STRALIS AS/AT/AD
EURO 4/5

BODYBUILDERS INSTRUCTIONS

HEAVY RANGE

IVECO

EDITION 2008

euro4
euro5

Publication Edited by:
Technical Application
Strada delle Cascinette, 424/34
10156 Turin - Italy

Publication Nr. 603.93.721 - 2nd Edition
Printed in Italy - 01/08

Produced by:

SATIZ

B.U. TECHNICAL PUBLISHING
Iveco Technical Publications
Lungo Stura Lazio, 15/19
10156 Turin - Italy

STRALIS AS/AT/AD EURO 4/5

Bodybuilders instructions
Print 603.93.721 - 2nd edition
Base - January 2008

UPDATE DATA

Section	Description	Page	Revision date
2	Frame	Paragraph 2.16 moved to chapter 5	January 2008
3	Structures	3-34: paragraph added 3.5.4.3	January 2008
4	Power take-off	Full overhaul chapters 4.6 and 4.7	January 2008
4	Power take-off	4-17: Control unit added Expansion Module (EM) (*)	January 2008
5	Electronic subsystems	5-4: Cab Module (CM) integrated in the Body Computer (BC) (*)	January 2008
5	Electronic subsystems	5-8,5-9: connectors ST14A e ST14B	January 2008
5	Electronic subsystems	5-40: note added to paragraph 5.4.8	January 2008
6	Exhaust systems with SCR	Chapters 6.6 and 6.7 added. Full overhaul chapter 6.5	January 2008

(*) Specific parts only for OBD1 Phase 2.

NOTE The eighth digit of the PIC (Product Identification Code) indicates STEP 2 of the vehicle:

3 - 4 - C - B	**Stralis AS**
3 - 4 - C	**Stralis AT/AD**

Update data

Update data

Foreword

This manual contains instructions and data for fitting body structures/ancillaries and Vehicle modifications and is intended for skilled and qualified personnel.

The bodybuilder is responsible for the design and fitting and any modifications necessary for the installation. The bodybuilder must ensure full compliance with the requirements set out in this manual and with national and international regulations (Construction and Use, and EEC Standards) in force.

Before starting any work make sure you are working form the latest Iveco Bodybuilders Instruction manual for the model. Make sure that all safety equipment e.g. eye protection, hard hat, shoe, gloves etc are used. Check that all mechanical equipment e.g. lifts and handling gear is in good working order and is used. Finally work on the vehicle in good conditions and ensure maximum safety at all times.

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

For installations / modifications and general information not covered by this manual contact **Iveco.**

On completion of the installation e.g. body, crane, wheelbase modification the vehicle and systems **must** be checked to ensure vehicle operation and safety is as designed by Iveco and has not been compromised. If a vehicle system needs to be set up i.e. engine control for PTO installation then contact your local Iveco Service Department.

IVECO shafl not be responsible for any change, modification or fittings concerning the vehicle.

Due to continuing vehicle improvements and changes in regulations which cover or affect the vehicle, the information in this publication may not always be up to date.

If the bodybuilder has any queries regarding the information contained in this manual regarding the vehicle that is to be worked on he should contact Iveco thbiveco@iveco.com **before** starting.

Symbols - Warnings

Danger to people:

failure to fully comply with these precautions can involve serious danger for personal safety.

Danger of serious damage to the vehicle

Partial or complete non observance of these precautions can cause serious damage to the vehicle and invalidate the Iveco warranty.

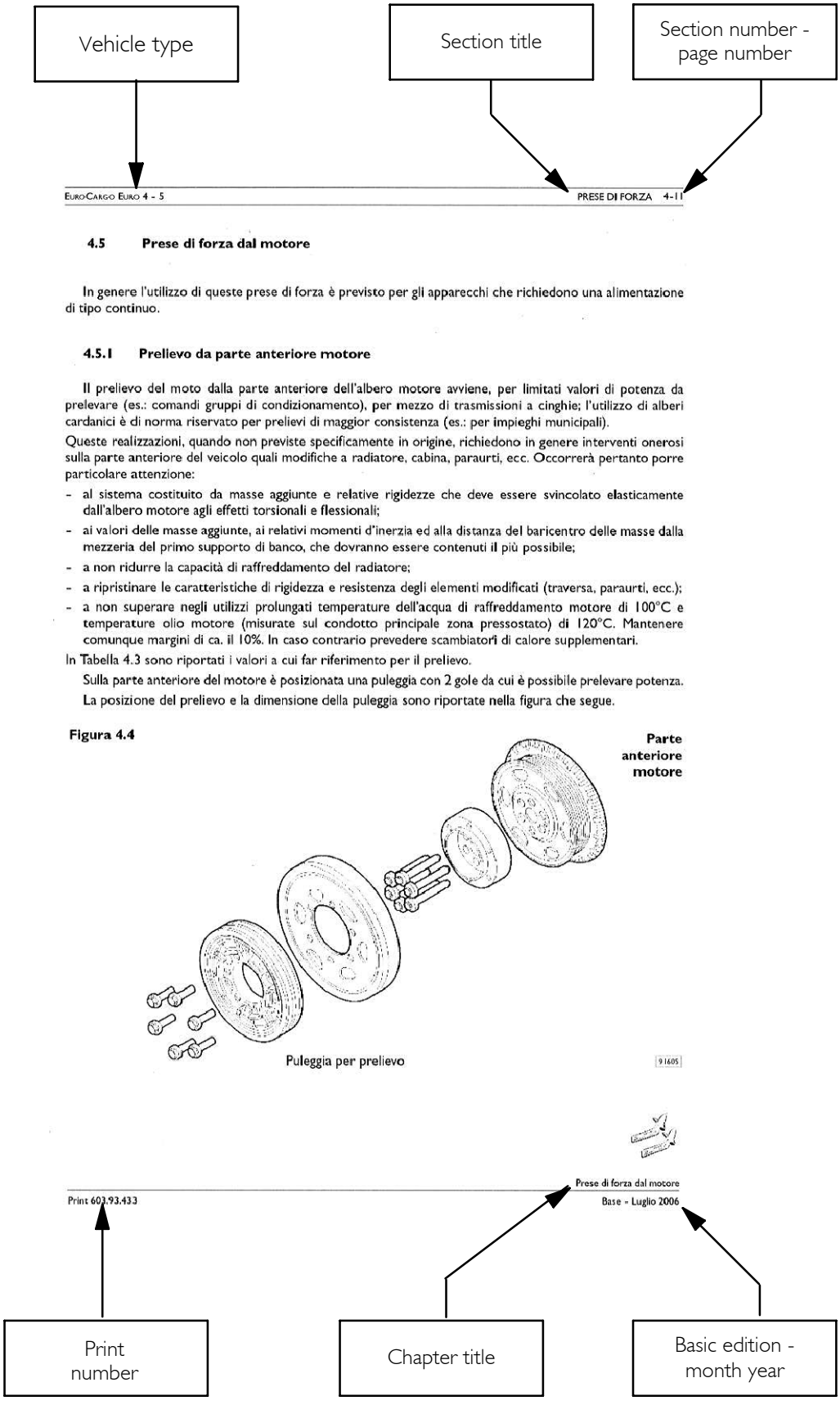
Warning / Precaution:

failure to fully comply with these precautions can result in serious danger to personal safety and damage to the vehicle with the loss of the vehicle warranty.

This indicates the correct use of materials in order to make the vehicle as environmentally friendly as possible.

NOTE Indicates additional information.

Page header and footer interpretation



INDEX OF SECTION

Index of section

Index of section

SECTION 1

General specifications

1.1 Aim of bodybuilders instructions

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

1.2 IVECO "no objection" for changes and fittings

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

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

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

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

Aim of bodybuilders instructions

1.3 Liabilities

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

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

1.4 Guarantees

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

- these specifications have not been adhered to or where unauthorised equipment was installed, or unauthorised modifications were carried out;
- an unsuitable vehicle/model has been used for the required conversion or application;
- the specifications, standards or instructions issued by the Manufacturer for the flawless execution of the operations have not been followed;
- original spare parts or components which IVECO has made available for specific conversions were not used.

Maintaining the functionality of vehicle components.
The effective operation of vehicle components, all component safety and running conditions, compliance with national and international regulations (e.g. EC Directives) and accident prevention standards must be guaranteed in all permitted conversions and applications.
All our vehicles are covered by a warranty as laid down in the specific documents.
The bodybuilder must carry out operations at least in an equivalent manner.

1.5 Request for a “no objection”

The requests for approval or support to carry out work or make modifications or fittings shall be forwarded to the IVECO marketing offices in charge.
To obtain the approval, the body builder shall provide adequate documents that illustrate the anticipated implementation, utilization and conditions of use on the vehicle. The drawings shall highlight any item differing from the instructions contained in this manual.
The body builder shall submit the modification and/or fitting to the competent authorities for approval.

Liabilities

1.6 IVECO technical documents available by means of computer

The following technical documents are available on the Internet at www.thbiveco.com:

- bodybuilder instruction manuals;
- specification sheets;
- chassis cab diagrams in .dwg and tiff formats;
- chassis diagrams in tiff formats;
- other specifications concerning the vehicle range.

1.7 Trademarks and Logos

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

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

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

Instruction for added assemblies

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

1.8 Legal Provisions

On completing the vehicle, the bodybuilder/chassis converter must check the work (modifications, body + equipment etc.) to ensure that the legal provisions required in the country of registration are observed (e.g. weights, dimensions, braking, noise, emissions etc.). Information regarding these matters may be obtained from the competent Authorities or the IVECO Area Network.

The vehicles manufactured at our plant (except some versions for Extra-European countries) comply with the EC directives. Converted vehicles must also comply with these directives. The only permissible exception is granted where local type approval differs from EC homologation.

1.9 Prevention of accidents

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

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

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

They should be removed before working with welding equipment and flames.

1.10 Choice of material to use: Ecology - Recycling

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

In this connection:

- everyone must be aware of the prohibitions on using harmful or potentially hazardous materials, such as ones containing asbestos, lead, halogen additives, fluorocarbons, cadmium, mercury, hexavalent chrome, etc.
- Use materials whose processing produces limited waste and that permit easy recycling after their first use.
- With composite synthetic materials, use components that are compatible with each other, envisaging also their possible utilization with the addition of other salvaged components. Affix the markings required in compliance with the current regulations.

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

Prevention of accidents

1.11 Vehicle delivery

Prior to delivering the vehicle, the body builder shall:

- verify that the work has been made correctly;
- perform vehicle and/or equipment set-up;
- check the operation and safety of the vehicle and/or equipment;
- prepare and deliver the necessary instructions for service and maintenance of the fitting and any additional units to the end customer;
- write the new data down on the special tags;
- confirm that the work carried out complies with the indications provided by the vehicle manufacturer and with all legal requirements;
- carry out the checks included in the "IVECO Pre-Delivery inspection" list (available from the IVECO network) with regard to the items affected by the work done;
- provide a guarantee for the modifications made;
- in the event that the connections originally provided with screws have been mounted and restored, the same screws must not be used. In such an instance, and in the event that rivets have been replaced with screws, you must again check the tightness of the connection after travelling approximately 500-1000 km, to ensure it is to the correct torque.
- measure the battery voltage. Ensure there is a minimum charge of 12.5 V. If the voltage reading is between 12.1 and 12.49 V, recharge the battery (slow charge). If the voltage is less than 12.1 V, the battery must be scrapped and replaced with a new one.

Vehicle delivery

1.12 Vehicles identification

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

	Cab Range		**Model**				**Power**		**Version**		Suspension		
CAB VERSIONS	**A**	**S**	**2**	**6**	**0**	**S**	**4**	**2**	**Y**		**/**	**P**	**S**
TRACTOR	**A**	**S**	**4**	**4**	**0**	**S**	**4**	**5**	**T**	**X**	**/**	**P**	
	AS AD AT		PTT-Cab versions (n°/10 → hung in ton) PTC-Tractors (with semitrailers) (n°/10 → hung in ton)			STRALIS	Engine power (n° x 10 → HP)		T X Y Z		/TN /P /PT /PS /FP /FS		
EXTERNAL NAMEPLATE ON VEHICLE													

CAB RANGE

AS = Active Space
AT = Active Time
AD = Active Day

VERSION

T = Tractor
X = 6x2C
Y = 6x2P
(Z= 6x4)

MISSION

GV = Bulky Goods transport
CM = Mobile Boxes
LT = Low Tractor
RR = Rough Roads
HM = Heavy Mission
D = Delivery
CT = With Transporter
HR = Hub Reduction

SUSPENSION

/TN = 6x2P, mechanics with third fixed axle to twinned wheels
/P = 4x2, 6x4, 6x2P, air suspension at rear. 6x2P with single wheels fixed third axle
/PT = Only for 6x2P, air suspension at rear with twin wheels fixed third axle
/PS = Only for 6x2P, air suspension at rear with single wheels third axle, controlled steering
/FP = 4x2, 6x4, 6x2P, full air
/FS = Only for 6x2P full air with single wheels third axle, controlled steering

Vehicles identification

1.13 Dimensions and weights

1.13.1 General Specifications

The dimensions and maximum permissible weight on the axles are indicated on drawings, on technical specifications and, in greater details, on the official documentation issued by IVECO.

The kerb weights refer to vehicles with standard equipment. Special equipment may involve considerable modification to the weight and its distribution on the axles.

Lights and rear-view mirrors positioning on our vehicles is designed for widths of 2,550 mm. This dimension may also be applied to special body versions with a width of 2,600 mm (e.g. refrigerator vans).

Weighing the Chassis

As a result of production factors there may be a variation in weight of approx. 5%.

It is, therefore, advisable to determine the weight of the vehicle with its cab before fitting the body and equipment and establishing their distribution on the axles.

1.13.2 Determining the Centre of Gravity of the Body and Payload

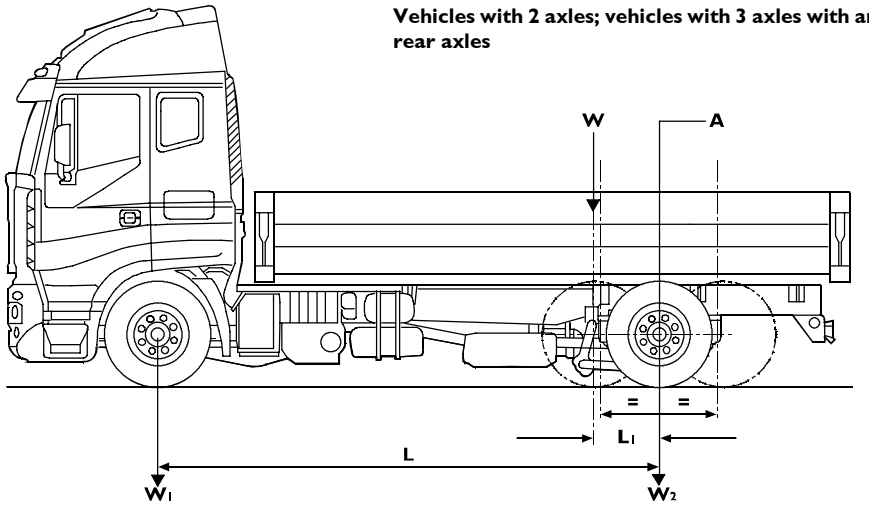
Positioning on longitudinal plane

To establish the location of the centre of gravity of the body and payload the following examples below may be used as guidelines.

The technical documentation specific to each model (chassis cab drawing) give the positions permitted with the vehicle in its standard form. The weight and positioning of the single components of the vehicle are given in the chassis and weight distribution diagram.

Figure 1.1

Vehicles with 2 axles; vehicles with 3 axles with an equal load on the two rear axles



Example to determine the position of the centre of gravity of the payload plus body

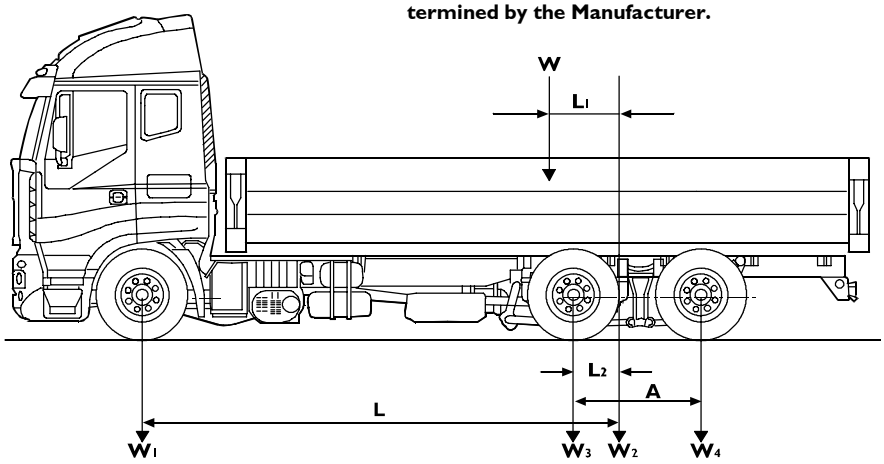
A = Rear axle or tandem mid axle
W = Payload + body
W_1 = Share of payload on front axle
W_2 = Share of payload on rear axle (or tandem)
L_1 = Distance of centre of gravity from centre-line of rear axle (or tandem centre-line)
L = Actual wheelbase

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

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

Figure 1.2

Vehicles with 3 or more axles with a constant mass distribution ratio on the two rear axles. For these vehicles the "ideal" values of the wheelbase and centreline between the axles, resulting from mass distribution, is determined by the Manufacturer.



Example to verify compliance of admitted weight on the axles

W = Payload + body
W_1 = Share of payload on front axle
W_2 = Share of payload on rear axles
W_3 = Share of payload on first rear axle
W_4 = Share of payload on second rear axle
L_1 = Distance of centre of gravity relative calculated centreline
L = Calculated wheelbase (ideal)
L_2 = Calculated centreline (ideal)
A = Distance between rear axles

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

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

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

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

Attention:
On vehicles with three or more axles, with a variable mass distribution ratio on the two rear axles depending on the load, the "ideal" values of wheelbase and centreline between the axles will have to be calculated on the basis of the information given in the chassis cab diagram, or in the specific documentation specially prepared by IVECO. In this way, for special versions (e.g. cranes on rear overhang) it will be possible to determine the correct positioning of the centre of gravity of the equipment and payload on the basis of the actual load (see point 5.4 in section 5).

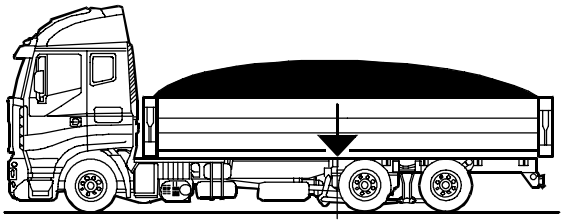
In order to apportion the payload on the axles, it must be uniformly distributed except when the shape of the loading surface itself entails a different distribution of the load.

As for equipment, the actual location of the centre of gravity is used.

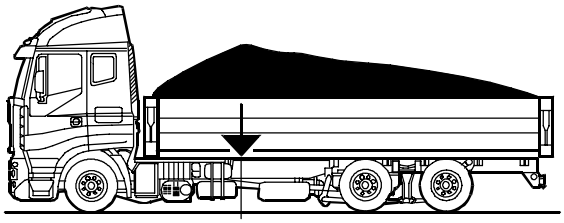
When building bodies or containers, loading and unloading systems for the transported goods must be devised which preclude excessive variations in the distribution of the load and/or excessive loads on the axles, also giving the relevant instructions to the users.

The bodybuilder will also need to install suitable payload securing systems on the body so that transport can be made with the utmost safety.

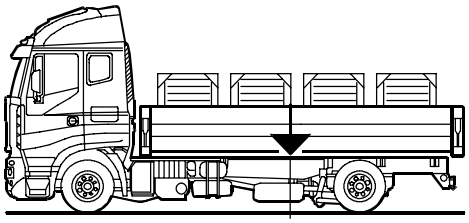
Figure 1.3



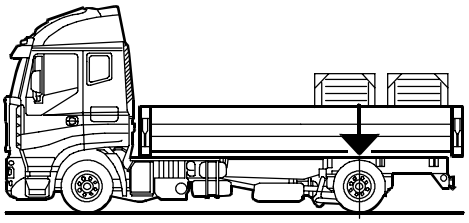
Uniform distribution of the load



Non-uniform distribution of the load due to the lack of rear overhang



Uniform distribution of the load



Non-uniform distribution of th e load (beware of load on axles and minimum ratio)

Height of the Centre of Gravity

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

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

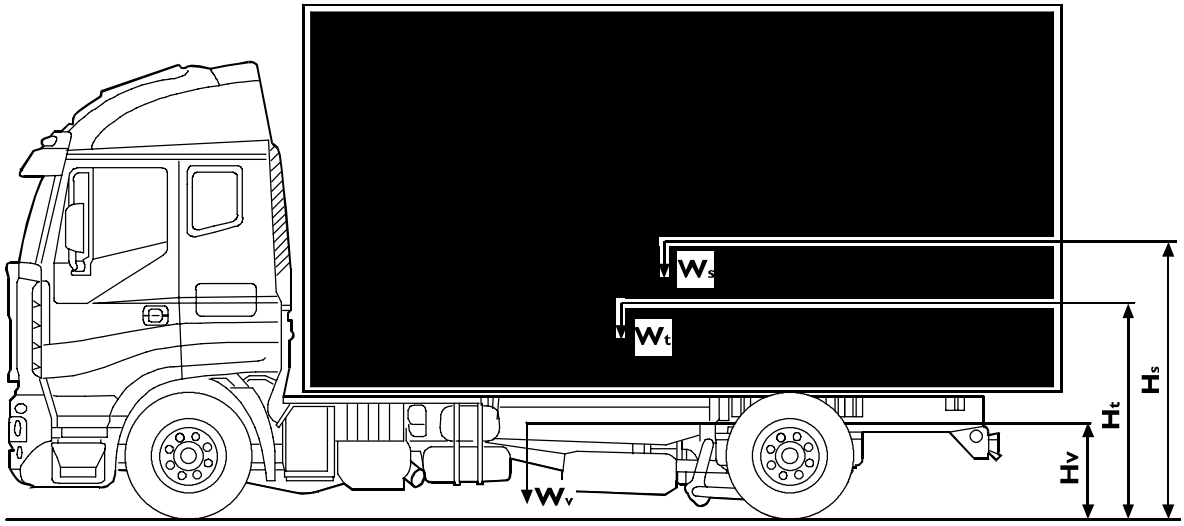
These limits are defined in compliance with the national or international regulations (e.g. as amended by the current EC braking Directive) or requested by the Manufacturer to ensure good handling of the vehicle (e.g. transverse stability of the moving vehicle).

In order to comply with the current EC Directive, IVECO provides information for the various models (wheelbase and specific body) on computer, regarding:

- height of centre of gravity of chassis cab (e.g. chassis cab diagram, braking data);
- maximum height of centre of gravity of complete vehicle at full load (e.g. national type-approval document);
- braking capacity of each single axle (e.g. braking data).

Figure 1.4

Verification with full load:



$$Ht = \frac{Wv \cdot Hv + Ws \cdot Hs}{Wv + Ws} \qquad Hs = \frac{(Wv + Ws) \cdot Ht - Wv \cdot Hv}{Ws}$$

Wv = Chassis cab vehicle kerb weight
Hv = Height of centre of gravity of chassis cab vehicle (laden condition)
Ws = Body and payload
Hs = Height of centre of gravity of body and payload in relation to ground
Wt = Vehicle weight when fully loaded
Ht = Height of centre of gravity of vehicle fully laden to gvw

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

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

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

Using Stabiliser Bars

Supplementary stabilising or anti-roll bars, where available, spring reinforcements or the application of rubber components (in compliance with point 2.7) may increase the height of the centre of gravity of the payload which must be defined as each occasion arises. The modification must be carried out after careful consideration has been given to the specifications of the version, to the wheelbase and to the distribution of the cross-stresses acting on the suspension both at the front and at the rear of the vehicle. It must be borne in mind that it is often advisable to modify the rear axle only since a modified front axle would give the driver a false sense of stability making it more difficult to perceive the safety limits. Modification to the front axle may be made where the load is positioned behind the cab (e.g. crane) or where the superstructures are very rigid (e.g. van conversion).

Exceeding the Limits

When transporting goods with an exceptionally high centre of gravity (e.g. machinery, indivisible cargo etc.) from a technical point of view it is possible to exceed the values indicated in the table provided that the steering system of the vehicle is suitably adapted to this condition (e.g. reduced speed, gradual changes on the steering wheel, etc.).

1.13.3 Observing the Permitted Weights

All limits indicated in our documentation must be adhered to. The load of the front axle is of particular importance under varying load conditions, in order to ensure the correct steering characteristics on road surfaces of all types.

Particular attention must therefore be paid to vehicles with a weight which is concentrated on the rear overhang (e.g. cranes, tail-lifts, centre axle trailers) and to vehicles with a short wheelbase and a high centre of gravity (e.g. silo vehicles, cement mixers).

When positioning the body and equipment, the loads must be correctly distributed transversally. For each wheel a variation in the rated load (1/2 of the axial load) of 4% is permitted (e.g. admitted load on axle: 10,000 kg load admitted on each wheel: 4,800 to 5,200 kg) provided that the tyres permit it, without impairing braking or driving stability.

For vehicles with an added rear lift axle it must be remembered that, with the axle in the raised position, the effective wheelbase is reduced, whereas the rear overhang is increased. It is therefore advisable that the centre of gravity of the body and payload is located in front of the centre line of the driving axle. In addition to this it is not advisable to equip a vehicle which has its load concentrated at the rear, with a lifting device.
Apart from different specifications for specific individual vehicles, the following may be taken to be the minimum values for the front axle:

- 20% of the total vehicle weight with uniformly distributed loads
- 25% of the total vehicle weight for loads that are concentrated on the rear overhang.

The rear overhang of the body must be built in strict observance of the permitted axle loads, the limitations in length, the positioning of the tow hook and of the underride guard stipulated by the relevant regulations and legal requirements.

Variations in the Permissible weight

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

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

A reduction in admissible vehicle load (downrating) may require modifications on some parts, such as the suspension. In these circumstances, the necessary information may be supplied.

The request for authorisation must include:

- Vehicle type, wheelbase, identification number, designated use.
- Weight distribution on the axles (e.g. vehicles equipped with crane and body) including positions of the centre of gravity of the payload.
- Proposals concerning the reinforcement of the vehicle components where necessary.

Dimensions and weights

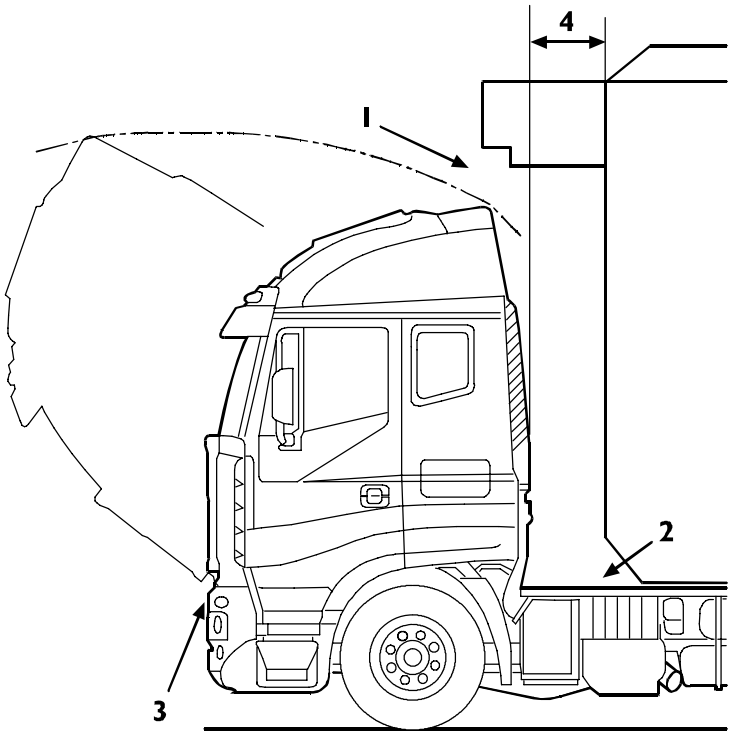
1.14 Instructions for the Correct Functioning of the Parts of the Vehicle and Accessibility for Maintenance

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

For example:

- Ready access to all parts requiring inspection or maintenance and periodic servicing must be provided. In the case of closed body types suitable opening doors must be provided.
- For tilting cabs, adequate space permitting tilting must be assured. In the case of structures which involve the space above the driver's cab, adequate space for the passage of intake air must be guaranteed (see 1.5).

Figure 1.5



1. Retain adequate room for tilting the driver's cab - 2. Retain the free space above the gearbox (for tractors with semitrailers consider the movement between tractor and semitrailer) - 3. Cab pivot point - 4. Min. distance to be met

- Service access to chassis/driveline components must be retained. For instance repairing the gearbox or clutch must be possible without necessitating the removal of major components of the added structure.
- The cooling system (radiator cowling, radiator, air passages, cooling circuit etc.), fuel supply (pump position, filters, pipe diameter, etc.) and the engine air intake must not be altered.
- The anti-noise panels must not be altered or moved in order to prevent changes in the approved noise levels of the vehicle. Should it be necessary to make openings (e.g. for the longitudinal runner of the body to pass through) these must be properly closed off using material with inflammability and soundproofing characteristics equivalent to those used originally.

- Adequate ventilation of the brakes and battery case (especially in the case of box bodies) must be guaranteed.
- The positioning of the mud-guards and wheel-arches must allow free movement of the rear wheels even when chains are being used. Sufficient space must also be ensured with lifting axles. Some of our models have 3rd axle steering which also steers in the raised position; and it is necessary to leave space for this function (see point 2.20).
- When the vehicle has been set up, for safety reasons, headlight attitude must be checked and adjusted as necessary. Perform the adjustment according to the instructions provided in the user and maintenance manual.
- In the case of parts which are supplied loose (e.g. spare wheel, chocks) it will be the responsibility of the bodybuilder to position and secure them in an accessible and safe manner in compliance with possible national regulations.

1.15 Quality System management

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

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

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

- organization charts for functions and responsibilities.
- Quality System.
- quality goals.
- technical design documentation.
- process and control phases with relevant resources.
- product improvement plan, obtained also with corrective actions.
- after sales service.
- staff training.
- manufacturer liability documentation.

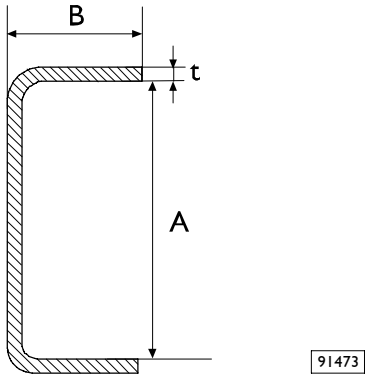
1.16 Vehicle maintenance

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

1.17 Conventions

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

Figure 1.6



Convention

SECTION 2

Chassis modifications

Index

2.1 General instructions for chassis modifications

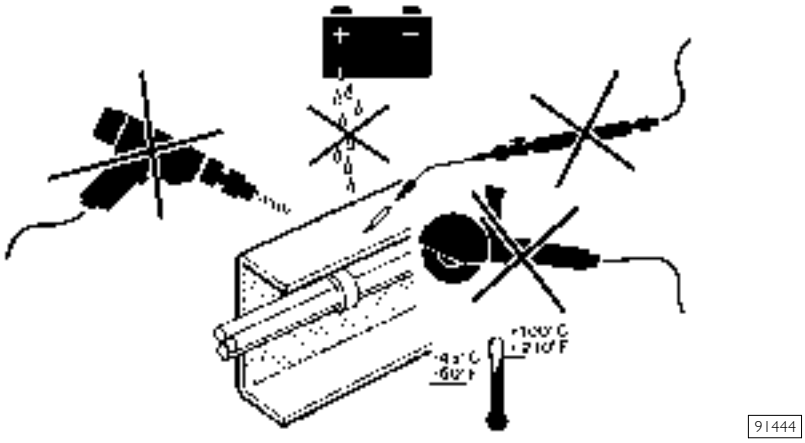
Particular attention must be given to the following points:

- **Welding to the bearing structures of the chassis is explicitly prohibited** (with the exception of the items described at points 2.3.4, 2.4 e 2.5).
- **Holes in the flanges of the side members are not permitted** (except for the items described at point 3.4).
- Where riveted connections exist and can be modified as explained below, these can be replaced by flanged-head screws and nuts of min. class 8.8 or by hex screws of the next greater diameter and self locking nuts. Screws greater than M14 must not be used (max. diameter of hole 15 mm) unless otherwise specified.
- In cases where the original joints were detached and rejoined with bolts it is forbidden to reuse the same bolts. In this event and when rivets are replaced with bolts, the bolt torque must be checked after the vehicle has been driven approximately 500 ÷ 1.000 kms.

2.1.1 Specific Precautions

During welding, drilling, grinding and cutting operations near brake system pipes, and electrical cables, adopt the appropriate precautions for their protection. Remove them altogether if necessary (observe the requirements set out under points 2.15.2 and 5.5).

Figure 2.1



Take precautions concerning the alternator and the electrical/electronic components

In order to avoid damaging the diode rectifier, never disconnect the batteries (or open the isolator) when the engine is running. If the vehicle has to be tow started make certain that the batteries are connected. Should it be necessary to charge the batteries, disconnect them from the vehicle circuit.
In order to run the engine with external means and in order to avoid current peaks which might damage the electric/electronic components, do not use the "start" function in conjunction with external charge devices if such devices are equipped with this function. Starting will have to be carried out only with the external battery trolley ensuring correct polarity.

Earth connections

As a general rule the original earth connections of the vehicle must not be changed. If it is necessary to move these connections or to implement further earth points use the existing holes on the chassis as far as possible and:

- Remove, mechanically, and/or with an appropriate chemical product, the paint on the chassis side and on the terminal side creating a resting plane free from indentations or ridges.
- Apply appropriate high conductivity paint between the cable terminal and the metal surface (e.g. galvanizing paint IVECO Part number 459622 by PPG).
- Connect the earth cables within 5 minutes from the application of the paint.

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

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

Electric wiring

Stralis vehicles are equipped with an innovative electronic system called MUX. Before performing any operation on the electrical system, read section 5 "Special instructions for electronic subsystems".

For further information regarding the braking and electronic system, refer to point 2.15 and 5.5.

List of technical guidelines and standards for correct installation of electrical cables in vehicle electronic systems

Power cables (+ direct type) must be fed on their own into corrugated piping (of appropriate diameter) and not together with other smaller cables (signal and negative cables); they must be spaced a minimum distance of 100 mm apart (reference value = 150 mm) from high heat sources (engine turbine, exhaust manifold, etc., ...). and a distance of at least 50 mm must be maintained from chemical agent containers (batteries, etc.).

This rule also applies to the area around moving parts.

Cables that run through perforated or angled panels must be protected by screw-on adaptors for cables (in addition to the corrugated pipe).

The corrugated pipe must wrap fully around the entire cable and must be secured with a heat-shrink sleeve or using adhesive tape to the plastic terminal caps. Collars securing the corrugated pipe cut along their length must not deform the pipe, otherwise the cables could be laid bare or come into contact with the sharp corners of the corrugated pipe.

All connection terminals (+) of the above cables and also their terminals must be covered with plastic caps waterproof version, at all points exposed to atmospheric ingress or where water builds up.

The fastening of the terminal on the clamps (including the earth clamps) must be protected against accidental loosening. For this reason, it is necessary to apply an appropriate tightening torque if possible. In the case of multiple terminal connections, these must be in a star configuration (but this connection method should be avoided if possible).

The relevant cable route must be supported by fastenings and collars spaced close together to prevent hanging cables. After repair, outfitting or conversion work, restore the wiring harness to its original condition.

When connecting the frame and the tipper cab, check the wiring with the cab raised and tipped to detect and correct any abrasions or tautness of the cables.

General instructions for chassis modifications

2.2 Painting and Rust Protection

2.2.1 Original components

Table 2.1 shows the protection and painting classes required for original vehicle components. Table 2.2 shows classes for unpainted or aluminium parts and Table 2.3 shows classes for painted parts.

Table 2.1 - Protection classes as for STD 18 - 1600 (Schedule I)

Class	Features of the part	Examples of the type of part
A	Parts in direct contact with atmospheric agents	Cab, rear view mirrors, cab fixing components
B	Parts in direct contact with atmospheric agents with mostly structural characteristics, directly visible	Chassis and related parts, including fixing. Components and parts under the hood
BI		Rear and front axles
C	Parts in direct contact with atmospheric agents, not directly visible	Engine and related parts
D	Parts not in direct contact with atmospheric agents	Pedals, seat frames, fixing components, internal cab pillars

Table 2.2 - Various unpainted and/or aluminium parts and components

Material	Type of protection		Class					
			A		B - BI		C	D
Stainless steel	-		yes		-		-	-
Ferrous	chemical coating		DAC 500/8/PL GEO 321/8/PL (*) GEO 321/8/PM (*)	(1)	DAC 320/5 GEO 321/5 (*) GEO 500/5 (*)	(1)	- - -	- - -
	FE/ZN 12 III	(2)	-		-		yes	yes
	FE/ZN 12 IV (*) Zinc treatment	(2)	-		-		yes	yes
	FE/ZN 12 V	(2)	-		yes		-	-
	FE/ZN 12 IV S (*)	(2)	-		yes		-	-
Aluminium	Anodizing		yes		yes		yes	yes
	Painting		yes		-		-	-

(*) Hexavalent chromium-free

(1) I.S. 18-1101

(2) I.S. 18-1102

Painting and Rust Protection

Table 2.3 - Painted parts as for STD 18 - 1600 (Schedule III)

Description of the cycle phase		Classes				
		A	B (5)	B1	C	D
Mechanical surface cleaning (including the removal of burrs / rust and cleaning of modified parts)	Sand blasting	-	yes •	-	yes •	yes •
	Brushing	yes •				
	Sanding					
Pre-treatment	Degreasing	-	-	-	yes •	yes •
	Phosphate degreasing					
	Phosphating of the heavy iron		yes •			
	Phosphating of the zinc	yes				
Cataphoretic treatment	High thickness (30-40 µm)	yes (1)	yes (4) •	-	yes (6) •	yes •
	Low thickness (15-25 µm)	yes (2)				
	Acrylic to finish (>35 µm)	-				
Anti-rust	Bicomponent (30-40 µm)	-	yes (7)	-		
	Monocomponent (30-40 µm)		-	yes		
Chip-resistant base	Mono (130 °C) or bicomponent (30-40 µm)	yes (2)	-	-	-	-
Paint	Mono (130 °C) or bicomponent (30-40 µm)	yes	yes •	-	yes •	yes •
	Powders (50-60 µm)	yes (3)	yes			
	Monocomponent at low temperature (30-40 µm)	-	-	yes		

(1) = Cycle for two-coat preparation.
(2) = Cycle for three-coat preparation.
(3) = Alternative to the mono or bicomponent paint, only for cab parts (windscreen wipers, rear view mirrors, etc.)
(4) = Excluding parts that cannot be immersed in pre-treatment and paint baths, due to their geometry (air tanks), their large size (castings) or where this would compromise their functionality (mechanical parts).
(5) = For ferrous steel or pre-coated fuel tanks, refer to Table 2.2.
(6) = Only parts fitted on the engine.
(7) = Parts that cannot be treated cataphoretically (4).
• = Alternative products and cycles for the same class, as long as they are compatible with the part being treated.

NOTE All components installed on chassis must be painted as per Sta Iveco 18-1600 Colour IC444RAL 7021 brightness 70/80 gloss.

2.2.2 Added or modified painted parts

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

There must be no unprotected areas on ferrous materials.

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

Never use powder enamels directly after degreasing.

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

Table 2.4 - Added or modified painted parts

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

(1) = Modifications to rear axles, front axles and engine (Classes B1 and C) are not allowed.
(2) = Preferably epoxy.
(3) = Preferably polyurethane.

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

Material	Type of protection	Class	
		A - B (1)	D
Stainless steel		yes	-
Ferrous	chemical coating		-
	Zinc treatment	-	yes
Aluminium	Anodizing	yes	yes
	Painting	-	-

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

2.2.3 Precautions

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

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

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

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

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

Ensure that the disc brakes are adequately protected.

The electronic components and modules must be removed.

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

2.2.4 Max indicative height of center of gravity of payload in relation to transverse stability 1)

Table 2.6

Models	Base equipment with anti roll bars				Max indicative height of center of gravity (including body or equipment) in relation to the ground (mm)
	Front		Rear		
	1	2	1	2	
AS/AD/AT 190	×		×		2720
AS/AD/AT 190/P	×		×		2750
AS/AD/AT 260 Y/TN	×		×		2740
AS/AD/AT 260 Y/P, Y/PS	×		×	×	2720
AS/AD/AT 260Z/P	×		×	×	2830
AS/AD/AT 260/P	×		×	×	2720

Notes:
1) = Values refer to the transverse stability of the vehicle, to hold present eventual other limitations takes from the national and international regulations in force (es. braking)
x = with standard anti-roll bar
- = without anti-roll bar
SW = to request roll bar

2.3 Drilling the Chassis

When it is necessary to mount assemblies or auxiliary units on the chassis, as a general rule, the existing holes made at the factory should be used.

Under no circumstances should the flanges of the supporting member of the vehicle be drilled unless in compliance with the indications given in point 3.3.1.

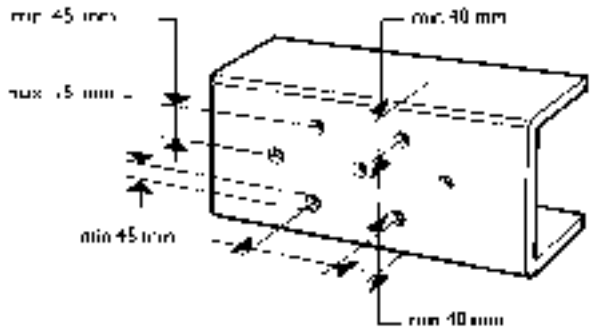
In those cases (installation of shelves, brackets etc.) where it is necessary to drill new holes, they must be drilled on the vertical web of the side member and must be carefully deburred and reamed.

