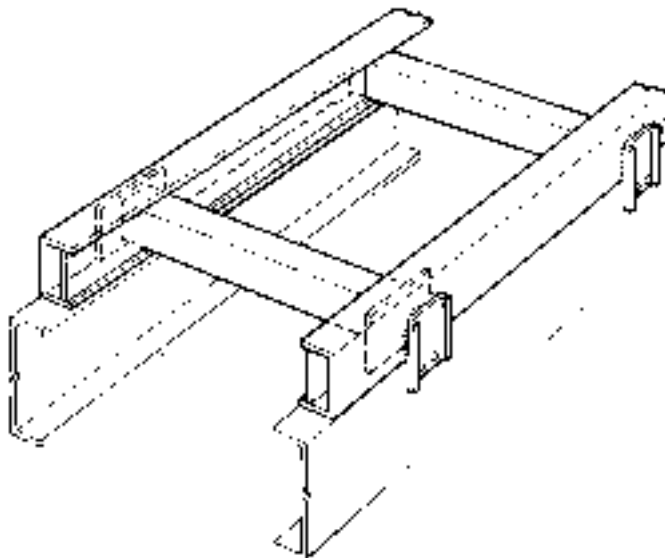
Stiffening of the counter chassis

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

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

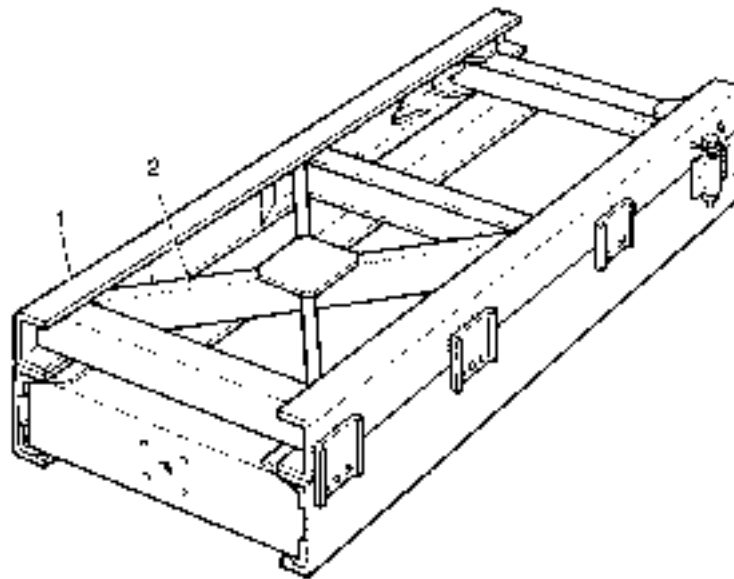
- boxing the longitudinal sections in the rear area;
- adopting closed section crossbars (see Figure 3.6);
- applying cross diagonals (see Figure 3.7);
- applying a torsion-resistant longitudinal element (see Figure 3.8).

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



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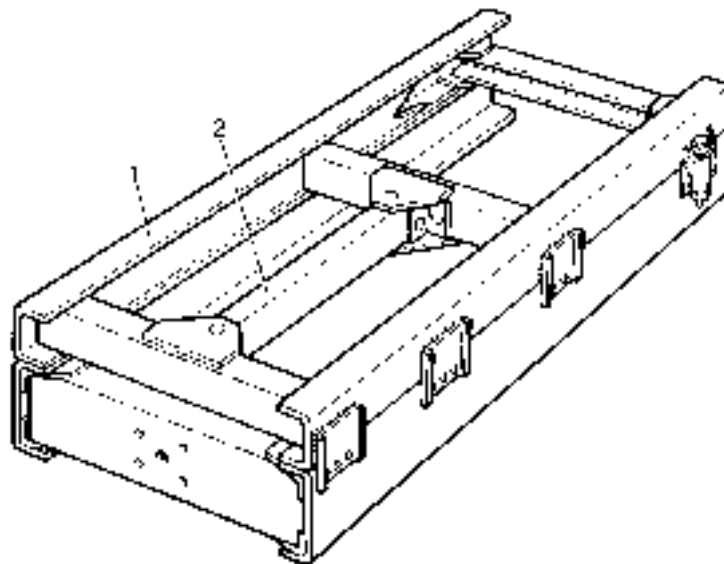
Figure 6



193869 **Figure 7**

1. Counter chassis

2. Diagonals



193870 **Figure 8**

1. Counter chassis

2. Box profile

Self-supporting superstructures with counter chassis functions

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

3.3 CONNECTION BETWEEN CHASSIS AND COUNTER CHASSIS

Choosing the type of connection

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

It can be elastic (brackets or clamps) or rigid, resistant to shear stress (plates sealed longitudinally and transversally); the choice must be made according to the type of superstructure to be applied (see Chapters 3.4 to 3.9), 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 put into its wings.**

In order to improve the longitudinal and transverse containment of the connection, punctures are permitted on the wings of the side members only in the rear end of the same, in a section that is no longer than 150 mm and without weakening the anchoring of any crossbars (see Figure 3.13).

Alternatively, use the connection in Figure 3.12, using the screws that connect the rear crossbar to the frame.



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

Connection characteristics

Elastic connections (see Figures 3.9, 3.10 and 3.11) allow limited movement between the chassis and the counter chassis; These connections make it possible to consider parallel cooperation of the two resistant sections, where each assumes a share of the bending moment proportional to its moment of inertia.

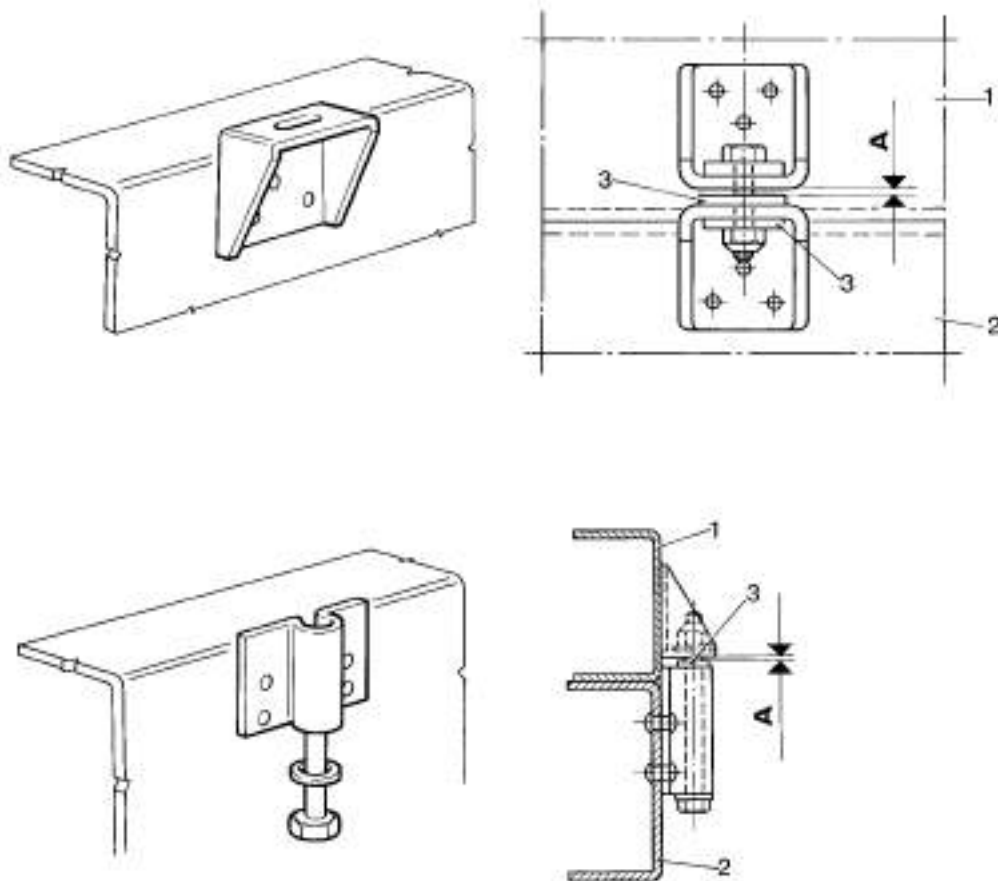
In the rigid connections (see Figure 3.12), a single resistant section can be considered for the two profiles, on the condition that the number and distribution of the connections are such as to withstand the consequent cutting forces.

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

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

Connection with brackets

Some examples of achievements of this type of connection, are shown in Figure 3.9.



193871 **Figure 9**

- 1. Counter chassis
- 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 counter chassis is $1 \div 2$ mm; greater distances should be reduced by means of suitable spacers. At the closure of the screws, brackets must be brought into contact.

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

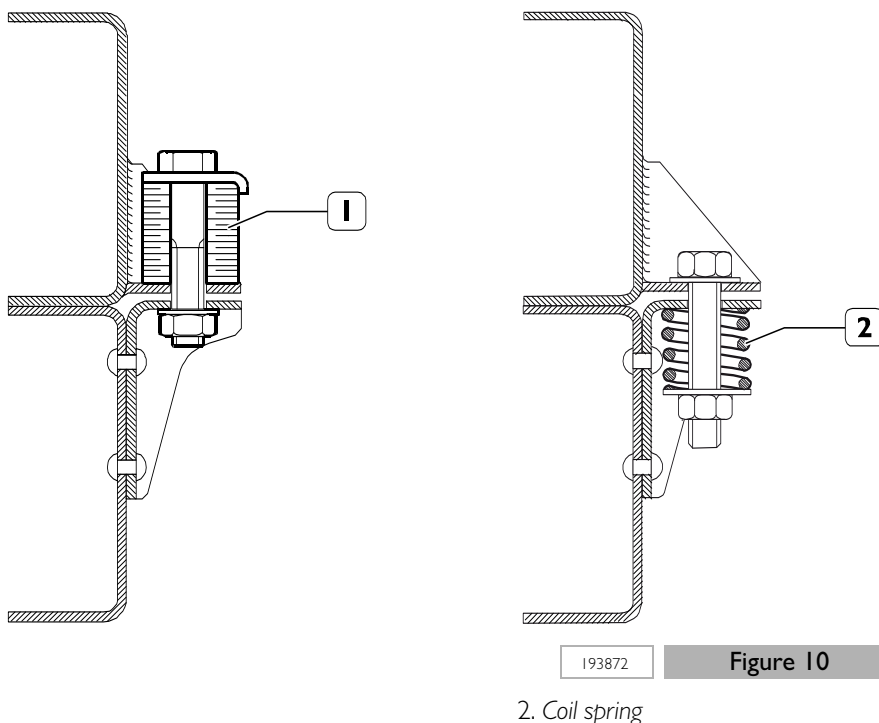
The brackets must be fixed to the rib of the side members of the vehicle by means of screws or nails.

In order to better contain the loads in the transverse direction, the brackets are normally applied so that there is a slight protrusion perpendicular to the upper edge of the chassis. If instead the brackets must be applied exactly to the wire, the side guide for the superstructure must be assured with other devices (e.g. using guide plates connected only to the counter chassis, or only to the vehicle chassis, see. Figure 3.12). When the front connection is elastic (see Figure 3.9), the lateral containment must be assured even in conditions of maximum torsion of the chassis (e.g. off-road applications).

In the event in which the vehicle chassis is already equipped with brackets for the attachment of a body of a type established by IVECO, these brackets must be used for this purpose. For the brackets applied to the counter chassis or to the superstructure, resistance characteristics not less than those originally mounted on the vehicle should be provided (see Table 2.1 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 3.10 should be adopted in the area behind the driver's cab. Brackets accompanied by rubber plugs (1) or coil springs (2) should be used.



1. Rubber block

2. Coil spring

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

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 counter chassis and avoid excessive bending moments on the original chassis.

Connections with clevis fasteners or clamps

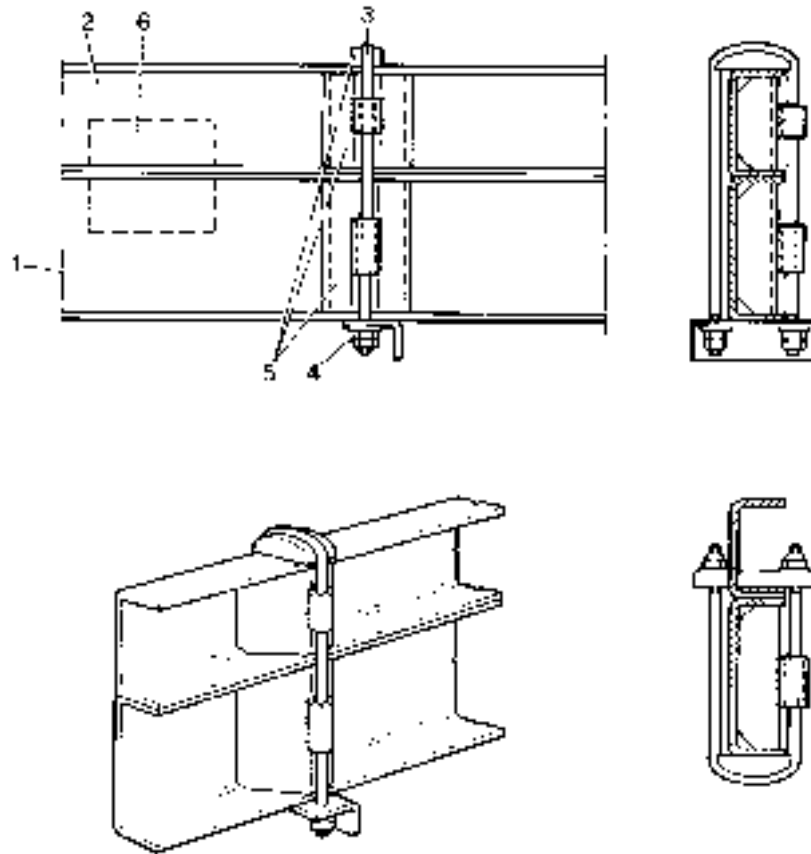
Figure 3.11 shows the main constructions of this type.

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 counter chassis as shown in Figure 3.12.

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 3.13.



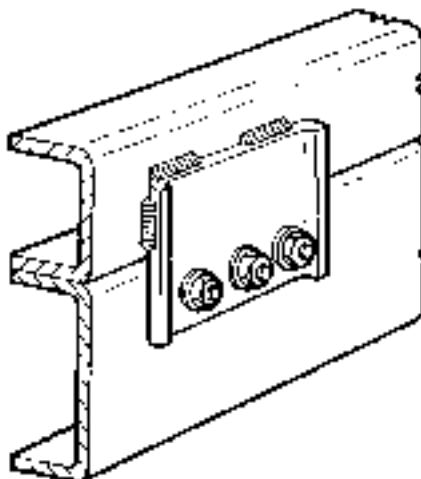
193873 **Figure 11**

- 1. Chassis
- 2. Counter chassis
- 3. Clevis fasteners

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

Connection with longitudinal and transverse sealing plates (rigid junction)

The type of mounting shown in Figure 3.12, made with plates that are welded or bolted to the counter chassis and fixed with nails or screws to the vehicle chassis, ensures a good capacity for reacting to longitudinal and transverse thrusts and the greatest contribution to the stiffness of the assembly.



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Figure 12

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

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

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

Table 3.3

Chassis and counter chassis height/section ratio	Max. distance between the centre lines of the cut-resistant plates [mm] ⁽¹⁾	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.

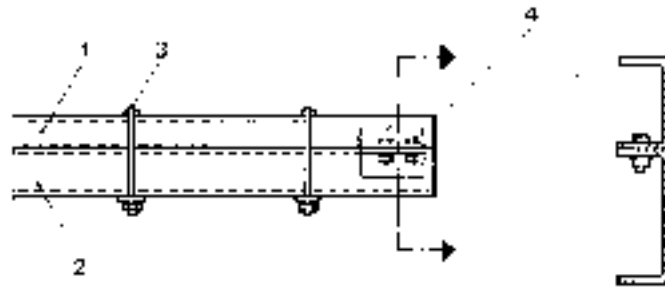
⁽²⁾ In the presence of contained thicknesses of the plates of the chassis and the counter chassis, it is advisable to connect by adopting spacer bushes, in order to use longer screws.

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 3.13.



193874 Figure 13

- 1. Counter chassis
- 2. Chassis

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

3.4 CONTAINER APPLICATION

Dimensions and centres of gravity

Check the correct load distribution and in particular, respect the indications regarding the height of the centre of gravity as provided in Section 1 using suitable construction precautions and ensure that the transported load has maximum stability while running.

Fixed bodies

The application on normal cab vehicles, valid only for road services, is normally made through a support structure consisting of longitudinal and transverse profiles. The minimum dimensions indicative of the longitudinal profiles are shown in Table 3.4, valid for front axle loads ≤ 8000 kg.

Table 3.4

Models	Wheelbase [mm] (with reference to drive shaft in 3 axle vehicles with rear third axle)	Modulus of resistance W_x [cm ³] of the minimum reinforcement section
STR 190 STR Hi-Way 190	up to 6300 ⁽²⁾	89 ⁽³⁾ ⁽⁴⁾
STR 260	up to 6050 ⁽²⁾	(46) ⁽¹⁾

⁽¹⁾ Possible alternative, using cut-resistant connections along the length of the chassis and connections with brackets in the front area.

⁽²⁾ For vehicles with wheelbase up to 5700 mm and rear overhang up to 2300 mm it is possible to 120x60x6 mm profile (W_{min} 46 cm³); this profile is also sufficient for all models with 2 and 3 axles up to 7500 kg on front axle.

⁽³⁾ For vehicles 190 P /FP with a wheelbase equal to 6300 mm and rear overhang greater than 2300 mm, designed to withstand the maximum permissible rear axle load, the longitudinal section must have characteristics of yield strength not less than 320 N/mm² and must be connected to the chassis with cut-resistance plates, starting at approximately 1000 mm before the engine axle centre line and up to the rear end of the chassis.

⁽⁴⁾ For 190 6x2 P / FP / PS / PT / FT vehicles with overhang greater than 1800 mm (from the centre line of the last axle), designed to withstand the maximum permissible load on the rear axles, the longitudinal section must be connected to the chassis with cut-resistant plates, starting at approximately 1000 mm before the engine axle centre line and up to the rear end of the chassis.

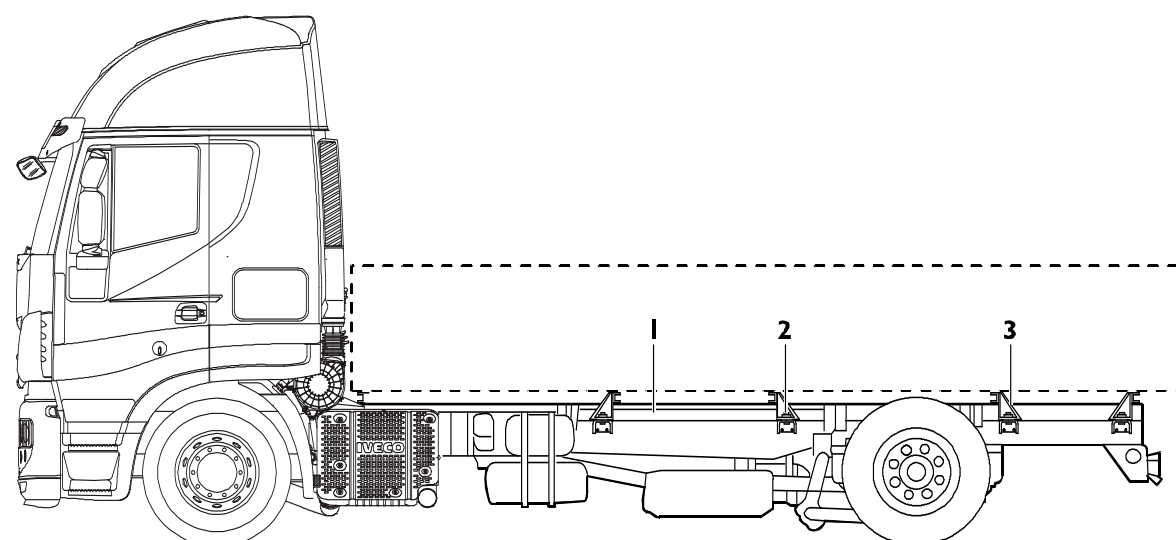
Note For the dimensions of the profiles see Table 3.2.

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 a longitudinal adequate containment, in the case of connections with brackets or clamps it is good practice to provide a rigid connection on the rear overhang (one per side), obtained with screws or plates on the upper wing of the side member (see Figure 3.12 and 3.13).

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

In cases in which the body uses elevated supports above the counter chassis (e.g. crossbars), it is necessary to suitably stiffen such supports, to contain the longitudinal thrusts, as shown in Figure 3.14.

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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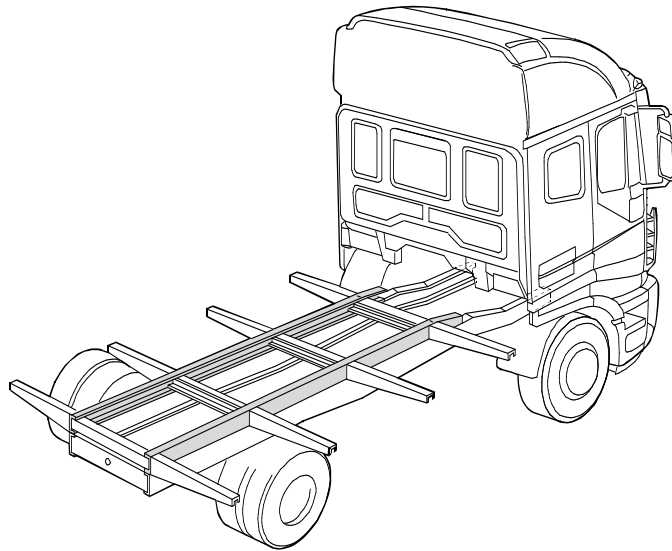
Figure 14

1. Counter chassis
2. Brackets

3. Containment elements

For special equipment where a reinforcing section of moderate height is needed, the structure of the counter chassis 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 3.15).

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



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Figure 15

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

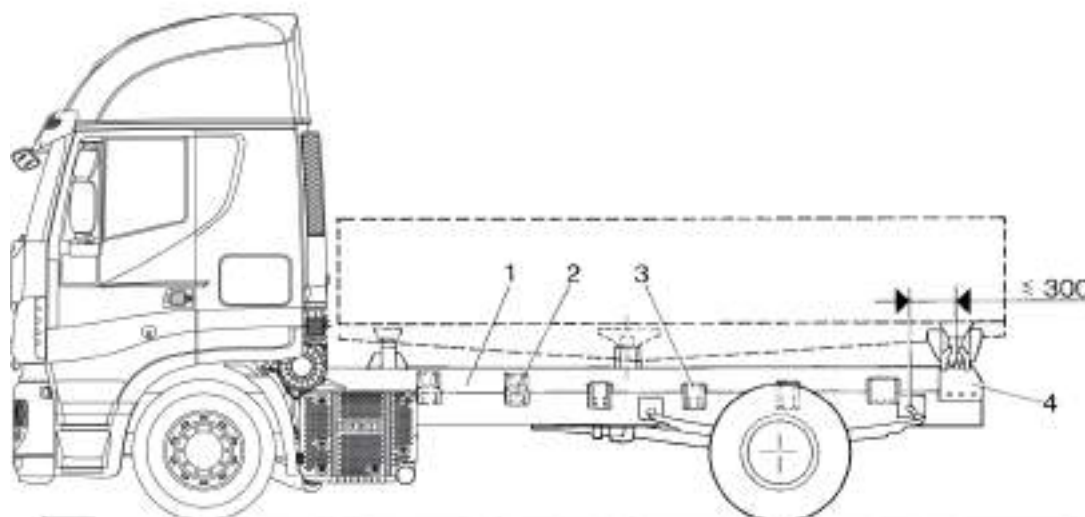
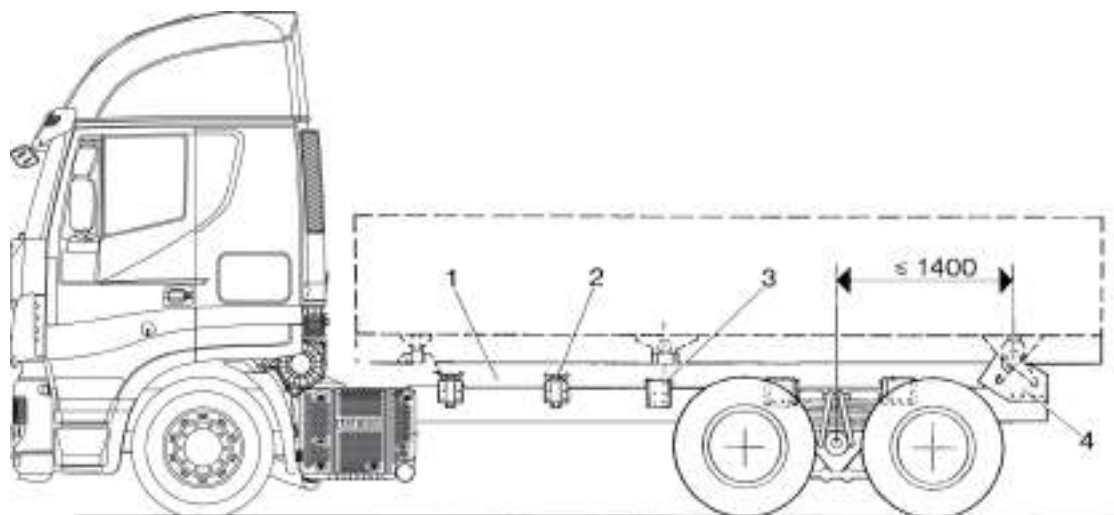
The use of tipper bodies, rear and three sided, generally subjects the chassis to considerable stress.

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 3.6 and Figure 3.7). The connections to the chassis must be flexible (brackets or supports) at the front end, whereas the rear section requires stiff connections (cleat plates) (see Figure 3.12) to allow the added structure to contribute more to the stiffness of the assembly. Omega shelves can be used on vehicles on where these are originally fitted.
3. The rear tipping hinge must be fitted on the counter chassis; its position must be as near as possible to the rear support of the rear suspension. In order not to 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 3.16. 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 3.17. If for technical reasons this cannot be achieved, small increases may be permitted provided a higher strength counter chassis is used, in order to increase the 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 with air suspension it is required to deflate the air bellows completely. See also Specification 01 in Chapter 5.2 (➔ Page 9).

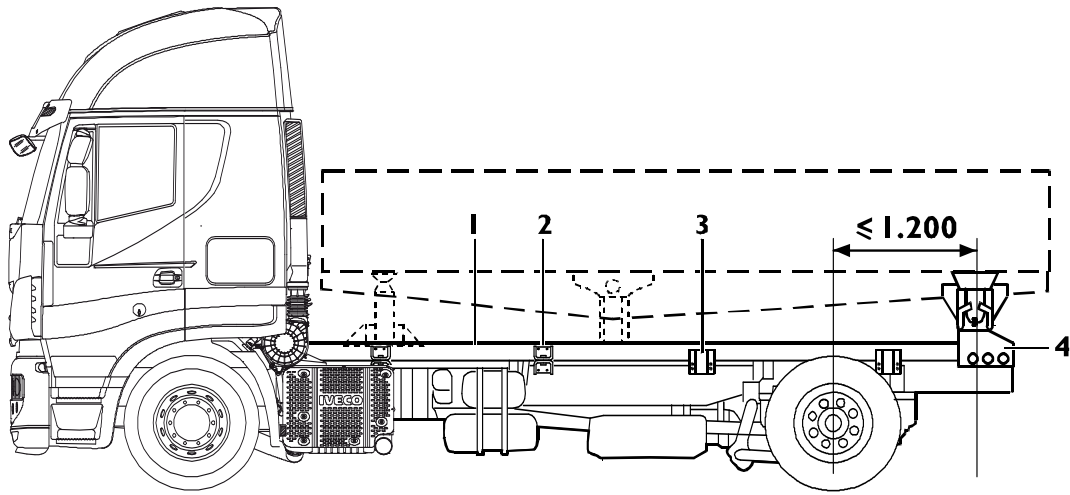
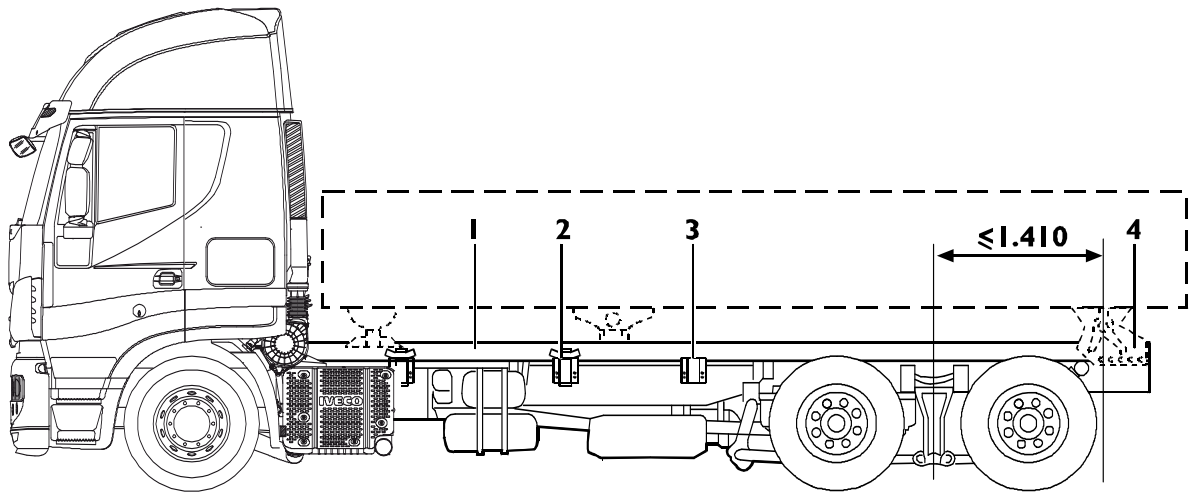


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Figure 16

- 1. Counter chassis
- 2. Brackets

- 3. Plates
- 4. Joint cover



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Figure 17

- 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 density 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 counter chassis 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 stabiliser 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 stabiliser 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	
	Front	Rear
STRALIS 190	46	46 ⁽¹⁾ / 56
	89 ⁽²⁾	89 ⁽¹⁾ ⁽²⁾ / 110
STRALIS 260 /TN	89	89 ⁽¹⁾ / 110
STRALIS 260 /PT, Z/P-HM	89	89 ⁽¹⁾ / 110
STRALIS 260 /P, /PS, /FP, /FS without (-GV)	89	89 ⁽¹⁾ / 110

⁽¹⁾ A box-section with shear-resistant connections from 1000 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

Roll off containers

Not all vehicles lend themselves equally well for the application of roll off containers (bodies moved onto the ground by placement or rear sliding via an on-board crane system). Heavy duty use vehicles are certainly better suited but it is recommended that the suitability of the various models in relation to the use of the vehicle is evaluated in collaboration with IVECO (Table 3.4).

For these outfittings, the additional stresses compared to those of normal on-road vehicles with fixed platform bodies are those which occur during the loading and unloading operations. For this reason, the counter chassis to be used (see Chapter 3.1 (► Page 5)) should be of the same dimensions as that for light tippers (see Section "Light-duty service" (► Page 22)).

In the case of vehicles with long wheelbases or rear overhangs, it may be necessary to use counter chassis sections of larger dimensions.

The interchangeable superstructure must rest on the chassis along its entire length or at least be in contact with an extensive area of the suspension attachment area.

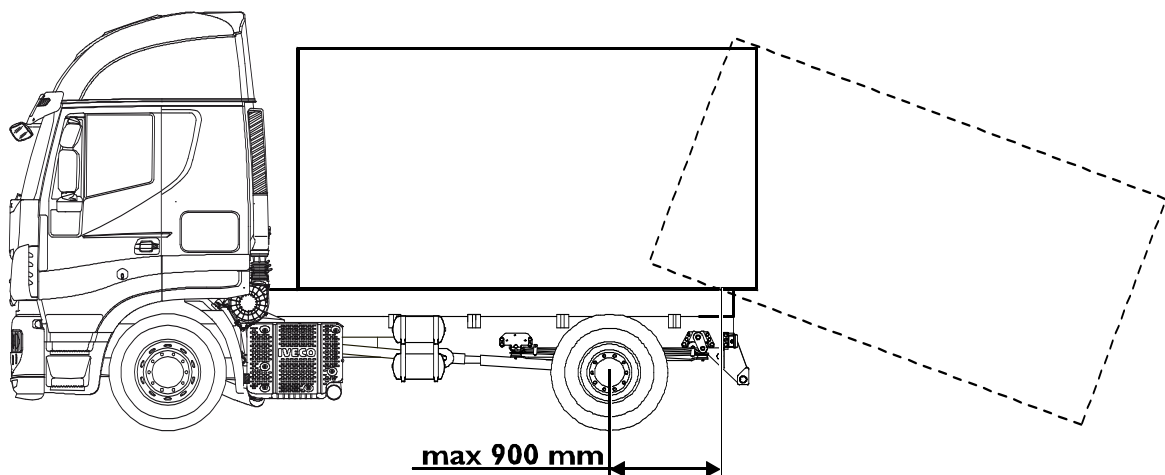
The lifting devices (on-board crane system) must be fixed to the counter chassis as indicated in Chapter 3.8 (► Page 36).

Vehicle stability must be guaranteed and comply with DIN standard 30722. The stability of the vehicle must always be ensured during loading and unloading operations; It is recommended that rear ends are fitted with supports (stabilisers) to be used during loading and unloading operations, particularly when roll off containers are used. These supports are also recommended if the rear axles have pneumatic or mixed suspensions.

Alternatively, refer to the indications given in the previous Section "Light duty service" (► Page 22), concerning the discharge of air from the suspension during the operation.

Note To ensure stability on vehicles with air suspension it is required to deflate the air bellows completely. See also Specification 01 in Chapter 5.2 (► Page 9).

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 stabiliser bar available if IVECO provides for this.



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Figure 18

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

3.5 TRACTOR FOR SEMI-TRAILER

Fifth wheel

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

The fifth wheel must be of the approved type. Follow the Manufacturer's specific instructions when securing it to the support structure.

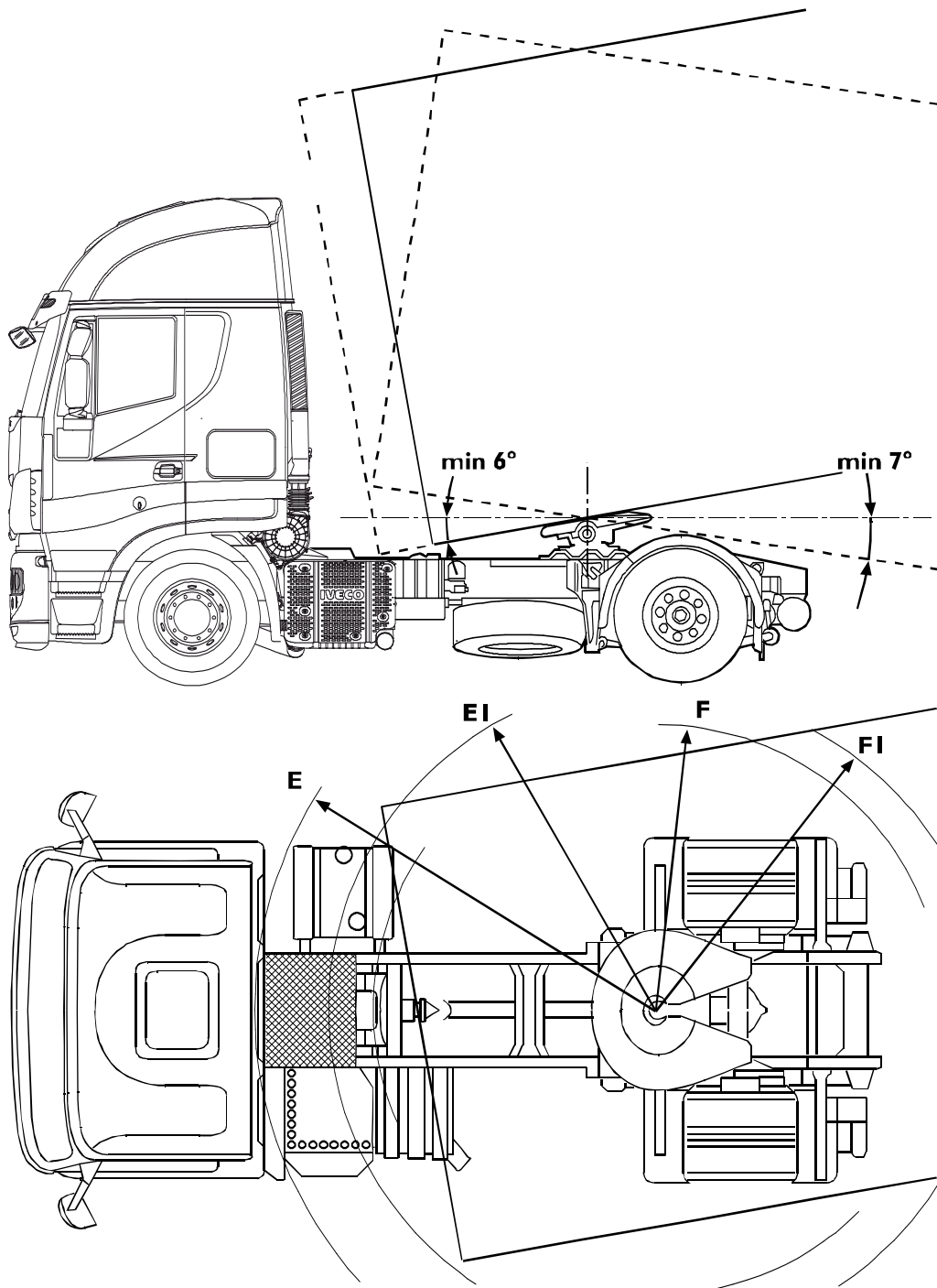
Fifth wheel advancement

The position of the fifth wheel may be chosen from the position advancements designed by IVECO; these refer to the kerb weight of the standard version tractor. If the unladen mass is changed for subsequent installations and/or transformations, you must refer to the actual mass of the tractor completely equipped (fuel, driver, tools etc) and check advancement according to the maximum permitted load on each axle (see Chapter 1.15 (► Page 11)).

All geometric conditions to ensure good coupling with the semi-trailer (see Paragraph "Coupling between tractor and semi-trailer" (► Page 24)) must be verified, particularly for fifth wheel advancements different from those normally shown.

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.). Respect the relative movements in the various conditions of use to ensure the necessary safety margins and respect the applicable laws and standard for use on roads when combining tractor and semi-trailer (see Figure 3.19).



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Figure 19

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

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

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;
- the structure must be fastened to the tractor (see Figures 3.20, 3.21, 3.22 and 3.23) on corner reinforcements where applicable 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

In principle, the fifth wheel support structure must consist of a ribbed plate (see Figure 3.20) connected to the chassis with longitudinal sections and specific shelves for tractors intended for normal vehicle use unless otherwise specified by IVECO.

The use of this type of structure also for off-road use is envisaged for some models and markets; In this case, the type of service and the loads do not require direct contribution of the structure on the chassis in terms of bending and torsion.

The ribbed plate is provided with the vehicle and fastened to it provisionally for transport.

The plate will be definitively fitted by the fifth wheel fitter.

The fifth wheel resting plate is a safety part (subject to specific approval in some countries) and assembly instructions must be respected and no changes are allowed.

Table 3.6 - Application of fifth wheel and plates

Fifth wheel support	4x2 Tractors		6x2C TRACTORS	6x2P TRACTORS	6x4 Tractors
	440 T/P	440 T/FP-LT	440 TX/P	440 TY/P	440 TZ/P-HM
Fifth wheel H = 140 mm - In-built plate	–	S	–	–	–
Fifth wheel H = 150 mm + plate 50 mm	○	–	–	–	–
Fifth wheel H = 150 mm + plate 40 mm	–	–	○	–	–
Fifth wheel H = 150 mm + plate 100 mm	○	–	○	○	○
Fifth wheel H = 150 mm + plate 12 mm	○	○	–	–	–
Rest plate H = 40 mm	–	–	○	–	–
Rest plate H = 50 mm	○	–	–	–	–
Rest plate H = 100 mm	○	–	○	○	○
Fifth wheel H = 185 mm + plate 50 mm	○	–	–	–	–
Fifth wheel H = 185 mm + plate 40 mm	–	–	○	–	–
Fifth wheel H = 185 mm + plate 100 mm	○	–	○	○	○

Fifth wheel support	4x2 Tractors		6x2C TRACTORS	6x2P TRACTORS	6x4 Tractors
	440 T/P	440 T/FP-LT	440 TX/P	440 TY/P	440 TZ/P-HM
Fifth wheel without plate H = 148 mm + plate 8 mm	○	–	–	–	–
Fifth wheel without plate H = 190 mm	○	–	–	–	–
Fifth wheel without plate H = 225 mm	○	–	–	–	–
Fifth wheel Alu (SAF) H = 180 mm	○	–	–	–	–
Fifth wheel Alu (SAF) H = 245 mm	○	–	–	–	–

S = Standard

O = Optional

Table 3.7 - Fifth wheel dimensions

Plate height [mm]	Fifth wheel height [mm]	Fifth wheel height without plate [mm]	Fifth wheel height with in-built plate [mm]	Resulting height [mm]
			140 (128+12)	140
		156 (148+8)		156
			162 (150+12)	162
			180 (Alu)	180
		190		190
40	150			190
50	150			200
		225		225
40	185			225
50	185			235
			245 (Alu)	245
100	150			250
100	185			285

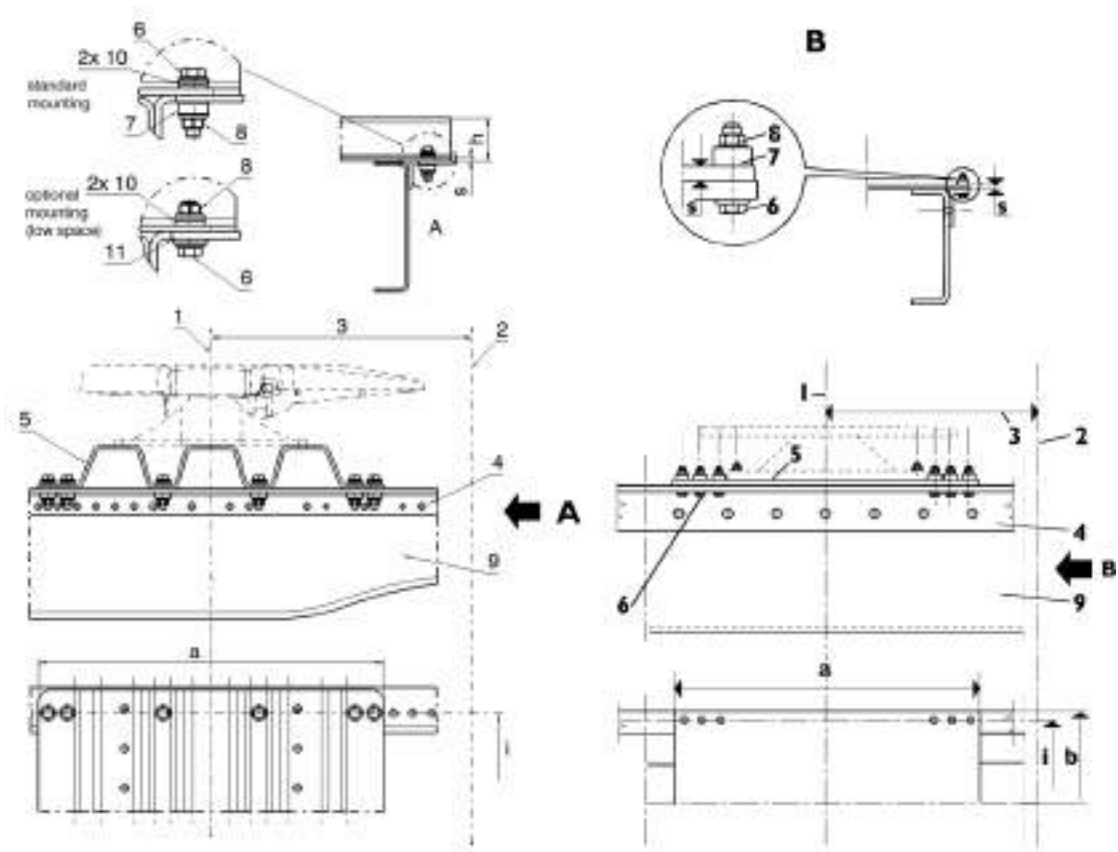
Table 3.8 - Tyre / model application (indicative)

Total height fifth wheel [mm]	Models Tractors	Alignment [mm]	Tyres	Mud guards Distance C (*) [mm]	Height from flat ground of fifth wheel with laden vehicle [mm]
200	4x2 /P	160 (S) 140 (O) (SW 06114)	315 / 80	150	~1160
			295 / 80		~1150
			315 / 70	120	~1110
			305 / 70		~1105
			315 / 60		~1085
			295 / 60		~1075
235	4x2 /P	160 (S)	315 / 80	180	~1195
			295 / 80		~1185
285	4x2 /P	160 (S)	315 / 80	180	~1245
			295 / 80		~1235
162	4x2 /P	140 (O) (SW 06114)	315 / 60	120	~1050
			295 / 60		~1040
			305 / 70		~1065
			315 / 70		~1070

Total height fifth wheel [mm]	Models Tractors	Alignment [mm]	Tyres	Mud guards Distance C (*) [mm]	Height from flat ground of fifth wheel with laden vehicle [mm]
180 (Alu)	4x2 /P	160 (S)	315 / 80 295 / 80	150	~1140 ~1130
		140 (O) (SW 06114)	315 / 70 305 / 70 315 / 60 295 / 60	120	~1090 ~1085 ~1065 ~1055
250 (245 Alu)	4x2 /P	160 (S)	315 / 80 295 / 80	150	~1210 ~1200
		140 (O) (SW 06114)	315 / 70 305 / 70 315 / 60 295 / 60	120	~1160 ~1155 ~1135 ~1125
190	4x2 /P	160 (S)	315 / 80 295 / 80	150	~1150 ~1140
		140 (O) (SW 06114)	315 / 70 305 / 70 315 / 60 295 / 60	120	~1100 ~1095 ~1075 ~1065
225	4x2 /P	160 (S)	315 / 80 295 / 80	150	~1185 ~1175
		140 (O) (SW 06114)	315 / 70 305 / 70 315 / 60 295 / 60	120	~1135 ~1130 ~1110 ~1100
140	4x2 /FP-LT	85	295 / 60 315 / 60	120	~960 ~970
162 (156)	4x2 /FP	85	295 / 60 315 / 60	120	~985 ~995
190	6x2C	140	295 / 60 295 / 80	180	~1065 ~1120
			305 / 70 315 / 70 315 / 80		~1095 ~1100 ~1130
225	6x2C	140	295 / 60 295 / 80	180	~1100 ~1155
			305 / 70 315 / 70 315 / 80		~1130 ~1135 ~1165
250	6x2C	140	295 / 60 295 / 80	180	~1125 ~1180
			305 / 70 315 / 70 315 / 80		~1155 ~1160 ~1190
285	6x2C	140	295 / 60 295 / 80	180	~1160 ~1215
			305 / 70 315 / 70 315 / 80		~1190 ~1195 ~1225
250	6x2P	140	315 / 80	180	~1190
			12 R 22.5 13 R 22.5		~1195 ~1215

Total height fifth wheel [mm]	Models Tractors	Alignment [mm]	Tyres	Mud guards Distance C (*) [mm]	Height from flat ground of fifth wheel with laden vehicle [mm]
285	6x2P	140	315 / 80 12 R 22.5 13 R 22.5	180	~1225 ~1230 ~1250
250	6x4	200	295 / 80 315 / 70 315 / 80 13 R 22.5	150	~1240 ~1220 ~1250 ~1275
285	6x4	200	295 / 80 315 / 70 315 / 80 13 R 22.5	150	~1275 ~1255 ~1285 ~1310

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



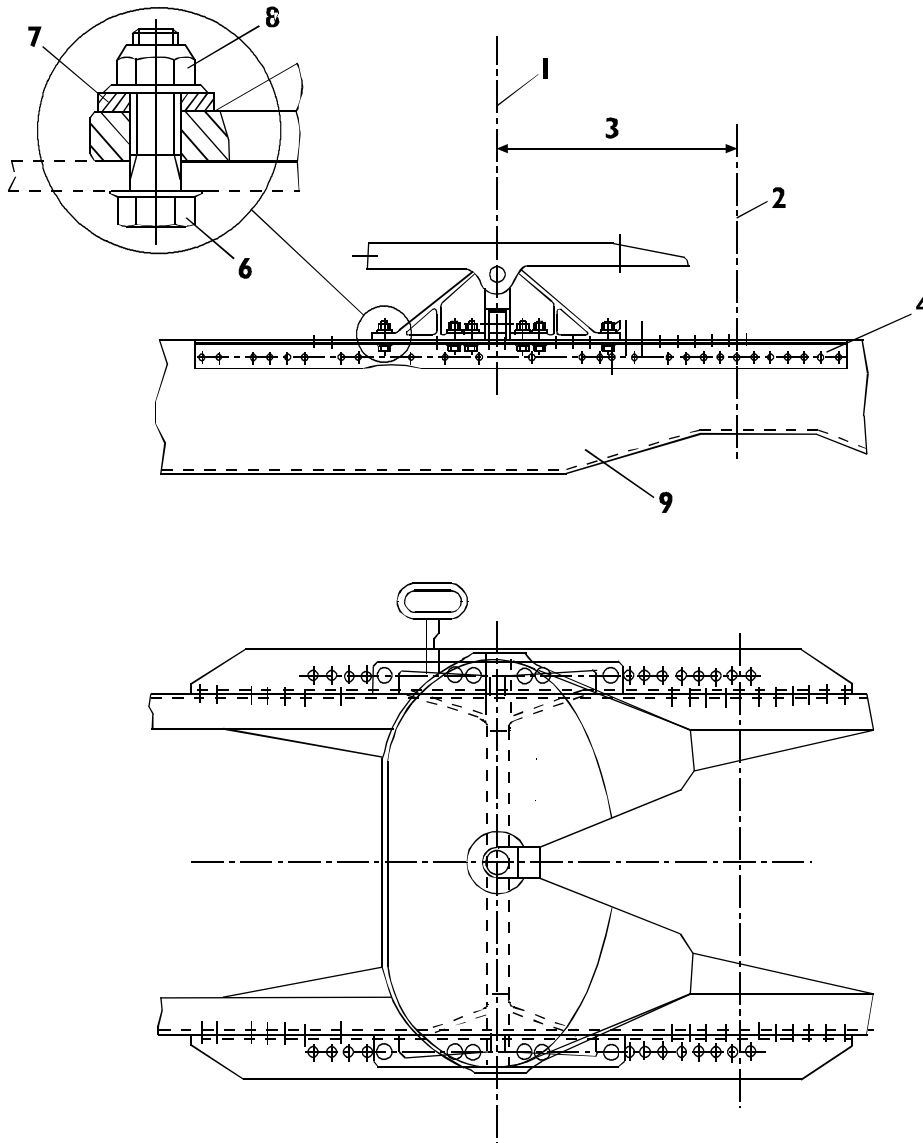
193890 **Figure 20**

- 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 mm)
- 8. Flanged head self-locking nuts
- 9. Chassis side members
- 10. Spring washer (16x34x4.4)
- 11. Fastening spacer (h = 15 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 and T/FP - With cross member (Opt. 7727 - 7728)



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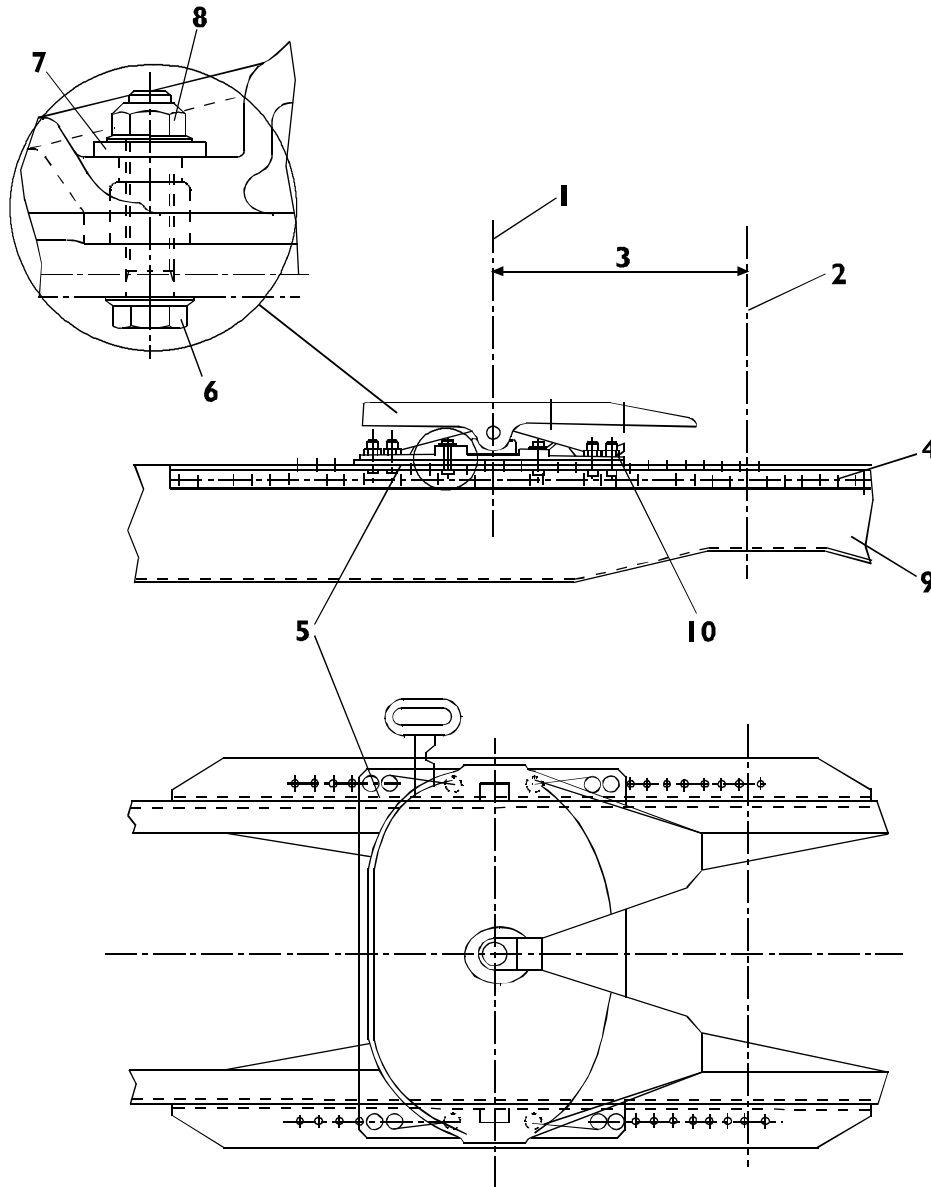
Figure 21

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 and T/FP - Without cross member (Opt. 703)



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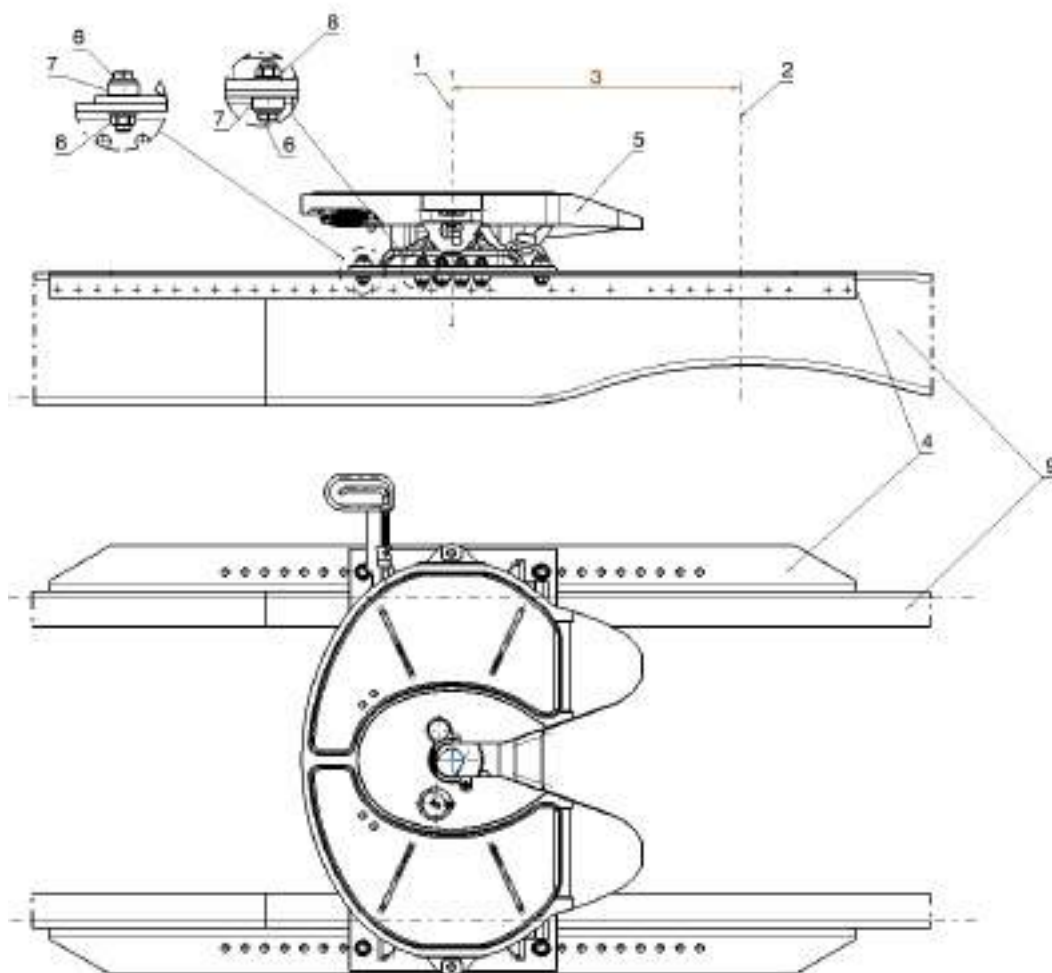
Figure 22

- 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 and T/FP - Without cross member (Opt. 5704 e 5705)



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Figure 23

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 secondary chassis structure (see Figure 3.24) in addition to distributing the load on the fifth wheel, provides a suitable torsional and bending contribution for the vehicle. 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.

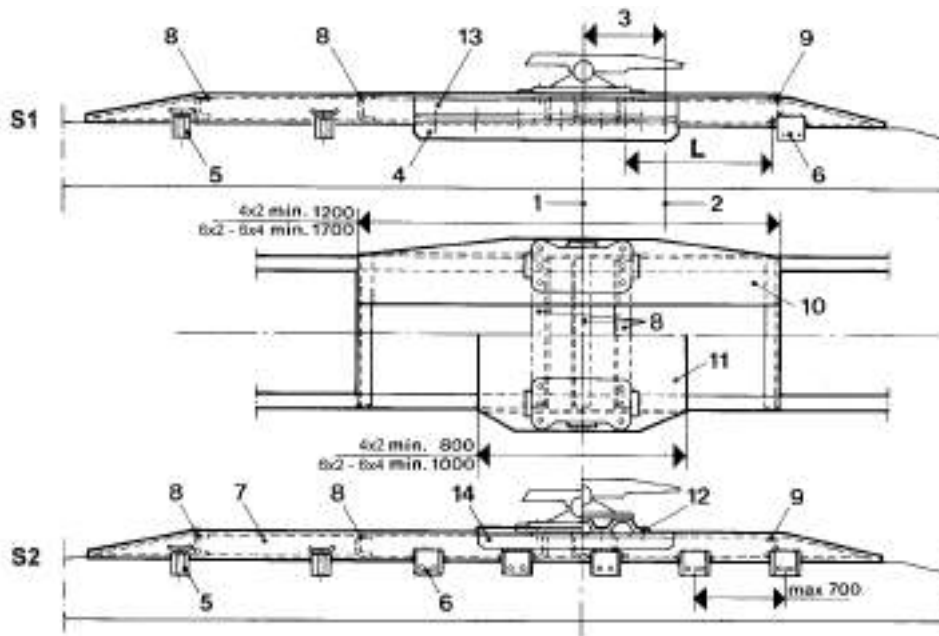
The typical application is that of Hi-Way 440TZ 6x4 vehicles with tandem axle.

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 shelves) for fastening the structure to the frame: good connections require the use of plates providing transversal and longitudinal resistance in the rear area and near the fifth wheel and shelves towards the front end (see Figure 3.24).



193894 **Figure 24**

- | | |
|---|---|
| <p>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</p> | <p>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</p> |
|---|---|

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 counter chassis

The installation of a counter chassis is usually used for installing tanks and containers on vehicle chassis.

The dimensions of the section to be used for the counter chassis are shown in Table 3.9.