Position and Size

The new holes must not be made in areas of high stress (such as supports for springs) and at variance with the cross-section of the side member.

The diameter of the holes must be proportional to the thickness of the steel. Under no circumstances must this exceed 15 mm unless otherwise specified. The distance from the centre of the hole to the edges of the side member must not be below 40 mm. The centres of the holes must never be located at a distance of less than 45 mm from each other or in relation to the existing holes. The holes must be staggered as shown in Figure 2.2. When moving spring support or crossmembers, the same drilling arrangement must be used always maintain the original boring.

Figure 2.2



91445

2.3.1 Screws and nuts

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

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

Drilling the Chassis

Table 2.7 - Classes of resistance for screws

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

(*) Do not use

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

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

Should it not be possible to source materials of the thickness indicated, the next greater thickness may be used (e.g. 1 mm instead of 6.1 mm).

Table 2.8 - Material to be used to modify the chassis

Steel name		Tensile strength (N/mm^2)	Yield point (N/mm^2)	A5 elongation
IVECO	FeE490	610	490	19%
Europe	S500MC			
Germany	QStE500TM			

Alternatively, just for rear overhang extension.

IVECO	Fe510D	520	360	22%
Europe	S355J2G3			
Germany	QSt52-3N			
UK	BS50D			

Drilling the Chassis

Table 2.9 - Chassis section dimension and thickness

Model	Wheelbase (mm)	AxBxt longitudinal pitch section(See Figure 1.6)
AD/AT/AS 190	Up to 6300	289/199x80x6,7
AS260/FP/FS	Up to 5100+1395	289/199x80x6,7
AS260 S/PT	Only 5700, 6050	289x80x7.7
AS260 (6X4)	4500	289x80x7.7

IVECO recommends the following chassis extension pieces, available from the Spare Part Division are used for chassis extensions.

2.3.3 Stresses on the chassis

Do not exceed the following stress values under static conditions:

Table 2.10

Range	Permitted static stress on the chassis (N/mm^2) σ amm.	
	On road	Off-road use
Stralis	150	100

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

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

Drilling the Chassis

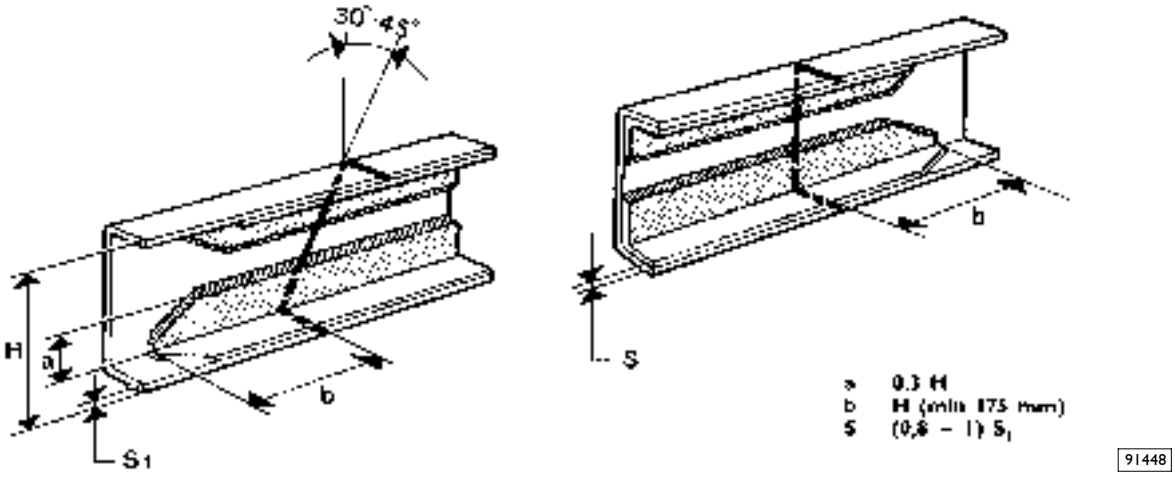
2.3.4 Welding the Chassis

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

Welding is permitted:

- When joining the sidemembers to extend or shorten the wheelbase or rear overhang.
- For the application of reinforcing L section flitch on a side member that is to be modified as detailed below (v. Figure 2.3).

Figure 2.3



When arc welding, the instructions below must be followed in order to protect electric units and ECUs:

- before disconnecting power cables, check to ensure all electrical items are switched off;
- where an electric switch is installed (battery isolation switch) wait for cycle end;
- disconnect negative power pole;
- disconnect positive power pole without connecting it to ground and DO NOT short circuit it with negative pole;
- disconnect ECUs connectors, carefully and do not touch ECU connector pins;
- when welding within the electronic control devices, disconnect them from the vehicle;
- connect welding machine ground directly to the part to be welded;
- protect plastic pipes against heat sources and remove, if necessary;
- if welding near leaf springs or air springs protect against welding spatters;
- avoid electrode or gun contact with spring leaves;

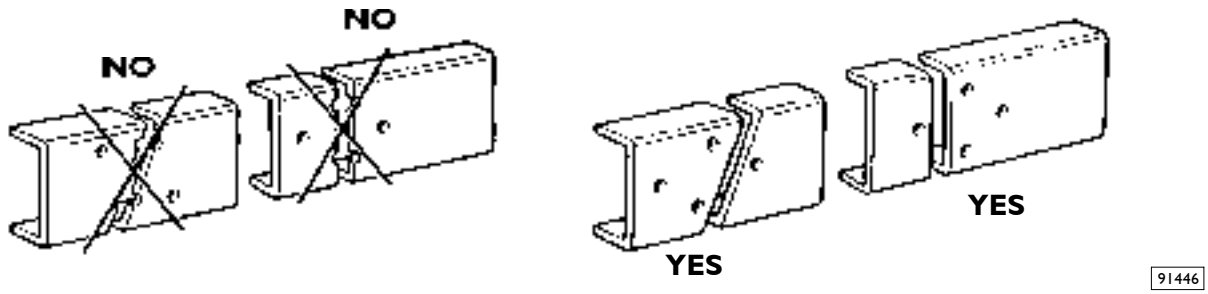
Drilling the Chassis

Operations for welding preparation

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

a) Cut the side members with a diagonal or vertical cut. (We recommend that the diagonal cut be used particularly for the section between the wheelbase) Cuts are not permitted in areas in which the profile of the side member as well as the chassis width change or in those where there is a high concentration of stresses (e.g. spring brackets). The cuts must not be made through the holes present in the side member (see Figure 2.4).

Figure 2.4



b) On the inner side of the side member give the parts that are to be joined a V-shaped chamfer of 60° along the entire length to be welded (see Figure 2.5).

c) Arc weld in stretches using carefully dried basic electrodes. The recommended electrodes are:
For S 500 MC (FeE490: QStE 500TM)
Diameter of the electrode is 2.5 mm, current intensity approx. 90A (max. 40A for each millimetre of diameter of the electrode).
Using MIG-MAG welding use a welding rod with the same characteristics as the material to be welded (diameter 1 to 1.2 mm).
Recommended welding rod: DIN 8559 - SG3 M2 5243
gas DIN 32526-M21 or DIN EN 439
If FeE490 is used at very low temperatures, we recommend:
PrEN 440 G7 AWS A 5.28 - ER 80S - Ni 1
gas DIN EN439-M21
Avoid current overloading. Welding must be free from marginal cuts and waste material.

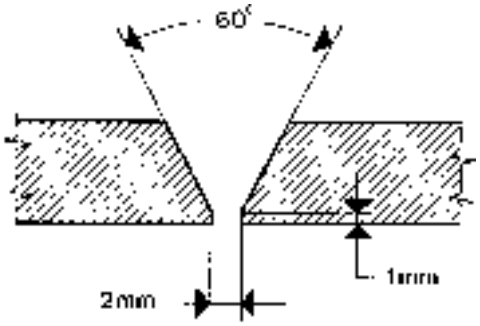
d) Repeat the operation on the reverse side by welding as detailed in point **c)**.

e) Allow the side members to cool slowly and uniformly. Cooling by air, water or other means is not permitted.

f) Remove excess material resulting from the welding operations by grinding.

Drilling the Chassis

Figure 2.5



g) On the inner side reinforcing L-section flitches should be applied. These should be made of steel and have the same characteristics as the steel used for the chassis. The minimum dimensions are given in Figure 2.3.
The reinforcements may only be fixed to the vertical web of the side member using welding beads, plug welds, bolts or rivets (Huck rivets may also be used).
The cross-section and the length of the weld bead, the number and distribution of the plug welds, bolts or rivets must be adequate to transmit the bending and shearing moment of the section.

2.3.5 Closing of existing holes

If, when making new holes, the existing holes are found to be too close (see Figure 2.2) these may be closed up by welding. To ensure the success of this operation the outer edge of the hole should be chamfered and copper plate used for the inner part.
For holes with a diameter of over 20 mm, chamfered plugs may be used, welded on both sides.

2.4 Modifying the Wheelbase

2.4.1 General Specifications

Any change to the wheelbase affecting the electrical circuits and/or entailing a relocation of the electrical/electronic components must be approved and performed according to the instructions provided in chapter 5.

As a rule, for each vehicle, modification to the wheelbase must be carried out on the standard wheelbase above or closer to the new wheelbase required.

The measurements given in the written authorisations will apply in all cases particularly for extensions made to the longest standard wheelbase.

Frame cutting must be performed according to the indications given at point 2.3.4. Whenever permitted by the body size, wheelbases should be made equal to those planned in our production. This enables the original transmission shafts and previously defined cross-member positions to be used.

When extending a wheelbase beyond the production longest planned, the vehicle used must have the longest production wheelbase to ensure the correct thickness side members are used. Particular care must be taken to comply with the limits set by national regulations particularly with regard to the limits for overall dimensions (where specified). Use only material shown at point 2.3.2.

2.4.2 Authorisation

The alteration of the wheelbase for the 4x2 versions is permitted without specific approval by IVECO in the following cases:

- If the wheelbase is to be lengthened and the new value is still within the standard range of length with the same side member section. These sizes are given in the specific technical documentation or in Table 2.8 and Table 2.9.
- If the wheelbase is to be shortened without falling below the standard minimum values established for each model.

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

For the 6x2 and 6x4 versions the wheelbase may only be modified following specific approval by IVECO.

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

2.4.3 Effects on the steering

Generally, lengthening the wheelbase has a negative effect on the steering.

Whenever national regulations require it, the limits on the overall dimensions must be observed as well as the limits concerning the effort applied on the steering wheel and the relevant operation times (e.g. ECE - R 79/01 standard or current EC Directive).

Tables 2.11 contain, the wheelbase extension limits for the various models, with series drive, at max load admissible on front axle and with tires admissible on vehicle.

Should vehicles with longer wheelbase be needed, for special applications, it will be necessary to fit various devices aimed at improving the steering characteristics such as a reduction in the maximum permitted load on the front axle or the installation of wheels and tyres with shorter kingpin offset values (Table 2.17).

The fitting of an additional pump and a dual circuit power steering unit, if not immediately available, will require authorisation and must only be installed by an authorised workshop.

Modifying the Wheelbase

2.4.4 Effect on braking

Generally, shortening the wheelbase has a negative effect on braking characteristics.

Table 2.11 gives the wheelbase alteration limits. Ask an authorised IVECO dealer for the conditions (brake cylinder, minimum tare settings see section, technically permitted masses, tyres, height of centre of gravity) under which these values are permissible.

Table 2.11 - Maximum permitted wheelbase lengthening depending on the load on the front axle and tyre dimensions (ECE - R79/01 regulation and EG/70/311)

Models	Max. load on front axle (observe tyre carrying capacity)	Max wheelbase value between 1st steering axle and 1st driving axle (mm)	Kingpin offset (mm)	Steering wheel dia. (mm)
AS/AD/AT 190 (without CM)	8000	6050	120	470
AS/AD/AT 190/FP-CM	8000 8000	5700 6700	120 120	470 510
AS/AD/AT 260 Y/P, Y/FP (without CM)	8000	6050	120	470
AS/AD/AT 260 Z/P - HM	8000	6050	120	470
AS/AD/AT 260 Y/FP -CM	8000 8000	4500 5100	120 120	470 510
AS/AD/AT 260 Y/PS, Y/FS (with CM)	7500 7500 8000	5700 6050 5700	120 120 120	470 510 470
AS/AD/AT 440TX/P (E5)	7500/7500	3140	120	470
AS/AD/AT 260XP	7500/7500	3140	120	470

For tyre type see Table 2.17.

2.4.5 Recommended procedure

To ensure the success of the conversion proceed as follows:

- Arrange the vehicle so that the chassis is perfectly level, using the appropriate stands.
- Disconnect the propeller shafts, the braking system pipes, the wiring harness and any equipment that might prevent the work being carried out correctly.
- Identify the reference points on the chassis (e.g. pilot holes, suspension supports).
- Mark the reference points with a light line of punch marks on the top flange on both side members after ensuring that their joining line is perfectly at right-angles to the longitudinal axis of the vehicle.
- When re-positioning the spring hanger brackets, identify the new position using the reference marks made previously.
  Check that the new measurements are identical between the left and right sides. Differences no greater than 2 mm should emerge from diagonal checking of the lengths less than 1,500 mm.
  Unless another tool is available, make new holes by using the supports and gussets of the cross members as a template.
  Fix the supports and cross members with rivets or bolts. If using bolts, fix the supports by reaming the holes and using class 10.9 calibrated bolts with nuts equipped with a device that prevents them from working loose. When space permits it use flanged-head screws and nuts.
- If cutting the chassis, make a second line of reference points so that the area affected by the modification is included between these and the previous points (in any event ensure a distance of not less than 1500 mm. measured when the work has been completed). Inside these two reference lines make points to mark out the area of the cut then proceed as indicated in point 2.3.4.
  Before welding, ensure that the side members, including any added portion, are perfectly aligned and take measurements on both sides and diagonally to check, as previously described. Fit the reinforcements as instructed at point 2.3.4.

Modifying the Wheelbase

Further indications

- Protect the surfaces from oxidation as described in point 2.2.2.
- Restore the electrical and braking systems as described in points 2.15 and 5.5.
- For changes to the drive line follow the instructions given in point 2.8.

2.4.6 Chassis Stress Level

When lengthening a wheelbase, in addition to local reinforcement on the side member joint, the bodybuilder must provide sufficient reinforcements to achieve the section moduli of the side member section no lower than that designed by IVECO for the same wheelbase or for next size up. Alternatively, when permitted by local regulations, larger subframe sections can be used.

The body builder shall verify that such stress is not greater than the one of the chassis with the original wheelbase, by assuming an evenly distributed load and the chassis being considered as a beam resting on the suspension supports. In any case, more restrictive limits (if any) set by the national standards shall be complied with.

When extending out from the longest original wheelbase the reinforcements must depend on the length of the extension, the type of body built and the use to which the vehicle is to be put.

2.4.7 Cross Members

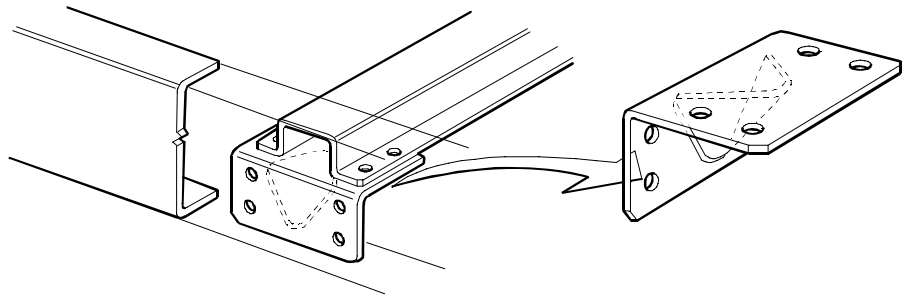
The necessity of applying one or more additional cross members depends on the length of the extension, the location of the transmission shaft support, the welding area, the introduction points of the forces produced by the body and the condition under which the vehicle is to be used.

Any supplementary cross members must have the same features as those already existing (flexural strength, torsional strength, quality of the material, connection to the side members, etc). In Figure 2.6 shows an example of the application. A cross member is mandatory for any extension over 600 mm.

As a general rule the distance between the two cross members must not be greater than 1000 to 1200 mm.

The minimum distance between two cross members must not be less than 600 mm, particularly for heavy-duty and off-road use; this limit does not apply to the "lightweight" transmission support cross member.

Figure 2.6



91449

2.4.8 Changes to transmissions

See chapter 2.8 for admissible changes.

Modifying the Wheelbase

2.5 Modifying the Rear Overhang

2.5.1 General Specifications

In modifying the rear overhang it must be borne in mind that such modification entails changes in the distribution of the payload on the axles relative to the loads established by IVECO (see point 1.13). The limitations established by national laws must also be respected as well as the maximum distance from the rear edge of the body and the ground clearance prescribed for the tow hook and the underrun bar. The distance from the extremity of the chassis to the rear edge of the body must not, as a general rule, exceed 350 to 400 mm.

Should the bolted rear cross member be re-positioned, the same standard type of connections should be maintained (i.e. number of screws, dimensions, class of resistance).

When re-positioning rear cross members fastened by rivets, these can be replaced by flanged nuts and bolts with same diameter or by class 8.8 hexagonal-headed screws with the next largest diameter. Use self-locking nuts (do not use bolts with a diameter larger than M14).

When the installation of a tow hook is planned an adequate distance (approximately 350 mm) must be left from the rear cross member to the next nearest cross member for mounting and removing the tow hook wherever necessary.

If the modifications are carried out competently and in compliance with the specifications contained in this manual, the towable weight originally established may be retained. In any case responsibility for the work rests with those who have carried it out.

Authorisation

Authorisation from IVECO is not required, if the frame is extended at the rear, or is shortened to the minimum value admissible for each model as standard, provided that this is done according to the instructions given in this manual.

If it proves necessary modify the length of the electrical circuits, see chapter 5 "Special instructions for electronic subsystems".

2.5.2 Reducing the Overhang

If the rear overhang of the chassis has to be reshortened, the last cross member must be moved forward.

If, when reducing the overhang, the rear cross member is found to be too close to an existing cross member, the latter must be removed if it does not affect the suspension supports.

2.5.3 Increasing the Overhang

Various methods of increasing the length are given in Figures, 2.7 and 2.8.

The frame may be straight cut. The minimum dimensions of the reinforcements the are to be fitted to the modified section are given in Figure 2.3.

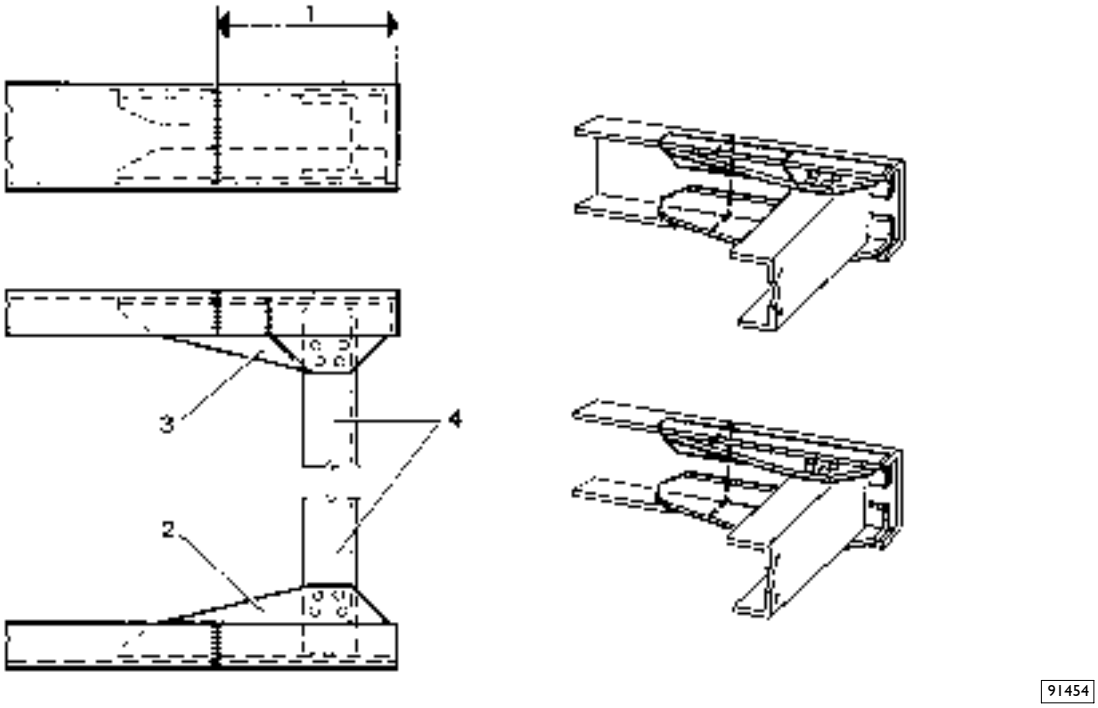
Figure 2.7 shows a typical method of extension for increases of 300 to 350 mm. In this case the reinforcing L-bars, which also serve to connect the cross member and the chassis frame, must be of the same thickness and width as the original gusset plate. The connection of the cross member and the plates, originally achieved with rivets, may be made with class 8.8 bolts with the next larger diameter.

Modifying the Rear Overhang

In those cases where the joint between the cross member and the gusset plate is made by means of a weld, it is permissible to join the gusset plate to the reinforcement by welding (see Figure 2.7).

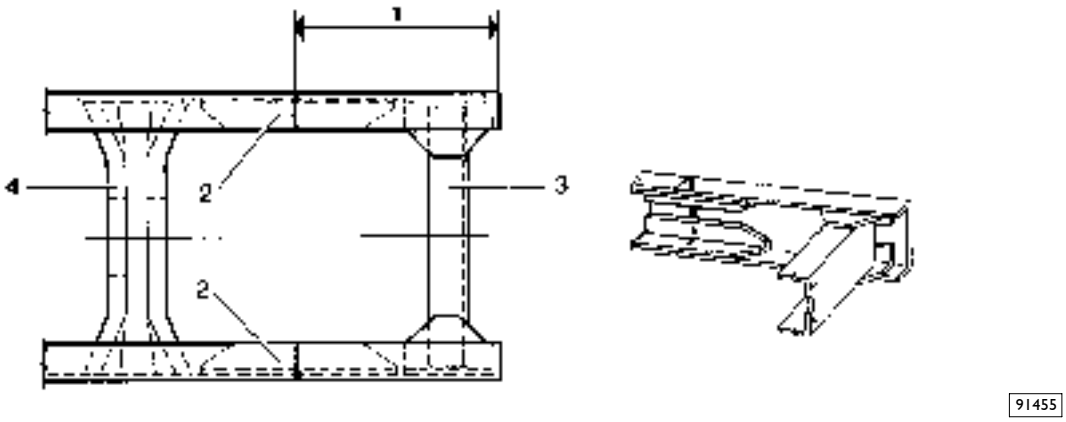
When the increase exceeds 350 mm, Figure 2.8 shows the procedure to be used.

Figure 2.7



1. Added portion - 2. Reinforcing runner - 3. Reinforcing runner (alternative solution) - 4. Original rear cross member

Figure 2.8



1. Added portion - 2. Reinforcing runner - 3. Original rear cross member - 4. Supplementary cross member (if necessary)

So will be necessary to examine on a case by case basis, the feasibility of installing a supplementary cross member to give the frame sufficient torsional rigidity. Adding a supplementary cross member with the same properties as the standard production cross member is necessary whenever the distance between two cross members is greater than 1200 mm.

Modifying the Rear Overhang

2.6 Installing a Towing Device

2.6.1 General Specifications

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

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

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

In trailers with one or more axles close together (centre axle trailers), considering the stress resulting in particular from the vertical dynamic load to which the rear cross member is subjected, the instructions given in point 2.6.4 must be taken into account.

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

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

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

This may vary as a function of national standards. In the European Community a maximum of 420 mm can be reached. If higher values are required, check the EC Directive for the conditions to be able to accomplish this.

Should the fixing holes in the flange of the coupling hook not match the holes in the rear towing crossmember of the vehicle then in certain cases re-drilling may be authorised in specific cases after applying appropriate reinforcements.

It is the bodybuilder's responsibility to ensure that no part of the body or structure creates a hazard or impairs the maneuverability of the trailer.

The trailer drawbar must be free to move unobstructed.

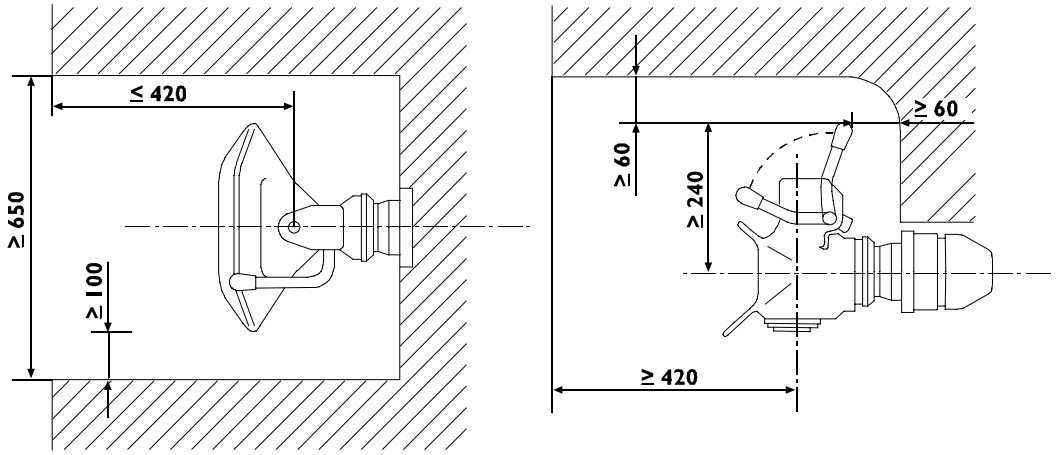
Installing a Towing Device

2.6.2 Traditional towing hooks

Choice of hook for traditional trailers

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

Figure 2.9



Free area for towing hooks

When selecting the appropriate hook and for the use of reinforcements for the rear cross member (where necessary), the effect of the horizontal forces produced by the weight of the tractor and trailer must be taken into account in accordance with the following formulas:

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

D = Representative value of the hook class (kN).
T = Maximum weight of tractor, in t.
R = Maximum weight of trailer, in t.

Installing a Towing Device

2.6.3 Towhook for mid-axled trailers

When using trailers with central axles or heavy single-axled trailers with enormous support loads (e.g. while braking or due to vehicle vibration caused by road surface irregularities), the final crossmember is subject to additional twisting stress and the bending moment on the protruding part of the frame is higher.

The towed load allowed for this type of trailer is therefore lower than that of normal trailers with a steering drawbar (see table 2.12).

For vehicles with very protruding crossmember or mid-axled trailers with high towed loads, a frame installation section (see table 2.12) that is sturdier than the one specified for this type of construction may have to be used.

On trailer with a fixed towbar, the installation frame must be fastened to the vehicle frame from the edge of the frame to the beginning of the first rear axle suspension via the end blocks (replace consoles with end blocks or add more end blocks, see figure 2.12). The towhook holes on the different towing terminal crossmembers available for most vehicles (for specific orders or as a conversion product) correspond to a given attachment size.

For different towing terminal crossmembers, the towing loads shown in table 2.12 may generally be type approved for mid-axled trailers provided the vehicle type is not subject to legal restrictions (e.g. engine power) or other construction units (e.g. transmission unit, braking system).

For this reason, the values shown in table 2.12 must be confirmed in any case in writing by the frame manufacturer (e.g. in the type approval certificates, in the manufacturer's certification).

The value of the maximum (static + dynamic) vertical load transmitted by the trailer to the hook can be determined more accurately through the following ISO formula:

$$Fv = a \cdot x^2/l^2 \cdot C \cdot 0.6 + S$$

Fv = Max vertical load (static + dynamic) transmitted by the trailer to the tow hook (kN)

a = Vertical acceleration in the drawbar/towing hook coupling area; depending on the rear suspension of the tractor for semi-trailer, use the following values:

- a =1.8 m/sec^2 for vehicles with pneumatic suspension (or equivalent)
- a =2.4 m/sec^2 for vehicles with other suspension types

x = Total length in mms of the loading area of the trailer (m).

l = Length of the trailer wheelbase (distance between drawbar towing eye centre and axle centre or trailer axle centre line) in m.

C = Total weight of trailer, R, minus the static load applied S (all values expressed in tons).

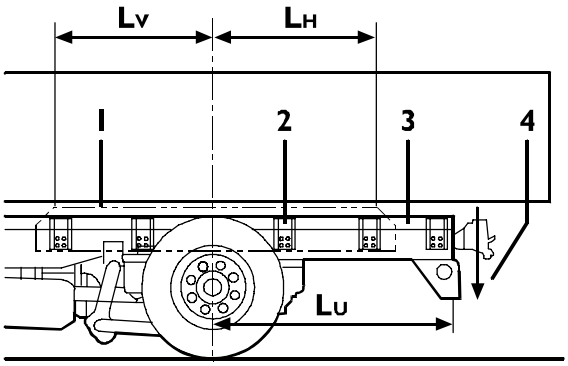
S = Static support load (kN).

0,6 = Deceleration factor.

Installing a Towing Device

Figure 2.10

Chassis reinforcement for centre axle trailers



1. Combined reinforcement - 2. Shear resistant connections (cleat plates) - 3. Subframe longitudinal runner - 4. Vertical load on tow hook

Table 2.12

Dimensions of flange (mm) (hook class)		Max. vertical loads permitted on hook (kg)		Maximum towable weight (kg) for centre-axle trailers R
		Static S	Total load * (static+dynamic) Fv	
120x55 (G135 or G3)		400	1130	4500
		650	1690	6500
140x80 (G140 or G4)		900	2340	9000
	G150	950	2470	9500
	G5	1000	2960	12000
160x100	G6	1000	4040	18000
	81 G5	1000	4400	20000
	700G61	1000	5120	24000

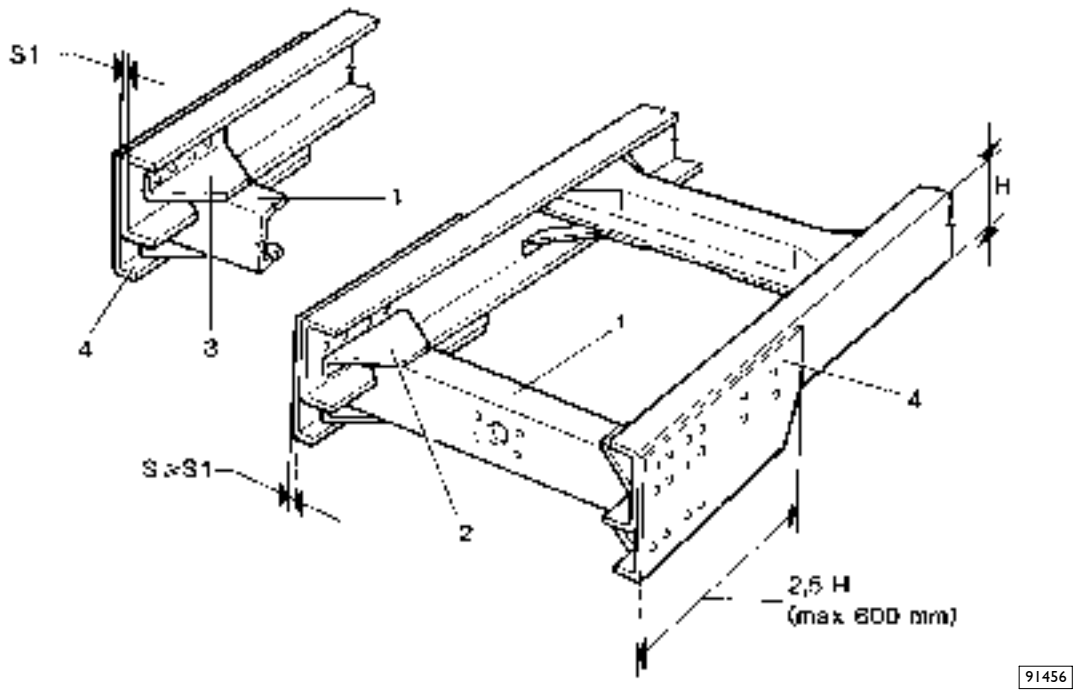
* Indicative values determined according to ISO/TCC22/SCI5/WG4 Annex A through the following formula Fv = 3 × C × 0.6 + S (see following page)

2.6.4 Lowered Rear Cross Member

If the type of trailer used requires that the tow hook be positioned lower than originally intended, IVECO may issue authorisation for the original cross member to be lowered or for an additional cross member (of the original type) to be fitted in a lower position. Figures. 2.11 and 2.12 give some examples of how this is done.

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

Figure 2.11



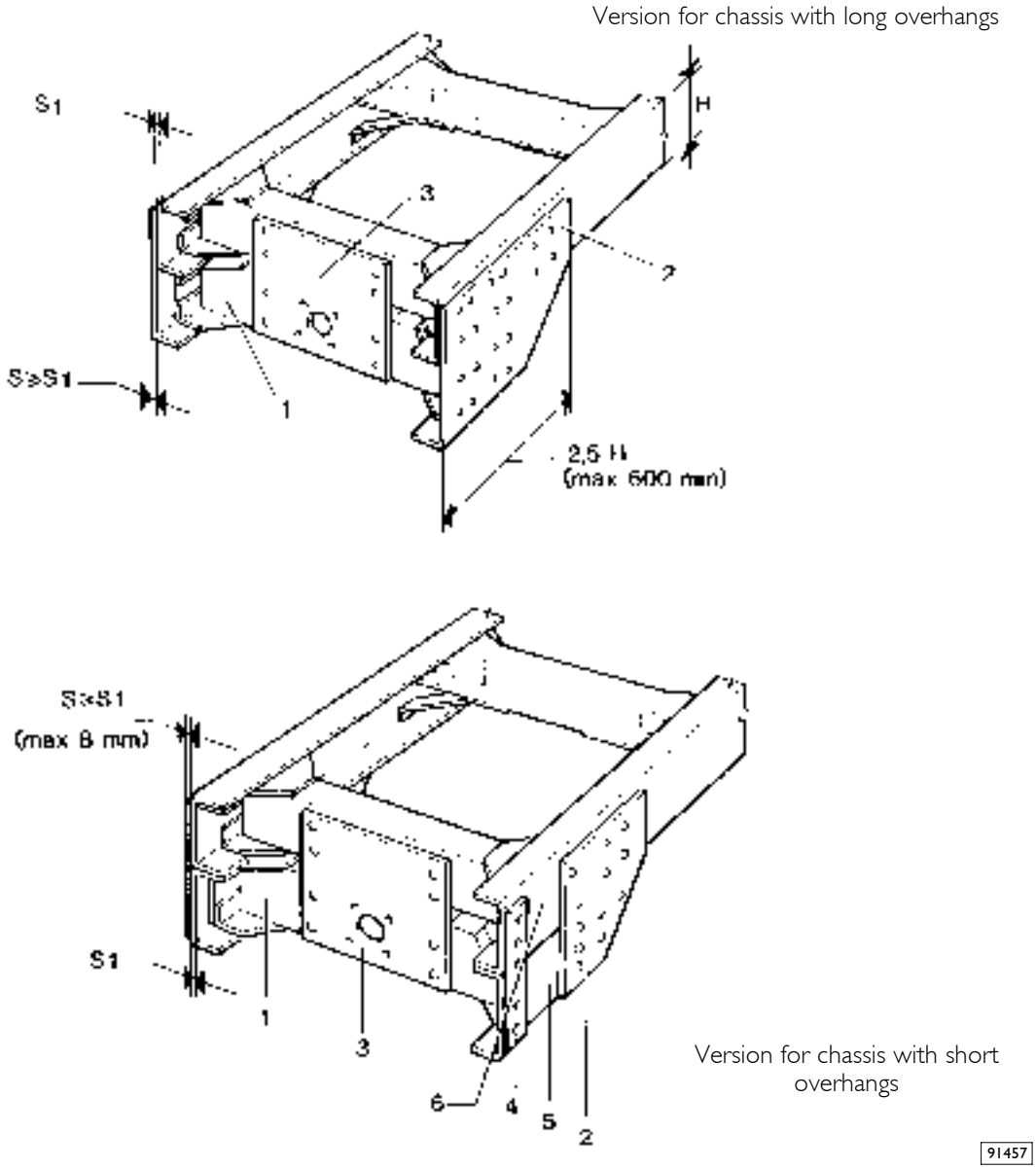
1. Original rear cross member - 2. Gusset - 3. Upside-down gusset - 4. Connecting angle piece

The thickness of the outer reinforcing angles must not be less than the thickness of the side members of the vehicle. They must cover a length which is at least 2,5 times the height of the side member itself (maximum 600 mm) and be made of material with the properties indicated in point 3.1.1. The angles are to be attached to the web of the side members using all the bolts joining the cross member to the frame, integrating them with the other bolts so that, as a result of their number and location, they will take into account the greater moment transmitted. As a general rule, when the cross member is lowered by an amount equivalent to the height of the side member, the number of bolts is increased by about 40%.

When an additional cross member is installed (see Figure 2.12) a central joining plate with a thickness commensurate with that of the cross members, must be employed.

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

Figure 2.12



1. Original rear cross member - 2. Connecting angle piece - 3. Connecting plate - 4. Gusset plate - 5. Pressed steel channel sections (same size as chassis) - 6. Space for rear sprung support

Assurance should be given that the movements between the tow bar and vehicle conform to current regulations. As a general rule, the original towable mass can be confirmed by IVECO. In any event the responsibility for the work carried out will rest with the bodybuilder.

The vehicle must be presented for inspection if local government regulations require it.

In Figure 2.12 shows an example of a lowered supplementary cross member.

When this solution is applied to short rear overhang vehicles, the external connecting plates must conform to the arrangement described in Figure 2.12. Should the brackets of the underrun bar be modified, following the lowering of the rear cross member, the new version will be equivalent to the original in terms of attachment, strength and stiffness and the positioning of the lights checked for compliance with the standards (local standards where applicable).