Table 3.9 - Installation of tanks

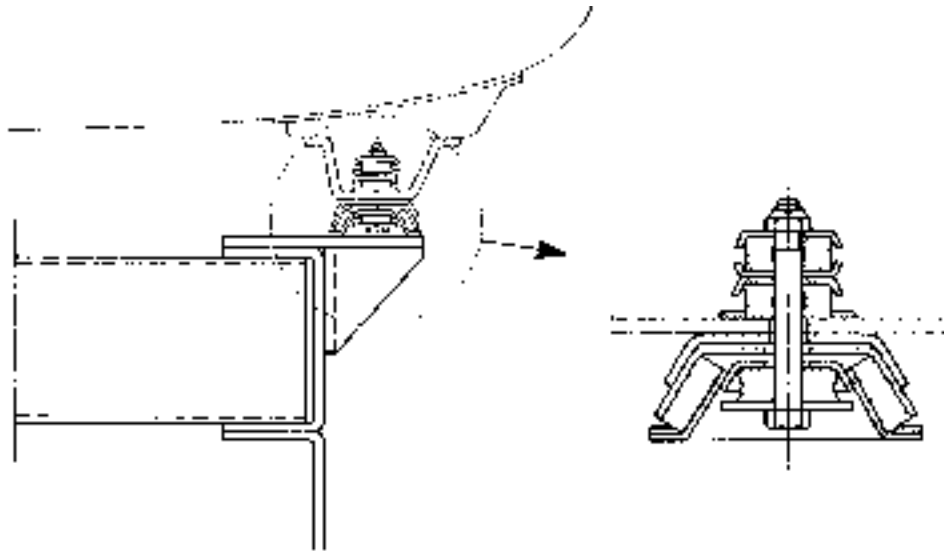
Model	Modulus of resistance W_x [cm ³] (Ultimate tensile strength of the material equal to 360 N/mm ²)
STRALIS 190	46 ⁽¹⁾ 89 ⁽²⁾
STRALIS 260	59 ⁽¹⁾ 89 ⁽²⁾

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

⁽²⁾ 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.

The assembly of tanks, or stiff torsional structures, must ensure sufficient and gradual flexibility of the chassis, avoiding high stress areas.

The use of flexible elements (see Figure 3.25) on the front end and stiff mounts resistant to longitudinal and transversal forces on the rear end are recommended for connecting the tank to the counter frame.



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Figure 25

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; flexible 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 3.9.

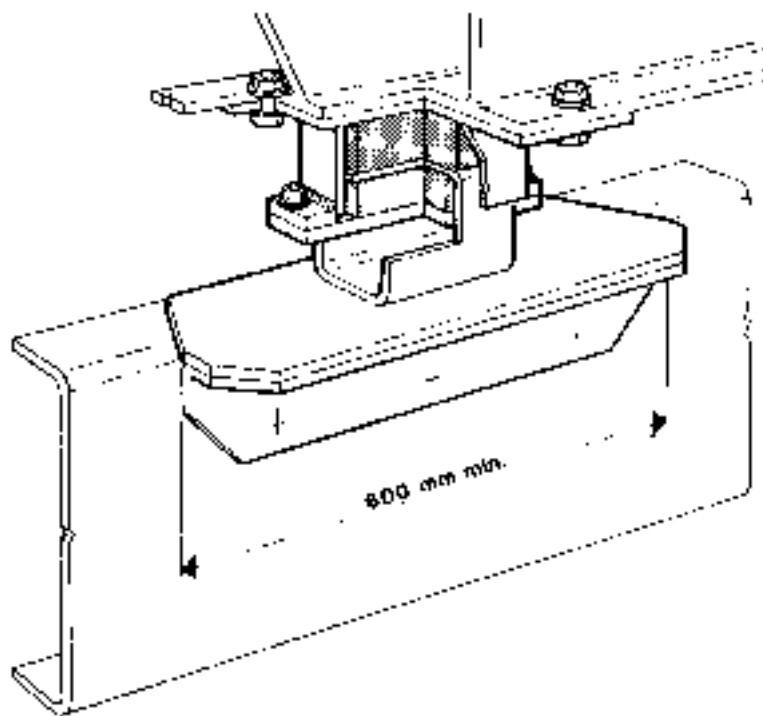
When defining flexible connections, consider the stiffness of the chassis in the area where the connections are applied and the type of functions for which it is intended.

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

b) Application without a counter chassis

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

- the distance between the various rests must be established according to the load to be transmitted (approximately no more than 1 m);
- the rests must be made to uniformly distribute the load on a suitably wide surface and with bracing to contain longitudinal and transversal forces.
- anchoring must be sufficiently extended in width (approximately 600 mm) and arranged near suspension mounts (maximum distance 400 mm).
Specifically, the front anchoring flexibility must be suited to contain the necessary torsional movements of the chassis;
- other anchoring solutions must be authorised by IVECO.



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Figure 26

A suitable counter chassis which ensures good distribution of load and suitable torsional stiffness for the frame-counter chassis 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 values, the degree of filling of the container and the volumetric mass of the carried goods must be defined to respect maximum weights on axles. In the case of tanks and single containers made with separate compartments, the minimum ratio between front axle weight and total fully loaded weight (see Chapter 1.15 (► Page 11)) as well as the maximum loads on axles must be respected in all conditions of load.

Considering the type of outfit, particular care must be devoted to containing the height of the centre of gravity as much as possible to obtain good vehicle handling stability (see Chapter 1.15 (► Page 11)); use of a vehicle with stabiliser bars is recommended.

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

Follow the safety laws in force (see Chapter 2.18 (► Page 53)) for containers intended to carry flammable liquids.

3.8 INSTALLING A CRANE

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

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

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

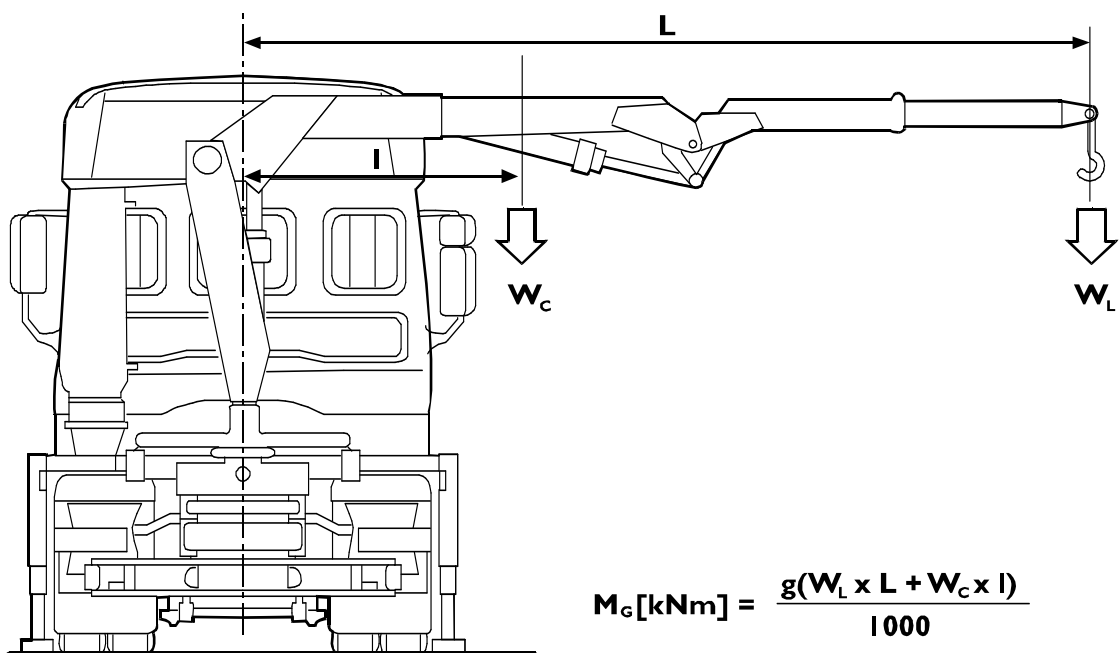
Note To ensure stability on vehicles with air suspension it is required to deflate the air bellows completely. See also Specification 01 in Chapter 5.2 (► Page 9).

As a general rule, the installation of a crane requires the use of a suitable counter chassis, the construction of which must take into account all general specifications (see Chapter 3.1 (► Page 5)), and the dimensions of the sections given in Tables 3.10, 3.11 and 3.12.

In those cases where no specific counter chassis is called for (areas indicated with the letter A) 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 modulus resistance greater than that required for the crane (eg 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 Table 3.10 (or for higher values) must be checked individually each time and must receive specific authorisation from IVECO.



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Figure 27

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

W_L = mass applied to crane extremity [kg]

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

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

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



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

Crane behind cab

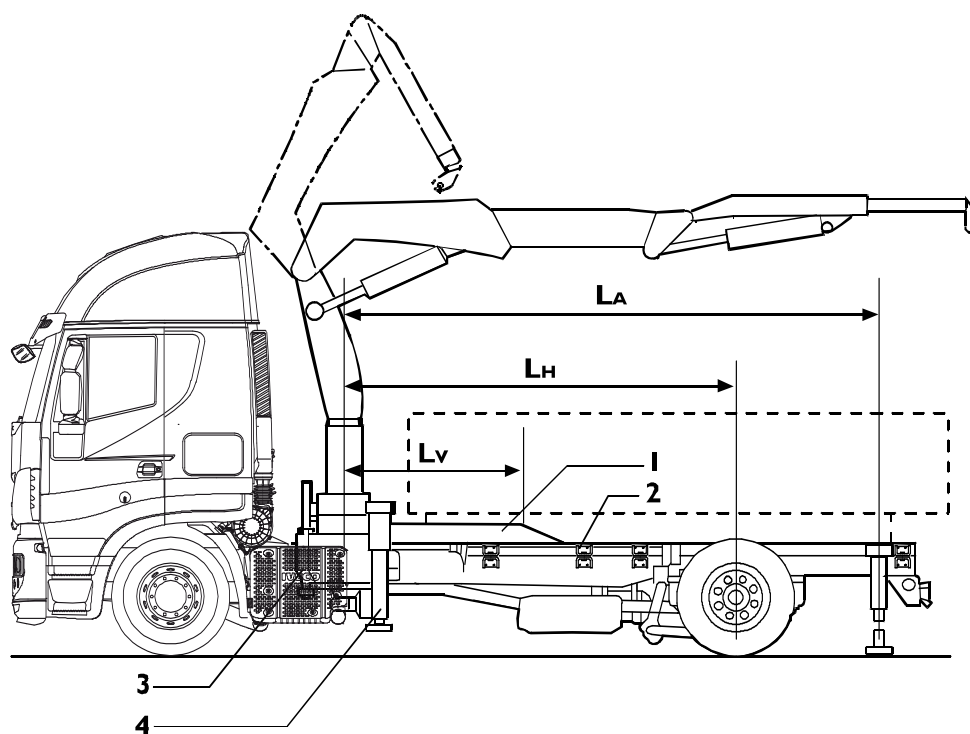
The standard shelves should be used for fastening the reinforcement sections to the chassis (see Figure 3.28) integrating, where necessary, other flexible fasteners (shelves or flanges) to maintain the bending and torsional characteristics of the chassis as much as possible.

The dimensions of the reinforcement sections to be used for this type of connection are shown in Table 3.10

On vehicles for road use only, shearing resistant connections (see Figure 3.29) may be used for fastening the counter chassis to reduce the counter chassis section height. The minimum reinforcement section dimensions for all these applications are given in Table 3.11.

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 3.10 and 3.11 as possible.

The crane counter chassis (Figure 3.28) can be integrated towards the rear end with that of the superstructure; the length "L_v" must in no case be less than 35% of the wheelbase if the superstructure section diameter is smaller.



193898 **Figure 28**

- 1. Counter chassis
- 2. Connections
- 3. Crane connections
- 4. Stabilisers

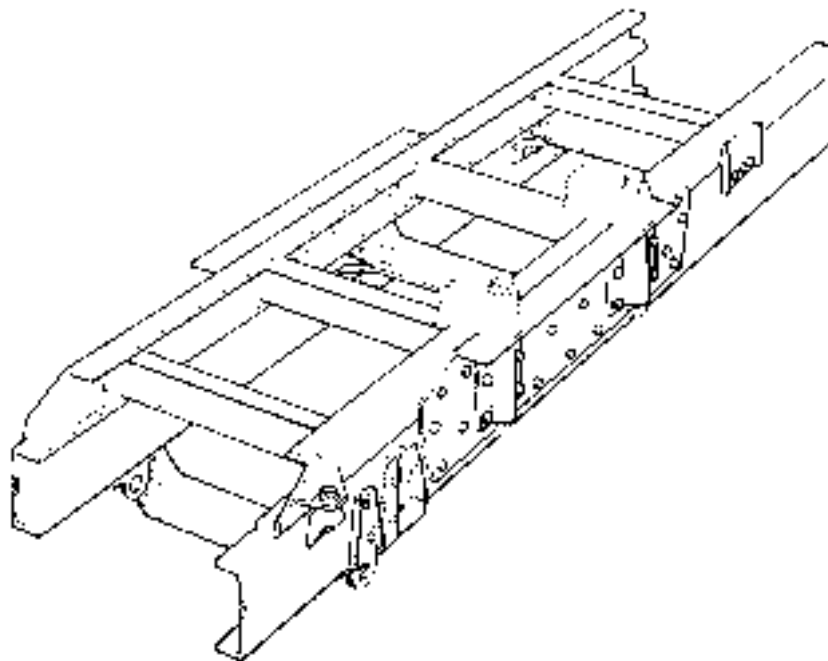
Table 3.10 - Crane behind cab (counter chassis secured with shelves or flanges)

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⁾																					
STR 190 STR 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	A A	21 ⁽¹⁾ 21 ⁽¹⁾	89 89	119 119	150 150	245 185	374 208	439 245	E 343	E 406
STR 260Y/P STR 260Z/P 289x80x7.7	5700/1395 6050/1395	360 420	A A	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 specified for the relevant superstructure is sufficient (eg. Table 3.4 for normal containers). 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 modulus of resistance is required for the superstructure (eg. container application) also use the latter for the crane.



193899 **Figure 29**

Flexible connections between chassis and counter chassis (see Figure 3.10) may be needed to avoid excessive constraint on the chassis torsional movement for application of crane on off-road vehicles on the front and middle parts. In these cases, the crane is practically connected to the counter chassis only, the dimensions of the longitudinal sections must therefore be suited to withstand the moment induced 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 mounts of the lifting device and the tipper rear hinges which must be as retracted as possible.

Table 3.11 - Crane behind cab (counter chassis secured with shearing resistant plates)

Models	Wheel-base [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	
Frame section [mm]			Minimum value of the modulus of resistance of the counter chassis section W _x [cm ³] ⁽¹⁾																			
STR 190	<6300	360	A	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	46	89	89	135	150	173	208	245
STR 260	<5100/1395		A	A	A	A	A	A	A	A	A	A	A	A	31	36 ⁽¹⁾	89	89	105	135	150	173
289x80x6.7			420	A	A	A	A	A	A	A	A	A	A	A	A	31	36 ⁽¹⁾	89	89	105	135	150
STR 260Y/P	5700/1395	360	A	A	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	36 ⁽¹⁾	89	89	105	135	150	173
STR 260Z/P	6050/1395		A	A	A	A	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	46	89	89	105	135
289x80x7.7			420	A	A	A	A	A	A	A	A	A	A	A	A	A	A	31 ⁽¹⁾	46	89	89	105
Modulus of resistance W _x [cm ³] 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 specified for the relevant superstructure is sufficient (eg. Table 3.4 for normal containers). 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 modulus of resistance is required for the superstructure (eg. container application) also use the latter for the crane.

⁽²⁾ The use of these crane capacities requires a careful verification on the stability of the vehicle (possible use of stabilisers covering a greater area or an adequate counter-weight).

⁽³⁾ Given that a reduction in the height of the counter chassis section corresponds to a reduction in the torsional resistance, in the case of cranes with four stabilisers, the Bodybuilder must make certain adjustments to provide sufficient stiffness to the counter chassis in the crane rest. For this reason it is recommended that sections with a minimum height of 120 mm are used. Since the construction of these solutions limits the torsional capacity of the chassis when running, they can only be used on vehicles which are exclusively for road use.

Crane at rear overhang

The counter chassis should extend for the entire length of the vehicle to the rear part of the cab; The dimensions of the longitudinal sections are shown in Table 3.12.

Considering the particular distribution of weights on the vehicle (load concentrated on overhang) and to ensure the necessary torsional stiffness for good performance on the road and during the working phase of the crane, the counter chassis must be suitably stiffened in relation to the crane capacity. Boxed sections and brace will be used (see Chapter 3.2 (► Page 7)) in correspondence with the rear suspension and for the entire rear overhang (distance L_v) - see Figure 3.30.

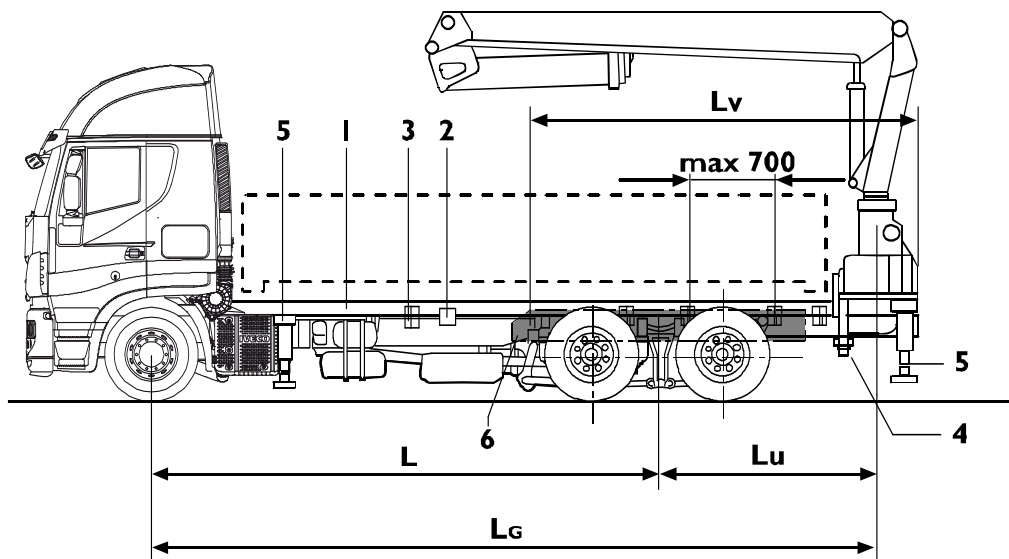
The passage between boxed sections and open sections must be well fitted as shown in Figure 3.4.

Shearing resistant connections (sufficient number of plates spaced at a maximum distance of 700 mm) must be used in the boxed section for fastening to the chassis. Flexible fastenings must be 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 counter chassis stiffness depends on various factors (e.g. crane capacity, resting surface dimensioning, vehicle kerb weight, chassis overhang), instructions valid for all situations cannot be given. For this reason Bodybuilders will, if necessary, proceed also by testing the vehicle's stability. If the test results show that stiffness is insufficient, the Bodybuilder will adopt suitable precautions so as to obtain correct realisation.

The rear crane overhang (distance L_u see Figure 3.30) must be as limited as possible (not exceeding 50% of the wheelbase) to maintain good characteristics in terms of vehicle handling and acceptable stress on the frame.

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.



194752 **Figure 30**

- 1. Counter chassis
- 2. Plates
- 3. Brackets

- 4. Crane connections
- 5. Stabilisers
- 6. Connecting corner

Table 3.12 - Crane on rear overhang (counter chassis secured with shearing resistant plates)

Models	Wheel-base [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	
Frame section [mm]			Minimum value of the modulus of resistance of the counter chassis section W _x [cm ³] ⁽¹⁾																			
STR 190/P	<6300																					
STR 260/P, /PS, /FP, /FS	<5100/1395	360	A	A	A	A	A	A	A	23 ⁽¹⁾	32 ⁽¹⁾	42 ⁽¹⁾	71	110	135	173	222	222	246	E	E	
STR 260/PT	<5100/1395	420	A	A	A	A	A	A	A	23 ⁽¹⁾	23 ⁽¹⁾	32 ⁽¹⁾	42 ⁽¹⁾	71	110	135	173	173	222	246	E	
289x80x6.7																						
STR 260Y/P	5700/1395																					
STR 260Z/P	<5700/1380	360	A	A	A	A	A	A	A	A	A	A	23	32	42	57	110	110	135	135	173	
	<6050/1395	420	A	A	A	A	A	A	A	A	A	A	23	23	23	42	57	71	110	135	173	
	<6050/1380																					
289x80x7.7																						
Modulus of resistance W _x [cm ³] 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 specified for the relevant superstructure is sufficient (eg. Table 3.4 for normal containers). 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 modulus of resistance is required for the superstructure (eg. container application) also use the latter for the crane.

(2) Given that a reduction in the height of the counter chassis section corresponds to a reduction in the torsional resistance, in the case of cranes with four stabilisers, the Bodybuilder must make certain adjustments to provide sufficient stiffness to the counter chassis in the crane rest. For this reason it is recommended that sections with a minimum height of 120 mm are used. Since the construction of these solutions limits the torsional capacity of the chassis when running, they can only be used on vehicles which are exclusively for road use.

Removable cranes

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

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

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

3.9 INSTALLATION OF TAIL LIFTS

Note The installation of tail lifts must be carried out with due regard for the maximum permissible weights on the rear axles of the vehicle and of the minimum load established for the front axle (see Chapter 1.15 (► Page 11)). If this is not possible, the rear overhang will have to be reduced.

The dimensions of the reinforcement structures to be used for installation of tail lifts are defined as follows:

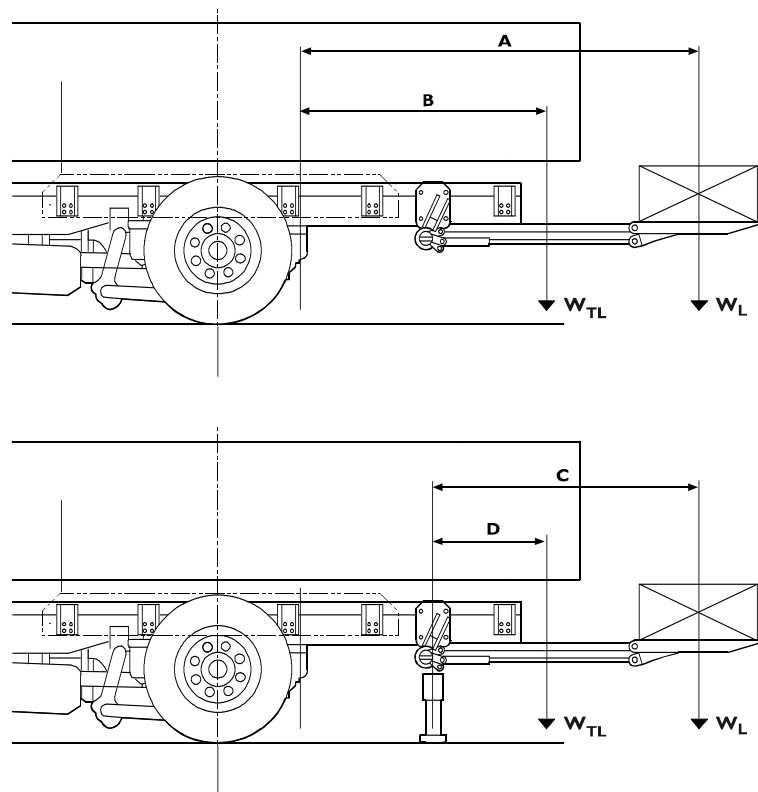
- using Table 3.13, in the case of standard rear overhangs and with mean bending moments induced by tail lifts, as a function of their capacity. The table also indicates the capacity values above which suitable stabilisers are to be used;
- for lengths which are different from the rear overhang or with specific tail lifts (e.g. aluminium), the flexible moments induced on the chassis can be determined using the indications provided in Figure 3.31, and the characteristics of the reinforcement sections can be defined using the relevant figure.

The Bodybuilder or the Manufacturer of the tail lift must take care to ascertain safety and operational stability, in particular when applying Table 3.14.

In any event, particularly in those specific uses where there is not a suitable counter chassis, the fixing for the tail lift must be provided by a structure which enables the distribution of the stress on the chassis.

Furthermore, to provide the necessary strength and rigidity, the connection between the chassis and the counter chassis must, especially in overhangs of over 1500 mm, be made using shear resistant plates (spaced no further than 700 mm from one another) in the area of the overhang, and up to the front support of the rear suspension (see Figure 3.31).

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



194753 **Figure 31**

W_{TL} = Weight of tail lift

W_L = Tail lift capacity

The bending moment on the chassis may be obtained using the following ratio:

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

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

The Bodybuilder must consider the need to use stabiliser even in those cases where merely in terms of stress on the chassis their use may not appear to be necessary; when evaluating the need for stabilisers in relation to the capacity of the tail lift, the stability and alignment of the vehicle resulting from the sag of the suspensions and chassis during loading operations must also be considered.

The stabilisers, preferably hydraulically operated, are to be attached to the platform's supporting structures and must be used during all loading procedures with the tail lift.

The stability of the vehicle in all operating phases of the tail lift must be verified in observance of legal regulations.

To compensate for the sag in the frame, which is inevitable when the tail lift is in operation, the Bodybuilder may make use of reinforcement structures of a larger size than those dimensions indicated in Tables 3.13 and 3.14

The dimensions of the reinforcement structures indicated in Table 3.13, apply to the rear overhangs shown. For greater overhangs, it may be necessary to consider the possibility of installing stabilisers or larger reinforcement structures (see Table 3.14).

The installation of tail lifts must be carried out with due regard for the maximum permissible weights on the 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.

When installing an electro-hydraulic tail lift, it is necessary to check that the capacity of the batteries and the power of the alternator is adequate (see Chapter 5.5 (► Page 30)).

Vehicles with liftable third axle, the use of a tail lift when the third axle is lifted is only allowed using stabilisers.

The Bodybuilder will be responsible for any modification to the under-run protection cross member, or for installing a different type (see Chapter 2.20 (► Page 54)), for preserving visibility of the rear lights, for the overhang angles, and for the positioning of the tow hook as provided by the respective national requirements.

Table 3.13 - Installation of tail lifts

Models Frame section [mm]	Wheel- base [mm]	Frame overhang [mm]	Max. super- structure overhang [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 counter chassis section modulus of resistance W_x [cm ³] with ultimate tensile strength of the material equal to 360 N/mm ²							
STR 190/P, /FP 289/199x80x6.7	3800	1847	2275	A	A	A	A	A	46	46	89
	4200	2072	2500	A	A	A	A	46	57	89	89
	4500	–	2230	A	A	A	A	A	46	46	89
	4800	–	2905	A	A	57	57	89	89	105	119
	5100	–	2815	A	A	46	46	57	89	89	105
	5700	–	2365	A	A	A	46	46	57	89	89
	6300	–	–	–	–	–	–	–	–	–	–
STR 260/P, /PS, /PT 289/199x80x6.7	3800	–	2207	46	46	46	89	89	89	119	135
	4200	–	2567	46	57	89	89	89	105	135	150
	4500	–	2522	46	57	89	89	89	105	135	150
	4800	–	2522	46	57	89	89	89	105	135	150
	5100	–	2252	46	46	46	89	89	89	119	135
STR 260/TN STR 260/PT (P. 5700/1380) 289x80x6.7	<5700 <5100	–	3475	A	A	A	A	A	A	A	A

Models Frame section [mm]	Wheel- base [mm]	Frame overhang [mm]	Max. super- structure overhang [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 counter chassis section modulus of resistance W_x [cm ³] with ultimate tensile strength of the material equal to 360 N/mm ²							
STR 260/P, /FP 289/199x80x6.7	4500	1307	1760	A	A	A	A	A	A	A	46
	4500	1802	2250	A	A	A	A	A	46	46	89
	5100	1577	2030	A	A	A	A	A	A	46	46
	5100	1982	2430	A	A	A	A	46	46	57	89
	5100	2207	2660	A	A	A	46	46	46	89	89
	5100	2387	2840	A	A	46	46	57	89	89	105
STR 260/P, /FP STR 260/FS, /PS 289/199x80x6.7	4200	1127	1580	A	A	A	A	46	46	57	89
	4200	1622	2070	A	46	46	46	89	89	89	135
	4500	1217	1670	A	A	A	A	46	46	57	89
	4500	1622	2070	A	46	46	46	89	89	89	135
	4800	1487	1940	A	A	46	46	46	89	89	105
	4800	1712	2160	46	46	46	57	89	89	105	135
	4800	2072	2520	46	57	89	89	89	105	135	150
	5100	1802	2250	46	46	57	89	89	89	105	135
STR 260/P, /FP 289x80x7.7	5700	–	2432	A	A	A	A	A	A	46	46
	5700	1982	2430	A	A	A	A	46	46	57	89
	5700	2207	2660	A	A	A	46	46	57	89	89
	6050	–	2660	A	A	A	A	A	A	46	46
	6300	2027	2480	A	A	A	A	46	46	89	89
	6300	2387	2840	A	A	46	46	57	89	89	105
	6300	2792	3240	46	46	57	89	89	89	135	150
STR 260 Z/P-HM 289x80x7.7	3800	1127	1580	A	A	A	A	A	A	A	A
	3800	1487	1940	A	A	A	A	A	A	A	A
	4200	1127	1580	A	A	A	A	A	A	A	A
	4200	1487	1940	A	A	A	A	A	A	A	A
	4200	1622	2070	A	A	A	A	A	A	A	A
	4200	1847	2300	A	A	A	A	A	A	A	A
STR 260 Y/FP, /FS, -GV 299/199x80x7.7	4500	1982	2430	A	A	A	A	A	A	A	46
	4200	2117	–	A	A	46	46	46	46	46	74
	4500	2072	–	A	46	46	46	46	46	57	74
	4800	2072	–	A	46	46	46	46	46	57	74
	5100	1802	–	A	A	A	46	46	46	46	57

For tail lifts with a capacity of up to 5 kN (500 kg), the reinforcement section specified for the relevant superstructure is sufficient (e.g. Table 3.4 for normal containers).

A = The reinforcement section specified for the relevant superstructure is sufficient (eg. Table.3.4 for normal containers).

⁽¹⁾Use sections of a greater dimensions if required by the superstructure (e.g. Table 3.4).