Table 2.13 - Longitudinal runner profiles of the subframe for centre axle trailers

Models (Chassis section) (mm)	Wheel base (mm)	Max. body overhang (mm)	Towable weight (R) static load on towhook (S) to centre axle (kg)															
			R≤ 9500 S≤ 950		R≤ 12000 S≤ 1000		R≤ 14000 S≤ 1000		R≤ 16000 S≤ 1000		R≤ 18000 S≤ 1000		R≤ 20000 S≤ 1000		R≤ 22000 S≤ 1000		R≤ 24000 S≤ 1000	
			Section modulus for each longitudinal section of subframe Wx (cm^3) depending on the material yield limit (N/mm^2)															
			S235 = ST 37 = FE 360 = 240 S355 = ST 52 = FE 510 = 360															
			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
AD AT 190, 115 t rear 289/199x80x6,7	3800	970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3800	1195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3800	1825	-	-	-	-	-	-	-	-	46	-	46	-	46	-	46	-
	4200	970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4200	1195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4200	2050	-	-	46	-	46	-	46	-	46	46	46	46	46	46	46	46
	4500	1780	-	-	-	-	46	-	46	-	46	-	46	-	46	46	46	46
	4800	2455	46	-	46	46	46	46	46	46	57	46	89	46	89	46	105	46
	5100	1555	-	-	-	-	-	-	-	-	46	-	46	-	46	-	46	-
	5100	1960	46	-	46	-	46	-	-	46	46	46	46	46	46	46	46	46
	5100	2185	46	-	46	46	46	46	46	46	46	46	57	46	74	46	89	46
	5100	2365	46	46	46	46	46	46	57	46	57	46	89	46	89	46	105	46
	5500	2185	46	-	46	46	46	46	46	46	57	46	57	46	74	46	89	46
	5700	2185	46	46	46	46	46	46	46	46	57	46	74	46	89	46	89	46
	6300	2005	46	-	46	46	46	46	46	46	46	46	57	46	57	46	74	46
	6300	2365	46	46	46	46	57	46	74	46	89	46	105	46	105	57	119	57
	6300	2770	57	46	89	46	105	46	105	57	119	74	150	89	173	105	173	105
	6700	3400	46	46	46	46	74	46	74	46	89	46	105	46	105	74	150	74
AD AT 190 13.0 t rear 289/199x80x6,7	3800	970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3800	1195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3800	1825	46	-	46	-	46	46	46	46	46	46	46	46	46	46	57	46
	4200	970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4200	1195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4200	2050	46	46	46	46	46	46	57	46	57	46	74	46	89	46	105	46
	4500	1780	46	-	46	46	46	46	46	46	46	46	46	46	57	46	57	46
	4800	2455	74	46	89	46	105	57	105	57	135	74	150	89	173	89	173	105
	5100	1555	46	-	46	-	46	-	46	-	46	-	46	46	46	46	46	46
	5100	1960	46	46	46	46	57	46	57	46	74	46	89	46	89	46	105	46
	5100	2185	57	46	74	46	89	46	89	46	105	46	105	57	119	57	135	74
	5100	2365	74	46	89	46	105	46	105	57	119	74	150	89	173	89	173	105
	5500	2185	57	46	89	46	89	46	105	46	105	57	105	57	119	74	150	89
	5700	2185	57	46	89	46	89	46	105	46	105	57	119	57	135	74	150	89
	6300	2005	46	46	57	46	74	46	89	46	89	46	105	46	105	57	105	57
	6300	2365	89	46	105	57	119	57	135	74	150	89	173	89	173	105	173	105
	6300	2770	150	89	173	89	173	105	173	105	245	119	245	150	245	173	245	173
	6700	3400	105	46	105	74	150	74	150	74	173	89	208	105	208	105	245	105

Installing a Towing Device

Table 2.13 - (continued) Longitudinal runner profiles of the subframe for centre axle trailers

Models (Chassis section) (mm)	Wheel base (mm)	Max. body overhang (mm)	Towable weight (R) static load on towhook (S) to centre axle (kg)															
			R≤ 9500 S≤ 950		R≤ 12000 S≤ 1000		R≤ 14000 S≤ 1000		R≤ 16000 S≤ 1000		R≤ 18000 S≤ 1000		R≤ 20000 S≤ 1000		R≤ 22000 S≤ 1000		R≤ 24000 S≤ 1000	
			Section modulus for each longitudinal section of subframe Wx (cm^3) depending on the material yield limit (N/mm^2)															
			S235 = ST 37 = FE 360 = 240 S355 = ST 52 = FE 510 = 360															
			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
AS 190S /P,/FP,/FP-CM 11.5 t rear 289/199x80x6,7	3800	1847	-	-	46	-	46	-	46	-	46	-	46	46	46	46	46	46
	4200	1217	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46	-
	4200	2072	46	-	46	-	46	46	46	46	46	46	46	46	46	46	57	46
	4500	1307	-	-	-	-	-	-	-	-	46	-	46	-	46	-	46	-
	4500	1802	46	-	46	-	46	-	46	46	46	46	46	46	46	46	46	46
	4800	2477	46	46	46	46	46	46	57	46	74	46	89	46	105	46	105	57
	5100	1577	46	-	46	-	46	-	46	-	46	46	46	46	46	46	46	46
	5100	1982	46	-	46	46	46	46	46	46	46	46	57	46	57	46	74	46
	5100	2207	46	46	46	46	46	46	57	46	57	46	74	46	89	46	105	46
	5100	2387	46	46	46	46	57	46	57	46	89	46	89	46	105	46	105	57
	5500	2207	46	46	46	46	46	46	57	46	74	46	89	46	89	46	105	46
	5700	1982	46	46	46	46	46	46	46	46	57	46	57	46	74	46	89	46
	5700	2207	46	46	46	46	57	46	57	46	74	46	89	46	105	46	105	57
	6300	2027	46	46	46	46	46	46	57	46	57	46	74	46	89	46	89	46
	6300	2387	46	46	57	46	74	46	89	46	105	46	105	57	119	57	135	74
	6300	2792	74	46	89	46	105	57	119	57	135	74	173	89	173	105	173	105
	6700	3422	46	46	46	46	74	46	74	46	74	46	89	46	105	57	105	74
AS 190S /P,/FP,/FP-CM 13.0 t rear 289/199x80x6,7	3800	1847	46	46	46	46	46	46	46	46	57	46	74	46	74	46	89	46
	4200	1217	-	-	46	-	46	-	46	-	46	-	46	-	46	-	46	46
	4200	2072	46	46	57	46	74	46	89	46	89	46	105	46	105	57	119	57
	4500	1307	46	-	46	-	46	-	46	-	46	46	46	46	46	46	46	46
	4500	1802	46	46	46	46	57	46	57	46	74	46	89	46	89	46	105	46
	4800	2477	89	46	105	57	119	57	135	74	150	89	173	89	173	105	173	105
	5100	1577	46	46	46	46	46	46	46	46	46	46	57	46	57	46	74	46
	5100	1982	57	46	74	46	89	46	89	46	105	46	105	57	105	57	119	74
	5100	2207	89	46	89	46	105	46	105	57	119	74	135	74	173	89	173	89
	5100	2387	89	46	105	57	119	57	135	74	150	89	173	89	173	105	173	105
	5500	2207	89	46	105	46	105	57	119	57	135	74	150	89	173	89	173	105
	5700	1982	57	46	89	46	89	46	105	46	105	57	105	57	119	57	135	74
	5700	2207	89	46	105	46	105	57	119	57	135	74	150	89	173	89	173	105
	6300	2027	74	46	89	46	105	46	105	57	105	57	119	74	135	74	150	89
	6300	2387	105	57	119	74	135	89	173	89	173	105	173	105	173	105	208	119
	6300	2792	173	89	173	105	173	105	173	119	245	135	245	150	245	173	245	173
	6700	3422	89	46	105	57	105	74	150	74	150	74	173	89	208	105	208	105

Installing a Towing Device

Table 2.13 - (continued) Longitudinal runner profiles of the subframe for centre axle trailers

Models (Chassis section) (mm)	Wheel base (mm)	Max. body overhang (mm)	Towable weight (R) static load on towhook (S) to centre axle (kg)															
			R≤ 9500 S≤ 950		R≤ 12000 S≤ 1000		R≤ 14000 S≤ 1000		R≤ 16000 S≤ 1000		R≤ 18000 S≤ 1000		R≤ 20000 S≤ 1000		R≤ 22000 S≤ 1000		R≤ 24000 S≤ 1000	
			Section modulus for each longitudinal section of subframe Wx (cm^3) depending on the material yield limit (N/mm^2)															
			S235 = ST 37 = FE 360 = 240 S355 = ST 52 = FE 510 = 360															
			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
AS 260 S .. Y/PT 19.0 t rear 289/199x80x6,7	3805	1757	46	46	46	46	46	46	46	46	57	46	74	46	74	46	89	46
	4200	2117	74	46	89	46	89	46	105	46	105	57	119	57	119	74	150	89
	4500	2072	74	46	89	46	105	46	105	46	105	57	119	57	135	74	150	89
	4800	1712	46	46	57	46	74	46	74	46	74	46	89	46	105	46	105	57
	4800	2072	89	46	89	46	105	46	105	57	119	57	135	74	150	89	173	89
	5100	1802	74	46	74	46	74	46	89	46	105	46	105	46	105	74	105	74
	5700	2432	105	46	105	74	150	74	150	74	173	74	208	89	208	105	208	105
	6050	2657	150	74	150	74	173	89	208	105	208	105	245	105	245	105	286	150
AS 260 S .. Y/PT 20.0 t rear 289/199x80x6,7	3805	1757	57	46	74	46	74	46	74	46	89	46	105	46	105	57	105	74
	4200	2117	105	46	105	57	119	57	135	74	150	89	173	89	173	105	208	105
	4500	2072	105	46	105	57	119	74	150	74	150	89	173	89	208	105	208	105
	4800	1712	74	46	89	46	105	46	105	57	105	74	135	74	150	74	150	74
	4800	2072	105	57	119	74	150	74	150	89	173	89	208	105	208	105	208	105
	5100	1802	105	46	105	57	105	74	105	74	150	74	150	74	173	74	208	89
	5700	2432	150	74	208	89	208	105	208	105	245	105	245	135	286	150	286	150
	6050	2657	208	105	245	105	245	105	245	150	286	150	286	150	317	173	343	208
AS 260 S Y/PT 21.0 t rear 289/199x80x6,7	3805	1757	89	46	105	46	105	57	105	74	135	74	150	74	150	74	173	89
	4200	2117	150	74	150	89	173	89	208	105	208	105	208	105	245	105	245	119
	4500	2072	150	74	173	89	208	89	208	105	208	105	245	105	245	119	245	150
	4800	1712	105	74	150	74	150	74	150	74	173	89	208	89	208	105	208	105
	4800	2072	173	89	208	89	208	105	208	105	245	105	245	105	245	150	286	150
	5100	1802	150	74	150	74	173	89	208	89	208	105	208	105	245	105	245	105
	5700	2432	245	105	245	105	286	150	286	150	286	150	317	173	343	208	343	208
	6050	2657	286	150	286	150	317	173	343	208	343	208	374	208	374	245	406	245
AS/AD/AT 260 S Y/P.., Y/FP 19.0 t rear Invalid for versions / TN,/PT CT and GV 289/199x80x6,7	3120	722	46	-	46	-	46	-	46	-	46	-	46	-	46	-	46	46
	3805	1757	105	46	105	57	119	57	119	74	150	89	173	89	173	105	173	105
	4200	1127	46	46	57	46	57	46	57	46	74	46	89	46	89	46	89	46
	4200	1622	105	46	105	57	119	57	119	74	150	89	173	89	173	89	173	105
	4200	2117	150	89	173	89	173	105	173	105	208	119	245	135	245	150	245	173
	4500	1217	57	46	74	46	74	46	89	46	89	46	105	46	105	57	105	57
	4500	1622	105	57	105	57	119	74	135	89	173	89	173	89	173	105	173	105
	4500	1802	119	57	135	89	173	89	173	89	173	105	173	105	173	105	208	119
	4500	2072	173	89	173	105	173	105	173	105	208	119	245	135	245	150	245	173
	4800	1487	105	46	105	57	105	57	119	74	135	74	150	89	173	89	173	105
	4800	1712	119	57	135	74	150	89	173	89	173	105	173	105	173	105	208	119
	4800	2072	173	105	173	105	173	105	208	119	245	135	245	150	245	173	245	173
	5100	1802	150	89	173	89	173	105	173	105	173	105	173	119	245	119	245	135
	5700	2432	105	46	105	74	150	74	150	74	173	74	208	89	208	105	208	105
	6050	2657	150	74	150	74	173	89	208	105	208	105	245	105	245	105	286	150

Installing a Towing Device

Table 2.13 - (continued) Longitudinal runner profiles of the subframe for centre axle trailers

Models (Chassis section) (mm)	Wheel base (mm)	Max. body overhang (mm)	Towable weight (R) static load on towhook (S) to centre axle (kg)															
			R≤ 9500 S≤ 950		R≤ 12000 S≤ 1000		R≤ 14000 S≤ 1000		R≤ 16000 S≤ 1000		R≤ 18000 S≤ 1000		R≤ 20000 S≤ 1000		R≤ 22000 S≤ 1000		R≤ 24000 S≤ 1000	
			Section modulus for each longitudinal section of subframe Wx (cm^3) depending on the material yield limit (N/mm^2)															
			S235 = ST 37 = FE 360 = 240 S355 = ST 52 = FE 510 = 360															
			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
AS/AD/AT 260 S Y/P.., Y/FP 20 t rear 289/199x80x6,7	3120	722	46	-	46	-	46	-	46	46	46	46	46	46	46	46	46	46
	3805	1757	135	74	173	89	173	89	173	105	173	105	173	105	208	119	245	135
	4200	1127	74	46	89	46	89	46	89	46	105	46	105	46	105	57	105	57
	4200	1622	135	74	150	89	173	89	173	105	173	105	173	105	173	105	208	119
	4200	2117	173	105	208	119	245	135	245	150	245	173	245	173	245	173	245	173
	4500	1217	89	46	89	46	105	46	105	57	105	57	119	57	135	74	135	89
	4500	1622	150	89	173	89	173	105	173	105	173	105	173	105	208	119	245	135
	4500	1802	173	105	173	105	173	105	208	119	245	119	245	135	245	173	245	173
	4500	2072	173	105	245	135	245	150	245	173	245	173	245	173	245	173	245	173
	4800	1487	119	74	135	89	173	89	173	89	173	105	173	105	173	105	173	105
	4800	1712	173	89	173	105	173	105	173	105	208	119	245	135	245	150	245	173
	4800	2072	208	119	245	135	245	173	245	173	245	173	245	173	245	173	343	173
	5100	1802	173	105	173	105	208	119	245	135	245	150	245	173	245	173	245	173
	5700	2432	150	74	208	89	208	105	208	105	245	105	245	135	286	150	286	150
	6050	2657	208	105	245	105	245	105	245	150	286	150	286	150	317	173	343	208
AS/AD/AT 260 S Y/P.., Y/FP Invalid for versions / TN,/PT CT and GV 21 t rear 289/199x80x6,7	3120	722	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46
	3805	1757	173	105	173	105	173	119	245	119	245	135	245	150	245	173	245	173
	4200	1127	89	46	105	46	105	57	105	57	119	57	119	74	135	74	150	89
	4200	1622	173	105	173	105	173	105	208	119	245	119	245	135	245	150	245	173
	4200	2117	245	173	245	173	245	173	245	173	245	173	343	208	343	245	374	245
	4500	1217	105	57	105	57	119	74	135	74	150	89	173	89	173	89	173	105
	4500	1622	173	105	173	105	173	119	208	119	245	135	245	150	245	173	245	173
	4500	1802	208	119	245	135	245	150	245	173	245	173	245	173	245	173	245	173
	4500	2072	245	173	245	173	245	173	245	173	245	173	343	208	343	245	374	245
	4800	1487	173	89	173	105	173	105	173	105	173	119	208	119	245	135	245	150
	4800	1712	173	105	245	119	245	135	245	150	245	173	245	173	245	173	245	173
	4800	2072	245	173	245	173	245	173	245	173	343	208	343	245	374	245	374	245
	5100	1802	245	135	245	150	245	173	245	173	245	173	245	173	245	173	317	173
	5700	2432	245	105	245	105	286	150	286	150	286	150	317	173	343	208	343	208
	6050	2657	286	150	286	150	317	173	343	208	343	208	374	208	374	245	406	245
AS/AD/AT 260 S Y/FP-GV only with CCM 11954 19 t rear 289/199x80x7,7	4200	2117	105	-	105	-	105	-	150	-	150	74	173	74	208	89	208	105
	4500	2072	105	-	105	-	135	-	150	74	150	74	173	89	208	105	208	105
	4800	2072	105	-	105	-	150	-	150	74	173	89	208	105	208	105	208	105
	5100	1802	89	-	105	-	105	-	135	-	150	-	150	74	173	74	208	89
	5700	2432	173	89	208	105	208	105	245	105	245	150	286	150	286	173	317	173
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Installing a Towing Device

Table 2.13 - (continued) Longitudinal runner profiles of the subframe for centre axle trailers

Models (Chassis section) (mm)	Wheel base (mm)	Max. body overhang (mm)	Towable weight (R) static load on towhook (S) to centre axle (kg)															
			R≤ 9500 S≤ 950		R≤ 12000 S≤ 1000		R≤ 14000 S≤ 1000		R≤ 16000 S≤ 1000		R≤ 18000 S≤ 1000		R≤ 20000 S≤ 1000		R≤ 22000 S≤ 1000		R≤ 24000 S≤ 1000	
			Section modulus for each longitudinal section of subframe Wx (cm^3) depending on the material yield limit (N/mm^2)															
			S235 = ST 37 = FE 360 = 240 S355 = ST 52 = FE 510 = 360															
			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
AS/AD/AT 260 S Y/FP-GV only with CCM 11954 1200 towbar 19 t rear 289/199x80x7,7	4200	2117	74	-	74	-	89	-	105	-	105	-	105	-	105	-	105	-
	4500	2072	74	-	89	-	105	-	105	-	105	-	105	-	105	-	150	-
	4800	2072	74	-	105	-	105	-	105	-	105	-	135	-	150	-	150	74
	5100	1802	74	-	74	-	89	-	105	-	105	-	105	-	105	-	150	-
	5700	2432	150	-	150	74	150	74	173	74	173	89	208	89	208	105	208	105
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AD/AT 260 S ../TN 19.0 t rear 289x80x6,7	3800	1765	46	46	46	46	57	46	74	46	74	46	74	46	89	46	105	46
	4200	1630	46	46	46	46	57	46	74	46	74	46	74	46	74	46	89	46
	4200	2125	74	46	89	46	105	46	105	57	105	74	150	74	150	74	150	74
	4500	1630	46	46	46	46	57	46	74	46	74	46	74	46	89	46	105	46
	4500	1810	57	46	74	46	74	46	74	46	89	46	105	46	105	57	105	74
	4500	2080	74	46	89	46	105	46	150	57	105	74	150	74	150	74	173	89
	4800	1495	46	46	46	46	46	46	57	46	74	46	74	46	74	46	74	46
	4800	1720	57	46	74	46	74	46	74	46	89	46	105	46	105	46	105	57
	4800	2080	74	46	105	46	105	57	105	74	150	74	150	74	150	74	173	89
	5100	1810	74	46	74	46	74	46	89	46	105	46	105	57	105	74	150	74
	5700	3025	245	105	245	150	286	150	286	173	317	208	343	208	374	208	406	245
	6050	2665	208	89	208	105	245	105	245	150	286	150	286	150	317	173	343	208
AD/AT 260 S ../TN 50:50 o 60:40 21.0 t rear 289x80x6,7	3800	1765	74	46	74	46	74	46	89	46	105	46	105	57	105	74	135	74
	4200	1630	74	46	74	46	74	46	89	46	89	46	105	46	105	57	105	74
	4200	2125	105	57	105	74	150	74	150	74	173	89	208	89	208	105	208	105
	4500	1630	74	46	74	46	74	46	89	46	105	46	105	46	105	57	105	74
	4500	1810	74	46	105	46	105	46	105	57	105	74	150	74	150	74	150	74
	4500	2080	105	57	135	74	150	74	150	74	173	89	208	105	208	105	245	105
	4800	1495	57	46	74	46	74	46	74	46	74	46	89	46	105	46	105	46
	4800	1720	74	46	89	46	105	46	105	57	105	74	105	74	150	74	150	74
	4800	2080	105	74	150	74	150	74	173	89	208	89	208	105	208	105	245	105
	5100	1810	89	46	105	46	105	57	105	74	150	74	150	74	150	74	173	89
	5700	3025	286	150	343	208	343	208	374	245	406	245	406	245	406	286	474	286
	6050	2665	245	135	286	150	286	173	317	208	343	208	374	208	374	245	406	245
	6050	2665	317	208	343	208	374	208	374	245	406	245	406	245	406	286	474	286

Table 2.13 - (continued) Longitudinal runner profiles of the subframe for centre axle trailers

Models (Chassis section) (mm)	Wheel base (mm)	Max. body overhang (mm)	Towable weight (R) static load on towhook (S) to centre axle (kg)															
			R≤ 9500 S≤ 950		R≤ 12000 S≤ 1000		R≤ 14000 S≤ 1000		R≤ 16000 S≤ 1000		R≤ 18000 S≤ 1000		R≤ 20000 S≤ 1000		R≤ 22000 S≤ 1000		R≤ 24000 S≤ 1000	
			Section modulus for each longitudinal section of subframe Wx (cm^3) depending on the material yield limit (N/mm^2)															
			S235 = ST 37 = FE 360 = 240 S355 = ST 52 = FE 510 = 360															
			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
AD/AT 260 S ../TN 21.0 t rear 289x80x6,7	3800	1765	89	46	105	46	105	57	105	74	150	74	150	74	150	74	173	89
	4200	1630	89	46	105	46	105	46	105	57	105	74	150	74	150	74	150	74
	4200	2125	150	74	173	89	205	105	208	105	245	105	245	105	245	150	286	150
	4500	1630	89	46	105	46	105	57	105	74	105	74	150	74	150	74	150	74
	4500	1810	105	57	105	74	150	74	150	74	173	74	208	89	208	105	208	105
	4500	2080	150	74	208	89	208	105	208	105	245	105	245	105	245	150	286	150
	4800	1495	74	46	74	46	89	46	105	46	105	46	105	57	105	74	135	74
	4800	1720	105	57	105	74	105	74	150	74	150	74	150	74	173	89	208	105
	4800	2080	173	89	208	105	208	105	245	105	245	105	245	135	286	150	286	150
	5100	1810	105	74	150	74	150	74	173	74	173	89	208	105	208	105	208	105
	5700	3025	374	245	406	245	406	286	474	286	474	286	SP	317	SP	343	SP	343
	6050	2665	317	208	343	208	374	208	374	245	406	245	406	245	406	286	474	286
AS 260 S .. X/P 19.0 t rear 289x80x6,7	2840	2072	46	-	46	-	46	-	46	-	46	46	46	46	46	46	46	46
	3140	1802	46	-	46	-	46	-	46	-	46	46	46	46	46	46	46	46
	3440	2477	46	46	46	46	57	46	74	46	74	46	74	46	89	46	105	46
	3740	2387	46	46	57	46	74	46	74	46	74	46	89	46	105	46	105	57
	4340	2207	74	46	74	46	74	46	89	46	105	46	105	46	105	57	105	74
	4690	2657	105	46	105	46	105	74	150	74	150	74	173	74	208	89	208	105
AS 260 S .. X/P 20.0 t rear 289x80x6,7	2840	2072	46	46	46	46	46	46	46	46	57	46	74	46	74	46	74	46
	3140	1802	46	46	46	46	46	46	46	46	57	46	74	46	74	46	74	46
	3440	2477	74	46	74	46	105	46	105	46	105	57	105	74	150	74	150	74
	3740	2387	74	46	105	46	105	46	105	74	105	74	150	74	150	74	173	89
	4340	2207	89	46	105	46	105	57	105	74	150	74	150	74	150	74	173	89
	4690	2657	150	74	173	74	208	89	208	105	208	105	245	105	245	105	286	150
AS 260 S .. X/P 21.0 t rear 289x80x6,7	2840	2072	57	46	74	46	74	46	74	46	89	46	105	46	105	57	105	74
	3140	1802	57	46	74	46	74	46	74	46	89	46	105	46	105	46	105	57
	3440	2477	105	57	105	74	150	74	150	74	173	89	208	105	208	105	208	105
	3740	2387	105	74	150	74	150	74	173	89	208	89	208	105	208	105	245	105
	4340	2207	150	74	150	74	173	74	208	89	208	105	208	105	245	105	245	105
	4690	2657	208	105	245	105	245	105	286	150	286	150	286	150	317	173	343	208
AS 260 S .. Z/P-HM 19.0 t rear 289x80x6,7	3800	1487	46	-	46	-	46	-	46	46	46	46	46	46	46	46	46	46
	4200	1847	46	46	46	46	46	46	46	46	57	46	74	46	74	46	74	46
	4500	1982	46	46	46	46	57	46	74	46	74	46	74	46	89	46	105	46
AS 260 S .. Z/P-HM 20.0 t rear 289x80x6,7	3800	1487	46	46	46	46	46	46	46	46	46	46	57	46	74	46	74	46
	4200	1847	57	46	74	46	74	46	74	46	89	46	89	46	105	46	105	57
	4500	1982	74	46	74	46	89	46	105	46	105	46	105	57	105	74	150	74
AS 260 S .. Z/P-HM 21.0 t rear 289x80x6,7	3800	1487	46	46	57	46	74	46	74	46	74	46	74	46	89	46	105	46
	4200	1847	89	46	105	46	105	46	105	57	105	74	150	74	150	74	150	74
	4500	1982	105	57	105	74	135	74	150	74	150	74	173	74	208	89	208	105

NOTE See Table 3.2 (section bar dimensions)

Installing a Towing Device

Table 2.14 - Combined section reinforcement runner profiles Table 3.4

	A	B	C or D	E	F	G
Material yield point (N/mm^2)	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm):	40	60	100	120	100	120
Combined reinforcements length L_V : L_H :	 0.5.L_U 0.6.L_U	 0.5.L_U 0.6.L_U	 0.8L_U 0.95L_U	 0.85L_U 1.0.L_U	 0.8.L_U 0.95.L_U	 0.85.L_U 1.0.L_U
Example: Combined section as an alternative to the channel section C250x80x8 (mm)	210X80X8	190X80X8	150x80x8 + straight section 15x80	130x80x8 + straight section 15x80	150x80x8 + angle section	130x80x8 + angle section
Actual height reduction (mm):	40	52	85	97	92	104

The continuity of combined reinforcement runners can be interrupted only in special cases and is subject to authorisation. Similarly, when it is difficult to apply an external reinforcing L section (items F and G Figure 3.4) - owing to the presence of suspension mountings or air spring connection brackets - and the recessing to be performed could excessively reduce the section's resisting capacity, the adopted solution will require special authorisation.

2.6.4.1 Centre axle trailers: towing cross member in lowered and forward positions (short coupling)

Vehicles designed to tow centre axle trailers for which a final cross member located in a lowered or forward position (next to the rear suspension rear mountings or air springs) is evisaged, do not require particular chassis reinforcing devices. For the sub-frame, the runner profile dimensions indicated for the different types of equipmen t (e.g. see Table 3.4 standard bodies) will be sufficient. The bodybuilder will accurately work out the size and position of the chassis connection structure (see point 2.6.3 and 2.6.4) and make use of a suitable cross member and an appropriate towing hook.

The tow hook position will be such to permit any movement between vehicle and trailer drawbar according to the various conditions of use, to comply with the required safety margins and the standards and legal regulations in force (where applicable). In these cases the standard underrun bar cannot be used, and the bodybuilder will investigate the possible permitted changes from specifications or the specific solutions to adopt (e.g. tilt type underrun bar).

2.6.4.2 Reinforcement of Standard Rear Cross Member

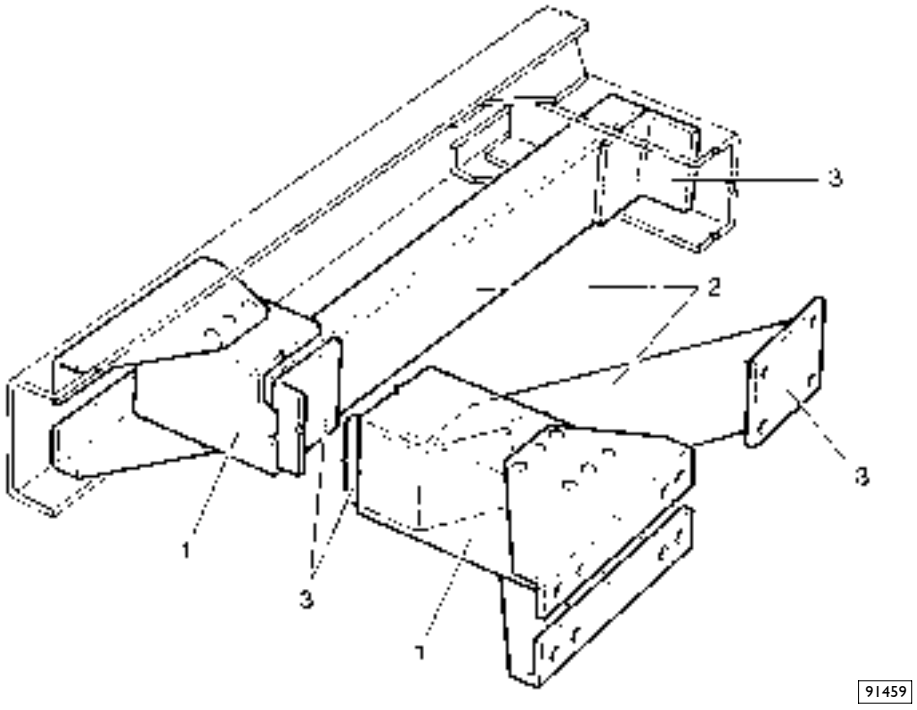
When it is necessary to reinforce the standard cross member and when original cross members are not available, the bodybuilder will provide suitable reinforcements for which he shall be responsible.

These reinforcements may consist of C-sections mounted on the inside of the cross member. Care must be taken to ensure that the connections between the cross member and the side members are also reinforced following the procedures recommended below, whenever stronger enforcements are required:

1) The mounting of a channel section on the inside of the cross member and joining it to the vertical web of the side member or to the following cross member of the chassis, if it is situated in close proximity, in compliance with the procedures illustrated in Figure 2.13.

Installing a Towing Device

Figure 2.13

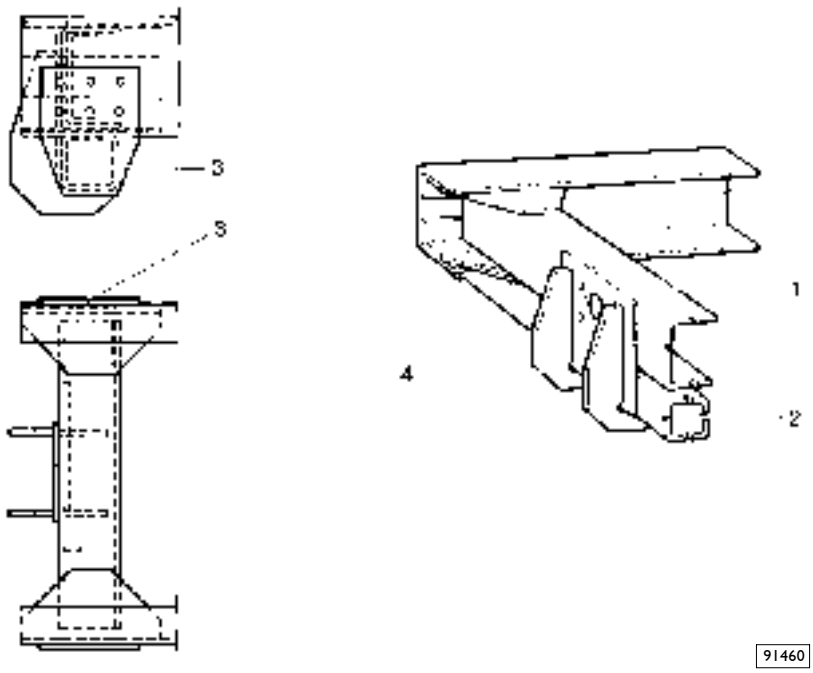


1. Original cross member - 2. Reinforcing rail - 3. Connecting angle pieces or plates

2) Mounting a box section of suitable dimensions underneath the cross member, anchored at the extremities to the vertical web of the side members and joined at the centre of the cross member as shown in Figure 2.14.
In vehicles having a short rear overhang and a subframe, the box section can be fitted within the subframe sections, above the cross-member, and connected to it by means of a plate (as shown in Figure 2.12).

Should box-section assembly require modification to underrun bar plates the original requirements for fastening, resistance and stiffness must be met (comply with local government regulations if any).

Figure 2.14



1. Original rear cross member - 2. Box section - 3. Connecting plate - 4. Ribbing plate

2.6.4.3 Tow hooks for Centre Axle Trailers

The use of centre axle trailers involues the use of tow hooks suitable for this purpose.

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

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

2.6.4.4 Remarks about the Payload

It should be ascertained that the static drawbar load does not cause the allowable load on the rear axle or axles to be exceeded and that the required minimum load acting on the front axle is adhered to see point 1.13.3.

2.6.4.5 Increasing the Towable weight

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

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

These include possible reinforcements to the standard cross member (see Figure 2.13), the instructions for installing a reinforced cross member when available, and those on the brake system to be made.

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

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

Installing a Towing Device

2.7 Installing a Supplementary Axle

The installation of an additional axle has heavy repercussions on the vehicle systems; in particular, it has a critical impact on the braking system, the compressed air system, the wiring harness and the MUX interconnection systems.
Accordingly, the addition of an extra axle must be approved by IVECO and must be performed according to the instructions given in chapter 5 "Special instructions for electronic subsystems".

2.7.1 General Specifications

On certain models IVECO may authorise, upon request, the installation of a supplementary axle and, consequently, an increase in the total weight of the vehicle.

The modification must respect the weight limitations and the conditions imposed by IVECO as well as all other conditions that may be imposed by national laws and such that are necessary to ensure the safety and proper functioning of the vehicle.

Diagrams of the installation procedure may be submitted for inspection. These proposals must indicate the parts necessary to connect the axle to the chassis as well as the reinforcements to, and modifications of the chassis. It is also necessary to submit diagrams showing the changes made to the systems.

The specifications given in points 2.5 and 2.6 are to be followed for all modifications of the chassis.

In view of the increased stresses due to the increase in permissible load, and in consideration of the different phases of the dynamic stresses in operation as a result of the different reactions on the chassis when the axle is added, it is necessary to provide appropriate reinforcements to the chassis.

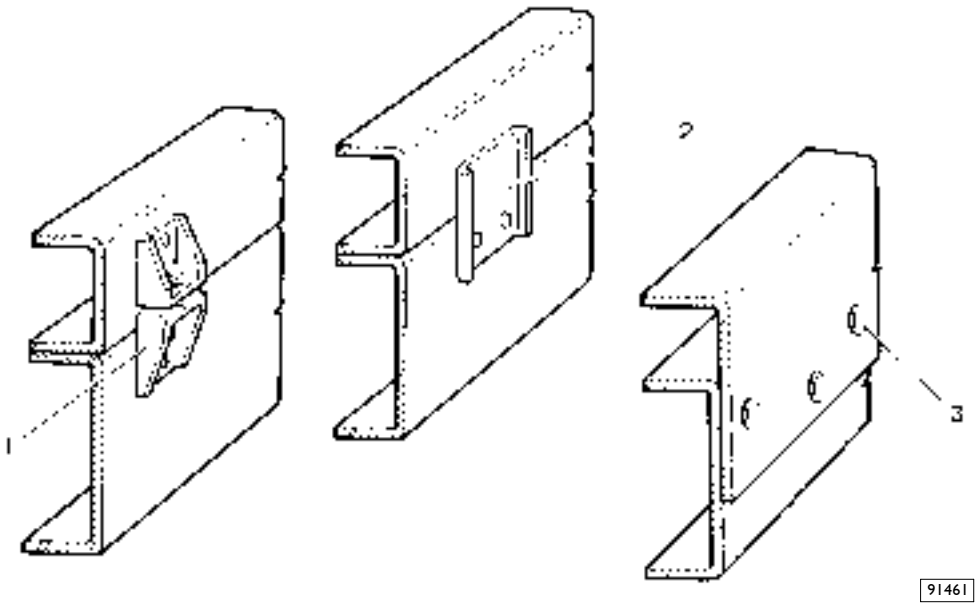
These reinforcements must in all cases satisfy all provisions of local applicable laws. The chassis that has thus been modified must not be subject to flexural stresses greater than those of the original chassis in the corresponding sections.

2.7.2 Chassis Frame Reinforcement

Figure 2.15 illustrates possible ways of modifying the chassis. The reinforcements must be continuous and must span the length of the entire frame of the vehicle up to the driver's cab. For their attachment to the side member - when using L-bars - class 8.8 reinforcement bolts must be used and their diameter and distribution must be such to enable the section reinforcements to provide the required strength.

Installing a Supplementary Axle

Figure 2.15



1. Bracket - 2. Plate - 3. Screws, rivets or Ø 20 to 30 mm holes to be filled with welding

Where an auxiliary frame is required as reinforcement (see point 3.1), the body mounting brackets on the chassis (if any) should be used for the attachment. An alternative method of attachment is shown in point 3.1.2 and those that follow it.

We recommend using shear resistant connection in the area of the rear overhang up to approximately the mid wheelbase (or to a point no closer than 2 m from the front axle) (see Figure 2.15).

The fitting of reinforcing plates directly onto the flanges of the side members, using holes filled with welded material is not permitted. This is to avoid affecting the strength of the original sections caused by poor welding.

This procedure is only permitted in special cases with specific IVECO authorization when there are proven difficulties in subsequent body applications.

It is possible to do without reinforcements on the frame if the static stress values in the Table 2.10 are not exceeded.

Any limitations, imposed by national regulations must be complied with.

Because of the deterioration of the material's properties during the welding process, if the installation is unavoidable it is then advisable to assume a reduction of 15% in the strength of the material when checking the load-effects acting on the various sections of the chassis.

As a general rule the thickness of the reinforcing plate must not exceed that of the flange of the original chassis.

The mounting must be carried out by skilled personnel and the bodybuilder will be responsible for any damage to the frame resulting from poor workmanship.

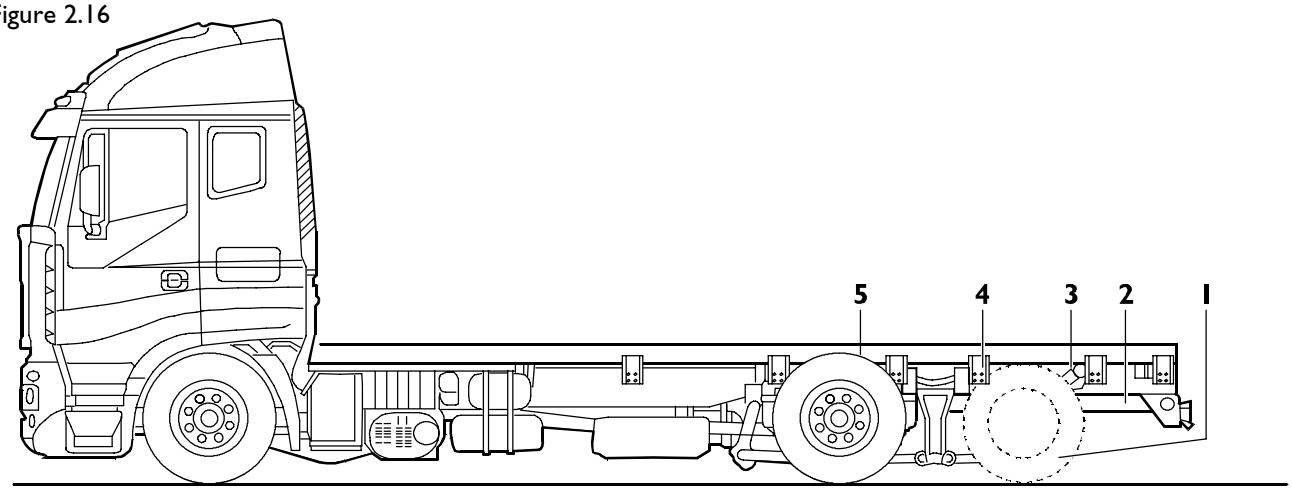
2.7.3 Installing a Rear Supplementary Axle

The installation of a rear supplementary axle generally implies that the chassis overhang should be lengthened, the extension must be carried out in compliance with the specifications given in point 2.5.3 relating to the modifications of the chassis, leaving the reinforcements mentioned above unaffected.

When an additional axle is added to the overhang with a section depth smaller than the depth within the wheelbase area the adjustment of the section to give a higher value could be a solution towards reducing the stress arising from the conversion.

In Figure 2.16 shows an example of the installation of a rear axle with an extension of the rear overhang.

Figure 2.16

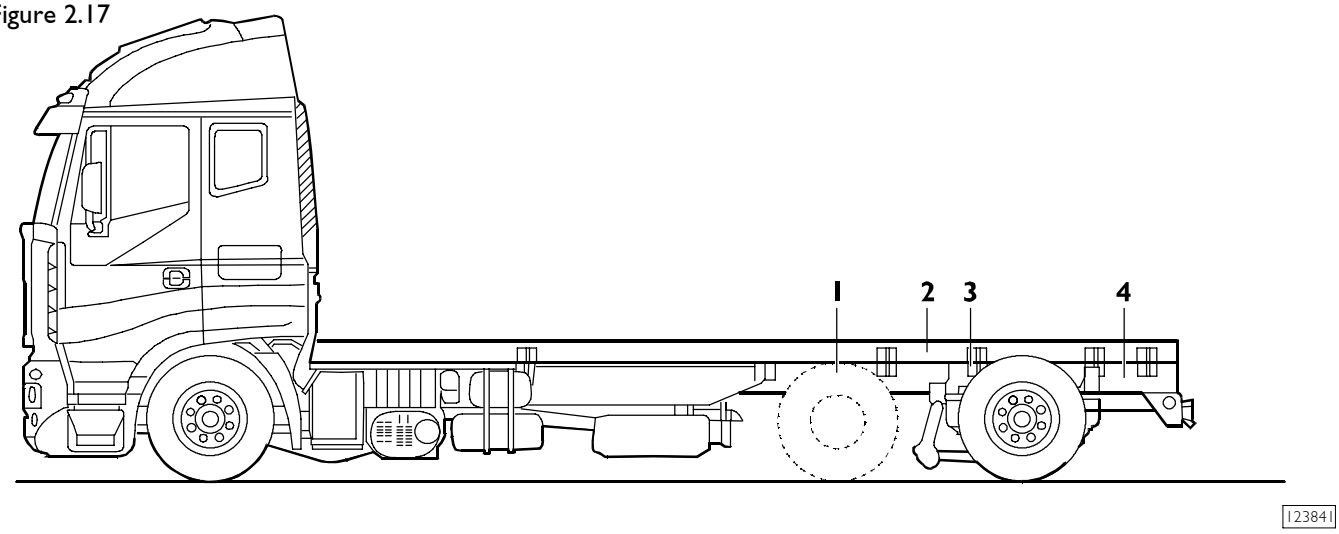


1. Added supplementary axle - 2. Extension to the overhang - 3. Reinforcements for the modification of the chassis - 4. Connections - 5. Reinforcing runner

Installing an Intermediate Supplementary Axle

The installation of an additional axle in a forward (intermediate) position relative to the drive axle may require a possible reduction in the rear overhang (see point 2.5.2) in order to obtain the proper distribution of the weights (see Figure 2.18).

Figure 2.17



1. Added supplementary axle - 2. Reinforcing runner - 3. Connections - 4. Reduction in the rear overhang

Installing a Supplementary Axle

2.7.4 Steering Axles

Steering axles can be installed both intermediately and at the rear. They can be of the self-steering or force-steering types and be designed and installed in such a way that the required dependability and road safety are guaranteed. The self-steering axle must be fitted with a device controlled from the driver's seat which will lock the axle in the straight position when reversing.

The installation of an axle whose force-steering is obtained by means of the original steering system of the vehicle requires specific authorisation from IVECO in relation to the suitability of the original components for the conversion in question. In this case, it will be necessary for diagrams of the supplementary system to be submitted for our inspection.

2.7.5 Components and Suspension

Manufacturing quality of all components used (axle, suspension, braking units, systems etc) must be ensured in order to guarantee driving safety and good vehicle operation.

Particular care and attention must be paid to the designing and construction of the suspension in consideration of its importance for the proper performance and handling of the vehicle on the road.

The designed suspension may be either of the mechanical leaf-spring type, pneumatic with air actuated springs or of a mixed type. Whatever type is used it must not negatively affect the handling characteristics of the vehicle and its components in terms of driving quality, comfort, road holding, working angle of die transmission and its working space in the case of an intermediate supplementary axle.

Where the additional axle has its own independent suspension, the suspension characteristics must be proportional to those of the original rear suspension in relation to the static loads applied to the two axles.