Table 3.14 - Installation of tail lift - Permitted bending moment for frame/counter chassis section

Models	Wheel-base [mm]	Ultimate tensile strength of counter chassis material [N/mm ²]	Modulus of resistance W_x [cm ³] of counter chassis section ⁽²⁾																
			46	57	89	105	119	135	150	173	208	245	286	317	343	374	406	439	474
			Permitted static bending moment for frame-counter chassis [kNm] (shear resistant connections)																
STR 190	<6300 <5100 /1395	360	102.8	108.6	134.7	143.4	145.2	161.2	176.0	187.7	207.0	227.1	249.0	264.6	280.0	297.7	315.2	333.2	351.9
STR 260			122.4	129.2	160.3	170.7	172.9	191.9	209.6	223.6	246.4	270.3	296.5	315.0	334.3	354.4	375.2	396.7	418.9
289/ 199x80x6.7		420																	
STR 260	> 5700 /1395	360	159.4	163.3	199.1	208.2	207.1	228.8	249.2	261.6	281.6	306.2	328.9	345.0	361.8	379.3	397.5	416.4	435.9
289x80x6.7			189.8	196.8	237.0	247.8	246.5	272.4	296.7	311.4	335.2	364.5	391.5	410.7	430.8	451.6	473.3	495.7	518.9
STR 260 (6x4)	all	360	159.4	163.3	199.1	208.2	207.1	228.8	249.2	261.6	281.6	306.2	328.9	345.0	361.8	379.3	397.5	416.4	435.9
289x80x7.7			189.8	196.8	237.0	247.8	246.5	272.4	296.7	311.4	335.2	364.5	391.5	410.7	430.8	451.6	473.3	495.7	518.9

Consider the need to use suitable stabilisers, verifying stability during the operating phase

⁽²⁾The possibility of using materials with superior mechanical characteristics requires verifying the total moment of resistance of the chassis plus counter chassis. However, where the section of the counter chassis is not reinforced, (C shaped section), a section with a modulus of resistance less than that specified for the superstructure is not to be used (e.g. Table 3.4 for fixed bodies).

3.10 INTERCHANGEABLE OUTFITS

Interchangeable outfits that are lifted for the operation of replacement (e.g. with lifting device or with the vehicle's air suspension) and are later positioned on four supports are, as a rule, made when using a counter chassis with longitudinal sections of the size indicated in Table 3.4, or with suitable structures including the lifting and connecting devices.

If the concentrated loads transmitted by the lifting systems produce great strains on the vehicle's frame, provision must be made for suitable reinforcement.

To assure proper functionality, the various conditions of the vehicle alignment must be carefully checked according to the characteristics of the suspension. Models equipped with pneumatic suspension on rear or full Pneumatic, can be particularly suited for these applications.

The lifting device acting in the vertical direction, as well as to the counter chassis, may, in particular cases be anchored to the connection plates between the chassis and the counter chassis provided they are of suitable dimensions.

For the body connections, especially when fast closing systems are used, verify that the longitudinal and transversal thrusts which occur under dynamic conditions are adequately withstood.

The possibility of doing without a counter chassis 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 PTO 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 speed (below 1000 rpm) must be avoided to prevent irregular running.

The available power can be calculated in relation to the PTO 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

Both occasional and continuous use may be considered.

For occasional use periods of under 30 minutes are considered.

The values for continuous use are those used for long periods. Whenever this is comparable to that of a stationary engine, the suitability of reducing the scheduled take-off values also on the basis of the conditions of use (engine cooling, gearbox etc.) should be evaluated.

The scheduled take-off values are also applicable for uses which do not involve large variations of torque either in frequency or magnitude.

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.

PTO transmission

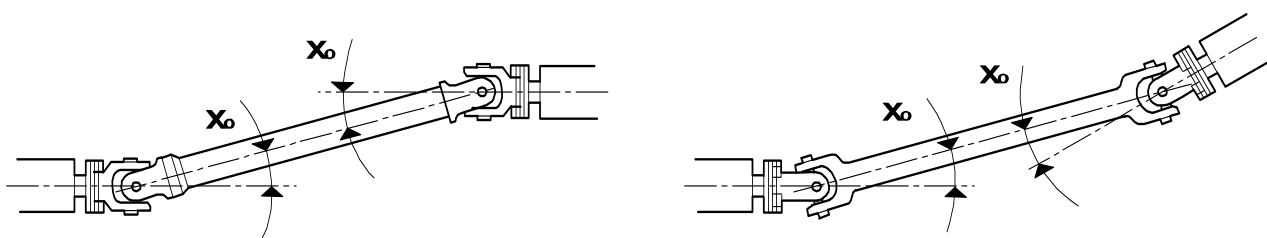
In full compliance of the Manufacturer's transmission specifications, the kinematic forces from the power take-off to the relevant apparatus should be carefully considered (angles, rpm, moment) during the design phase as well as the dynamic behaviour in the installation phase.

This means that:

- the dimensions should take into consideration the forces which might occur under maximum power and torque conditions;
- to obtain a uniformity of kinetic forces angles of equal value, maximum of 7°, should be obtained at the extremities (Figure 4.1);
- solution Z is preferred to solution W due to the lower loads on the bearings of the power take-off and the equipment being driven. When it is necessary to obtain a different transmission line with spatial inclinations according to angle ϕ (as shown in

Figure 4.2), 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 37).

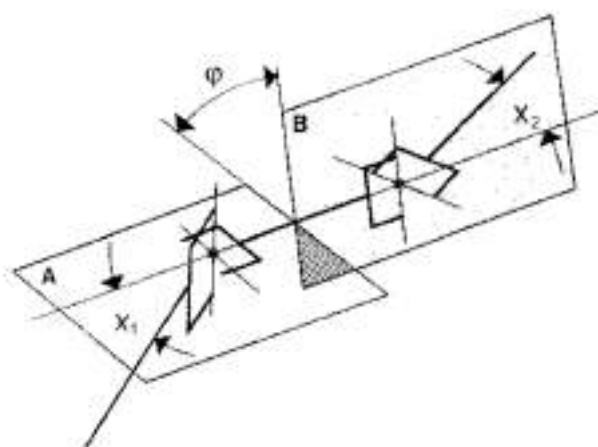


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Figure 1

Solution Z

Solution W



91523

Figure 2

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 47).

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 types of PTO provided by ZF and Hydrocar.

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 14).

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 P.T.O. requirements.

Table 4.1 - PTO on gearbox tested by IVECO

Gearbox	Option no.	PTO type	Assembly side	Total PTO ratio	Available torque (*) [Nm]
9 S 1310 TO	5202	NH/1b	central	0.97	800
	5205	NH/1c	central	0.97	800
	5209	NH/4b	lower	1.24	430 (1)
	5210	NH/4c	lower	1.24	430 (1)
	5258	N109/10b	high	1.45	530
	5255	N109/10c	high	1.19	630
	5259	N109/10c	high	1.45	530
16 S 1620 TD 16 S 1920 TD 16 S 2220 TD 16 S 2320 TD	5202	NH/1b	central	0.91 / 0.77	1000
	5205	NH/1c	central	0.91 / 0.77	1000
	5209	NH/4b	right	1.17 / 0.98	430 (1)
	5210	NH/4c	right	1.17 / 0.98	430 (1)
	5258	N221/10b	above	1.35 / 1.14	730
	5260	N221/10b	above	1.75 / 1.47	560
	5264	N221/10b	above	2.00 / 1.68	470
	5255	N221/10c	above	1.13 / 0.95	870
	5259	N221/10c	above	1.35 / 1.14	730
16 S 1820 TO 16 S 2220 TO 16 S 2520 TO	5202	NH/1b	central	1.09 / 0.91	1000
	5205	NH/1c	central	1.09 / 0.91	1000
	5209	NH/4b	right	1.40 / 1.17	430 (1)
	5210	NH/4c	right	1.40 / 1.17	430 (1)
	5258	N221/10b	above	1.62 / 1.35	730

Gearbox	Option no.	PTO type	Assembly side	Total PTO ratio	Available torque (*) [Nm]
16 S 1820 TO 16 S 2220 TO 16 S 2520 TO	5260	N221/10b	above	2.09 / 1.75	560
	5264	N221/10b	above	2.40 / 2.00	470
	5255	N221/10c	above	1.35 / 1.13	870
	5259	N221/10c	above	1.62 / 1.35	730
12 AS 1420 TD	5202	NH/1b	central	0.81 / 0.99	800
	5205	NH/1c	central	0.81 / 0.99	800
	5209	NH/4b	lower	1.02 / 1.27	430 (†)
	5210	NH/4c	lower	1.02 / 1.27	430 (†)
	5260	Nm AS/10b	above	1.53 / 1.89	420 (†)
12 AS 1930 TD 12 AS 2330 TD	5202	NH/1b	central	0.82	1000
	5209	NH/4b	right	1.05	430 (†)
	5210	NH/4c	right	1.05	430 (†)
	5260	N AS/10b flanges	above /H	1.92	400
	6420	N AS/10c+b double output	above/L/pump lower/H/flange	1.21 1.92	670 400
12 AS 2330 TO 12 AS 2530 TO	5202	NH/1b	central	1.35	1000
	5209	NH/4b	right	1.22	430 (†)
	5210	NH/4c	right	1.22	430 (†)
	5260	N AS/10b flanges	above /H	2.15	490
	6420	N AS/10c+b double output	above/L/pump lower/H/flange	1.23 1.73	720 580
Allison 3200	00032	17A1	right	0.93	600

(*) Available torque with PTO at 1500 rpm

(†) 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.

Furthermore, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine.



► **Observe values in Table 4.1 for torque take-offs**



► **During prolonged use, the gearbox oil temperature must not exceed 110 °C and the water temperature must not exceed 100 °C.**



► **Not all types of power take-offs available on the market are suitable for continuous use; the specific instructions for the power take-off must be followed during use (working period, breaks etc).**

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 drive take-off may be operated only when the vehicle is stationary. The PTO engagement /disengagement shall be performed in gearbox Neutral. During engagement and disengagement power absorption from BodyBuilder must be reduced to 0 Nm;
- the power take-off rpm is dependent on the gear selected;
- the power take-off must be located immediately downstream of the gearbox; for vehicles with the drive line in two or more sections, the power take-off may also be fitted at the flexible support between the first and second sections (respect the indications given in Chapter 2.8 (► Page 37));
- 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 must only be carried out by specialist companies approved by the supplier of the transmission.**



- ▶ **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 PTO from the front of the engine

The drive take-off from the front of the crankshaft occurs, for limited power values to be drawn off (eg.: air conditioning units), by drive belt transmission; the use of coupling shafts is normally reserved for take-offs of a greater magnitude (e.g: municipal use).

These uses, when not specifically planned, require precise modifications to the front part of the vehicle, e.g. modifications to the radiator, cab, bumpers etc. Particular attention must therefore be paid:

- to the system comprising additional masses and relative rigidity which must be flexibly disengaged from the crankshaft with regard to the torsional and flexional effects;
- to the additional mass values and relative moments of inertia and to the distance from the centre of gravity of the masses from the centre line of the first main bearing 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).

Torque PTO from the rear of the engine

Multipower PTO on engine fly-wheel

On some models it is possible to install an optional IVECO Multipower power take-off, designed to take off higher torques than those of other PTOs. This unit is fitted on the rear part of the engine and takes drive from the flywheel and is independent of the vehicle clutch drive; it is suitable for use with the vehicle running and/or at a standstill (e.g. municipal applications, concrete mixers etc.).

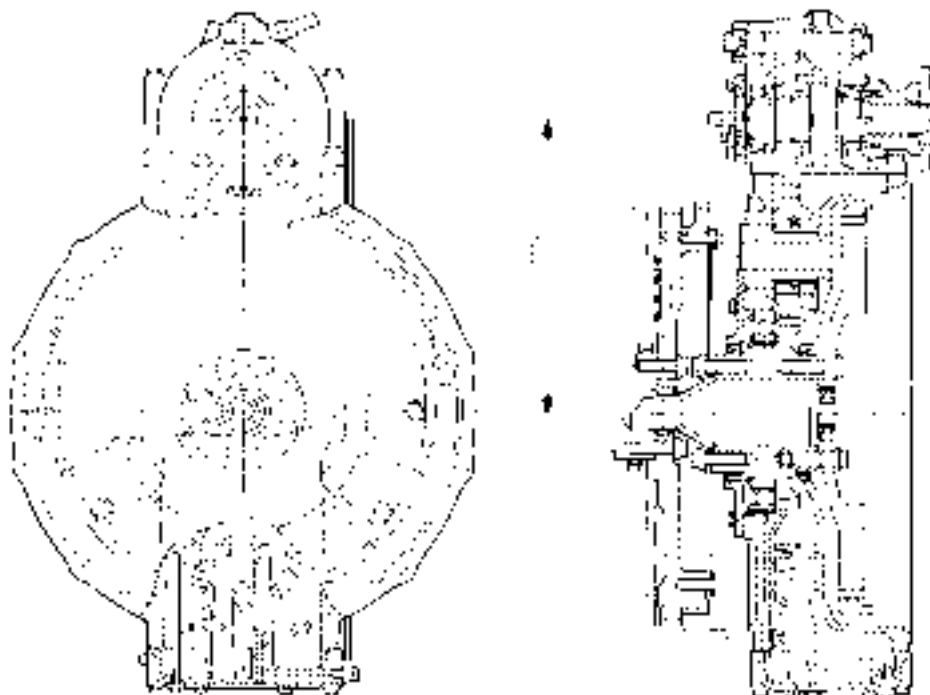
Some precautions:

- the PTO must be engaged only with the engine at a standstill (The Expansion Module offers a configuration that a safety device prevents engagement with the engine running in any case);
- the unit may be disengaged with the engine running but only if not any power is absorbed by BB. The torque shall be 0Nm.
- the during engine must be started when no torque is being taken from shall be absorbed/consumed by the PTO.



- **To guarantee correct engagement, the static moment of connected units must not exceed 35 Nm. According to the version of the connected units, it may be necessary to consider a clutch engageable by load (weight) in the transmission.**

The main dimensional specifications are given in Figure 4.3 and in Table 4.3, while the technical specifications are given in Table 4.2.



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Figure 3

Table 4.2 - Technical specifications

Ratio revolutions - rpm	1.29
-------------------------	------

Max. torque available	900 Nm
Output flange	ISO 7646-120 × 8 × 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 during 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 (e.g.: an engine speed of 1800 rpm corresponds to a pump speed of 2400 rpm).

Power take-off from the camshaft gearing

Models equipped with Cursor 9 and Cursor 13 series engines can be supplied with friction clutch power takeoff. They are driven from the camshaft gearings, independently from the vehicle's clutch.

The PTO is available in direct pump mounting or with flange for connecting to propeller shaft.

Note *The installation of this power take-off must be requested when ordering the vehicle; retrofitting in AfterSales would require the replacement of the whole engine.*

When torque take-off of 600 Nm (CURSOR 9) and 800 Nm (CURSOR 11/13) by Bodybuilder application is needed, then the moment of inertia of the connected (including the coupling shaft) rotating masses, must be no greater than 0.03 kgm².

The max. available torque of 600 Nm (CURSOR 9) and 800 Nm (CURSOR 11/13) must never be exceeded.

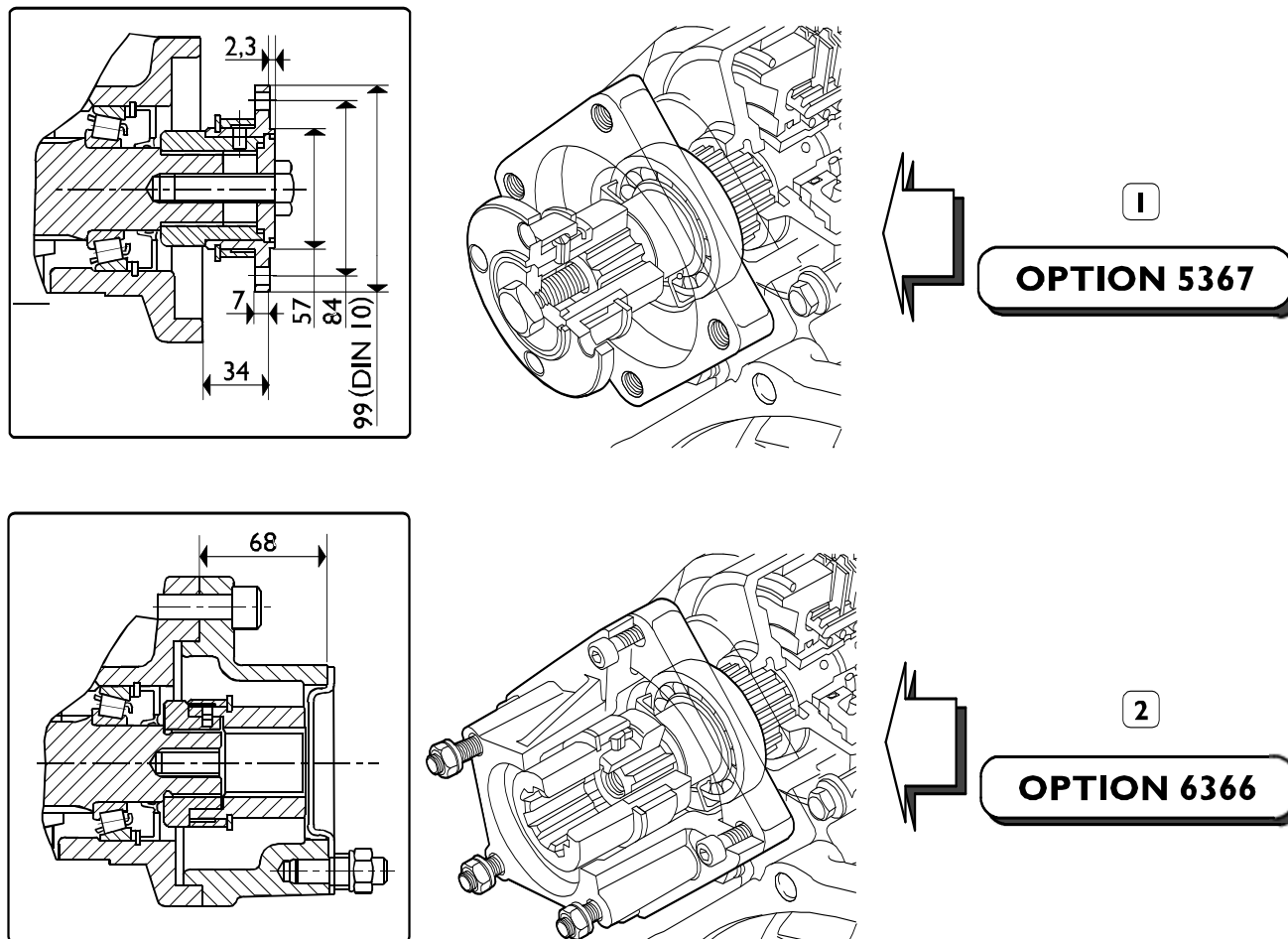
Direct pump application

The static moment due to the added masses must not exceed 90Nm, measured on the pump coupling surface.

Connection with coupling shaft.

On exceeding the maximum admissible value of the inertia, given above, it is necessary to apply a flexible coupling, specifications of which are to be requested directly from IVECO.

Power take-off from timing gears for Eurotronic 2 gearboxes



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Figure 4

1. Flange connection DIN 10

2. Pump connection ISO 4 holes - 7653

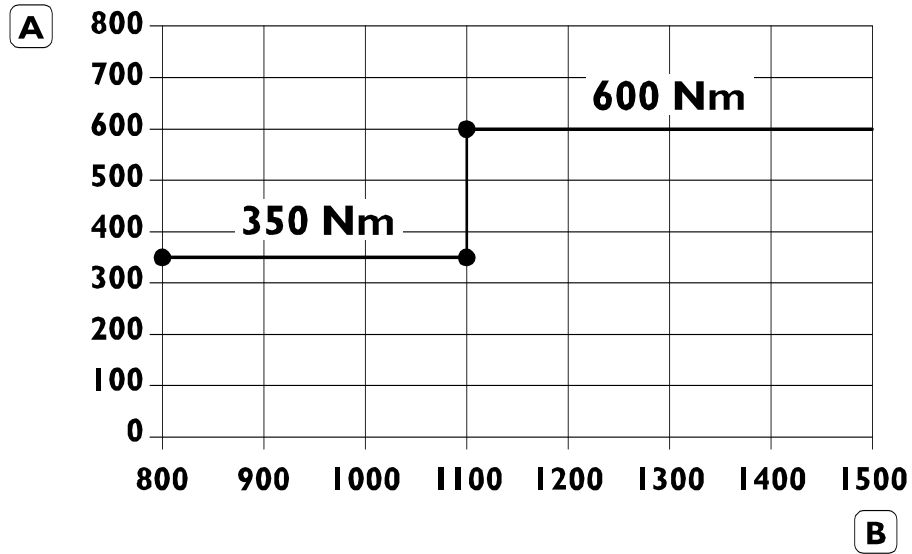
Note When using OPT 6366 it is necessary to check compatibility between the pump to be applied and the fitting case by case.

Table 4.3 - PTO specifications

Engine	Max. torque available [Nm]	Ratio revolutions - rpm	Power take-off		Direction of rotation
			Output type		
			Pump connection	Flange connection	
CURSOR 9	600	1,14	ISO 4 holes (7653)	DIN 10	Opposite to engine
CURSOR 11/13	800	1,12	ISO 4 holes (7653)	DIN 10	Opposite to engine

Note The PTO can be equipped with a pneumatic disc clutch in oil bath system.

Maximum allowed PTO Torque depending on engine speed



193877 **Figure 5**

CURSOR 9

A. Available torque [Nm]

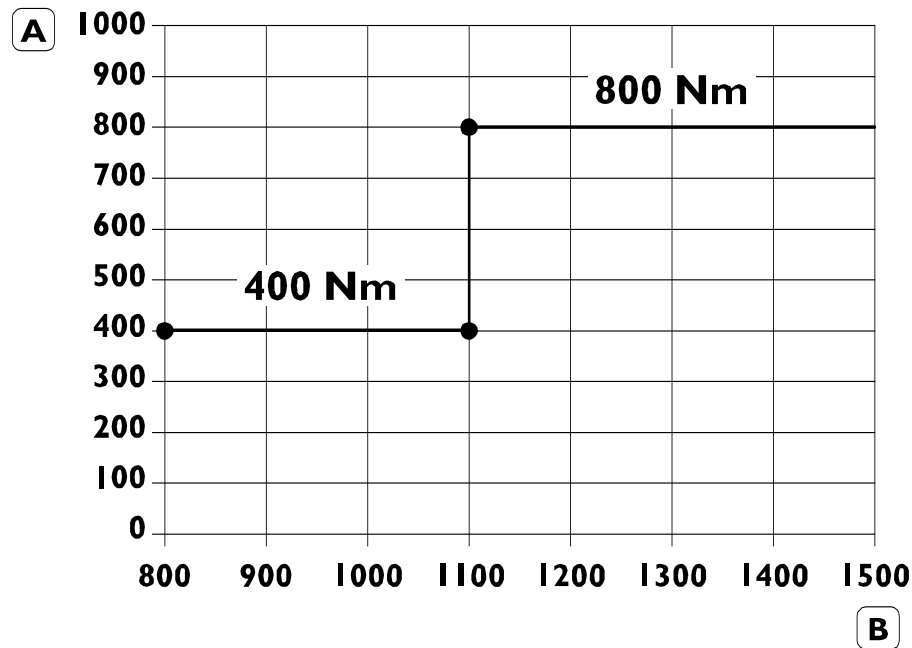
B. Engine speed [rpm]

Vehicle stationary - PTO mode ON

- Torque take-off of 600 Nm is permitted at engine speed over 1100 rpm.

Vehicle running - PTO mode ON

- No limit of the available torque which can be taken by PTO in relation to rpm
- engine idle running at 800 rpm.
- The air supply system pressure for PTO clutch engagement must exceed 8.5 bar.



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Figure 6

CURSOR 11/13

A. Available torque [Nm]

B. Engine speed [rpm]

Vehicle stationary - PTO mode ON

- Torque take-off of 800 Nm is permitted at engine speed over 1100 rpm.

Vehicle running - PTO mode ON

- No limit of the available torque which can be taken by PTO in relation to rpm
- Engine idle running at 700 rpm.
- The air supply system pressure for PTO clutch engagement must exceed 8.5 bar.

4.6 PTO MANAGEMENT

- ▶ **Operations which do not comply with the instructions specified by IVECO or carried out by non qualified personnel can cause severe damage to on-board systems, affect driving safety, reliability and good operation of the vehicle and cause considerable damage which is not covered by warranty.**

General information

PTOs are activated electrically by means of a solenoid and the PTO engagement is checked by the PTO feedback signal. The entire PTO & Intermediate Speed Control mode configuration involves the programming of following control units: Expansion module (EM) and Vehicle Control Module (VCM), if PTO mounted on EuroTronic gearbox also ET2 is to be configured.

The EM is able to drive up to three physical PTOs and controls their activation and the deactivation individually.

PTO management also makes it possible to considerably simplify conversion because it incorporates a set of safety and control functions and activate after successful PTO engagement also the intermediate Speed control.

The set of safety functions for the PTO management offers, for example, engagement only under certain limit conditions and it offers also a supervision and control during PTO in operation. Furthermore the Bodybuilder can verify a successful PTO engagement either via HW-output (any PTO engaged) or via Bodybuilder CAN (w/ CANopen option). When multiple PTO's are engaged contemporaneously then successful engagement of each PTO can be verified only via Bodybuilder CAN.

Definitions

MUX

The term MUX describes a set of two three control units: Body Computer (BC), Front Frame Computer (FFC) and Rear Frame Computer (RFC).

This network is connected to other electronic systems such as the EDC, VCM, Brake system, ECAS, EuroTronic 2, Instrument Cluster, etc.

Information and messages are exchanged by means of Bus CAN lines

PTO switch (PTOsw x, x = 1, 2, 3)

Switch located in the middle of the dashboard (control panel). This is used to request an action relating to a given PTO (e.g. depending on EM programming, PTO engagement/disengagement, activation of Intermediate Speed Control).

Since the EM and VCM are able to control up to three PTOs, there might be up to three switches (from PTOsw1 to PTOsw3).

Each switch is connected to connector ST14A (pins 18, 19, 20).

Connector ST14A

Connector ST14A provided specifically for body builders is located on the passenger side below the electric control unit in the foot area.

More detailed information is given in Chapter 5.2 (► Page 8).

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),
- a 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 PTO Activation configuration is stored in the EM, as well as selection if Intermediate Speed Control should be requested from VCM control.

Intermediate Speed Control mode x (x = 1, 2, 3)

The Intermediate Speed Control mode may 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 *Because the engine can service only one single set of parameters, a choice must be made when multiple Intermediate Speed Control modes are requested.*

This is performed by priority assignments. ISC mode 1 (low prio) / ISC mode 2 (medium prio) / ISC mode 3 (high prio).

It is absolutely necessary to consider these priorities in management of the conversion!

Functional sequence

When both physical PTO activation and Intermediate Speed control are configured the engagement is performed according following sequence:

1. Request received via ST14A (pins 18, 19, 20).
2. EM checks PTO engagement restriction (max 20sec, then request cleared).
3. If restrictions o.k., then PTO solenoid activated.
4. PTO feedback signal arrived - expected within configured time (PTO type dependent, if not arrived in time PTO solenoid switched off, then request needs to be cycled).
5. EM sent Intermediate Speed Control Mode X to VCM.
6. VCM activates Intermediate Speed Control Mode_X acc. to the configured values.

In each case, a power take-off must be electrically activated by means of an electromagnetic valve.

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).

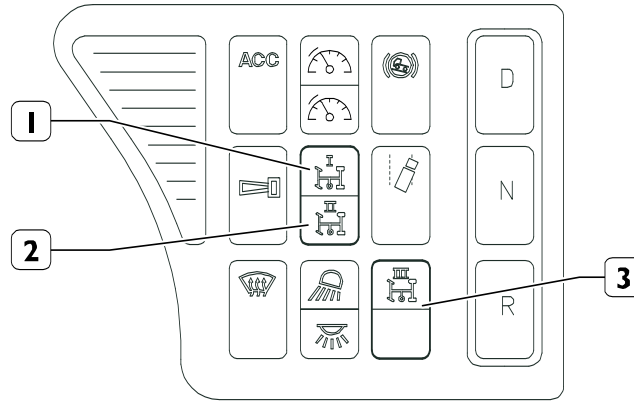
Air-activated power take-off and/or without connection to the EM control unit are not therefore not recommended by IVECO.

Note *The electromagnetic valve used to activate a power take-off is connected in the chassis to the relevant ST91 connector (PTO1) / ST92 (PTO2) / ST93 (PTO3).*

An electromagnetic valve is to be allocated to each power take-off.

PTO switch

The following Figure shows the installation position of the PTO switches. As already mentioned, up to three PTO switches may be fitted in the dashboard.



193879 **Figure 7**

- 1. PTO 1 switch
- 2. PTO 2 switch

- 3. PTO 3 switch

Table 4.4 - PTO switches

PTO switch	Connected to pin ST14A	Description	IVECO Part Number
PTOsw 1	18	PTO 1	580132 8776
PTOsw 2	19	PTO 2	580132 8710
PTOsw 3	20	PTO 3	580145 7839

Note The command may be also given directly on ST14A.

The PTO switches may be purchased directly through IVECO; the table summarises the part numbers.

PTO modes

Operation of a power take-off is generally determined by:

- 1. Physical PTO activation configuration.
- 2. Intermediate Speed Control mode configuration.

EM - PTO 1, 2, 3 configuration

Depending on the planned use of the vehicle, body builders are bound to contact IVECO Service in order to carry out the necessary programming of the controls involved (EM, VCM, EuroTronic Transmissions) in the operation of a power take-off.

Body builders may examine the following tables to organise the configuration of a system in advance (described as PTO configuration below).

A PTO unit may then be selected.

If the body builder needs custom settings, these may be programmed via IVECO Service for each individual power take-off.



As already mentioned, the body builder shall respect the PTO mode priority already in the early project phase. Changes later on would require unnecessary efforts, since wiring harness changes and EM/VCM/EuroTronic re-programmings would result.

EM - PTO 1, 2, 3 Programming

PTO programming includes the following function groups:

1. PTO switch function

Possibility of choosing between:

- physical activation of PTO only;
- physical activation of PTO and activation of Intermediate speed Control mode (after successful PTO engagement);
- activation of Intermediate speed control mode only.

2. PTO hardware

For the selection of:

- PTO type including PTO activation and feedback method (status signal).

3. Conditions for mechanical engagement of the PTO (see the following table for EM programming)

The selection determines which conditions must be satisfied in order to engage the PTO mechanically (electrical activation by means of the electromagnetic valve).

4. Conditions for mechanical engagement of the PTO (see the following table for EM programming)

The selection determines the conditions and the limit values that must not be exceeded or that must at least be reached, respectively.

5. Extended functions (see the following table for programming in EM)

- Dynamic behaviour relating to PTO activation/deactivation..