2.7.6 Stabilisers

When pneumatic suspension is used for the added axle, depending on the solution adopted, it may be further necessary to fit an antiroll bar in particular when a body with a high centre of gravity is used.

Similar measures must be adopted to ensure stability in relation to mixed type suspension on an additional rear axle.

2.7.7 Connection to the Chassis Frame

The connections of the added axle to the chassis must be such as to be able to withstand all longitudinal and transverse stress forces without transmitting them to the drive axle.

At the points in which the forces are introduced (spring supports, air spring brackets etc.), appropriate cross members or suitable frame reinforcements must be provided.

Ensure that the added axle is at right angles and aligned properly in relation to the longitudinal axis of the vehicle and the live axle. Check using the appropriate equipment available in the market.

Installing a Supplementary Axle

2.7.8 Braking system for additional axle

The braking system, considering its importance relative to the active safety of the vehicle, must be extremely well developed and constructed.

Braking units, hoses and joints of the same type as on the original vehicle must be used.
The auxiliary axle must be equipped with the same brake components as those provided for the front axle.
Use flexible pipes to form the connection between the fixed parts (chassis) and moving parts (axles).
The braking torque must be proportional to the static and dynamic loads in order to provide an even distribution of the braking action to all the axles of the vehicle.
The total braking capacity of the modified vehicle must, as a general rule, be proportional to that of the original vehicle, allowing for the different total mass that is now applicable. The performance of the braking system (service, emergency and parking) must in all cases satisfy the current government regulations in terms of deceleration, behaviour when hot, response time, efficiency of engine braking and so forth.
If the Technical Control Authority demands that the technical documentation regarding the braking system be submitted (e.g. adhesion curves, compatibility range diagram) this must be provided by the company in charge of the conversion or the manufacturer of the auxiliary axle.
Upon request, technical documentation with characteristics and attainable performances of the braking system of the original vehicle may be made available.
For the construction of the braking circuit for the additional axle it is advisable to employ equipment and circuits specially provided for each single model by the Manufacturer of the equipment in use on the original vehicles.
Solutions are allowed that include direct connection between the additional axle braking section and the engine axle braking section.
Check that the air tank capacity is sufficient for the size of the new additional brake cylinders. If necessary, fit a supplementary air tank.
Current legal requirements must be complied with for the emergency and parking brake. We recommend that a parking brake is fitted on the additional axle.

For indications of a general nature concerning the braking system, see the instructions given at point 2.15.

For the electrical system, comply with the indications provided at point 5.5.

2.7.9 Raise Device

The additional axle may be equipped with a raise device and may also be used in specific cases where permitted by government regulations, to increase the adhesion of the drive axle to the ground under certain conditions (starting uphill, slippery or snow/ice covered roads) provided that:

- This modification is made conditional to the issue by IVECO of a permit in which the maximum permitted load on the overloaded axle is specified.
- The device is used only for driving short distances for the uses stated above, and at the maximum speed stated on the specific authorization.

Some national regulations permit the use of the lifting device even during normal vehicle travel, provided that the max. type-approval load specified for the drive axle and admissible speed limits are not exceeded.
In such cases the indications given in point 1.13.2 should be heeded concerning the centre of gravity of the body plus the payload.

Approval of and Responsibility for the Operations Carried Out

Following conversion, the vehicle must be submitted to local authority technical control for approval (e.g. single inspection or type approval).

The authorisation given by IVECO to install an auxiliary axle and the passing of the approval inspection do not free the bodybuilder/converter from responsibility for the conversion in question, or its effect on the vehicle.
For the added assemblies, the required service or maintenance operations with relevant schedule, consistent with the operations and relevant schedule planned for the original vehicle must be defined and entered in the specific documentation.

Installing a Supplementary Axle

2.7.10 Modifying the suspension

Changes to the suspension can be made only with IVECO's prior approval, the suspension being a system of decisive importance to riding safety.

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

The use on the same axle of one parabolic spring and one trapezoidal spring is not allowed.

Installing a Supplementary Axle

2.8 Modifying the Drive Line

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

In cases of particular difficulty, the assistance of the company may be sought. A diagram giving the length and inclination of the proposed new transmission must accompany the request.

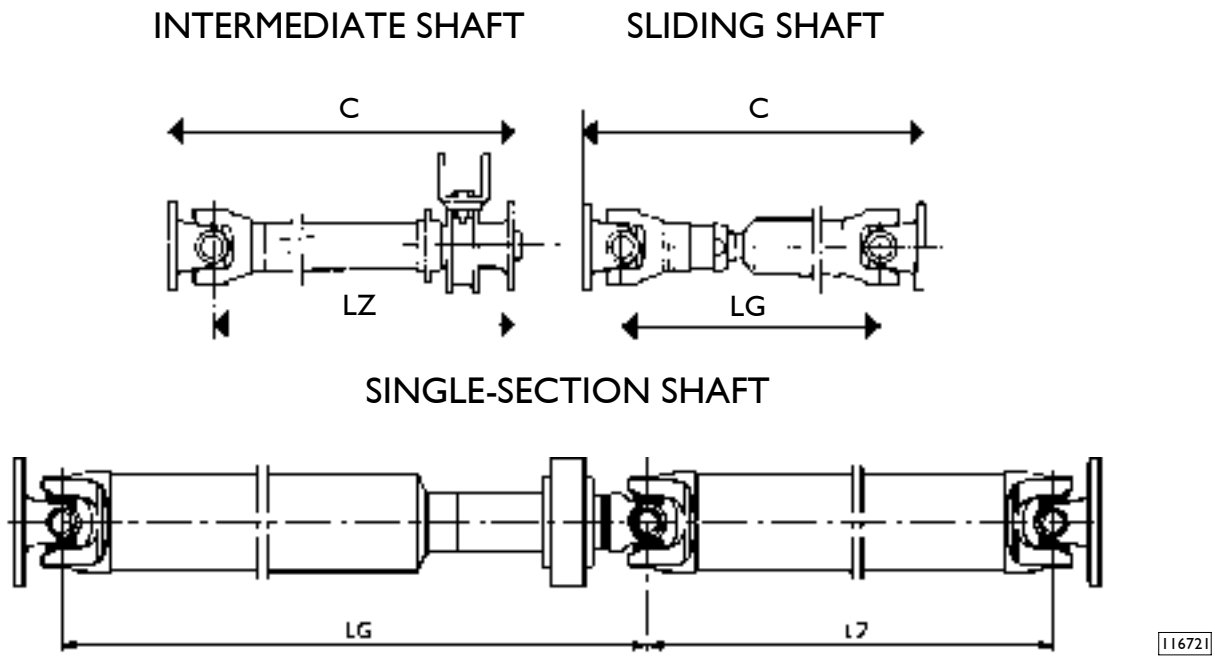
The purpose of the specifications contained in this manual is to ensure the proper functioning of the transmission, to limit its noise and to avoid the build-up of stress transmitted from the engine assembly. In no way does this diminish the responsibility of the bodybuilder for the work he has completed.

2.8.1 Permitted lengths

The maximum operating lengths obtainable for both the intermediate shaft sections and the sliding shafts "LG" or "LZ" (see Figure 2.18) can be determined according to the external diameter of the tube existing on the vehicle and the maximum operating rotational speed (see formula). These are specified in Table 2.15.

For the propeller shaft length specified in Table 2.15 when the tube diameter is not sufficient, a new shaft section with the same characteristics as the existing shafts must be used. As an alternative, in some cases the transmission shaft with a larger diameter tube can be used. The tube diameter required can be determined in compliance with the required length and the maximum rotational speed, directly from Table 2.16.

Figure 2.18



As far as sliding shafts are concerned, length LG is measured between the universal joint centres, with the sliding stub in its intermediate position.
As regards single-stub shafts, check both branches LG and LZ.
The maximum working revs can be obtained using the formula below:

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

n_{max} = maximum number of engine revolutions (rpm).
i_G = gear ratio in fastest gear.
i_V = transfer box ratio, equal to 1 if not present or for shafts upstream of the transfer box.

The maximum propeller shaft speed is determined on the basis of the following formula (the necessary data may be obtained from the vehicle specifications and from the data plates on the engine, gearbox or transfer case).

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

n_g = Max. prop. shaft speed (rpm).
n_{max} = Max. engine speed (r.p.m.).
i_G = Gearbox ratio at top speed.

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

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

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

The minimum operating length (from flange to flange) must not be less than 800 mm for the sliding sections and 700 mm for the intermediate sections.

Table 2.15 - Obtainable propeller shaft characteristics

Joint size	Outer diameter x thickness (mm)	Max achievable lengths LG or LZ (mm)							
		1800	1900	2000	2100	2200	2300	2400	2500
		Maximum number of propeller shaft revolutions (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

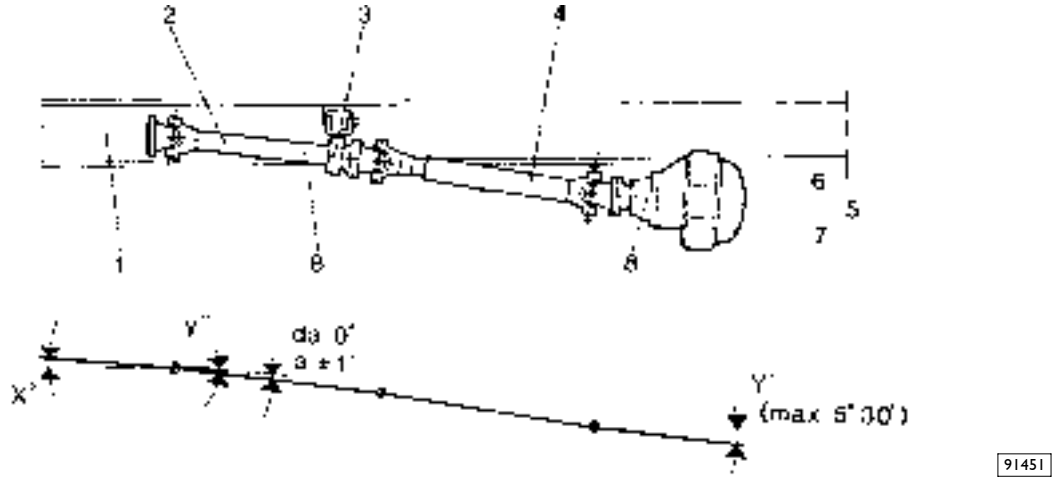
The maximum possible lengths given above refer to the original shafts; plan for shorter lengths (-10%) for shafts obtained for by modification.

2.8.2 Determining Driveshaft Positions

In the case of drive lines which consist of several shafts, the individual shafts must all be approximately of the same length. As a general rule, the difference in length between a non sliding and a splined shaft (see Figure 2.19) must not exceed 600 mm. The difference in length between the shafts must not be more than 400 mm. A margin of at least 25 mm must be left so that the sliding joint can travel when the splined shaft is closed. When fully extended the shaft sliding sleeve should cover the splined stub for a length that should be about twice the diameter of the splined stub itself.

When the required length of the drive line exceeds the permissible length, an additional driven shaft must be provided as illustrated in Figure 2.19.

Figure 2.19



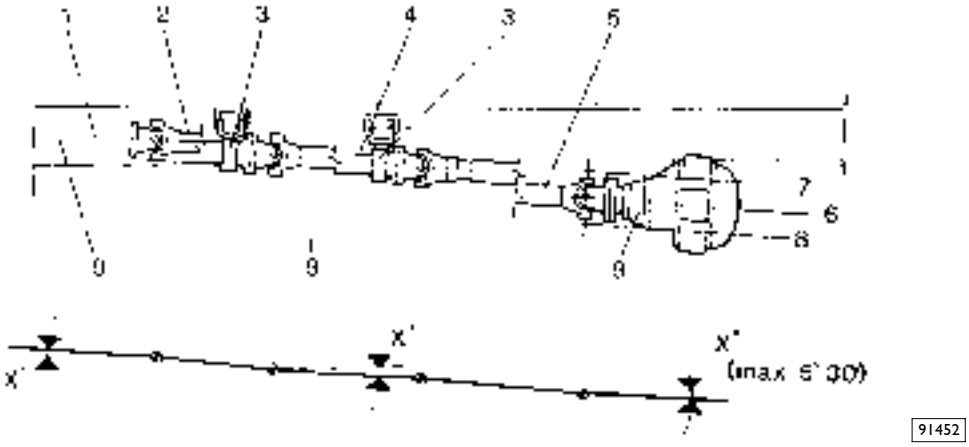
1. Engine, clutch, gearbox axis - 2. Intermediate shaft (non sliding) - 3. Intermediate shaft support - 4. Propeller shaft with sliding end - 5. Inclination of rear axle case (static load) - 6. Inclination of rear axle case (max. compression) - 7. Inclination of rear axle case (unladen) - 8. Intermediate shaft and axle case axis must have the same inclination

The intermediate shaft and the inclination of the rear axle case must be aligned accurately.
The difference in their inclination relative to the engine-clutch-gearbox axis must not vary more than 1°. This can be achieved by fitting wedges between the rear axle and the springs, or by adjusting the rear axle reaction bars. The inclination of the rear axle must not exceed 5.5°

When, with a loaded vehicle, the rear axle flange is at a level which is lower than that of the gearbox flange, care must be taken to ensure that the inclination of the differential housing and of the driven shaft are greater than the inclination of the engine-gearbox axis. On the other hand, if, with a loaded vehicle, the rear axle flange is at a level which is higher than that of the gearbox flange, the inclination of the differential housing and of the driven shaft must be less than the inclination of the engine-gearbox axis.

When lengthening the wheelbase is substantial, it may become necessary to fit a supplementary intermediate shaft as shown in Figure 2.20. In this case the same inclination must be maintained between the engine-gearbox axis, the second intermediate shaft and the axis of the differential housing.

Figure 2.20

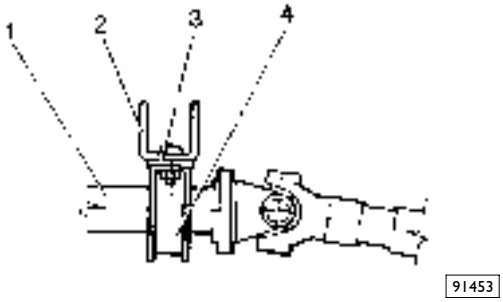


1. Engine, clutch, gearbox axis - 2. 1st intermediate shaft - 3. Intermediate shaft support - 4. 2nd intermediate shaft - 5. Propeller shaft with splined end - 6. Inclination of rear axle case (static load) - 7. Inclination of rear axle case (max. compression) - 8. Inclination of rear axle case (unladen) - 9. Gearbox, 2nd intermediate shaft and rear axle case axis must have same inclination.

Elastic supports must be fitted with the aid of supporting plates, at least 5 mm thick (see Figure 2.21), connected to cross-members having the same characteristics as those specified by IVECO.

When reducing the wheelbase it is recommended that the intermediate shafts are removed if the length of the splined shaft is less than approximately 800 mm.

Figure 2.21



1. Intermediate shaft - 2. Support bracket - 3. Backing plate - 4. Support of intermediate shaft

If the drive line consists of a single shaft the inclination of the axle housing must be the same as the inclination of the engine-gearbox axis.

The same holds true also for vehicles with separate gearbox. In addition to this, as a general rule, the wheelbase of such vehicles cannot be reduced beyond the measurement of the shorter wheelbase contemplated for standard production (tippers for example).

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

Modifications to the universal joints are not permitted.

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

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

IVECO's approval is not required, if the frame is extended at the rear, or is shortened to the minimum value admissible for each model as standard, provided that this is done according to the instructions given herein.

If it proves necessary modify the length of the electrical circuits, see chapter 5 "Special instructions for electronic subsystems".

Modifying the Drive Line

2.9 Modifications of the Engine Air Intake and Exhaust System

2.9.1 Intake

The specifications of the engine air intake and exhaust systems must not be altered without prior authorisation from IVECO. Modifications carried out must not alter the vacuum levels (for the intake) or the original exhaust back pressure levels.

Table 2.16 - Engine Back Pressures

Engines	Engine Code	Maximum exhaust back pressure (kPa)	Maximum intake back pressure (kPa)
CURSOR 8			
E31	F2BE3681C	20	6.5
E33	F2BE3681B		
E36	F2BE3681A		
CURSOR 10			
E42	F3A3681B	19	6.5
E45	F3A3681A		
E46	F3A3681Y		
CURSOR 13			
E41	F3B3681D	28	6.5
E44	F3B3681G		
E45	F3B3681C		
E48	F3B3681F		
E50	F3B3681B		
E52	F3B3681E		
E56	F3B3681A		

The air intake must be positioned to avoid the intake of hot air from the engine and/or dusty air snow or rain. The apertures for the intake of air which may have to be made in the side of integral bodies, must have a working surface of not less than two and a half times that of the master hose located upstream of the filter. These apertures (e.g openings in the grill) must be of such a dimension that they do not become obstructed. It is prohibited to alter the air filer or replace the original filter with a lower air capacity unit. Any connections on the intake duct must guarantee resistance of the tube to penetration by water or dust and free from sharp/rough edges (or welding burrs inside metal tube). It is not permissible to modify or substitute the original air filter.

2.9.2 Engine exhaust

The routing of the exhaust pipe must be as even as possible. Bends must not have an angle of less than 90° and the radii should not be less than 2.5 times the external diameter. Avoid kinks and use cross-sections which are no smaller than those corresponding to the original system. Any connections on the intake duct must guarantee resistance of the tube to penetration by water or dust and absence of sharp edges or welding burrs inside the tube. Sufficient clearance should be maintained (min. 150 mm) between the exhaust pipe and the electrical system, plastic hoses, the spare wheel, the plastic fuel tank (min. 100 mm), etc. Lower values (e.g. 80 mm) may be permitted if suitable sheet metal shielding is used. Further reductions require the use of heat insulation and the substitution of the plastic tubes with steel pipes. It is not permissible to modify or substitute the original air filter; the silencer body cannot be altered. Modifications to the silencer body and engine equipment (injectors, engine control unit etc.) are not permissible as this may alter the correct functioning of the engine and adversely affect the emissions of gases from the exhaust.

NOTE Chapter 6 concerning SCR contains additional information on exhaust system changes.

2.10 Modification of the Engine Cooling System

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

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

Modification of the Engine Cooling System

2.11 Installation of a Supplementary Heating System

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

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

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

Furthermore:

- ensure correct operation of the vehicle components and equipment (i.e. cooling system);
- check the electrical system to ensure that the battery capacity and alternator output is sufficient for the higher current requirements (see point 5.5). Provide the new circuitry with a protection fuse;
- connect the intake of the newly added fuel system to the reservoir connected to the engine fuel return line. Direct feed from the vehicle fuel tank is permitted only if this is independent from the engine fuel system and the new circuit is perfectly leakproof;
- trace pipe and cable paths, the location of brackets and hoses bearing in mind that the overall dimensions and heat affect the various units on the chassis. Avoid runs and arrangements that could lead to hazards when the vehicle is running. Use shields or armouring if necessary;
- When installing a water heater, original vehicle heating and engine cooling circuits are involved (see point 2.10), it is advisable to follow the instructions listed below to ensure reliability of the heating system and safe operation of the original system:
  - ❑ special care must be taken when defining the connections between the supplementary equipment and the main one; refer to IVECO, if necessary;
  - ❑ determine a rational arrangement for piping, avoid neckings and siphonings;
  - ❑ install proper venting valve (bleeding points) to ensure proper filling of the system;
  - ❑ supplementary plugs should be installed to ensure draining of the system, if necessary;
  - ❑ proper insulation should be used to prevent heat dissipation.
- When air heaters are used and when the installation is to be made directly in the cab, make sure that the engine exhaust system does not touch the added installation (to prevent exhaust gas circulation inside the vehicle) and have the correct warm air distribution by avoiding direct air flows;
- the complete installation should be designed to ensure good accessibility for quick and easy servicing.

Installation of a Supplementary Heating System

2.12 Installing an Air-Conditioning System

When the installation of an air conditioning system is deemed necessary, it is advisable to use the types recommended by IVECO.

If this procedure is not applicable, the installation must be carried out in accordance with the supplier's instructions and the following points:

- the installation must not interfere with the correct operation of the vehicle components and of equipment which may be connected with the installation;
- check the electrical system to ensure that the battery capacity and alternator output is sufficient for the higher current requirements (see point 5.5.3). Provide the new circuitry with a protection fuse;
- in liaison with IVECO, establish a method for installing the compressor; if it is fitted to the engine, use the original IVECO compressor;
- trace pipe and cable paths, the location of brackets and hoses bearing in mind that the overall dimensions and heat affect the various units on the chassis. Avoid runs and arrangements that could lead to hazards when the vehicle is running. Use shields or armouring if necessary;
- the complete installation should be designed to ensure good accessibility for quick and easy servicing. At vehicle delivery, the bodybuilder will supply all service and maintenance instructions which are deemed necessary.

Furthermore, according to the system operations:

a) Equipment installed inside the cab

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

b) Equipment fitted on the cab roof

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

Installing an Air-Conditioning System

2.13 Cab Modifications

2.13.1 General Specifications

Any work on the driver's cab must first be authorised by IVECO before any work is started.

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

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

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

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

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

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

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

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

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

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

2.13.2 Roof Panel Modifications

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

When fitting assemblies or devices on the roof, make sure that their weight does not exceed that permitted for the cab. These limits can be supplied on request, as a function of type of superstructure.

Cab Modifications

2.14 Changing the Size of the Tyres

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

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

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

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

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

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

The use of tyres with a different outside diameter affects the performance of the vehicle in terms of speed, maximum gradability, pulling force, braking power etc. The tachograph must be recalibrated by an authorised workshop. The load capacity and the relative reference speed must always be compatible with the performance of the vehicle. When the tyres with a load capacity or speed limit are chosen for a given vehicle, the permissible loads of the vehicle or its performance, must be reduced accordingly. On the other hand, the use of tyres with a greater load capacity does not automatically increase the maximum permissible weight on the axles.

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

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

Changing the Size of the Tyres

Table 2.17 - Tyre configuration

Tyre size	Rim	Steel wheel offset (mm)	Aluminium wheel offset (mm)
285/60R22,5	8.25 9.0	98 89	105 99
295/60R22,5	8.25 9.0	98 89	105 99
305/60R2,5	8.25 9.0	96 87	103 94
315/60R22,5	9.0	87	97
385/55R22,5	11.75	115	125
385/65R22,5	11.75	110	120
275/70R22,5	7.5	99	
305/70R22,5	8.25 9.0	93 84	100 94
315/70R22,5	9.0	82	94
275/80R22,5	7.5 8.25	95 91	 95
395/080R22.5 295/80R22.5	8.25 9.0	89 80	96 91
315/80R22,5	9.0	79	89

Tyre loading capacity is given in the individual manufacturers' manuals.

Changing the Size of the Tyres

2.15 Modifications to the Braking System

2.15.1 General Specifications

The braking system with its components represents an element of crucial importance to vehicle safety.

It is prohibited to make changes to units such as the brake force control system, distributor, brake cylinders, valves, etc, which are rated as safety components.

Any changes to the braking system (changes to the piping, fitting additional operating cylinders, etc.) require prior authorisation from IVECO.

For new equipment we recommend the same make as those fitted to the original vehicle.

When required by national regulations, the vehicle must be submitted for testing to the respective authority.

In the event of the regulating valves, air drier etc., being moved, reinstate the same type of installation as originally envisaged, verifying correct operation. In addition, operations carried out on the air drier must not affect cooling of the air supplied by the compressor.

2.15.2 Brake Pipes

When the wheelbase or rear overhang of the chassis are modified, the brake pipes concerned must be replaced by a single length of new pipe. Where this is not possible the connectors used must be of the same type as those used originally on the vehicle. When replacing observe the minimum internal dimensions of the existing pipes.

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

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

Plastic Pipes

When fitting new pipes or replacing others, plastic must not be used for the following:

- in areas where the temperature reaches more than 80°C (e.g. within 100 mm of the engine exhaust system).
- Between fixed and moving parts, in this case special hoses are to be used.
- On the hydraulic lines.

During modification the following must be observed:

- Material and dimensions : Standard DIN 74324 (Iveco Standard 18-0400) (max. operating pressure 11 bars)
- Radii of curvature (referred to the pipe centreline) : min. 6 Ø outer dia

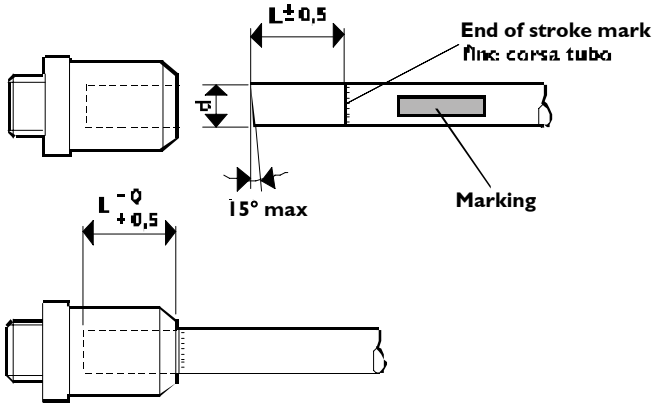
Modifications to the Braking System

Preparation and installation (Iveco Standard 17-2403)

Cut the pipe at right angles (max. permissible variation 15°) using the correct tools to avoid flaws which could impair tightness. Mark the portion of the length L (see Figure 2.22) to be inserted in the connector with indelible ink or adhesive tape to ensure tightness. Mark the pipe to avoid confusion while it is being installed for subsequent modifications.

The Voss connector configurations are as shown in drawing 504225097.

Figure 2.22



d (mm)	L(mm)
6	19.8
8	20.5
10	24
12	25
16	27.1

91463

Table 2.18 - Configuration of the new connectors VOSS - SV214/W

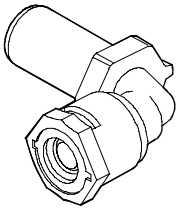
Type	pipe ∅	coupling ∅	VOSS reference	IVECO reference	GENERAL NOTES Possible couplings with other connectors
 SV 214/W	6	6	5214010000	504149122	Straight connector ∅ 6 IVECO No. 504148941 with thread M10x1 IVECO No. 504148950 with thread M12x1.5 IVECO No. 504148962 with thread M12x1.5 IVECO No. 504148965 with thread M22x1.5 Intermediate connector ∅ 6 - 6 IVECO No. 504149318
	8	8	5214010200	504149132	Straight connector ∅ 8 IVECO No. 504148948 with thread M10x1 IVECO No. 504148956 with thread M12x1.5 IVECO No. 504148963 with thread M16x1.5 IVECO No. 504148966 with thread M22x1.5 Intermediate connector ∅ 8 - 8 IVECO No. 504149327
	6	12	5214010700	504149133	Straight connector ∅ 12 IVECO No. 504148959 with thread M12x1 IVECO No. 504148964 with thread M16x1.5 IVECO No. 504149016 with thread M22x1.5
	8		5214010900	504149136	
	12		52140111100	504149139	**Intermediate connector ∅ 12 - 6/8/12** IVECO No. 504149332

Table 2.19 - Configuration of the new connectors VOSS - SV214/GV SV214/GE

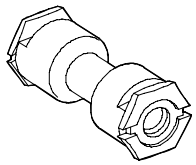
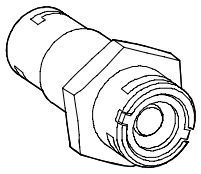
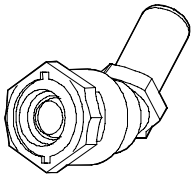
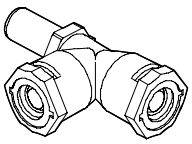
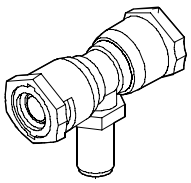
Type	SW key	pipe Ø	Receptacle connector thread	VOSS reference	IVECO reference	GENERAL NOTES Possible couplings with other connectors
 SV 214/GV		6		5214012000	504149318	**90° connector Ø 6** IVECO No. 504149122 coupling Ø 6
		8		52140121 00	504149327	**90° connector Ø 8** IVECO No. 504149132 coupling Ø 8
		12		5014012200	504149332	**90° connector Ø 6** IVECO No. 504149133 coupling Ø 12 90° connector Ø 6 IVECO No. 504149136 coupling Ø 12 90° connector Ø 6 IVECO No. 504149139 coupling Ø 12 **45° connector Ø 12** IVECO No. 504149148 coupling Ø 12 L connector Ø 12 IVECO No. 504149170 coupling Ø 12 T connector Ø 12 IVECO No. 504149174 coupling Ø 12
 SV 214/GE	22	(2x) 8	m16 x 1.5	5214006400	504140020	**90° connector Ø 8** IVECO No. 504149132 coupling Ø 8
	24	12	M18 x 1.5 (with sealing taper seat with pipe j 16) on one side	5214006200	504149022	**90° connector Ø 6** IVECO No. 504149133 coupling Ø 12 **90° connector Ø 8** IVECO No. 504149136 coupling Ø 12 **90° connector Ø 12** IVECO No. 504149139 coupling Ø 12
	28	(2x) 12	M22 x 1.5	5214006000	504149021	**L connector Ø 12** IVECO No. 504149170 coupling Ø 12
	28	12	M22 x 1.5 (inner thread M16 x 1.5) on one side	52140061 00	504149026	**T connector Ø 12** IVECO No. 504149174 coupling Ø 12

Table 2.20 - Configuration of the new connectors VOSS - SV214/W VOSS - 214/L VOSS - 214/T

Type	pipe Ø	VOSS reference	IVECO reference	GENERAL NOTES Possible couplings with other connectors
 SV 214/W	12	5214011600	504149148	**Straight connector ∅ 12** IVECO No. 504148959 with thread M12x1.5 IVECO No. 504148964 with thread M16x1.5 IVECO No. 504149016 with thread M22x1.5 **Receptacle connector ∅ 12** IVECO No. 504149022 with thread M18x1.5 IVECO No. 504149021 with thread M22x1.5 IVECO No. 504149026 with thread M22x1.5
 SV 214/L		5214011200	504149170	
 SV 214/T		5214011300	504149174	

As a rule quick coupling connectors should be used. We recommend that the same makes present on the original vehicle be used. When necessary (e.g. near bends), connectors with metal inserts may be used. Before inserting the pipe into the connector the latter must be screwed into its threaded seat on the component (e.g. pneumatic valve) adopting the tightening torques indicated below.

Table 2.21

Thread	Tightening torque (Nm + 10%)
M 12 X 1.5 MM	24
M 14 X 1.5 MM	28
M 16 X 1.5 MM	35
M 22 X 1.5 MM	40

Insert the portion of the length L, previously marked, of the pipe into the connector applying force for 30 to 120 N depending on the dimension of the pipe.

The replacement of the components (valves etc.) is made possible since the coupling and connector may be internally rotated while screwing or unscrewing.

Should piping be replaced:

1. **If the connectors are of the Raufoss P5 type, use new connectors.**
2. **If the connectors are of the Voss 214 type, disassemble them using the special pliers, then re-fit them on the new piping.**

Installation of piping on vehicle

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

Pipes must be fixed in their correct position. The fixing clips must go right round the pipe. They may be of plastic, metal or rubber.

Observe adequate distances between the various fixing elements. As a rule a maximum distance of 500 mm for plastic pipes and 600 mm for metal pipes is applicable.

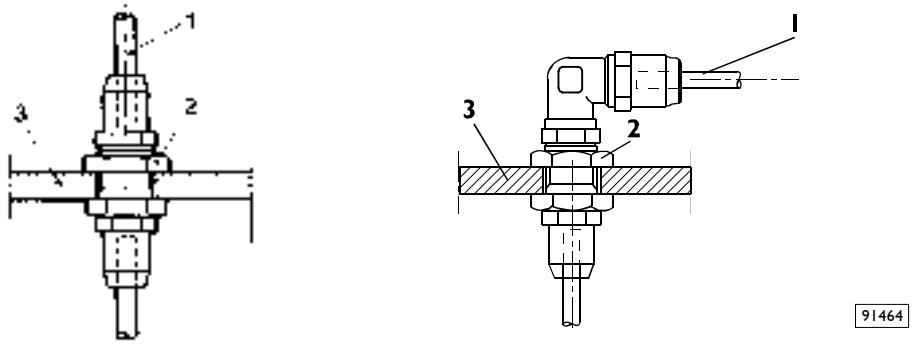
For plastic pipes, in order to prevent distortion and tension on the connectors when fitting them, take the necessary precautions when working out the run and fitting the fixing brackets onto the chassis. Correct fitting of the fixing brackets will ensure that the pipes do not rub against the fixed parts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

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

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

A solution which can be used as a bulkhead connection for a straight or angled run is given in Figure 2.23:

Figure 2.23



1. Pipe - 2. Bulkhead connector - 3. Chassis

After completing any work either on the system or the equipment, the braking system must be checked to ensure its efficiency.

For air systems, build up the pressure to its maximum value. Check for leaks in the areas affected by the work carried out.

To ensure that the connections have been made correctly, the air reservoir for one axle may be discharged. This check can be performed by reading the on-board gauge and, by working the brake pedal, by checking the pressure in the remaining brake section (or sections).

In hydraulic circuits, on completing the work, the normal air bleeding operation must be performed.

2.15.3 Electronic braking system control devices

For any changes to the electrical circuits, read carefully chapter 5.

When modifying the wheelbase, the ABS modulators must be kept in their original position in relation to the rear axle. The electrical wires (harness) between the sensors on the rear axle and the control unit and between the control unit and modulators must be modified accordingly by fitting the harness(s) from a longer wheelbase IVECO vehicle should there be insufficient length in the originals. Brake pipes upstream of the modulators must be similarly modified.

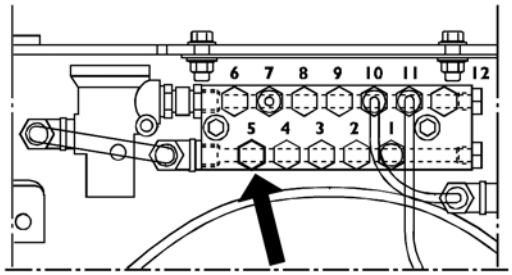
2.15.4 Taking air from the system

In vehicles with an air braking system it is possible to obtain small amounts of air from the air tank in the auxiliary circuit. Air should only be taken in through a reflux valve that is able to prevent tank pressure dropping to below 8.5 bars in the service brake circuit and auxiliary circuit.

Air must be taken in directly behind the brake system four circuit protection valve (output 24).

In the Stralis series, air may be taken in directly on the valve plate on connection 5 unless this is already in use (see Figure 2.24).

Figure 2.24



If larger quantities of air are required a supplementary air reservoir must be fitted. In this case, it will be necessary to check that the air compressor fitted is capable of charging the brake system reservoirs within the prescribed times.

If necessary a larger capacity compressor must be fitted.

2.16 Electrical System: Modifications and Drawing-Off Power

NOTE Subject moved to chapter 5.5

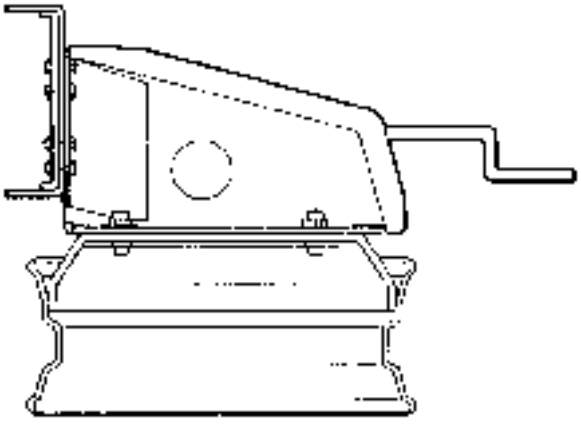
2.17 Repositioning Parts and Mounting Auxiliary Assemblies and Equipment

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

In the case of vehicles not equipped with a spare wheel carrier, and vehicles in which the spare wheel carrier must be relocated, the spare wheel must be secured to a suitable wheel carrier which allows the wheel to be readily removed.

To secure the spare wheel to the side of the vehicle with a support attached to the web of the side member, it is advisable to use a reinforcing plate on the inside or outside of the side member. The size of this plate must take into account both the weight of the wheel and the possible presence of other reinforcements on the side member (see Figure 2.25).

Figure 2.25



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

A similar procedure should be adopted when fitting additional units such as tanks, compressors etc. When positioning them, due consideration must be given to the distribution of the weights (see point 1.13.3).

In any event, an adequate distance of their height from the ground must be ensured with due consideration given to the use of the vehicle.

It is advisable to take measures to reinforce the frame depending on the weight of the construction parts. On request, Iveco is able to provide further information on this topic.

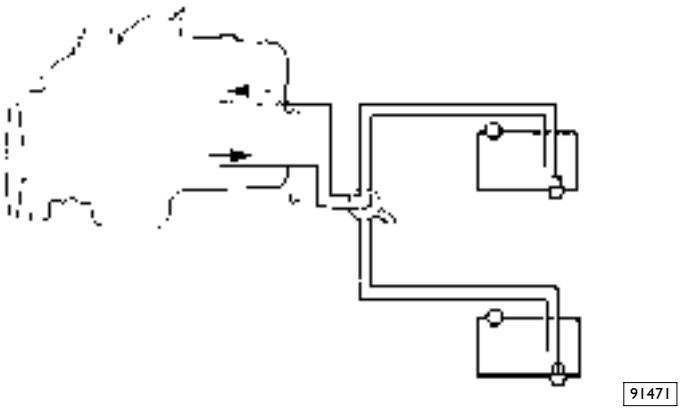
Any holes that are necessary for the relocation must be made on the web of the side member in accordance with the specifications given in point 2.3 Holes already present must be made use of to the greatest extent possible.

When tank refilling is hindered by the positions of the body structure, the tank mounting brackets may be installed one drilling unit lower (45 mm).

Supplementary fuel tank

If a supplementary fuel tank is to be added, the best solution is to use the same system arrangement already used for original fuel tank, using, whenever possible, original elements. The use of a switching system allows the alternative feeding from the two tanks (see Figure 2.26).

Figure 2.26



The use of the above system is advisable when the added tank is located on the side opposite the original one. When the tanks are in line on the same side it is possible to maintain fuel feed from the original tank then the added one should be connected directly to the former through hoses. The arrangement must conform to national rules and regulations. The tank-to-tank connecting line must be leakproof and not of a smaller internal dimension, have the same technical characteristics as those envisaged for the original system and be properly secured.

Table 2.22 - Stralis AT-AD, Cursor 8 engines, available tanks

Model	Engine	Fuel tanks					
		200L Plastic	300L Aluminium	400L Aluminium	600L Aluminium	800L Aluminium	800L+400L Aluminium
AT-AD190S AT-AD190S/P AT-AD190S/FP-D	S27	standard	opt 6170	opt 6172	opt 6173	opt 6177	-
	S30						
	S31						
	S35	-	standard				opt 6172
AT-AD440ST/P AT-AD440ST/P - HR	S31	-	standard	opt 6172	opt 6173	opt 6177	-
	S35						opt 7855
AT-AD260SY/PT AT-AD260SY/TN	S27	standard	opt 6170	opt 6172	opt 6173	opt 6177	-
	S31						
	S35	-	standard				opt 7855
AD260SX/P AD260SX/FP	S27	-	-	-	-	-	-
	S30						
	S31						
AT-AD260SY/P AT-AD260SY/PS AT-AD260SY/FP-D AT-AD260SY/FS-D	S27	standard	opt 6170	opt 6172	opt 6173	opt 6177	-
	S30						
	S31						
	S35	-	standard				opt 7855

Table 2.23 - Stralis AT-AD, Cursor 10 engines, available tanks

Model	Fuel tanks						
	300L Aluminium	400L Aluminium	600L Aluminium	300L+300L Aluminium	800L Aluminium	600L+300L Aluminium	800L+400L Aluminium
AT-AD190S AT-AD190S/P AT-AD190S/FP-D	standard	opt 6172		-	opt 6177	-	opt 7855
AT-AD190S/FP-CT	-	-	-	standard	-	opt 7854	-
AT-AD440ST/P AT-AD440ST/P - HR	standard		opt 6173	-		-	opt 7855
AT-AD440ST/P - LT	-	-	-	standard	-	opt 7854	-
AT-AD440ST/P - CT							
AT-AD260SY/PT AT-AD260SY/TN	standard	opt 6172	opt 6173	-	opt 6177	-	opt 7855
AT440S43TZ/P	standard	opt 6172	opt 6173	-	-	-	-
AT-AD260SY/P AT-AD260SY/PS AT-AD260SY/FP-D AT-AD260SY/FS-D AT-AD260SY/FS-CM	standard	opt 6172	opt 6173	-	opt 6177	-	opt 7855

2.18 Transporting hazardous goods ADR

Vehicles used to transport dangerous Goods - for instance inflammable materials or explosives - must be built in compliance with the safety specifications established for this type of transport by national or international regulations.

Stralis vehicles may be fitted with option 2342 (ADR) in combination with option 8818 (Digital Tachograph for ADR).

The optional 2342 consists of:

- special electric disconnector positioned on frame.
- Disconnector control switch positioned in cab.
- Emergency switch.
- Protected electrical connections.
- Wiring protected using polyamide sheath.
- ADR type approval plate.
- Operating instructions.

If option 2342 is fitted, central door locking is not available.

On the assumption that the Bodybuilder is aware of, and in compliance with, the particular specifications relative to this subject we would like to recall, nonetheless, that all vehicles crossing borders within Europe must be in compliance with the "European Agreement on international transport of dangerous substances on roads" (ADR), now included in the specific EC Directive.

As a case in point, we list below some of the requirements in the above mentioned Agreement (ADR), which in any case must be carefully examined:

1) Electrical equipment.
Electric wiring must be suitably insulated and protected in conduits from impact, stones, heat etc.
Circuits must be protected against overloads by fuses or automatic disconnectors.
A general circuit breaker (excluding the tachograph supplied directly by the batteries) with suitable safety devices, located close to the batteries, with direct or remote control in the cab or outside.

2) Braking:
Compliance with the specific EC Directives.
Anti-lock braking system (ABS) and retarder compulsory in the cases required by the law.

3) Protection of the cab.
Use of virtually flameproof materials, in conformity with ISO 3795, with combustion speeds no greater than 100 mm/min. Otherwise, have a protective wall between the driver's cab and the transported container.

4) Exhaust system.
Those parts of the exhaust system which reach temperatures of more than 200°C and cannot be moved in front of the protective wall, must be adequately insulated.
If the exit of the exhaust cannot be turned outwards, in the case of tranporting explosives, it must be equipped with a spark arresting device.
(If any modifications of the exhaust pipes are necessary, they must be carried out in accordance with point 2.9).

5) Fuel tank.
This needs to be positioned so it is protected against bumps. In the event of it over turning or of leakage, the liquid has to run off straight onto the ground.

Transporting hazardous goods ADR

6) Independent heater.
This must be safe as regards fire protection. It has to be positioned in front of the cab rear panel, at least 80 cm off the ground, with the heated parts protected.

7) Speed limiting device.
Compulsory for vehicles with GVW greater than 12 m.t., in compliance with current EC Directives and set to 85 km/h.

8) Safety equipment.
A minimum of two fire extinguishers, two portable lamps that are independent from the electrical system of the vehicle, and whose operation cannot cause the combustion of the cargo being transported.

9) 3rd axle.
The electric lifting device for the 3rd axle has to be positioned outside the side members of the chassis frame, in a watertight box.

Check the availability of these outfits for our models with IVECO.

2.19 Retarder installation

Retarder brakes other than those supplied as options cannot be fitted on Stralis.
IVECO does not allow fitting any type of retarder brake system after-market.
For this reason, no approval will be given for the application of retarder brakes.

Any unauthorised interventions or changes concerning brake functionality will void the vehicle warranty.

Retarder installation

2.20 Modifications to the Rear Underrun

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

The maximum permitted distance from the bar to the rearmost part of the body is 400mm. For further information see the official information issued by IVECO.

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

When modifying the vehicle or installing special equipment (e.g. tail lifts) it may be necessary to modify the structure of the underrun bar. Such modifications must not change the original resistance and stiffness specifications (comply with local government regulations, if any). The firm carrying out the modification must be prepared to present the relevant documentation on the required specifications upon request.

Whenever a different underrun bar must be used, check relevant current regulations. Documentation or quality control certificates must be presented upon request from the competent authority.

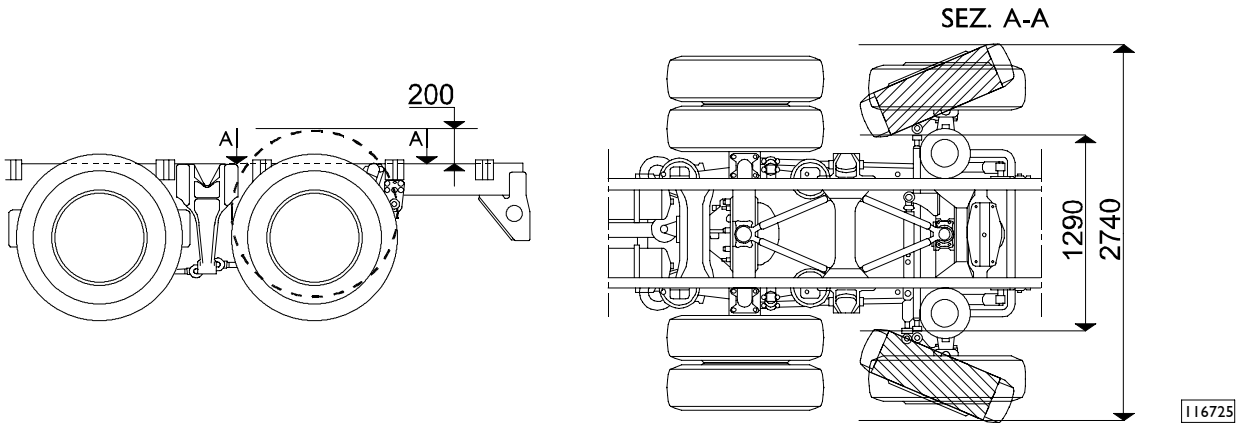
Modifications to the Rear Underrun

2.21 Rear Mudguards and Wheel Boxes

When vehicles are supplied without mudguards, the bodybuilder must fit them using similar installations are used by IVECO on similar vehicles. The following points must be observed:

- Ensure the wheels can turn without any foul conditions even in the full bump condition with snow chains fitted, in compliance with the limits shown in the documentation supplied by IVECO.
- On vehicles with lifting axles sufficient space must be allowed for the axle to fully lift without the tyres fouling any structure, following the instructions given the relevant documentation.
  On the 6x2/PS and FS (Steering Version 2)the axle also steers when the axle is raised, therefore sufficient space must be allowed for this function as shown in Figure 2.27. The dimensions shown refer to 315/80R22.5 tyres, allow another 50 mm if 385/65R22.5 tyres are fitted.
- The maximum width of the vehicle over the tyres must comply with the legal limits.

Figure 2.27

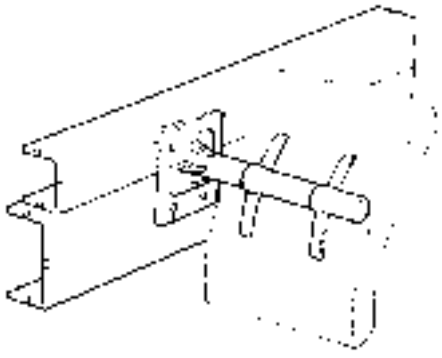


When fitting mudguards or making whell boxes the following points should be considered:

- The supporting structure should be sufficiently strong enough, avoiding any sudden variation in section.
- If the supports are fixed to the web of the sidemembers they must be bolted, the sidemembers must not be welded (see Figure 2.28).

If the supports are fixed the body longitudinals they can be welded or bolted.

Figure 2.28



2.22 Mudflaps

If legally required, unless already fitted ex-factory, the bodybuilder must ensure that the complete vehicle is fitted with mudflaps. When mounting them legally required distances must be complied with.

Mudflaps

2.23 Side Guards

In some countries local or EC regulations require that the vehicle be fitted with side guards. The Bodybuilder who finishes off the vehicle must ensure compliance with the required characteristics unless it is already equipped with them ex-factory.

On permanently fitted structures such as fixed platform bodies, vans etc, the side guards will be fitted directly to their basic structure (floor ribbings cross members) whereas on mobile structures (such as tippers, interchangeable equipment, removable containers), the side guards will be connected to the auxiliary frame by way of suitable brackets or installed directly on the chassis. In the latter case, we suggest that the Bodybuilder makes use as far as possible, of the holes already existing on the side member vertical web in compliance with point 2.3.

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

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

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

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

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

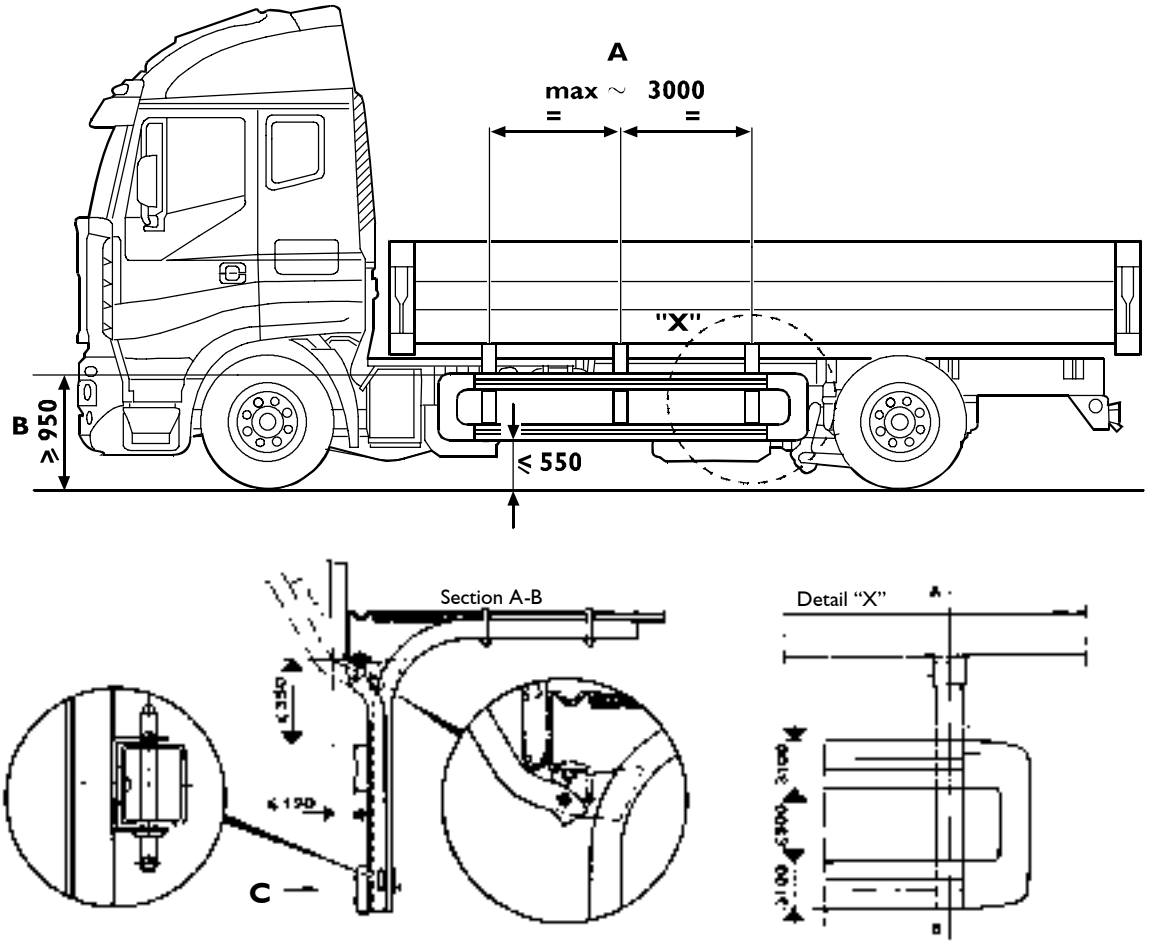
Particular care must be taken when fitting to ensure the clearance from the ground and the distances to the various components required by the regulations.

In Figure 2.29 shows a type of side guard designed in compliance with the relevant EC Directive to be fitted to fixed bodies (available on request). The illustration also shows a specimen of a support designed for the combined fastening on the side guard and the rear wheel mudguard which can be fitted to mobile auxiliary subframes.

The Bodybuilder will take care of the preparation and the arrangement of the side guard depending on the type of auxiliary subframe concerned, as it is not possible to provide instructions of a general character applying to all equipment versions.

Side Guards

Figure 2.29



A For IVECO section

B Either the bottom part of the auxiliary frame is over 1,300 mm from the ground or the width of the auxiliary subframe is less than the external space occupied by the tyres.

C Test load 1 kN Permitted sag values under test load:
≤ 30 mm on the rear, included in the last 250 mm of the device
≤ 150 mm on the remaining parts of the device

D Supporting structure for the combined fastening of the side guard and rear mudguard.

2.24 Chocks

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

Chocks

Chocks

SECTION 3

Building & Mounting the structures

Index

Page

NOTE The following detailed instructions complement the general information given in Chapter 1.

3.1 Subframes and Bodies

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

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

3.1.1 Material (steel subframe)

Usually, provided the subframe is not to undergo great stress, the material used for its construction may be of a lower grade than that used for the vehicle chassis. It must have good welding characteristics and limits of no less than valoes (1) shown in Table 3.1.

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

The properties of some materials that can be considered for the applications indicated are as follows.

Table 3.1 - Material to be used for body manufacturing continued

Steel name		Breaking load (N/mm^2)	Yield point (N/mm^2)	Elongation A5
IVECO	FE360D	360 (1)	235 (1)	25% (1)
EUROPE	S235J2G3			
GERMANY	ST37-3N			
UK	40D			
IVECO	FEE420	530	420	21%
EUROPE	S420MC			
GERMANY	QSTE420TM			
UK	50F45			
IVECO	FE510D	520	360	22%
EUROPE	S355J2G3			
GERMANY	ST52-3N			
UK	50D			

Subframes and Bodies

3.1.2 Material (Aluminum Subframe)

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

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

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

It should be remembered that, when stating the minimum dimensions for the reinforcement runners, besides the admitted limit of stress for the aluminium, the different elastic modulus compared to steel (approx. 7,000 kg/mm^2 as against 21,000 kg/mm^2 for steel) will also have to be considered. This will result in larger dimensions for the runners.

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

In the final analysis, if the subframe has to contribute to the frames Strength / stiffness, higher sectional dimensions for the runners must be used if aluminum in to be used instead of steel.

Subframes and Bodies

3.1.3 Longitudinal section dimensions

The table below gives the values for the section modulus W_x for C-section longitudinals recommended by IVECO. The indicated W_x value refers to the true section and allows for the section radii (this can be calculated with some approximation by multiplying the value obtained when considering the section made up of simple rectangles by 0,95). Longitudinals of different sections can be used instead of those shown provided the section modulus W_x and the moment of inertia J_x of the new C-section are not lower than those shown in the table.

Table 3.2 - Section bar dimensions

Strength modulus Wx (cm3)	Recommended C-section profile (mm)		
16 ≤ W ≤ 19	80 X 50 X 4	80 X 60 X 4	80 X 50 X 5
20 ≤ W ≤ 23		80 X 60 X 5	
24 ≤ W ≤ 26		80 X 60 X 6	
27 ≤ W ≤ 30		80 X 60 X 7	100 X 50 X 5
31 ≤ W≤ 33		80 X 60 X 8	100 X 60 X 5
34 ≤ W ≤ 36		100 X 60 X 6	
37 ≤ W ≤ 41		100 X 60 X 7	
42 ≤ W ≤ 45	80 X 80 X 8	100 X 60 X 8	
46 ≤ W ≤ 52	120 X 60 X 6	120 X 60 X 7	
53 ≤ W ≤ 58		120 X 60 X 8	
59 ≤ W ≤ 65		140 X 60 X 7	120 X 70 X 7
66 ≤ W ≤ 72		140 X 60 X 8	120 X 80 X 8
73 ≤ W≤ 79		160 X 60 X 7	
80 ≤ W ≤ 88		180 X 60 X 8	
89 ≤ W ≤ 93	106 X 70 X 7	180 X 60 X 7	140 X 80 X 8
94 ≤ W ≤ 104		180 X 60 X 8	
105 ≤ W ≤ 122	200 X 80 X 6	200 X 60 X 8	180 X 70 X 7
123 ≤ W ≤ 126		220 X 60 X 7	
127 ≤ W≤ 141		220 X 60 X 8	
142 ≤ W ≤ 160	200 X 80 X 8	240 X 60 X 8	
161 ≤ W ≤ 178	220 X 80 X 8	240 X 70 X 8	
179 ≤ W ≤ 201	250 X 80 X 7	260 X 70 X 8	
202 ≤ W ≤ 220	250 X 80 X 8	260 X 80 X 8	
221 ≤ W ≤ 224	220 X 80 X 8	280 X 70 X 8	
225 ≤ W ≤ 245	250 X 100 X 8	280 X 80 X 8	
246 ≤ W ≤ 286	280 X 100 X 8		
290 ≤ W ≤ 316	300 X 80 X 8		
316 ≤ W ≤ 380	340 X 100 X 8		
440	380 X 100 X 8		
480	400 X 100 X 8		

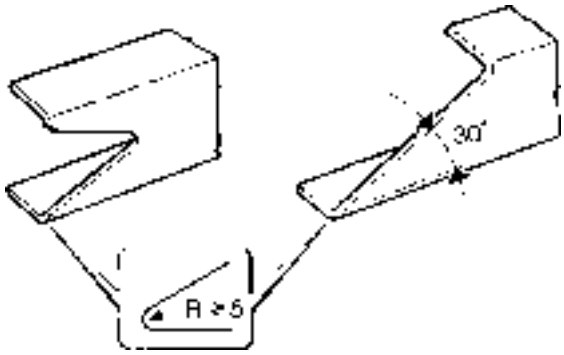
3.2 Elements making up the subframe

3.2.1 Longitudinal Runner Profiles

The longitudinals of the added structure must be continuous, extending as far as possible forward to the front of the vehicle to include, if possible, the area of the rear support of the front spring, and rest on the chassis of the vehicle but not on the brackets.

In order to achieve a gradual reduction in the resistant section, the front ends of the longitudinal runner must be tapered upwards at an angle of no more than 30°, or tapered in some other equivalent way (see Figure 3.1), ensuring that the front end in contact with the chassis is suitably connected, min radius 5 mm.

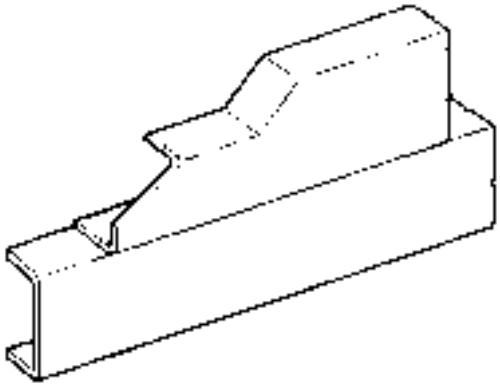
Figure 3.1



91136

If the cab's rear suspension components do not allow the entire runner to pass through, the latter may be shaped as shown in Figure 3.2. If the front part of the frame is subject to strong bending moments for certain types of construction (e.g. in the case of a crane with its working field at the front), the installation profile must be upgraded to take into account these forces

Figure 3.2



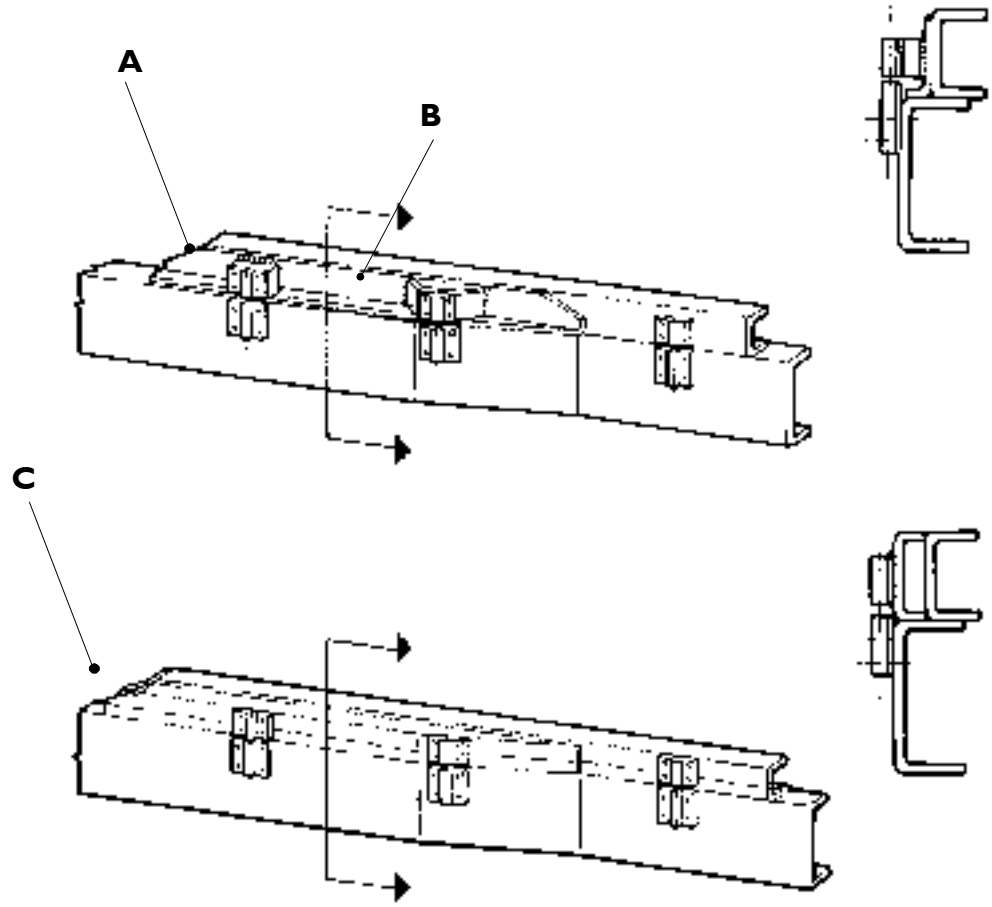
91137

The construction of auxiliary frames either wider or narrower than the chassis structure is permitted only in particular cases (e.g. removable containers sliding on rollers operated by mechanical or hydraulic systems). In these cases a necessary precaution will be that of ensuring a correct transmission of the forces between the auxiliary frame and the side member vertical web. This can be obtained by inserting an intermediate runner profile shaped according to the vehicle's side member or by applying a stiffened connecting L-section.

Elements making up the subframe

The vehicle chassis is shaped and therefore the subframe runner profile must follow the shape of the main side members. Should the front part of the subframe be narrower than the chassis, either a number of suitably shaped U-sections or of angle L-sections with the appropriate gussetts can be installed on the outside of the subframe (see Figure 3.3).

Figure 3.3



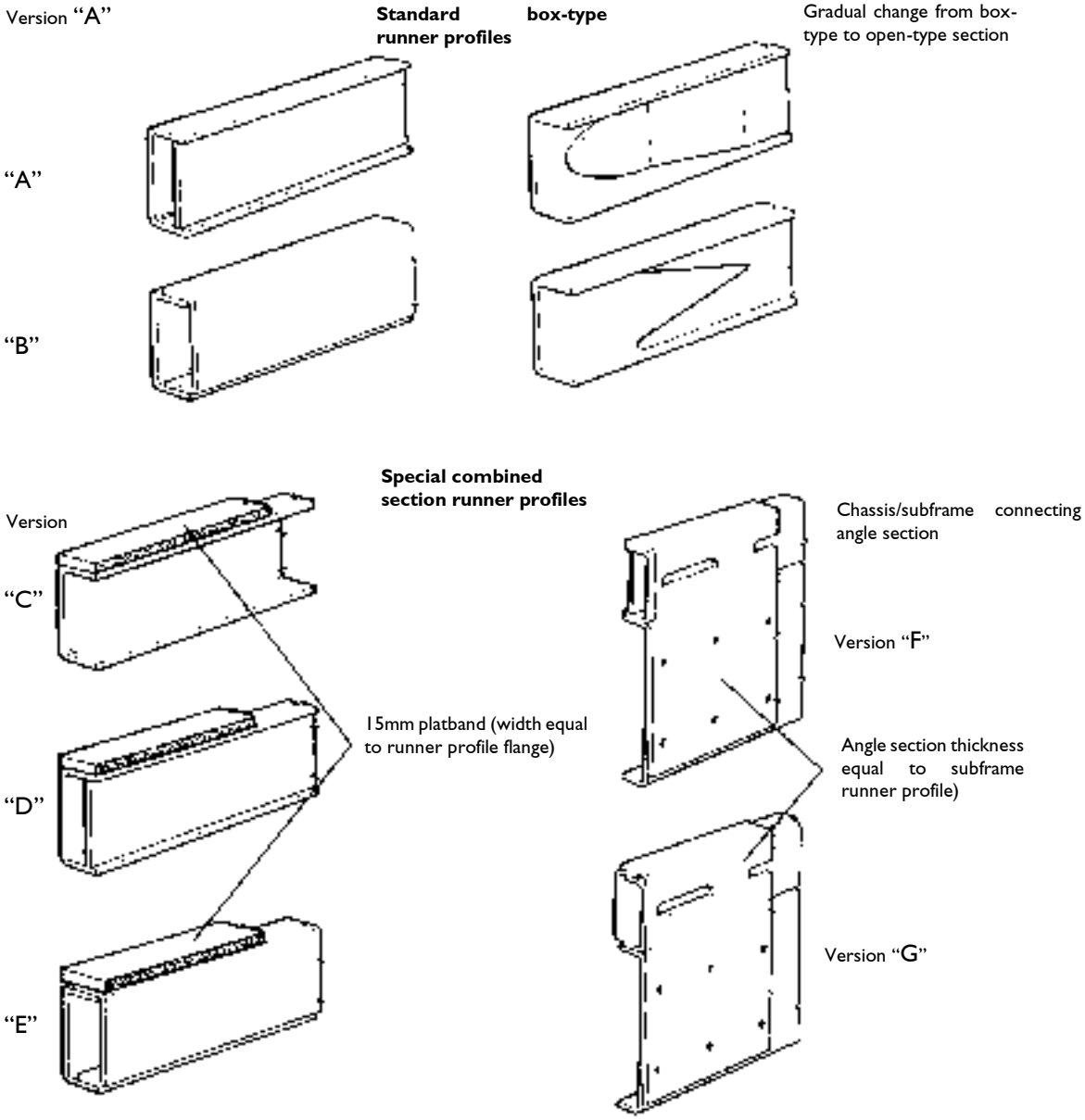
A. L section - B. Alternative solution - C. Channel section

The type of section of the runner must be determined with due consideration to the function of the subframe and to the type of structure that is above it. It is advisable to use open U-sections if the subframe has to adapt itself elastically to the vehicle's chassis, and to use box-type sections when added rigidity is needed.

Proper care must be taken to ensure a gradual change from the box- type section to the open type section. Some examples on how this can be achieved are shown in Figure 3.5.

NOTE Cleat plates must not be used at the profile section of the sidemembers.

Figure 3.4



There must be continuity between the longitudinal runners of the subframe and the vehicle. Where this is not possible, continuity may be restored by fitting cleat plate brackets.
If a rubber antifriction strip is inserted, specifications and thickness must be equal to those originally used by the Manufacturer (hardness 80 Shore, max. thickness 3mm). The application of antifriction material may prevent abrasive actions which can cause corrosion when using material with a different composition (e.g. aluminium and steel).

The minimum recommended dimensions are shown for the sidemembers with various bodies. These values are generally valid for vehicles with standard wheelbase and rear overhang (see Tables from 3.4 to 3.21). In all cases similar sections, whose moment of inertia and resistance is not lower, can be used. It should be borne in mind that the moment of inertia, apart from being an important factor for the calculation of the share of bending moment to be applied, also represents the most adequate response to the degree of torsional stress required for the specific type of connecting section in use. Therefore, the moment of resistance is a determining factor as regards the stress exerted on the material.

Elements making up the subframe

3.2.2 Cross Members

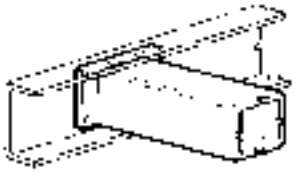
An adequate number of cross members, which should be positioned if possible adjacent to the body mounting brackets, are required to brace the two runners of the subframe.

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

Suitable gusset plates must be used to connect the crossmembers to the longitudinals to ensure sufficient strength at the connection (see Figure 3.5). In cases, where greater rigidity is required for the connection, this can be achieved as illustrated in Figure 3.6.

Figure 3.5

Figure 3.6



Stiffening the Subframe

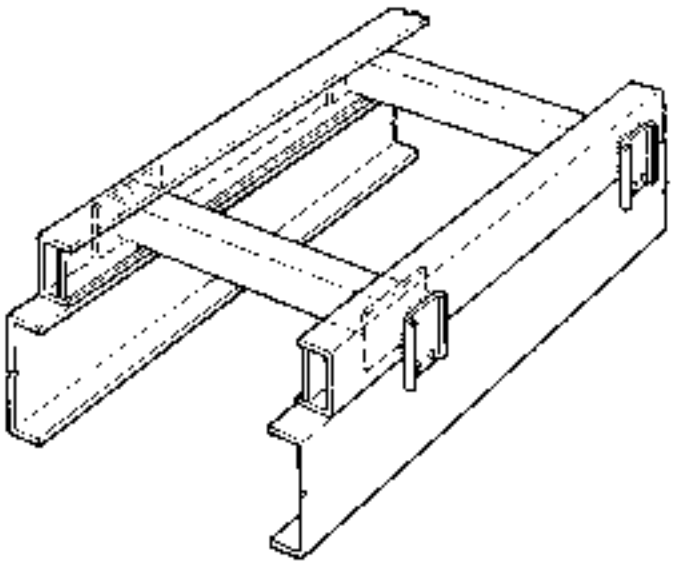
In the case of certain bodies, such as tippers, cement mixers, crane on rear overhang or bodies with a high centre of gravity, the subframe must be additionally stiffened at the rear end.

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

- Joining the rear section of the longitudinal member by a box-frame construction.
- Box-frame construction, closed-section cross members (see Figure 3.7).
- Box-frame construction, whit a cruciform (see Figure 3.8).
- By applying in addition to the box-frame construction a longitudinal torsion-resistant bar (see Figure 3.9).

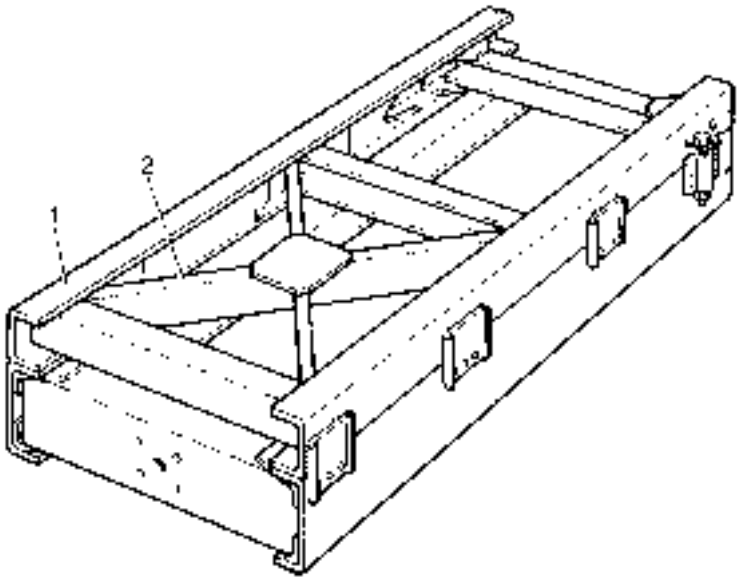
As a general rule, the box-frame construction of the longitudinal runners should not be used in the front end.

Figure 3.7



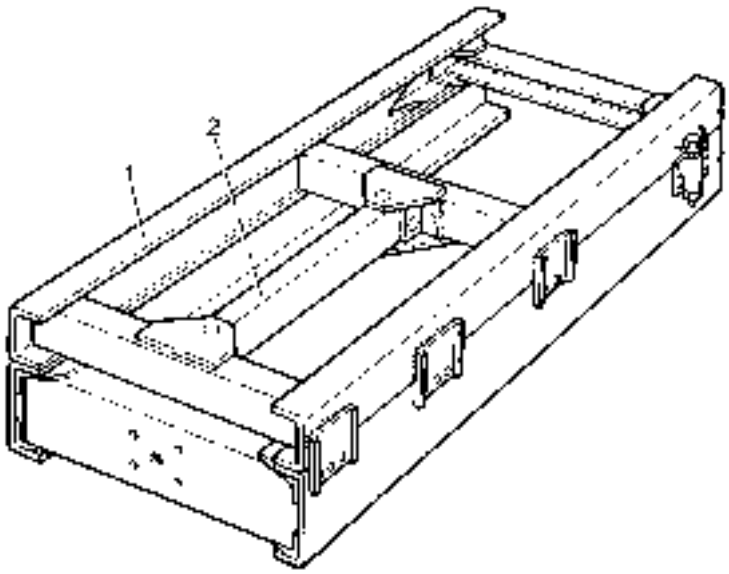
Elements making up the subframe

Figure 3.8



1. Subframe - 2. Cruciform

Figure 3.9



1. Subframe - 2. Box-section

Self-supporting Bodies as Subframes

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

Elements making up the subframe

3.3 Connections between frame and subframe

3.3.1 Choosing the Type of Body Mounting

The selection of the type of connection to be used - if not provided initially by IVECO - is very important in terms of the subframe providing strength and stiffness for the appropriate body type.
The subframe connection may be flexible (brackets or clamps) or it may be rigid, resistant to shear stress (longitudinal or transverse plates); the choice must be made based on the type of body that is to be mounted (see points 3.4 to 3.8) analysing the stress forces which the additional equipment transmits to the chassis both under static and dynamic conditions. The number, size and type of fixing device properly subdivided over the length of the subframe, must be such as to ensure a good connection between the vehicle chassis and the subframe.
The screws and clamps must be of a strength class no lower than 8.8, the nuts must be equipped with devices that prevents them from working loose. The first fixing must be located, if possible, at a distance of approx. 250 to 350 mm from the front end of the subframe.
Any body fixing brackets already fitted on the vehicle frame must be used first.
Compliance with the position for the first mounting mentioned above must be ensured in cases where the body applies concentrated loads behind the cab and requires additional stability (e.g. cranes, front end tipping gears etc.) in order to prevent overstressing the chassis frame. If necessary, additional fixings must be fitted.
If the body to be fitted has different characteristics to those permitted on the original chassis (e.g tipper on a haulage chassis), the bodybuilder must provide the appropriate mountings (e.g. the replacement of brackets by cleat plates in the rear area of the chassis).

NOTE When fixing the body to the frame, no welding is allowed on the frame of the vehicle, nor can holes be drilled in the flanges of the sidemembers.

When fixing the body to the frame, no welding is allowed on the frame of the vehicle, nor can holes be drilled in the flanges of the sidemembers.

In order to improve the longitudinal or transverse securing of the connection, it is permissible to have holes in the top flanges of the side members, but only at the rear end of the members, over a length of not more than 150 mm, providing the fixing of any cross members that may be present is not weakened (see Figure 3.14). The mountings shown in Figure 3.15 may be used, using the screws which connect the rear cross member or underrun brackets to the chassis.

NOTE In all other cases, holes must not be drilled in the flanges of the sidemembers.

In all other cases, holes must not be drilled in the flanges of the sidemembers.

3.3.2 Body Mounting Characteristics

Flexible mountings (see Figure 3.10, 3.11, 3.12 and 3.13) permit limited movement between the frame and the subframe, and permit the use of two parallel working strong sections. Each bears a part of the bending moment in proportion to its moment of inertia.

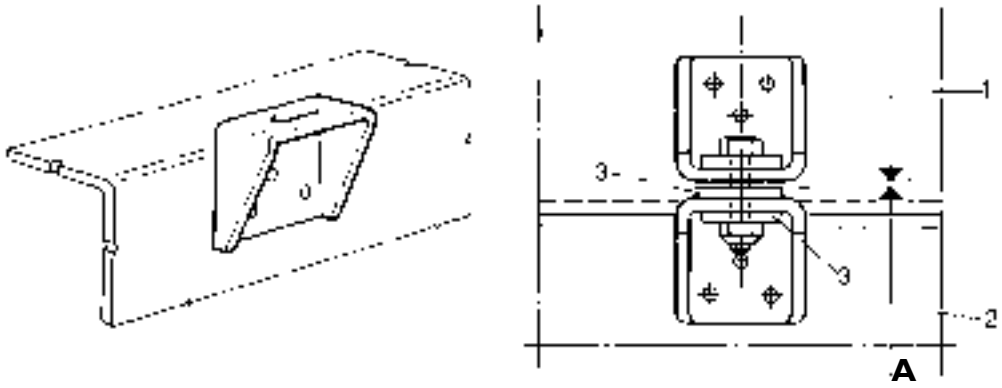
For the rigid type of joint (see Figure 3.15) between subframe and chassis, a single strong section is obtained, provided the number and position of the mountings are adequate to support the resulting shear stresses.
When using sheer resisting plates to secure the subframe to the sidemembers, a single strong section is formed which has a higher strength capacity when compared with the MTG made using brakets or clamps. This has the following advantages:
- Lower height of the subframe profile under the same bending moment acting on the section.
- Higher bending moment under the same subframe profile dimensions.
- Further increase in the strength capacity, when the subframe is made up of high mechanical characteristic materials.

Connections between frame and counterframe

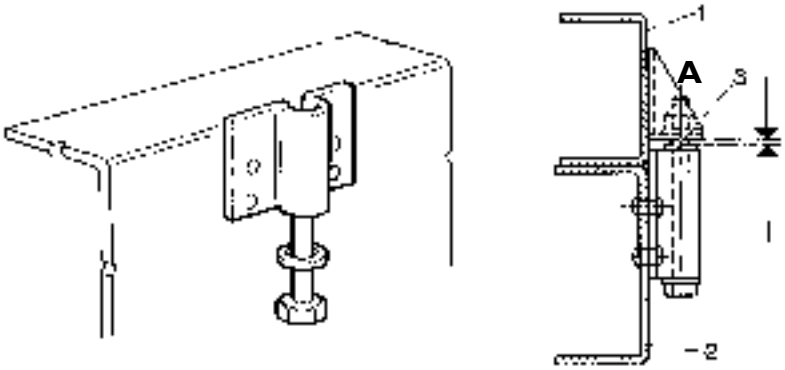
3.3.3 Connection with Brackets

A few examples of this type of connection (flexibility mounting), are shown in Figure 3.10.

Figure 3.10



A. Leave a clearance of 1 to 2 mm before tightening



1. Subframe - 2. Frame - 3. Shims

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

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

In order to guide and better contain the loads transversally, a slight protrusion of the brackets above the chassis is recommended. When the brackets are fitted flush with the upper flange of the side member, the lateral movement of the body structure must be secured by other means (e.g. using guide plates fixed only to the chassis - see Figure 3.13). When the front connection is of the coli springstype (Figure 3.11), longitudinal securing must be ensured even in conditions of maximum twisting of the chassis (e.g. off-road).

When the chassis already has factory fitted brackets for the installation of a box-type body, these brackets must be used for the installation of the structure. The brackets fitted to the subframe or to the body must have characteristics of strength no lower than those of the original brackets fitted to the vehicle.

Connections between frame and counterframe

3.3.4 Connection with Greater Elasticity

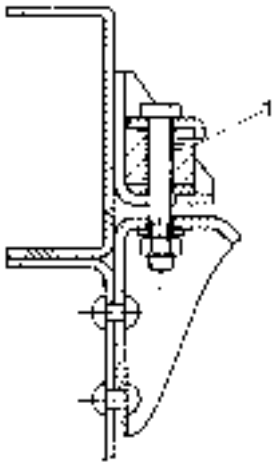
Given that there is not a clear definition of range of torsion of the vehicle rigid structure, due to its tough mission, the structure flexibility is always requested, except for special uses (e.g. installation of cranes). A coil spring should be used on each side of the connection points between frame and sub-frame.
The detail of the body mounting and installation is as follows:

Figure 3.11

- Spring stiffness = 424 N/mm.
- With the longitudinal hard on the top flange there must be a grap of 5 mm between the faces of the two brackets before the upper bracket is fixed to the longitudinal.
- The body securing bolt should be 14 mm diameter grade 8.8 and secured with lock nuts.
- Flat washers 4 mm thick by 32 mm outside diameter (minimum in both cases) should be fitted between the spring and the head of the bolt and between the lock nut and frame bracket.

When using rubber inserts, use materials which gives a good working life (elasticity). The relevant instructions for the regular inspections of the body mounting for deterioration and the bolt torque must be given to the operation.

Figure 3.12



1. Element rubber.

The whole connection capacity can, if necessary, be re-established by fitting shear resisting plates from the rear spring front hanger brackets ti the end of the frame instead of the normal factory body brackets.

On installations where the vehicleis supported by means of hydraulic stabilisers (e.g. cranes, lifting platforms), the movement of the elastic connection should be limited to 30 ÷ 40 mm to ensure sufficient coordinated movement of the subframe and avoid excessive bending moments on the original chassis.

Connections between frame and counterframe

3.3.5 Connection with U-bolts (clamps)

The most important mounting of this type is illustrated in Figure 3.13.

In this type of construction the bodybuilder must place metal spacers, between the flanges of the two side members and in the subframe at the point where the U-bolts are located, in order to prevent the flanges bending when the U-bolts are tightened.

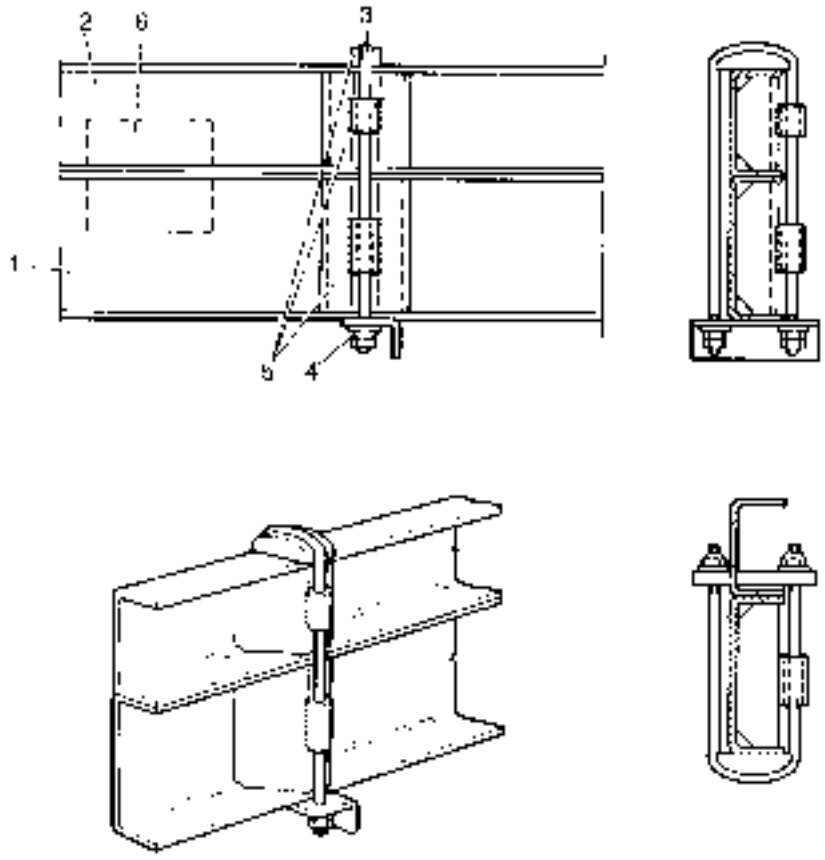
In order to guide and contain transverse movement of the structure attached to the vehicle's chassis, this type of connection must also have guide plates that are attached only to the chassis as shown in Figure 3.13.