The adjustments within the five function groups may be defined separately for each PTO mode x1, 2, 3.

1) PTO switch function

The EM control unit controls the PTO modes and speeds by means of a PTO SW switch from 1 to 3 allocated on each individual occasion, located in the dashboard, which is connected to the relevant pin of the ST14A connector.

Operation of the switch may determine one of the following actions:

1. Mechanical engagement of the PTO (in conjunction with a given PTO configuration)
2. Activation of Intermediate speed Control mode
3. Mechanical engagement of the PTO (in conjunction with a given PTO configuration) and after successful engagement activation of Intermediate speed control mode
4. No effect

Each switch is allocated to a one single PTO, in other words two switches are required if two PTOs are fitted.

Activation of a PTO by the EM is always connected to a switch operation. Switch operation should not, however, necessary lead to engagement of a PTO, can be used (see table above).

Each switch may be allocated its own PTO configuration. A switch operation also activates fast mode, a selection must be made in the case of simultaneous operation of various switches. 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.



- ▶ **As already mentioned, the body builder shall respect the PTO mode priority already in the early project phase. Changes later on would require unnecessary efforts, since wiring harness changes and EM/VCM/EuroTronic re-programmings would result.**

2) PTO hardware

The following PTOs may be installed and activated:

- Predisposition, no PTO installed,
- PTO dependant on engine (PTO engines),
- PTO1 on manual gearbox,
- PTO2 on manual gearbox,
- Switchable multipower,
- PTO1 on Allison transmission,
- PTO2 on Allison transmission,
- PTO1 on EuroTronic transmission,
- PTO2 on EuroTronic transmission,
- PTO on transfer box,
- ZF NMV.

On one vehicle, up to 3 of these PTOs may be installed and managed simultaneously.

Table 4.5

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

3) Selection of conditions for PTO engagement

The power take-off is engaged only if all conditions are met.

All the configured conditions should be met within a certain time (20 s standard), if not the EM generate warning message to IC display and stops the engagement procedure.

PTO engagement must be requested again (deactivation and reactivation of the PTO switch).

4) Selection of conditions for PTO deactivation of an engaged PTO

Table 4.6

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		

Parameter	Option 1	Option 2	Option 3
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

The engaged PTO is supervised. If any conditions is violated, the ShutOff case is detected and certain actions can be initiated (PTO disengagement, sending a ISC Off or ISC RESUME command) and a warning is displayed on IC (Instrument Cluster).

When selecting the activation/deactivation parameter, care must be taken to ensure no plausibility is violated (for example, activation condition: Brake pedal operated and simultaneously condition for deactivation: Brake pedal operated).

5) Extended functions

Timing behaviour of PTO Mode request

The EM control unit expects certain PTO engagement conditions to be 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 s). The PTO switch must then be cycled (switched off and on again).

Timing behaviour of physical PTO engagement monitoring

Establishes the interval between PTO solenoid 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.

Timing behaviour of PTO ShutOff condition monitoring

If any configured ShutOff condition during PTO being physically engaged gets violated for longer than a timeout default (10 seconds standard), the configured actions (physical PTO de-activation, sending an ISC OFF command, sending an ISC RESUME command) will be initiated and an error is displayed. The time interval is programmable (0 - 10s).

Timing behaviour of physical PTO disengagement

Establishes the interval between PTO solenoid de-activation and physical PTO disengagement, being checked by PTO feedback signal. If the time interval is exceeded, an error message is displayed.

Timing behaviour between clutch depression 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).

Timing behaviour of error identification

Time that elapses before an error activates Degraded Mode.

Table 4.7

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

Parameter	Condition 1	Condition 2
Timeout for error identification	1 - 10 s	Not controlled

Note In general, 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.

Status of number of revs (to be programmed in VCM control unit)

A speed mode may be allocated to a PTO within the VCM control unit. The speed mode may be activated directly by means of a PTO switch or after a successful PTO engagement (based on the programmed PTO switch function).

RPM 0 mode (driving mode)

When the vehicle speed is for example below 25 km/h, an intermediate engine rpm may be activated.

Activation of an intermediate speed may take place by activating the Resume function, from SET+ or SET- on the control lever or by means of the respective inputs of ST14A connector.

The intermediate engine rpm on a standard vehicle is set to 900 rpm and may be altered on the basis of the following procedure:

1. activate Resume
2. adjust the speed to the required level using SET+ or SET-
3. activate the Resume function for at least 5 seconds in order to store the set speed.

The speed adjustment range with the gearbox in neutral is set to 100 rpm. It may be increased up to 200 rpm. The selective setting will then apply also to the speed modes.

Speed mode "0" will be considered the standard speed mode. For safety reasons, it is not possible to modify the following settings:

Table 4.8

Parameter	Function
Resume/OFF	Activation/deactivation of intermediate speed
SET+ / SET-	Increase/reduction of intermediate speed
Conditions leading to intermediate speed deactivation	<ul style="list-style-type: none"> • 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

Configurable rpm mode 1, 2, 3

For each programming action, it is possible to establish three independent parameter sets for engine control (on the basis of speed modes from 1 to 3).

With the simultaneous activation of several inputs, it is necessary to determine an input priority with regard to engine control. The following priorities are set for this purpose:

- 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.



- **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 that must be determined individually for each mode (programming by IVECO Service).

Table 4.9

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
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

- (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.

Custom settings

Table 4.10

Parameter	Option 1	Option 2
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)		

(17) If a power take-off is used on the propeller shaft (N90 - Omsi - etc.), it is possible to engage a speed higher than 90km/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.

Setting for special functions

Table 4.11

Parameter	Option 1
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)	

⁽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.

Changes to the torque curve, maximum rotation speed and steepness of the maximum rotation speed limiter

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 4.8 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).



193880 **Figure 8**

- 1. Engine curve
- 2. Maximum torque straight limitation line

- 3. Over-revving adjustment
- 4. Engine curve point

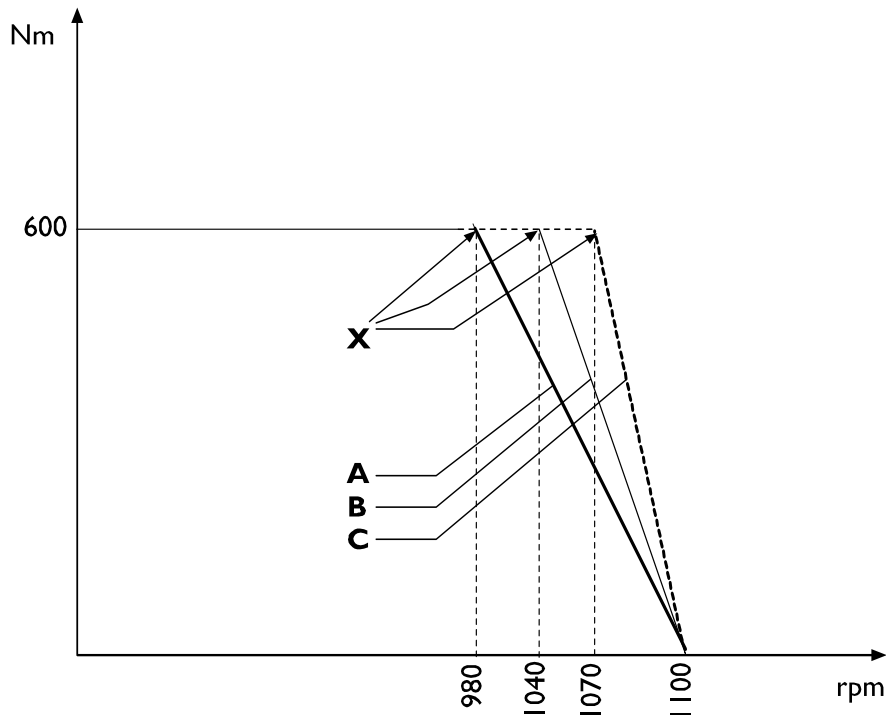
After setting a maximum for engine rpm and a variation mode (slope 3), we obtain a point of intersection X with the straight line of the set torque and therefore the maximum rpm compatible with this torque on the x-axis.

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 that of 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.



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Figure 9

We will take a look at the example in Figure 4.9:

- 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):

$$P = (600 \times 1100) / 9550 = 69 \text{ kW} = 94 \text{ HP}$$

The overreving regulator curve (gradient) depends on the specific application.

With stationary operation, a steep overreving 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

No PTO installed or PTO predisposition

Default configuration

PTO options: 5194, 6368, 1483, 1484.

Only the engine speed programming is requested by the VCM.

The switches select the three speed modes.

Table 4.12

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

Default configuration

PTO option: 2395 for all gearboxes.

Only the engine speed programming is requested by the VCM.

The switches select the three speed modes.

Note These conditions may be modified in Customer Service.

Table 4.13 - Activation conditions

Engine status	OFF
Pressure switch	ST91 - pin closed
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Table 4.14 - Deactivation conditions

Coolant temperature	> 120 [°C]
---------------------	------------

PTOI,2 manual gearbox

Default configuration

PTO options: 6392, 6393, 1459, 1505, 1507, 1509, 6384, 14553, 14554 for all manual gearboxes.

Note These conditions may be modified in Customer Service.

Table 4.15 - Activation conditions

Engine status	ON
Coolant temperature	< 120 [°C]

Table 4.16 - Deactivation conditions

Engine status	OFF
Coolant temperature	> 120 [°C]

PTO 1,2 Allison gearbox**Default configuration**

Allison automatic gearbox option: 8292 (PTO included)

Note *These conditions may be modified in Customer Service.*

Table 4.17 - Activation conditions

Engine status	ON
Gearbox status	neutral
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Table 4.18 - Deactivation conditions

Engine status	OFF
Coolant temperature	> 120 [°C]

PTO FOCSA**Default configuration**

Option: 5151

Note *These conditions may be modified in Customer Service.*

Table 4.19 - Activation conditions

Engine status	ON (always enabled)
---------------	---------------------

Table 4.20 - Deactivation conditions

Engine status	OFF
---------------	-----

Engine PTO**Default configuration**

Option: 5367

Note *These conditions may be modified in Customer Service.*

Table 4.21 - Activation conditions

Engine status	ON (engine speed < 1000 rpm)
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Table 4.22 - Deactivation conditions

Vehicle status	OFF
Coolant temperature	> 120 [°C]

PTO 1,2 Eurotronic 2 gearbox**Default configuration**

Note *These conditions may be modified in Customer Service.*

Table 4.23 - Activation conditions

Gearbox status	consent
Engine status	ON
Vehicle status	stationary
Coolant temperature	< 120 [°C]

Table 4.24 - Deactivation conditions

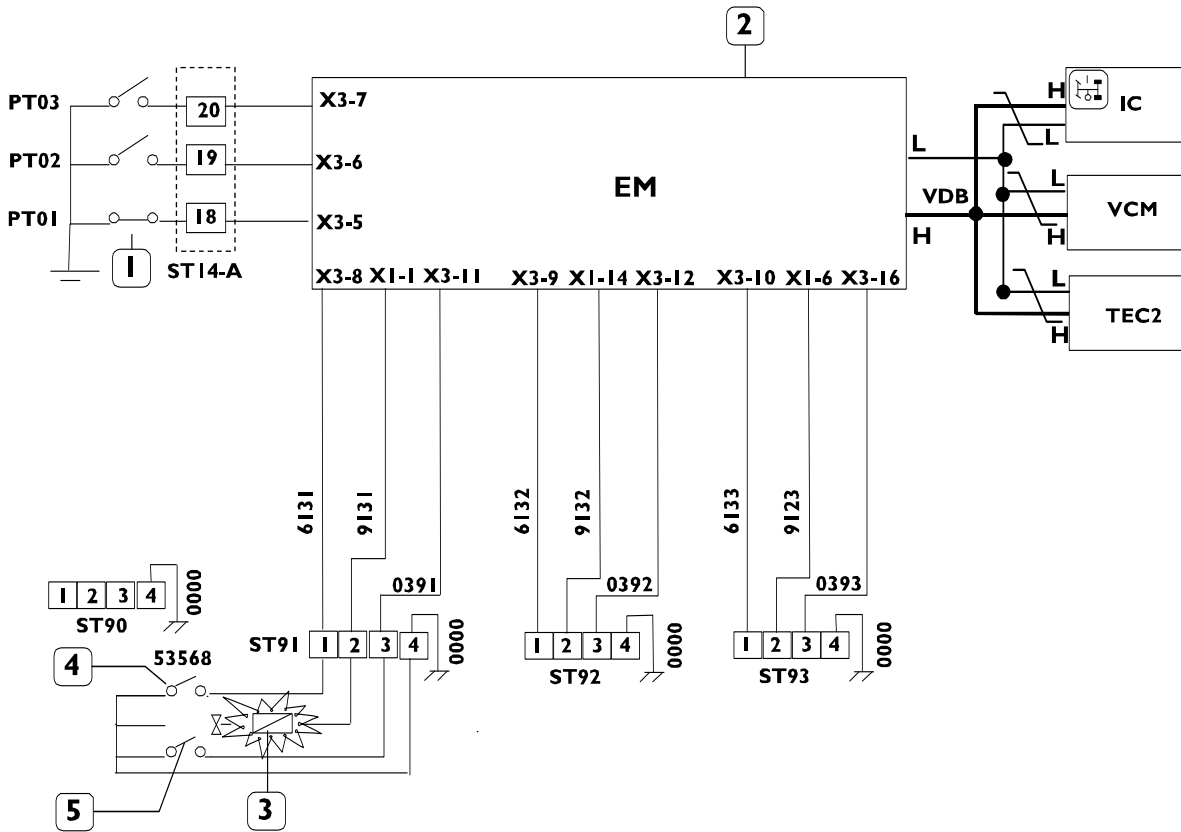
Vehicle status	OFF
Coolant temperature	> 120 [°C]

4.8 EM (EXPANSION MODULE)

The optional 4572, EM (Expansion Module), is available for Stralis Euro6. Furthermore the optional 0384 offers a CANopen interface for Bodybuilder in addition.

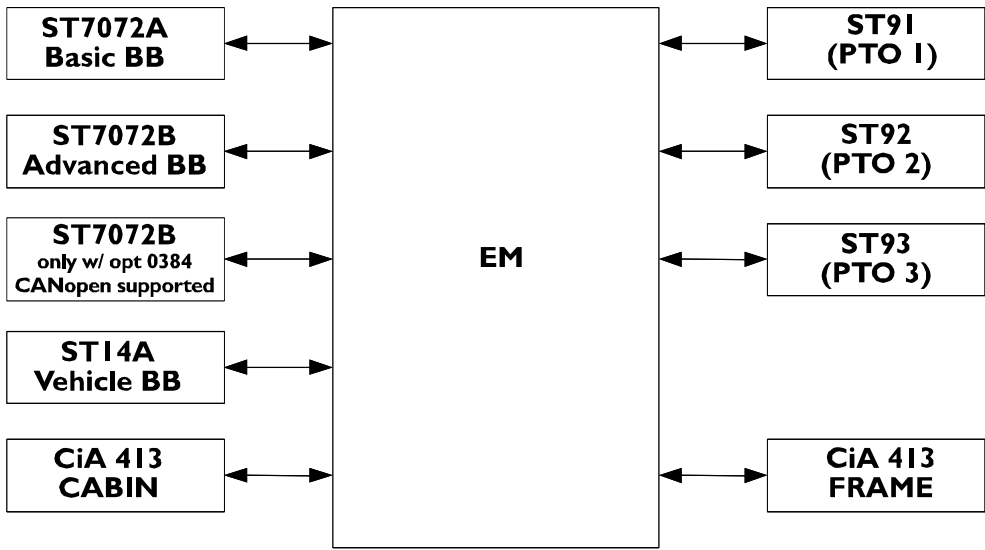
The EM control unit can be used for electrical management of the PTO and for special applications like EN1501 for refuse vehicles (option 6821). Optionally it provides special gateways for Bodybuilder in accordance to CiA 413 Truck Gateway standard.(BB in development phase).

The wiring diagram for the Expansion Module hardware is shown in Figure 4.10, and the block diagram of the hardware structure is shown in Figure 4.11.



193882 **Figure 10**

- 1. PTO switch
- 2. EM control unit
- 3. PTO solenoid valve control
- 4. PTO return signal
- 5. PTO Pressure switch resp. Bodybuilder PTO engagement consent



193883 **Figure 11**

The EM allows PTO activation only when configures conditions are satisfied – managed by Engagement restriction monitoring.

Furthermore it offers monitoring of conditions during PTO being engaged – managed by ShutOff condition monitoring.

When ShutOff conditions are violated the initiated actions can be configured.

The connections on ST91, ST92 and ST93 must be used as described to ensure PTO activation and representation on IC display.

The predefined set conditions for Stralis Euro 6 are described in Chapter 4.6 - Paragraph " PTO Modes- Programming EM-PTO 1, 2, 3" (➡ Page 17).

Connections

Table 4.25 - PTO mode request: ST14A

PTO 1	Pin 18
PTO 2	Pin 19
PTO 3	Pin 20

To carry out request, close the pins on ground of pin 17.

Table 4.26 - PTO IN/OUT: ST91 PTO 1, ST92 PTO 2, ST93 PTO 3

Pin 1	PTO feed-back
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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ELECTRONIC SUB-SYSTEMS

5.1 ELECTRONIC SYSTEMS

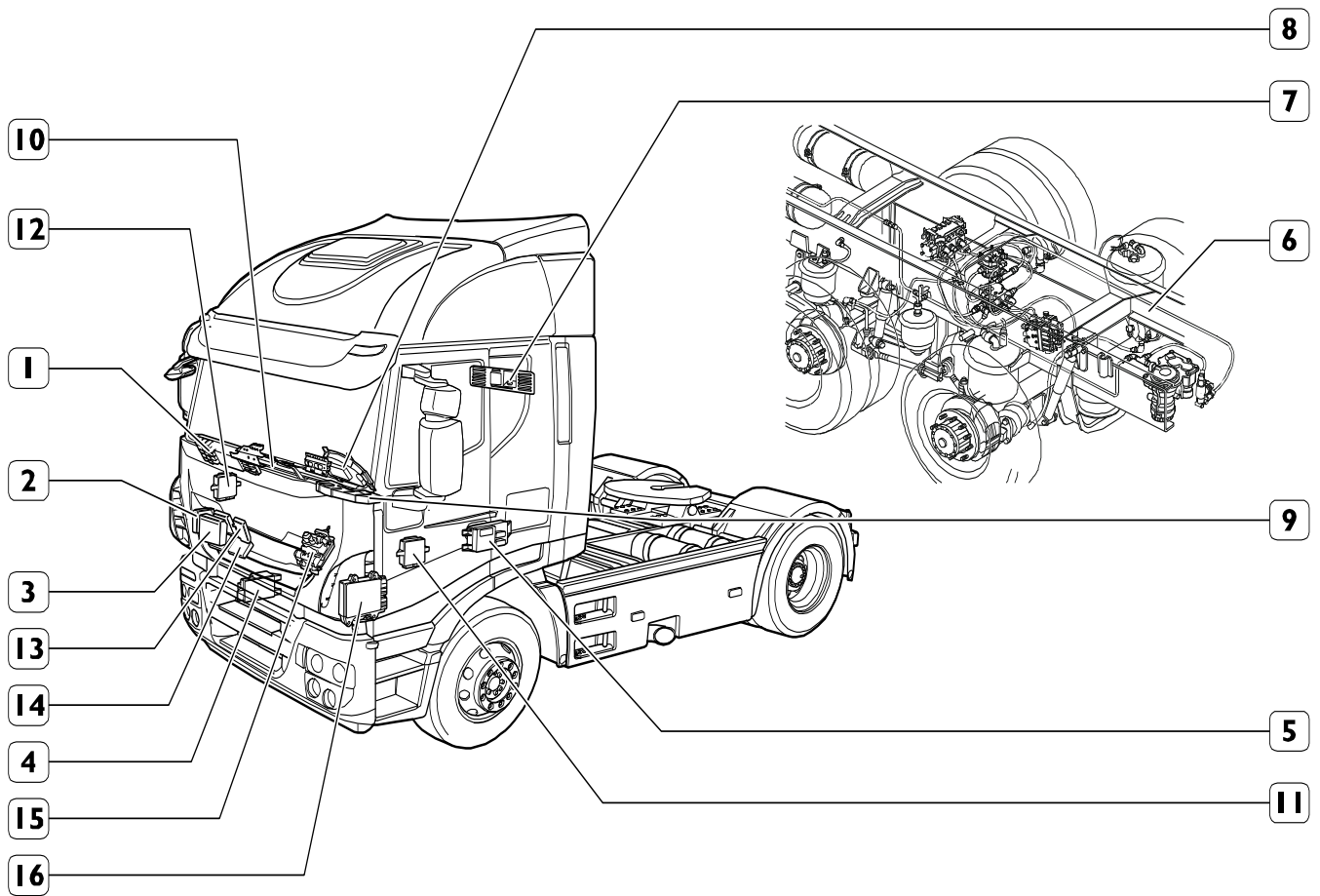
An innovative electronic system, called Multiplex, manages and controls the vehicle subsystems by means of CAN lines.

For a better understanding of this system, the location (see Figure 5.1) and the functions of the main control units installed on the vehicle are described below.



► **It is not permitted to connect devices or electrical circuits directly to the control units. Only the connectors or special interfaces listed in Chapter 5.2 may be used.**

Position of electronic control units



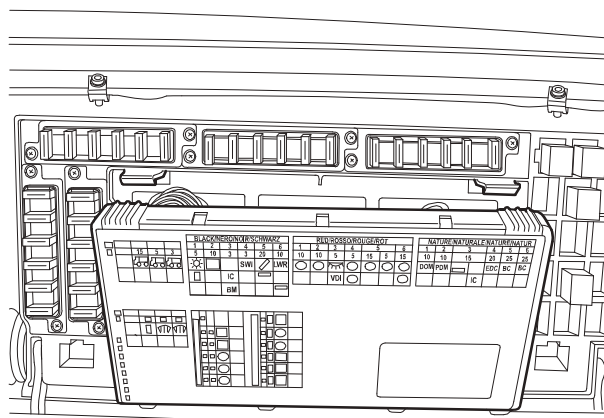
190401 **Figure 1**

- | | |
|---------------------------------------|--|
| 1. BC Body Computer | 9. Steering control shaft |
| 2. EM Expansion Module | 10. CC Climate Control |
| 3. VCM Vehicle Control Module | 11. DDM Drive Door Module |
| 4. FFC Front Frame Computer | 12. PDM Passenger Door Module |
| 5. RFC Rear Frame Computer on tractor | 13. Central locking |
| 6. RFC Rear Frame on trucks | 14. ECAS Electronic Control Air Suspension |
| 7. BM Bed Module | 15. EBS Electronic Brake System |
| 8. IC Instrument Cluster | 16. EDC Engine Diesel Control |

Body Computer (BC)

The Body Computer is the vehicle's central control unit and all the signals (input and output) which are important for interaction with individual vehicle systems are processed here.

The Body Computer is located in the cab, below the dashboard in front of the passenger seat. The fuses and relays are also housed here.

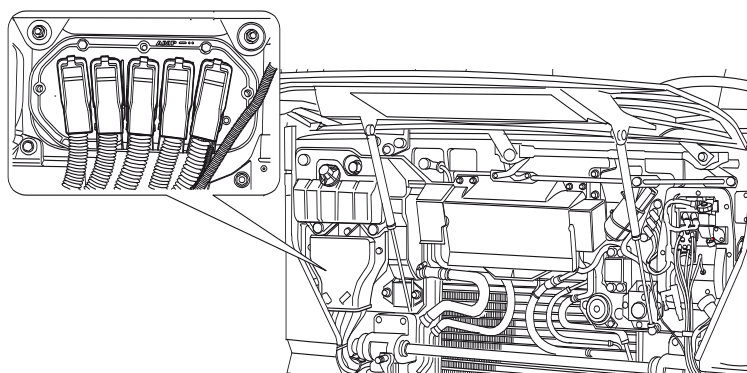


49845 **Figure 2**

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.



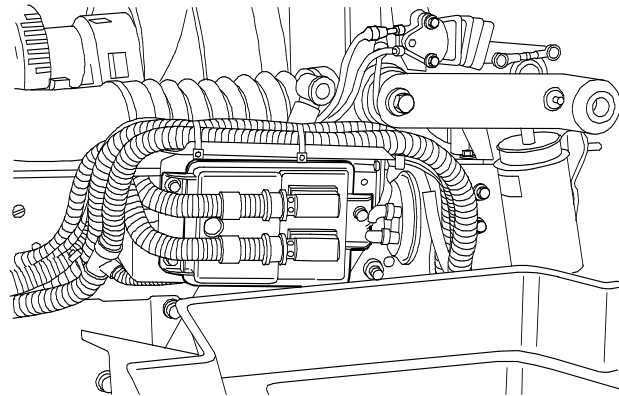
190402 **Figure 3**

Front Frame Computer (FFC)

The Front Frame Computer (FFC) receives information from on all electrical/electronic components located in the front part ("front frame") of the vehicle, (front lighting system, brake and engine system sensors).

This information is then forwarded to the vehicle systems to which the information is relevant by means of the Body Computer .

The FFC is located behind the cab exit footboard on the right.



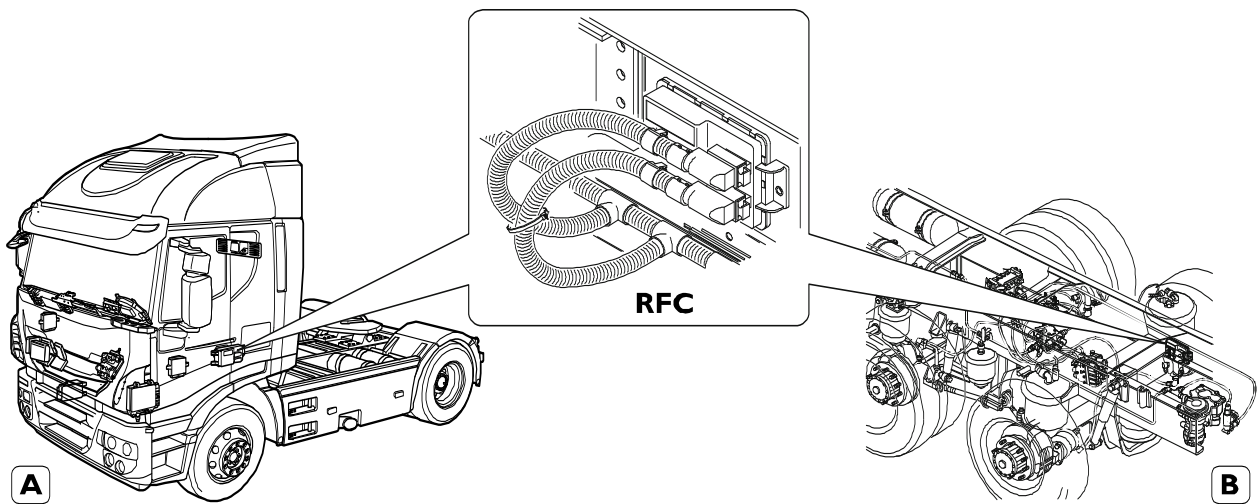
190410 **Figure 4**

Rear Frame Computer (RFC)

The Rear Frame Computer (RFC) processes the information received from the subsystems and the Bodybuilder connectors located in the rear part ("rear frame") of the chassis as well as the signals from the trailer/semi-trailer.

The signalling is then forwarded to the Body Computer.

The RFC is located inside the right side member: on the truck it is located behind the rear axle; on tractors it is near the fifth wheel coupling.



190403 **Figure 5**

A. Tractor

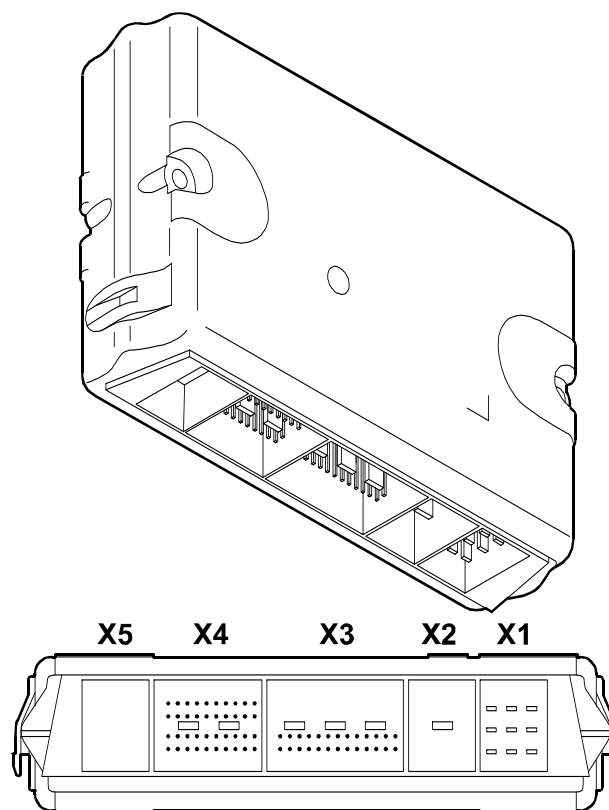
B. Truck

Expansion Module (EM)

The EM (Expansion Module) control unit located in the cab control unit compartment (passenger's side) controls the power takeoffs and, unlike the DMI, makes it possible to carry out complicated 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.



112596

Figure 6

For an in-depth analysis of the EM functions, please contact the IVECO Customer Centre.

5.2 BODYBUILDER CONNECTORS

Standard vehicle outfitting provides for connectors **ST14A** and **ST14B**.

Optional connectors are: **ST14C**, **ST40**, **72072**, **ST91**, **ST92**, **ST93**.

Each is described below depending on its location in the cab (§ 5.2.1) or on the chassis (§ 5.2.2).