In order to keep the added structure from sliding and to increase the rigidity, it is necessary to provide positive attachment towards the rear with cleat plates to contain both longitudinally and transversal movement.

Alternatively it is also possible to use bolt-type connections at the rear end of the chassis as illustrated in Figure 3.14.

Due to the nature of this type of connection, its all-round use on the vehicle is not advisable.

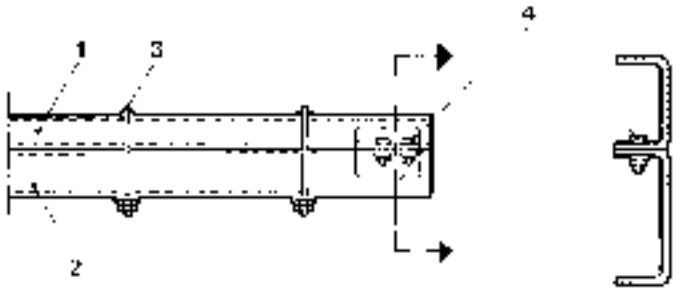
Figure 3.13



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

Connections between frame and counterframe

Figure 3.14



1. Subframe - 2. Frame - 3. U-bolts - 4. Longitudinal transversal securing

3.3.6 Connection with cleate (shear resisting) plates to contain longitudinal and transverse forces

This type of fixing shown in Figure 3.15 is achieved by means of a plate that is bolted or welded to the subframe and is secured to the chassis by bolts or rivets. This ensures regeneration following longitudinal and transverse thrust and provides maximum rigidity to the whole.

When this type of joint is used, the following must be observed:

- The plate must only be attached to the vertical web of the main sidemembers.
  Before fixing ensure that the subframe is mounted correctly on the top flange with no gaps between the two mating surfaces.
- Use of cleat plates must be confined to the central and rear sections of the frame.
- The number of plates, thickness and number of securing bolts must be adequate for the transmission of the sections shear and bending moments. As a rule the thickness of the plate will be equal to that of the vehicles sidemember. These values can be correctly determined by calculation according to the necessary elements.
  Good results can however be achieved taking the following into account:

The shear resistant plates and the omega brackets which are standard on some models are generally sufficient for normal bodies such as fixed loading platforms, tilting bodies, concrete mixers, provided the conditions of paragraphs 3.3 and 3.4 are met and comply, in terms of dimensions and positioning, with the normal bodies.

The shear resistant plates already fitted to the vehicles can on the other hand meet the requirements of all installations which cause small bending moments on the vehicle frame (e.g. tail lifts, reduced capacity cranes).

When a body cause high bending moments on the frame and the relevant strength has to be increased by means of shear resistant plates between the frame and subframe, or the subframe height has to be limited as far as possible (e.g. towing of central axle trailers, crane on rear overhang, tail lifts), observe the following instructions:

Table 3.3

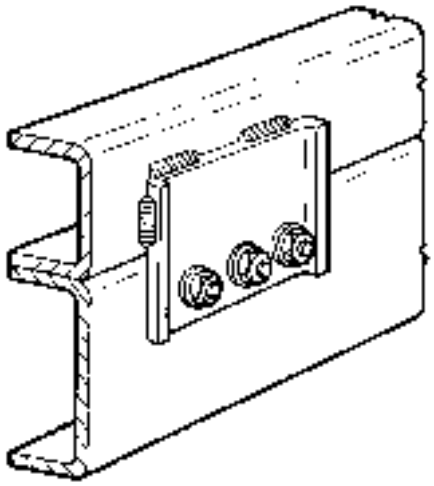
Frame/subframe section height ratio	Max. distance between the centreline of the shearing resistant plates 1)	Min. characteristics of the plates	
		Thickness (mm)	Fixing hardware dimensions (at least 3 screws each plate) 2)
≤1.0	500	8	M 14

NOTE Table applies to all models

1) The number of bolts per plate enables a proportional increase in the distance between the plates (a double number of bolts enables greater distance between the plates). In the bearing areas of the frame (e.g. supports of the rear spring, of the tandem axle spring and of the rear air springs) closer spaced plates will have to be considered.

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

Figure 3.15



3.3.7 Mixed Connection

On the basis of instructions given for the construction of the subframe (point 3.1) and considerations included in the general section, the mounting between the vehicle frame and subframe can be of the mixed type, i.e. it may be obtained through a rational use of elastic (springs), flexible connections (brackets, clamps) and rigid connections (plates for longitudinal and transversal anchorage).

As a guide it is advisable to have coli springsconnections on the front section of the subframe (at least two on each side) while plate connections are recommended for the rear section of the vehicle when a stiffer structure is required for the whole assembly.

Connections between frame and counterframe

3.4 Fitting Box-bodies

3.4.1 Fixed bodies

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

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

Table 3.4 - (for models of class AS 190 up to AS 260, the data given below apply to loads on front axle up to 8000 kg).

Models	Wheelbase (mm) (referring to the driving axle, on vehicles with 3 axles with third rear axle)	Minimum reinforcing runner
		Section modulus Wx (cm^3)
AS/AT/AD 190; AS 190[2)4)]	up to 6300[2)]	89[3)]
AS/AT/AD 260	up to 6050[2)]	(46)[1)]

1) Possible alternatively, using shear resistance connections for the entire length of the chassis and connection with brackets in the front area.

2) For vehicles with wheelbase up to 5700 mm and rear overhang up to 2300 mm, 120x60x6 mm section can be used (Wmin. 46 cm^3); this profile is sufficient for all 2 and 3 axle models up to 7500 kg on front axle.

3) For models with pneumatic suspension (190P; FP) with wheelbase up to 6300 mm and rear overhang over 2300 mm. When the maximum permitted rear load is used, the longitudinal runner must use materials with a yield of over 320 Nm/mm2 and be connected to the chassis by shear resistant plates (cleat plates). The plates should start approximately 1000 mm before the centre line of the drive axle and continue to the end of the chassis.

4) For models 6x2 P; FP; PS; PT; FT; with a rear overhang over 1800 mm (from the centre line of the last axle). When the maximum permitted rear axle load is used, the longitudinal runner must be connected to the chassis by shear resistant plates. The plates should start approximately 1000 mm before the centre line of the drive axle and continue to the end of the chassis.

5) For section dimensions see Table 3.2

The attachment is carried out using the brackets arranged on the vertical web of the side members. If such brackets have not been provided by Iveco, they must be installed according to the specifications given in point 3.3. In order to provide an adequate lengthwise securing when brackets or clamps are used, it is good common practice to arrange a rigid joint (one on each side) on the rear overhang, using cleat plates on the web or bolts on the upper flange of the side member (see Figure. 3.14 and 3.15).

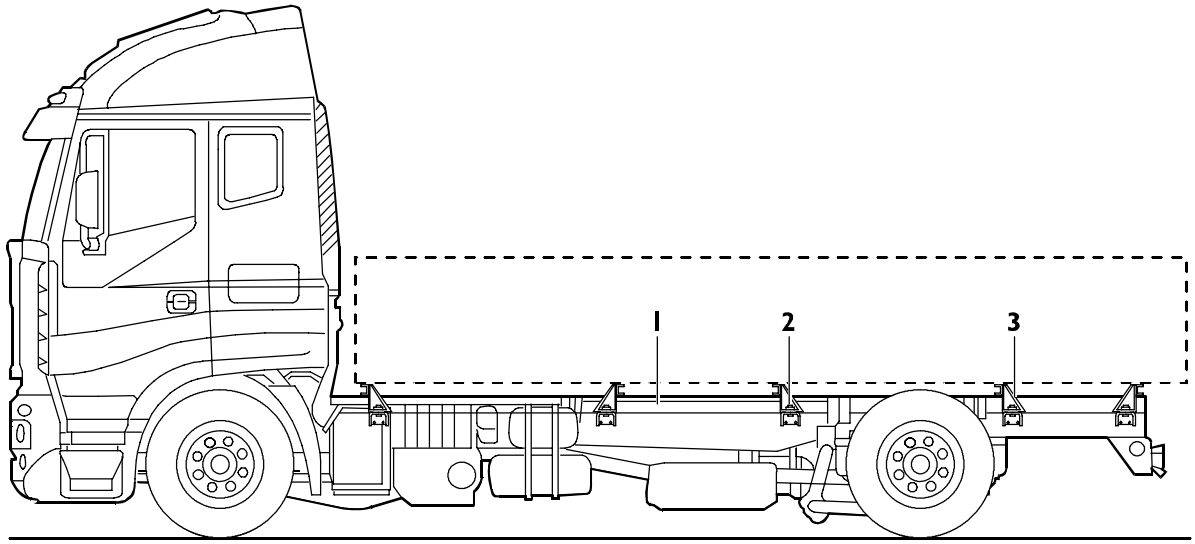
The front of the body must be able to withstand the force applied to it by the transported load during sharp braking.

Fitting Box-bodies

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

In those instances in which the box-body uses supports that are raised above the subframe (such as cross members) it will be necessary to stiffen these supports in an appropriate manner in order to contain the longitudinalwise thrusts, as shown in Figure 3.16

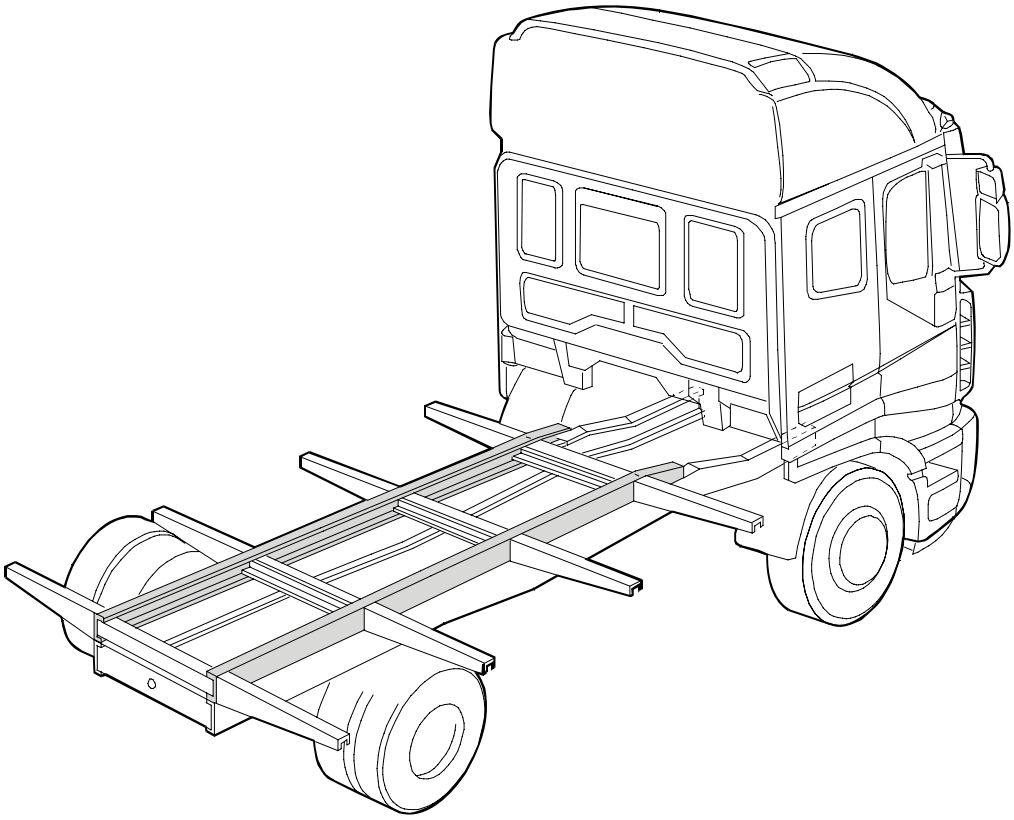
Figure 3.16



1. Subframe - 2. Brackets - 3. Securing anchorages

For special builds when a reinforcing runner of limited height is needed, the subframe structure may be integrated with the body anchoring brackets matching the height of the whole longitudinal reinforcement runner (see Figure 3.17). In this case, rear wheel boxes may be fitted at the base of the fixture.

Figure 3.17



In the case of self-supporting bodies whose bearing structure operates as a subframe, the above explained installation of the reinforcing runners need not be affected.

The application of box bodies and structures with high torsional (1), stiffness in general requires the use of elastic connections towards the front of the structure (2) to avoid excessive reduction of main chassis distortion in particularly demanding applications (3).

1) Es. vehicle preparation furgonato

2) Figures 3.11 and 3.12

3) In the anterior part they are had to apply plates that limit the side move of the superstructure in comparison to the chassis.

Fitting Box-bodies

3.4.2 Tipper Bodies

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

Furthermore any government regulations concerning these vehicles must also be adhered to.

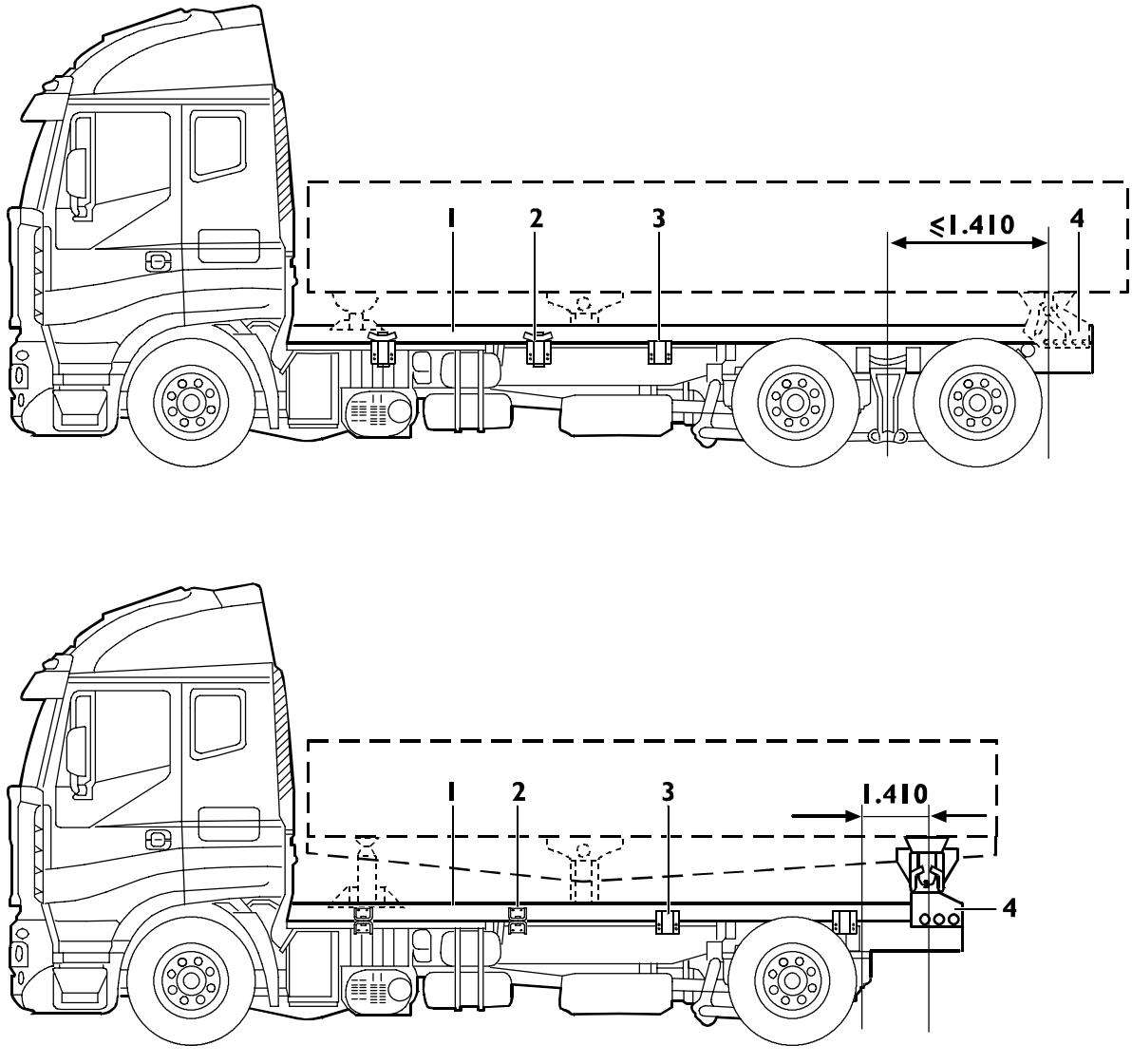
Where Iveco offer a rear stabilizer bar as an option it is recommended this should be fitted.

The following points must be kept in mind:

- The subframe must be (see Figure 3.8 and 3.9) suitable for the vehicle type and for the specific operating conditions. It must have adequately dimensioned longitudinals and cross members and be stiffened at the rear by box-type construction and cruciform.
  Fixing the subframe to the chassis, flexible connections (brackets or clamps) must be placed at the front end, whereas the rear section requires rigid-type joints (cleat plates, see Figure 3.16) to allow the added structure to contribute more to the rigidity of the whole. The "omega" brackets can be used on vehicles which are already fitted with them.
- The rear tipping hinge must be fitted on the subframe as near as possible to the rear support of the rear suspension. In order not to impair the stability of the vehicle during tipping operations and not to increase excessively the stress on the chassis, it is recommended that the distances between the tipping hinge and the rear spring rear hanger or tandem centreline is observed (see Figure 3.21). If for technical reasons this cannot be achieved, small increases may be permitted provided a higher strength subframe is used, in order to increase the rigidity of the rear end. Where long bodies are needed to transport large volumes, it is advisable (in those cases where it is permissible) to lengthen the wheelbase of the vehicle.
- Great care must be given to the positioning of the lifting ram both in terms of providing supports of adequate strength and in order to correctly position the mountings, 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 into the chassis.
- For both under floor and front end tipping gear installations it is recommended that an appropriate stabilizer is fitted to act as a guide during the tipping operation.
- The lifting ram must be mounted on the subframe. The useful volume in the body must conform. With the maximum permissible load on the axles. To the density of the material that is to be transported (a density mass of approx. 1600 kg/m^3 is to be used for excavated material).
  When freight having a low density is transported, the useful volume may be increased within the limits established for the maximum height of the centre of gravity of the payload plus the fixtures.
- The bodybuilders must ensure the functioning and safety of all parts of the vehicle (for instance, the positioning of lights, tow hook etc.) is safeguarded and in full compliance with the current safety regulations.

Fitting Box-bodies

Figure 3.18



1. Subframe - 2. Brackets - 3. Plates - 4. Tipping hinge bracket

3.4.3 Heavy-duty Service

NOTE Not applied to Stralis

3.4.4 Light-duty Service

For these operations we recommend using vehicles with short wheelbases. In Table 3.5 are listed the longitudinal runners to be used. 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 coefficient of friction.

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

- Carefully check the chassis specifications (suspension, chassis, number of axles) to select a vehicle suitable for the body and its intended operation.
- The rear end of the subframe must be stiffened using box-type sections, crossbraces, cleat plates etc.
- The rear tipping hinge must be placed as near as possible to the rear hanger bracket of the rear suspension.
- In cases of vehicles having wheelbase longer than the standard tipper wheelbase, 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 45° while the user should be informed that the tipping should be done on as flat a surface as possible.
- Use the most rigid rear suspension available and rear anti roll bars. When parabolic rear springs are used, the stiffness should be increased using rubber elements that operate at static load.
- For vehicles with pneumatic rear suspension, (for 6x4 tandems with four air springs for each axle), dump the air from the suspension during the tipping operation to allow the vehicle the greatest stability during tipping. It is important that this operation takes place automatically from the tipping control. The resetting (raising) of the suspension can also be operated by the tipping control as the body is lowered.
- On vehicles with standard third axle or added third axle (6x2), an antiroll bar may have to be fitted onto the 3rd axle depending on the type of installed 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 tipping support location in relation to the rear axles, to suspension types and to intended operation. The third axle must never lift when tipping.

Table 3.5

Model	Minimum subframe section (yield limit of the material used)	
	Section modulus depending on the material yield limit (N/mm^2)	
	240	360
AT-AD190	46	
	89(2)	
AS/AD/AT260/TN	89/110 (1)	
AS/AD/AT260/PT260Z/P	150/190 (1)	
	89/110 (1)	
AS/AD/AT260/P(S)FP/FS	173/222 (1)	
	89/110 (1)	

(1) Necessity for a boxed section with connections resistant to shearing, starting from approx. 1000 mm in front of the centreline of the drive axle(s) up to the rear end of the chassis.

(2) For 8000 kg. On axle

Fitting Box-bodies

3.4.5 Containers

Not all vehicles lend themselves equally well to be used for removable type containers (i.e. the containers which can be unloaded by sliding along the subframe). Heavy duty vehicles are certainly better suited to this use but it is best to consult IVECO concerning the suitability of the various models in relation to the use of the vehicle. (Table 3.4)

This type of operation is subject to additional stresses compared to those of normal on-road vehicles with fixed platform bodies, in particular as regards loading/unloading operations.

For this reason, the auxiliary frame used (see point 3.1) should be of the same dimensions as that for light tippers. (point 3.4.4)

Where vehicles with long wheelbases or rear overhangs are used, it may be necessary to use runners of larger dimensions for the subframe.

The interchangeable body must rest on the vehicle subframe along its entire length or a least be in contact with an extensive area of the suspension attachment points.

The lifting devices must be fixed to the subframe as indicated in point 3.6.

Vehicle stability must be guaranteed and comply with DIN standard 30722.

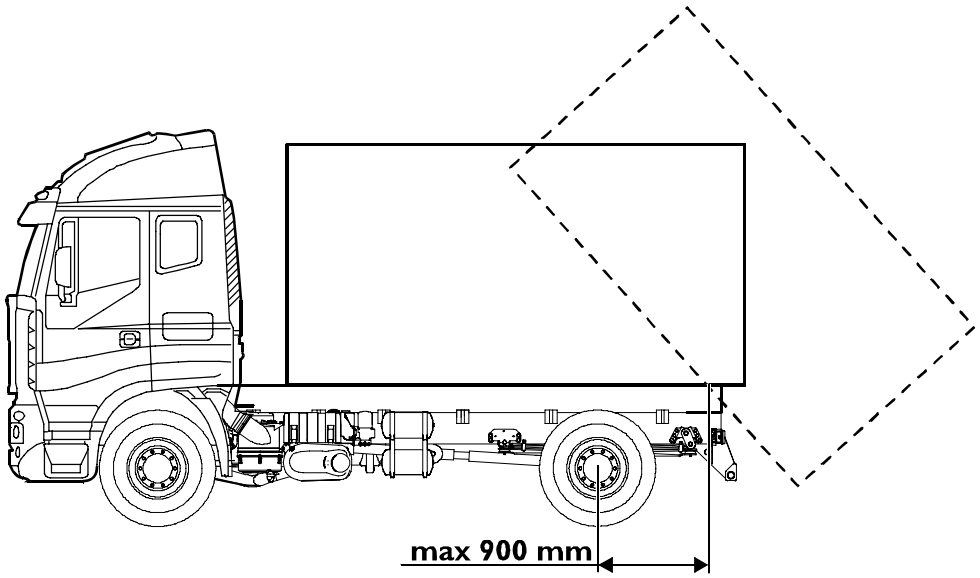
The stability of the vehicle must always be ensured during loading and unloading operations. We recommend fitting the rear ends with supports (stabilisers) that are to be used during loading and unloading operations particularly when roll on, roll off containers are used.

These supports are also recommended if the rear axles have pneumatic suspensions.

As an alternative, refer to the explanations in point 3.4.4, concerning dumping the air from the suspension during the operation.

It is very important, with this type of vehicle, to adhere to the specifications concerning the height of the centre of gravity (see point 1.13.2), when containers for high payloads are used.

Figure 3.19



123839

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

3.5 Tractors for Semitrailers

For this use the vehicles provided by Iveco with specially designed equipment (chassis, suspension, brakes) should be used. The models with pneumatic rear suspension are particularly well suited because of the constant height of the fifth wheel to transport containers.

3.5.1 Position of the Fifth Wheel

The position of the fifth wheel may be selected from among the positions established by Iveco in relation to the kerb weight of the tractor in its standard version. If, as a result of subsequent additions and/or modifications, the kerb weight should be changed, reference must be made to the actual weight of the tractor and its complete equipment (supplies, driver, equipment etc.) in observance of the permissible loads on the axles when checking the position (see point 1.13.1).

To ensure a correct coupling with the semitrailer, particularly when the fifth wheel forward positions differ from the standard ones, the geometric positioning must be carefully checked (see point 3.5.3).

3.5.2 The Fifth Wheel

All fifth wheels having load characteristics, dimensions and performance that have been declared suitable for a specific use by their manufacturer, may be used on our vehicles. The type of fifth wheel to be selected depends on the vehicle and on the type of transport to be carried. For instance, for off-road use, fifth wheels with an adequate degree of transverse oscillation must be used to avoid excess stress on the vehicle's chassis due to torsion.

Where government regulations require it, fifth wheels must meet all requirements or be homologated. Regarding their mounting, number of bolts, dimensions, materials and positioning of longitudinal and transverse stops, see the instructions provided by the manufacture of the fifth wheels.

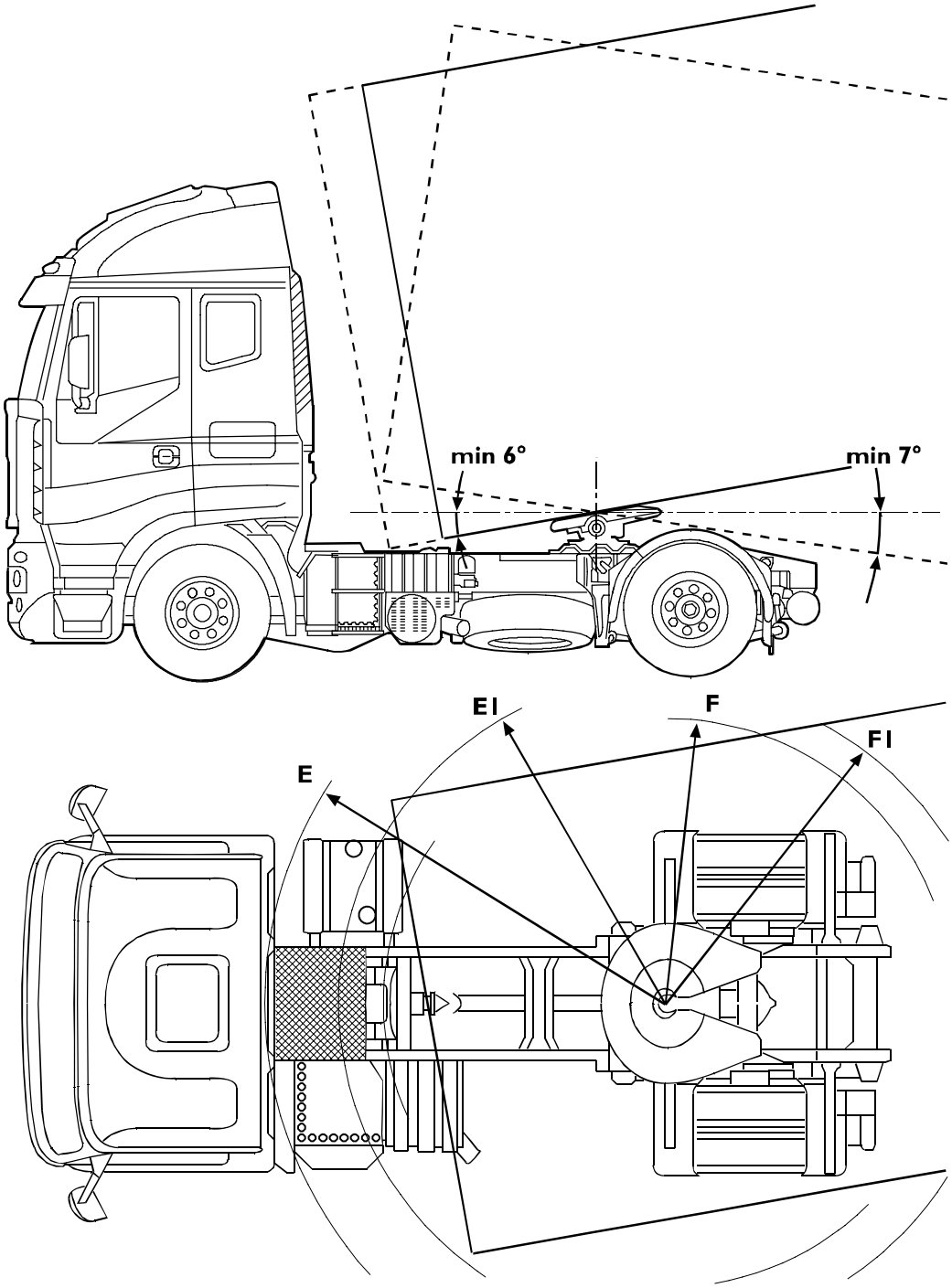
As the fifth wheel is very important to vehicle safety, it must not be modified in any way.

3.5.3 Coupling of Tractor and Semitrailer

Semitrailers must not have constructive characteristics (such as excessively flexible chassis, inadequate braking power) that would adversely affect the operation of the tractor. The coupling of the tractor and the semitrailer must take into account all their respective movements under all operating conditions and ensure adequate safety margins which may be required by law or regulations for road use (see Figure 3.20).

Tractors for Semitrailers

Figure 3.20



E=Front tractor clearance space - E1=Front tractor turning radius -
F=Rear tractor turning radius - F1 =Rear semitrailer clearance space

When required to do so, the required manoeuvring space in curves must be checked.

Concerning the definition of the height from the level of the 5th wheel, any limits imposed by the Manufacturer and/or government regulations must be observed.

3.5.4 Fifth Wheel Mountings

When the tractor is delivered without the bed plate for the fifth wheel, the following instructions must be adhered to for its construction:

- The mounting must be adequately dimensioned to handle the vertical and horizontal loads transmitted by the fifth wheel. Concerning its height, bear in mind what has been said in previous points.
- Concerning the properties of the material and mounting, refer to point 3.1.1 and 3.1.2
- The upper and lower surfaces of the mounting must be even to ensure a good bearing on the chassis of the vehicle and of the base of the fifth wheel.
- In cases where the mounting is supplied in component parts they must be assembled by welding and/or riveting.
- The fixing of the mounting to the chassis (see Figure. 3.21, 3.22 and 3.23) must be made on the angle support, if provided or as otherwise specified.

For the fixing use flanged head bolts and nuts with a min, class of 8.8. An arragement to stop the bolts working loose must be used. The number of bolts and diameter must be at least equal to that require to secure the fifth wheel.

When attaching logitudinal stop this must be achieved without welding or making holes in the sidemember flanges.

It is permissible to attach cad up ramps to the chassis, on marking and fitting them. The following must be considered.

- To make them of suitable size to ensure that the semitrailer can be properly engaged with the fifth wheel.
- That the fixing to the chassis must be achieved without welding or making holes in the side member flanges.

Installation of Simple Plate-type Mounting

As a general rule, for tractors that are intended for normal road use, and if not otherwise specified by Iveco, the mounting plate for the fifth wheel must be fret-shaped (see Figure 3.21), connected to the chassis by means of longitudinal runners and appropriate brackets.

For certain models and markets this type of installation may also be permitted not exclusively for on-road uses. In these cases, the nature of the use and of the loads does not require direct contribution by the structure to the chassis to counteract the effects of flexing and torsion.

The fret -shaped plate is supplied with the vehicle and provisionally fastened to it.

The final installation will be carried out by the person in charge of the installation of the fifth wheel.

The fifth wheel support plate is especially important to safety (in some countries it must be specifically certified). Assembly instructions must be strictly followed and no modification carried out.

Table 3.6 - Fifth wheels

Fifth wheel and plate application	Tractors 4x2		Tractors 6x2C	Tractors 6x4
Fifth wheel mounting plate	**440T/P**	**440T/FP-LT**	**440TX/P**	**440TZ/P-HM**
Fifth wheel with pin 2", H = 140 mm integrated plate	/	S	/	/
Fifth wheel with pin 2", H = 150 mm - Jost + plate 50 mm	○	/	○	○
Fifth wheel H = 150 mm + plate 100 mm	○	/	○	○
Fifth wheel rest plate H = 150 mm + plate 12 mm	○	○	/	/
Fifth wheel mtg plate H = 100 mm	○	/	○	○
Fifth wheel mtg plate H = 50 mm	○	/	○	/
Fifth wheel with pin 2", H = 185 mm + plate H = 12 mm	○	/	○	○
Fifth wheel with pin 2", H = 185 mm + plate H = 100 mm	○	/	○	○
Fifth wheel without plate - Jost H = 190 mm	○	/	/	/
Fifth wheel without plate - Jost H = 225 mm	○	/	/	/
Fifth wheel H = 148 mm + plate H = 8 mm	○	/	/	/

S standard

○ optional

Table 3.7 - Fifth wheel dimensions

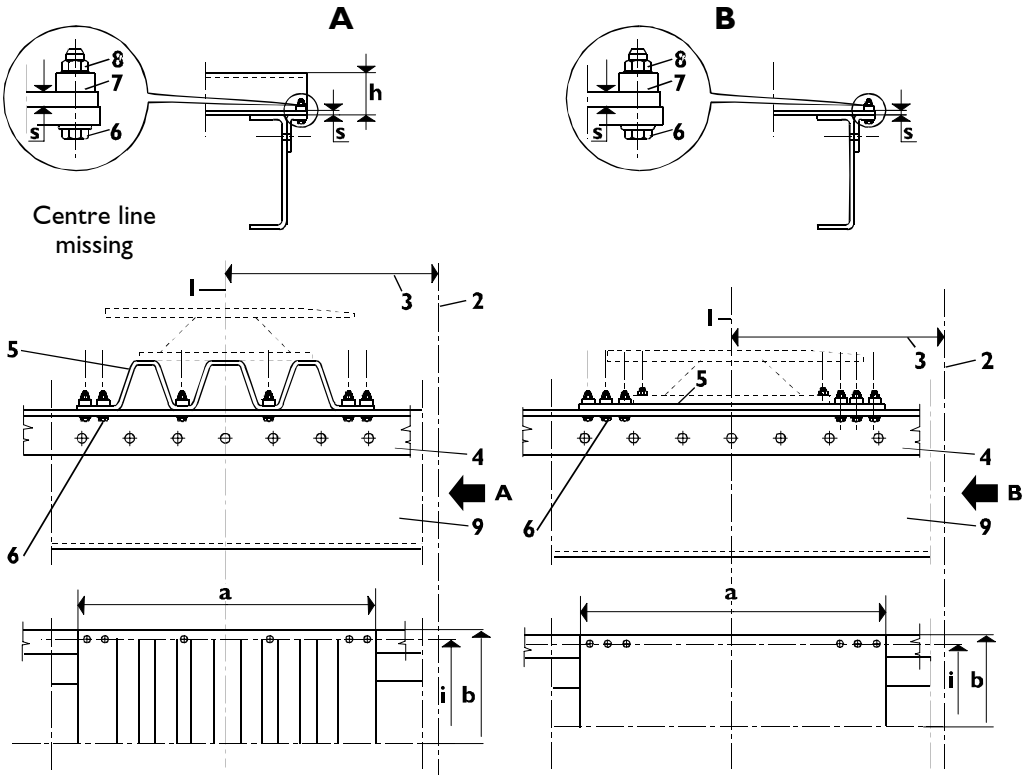
Plate height	Fifth wheel height	Iveco / Jost fifth wheel height (without plate)	Fifth wheel height with integrated plate
(mm)	(mm)	(mm)	(mm)
50	150	200	
50	185	235	
100	185		
12	150		162 Iveco
8	148		140 Jost

Table 3.8 - Model/type application

Total fifth wheel height	Models	Suspension setting	Tyres	Mudguard	Fifth wheel plate height from the ground
(mm)		(mm)		Dimension C (*) (mm)	(mm laden)
200	4X2 / P	160 (S)	315 / 80	150	~1170
			295 / 80		~1155
		140 (O)	315 / 70	120	~1120
		(SW 06114)	305 / 70		~1110
			315 / 60		~1090
			295 / 60		~1075
235	4X2 / P	160 (S)	315 / 80	174	~1205
			295 / 80		~1190
285	4X2 / P	160 (S)	315 / 80	174	~1255
			295 / 80		~1240
162	4X2 / P	140 (O)	315 / 60	120	~1050
		(SW 06114)	295 / 60		~1035
			305 / 70		~1070
			315 / 70		~1080
140	4X2 / FP-LT	85	295 / 60	120	~960
			315 / 60		~975
162	4X2 / FP	85	295 / 60	120	~985
(156)			315 / 60		~1000

Fitting instructions for 4x2 models: AS/AD/AT 440 S... T/P and T/FP

Figure 3.21



A View from A

B View from B

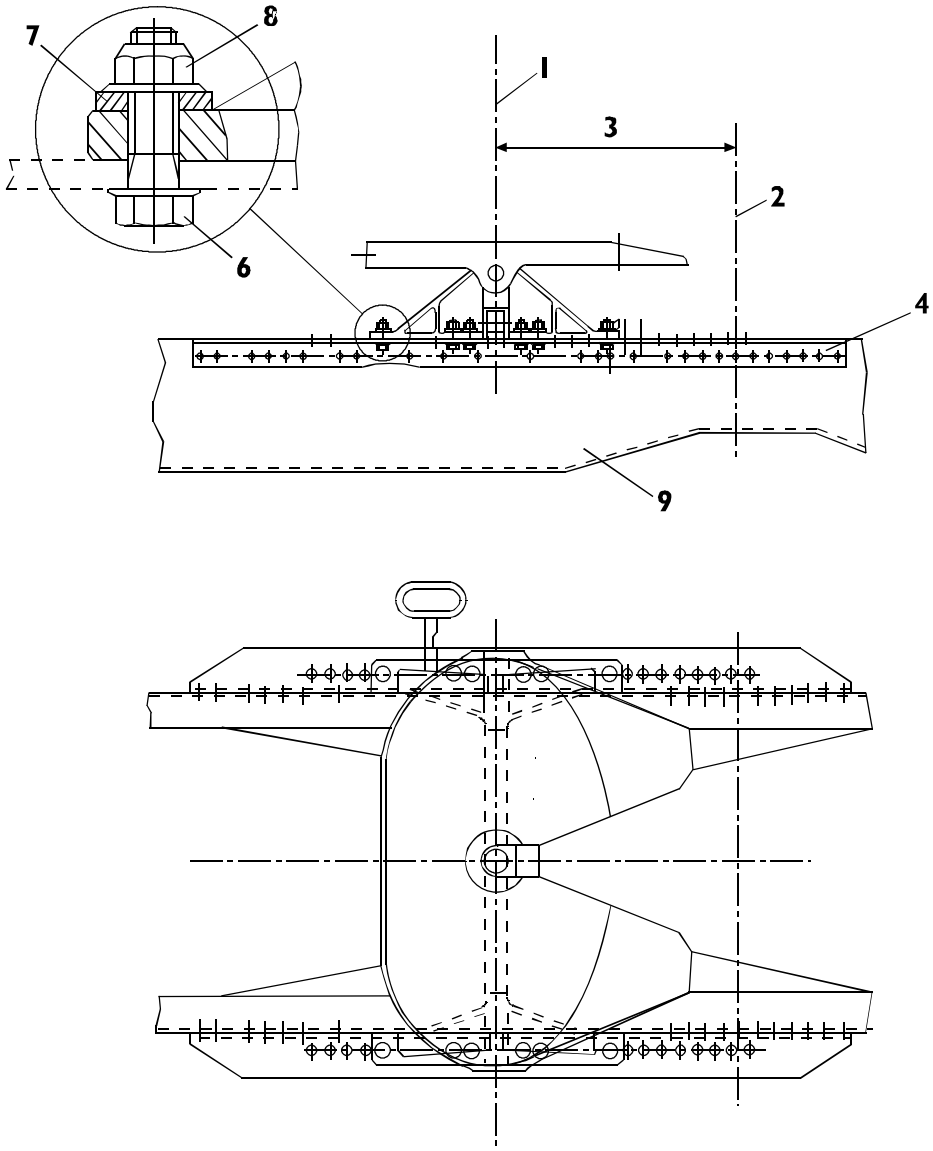
1. Fifth wheel centreline - 2. Rear wheel centreline - 3. Fifth wheel position - 4. Longitudinal runners - 5. Fifth wheel bed plate - 6. Class 10.9 M16x1.5 screws - 7. Fixing spacers (h=15mm) - 8. Self-locking flanged-head nuts - 9. Chassis side members

Bed Plate Fixing

- Having determined the fifth wheel forward position, secure the longitudinal runners to the plate using screws (6), spacers (7) and the self-locking nuts (8).
- Tighten the nuts (8) (tightening torque 260 to 300 Nm).