In order to interface with its own devices, the Bodybuilder must use the counterpart (female) and the contacts as per the following table:

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

The following indications are only valid for connector 72072B:

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

Connectors in cab

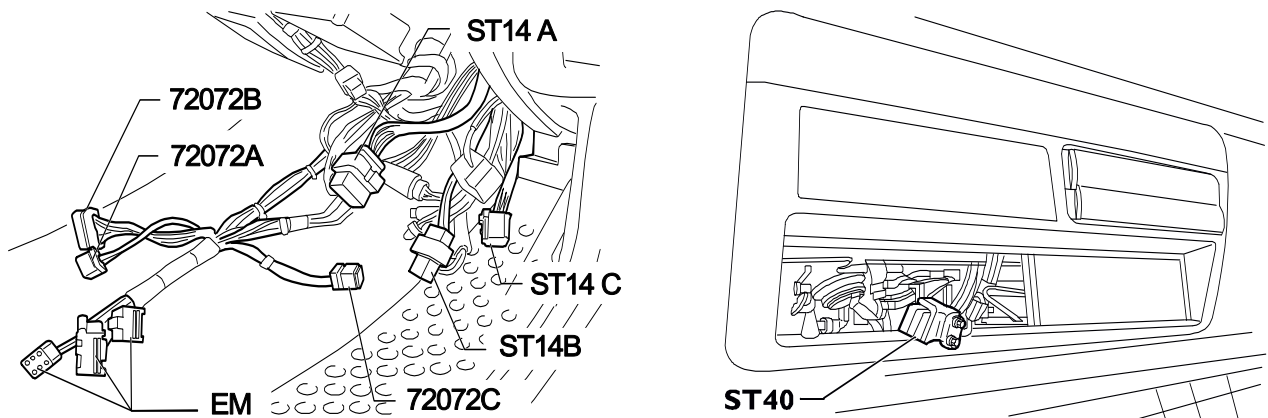
The following connectors are located inside the cab:

- 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

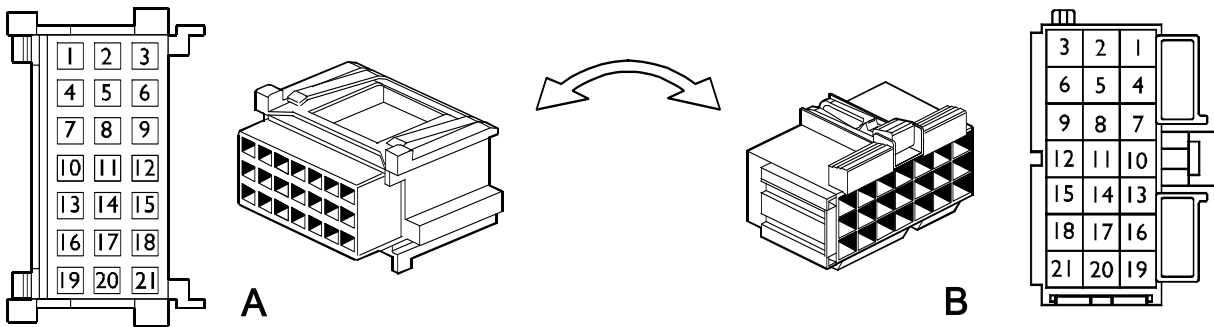
The connectors in the cab are almost all housed behind a cover in the passenger side foot rest compartment.

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.



190409 **Figure 7**

Standard connector STI4A: 21 pin, blue



190411

Figure 8

A. 41118338 Counterpart to be coupled (female)

B. 41118319 Existing part on vehicle (male)

Connector STI4A basic functions

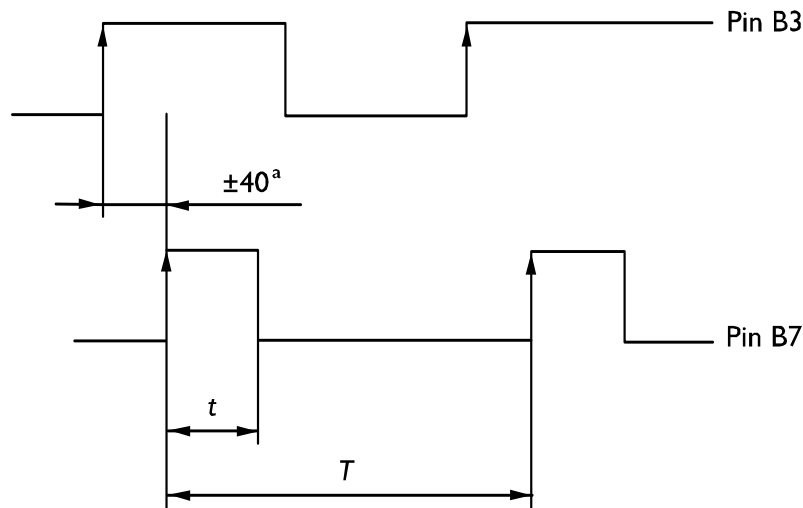
Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Engine Start	8892	10 mA	VCM X3-27	Ground = start engine (signal must be permanently active till engine starter runs) Open wire = no action
2	Engine stop	0151	10 mA	VCM X3-26	Ground = stop engine (short activation sufficient to stop engine); Open wire = no action
3	Service brake	1165	200 mA	VCM X1-13	0 V = service brake not pressed +24 V = service brake pressed
4	Vehicle standstill	5515	200 mA	BC2 J5-01	+24 V = vehicle standstill 0 V = vehicle moving
5	Parking brake	6656	200 mA	VCM X1-10	0 V = not engaged +24V = engaged
6	Not connected				
7	Vehicle speed	5540	10 mA	40011-B7	Pulse signal ⁽¹⁾
8	Engine status	7778	200 mA	BC2 J7-04	Engine status output 0 V = engine standstill +24 V = engine running > 400 rpm
9	Gearbox neutral	8050	200 mA	VCM X1-07 EM X1-07	0 V = neutral not engaged +24 V = neutral engaged Input driven by EM, when installed Else input driven by VCM
10	Reverse gear	2268	200 mA	BC2 J5-05	0 V = reverse gear not engaged +24 V = reverse gear engaged
11	K15	8871	3 A	BC2 J7-03	K15 (socket under key switch)
12	CC Set+	8156	10 mA	VCM X3-33	Input signal ⁽²⁾ Open wire = Set + not activated Ground = Set+ activated
13	CC Set-	8157	10 mA	VCM X3-32	Input signal ⁽²⁾ Open wire = Set - not activated Ground = Set - activated

Pin	Description	Wire code	Max. Load	Connected to	Remarks
14	CC OFF	8154	10 mA	VCM X3-30	Input signal ⁽²⁾ Open wire = Off not activated Ground = OFF activated
15	CC Resume	8155	15 mA	VCM X3-31	Input signal ⁽²⁾ Open wire = RES not activated Ground = RES activated
16	CC Driver/BB	0152	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	10 A	Wiring	Ground
18	PTO 1 sw	0131	10 mA	VCM X3-47 EM X3-5	Input signal ⁽³⁾ Open wire = PTO mode 1 not activated Ground = PTO mode 1 activated Input driven by EM, when installed Else input driven by VCM
19	PTO 2 sw	0132	10 mA	VCM X3-46 EM X3-6	Input signal ⁽³⁾ Open wire = PTO mode 2 not activated Ground = PTO mode 2 activated Input driven by EM, when installed Else input driven by VCM
20	PTO 3 sw	0123	10 mA	VCM X3-45 EM X3-7	Input signal ⁽³⁾ Open wire = PTO mode 3 not activated Ground = PTO mode 3 activated Input driven by EM, when installed Else input driven by VCM
21	K30	7772	10 A		K30

(1) Tachograph B7 Signal

Parameter	Min	Typ	Max	Unit	Remarks
Voltage U _{low}			1,5	V	I = 1 mA
Voltage U _{high}	5,5			V	I = -1 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.



I91314

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. 40 μ s delay \pm 10 μ s jitter.

(2) Input monitored only when ST I4A/pin I6 CC driver/bodybuilder connected to ground, else input ignored

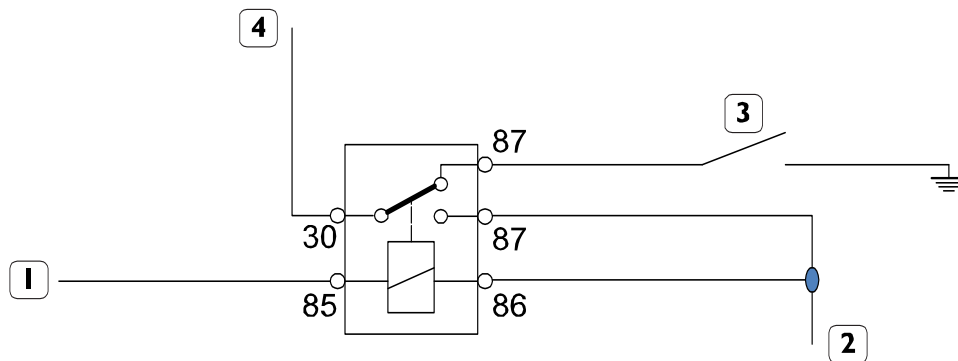
(3) Cycling of PTO_x sw inputs must be not faster than 500ms. Switching faster may ignore the request. Input will activate physical PTO - when configured - and VCM intermediate Speed Control Mode 1,2,3 On contemporaneous activations of PTO 1,2,3 inputs the VCM intermediate Speed Control Mode is assigned by means of prioritization: PTO_3 - highest priority, PTO_2 - medium priority, PTO_1 - lowest priority

CAUTION: The Deactivation of a physical PTO is only allowed in load-free conditions. Therefore the deactivation of a physical stationary/Non stationary PTO device during driving operation and/or with a gear engaged is not permitted as in such a case 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)

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 ST I4A 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:



195812 **Figure 10**

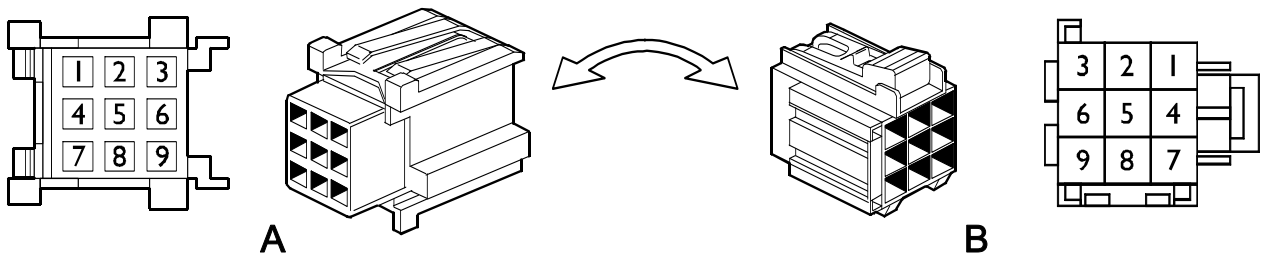
- 1. PTO request / ST14 pin 18
- 2. +15 / ST14 pin 11
- 3. 2 speed level / Reset ECAS
- 4. ECU ECAS / X1 pin 5

Lowering the air suspension via connector X1 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.

Amendment (only 190/IFP-CM, 260..IFP IFS-CM)

If on fully air suspended vehicles type "-CM" the front axle is lifted with outriggers or when loading a roller container, an overflow valve with backflow (Knorr-Bremse DR4151-K000615) has to be mounted in the supply line of the front axle ECAS valve according IVECO drawing 5801691560. This will prevent a dislocation of the air bellow rubber from the piston.

Standard connector ST14B: 9 pin, blue



190412 **Figure 11**

A. 41118303 Counterpart to be coupled (female)

B. 41118302 Existing part on vehicle (male)

Connector ST14B basic functions

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	2nd speed-limiter	8223	10 mA	VCM X3-13	2nd speed limiter activation Open wire = not activated +24V = engaged
2	Reserved				
3	Clutch status output	9963	200 mA	VCM X1-12	Open circuit = clutch not activated Connected to ground = clutch activated
4	PTS	5542	200 mA	VCM X1-14	PTS = Programmable Threshold Speed (1) Programmable threshold (rpm or vehicle speed) +24 V = limit exceeded 0 V = limit not exceeded

Pin	Description	Wire code	Max. Load	Connected to	Remarks
5	Emergency lights	1113	10 mA	BC2 J4-04	Input signal ⁽²⁾ Connected to ground = on Open circuit = off
6	Reserved				
7	Reserved				
8	Engine speed signal	5587	10 mA	ECM 33	Pulse signal
9	External lights	3333	5 A	BC2 J1-09	0 V = lights off +24 V = lights on (parking, low and high beam)

⁽¹⁾ VCM Default Vehicle Speed is 3 km/h

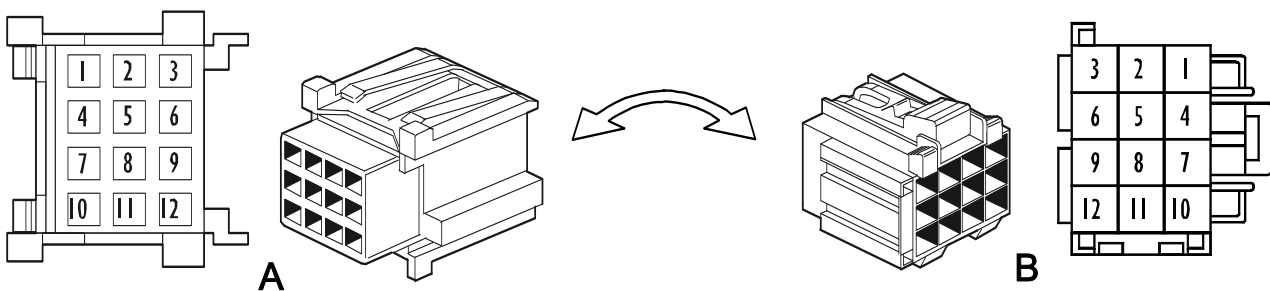
The value cannot be modified in Customer Service with EASY on following options:

- Certain Refurbishing Near Market requests for RCV (pls contact IVECO Bodybuilders market responsible)

⁽²⁾ Vehicles with electrically activated main battery switch (OPT 2532)

- Emergency lights will be activated for no longer than 30 minutes. After 30 minutes the emergency lights are switched off and the main battery switch will be opened.

Optional connector ST14C: 12 pin, grey



190413

Figure 12

A. 41118329 Counterpart to be coupled (female)

B. 41118310 Existing part on vehicle (male)

Basic functions of connector ST14C (Allison gearbox for Waste Collection vehicles)

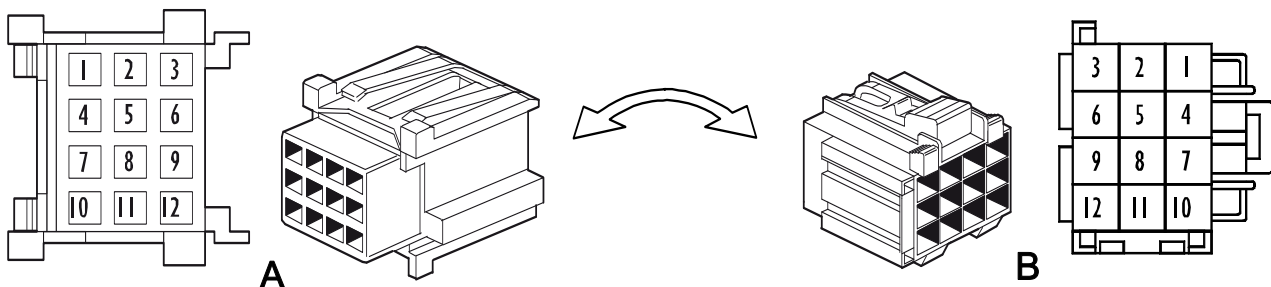
Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Neutral indicator for Extra PTO	145	500 mA	ALL 45	Gearbox in neutral. Ground for neutral engaged. This output function is activated by the TCM when Neutral is attained and a programmable combination of engine speed and transmission output speed has been detected.

Pin	Description	Wire code	Max. Load	Connected to	Remarks
2	Multi-state switch	I23	15 mA	ALL 23	<p>Limitation 1st gear and inhibition reverse gear</p> <p>Open wire = function active</p> <p>+24V = function not engaged</p> <p>Ground = function active</p> <p>This function is normally enabled with an operator-controlled momentary switch.</p> <p>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.</p> <p>If the function is enabled with Reverse selected on the shift selector, the transmission will shift to Neutral.</p> <p>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.</p> <p>The function is disabled when the enabling switch is released.</p>
3	–	I42		ALL 42	
4	PTO active	I43	15 mA	ALL 43	<p>For special applications - Input from PTO switch .</p> <p>Open wire = inactive</p> <p>+24V = active</p> <p>Ground = inactive</p> <p>Enabling this function alerts the TCM that PTO operation has been requested by the operator.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • accelerator position is "low"; • engine speed and output speed are within Customer Modifiable Constant limits.
5	PTO control	I30	500 mA	ALL 30	<p>For special applications - 24V output to activate the PTO</p> <p>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.</p>
6	Reserved				
7	Reserved				
8	Double Automatic Neutral Input	I17	5 mA	ALL 17	<p>For special applications - Logic mode "and" mode with pin 9</p> <p>Open wire = function inactive</p> <p>+24 V = function active</p> <p>Ground = function active</p> <p>The TCM determines this function enable request to be valid only after receiving two separate input signals.</p> <p>When properly integrated into the vehicle system, the enabled function automatically commands the transmission to Neutral when a supplementary vehicle brake is engaged.</p>

Pin	Description	Wire code	Max. Load	Connected to	Remarks
9	Double Automatic Neutral Input	101	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	103		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	113	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	102	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: <ul style="list-style-type: none"> • Vehicle is stationary; • service brakes are applied; • throttle position is "low".

Contact Customer Service for any modifications.

Optional connector ST40: 12 pin, blue



190413

Figure 13

A. 41118264 Counterpart to be coupled (female)

B. 41118266 Existing part on vehicle (male)

Basic functions of connector ST40

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	K30	7772	5 A	70604-3	Protected by fuse 5 A
2	K15	8871	7.5 A	70605-6	Protected by fuse 7,5 A
3	Vehicle speed	5541	10 mA	IC 20 (Instrument Cluster = Dashboard)	

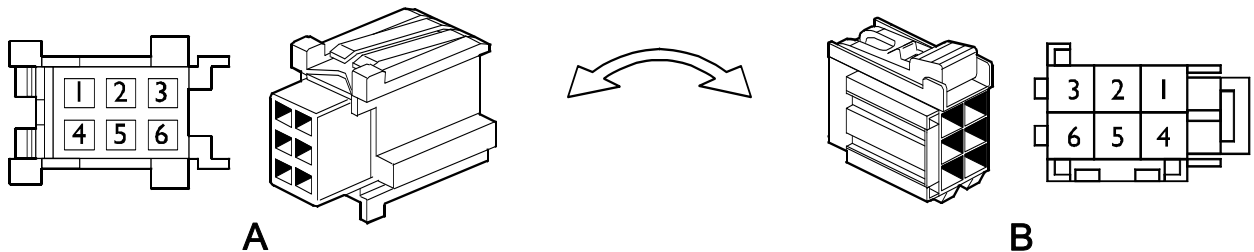
Pin	Description	Wire code	Max. Load	Connected to	Remarks
4	+12 V	7712	7.5 A	70601-2	
5	CAN H		10 mA	VCM X3-37	FMS ⁽¹⁾ CAN H (line activated with opt I4569) +24V = engaged
6	CAN L		10 mA	VCM X3-38	FMS ⁽¹⁾ CAN L (line activated with opt I4569) +24V = engaged
7	Dashboard lights	4442	1 A	BC2 J7-19	
8	Reversing lights	2268	200 mA	BC2 J5-05	+24 V = reverse gear engaged
9	Ground	0000	5 A		
10	K30	7972	5 A	70601-2	Protected by fuse 5 A
11	Reserved				
12	Reserved				

⁽¹⁾ Fleet Management System

FMS CAN line is enabled with option I4569.

For further information please see Chapter 5.3 (➔ Page 28)

Optional connector 72072A: 6 pin, yellow



190414 **Figure I4**

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.

Basic function of connector 72072A

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Reserved				
2	Request gearbox in neutral Gearbox activation	6983	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
3	Bodybuilder Enable	0991	Load between 10 mA and 1 A ⁽¹⁾	EM X3-17	To be activated by Bodybuilder at active Bodybuilder mission. Else certain Bodybuilder functions will not be supported <ul style="list-style-type: none"> • Neutral shift for automatic gearboxes • Safe State activation by BB EMCY (ST14B/2) • Controls for CANopen under Firewall monitoring Ground = active, low side switch

Pin	Description	Wire code	Max. Load	Connected to	Remarks
4	Vehicle CAN fully operational signal	9089	10 A ⁽²⁾	Relay wiring: Activated via EM X4-04 and 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 K15 OFF phase input will not be activated to avoid increased sleep current.

⁽²⁾ Up to 10A can be used in combination with CiA cab connector 72072C / Pin 1

⁽³⁾ Allows Bodybuilder the supervision of "Vehicle CAN fully operational" information at the same time:

- IVN (In Vehicle Network) communication w/o timeouts and
- Bodybuilder interface application running

Output Signal is debounced by 1sec in order to filter temporary disturbances . Output remains off for ~5 sec after K15 ON. Bodybuilder is to verify 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)
- MUX BodyComputer System
- Tachograph

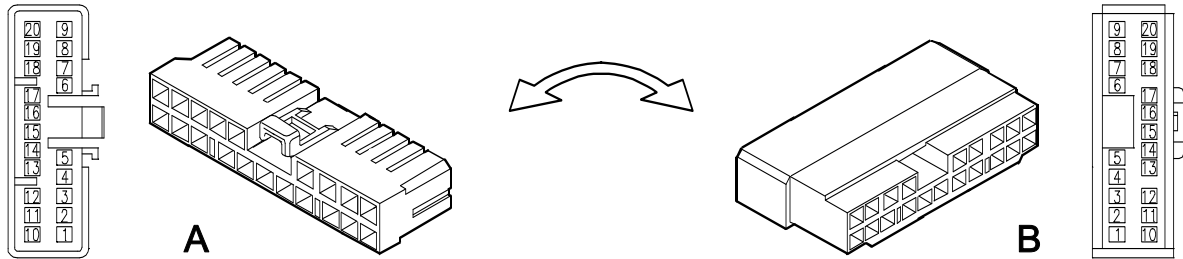
Detailed information for each system are available via CANopen – see EMCY object 0x1014

Requirements for Functional Safety

- When Bodybuilder application is interfacing the vehicle for Safety related functions then IVECO supports the Bodybuilder application with a "Vehicle CAN fully operational" output. For Safety related Bodybuilder applications, which are interfacing the vehicle, IVECO requires from the BodyBuilder to integrate this information in the Bodybuilder application Technical Safety Concept. The "Vehicle CAN fully operational" information does not check the contents of any transmitted CAN message, but it ensures that CAN communication - and as a result, also extracted information provided to the BodyBuilder - are still regularly updated within their timing constraints.
- Furthermore, at each K15 cycle, the delayed state change (between 4 to 6 sec after K15 ON) needs to be checked. When this check fails, the "Vehicle CAN fully operational" output is not to be considered valid.
- Since the "Vehicle CAN fully operational" output is active, it provides the information that none of the monitored messages of the Vehicle CAN systems remains in CAN timeout for more than 1 s.
- In case of OPT 0384 present:
 - Bodybuilder is able to identify the vehicle degradation level by reading CANopen EMCY message and
 - use BB EMCY input, see BB EMCY (ST 72072B, pin 2) input for Vehicle StoppedState management
- When the "Vehicle CAN fully operational" output is not active then the Bodybuilder application does not have to implement actions (or rather reactions) which rely on the EM nor on the entire IVECO Bodybuilders interface functioning properly (as for instance the CAN-open gateway). The Bodybuilder is responsible for initiating measures that make sure that the Safe State of its application is entered autonomously.
When the application specifies that the Bodybuilder also requests a recovery strategy while the "Vehicle in full CAN option" output is passive, contact IVECO if support is requested to complete the design specifications of this recovery strategy.
- When in Customer Service a client specific programming have been required, then after each programming session the affected functionality is to be checked and confirmed by the BodyBuilder.

- The Bodybuilders have to ensure reliable design and wiring for all connections with the IVECO BodyBuilder interface.

Optional connector 72072B: 20 pin, black



190415 **Figure 15**

A. 500314809 Existing part on vehicle (male)

B. 500314816 Counterpart to be coupled (female)

Only available with OPT 0384 (EM-full) installed.

Basic functions of connector 72072B

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Request gearbox in neutral signal	0992	10 mA ⁽¹⁾	EM X3-18	Only supported with OPT 6821 and AutoGbx. Only if Bodybuilder Enable is also active (72072A/3). Signal change needed, earliest 1 second after K15 ON. Ground = active, low side switch
2	Bodybuilder Emergency Signal	0993	10 mA ⁽¹⁾	EM X3-19	Input to activate the Vehicle StoppedState values, only with Bodybuilder Enable (72072A/pin 2) also activated (short activation sufficient to stop engine); List of configurable signals ⁽²⁾ Ground = active, low side switch
3	Ext. SB request (EN1501)	0994	10 mA ⁽¹⁾	EM X3-20	Only supported with opt 6821 ⁽³⁾ Input to activate the Stopping brake (V<2km/h) Ground = active, low side switch
4	Reserved				
5	Stepper swt req. (EN1501)	0996	10 mA ⁽¹⁾	EM X4-06	Only supported with opt 6821 ⁽⁴⁾ Input to activate the Refuse stepper switch Ground = active, low side switch n.a. when ABS-HSA (OPT 14861) installed
6	LMM (Light Management Module) Right direction light	6985	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	1.5 A	EM X1-08	Left turn signal light 0 V = not engaged +24V = engaged
8	Reserved				
9	Keep EM alive	6988	1 A	EM X4-02	0 V = not engaged +24V = engaged
10	Brake diagnostics lamp EN1501	6989	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) n.a. when ABS-HSA (OPT 14861) installed

Pin	Description	Wire code	Max. Load	Connected to	Remarks
11	Reserved				
12	Neutral gear request (EN1501)	6991	1 A	EM X4-22	reserved for IVECO exclusively Only supported w/ OPT 6821 & AutoGbx 0 V = not engaged +24V = engaged
13	Chassis ready (acc. EN1501)	6992	1 A	EM X4-23	for adjustment contact IVECO CS organisation 0 V = Off- Frame not ready +24 V = On - Frame ready
14	Low accelerator pedal idle switch	6993	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	1 A	EM X4-32	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	0-32 V, 0-500 Ohm ⁽¹⁾	EM X4-14	Analogue input for IC display of Bodybuilder fluid level ⁽⁵⁾ when enabled CANopen 0x6167 n.a.
17	Bodybuilder pressure	5982	0-32 V, 0-500 Ohm ⁽¹⁾	EM X4-15	Analogue input for IC display of Bodybuilder pressure ⁽⁵⁾ when enabled CANopen 0x6167 n.a.
18	Bodybuilder Thermal Temperature	5983	0-32 V, 0-500 Ohm ⁽¹⁾	EM X4-29	Analogue input for IC display of Bodybuilder temperature ⁽⁵⁾ when enabled CANopen 0x6167 n.a.
19	ReGen inhibit	5991	0-2000 Hz ⁽¹⁾	EM X4-16	reserved for IVECO exclusively used by IVECO for Cummins application
20	ReGen force	5992	0-2000 Hz ⁽¹⁾	EM X4-38	reserved for IVECO exclusively used by IVECO for Cummins application

⁽¹⁾ During K15 OFF phase, input will not be enabled to avoid increased sleep current.

⁽²⁾ Requirements for Functional Safety

In case of an emergency inside the Bodybuilder application, IVECO offers the activation of the Bodybuilder Emergency input. When input activated the vehicle enters - depending on configuration - autonomously in a Vehicle StoppedState. IVECO offers a set of pre-configured StoppedState settings to satisfy Bodybuilders application specific needs; for details please contact IVECO.

- This feature shall only be available during Bodybuilder application really in mission and not during standard vehicle driving. Therefore, the Bodybuilder enable input (ST 72072A, pin 3) will be switched simultaneously to Ground; otherwise no action will be initiated..
- Please note that the Vehicle Stopped State values are transmitted via CAN to the other vehicle subsystems. Therefore, this feature requires that the "Vehicle CAN fully operational" output is active.
- When the "Vehicle CAN fully operational" output is not active then the Bodybuilder application does not have to implement actions (or rather reactions) which rely on the EM nor on the entire IVECO Bodybuilder interface functioning properly (as for instance the CAN-open gateway). The Bodybuilder is responsible for initiating measures that make sure that the Safe State of its application is entered autonomously.

When the application specifies that the Bodybuilder also requests a recovery strategy while the "Vehicle in full CAN option" output is passive, contact IVECO if support is requested to complete the design specifications of this recovery strategy.

- All the below listed Signals will be transmitted as one entire package - it is not possible to exclude some of them.
- The values of the 'Vehicle StoppedState' signals will be transmitted directly after the Bodybuilder Emergency has been activated and will remain active until:
 - K15 being switched off or
 - CANopen NMT 'Start Node' command received or
 - or the CANopen NMT 'Start Node' command is received

Rem: During this 'StoppedState' phase the affected CANopen signals received on BB-CAN are ignored.

(3) The stopping brake can only be activated with vehicle speed less than 2 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 w/ EBS braking System the Bodybuilder shall automatically switch off Stopping Brake request when K15 switched off.

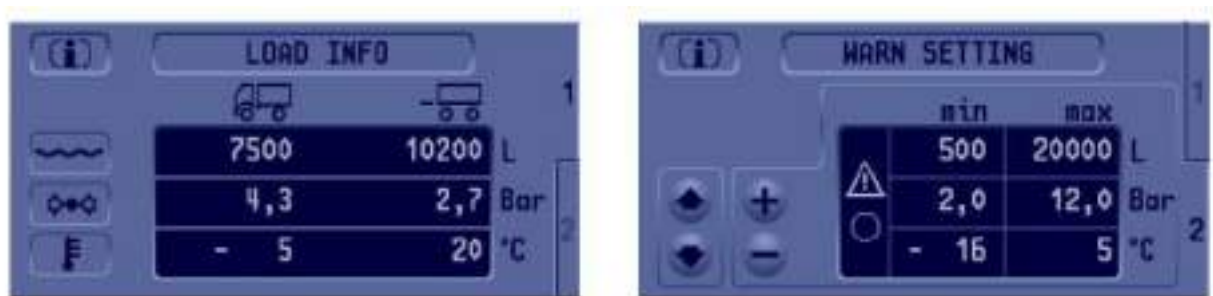
(4) The refuse packer Step swt input, as well as the CAN open object 0x6148 (Refuse packet step switch) activate the following actions on occupied stepper switch as described in Standard Fpr EN 1501-1:2010 date: 2010-02, Chpt 5.11.3.3.1 – Provisions for footboard(s) occupied:

- speed limiting
- reversing of rear loaded RCV. Reversing protection by means of:
 - brake activation in case of reversing;
 - torque limit set to 0% (only low idle governor) in case of reversing;
 - inhibiting reverse gear on automatic gearboxes in case of reversing, only as long as Bodybuilder enable input (72072A/03) is connected to Ground by the BodyBuilder.

Requirements for Functional Safety

The vehicle shall not be responsible to fulfil all DIN EN 1501-1 safety requirements. The Bodybuilder has the responsibility that the final application corresponds to the Safety standards as described in EN 1501. Especially the EN 1501-1 Overriding Safety devices described in Standard Fpr EN 1501-1:2010 date: 2010-02; Chpt 5.11.3.3.2 including the reset management in case of function failures or traffic emergency shall be managed by BodyBuilder (refer to EN 1501-1 chapter 5.11.3.3.2).

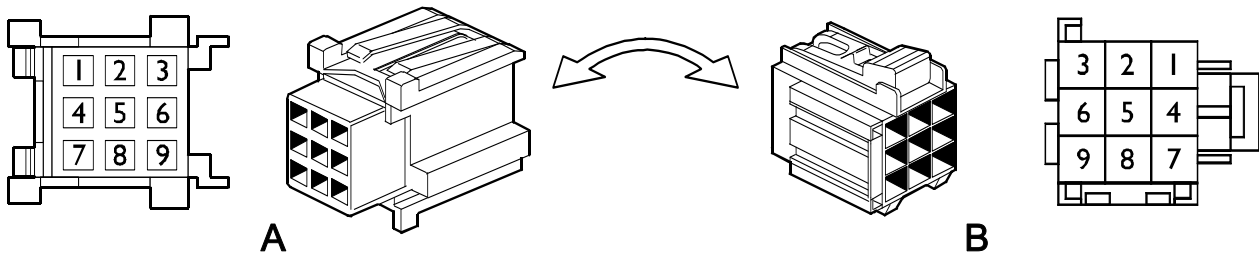
(5) It is possible to display payload information of the truck on Instrument cluster display, but limited to comfort functions. The functionality is per default disabled, for enabling please contact IVECO Customer Services. When wiring added to the input(s) the related CANopen Truck payload information objects are no longer available. The Trailer payload information(s) via ISO 11992-3 are not supported on Euro6 range.



191315

Figure 16

Using this function the driver can also set alarm thresholds for each type of payload.

Optional connector 72072C: 9 pin, yellow

190412

Figure 17

A. 41200681 Counterpart to be coupled (female)

B. 41020340 Existing part on vehicle (male)

Only available with OPT 0384 (EM-full) installed.

Basic functions of 72072C

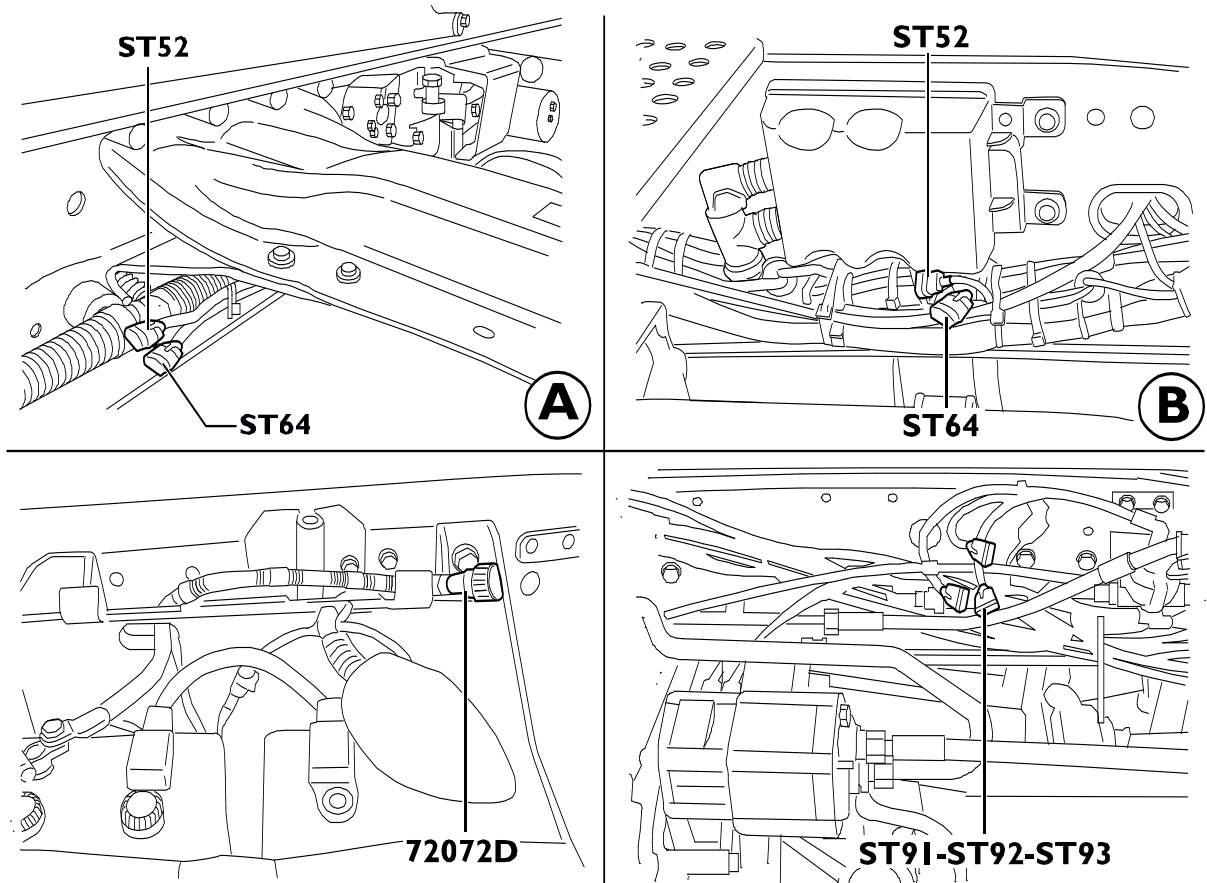
Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	K30	7796	10 A ⁽¹⁾	K30	Protected by fuse 10 A
2	Ground	0000		Ground	
3	CO (CANopen) operational	0975	0.5 A	EM X4-28	LSO (Low Side Output), activated in the case of CO initiated (typically ~3 seconds after K15 ON) for adjustment contact IVECO CS Open circuit = CANopen not operational 0 V = CANopen operational
4	Bodybuilder CAN	CAN H		EM X4-17	CANopen Truckgateway, see CIA 413
5	CAN Gnd	0999		EM X4-09	HF Ground (High Frequency), capacitive coupled
6	Bodybuilder CAN	CAN L		EM X4-19	CANopen Truckgateway, see CIA 413
7	Reserved				
8	Reserved				
9	Reserved				

⁽¹⁾ 10A can be used in combination with "Vehicle CAN fully operational" signal, connector 72072A pin 4**Connectors on frame**

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

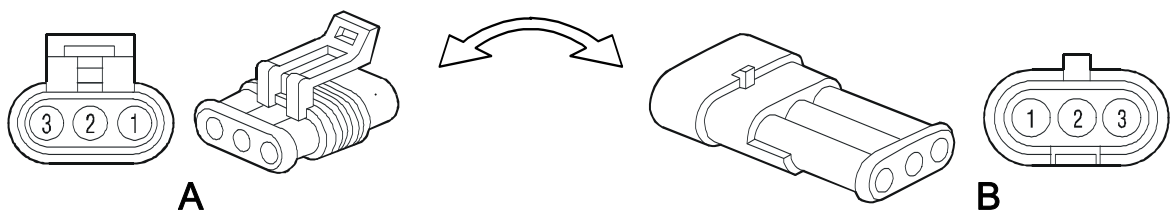


191300 **Figure 18**

A. Truck

B. Tractor

Connectors ST52 and ST64: 3 pin, black



190416 **Figure 19**

A. 98435337 Counterpart to be coupled (female)

B. 98435341 Existing part on vehicle (male)

Basic functions of connector ST52

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Positive +15 for fitters	8871		J1-A02	Also connected to ST64-2
2	Ground	0000		Ground	
3	Side lights	3333		J2-A06	(1)

(1) +24 V when:

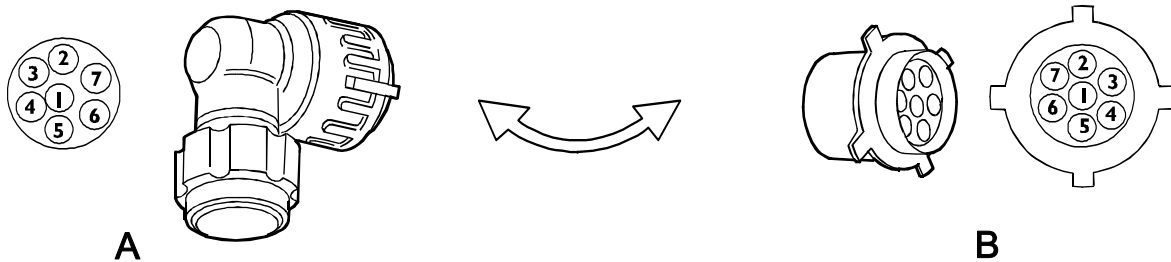
- K15 OFF and side lights on
- K15 ON and side lights on
- K15 ON and lights on (low and/or high beam)

Basic functions of connector ST64

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Trailer socket	8875-1		72010-11	
2	Positive +15 for fitters	8875-2		J1-A02	Also connected to ST52-1
3	Trailer socket	6021		72010-10	

For general use by Bodybuilder: allows the use of 3 terminals of the 15 pole connector for the trailer.

Optional connector 72072D: 7 pin, black



190417

Figure 20

A. 504111928 Counterpart to be coupled (female)

B. 41118387 Existing part on vehicle (male)

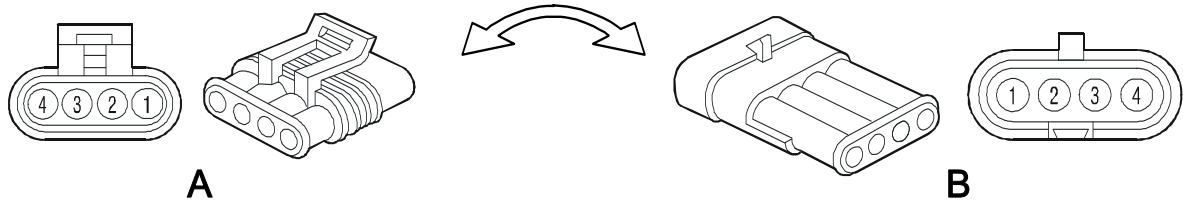
Only available with OPT 0384 (EM-full) installed.

Basic functions of connector 72072D

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	K30	7795	10 A	K30	Protected by fuse 10A (1)
2	Ground	0000		Ground	
3	CO enable (CANopen)	0975	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 CS Open circuit = CANopen not operational 0 V = CANopen operational
4	Bodybuilder CAN	CAN H		EM X4-17	CANopen Truckgateway, see CIA 413
5	CAN line Ground	0999		EM X4-09	HF Ground (High Frequency), capacitive coupled
6	Bodybuilder CAN	CAN L		EM X4-19	CANopen Truckgateway, see CIA 413
7	Reserved				

(1) 10A can be used in combination with K30 on connector ST14A pin 21

Optional connectors ST91, ST92, ST93: 4 pin, black



190418 **Figure 21**

A. 98435337 Counterpart to be coupled (female)

B. 98435341 Existing part on vehicle (male)

Only available with OPT 4572 (EM-light) or OPT 0384 (EM-full) installed.

Basic functions of connector ST91

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	PTO feedback signal	6131	10 mA ⁽¹⁾	EM X3-08	Connect to ground to read PTO feedback signal
2	PTO activation via electromagnetic valve	9131	1.5 A	EM X1-01	OFF = 0V = valve not activated ON = +24V = valve activated Max load in Lite = 2.0 A
3	PTO Press Switch	0391	10 mA ⁽¹⁾	EM X3-11	
4	Ground	0000		Ground	

⁽¹⁾ During K15 OFF phase input will not be activated to avoid increased sleep current.

Basic functions of connector ST92

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	PTO feedback signal	6132	10 mA ⁽¹⁾	EM X3-09	Connect to ground to read PTO feedback signal
2	PTO activation via electromagnetic valve	9132	1.5 A	EM X1-04	OFF = 0V = valve not activated ON = +24V = valve activated Max load in Lite = 2.0 A
3	PTO Press Switch	0392	10 mA ⁽¹⁾	EM X3-12	
4	Ground	0000		Ground	

⁽¹⁾ During K15 OFF phase input will not be activated to avoid increased sleep current.

Basic functions of connector ST93

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	PTO feedback signal	6133	10 mA ⁽¹⁾	EM X3-10	Connect to ground to read PTO feedback signal
2	PTO activation via electromagnetic valve	9123	1.5 A	EM X1-06	OFF= 0V =valve not activated ON = +24V = valve activated Max load in Lite = 2.0 A
3	PTO Press Switch	0393	10 mA ⁽¹⁾	EM X3-16	
4	Ground	0000		Ground	

⁽¹⁾ During K15 OFF phase input will not be activated to avoid increased sleep current.

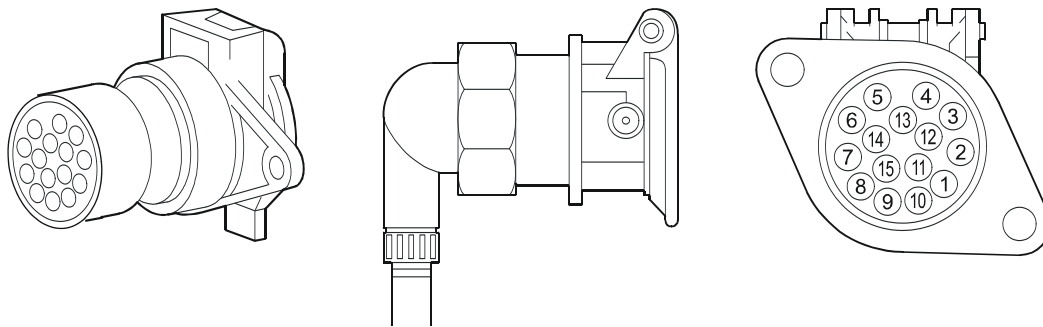
Trailer connectors

Two connectors are provided for connecting the trailer: and 7-pin for vehicles with EBS.

- 15-pin for electrical devices in general, located on the left:
- 7-pin for vehicles with EBS, located on the right:

These are on the rear wall of the cab (tractors) or on the rear cross member of the chassis (trucks).

Trailer connector: 15 pin



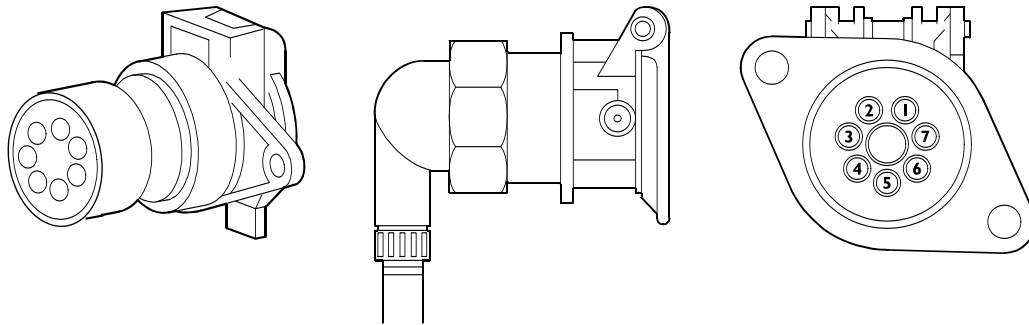
113251

Figure 22

Basic functions of 15 pin connector for connecting to trailer

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Left trailer indicator	1180	6 A	J1-B24	
2	Right trailer indicator	1185	6 A	J1-B07	
3	Trailer rear fog light	2283	6 A	J1-B32	
4	Ground	0000	11 A	Ground	
5	Left trailer clearance light	3339	6 A	J1-A04	
6	Right trailer clearance light	3330	6 A	J1-A03	
7	Trailer stop lights	1179	6 A	J1-A06	
8	Trailer reverse light	2226	6 A	J1-A07	
9	ADR, pin 30	7790	11 A	B LL. 39	if there is no ADR, it remains available for other uses
10	Connected to pin 3 of ST64	6021	11 A	ST64-3	
11	Connected to pin 1 of ST64	8075	11 A	ST64-1	
12	Axle for trailer in raised position	6642	11 A	B LL. 24	
13	Ground	0000	11 A	Ground	
14	CAN H line	WS/BI	11 A	B LL. 36	
15	CAN L line	GN/Ve	11 A	B LL. 35	

Trailer connector: 7 pin



113252 **Figure 23**

Basic functions of 7 pin connector for connecting to trailer

Pin	Description	Wire code	Max. Load	Connected to	Remarks
1	Battery positive connected to fuse for ABS trailer	7772	30 A	70000-5	
2	Ignition operated positive protected by a fuse for ABS/speed limiter	8847	10 A	70404-2	
3	Ground	0000	6 A	Ground	
4	Ground	0000	11 A	Ground	
5	Trailer fault signal	6671	6 A	J6-B10	
6	CAN H line	Bi/Ma	11 A	ST62-2	Connected to EBS control unit
7	CAN L line	Bi/Ve	11 A	ST62-1	Connected to EBS control unit

Fuses

Special fuses are for the exclusive use of the Bodybuilder. Their position is shown in the following table.

Connector	Pin	Maximum load	Location	Description
72072D	1	10 A	70403-2	Battery (24 V) - After TGC (Main Current Contactor)
72072C	1	10 A	70403-1	Battery (24 V) - After TGC (Main Current Contactor)
ST14A	11	3 A	n.a.	K15 (24 V)
ST14A	21	10 A	70401-3	K30 (24 V) - After TGC (Main Current Contactor)

5.3 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 I4569, which consists of:

- a green connector (FMS), housed in one of the DIN coating cases above the windshield;
- a bridle, 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 I4569, 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. I1898 (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 I3", relative to problems on the CAN network, could appear on the tachograph.

5.4 ELECTRICAL CIRCUIT MODIFICATIONS



- ▶ **CAN line wires and electric/electronic devices must not be modified.**



- ▶ **Any modifications on the electrical system will reduce quality and safety characteristics.**



- ▶ **Bodybuilders must use genuine IVECO spare parts if changes to the electrical system are inevitable.**



- **IVECO cannot be liable for system malfunctioning if the instructions contained in this chapter are not followed.**

General information

The instructions provided in Chapter 2.1 - Paragraph "Special precautions" (► Page 5) also refer to Multiplex system wiring.

The connectors and the respective terminals cannot be modified. Avoid connecting and disconnecting the chassis control unit connectors for more than three times to prevent damaging the gel which ensures tightness of the connections.

Wiring harness length

The CAN line and the electrical wires form a single wiring harness. Consequently, it is not possible to replace only the CAN line or the electrical wiring where the electrical system is formed by both types of wires.

The wire length (CAN line + electrical wires) may not be correct when repositioning Multiplex system electronic control units.

1. If the length is excessive, fold the wires without forming rings as this could cause undesired electromagnetic effects. The wiring which is very stiff and for this reason, it must be replaced with shorter wiring when it cannot be folded.
2. If the wiring length is not sufficient it must be replaced.

Only use genuine IVECO spare parts (contact the IVECO service network).



- **The CAN line cannot be changed. All modifications are expressly forbidden.**

IVECO can be consulted in particularly difficult cases by sending a diagram of the chassis dimensions and the new position of the electronic control units.

Disconnecting electronic control units



- **Operations which do not comply with the instructions specified by IVECO or carried out by non qualified personnel can cause severe damage to on-board systems which is not covered by warranty. Driving safety, reliability and good operation of the vehicle could also be affected.**

Follow the instructions below carefully before disconnecting an electronic control unit:

- turn the ignition key to OFF and remove it;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light of the corresponding key will go out);
- open the TGC (Main Current Contactor);
- isolate the battery by disconnecting the battery cables: disconnect the negative terminal first followed by the positive terminal;
- disconnect the control unit.

Repositioning electronic control units

IVECO recommends avoiding modifications which entail the repositioning of the electronic control units. However, if repositioning is unavoidable, follow the instructions below:

- the electronic control units must be positioned on the chassis or in the cab and secured with a fastening similar to the original one (i.e. bracket);
- in order to avoid any malfunctions the electronic control units must not be turned in relation to the chassis and must maintain the original orientation (e.g. to avoid water ingress).
- electronic control units must not be fitted on the counter chassis;
- the cover must always be refitted;
- avoid subjecting electronic control units to knocks from debris and stones from the road when travelling.

5.5 ELECTRICAL SYSTEM: CURRENT INTERVENTIONS AND DRAWS

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 electrical system of the vehicle, refer to the specific workshop manuals, printout 603.95.403 (STRALIS Hi-Way) and printout 603.95.413 (STRALIS Hi-Road and Hi-Street).

These manuals are available through the Assistance Network and can also be requested from sales bodies.

Precautions for work on the system



- ▶ **Interventions on the electrical system (e.g. removal of cables, addition of circuits, replacement of equipment or fuses etc) carried out in a manner which is not compliant with IVECO's instructions or carried out by non qualified personnel, can cause severe damage to on-board systems (control units, wiring, sensors etc), affect driving safety and good operation of the vehicle and cause serious damage to the vehicle (e.g. short circuits with the possibility of fire risk or destruction) which is not covered by warranty.**

Before removing any electrical/electronic equipment, disconnect the ground cable from the battery negative terminal.

To prevent damage to the vehicle's electrical system, follow the instructions of the cable manufacturer. The cables must have suitable sectioning for the type of load and the position of the load in the vehicle;

- The power cables (+ direct) must:
 - be individually intubated in conduits (of suitable diameter) and not together with other different cables for signal and negative;
 - be placed at a distance of at least 100 mm (reference value = 150 mm) from the high heat parts (turbine engine, exhaust manifold, etc.);
 - be placed at least 50 mm from containers of chemical agents (batteries, etc.);
 - be placed at least 50 mm from moving parts.

- The route of the cables should be defined as much as possible by dedicated and closely placed brackets, to avoid dangling parts and provide the possibility (and the obligation) to reconstruct the same installation in the case of repairs or installations.
- The cables must have a suitable sectioning for the type of load and the position of the load in the vehicle.
- The passage of cables in the holes and on the edges of metal sheets must be protected by cable gaskets (in addition to the corrugated tube).
- The corrugated tubing must completely protect the entire cable and be connected (with heat shrinking or taping) to the rubber caps on the terminals. In addition, the clamps of the hose (cut lengthwise) must not be in contact with the sharp edge of the tube.
- All the terminals (+) connection of these cables and their housings must be protected by rubber caps, (hermetic for areas exposed to atmospheric agents or with possible water stagnation).
- 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).

It is always necessary to isolate the battery before performing any work on the electrical system, disconnecting the power cables, the negative terminal first and then the positive.

Use fuses with the prescribed capacity for the specific function, and do not under any circumstances use higher capacity fuses; replace with keys and users disconnected, only after eliminating the problem.

Restore the original conditions of the wiring (paths, protections, strips, completely preventing the cable from coming into contact with the surface of the metal structure that can affect its integrity), if operations have been carried out on the system.

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).

In cases where the application of additional devices requires it, the installation of protective diodes for inductive current spikes must be provided for.

The ground signal from the analogue sensors must be wired exclusively on the specific receiver; additional ground connections may distort the output signal from this sensor.

The cable bundles for low signal intensity electronic components must be arranged parallel to the metal plane of reference, that is adherent to the chassis/cab structure, in order to minimise parasitic capacities; space the path of the cable bundle added to the existing one as much as possible.

The added systems must be connected to the ground of the system with the utmost care (see Paragraph "Ground Points" (► Page 31)); the related wiring harnesses should not be coupled to the electronic circuits that already exist on the vehicle in order to avoid electromagnetic interference.

Ensure that the wiring of the electronic devices (length, type of conductor, dislocation, strips, cable shielding connection, etc.) comply with the original IVECO provision.

Carefully restore the original system after any operations.

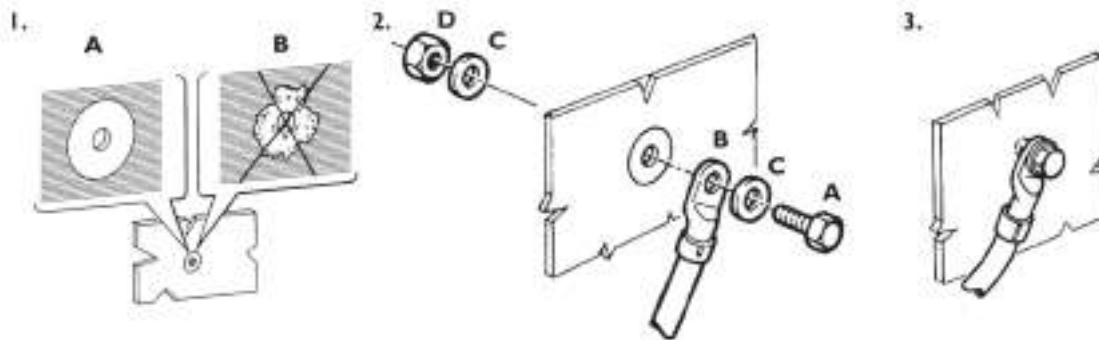
Ground points

In general, original vehicle ground connections are not to be modified; in cases where these connections must be moved or new connections added, use the holes present on the chassis to the extent possible, taking care to:

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

As regards the signal related ground connections (e.g. sensors or low-absorption devices), do not use the standardized points. Under no circumstances use standardized points for engine ground connection and chassis ground connection.

Additional signal grounds must be positioned at different points from the power ground.



191316

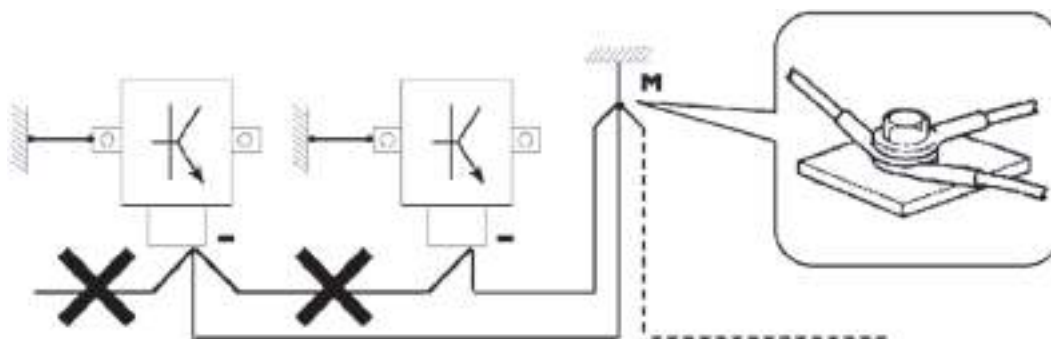
Figure 24

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

The negative leads connected to a ground point in the system must be as short as possible and must be connected to each other in a "star" formation, while tightening must be done in an orderly and adequate manner.

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

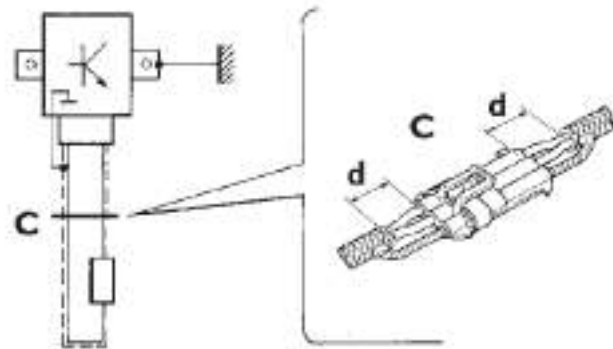
- electronic control units must be connected to the system ground when equipped with metal housings.
- the negative cables of the electronic control units are to be connected to a system ground point, connected to the negative terminal of the battery;
- the analogue grounds (sensors), while not being connected to the system ground/negative terminal of the battery, are to have good conductivity. Consequently, particular care should be given to terminal parasitic resistances: oxidation, scratches, etc.
- the metal braid of the shielded circuits must be in electrical contact only at the control unit side to which the signal is to be sent.
- In the presence of junction connectors the unshielded section *d*, near them, should be as short as possible;
- The cables must be routed in such a way as to be parallel to the reference plane, as close as possible to the chassis/body.



191317

Figure 25

"STELLA" connections of various negatives with the system ground



191318

Figure 26

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 12 V power supplies are given in the following table:

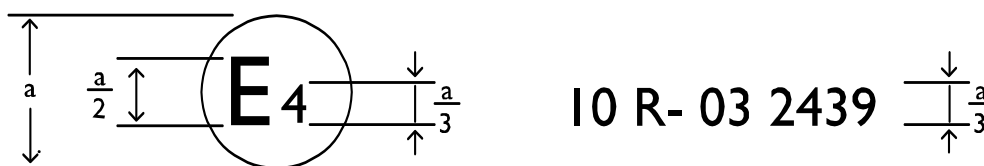
Electromagnetic emission levels

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 IOR3 on electromagnetic compatibility in the automotive field is shown below:



191312

Figure 27

$a \geq 6$ mm

The values in the table are only to be considered respected if the device comes from "IVECO Spare Parts" or it has been certified as per the international standards ISO, CISPR, VDE etc.

Whenever equipment is used which runs on mains power (220 V AC) for its primary or secondary source of power, it must be checked to ensure that its characteristics are in line with IEC regulations.

Reception/transmission systems

The most frequent applications include:

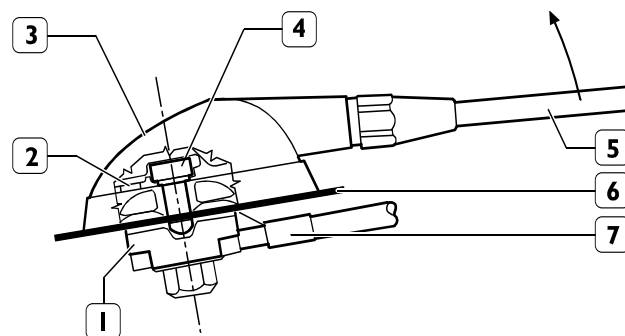
- amateur receiver-transmitter units for CB (City Band) and 2 m bands;
- receiver-transmitter units for cellular telephones and TETRA/TETRAPOL;
- GPS receiver and satellite navigation units.



- **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 5.29);
 - 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 5.28).
Installation on the centre of the roof is to be considered the best by far, as the grounding is proportional in all directions.
Inside the cab, the transmitter equipment must be positioned as shown in Figure 5.29.
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.