Fitting instructions for models 4x2: AS/AD/ATD 440 S...T/P and T/FP With crossbrace (Option 7727 - 7728)

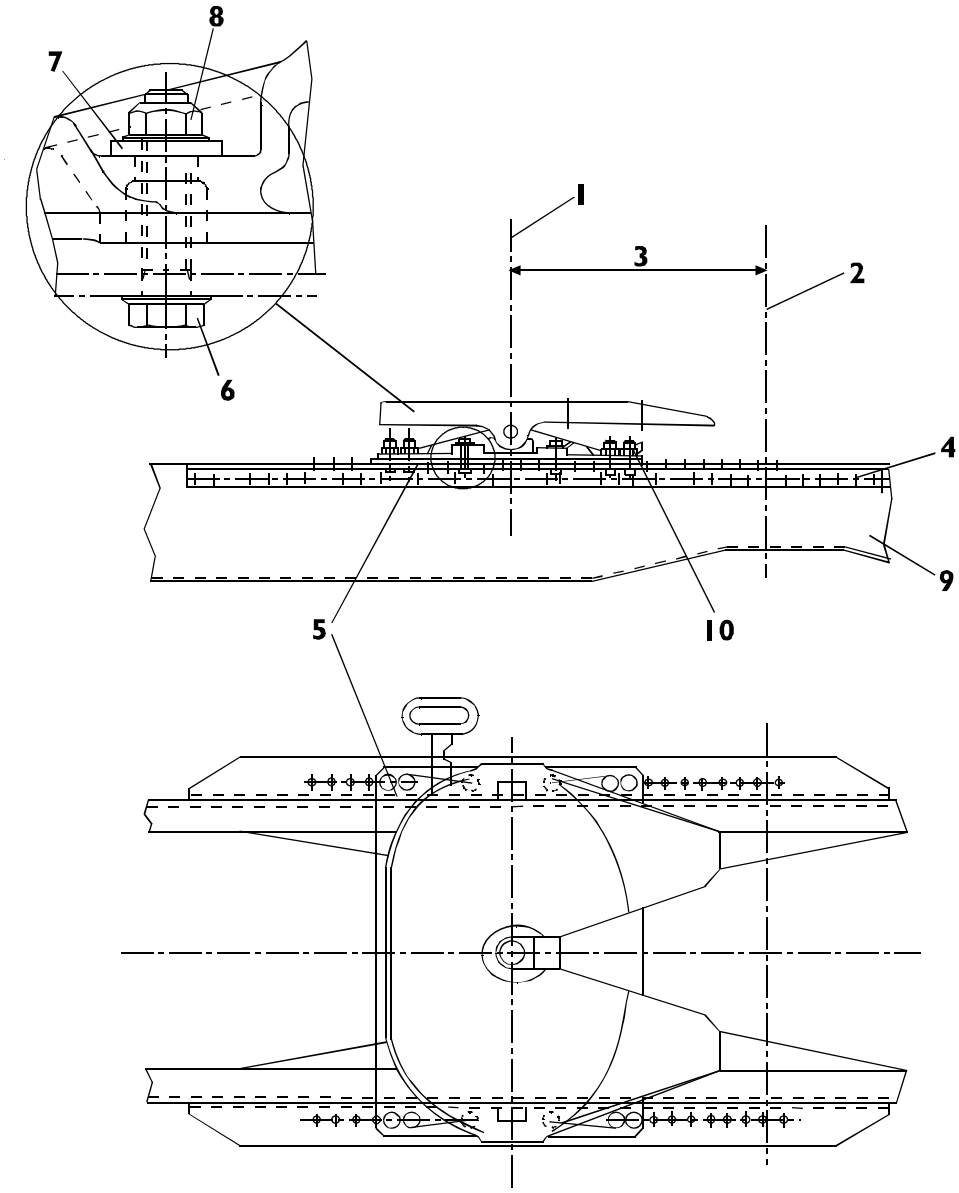
Figure 3.22



1. Fifth wheel centreline - 2. Rear wheel centreline - 3. Fifth wheel position - 4. Longitudinal Runners - 6. Class 10.9 M16x1.5 screws with flange - 7. Washer (h=6mm) - 8. Self-locking flanged-head nuts - 9. Chassis side members

Fitting instructions for models 4x2: AS/AD/AT 440 S...T/P and T/FP Without crossbrace (Option 7830)

Figure 3.23



1. Fifth wheel centreline - 2. Rear wheel centreline - 3. Fifth wheel position - 4. Longitudinal Runners - 5. Plate - 6. Class 10.9 M16x1.5 screws with flange - 7. Washer (h=6mm) - 8. Self-locking flanged-head nuts - 9. Chassis side members - 10. Fixing spacers (h=15mm)

3.5.4.1 Preparation and installations of a Structure Working together with Chassis

In addition to distributing the weight that bears on the fifth wheel the purpose of installing a suitable mounting similar in construction to the subframe shown in Figure 3.24, is to give the vehicle's chassis added torsional and flexional strength. It is required for extreme heavy- duty operations in certain markets for the models indicated in Table 3.9. The table also gives the minimum dimensions for the longitudinal runners for the side members. For dimensions, see table 3.2 depending on modulus of resistance Wx.

These must be connected by cross members, an adequate number of which must be placed in the area where the fifth wheel is positioned, while the remainder are distributed at the end of the straight section.

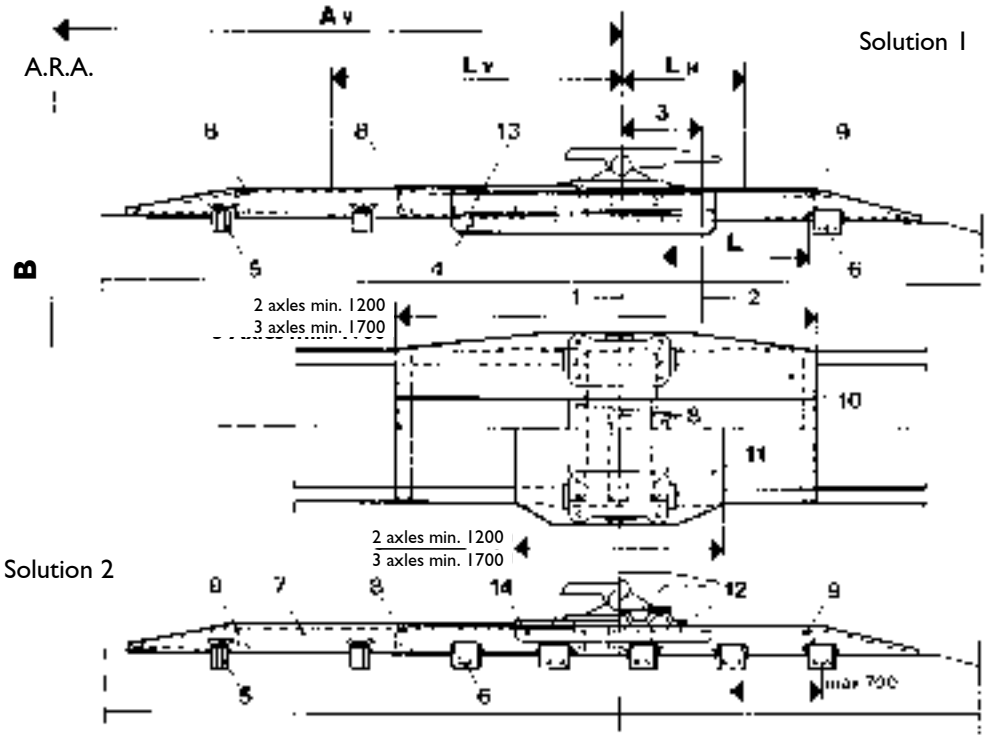
The mounting plate bearing the fifth wheel may be constructed in one of the following ways:

- by means of a plate of suitable thickness, of a length and width which is proportional to the fifth wheel supports or by means of two plate halves of greater length;
- by means of a fret-shaped plate which the Manufacturer of the fifth wheel can supply (height 30 or 40 mm) where there are no problems concerning the height of the fifth wheel.

The plate(s) on which the fifth wheel is fitted must be joined rigidly to the framework of the base (side and cross members).

The supports already provided by Iveco (longitudinal and/or cross members) must be used to secure the structure to the main frame. The best type of connection is provided by the use of plates at the rear and in proximity to the fifth wheel to stop sideways and lengthwise movement, and brackets towards the front (see Figure 3.24). In addition to the other general type specifications given in point 3.5.4, the specific requirements stipulated for certain models on their respective drawings (are available on request) must also be adhered to.

Figure 3.24



1. Fifth wheel pivot centreline - 2. Rear wheel or tandem centreline - 3. Fifth wheel position - 4. Standard equipment angle piece - 14 dia. screws - 5. Front brackets - 16 dia. screws - 6. Plates - 14 dia. screws - 7. Longitudinal runner (see Table 3.5) A_V = Distance between front axle and fifth wheel centreline L_V = Minimum required reinforcement lenght when a L_H = special runner profile (see Table 3.9) is used - 8. Stiffening crossties - 9. Rear cross members (for L> 400 mm) - 10. Half-plate (min thickness = 8 mm) - 11. Plate (min. thickness = 10 mm) - 12. Fret-shaped plate - 13. Channel profile - 14. Fixing angle piece

Table 3.9 - Minimum indications of subframe profile

Models	Wheelbase (mm)	Minimum reinforcement profile	
		Section modulus based on the yield point of the material (N/mm^2)	
		FE240 = S235	FE360 = S355
		240	360
AS/AT/AD 190[1)] AS/AT/AD 440 T; T/P: T/FP	3200	90[2)3)]	57[2)5)]
	≤ 3500	150[2)3)]	57[2)4)]
	≤ 3800	208[2)3)]	90[2)4)]
AS/AD/AT 260/Z/P[1)] AS/AD/AT 440 T	3200/1380	173[6)]	42[6)]
		208[2)3)]	150[2)5)]
	3500/1380	208[6)]	57[6)]
		208[2)3)]	208[2)5)]
AS /AD/AT 260/P; /PS; /FP; /FS; /FT; /FT[1)]	3200/1395	208[6)]	73[6)]
			208[2)5)]
AS/AD/AT 260/P; /FP[1)] AS/AD/AT 440 TZ/P;	2800/1395	208[6)]	57[6)]
			208[2)5)]

1) When converting a truck into a semitrailer tractor, the wheelbase to be used must be equal to that of standard tractors, or suitably reduced.

2) For heavy-duty use of vehicle (e.g. non-EU countries).

3) For heavy-duty use of vehicle up to 6500 kg on the front axle

4) For heavy-duty use of vehicle up to 7000 kg on the front axle

5) For heavy-duty use of vehicle up to 7500 kg on the front axle

6) For on-road use of vehicle and load on front axle ranging from 7500 to 8000 kg (this is obtained by means of high fifth wheel displacement values).

Should it be necessary to reduce the height of the runner profile using shear resistant connections between the chassis and the subframe (see Table 3.9) instead of the channel profile specified in Figure 3.24, it is possible to make use of combined section runner profiles (see table below) provided the width and thickness values are no less than the tabulated ones. These are instructions of a general nature applying to the material covered by this manual. Materials of higher mechanical specifications call for the measurement of the overall chassis and subframe bending moment. Do not use sections with a height of less than 80 mm in order to provide the chassis with adequate stiffness characteristics.

For section dimensions see Table 3.2.

Solutions adopting combined section reinforcement profiles (see Figure 3.3)

	A	B	C o D	E	F	G
Material yield point (N/mm^2)	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm)	40	60	100	120	100	120
Combined reinforcements length L_V: L_H: (see Figure 3.23)	 $0.3A_V$ $0.2A_V$	 $0.4A_VV$ $0.22A_VV$	 $0.5A_V$ $0.25A_V$	 $0.55A_V$ $0.25A_V$	 $0.5A_V$ $0.25A_V$	 $0.55A_V$ $0.25A_VV$
Example: Combined section as an alternative to the channel section (mm):	210X80X8	190X80X8	150x80x8 + straight section 15x80	130x80x8 + straight section 15x80	150x80x8 + angle section	130x80x8 + angle section
Actual height reduction (mm)	40	52	85	97	92	104

The above data cannot be used when the subframe is connected to the vehicle chassis by means of brackets. In this case, moments of resistance and stress data must be calculated for each chassis and subframe section.

3.5.4.2 Converting a Truck into a Semitrailer Tractor

In certain cases, on models where no tractor unit was originally planned, it is possible to obtain the necessary authorisation to convert a truck into a semitrailer/tractor. The specifications relative to such a conversion in terms of fifth wheel mountings, modifications of the chassis (i.e. suspension, braking system etc.) based on the use of the vehicle, must be defined in each case.

3.5.4.3 Variable height fifth wheel (only for Low tractor)

Iveco offers its Customers a variable height fifth wheel solution, type-approved only for Low tractor units.

It must be clarified that the above device may be used in the lower position for any type of vehicle (except quarry and building site and tipper trucks), while in the higher position it must not be permitted under any circumstances for the following applications:

- Conversions with high centre of gravity
- silos
- Tanker trucks
- Tipper trucks
- Quarry and building site vehicles

The maximum height of the fifth wheel measured from the ground surface is also authorised up to 1200 mm in accordance with EEC Braking certificate.

3.6 Transport of Indivisible Materials (bascules)

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

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

The structure that bears the weight on the tractor must use a subframe (see point 3.5.4.1): other conditions that must be met for this type of transport will be specified each time in our authorisations.

Transport of Indivisible Materials (Bascules)

3.7 Installation of Tanks and Containers for Bulk Materials

a) Installation through application of a subframe

As a general rule, the installation of tanks and containers on our vehicles requires the use of an appropriate subframe. Table 3.10 contains the recommendations for the dimensions of the longitudinal runners to be used for the subframe.

Table 3.10 - Installation of tanks

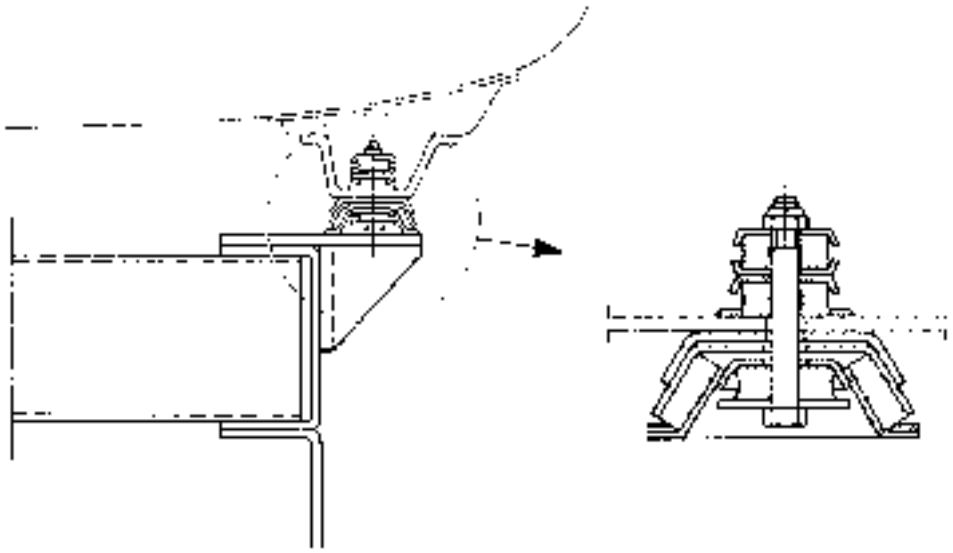
Models	Minimum reinforcement profile
	Section modulus Wx (cm^3) (Yield limit of material used=360N/mm^2)
AS/AD/AT 190	46[1)] 89[2)]
AS/AD/AT 260	59[1)] 89[2)]

(1) Stiffen the subframe in the area on which the tanks and containers rest;

(2) Locate the front tank support in front or near to the rear support of the spring on the 2nd front axle, otherwise the use of a larger section and specific authorisation will be necessary.

Tankers, or more generally, structures which are torsionally very rigid, must be fitted so that the vehicle chassis retains sufficient and gradual torsional flexibility, by avoiding areas of high stress.
When installing a tank we recommend using elastic joints (see Figure 3.25) between the body of the tank and the subframe in front and rigid supports that are capable of withstanding longitudinal and transverse forces at the rear.

Figure 3.25



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

When faced with a different situation, a possible solution could be that of reinforcing the structure by means of longitudinal runner profiles of larger dimensions in comparison with those given in Table 3.10.

The rigidity characteristics of the vehicle chassis as well as the area where the connections are to be installed and the type of use for which it is intended must be taken into account.
As a rule, for road use, it can be said that the first front elastic connection will allow for a gap of approximately 10 mm between the subframe and frame during the chassis torsional stage.

In order to define the elastic connection.

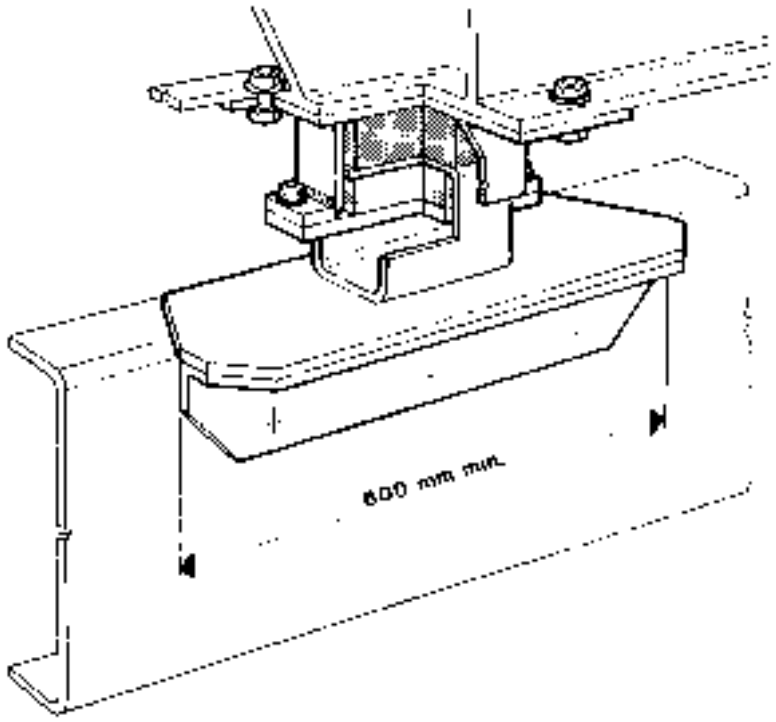
b) Installation without application of a subframe

Tanks may be mounted directly onto the vehicle chassis without fitting an subframe under the following conditions:

- the distance between saddles must be determined depending on the load to be carried and must not exceed 1 meter.
- saddles must be fitted so as to allow an even distribution of the loads over a considerably large surface. Suitable brackets must be provided between the saddles to limit the longitudinal and transverse thrusts.
- other anchoring solutions may be authorised by Iveco.
- self-bearing tanks may be positioned directly on the chassis by means of suitable mountings located right behind the cab and in the area of the rear axle(s). The number and distribution depends on the number of axles and the wheelbase; this may vary from min. 2 for each side on 2- axle vehicles with short wheelbases to min. 3 for 3/4-axle vehicles with short wheelbases (see Figure 3.26).
- the mountings must be sufficiently long (600 mm approx) and be positioned next to the suspension mountings (max. distance 400 mm).
- to permit the necessary torsional movements of the chassis, elastic front mounting should be used where possible.

Other solutions are possible depending on the type of construction.

Figure 3.26



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

In order to adhere to the maximum admissible load limits on the axles, it is necessary to establish the maximum volume, the degree of filling of the container and the density of the freight. When separate tanks or individual containers with separate compartments are used, care must be taken to ensure that with every degree of filling the maximum permissible load on the axles is respected as well as the minimum ratio between the load on the front axle and fully loaded vehicle weight (see point 1.13.2).

In consideration of the nature of this equipment, special attention must be paid to limiting the height of the centre of gravity as much as possible to ensure good handling (see point point 1.13.2); we recommend the use of vehicles with stabiliser bars.

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

The same holds true for trailers and semitrailers, in order to avoid dynamic loading on the coupling devices.

Concerning the installation of containers for fuel or flammable liquids, all current government safety regulations must be abided by (see point 2.18).

3.8 Installing a crane

The selection of the crane must be made with due consideration to its characteristics (weight, maximum torque) in relation to the performance of the vehicle.

The positioning of the crane and of the payload must be done within the load limits permitted for the vehicle. Installation of the crane must be carried out in compliance with statutory requirements, national standards (e.g. CUNA, DIN) and international standards (e.g. ISO, CEN), depending on which of these is pertinent to the particular vehicle.

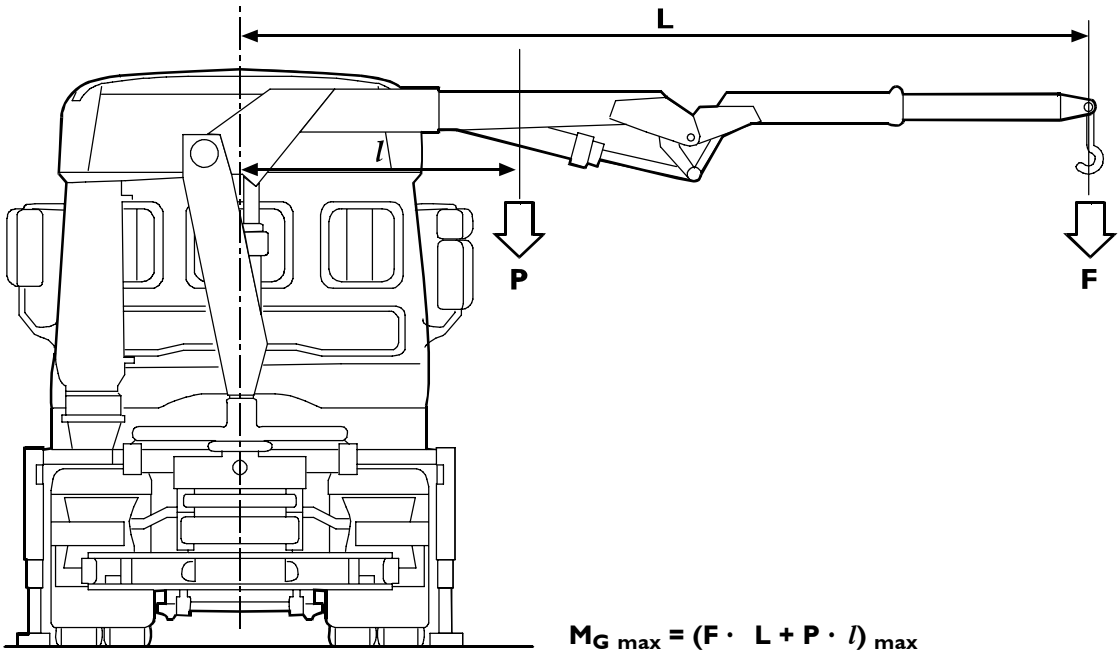
While the crane is operating, the stabilisers (hydraulic if possible) must be used and be in contact with the ground. As a general rule, the installation of a crane requires the use of a suitable subframe, whose construction must taken into account all general specifications relating to it (point 3.1). Concerning the dimensions of the runners for the subframe, refer to Tables 3.12, 3.13 and 3.14.

In those cases where no specific subframe is called for (areas indicated with an "A") it is still necessary to provide a suitable mounting on the chassis for the crane using the standard body subframe (the length of the section members must be at least 2.5 times the width of the base structure of the crane) in order to distribute the load and the stress developed during the operation of the crane.

If the vehicle requires the use of its own subframe, it may also be used for the crane provided that its dimensions are adequate.

Special cases, whose Mg value fall within the areas designated with the letter "E" (or for higher values) must be checked individually each time.

Figure 3.27



The dimensions of the subframe refer to the total maximum static moment of the crane (M_G max.) which is calculated on the basis of the equation given in Figure 3.27.

The decision concerning the number of stabilisers and the type of subframe to be used, particularly in terms of torsional rigidity (box-type sections, cross members etc.) is determined by the maximum moment of the crane and its position for which the Manufacturer of the crane and installer are responsible.

The verification of the stability of the vehicle when the crane is operating must be done in compliance with the applicable government regulations.

Installing a crane

3.8.1 Crane Behind the Driver's Cab

The mounting of the subframe onto the chassis will as a rule, be made using the standard brackets (see Figure 3.28) to which are added, if necessary, other flexible anchorages (brackets or clamps) so that the flexibility and torsional characteristics of the chassis remain unchanged.

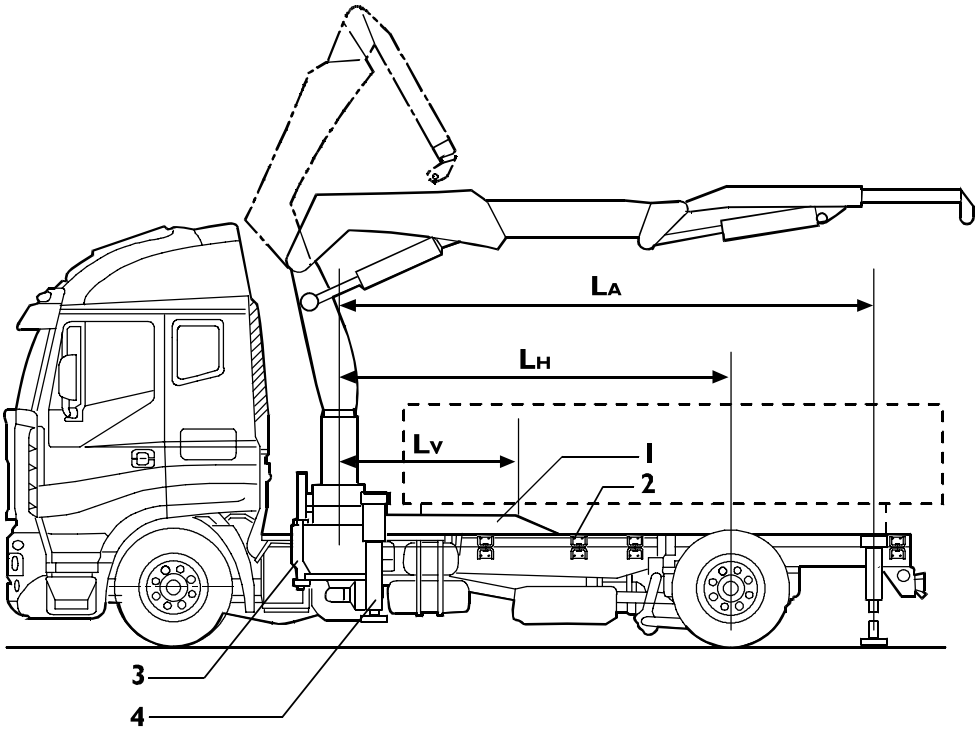
The dimensions and the subframe to be used for this type of installation are specified in Table 3.9.

For on-road vehicles only if the height of the subframe runner profile has to be reduced (e.g. to lower the total height of the vehicle) the mounting of the subframe may be carried out with shear resisting connections (see Figure 3.29). For these applications, the minimum dimensions of the reinforcing runner are specified in Table 3.10. In all case the maximun rear wheel travel / movement must be allowed.

The use of runners with a constant cross-section is recommended over the entire useful length of the vehicle. Any possible gradual reduction of the cross-section of the runners is permissible in those areas in which the flexional moment induced by the crane assumes values that correspond for those of boxes marked "A"in Tables 3.12. and 3.13.

The subframe for the crane may be integrated with the body longitudinal runner as shown in Figure 3.28 Length "Lv" must not be less than 35% of the wheelbase for vehicles with forward-control cab when the body runner has a smaller cross-section.

Figure 3.28



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

Installing a crane

Table 3.11 - Cranes mounted behind the driver's cab (subframe mounted with brackets or clamps)

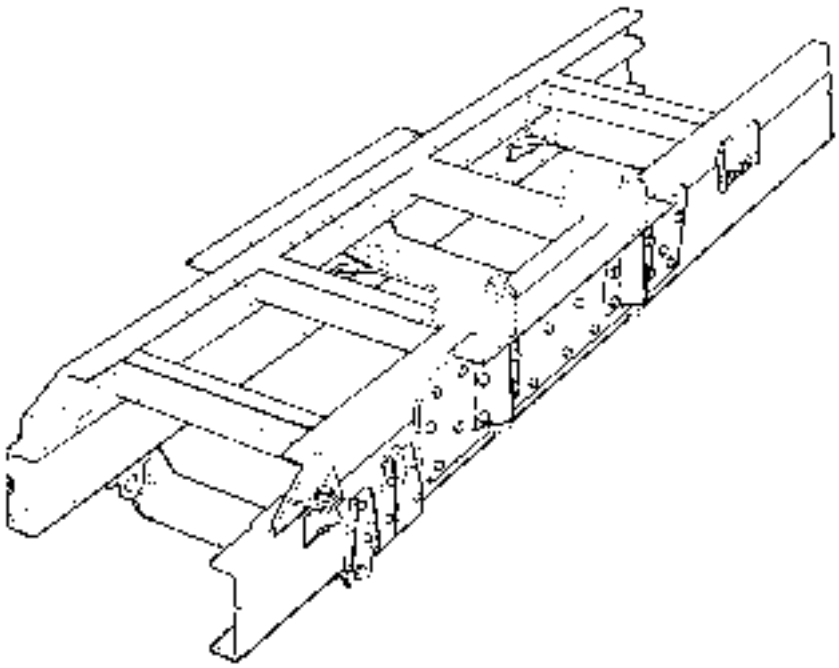
Models	Wheelbase (mm)	Crane capacity MG max (kNm)																		
(Chassis frame section in mm)		Yield point of subframe material (N/mm^2)	20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240	240 - 260	260 - 280	280 - 300
			Minimum value of subframe Section Modulus Wx (cm^3)																	
AS 190		240	A	A	A	A	A	A	A	A	A	A	21 [1]	89	343	439	E	E	E	E	E
AS 260		360	A	A	A	A	A	A	A	A	A	A	21 [1]	89	119	150	245	374	439	E	E
(289X80X6,7)		420	A	A	A	A	A	A	A	A	A		21 [1]	89	119	150	185	208	245	343	406
AS 260 Y/P	5700/1395	240	A	A	A	A	A	A	A	A	A	A	A	21 [1]	89	406	E	E	E	E	E
AS 260 Z/P	6050/1395	360	A	A	A	A	A	A	A	A	A	A	A	21 [1]	89	119	150	245	374	474	E
(289X80X7,7)		420	A	A	A	A	A	A	A	A	A	A	A	21 [1]	89	119	150	185	208	245	343

A = The reinforcing profile prescribed for the respective superstructure is sufficient (e.g. for normal bodies). Close the reinforcing profile in the crane mounting area. In the crane area, reinforcing profiles with thickness of less than 5 mm must be reinforced.

E = To be checked on a case-by-case basis. Send the technical documentation with the checks of stresses and stability to the appropriate IVECO bodies.

(1) When the auxiliary frame requires a high moment of resistance (e.g to install platforms) the latter shall be established also for the crane.

Figure 3.29



When installing cranes on large-cab vehicles, should it be impossible to extend the subframe up to the rear support of the front spring, it may be necessary to contain crane rotation according to crane capacity, so as not to exceed bending moment allowance for the chassis.

Installing a crane

Installation of cranes on off-road vehicles may require fitting elastic mountings between the chassis frame and subframe on the front and central areas (see Figure 3.11) so as not to excessively constrain the chassis torsional movement. Since in such cases the crane will be virtually connected to the subframe only, the size of the longitudinal runners must be adequate to resist the crane operation-generated movements.

The functioning of the equipment that is placed behind the cab (e.g. gear levers, air filter, locking device for the tilting cab etc.) must not be impaired. Relocating assemblies such as batteries box or fuel tank is permissible provided that the original type of connections are re-established.

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

Table 3.12 - Cranes mounted behind cab (subframe fixing with shear-resistant plates)

Models	Wheelbase (mm)		Crane capacity MG max (kNm)																		
(Chassis frame section in mm)		Yield point of subframe material (N/mm²)	20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240	240 - 260	260 - 280	280 - 300
			Minimum value of subframe Section Modulus Wx (cm³)[1]																		
AS 190	up to 6300	240	A	A	A	A	A	A	A	A	31[1]	46	89	105	150	173	245	E			
AS 260	up to 5100/1395	360	A	A	A	A	A	A	A	A	A	A	31[1]	46	89	89	135	150	173	208	245
(289X80X6,7)		420	A	A	A	A	A	A	A	A	A	A	A	31	36[1]	89	89	105	135	150	173
AS 260 Y/P	5700/1395	240	A	A	A	A	A	A	A	A	A	31[1]	36[1]	89	89	135	150	208	245	E	
AS 260 Z/P	6050/1395	360	A	A	A	A	A	A	A	A	A	A	A	31[1]	36[1]	89	89	105	135	150	173
(289X80X7,7)		420	A	A	A	A	A	A	A	A	A	A	A	A	A	31[1]	46	89	89	105	135
Section modulus Wx (cm³) required for the chassis + subframe aggregate section		240	63	94	125	157	188	219	250	282	313	375	438	500	563	625	688	750	813	875	938
		360	48	72	96	120	143	167	191	215	238	286	334	381	329	477	524	572	169	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

* Also valid for chassis runner profile (lower flange of the aggregate section).

A = The reinforcing runner required for the corresponding subframe is sufficient (e.g. Table 3.4 for standard platform bodies).

The reinforcing runner in the crane's mounting area is to be closed. In the same area, the reinforcing runners with thickness less than 5 mm are to be reinforced.

E = To be checked for case to case (submit the technical documentation with the calculation made to determine stress and stability).

(1) When the auxiliary frame requires a high moment of resistance (e.g to install platforms as per Table 3.1) the latter must be established also for the crane.

2) The application of these capacity ranges of the cranes requires that the vehicle's stability be carefully verified (possibility of using stabilisers with a greater extension or resorting to heavier ballast).

3) Should one wish to reduce the height of the runner profile using shear resistant connections between the chassis and subframe instead of the specified channel section (moment of resistance as per Table 3.12) it is possible to make use of combined section runner profiles (see table below) provided that the flange width and thickness values are no less than the tabulated ones. These are instructions of a general nature appl ying to materials covered by this manual. Material with higher mechanical specifications call for the measurement of the overall chassis and subframe bending moment (see last part of Table 3.13). However it should be remembered that for the part of the runner profile which is not reinforced (channel section) the moment of resistance must not be less than the one required for the subframe concerned (i.e. Table 3.4 for fixed platform bodies).
As a reduction of the subframe runner entails a reduction in the subframe moment of resistance, the Bodybuilder who is envisaging the installation of a crane with 4 stabilisers will have to work out the means for ensuring adequate torsional stiffness for the af in the crane resting area. For this reason we recommend that the height of the runner profiles be not less than 120 mm. However, as this solution also implies a restriction of the torsional capacity of the main chassis while the vehicle is travelling, we recommend that its use be confined to on-road use

Installing a crane

Table 3.13 - Solutions with combined section runner profiles (see Figure 3.5)

	A	B	C o D	E	F	G
Material yield point (N/mm^2):	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm):	40	60	100	120	100	120
Combined reinforcements length (see Figure 3.26) L_V=	0.25L_h or	L_A 0.35L_h or	L_A 0.4L_h or	L_A 0.45L_h or	L_A 0.55L_h or	L_A 0.6L_h or. L_A
Example: Combined section as an alternative to the channel section (mm): C250x80x8 mm:	210x80x8	90x80x8	150x80x8 + straight section 15x80	130x80x8 + straight section 15x80	150x80x8 + angle section	130x80x8 + angle section
Actual height reduction (mm)	40	52	85	97	92	104

The above data cannot be used when the subframe is connected to the vehicle chassis by means of brackets (see Table 3.11). In this case, moments of resistance and stress data must be calculated for each chassis and subframe section.

3.8.2 Crane on Rear Overhang

It is advisable for this type of application, to extend the subframe over the entire length of the vehicle that is available for the body up to the back of the cab or if this is no possible the rear support of the front spring. The dimensions of the runners to be used are given in Table 3.14.

In consideration of the particular distribution of the load on the vehicle, where the load is concentrated on the rear overhang, in order to ensure the rigidity that is necessary for good performance on the road and when the crane is in operation, the subframe must be strengthened and stiffened in relation to the capacity of the crane. Box-type sections (see point 3.2) and brackets are to be used in the area of the rear suspension and the rear overhang (Length Lv as per Figure 3.30). Care must also be taken to ensure that the transition from box-type to open section is well blended as illustrated in Figure 3.5 and 3.6.

In the area that is affected by the box-type section, the frame must be secured to the chassis of the vehicle by means of shear-resistant plates (i.e. an adequate number of plates spaced at most 700 mm from each other), whereas elastic mountings are to be used in the front part. Due care must be taken to ensure that under any load conditions, the ratio of the weight on the front axle to the rear axle or axles, respects the limits set for the vehicle (see point 1.13.3).

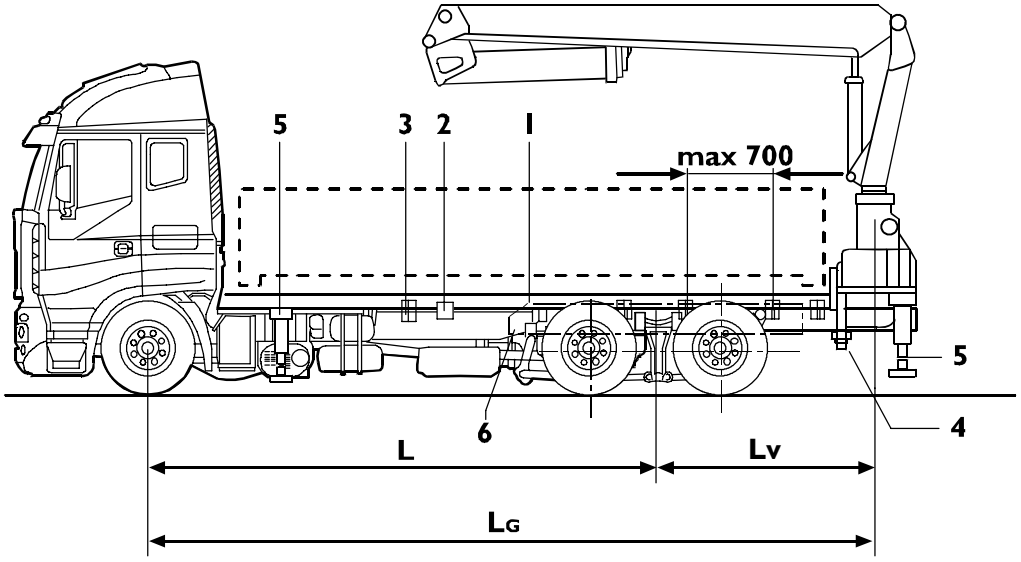
As the required stiffness of the subframe depends on various factors (i.e. crane capacity, size of its supporting base, vehicle kerb weight, chassis overhang) we cannot give information valid for all possible conditions. For this reason the bodybuilder will have to assess the vehicle stability also by means of practical tests. If, as a consequence of such tests , the subframe stiffness proves insufficient, the bodybuilder will have to achieve this objective by means of alternative methods.

The rear overhang of the crane (length Lu, see Figure 3.30) must be limited as much as possible in order to preserve the good driving characteristics of the vehicle and acceptable stress conditions. This value must not exceed 50% of the wheelbase.

In the case of vehicles with a lifting rear axle, the verification of the minimum load on the front axle must be done with the rear axle in the raised position in those countries which permit driving under those conditions (see point 1.13.3). If the minimum prescribed value is not reached, the vehicle must be allowed to drive only with the axle in the lowered position.

Installing a crane

Figure 3.30



1. Subframe - 2. Plates - 3. Brackets - 4. Crane joints - 5. Stabilisers - 6. Connecting angle bar

Table 3.14 - Cranes mounted on rear overhang (subframe mounting with shear resistant plates)

Models	Wheelbase (mm)	Crane capacity MG max (kNm)																			
(Chassis frame section in mm)		Yield point of subframe material (N/mm²)	20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240	240 - 260	260 - 280	280 - 300
			Minimum value of subframe Section Modulus Wx (cm³)[1]																		
AS 190/P AS 260/P; /PS; /FP; /FS AS 260/PT (289x80x6,7)	up to 6300 up to 5100/1395 up to 5100/1395 up to 5100/1395 up to 5100/1395	240 360 420	A A A	A A A	A A A	A A A	A A A	23[1] A A	32[1] A A	42[1] 23[1] 23[1]	57 32[1] 23[1]	110 42[1] 32[1]	135 71 42[1]	173 110 71	222 135 110	246 173 135	E 222 173	222 173	246 222	E 246	E
AS 260 Y/P AS 260 Z/P (289X80X7,7)	5700/1395 up to 5700/1380 up to 6050/1395 up to 6050/1380	240 360 420	A A A	A A A	A A A	A A A	A A A	A A A	A A A	A A A	A A A	A A A	42 23 23	71 32 23	110 42 23	135 57 42	173 110 57	222 110 71	222 135 110	E 135 135	173 173
Section modulus Wx (cm³) required for the chassis + subframe combined section		240 360 420 490 } *	63 48 40 34	94 72 60 50	125 96 80 67	157 120 100 84	188 143 120 100	219 167 140 117	250 191 160 134	282 215 180 150	313 238 200 167	375 286 240 200	438 334 280 234	500 381 320 267	563 329 360 300	625 477 400 334	688 524 440 367	750 572 480 400	813 169 520 434	875 667 560 467	938 715 600 500

* Also valid for chassis runner profile (lower flange of the combined section).

A = The reinforcing runner required for the corresponding subframe is sufficient (e.g. Table 3.1 for standard platform bodies).

The reinforcing runner in the crane's mounting area is to be closed. In the same area, the reinforcing runners with thickness less than 5 mm are to be reinforced.

E = To be checked for case to case (submit the technical documentation with the calculation made to determine stress and stability).

1 = When the auxiliary frame requires a high moment of resistance (e.g to install platforms as per Table 3.1) the latter shall be used also for the crane.