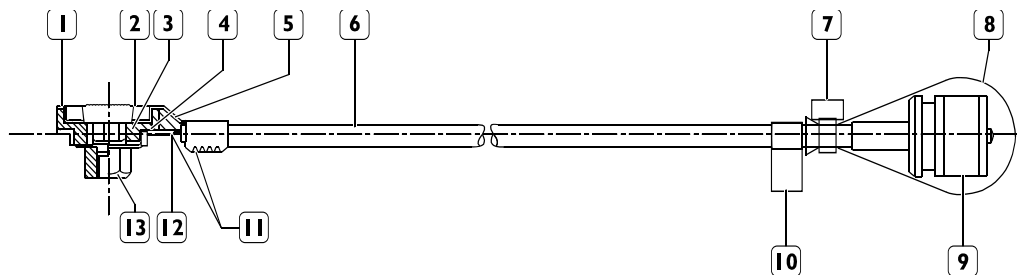


98915

Figure 28

1. Antenna support
2. Gasket
3. Fixed joint cover

4. Fastening screw M6x8.5 (tighten to a tightening torque of 2 Nm)
5. Aerial
6. Roof panel
7. Antenna extension cable



99349

Figure 29

- | | |
|--|--|
| <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 9. Connector (N.C. SO - 239) transceiver 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.

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

Amateur equipment for CB (27 MHz) and 2 m band (144 MHz)

The transmitter part must be installed in a separate area from the vehicle's electrical components; if the transmission is impulsive it must be at a distance of least 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 < 1V/m.
In any case, limits set by the applicable European legislation must never be exceeded.

To determine whether the system is functioning well and to check that the antenna is calibrated, it is suggested that the following information is taken into account:

1. if the ROS (Stationary Wave Ratio) is higher on the lower channels than on the higher ones, the antenna should be lengthened;
2. if the ROS (Stationary Wave Ratio) is higher on the higher channels than on the lower ones, the antenna should be shortened;

After having calibrated the antenna, it is advisable to re-check the ROS (Stationary Wave Ratio) value on all the channels.

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 at least 1 meter away from other devices.

- The ROS value (Stationary Wave Ratio) must be as close as possible to the unit (the recommended value is 1.5), while the maximum acceptable value must never be greater than 2.
- The ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the 380-460 MHz band and 870-960 MHz and 2 dB in the 1710-2000 MHz band.
- The IRRADIATED FIELD in cab value must be as low as possible, and however $< 1\text{V/m}$.
In any case, limits set by the applicable European Directive must never be exceeded.

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

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 ± 1.023 MHz).
- the ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value to the order of 1.5 dB in the 1575.42 ± 1.023 MHz band.

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.

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 thermal motor 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.

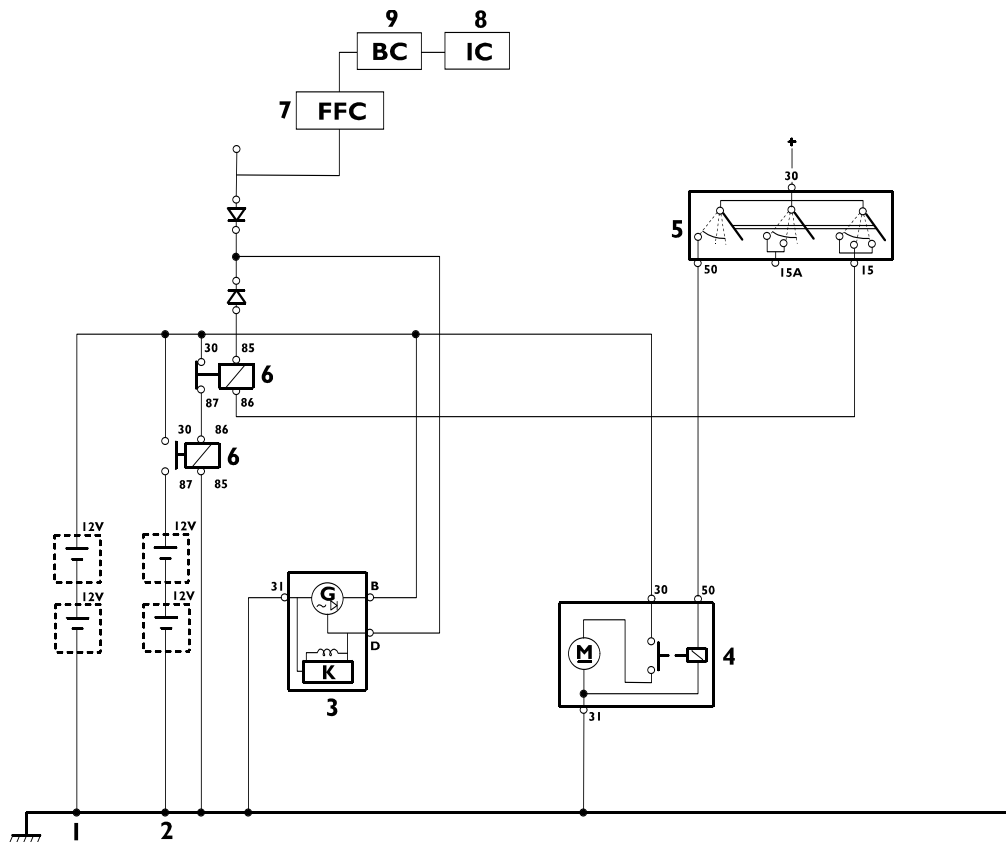
If type 2 batteries are used, it is necessary to use batteries equipped with:

- 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 is to be made using a cable of adequate section, as short as possible.**



117409

Figure 30

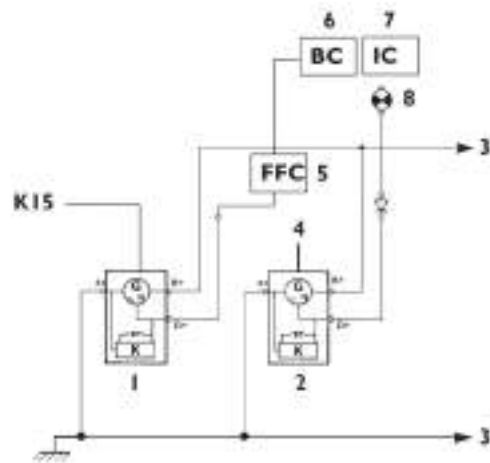
- 1. Standard batteries
- 2. Additional batteries
- 3. Alternator with built-in regulator
- 4. Starter motor
- 5. Ignition switch
- 6. Contactor switches
- 7. Front Frame Computer
- 8. Instrument panel
- 9. Body Computer



► **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.



191320

Figure 31

1. Standard alternator
2. Supplementary alternator
3. To the batteries
4. Signal K15 from connector ST14A/pin 11

5. Front Frame Computer
6. Body Computer
7. Instrument panel
8. 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

Special care must be given when installing cooling units that use a second alternator, mounted on the engine (extra 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.

Drawing current

On Stralis it is forbidden to connect additional electrical systems directly to the positive battery; the positive pole is occupied by the cables going to the fuse box located on the side of the battery casing.

The fuse holder must not be changed or moved.

Current draws are possible from the general switch (standard equipment) or the TGC main current contactor (if installed).

General battery switch

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.

Specific solutions must be authorised by IVECO.

Note *It is permissible to connect in parallel with the output of the diverter (max 100 A).*

Main power contactor (option)

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.



- ▶ **Before drawing any current, read Chapter 5.2 carefully. The drawn current may not exceed the maximum load value as indicated in the Chapter.**
-

Voltage reducer

The electrical system of the vehicle is prepared for the power supply of 12V devices. In the cab there is a connection with a voltage reducer (from 24 V a 12 V).

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.**
-

On the chassis



- ▶ **It is not possible to draw current from the bulkhead connector below the grille nor is it possible to disconnect or modify the terminals used.**
-

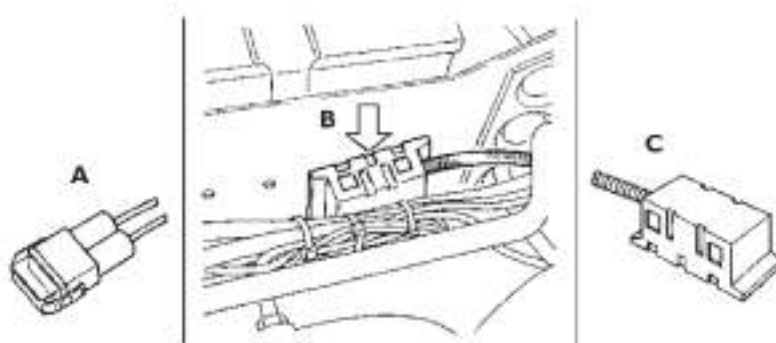


- ▶ **Operations which do not comply with the instructions specified by IVECO or carried out by non qualified personnel can cause severe damage to on-board systems, affect driving safety, reliability and good operation of the vehicle and cause considerable damage which is not covered by warranty.**
-

Maxifuse and Megafuse fuses

At IVECO Shop there are five fuse holder kits available, to protect high absorption draws.

Their positioning (always as close as possible to the draw terminal on the batteries), will be made by the bodybuilder depending on the space available on the vehicle.



191313

Figure 32

- A. Maxifuse
B. Battery case

- C. Megafuse

Maxifuse

Capacity	Reference number of IVECO electrical kit accessories	Fusebox body design number	Cable cross-section
KIT 40 A	4104 0110 KZ	500317518	10 mm ²
KIT 60 A	4104 0111 KZ	500317518	10 mm ²

Megafuse

Capacity	Reference number of IVECO electrical kit accessories	Fusebox body design number	Cable cross-section
KIT 100 A	4104 0112 KZ	500315861	25 mm ²
KIT 125 A	4104 0113 KZ	500315861	35 mm ²
KIT 100 A	4104 0114 KZ	500315861	50 mm ²

The fuse must be fastened to the chassis with a tightening torque of 2 ± 0.2 Nm.

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).

Whenever 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:

Use cables and fuses in accordance with the current draw:

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

⁽¹⁾ For uses of more than 30 seconds.

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



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

Precautions

- Incorrect installation of electrical accessories may affect occupant safety and cause severe damage to the vehicle. Contact IVECO if you have any questions.
- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).
It should be noted that when grouping several cables together, in order to compensate for 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.**

Modifying wheelbase and overhang

Should it be necessary to lengthen the wires on the chassis owing to the new dimensions of wheelbase and overhang, a watertight junction box must be used which has the same characteristics as those used on the standard vehicle. The electrical components used such as wires, connectors, terminal blocks, conduits etc. must be of the same type as those used originally and must be correctly fitted.

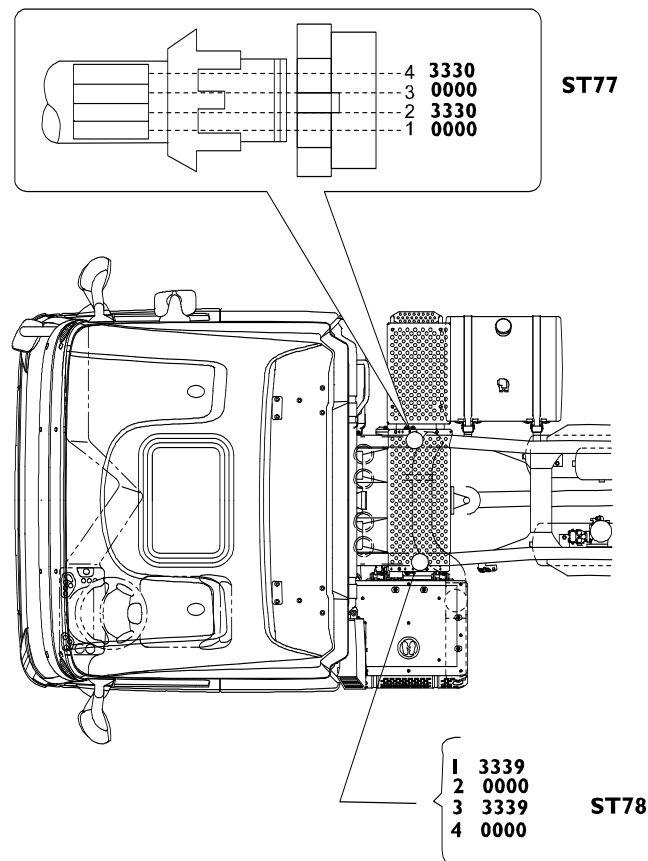
Side Marker Lamp installation

EC regulations require that vehicles are provided with side and clearance lights when the total length exceeds 6 m.

The installation of side marker lights must be carried out on the added structures (containers, van conversions etc), while electrical power supply must be provided by the specific connectors ST77 and ST78 on the frame.

Below is an illustration of the position for these terminals.

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



195917

Figure 33

Side light connectors

Connector on the vehicle	Interface to be used	
9843 5343 Female connector	9843 5339 Male connector	No. 1

Connector on the vehicle	Interface to be used	
	9844 7233 Half shell	No. 1
	9843 5370 Cable terminal	No. 6
	486 1936 Gasket	No. 6

SECTION 6

**SPECIAL INSTRUCTIONS
FOR SCR EXHAUST SYSTEM**

Index

6.1	GENERAL INFORMATION	5
6.2	THE NITROGEN OXIDE CATALYTIC REDUCTION PRINCIPLE	5
6.3	INSTRUCTIONS	6
	Interventions on AdBlue tank	6
	Moving AdBlue system components	8
	Operations on pipes for AdBlue and heating water	10

SPECIAL INSTRUCTIONS FOR SCR EXHAUST SYSTEM

6.1 GENERAL INFORMATION

To comply with Euro VI requirements on engine gas emissions, Iveco has developed the "Hi-e SCR" (High-efficiency Selective Catalytic Reduction) system, consisting of the combined action of a diesel particulate filter (DPF) and post-treatment of exhaust gases (SCR).

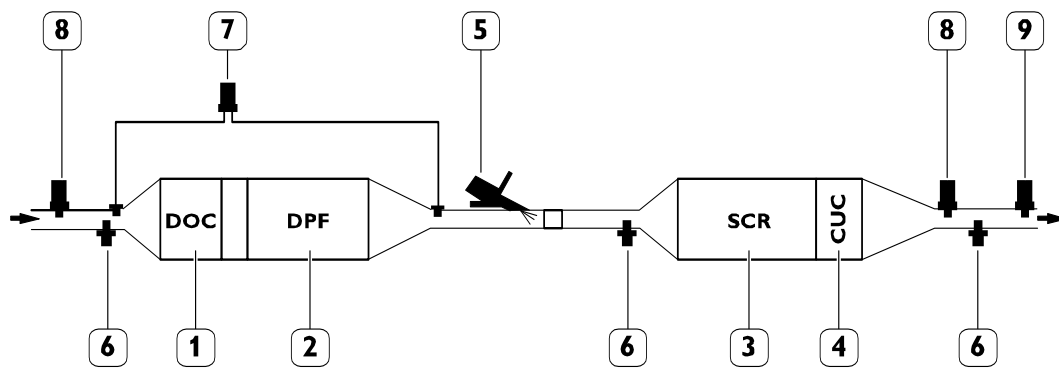
This post-treatment requires the use of an additive, commercially known as AdBlue (urea solution+water).

6.2 THE NITROGEN OXIDE CATALYTIC REDUCTION PRINCIPLE

The additive AdBlue, is sent from a dedicated reservoir 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



189102

Figure 1

- | | |
|-----------------------|---------------------------|
| 1. DOC | 6. Temperature sensors |
| 2. DPF | 7. DPF Δp sensors |
| 3. SCR | 8. NO_x sensors |
| 4. CUC | 9. NH_3 Sensor |
| 5. DM (Dosing Module) | |

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

The following instructions are intended for the AdBlue injection system of the Bosch Denoxtronic 2.2 type.

If changes are made to the chassis which involve this system, the following procedure must be followed under all circumstances:

- all post-treatment components must be installed under extremely clean conditions;
- the protection caps of the SM, DM and the AdBlue pipe bundle may only be removed just before assembly;
- the SM and DM fittings must be handled with care;
- the SM and DM fastening screws must be tightened to the torque specified in the relevant assembly diagrams;
- the following disassembly/assembly sequence on the SM and DM must be respected so as to prevent the AdBlue coming into contact with the electrical connectors:
(disassembly) AdBlue fittings - water fittings - electrical connectors
(assembly) electrical connectors - water fittings - AdBlue fittings;
- the seal of the DM flange on the ATS side must be replaced each time the DM is disassembled (the seal may only be used once);
- the "after-run" phase must not be interrupted using the battery manual switch or the ADR switch (the AdBlue pipes must always be emptied to prevent any crystallization or damage from freezing);
- the DM screw threads must be treated with a sealant paste as specified on the assembly diagrams however, the DM and the inside of the exhaust silencer must not be contaminated with the sealant.

Interventions on AdBlue tank

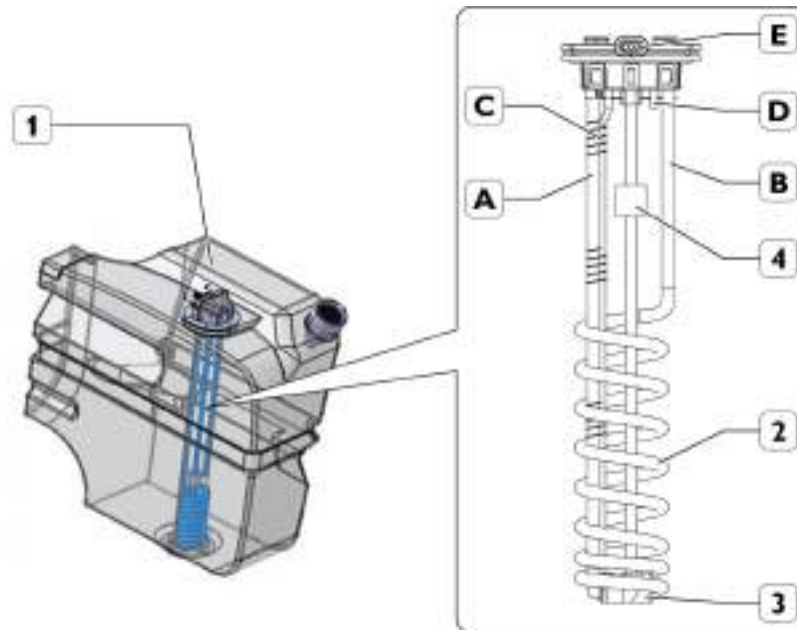
Note *The level sensor is specific to the type of tank to which it is connected. Therefore, the tank and sensor cannot be modified independently of each other.*

Use a standard tank in order to respect the constraints highlighted in the **Note**.

50, 60, 80 and 135 litres tanks are available depending on the required capacity.

If necessary, a smaller 30 litre tank is available from the Eurocargo range. However, this tank does require the detection system of the quantity of liquid present to be specifically adapted.

Since the AdBlue solution may be corrosive to steel alloys, any specifically shaped tanks must be made out of polyethylene or stainless steel (code I.4571 - I.4541 - I.4112 - I.4310 - standard DIN 17440).

AdBlue tank

189103

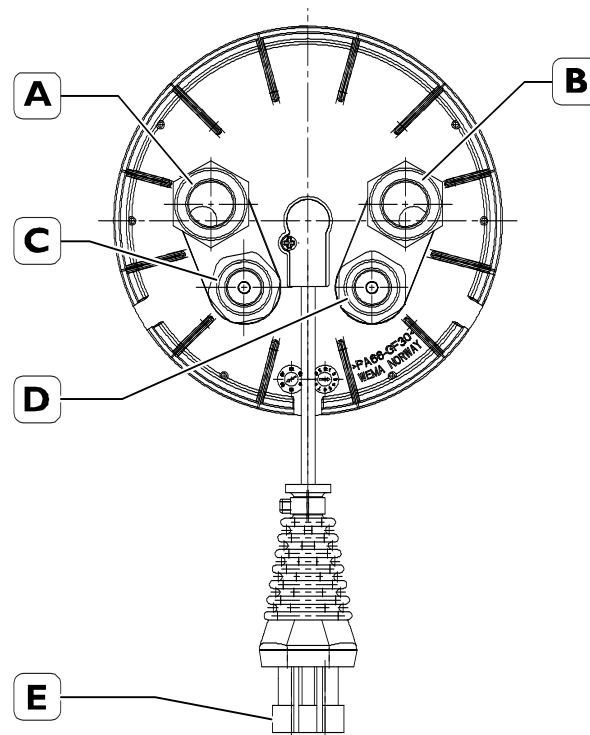
Figure 2

- A. Water inlet pipe
- B. Water outlet pipe
- C. AdBlue delivery pipe
- D. AdBlue return pipe
- E. Electrical connector

- 1. AdBlue tank
- 2. Heating coil
- 3. AdBlue temperature sensor
- 4. Float

At the end of any operations which involve the AdBlue tank, make sure that:

- the tank ventilation pipe is not closed;
- the tank contains at least 5 litres of AdBlue to ensure the dosing module is cooled;
- the tank does not contain more than 85% of AdBlue (corresponding to the maximum reading of the level sensor) with respect to the tank total volume, so as to guarantee enough room for AdBlue to expand during freezing at temperatures below $-11\text{ }^{\circ}\text{C}$.

Fittings on the AdBlue tank

189104

Figure 3

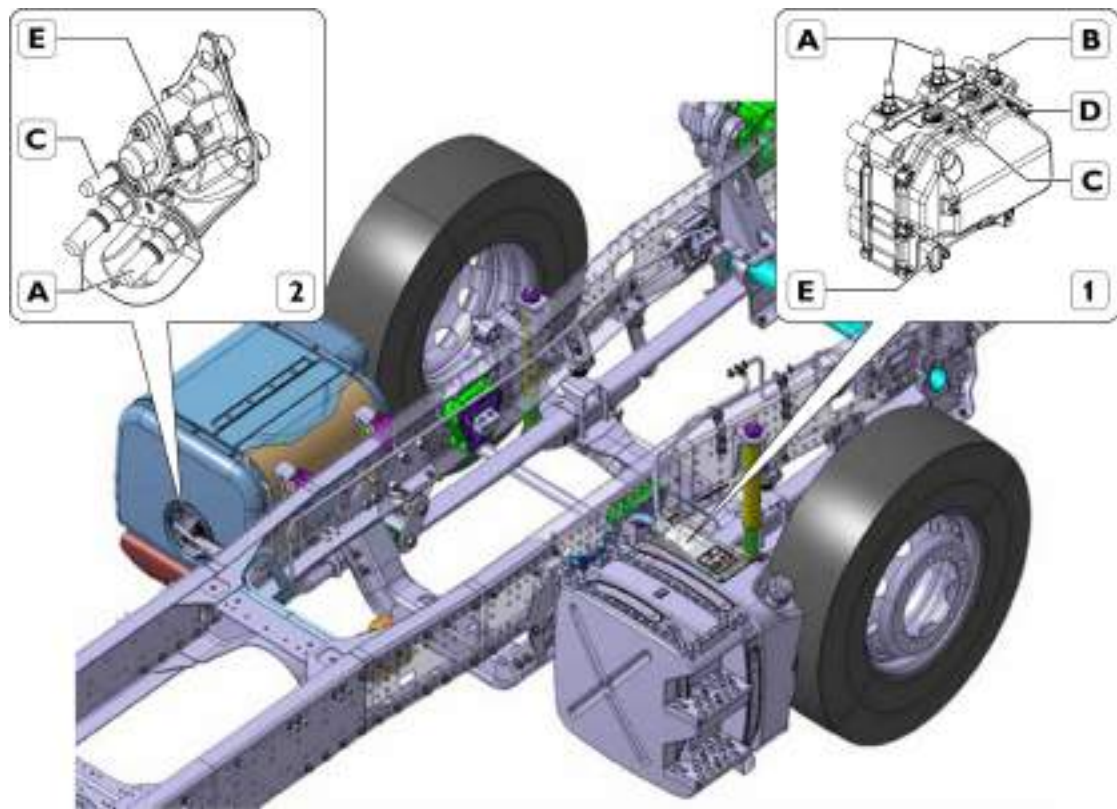
- A. Water inlet fitting
- B. Water outlet fitting
- C. AdBlue delivery union

- D. AdBlue return union
- E. Electrical connector

Moving AdBlue system components

In order to comply with Euro VI requirements, the positioning of the main components of the AdBlue tank has been optimised.

In particular, the SM and the DM have been inserted into the AdBlue tank and silencer respectively (see figure below), giving benefits in terms of space and reduced length of pipes (better pressure stability)



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Figure 4

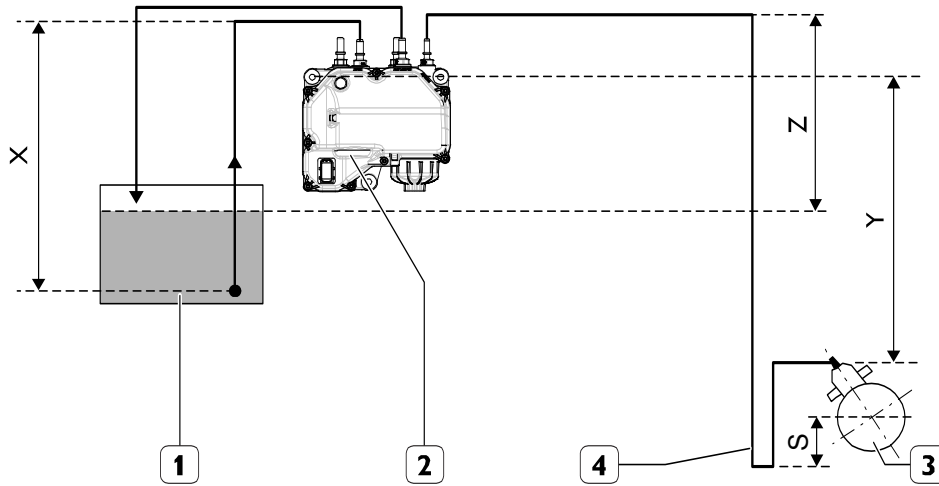
1. Pumping module (SM)
2. Dosing module (DM)

- A. Water inlet/outlet fittings
- B. AdBlue pressure line fitting
- C. AdBlue delivery union
- D. AdBlue return union
- E. Electrical connector

If for outfitting needs it is necessary to move one or both of these assemblies, this must be done making sure that the installation heights of the SM, DM and piping respect the conditions illustrated in the following figure.

In this diagram it can be seen that the pipes provide an adequate siphoning system in order to prevent any damage occurring following should the AdBlue freeze.

The siphon should have an internal collection volume of 12 cm³ and is to be located below the reference distance of the DM (for example S = 10 mm).



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Figure 5

1. AdBlue tank
2. Pump module
3. Dosing module
4. Siphon

- $X < 1$ metre
 $Y < 1$ metre
 $Z > 0$
 $S > 0$

Always pay close attention to protecting the sensor in the case of exposure the heat, water or stones.

With regards to the electrical wiring please note that:

- it is only possible to lengthen cables for the temperature sensors
- it is not possible to alter the length of the NO_x sensor cable.

Operations on pipes for AdBlue and heating water

No folding of the pipes is allowed; only operations to lengthen and shorten the pipes are allowed.

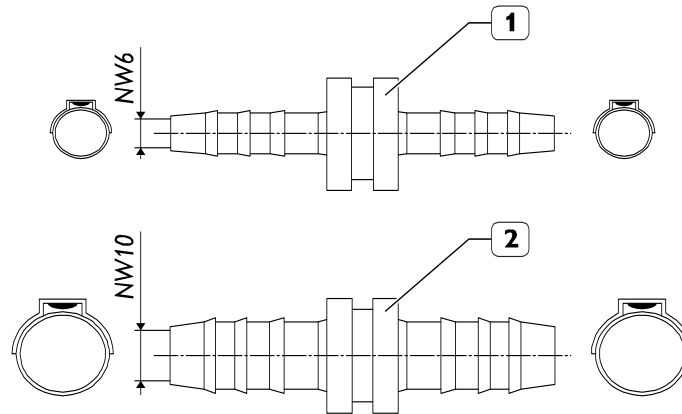
Note In order to limit the loss of load, only one lengthened stretch is allowed per pipe. The maximum permitted length for the pipes between the pumping module and the dosing module is 3 metres.

The pipes may be modified using specific equipment and fittings; for the most appropriate choice and to obtain them, please contact IVECO Customer Service.

To change the length of the pipes, (ref 8.8x1.4 - PAWD- 0.2 mm - PA/PUR for AdBlue and ref. 13x1.5 - PA12PHL-Y -TFT for water) it is necessary to:

- have the specific fittings of the type indicated in the following Figure;

Pipe fittings



189107 **Figure 6**

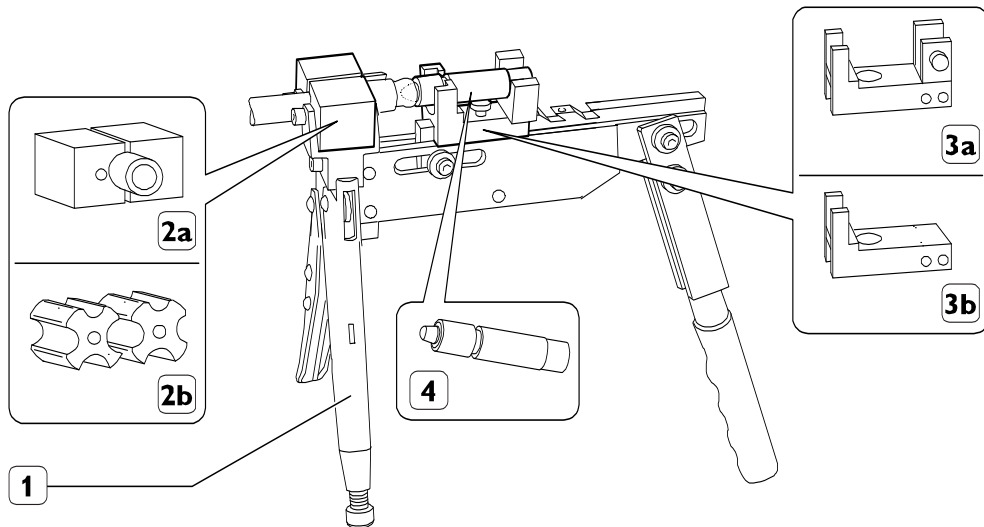
- 1. NW6 fitting (Part 41283741) for AdBlue pipes
- 2. Fitting NW10 (Part 41283747) for water pipes

- mark the delivery and return pipes before separating them to ensure there is no confusion during subsequent reassembly;
- cut the pipes with the appropriate pipe cutting clippers in order to ensure an accurate cutting area;
- insert the fittings into the cut parts of the pipe making use of specific tools (pliers, drift, spindle to enlarge the pipe and collar. See following Figure).



► **It is compulsory to work in a completely dust-free environment to prevent dust from reaching the injectors and subsequently clogging them.**

Pipe assembly tools



189108 **Figure 7**

- 1. Plastic pipe mounting pliers (Part 99387101)
- 2a. Clamping jaws for AdBlue pipe (Part 99387102)
- 2b. Clamping jaws for water pipes (Dis. 99387103)
- 3a. Support for fitting NW6 for AdBlue pipes (Part. 99387104)
- 3b. Support for fitting NW10 for water pipes (Part. 99387105)
- 4. Pipe widening spindle for AdBlue pipes (Part 99387106)