2 = Should one wish to reduce the height of the runner profile using shear resistant connections between the chassis and subframe instead of the specified channel section (moment of resistance as per Table 3.14) it is possible to make use of combined section runner profiles (see table below) provided the flange width and thickness values are no less than the tabulated ones. These are instructions of a general nature applying to materials covered by this manual. Material with higher mechanical specifications call for the measurement of the overall chassis and subframe bending moment (see last part of Table 3.14). However it should be remembered that for the part of the runner profile which is not reinforced (channel section) the moment of resistance must not be less than the one required for the subframe concerned (i.e. Table 3.1 for fixed platform bodies). As a reduction of the subframe runner entails a reduction in the subframe moment of resistance, we recommend that the height of the runner profiles be no less than 120 mm.

Installing a crane

Table 3.15 - Solutions with combined section runner profiles (see Figure 3.4)

	B	D	G
Material yield point (N/mm^2)	320	240	≤ 360
Max. runner profile height reduction (mm):	20	60	80
Combined reinforcements length (see Figure 3.31) L_V =	-	0.45 L_G	0.65 L_G
Example: Combined section as an alternative to the channel section (mm) : 220 x 80 x 8 mm	200x80x8	160x80x8 + straight section 15x80	140x80x8 + angle section
Actual height reduction (mm)	12	45	64

The continuity of combined reinforcement runners can be interrupted only in special cases and is subject to authorisation. Similarly, when it is difficult to apply an external reinforcing L section (items F and G Figure 3.4) - owing to the presence of suspension mountings or air spring connection brackets - and recessing to be performed could excessively reduce the section's resisting capacity, the adopted solution will need special authorisation.

3.8.3 Removable Cranes

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

In consideration that the vehicle may be used with or without the crane, we recommend marking on the body the position of the useful load consistent for the two types of operating condition.

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

Installing a crane

3.9 Installation of Tail Lifts

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

- By means of Table 3.16, with the standard rear overhangs and mean bending moments induced by tail lifts; as a function of their capacity. In the table, the minimum capacity values are specified above which suitable stabilisers must be used.
- When cantilever tail lifts or with different lengths of the rear overhang and with special tail lifts (e.g. aluminium), the flexural moments induced on the chassis frame can be determined by means of Figure 3.31, whereas the characteristics of the longitudinal runners 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 3.17.

In any event, particularly in those specific uses where there is not a suitable subframe (as in the case with box- type bodies built by means of cross members), the fixing for the tail lift must be provided by a structure that enables

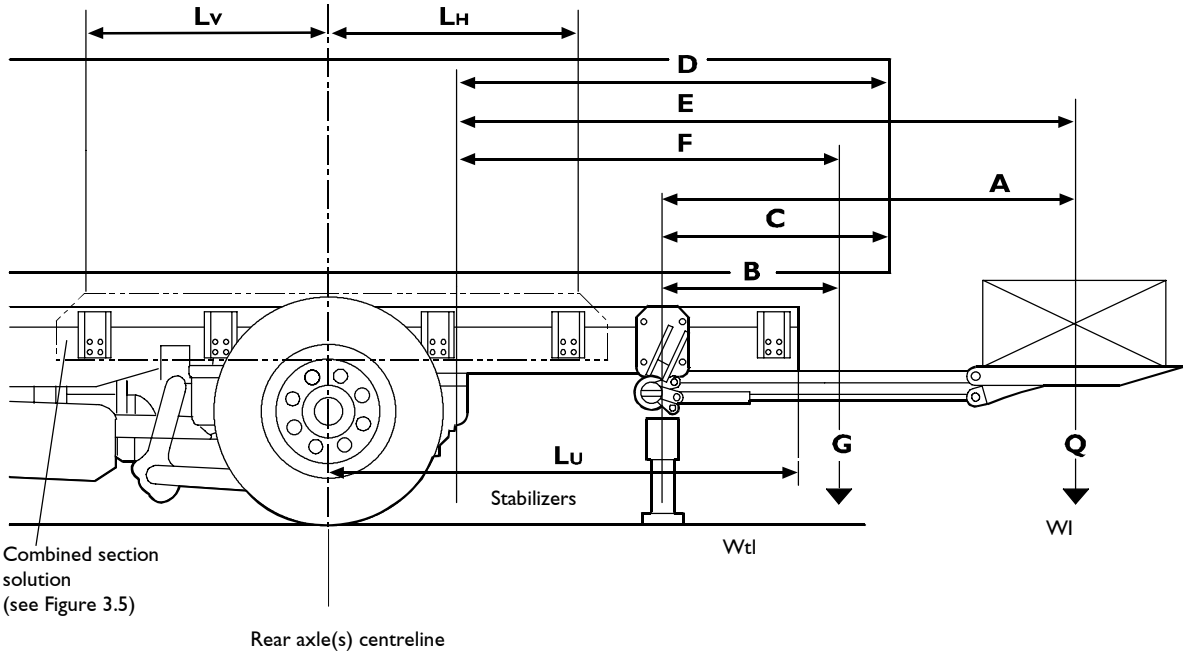
The stress to be distributed over the chassis of the vehicle.

Fixing with Shear Resisting Plates (ALL TAIL LIFT INSTALLATIONS)

To provide the necessary strength and rigidity at the rear of the chassis, the connection between the chassis and the subframe must (especially in overhangs of over 1500 mm) be made using shear resisting plates. These must be fitted in the area of the overhang and of the rear suspension and spaced not more than 700 mm from one another as shown in Figure 3.31.

Procedure for calculating the frame bending moment during loading of a tail lift.

Figure 3.31



W_{TL} = weight of tail lift
W_L = tail lift capacity

The bending moment of the frame can be calculated using the following formula:

For tail lifts without stabilisers $M\ [Nm] = W_L \times A + W_{TL} \times B$

For tail lifts with stabilisers $M\ [Nm] = W_L \times C + W_{TL} \times D$

NOTE C, D, W_{TL}, W_L : According to tail lift manufacturer's data.

Installation of Tail Lifts

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

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

The stability of the vehicle must be verified in observance of government regulations in all operating phases of the platform.

To compensate for the elastic give of the chassis, which is inevitable when the tail lift is in operation, the bodybuilder may make use of reinforcement runner profiles of larger size in comparison to the one indicated in Table 3.16 and 3.17.

The runner profile dimensions given in Table 3.16 apply to the rear overhangs shown. Should the latter be of larger size, it may be necessary to consider the possibility of either installing stabilisers or larger runner profiles (see Table 3.17).

The installation of tail lifts must be carried out with due regard for the maximum permissible weights on the rear axle or axles and of the minimum load established for the front axle (see point 1.13.3); if this should not be the case, the rear overhang will have to be reduced.

When electro-hydraulic tail lifts are installed, it is necessary to check that the capacity of the batteries and of the alternator is adequate (see point 5.5).

Vehicles with liftable third axles, 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 rear underrun guard or for installing a different type (see point 2.20) for preserving the visibility of the rear lights, for the overhang angles, and for the positioning of the tow hook as provided by the respective national requirements.

Installation of Tail Lifts

Table 3.16 - Installation of tail lifts

Models				**Tail lift capacity kN (kg)**															
	Wheelbase	**Max. body overhang (mm)**		**7.5 (750)**		**10 (1000)**		**12.5 (1250)**		**15 (1500)**		**17.5 (1750)**		**20 (2000)**		**25 (2500)**		**30 (3000)**	
				Minimum value of subframe Section Modulus Wx (cm^3) as a function of the yield point of the material (N/mm^2)															
(Chassis frame section in mm)	**(mm)**			**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**
AS 190/P	3800	1847	2275	A	A	A	A	A	A	A	A	57	A	89	46	89	46	135	89
	4200	2072	2500	A	A	A	A	A	A	57	A	89	46	105	57	135	89	150	89
AS/AD/AT 260/P; /PS; /PT (302,4/212,4x80x6,7)	3800	-	2207	89	46	89	46	89	46	135	89	135	89	135	89	150	119	208	135
	4200	-	2567	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
	4500	-	2522	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
	4800	-	2522	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
	5100	-	2252	89	46	89	46	89	46	135	89	135	89	135	89	150	119	208	135
AS/AD/AT 260/TN AS/AD/AT 260/PT (P. 5700/1380) (302,4x80x6,7)	bis 5700 bis 5100	-	3475	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
AS/AD/AT 260/P; /FP; (302,4/212,4x80x6,7)	4471	1307	1760	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	46
	4471	1802	2250	A	A	A	A	A	A	A	A	57	A	89	46	89	46	135	89
	5101	1577	2030	A	A	A	A	A	A	A	A	A	A	A	A	89	46	89	46
	5101	1982	2430	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
	5101	2207	2660	A	A	A	A	57	A	89	46	89	46	89	46	135	89	150	89
	5101	2387	2840	A	A	57	A	89	46	89	46	105	57	135	89	150	89	173	105
	5686	1982	2430	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
	5686	2207	2660	A	A	A	A	57	A	89	46	89	46	105	57	135	89	150	89
	6271	2027	2480	A	A	A	A	A	A	57[1]	A	89	46[1]	89	46[1]	135	89	150	89
	6271	2387	2840	A	A	57[1]	A	89	46[1]	89	46[1]	105	57[1]	135	89	150	89	208	105
	6271	2792	3240	89	46[1]	89	46[1]	105	57[1]	135	89	135	89	150	89	208	135	245	150
AS/AD/AT 260/P; /FP; /FS; /PS (302,4/212,4x80x6,7)	4201	1127	1580	A	A	A	A	A	A	46	A	89	46	89	46	105	57	135	89
	4201	1622	2070	57	A	89	46	89	46	89	46	105	89	135	89	150	89	208	135
	4471	1217	1670	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
	4471	1622	2070	57	A	89	46	89	46	89	46	105	89	135	89	150	89	208	135
	4786	1487	1940	A	A	57	A	89	46	89	46	89	46	105	89	150	89	173	105
	4786	1712	2160	89	46	89	46	89	46	105	57	135	89	135	89	173	105	208	135
	4786	2072	2520	89	46	105	57	135	89	150	89	150	89	173	105	207	135	286	150
	5101	1802	2250	89	46	89	46	105	57	135	89	135	89	150	89	173	105	208	135
AS/AD/AT 260/P; /FP (304,4 X 80 X 7,7)	5686	-	2432	A	A	A	A	A	A	A	A	46	A	46	A	46	46	46	46
	6050		2660	A	A	A	A	46	A	46	A	46	A	46	A	46	46	73	46
AS/AD/AT 260 Z/P-HM (304,4 x 80 x 7,7)	3796	1127	1580	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3796	1487	1940	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4201	1127	1580	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4201	1487	1940	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4201	1622	2070	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4201	1847	2300	A	A	A	A	A	A	A	A	A	A	A	A	46	A	89	A
	4471	1982	2430	A	A	A	A	A	A	A	A	A	A	A	A	89	A	89	46

For the tail lifts with capacity up to 5 kN (500 kg) the reinforcing runner profile provided for the corresponding subframe is sufficient (e.g. Table 3.4 for standard platform bodies).

For modes AS 190 S../P with 2792 mm rear overhang and models AS 260 S../P with 1802 and 2072 mm rear overhang, with 5 kN (500kg) tail lifts use the reinforcing runner profiles provided for the corresponding subframe (e.g. Table 3.4 for standard bodies).

Installation of Tail Lifts

Table 3.17 - Installation of tail lifts
Bending moment permitted for runner of chassis frame/subframe

Models			Moment of resistance Wx (cm^3) of subframe runner 2)										
Chassis frame section (mm)	Wheelbase (mm)	Subframe material yield point (N/mm^2)	16	19	21	26	31	36	46	57	89	105	119
			Static bending moment permitted or chassis frame/subframe runner (shear resistant connections) (kNm)										
(212.4x80x6.7 rear)	up to 6300	240	55.2	61.3	65.6	63.3	67.6	74.7	78.4	82.7	(102.6)	(109.2)	(110.7)
	up to 5100/1395	360	72.5	80.5	86.1	83.1	88.7	(98.1)	(102.8)	(108.6)	(134.7)	(143.4)	(145.2)
		420	86.3	(95.9)	(102.5)	(99.0)	(105.6)	(116.8)	(122.4)	(129.2)	(160.3)	(170.7)	(172.9)
AS/AD/AT 260	up to 5700/1395	240											
	up to 6050/1395	360											
(289x80x6.7)		420											
AS/AD/AT 260 (6X4)	up to 4500/1395	240	90.7	99.6	(105.7)	(101.4)	(107.5)	(117.8)	(121.5)	(125.9)	(151.7)	(158.0)	(157.8)
		360	(119.0)	(130.7)	(138.7)	(133.1)	(141.0)	(154.6)	(159.4)	(163.3)	(199.1)	(208.2)	(207.1)
(289x80x7.7)		420	(141.7)	(155.6)	(165.1)	(158.5)	(167.9)	(184,1)	(189.8)	(196.8)	(237.0)	(247.8)	(246.5)

Models			Moment of resistance Wx (cm^3) of subframe runner 2)										
Chassis frame section (mm)	Wheelbase (mm)	Subframe material yield point (N/mm^2)	135	150	173	208	245	286	317	343	374	406	439	474
			Static bending moment permitted or chassis frame/subframe runner (shear resistant connections) (kNm)										
AS/AD/AT 190	up to 6300	240	(122.8)	(134.1)	(143.1)	(157.7)	(173.0)	(189.7)	(201.6)	(213.9)	(226.8)	(240.1)	(253.9)	(268.1)
AS/AD/AT 260	up to 5100/1395	360	(161.2)	(176.0)	(187.7)	(207.0)	(227.1)	(249.0)	(264.6)	(280.0)	(297.7)	(315.2)	(333.2)	(351.9)
(199x80x6,7 rear)		420	(191.9)	(209.6)	(223.6)	(246.4)	(270.3)	(296.5)	(315.0)	(334.3)	(354.4)	(375.2)	(396.7)	(418.9)
AS/AD/AT 260	up to 5700/1395	240												
	up to 6050/1395	360												
(289x80x6.7)		420												
AS/AD/AT 260 (6x4)	up to 4500/1395	240	(174.3)	(189.9)	(199.3)	(214.5)	(233.3)	(250.5)	(262.8)	(275.7)	(289.0)	(302.9)	(317.2)	(332.1)
		360	(228.8)	(249.2)	(216.6)	(281.6)	(306.2)	(328.9)	(345.0)	(361.8)	(379.3)	(397.5)	(416.4)	(435.9)
(289x80x7.7)		420	(272.4)	(296.7)	(311.4)	(335.2)	(364.5)	(391.5)	(410.7)	(430.8)	(451.6)	(473.3)	(495.7)	(518.9)

( ) The necessity of installing stabilisers and checking stability during operation is to be ascertained.

A = The reinforcing runner required for the corresponding subframe is sufficient (e.g. Table 3.4 for standard platform bodies).

S = Stabilisers must be installed

E = To be checked for case to case (submit the technical documentation with the calculation made to determine stress and stability).

C = Normal (short) cab

L = Long cab

I = If the type of subframe requires it, use larger runner profiles (see Table 3.4)

2 = Should one wish to reduce the height of the runner profile using shear resistant connections between the chassis and subframe instead of the specified channel section (Section Modulus as per Table 3.16) it is possible to make use of combined section runner profiles (see table below) provided the flange width and thickness values are no less than the tabulated ones. These are instructions of a general nature applying to materials covered by this manual. Material with higher mechanical specifications call for the measurement of the overall chassis and subframe bending moment. However it should be remembered that for the part of the runner profile which is not reinforced (channel section) the moment of resistance must not be less than the one required for the subframe concerned (i.e. Table 3.4 for fixed platform bodies). In all case the maximum rear wheel travel / movement must be allowed.

Installation of Tail Lifts

Installation of Tail Lifts

SECTION 4

Power take-offs

Index

Page

4.1 General Specifications

Different types of power takeoffs can be used dependine on the type of use and the performances required, the PTO (Power Take OFF) can be fitted to:

- the gearbox;
- 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 r.p.m. (below 1000 r .p.m.) must be avoided to prevent irregular running.

The power taken in relation to the number of revolutions of the power take-off at the required torque.

$$P(hp) = \frac{M \cdot n}{7023} \qquad P(kW) = \frac{M \cdot n}{9550}$$

P = Useable power
M = Torque permitted for the power take-off (Nm)
n = power take-off r.p.m.

Type of use

Both occasional and continuous use should be considered.

For occasional use periods of under 30 minutes are considered.

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

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

To avoid overloading, in some cases (e.g. hydraulic pumps, compressors) it may be necessary to include the application of devices like clutches or safety valves.

PTO transmissions

The kinematic forces of the transmission from the power take-off to the relevant apparatus should be carefully considered (angles, r.p.m., moment) during the design phase and the dynamic behaviour during operation in compliance with the transmission Manufacturer's instructions should be respected. The dimensions should take into consideration the forces which might occur under maximum power and torque conditions.

To obtain a uniformity of kinetic forces angles of equal value, maximum of 7°, should be obtained at the extremities (Figure 4.1). Solution Z is preferred to solution W due to the lower loads on the bearings of the power take-off and the equipment being driven. When it is necessary to obtain different spatial inclinations (φ), the variations in r.p.m. should be compensated for with the arrangement of the forks shown in Figure 4.2.

For transmissions employing multiple sections, the instructions given at point 2.8.2 should be followed.

Figure 4.1

Solution Z

Solution W

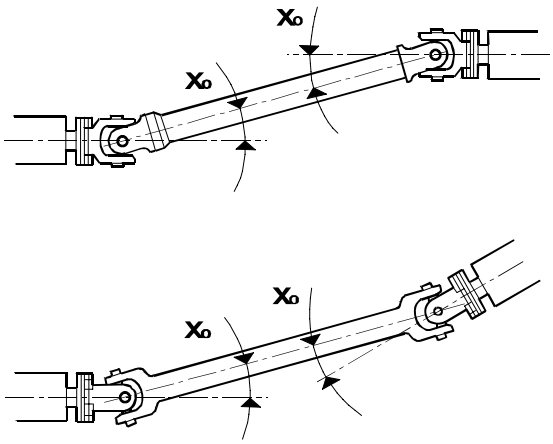
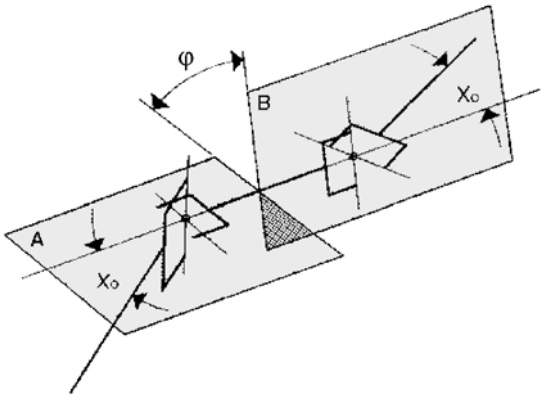


Figure 4.2



Electrical system

The VCM and EM electrical/electronic system makes available innovative methods and processes for control of power take-offs that can significantly improve safety and reliability. Activation takes place by connecting the power take-off control switch to connector ST14A.
This connector is fitted as standard if the customer has chosen a power take-off as standard. If a later power take-off is installed, please observe the instructions given in Chapter 4.6.

Pneumatic system

See description in Paragraph 2.15.4.

4.2 Power Take-off from Gearbox

Depending on the type of gearbox power can be taken from the layshaft through the flange or spline located on the rear, side or lower part of the gearbox.

The technical characteristics necessary are given in the documentation supplied upon request for the various gearboxes.

The types of power take-off and the torque values obtained with the ratio between the number of output revolutions and engine r.p.m. are shown in Table 4.1.

The values refer to the conditions indicated in the table.

Higher values for occasional use must be agreed upon as each occasion arises depending on the type of use.

Check the vehicle to ascertain whether it is possible to fit a power take-off suitable to its size.

The power take-off applied to the gearbox must only be used when the vehicle is stationary and must be engaged and disengaged when the clutch is disengaged to avoid excessive stress on the synchronisers during gear change. For special situations when the power take-off is used and the vehicle is moving the gear must not be changed.

For gearboxes equipped with a torque converter, the same power take- offs used for normal gearboxes are, as a rule, used. It should be carefully noted that, when the engine r.p.m. is below 60% of the max. value the converter will be in the phase of hydraulic r.p.m.; in this phase, depending on the absorbed power, the r.p.m. of the power take-off is subject to oscillation despite the fact that the engine r.p.m. is constant.

Direct Application of Pumps

When the application of pumps of other equipment (e.g. for tippers or cranes) is carried out directly from the power take-off, without the use of intermediate shafts and after checking that the size of the pump permits margins of safety with chassis and engine unit (cross member, transmission shaft etc.), the static and dynamic torques exerted by the mass of the pump and by the power take-off should be checked for compatibility with the resistance of the walls of the gearbox. By way of an example, the moment due to the additional masses must not have values of over 3% approx. of the maximum engine torque.

In cases where the gearbox is applied in a single unit with the engine, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine r.p.m.

When fitting power take-offs the torque values shown in Table 4.1 must not be exceeded.

Transmission oil temperature must not exceed 120°C during prolonged use. Coolant temperature must not exceed 100°C. Not all types of power take-off available on the market are suitable for continuous use. When in use the specifications (working periods, pauses etc.) specific to the power take-off in question should be respected.

Transmission PTO data

The following table shows the types of P.T.O. provided by ZF and by Hydrocar.

The transmission ECU and the Body Computer (BC) will need to be reprogrammed when a PTO is applied after-market. Interventions on the electrical and pneumatic system are required. Read paragraph 4.6 "PTO management" carefully before applying a PTO.

Re-programming of the electronic control units must be carried out in accordance with the instructions in the IVECO technical manual using exclusively the diagnostic instrument (available from IVECO dealers and authorised IVECO service centres), providing the information regardine the specific P.T.O. requirements.

Power Take-off from Gearbox

Table 4.1 - PTO types provided by ZF

Transmission	N. P.T.O.	Type P.T.O.	Assembly side	Ratio Total PTO	Maximum take-off torque (Nm)
9S1310 TO	5202	ZF -NH/1b	center	0.97	800
	5205	ZF -NH/1c	center	0.97	800
	5209	ZF -NH/4b	lower	1.24	430 (1)
	5210	ZF -NH/4c	lower	1.24	430 (1)
	5258	ZF -N109/10b	high	0.97	600
	5255	ZF -N109/10c	high	1.19	630
	5259	ZF -N109/10c	high	0.97	600
16 S 1620 TD 16 S 1920 TD 16 S 2220 TD 16 S 2320 TD	5202	ZF -NH/1b	center	0.91 / 0.77	1000
	5205	ZF -NH/1c	center	0.91 / 0,77	1000
	5209	ZF -NH/4b	right	1.17 / 0.98	430 (1)
	5210	ZF -NH/4c	right	1.17 / 0,98	430(1)
	5258	ZF -N221 10/B	above	1.35 / 1.14	730
	5260	ZF -N221 10/B	above	1.75 / 1.47	560
	5264	ZF -N221 10/B	above	2.00 / 1.68	470
	5255	ZF -N221 10/C	above	1.13 / 0.95	870
	5259	ZF -N221 10/C	above	1.35 / 1.14	730
16 S 2220 TO 16 S 2520 TO	5202	ZF -NH/1b	center	1.09 / 0.91	1000
	5205	ZF -NH/1c	center	1.09 / 0.91	1000
	5209	ZF -NH/4b	right	1.40 / 1.17	430 (1)
	5210	ZF -NH/4c	right	1.40 / 1.17	430 (1)
	5258	ZF -N221 10/B	above	1.62 / 1.35	730
	5260	ZF -N221 10/B	above	2.09 / 1.75	560
	5264	ZF -N221 10/B	above	2.40 / 2.00	470
	5255	ZF -N221 10/C	above	1.35 / 1.13	870
	5259	ZF -N221 10/C	above	1.62 / 1.35	730

1) Limit 1 hour of use

Power Take-off from Gearbox

Table 4.1 - (continued) PTO types provided by ZF

Transmission	N. P.T.O.	Type P.T.O.	Assembly side	Ratio Total PTO	Maximum take-off torque (Nm)
12 AS 1420 TD	5202	ZF -NH/1b	center	0.79	800
	5205	ZF -NH/1C	center	0.79	800
	5209	ZF -NH/4b	lower	1.01	430 (1)
	5210	ZF -NH/4c	lower	1.01	430 (1)
	5260	ZF -Nm AS/10 b	above	1.92	380 (1)
12 AS 1930 TD 12 AS 2330 TD	5202	ZF -NH/1b	center	0.82	1000
	5209	ZF -NH/4b	right	1.05	430 (1)
	5210	ZF -NH/4c	above /H	1.05	430 (1)
	5260	ZF N AS/10b flange	above /H	1.92	400
	6420	ZF -Nm AS/10b double output	above/L/pump lower/H/flange	1.21	670
				1.92	400
12 AS 2530 TD	5202	ZF -NH/1b	center	1.35	1000
	5209	ZF -NH/4b	right	1.22	430 (1)
	5210	ZF -NH/4c	above /H	1.22	430 (1)
	5260	ZF N AS/10b flange	above /H	2.15	400
	6420	ZF -Nm AS/10b double output	above/L/pump lower/H/flange	1.23	670
				1.73	400

1) Limit 1 hour of use

Power Take-off from Gearbox

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 Company.

The various 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 power take-off r.p.m. 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 included between the first and second sections (respect the indications given in point 2.8.2).
- 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 motor running.
- The power take-off must be fixed to the chassis with its own suspension.

NOTE As the transmission is an important part for the safety of the vehicle, modification to it must only be carried out by specialist companies approved by the supplier of the transmission.

NOTE The power take-offs on the universal joint line cannot be used in conjunction with EuroTronic transmissions!

Power Take-off from Transfer Box / Power Take-off from Drive line

4.5 Power Take-off from Engine

In general the use of these power take-offs is planned for apparatus requiring a continuous power supply.

4.5.1 Torque power take off from the front of the engine

The drive take-off from the front part of the crankshaft is obtained, for limited power values to be drawn off (e.g. air conditioning etc.) 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 centreline of the first main bearing which must be kept to a minimum.
- To avoiding a reduction in the radiator cooling capacity and dead water areas.
- 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 110 to 120°C. A margin of approx. 10% should however be left. In other cases include supplementary heat exchangers.

Table 4.2 shows the values to be referred to for the take-off.

Table 4.2 - Power take-off from front of engine

Engine type (power)	Rpm corresp. to full power		Max. rpm admitted (start of red band)		Max. take-off values				
					Max. torque available	Max. moment of inertia	Max. bending moment	Moment multipl. factor	Multipl. factor ang. pos.
(kW/Cv)	rad/s	(rpm)	rad/s	(rpm)	(Nm)	(kgm^2)[1]	(Nm)[2]	(-)[3]	(degrees)[4]
Serie Cursor 10 - F3A									
E0681E (287/390)	220	2100	283	2700	500	0.050	150	1	0-180
E0681B (294/400)	220	2100	283	2700	500	0.050	150	2	180-210
E0681D (316/430)	220	2100	283	2700	500	0.050	150	3	210-240
								4	240-300
								3	300-330
								2	330-360
Serie Cursor 13 - F3B									
E0681G (279/380)	199	1900	262	2500	500	0.050	150	1	0-180
E0681C (324/440)	199	1900	262	2500	500	0.050	150	2	180-210
E0681E (353/480)	199	1900	262	2500	500	0.050	150	3	210-240
								4	240-300
								3	300-330
								2	330-360

1) Maximum moment of inertia of rigidly added masses.
2) Max. moment of flexure due to radial forces in relation to the first main support.
3) Amplification factor of the max. permitted flexural moment (depending on the angular position of the additional radial forces)
4) Direction of the additional radial forces. (zero: TDC cylinder axis; rotation: clockwise).

Power Take-off from Engine

4.5.2 Power take off from the rear of the engine

4.5.2.1 Multipower power take-off on flywheel side

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. It is independent of the vehicle clutch drive and suitable for use with the vehicle running and/or at a standstill (e.g. municipal applications, concrete mixers, etc.).

Some precautions:

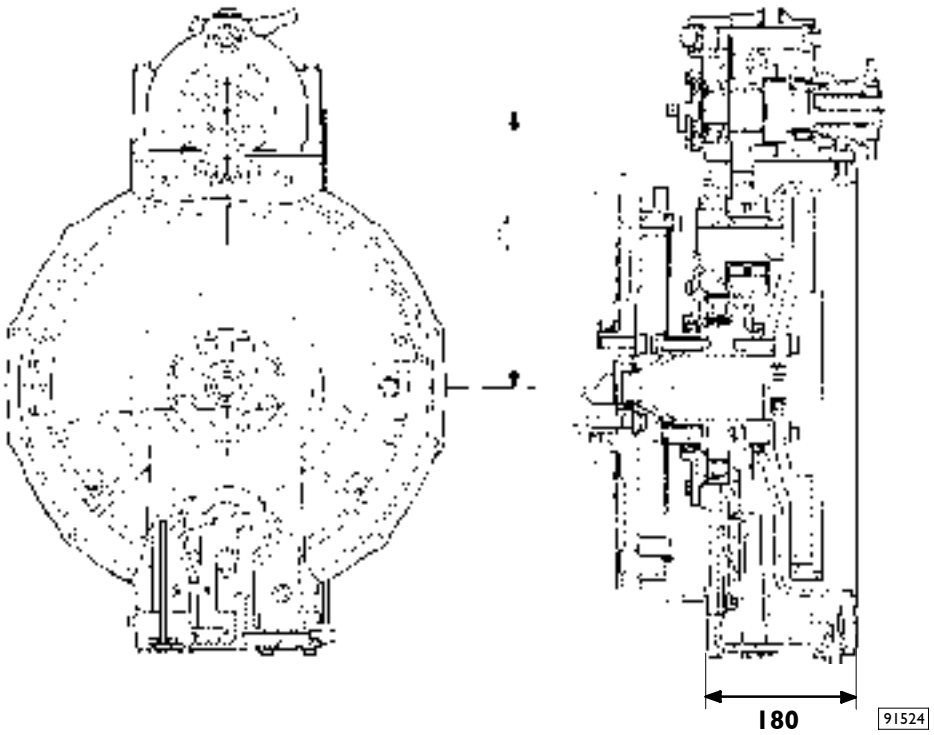
- the PTO must be engaged only with the engine at a standstill (a safety device prevents engagement with the engine running in any case);
- the unit may be disengaged with the engine running but only if power is not currently being taken off;

To guarantee correct engagement, the static a 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 engine must be started when no torque is being taken from the PTO.

The main dimensional specifications are given in Figure 4.3/4.4 and Figure 4.5, while the technical specifications are given in Table 4.3.

Figure 4.3



Power Take-off from Engine

Table 4.3

Output rpm/engine rpm ratio	1.29
Max. torque available	900 Nm
Output flange	ISO 7646-120 X 8 X 10
Control	pneumatic
Direction of rotation	as engine
Installation on engines	Cursor 8-10-13

If turned on during transfers, you must be well aware that depending on the gearing ratio of the power take-off (see tab. 4.3), connected pumps may reach high rotating speeds (e.g.: an engine speed of 1800 rpm corresponds to a pump speed of 2400 rpm).

Consequently, in order to operate FMO FMO (FAST MOVING OBJECTS) equipment with this type of power takeoff, the vehicle control unit must have the three following function modes enabled:

a) Vehicle in motion

With Multipower engaged and the vehicle in motion, the vehicle control unit must receive the PTO engaged signal.

Acceleration of the vehicle is permitted, but it is not allowed to exceed the 1800 rpm threshold, set in the program of the vehicle control unit.

b) Pump engaged with accelerator de-activated

After engagement of the pump, if no part of the equipment is in operation (if no loading and unloading operations are being preformed and the compactor is not engaged), the vehicle control unit receives the pump engaged signal. The rotating speed, set by the vehicle control unit program, is kept to a minimum and accelerations from the operator are not permitted (if the accelerator pedal remains de-activated).

NOTE **This condition can be found even when, the movement of the equipment is interrupted during operation because of an alarm.**

During emergency movements, for example for the return into the profile of the members, it is advisable to carry out the manoeuvres with a reduced motor rotation speed.

Remember that with these enabled pump without accelerator request conditions during normal operation may not be frequent: in fact the compactor is always on during normal equipment operation and this implies the accelerator enabling request.

Power Take-off from Engine

c) Pumps engaged with accelerator activated

After engauging the PTO pump and with the equipment in operation (loading, unloading and compacting operations), the vehicle control unit receives the accelerator request signal.

The rotating speed set by means of the vehicle control unit, is carried to the optimal value required to obtain the oil flow capacity required for equipment operation.

Even in this stage the operator cannot accelerate.

Therefore, three different vehicle rotating speeds and thresholds are required and must be obtained by means of three different signals that are to be sent by the equipment to the vehicle control unit.

FMO equipment without Multipower operate only on function b and c.

4.5.2.2 Power take-off from the timing gears at rear of engine

Models equipped with engines of the Cursor 8 and Cursor 13 series are supplied with friction clutch power takeoff which picks motion from the distribution gears, independently from the vehicle's clutch.

The power takeoff is available in the direct pump mount version, or with a flange for Cardan shaft.

The installation of this power takeoff must be requested when ordering the vehicle; subsequent applications require the replacement of the whole engine.

Figure 4.4 shows diagrams with dimensions and position of the PTO in relation to the engine and vehicle.

Table 4.4 gives the main data.

To take off a max. torque of 600 Nm (CURSOR 8) and 800 Nm (CURSOR 10/13) the moment of inertia of the rotating masses, movement after the power take-off (including the coupling shaft), must be no greater than: **0.03 Kgm^2.**

In no case must the max. available torque of 600 Nm (CURSOR 8) and 800 Nm (CURSOR 10/13) be exceeded.

Direct pump application

The static moment due to the added masses must not exceed 90 Nm, measured on the pump mating 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 the coupling to be requested directly to IVECO.

Power Take-off from Engine

Figure 4.4

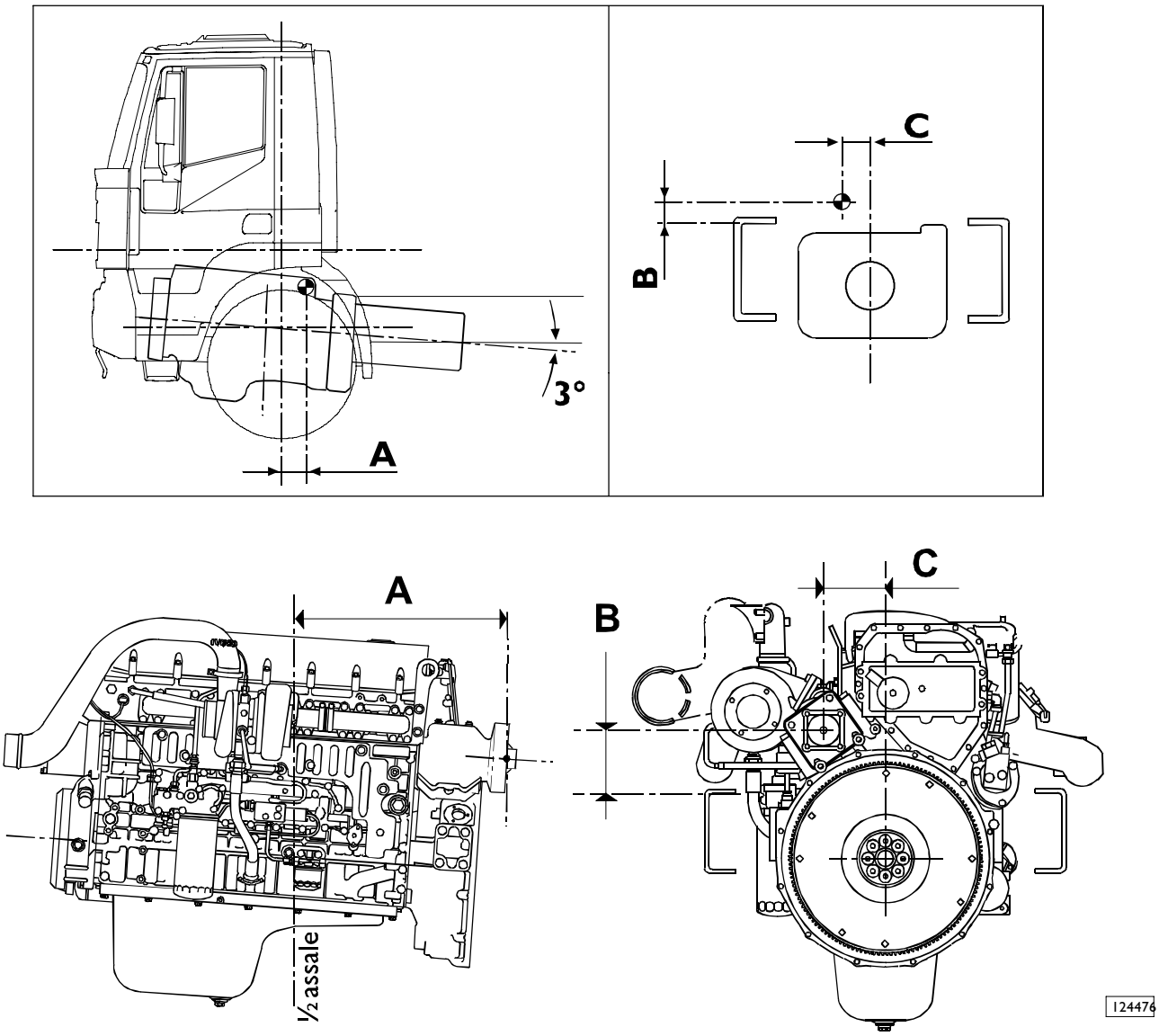


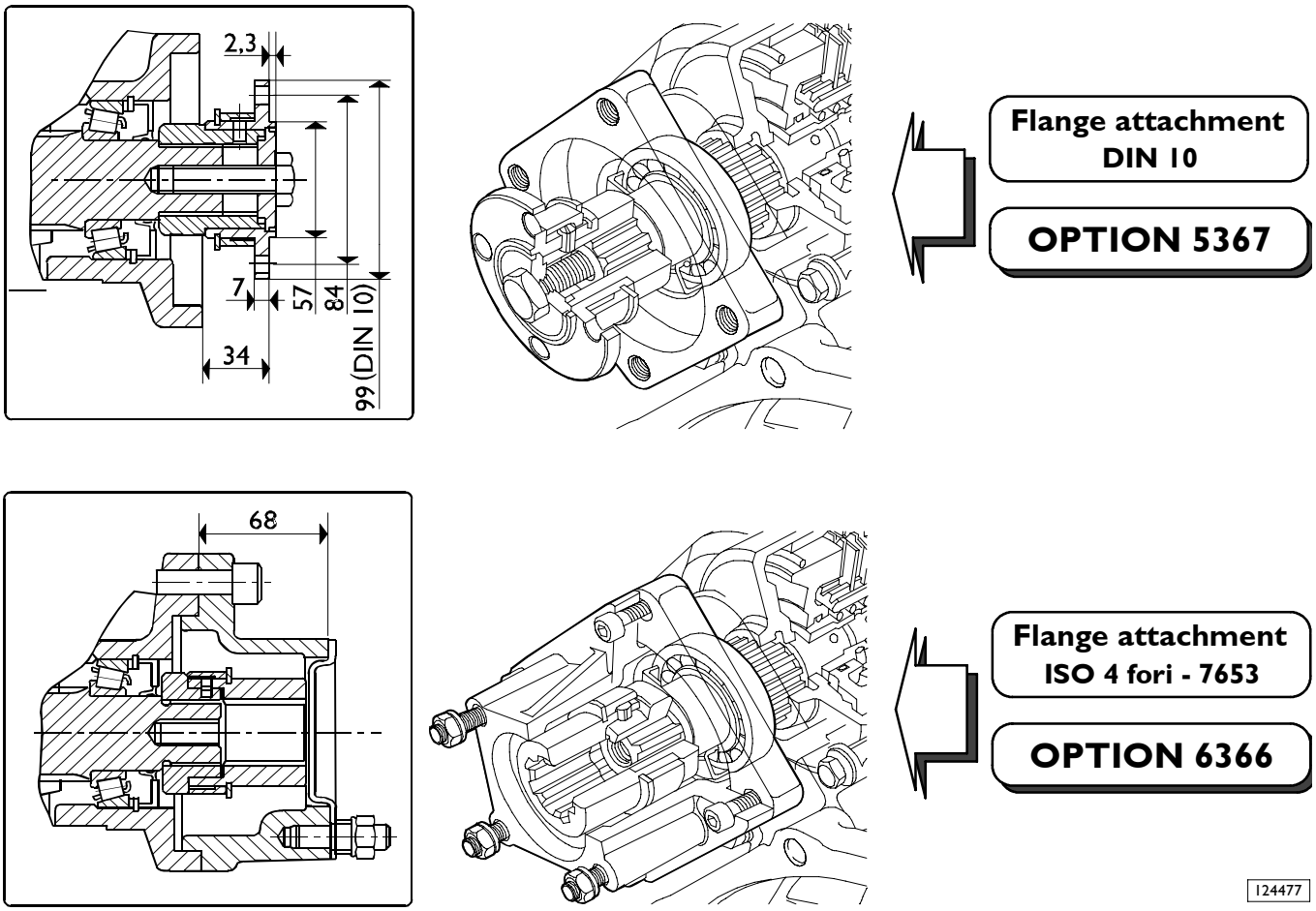
Table 4.4 - (Illustrative examples of possible configurations)

Type engine	PTO Type Hydrocar	A / Flange	A / Pump	B	C
Cursor 8	F210	555 mm	589 mm	73 mm	154 mm
Cursor 10	F211	542 mm	576 mm	119 mm	167 mm
Cursor 13	F211	542 mm	576 mm	119 mm	167 mm

Power Take-off from Engine

Power take-off from timing gears for Eurotronic 2 transmissions

Figure 4.5



NOTE **It is, however, necessary to check compatibility between the pump to be applied and the fitting case by case.**

Table 4.5 - PTO Specifications

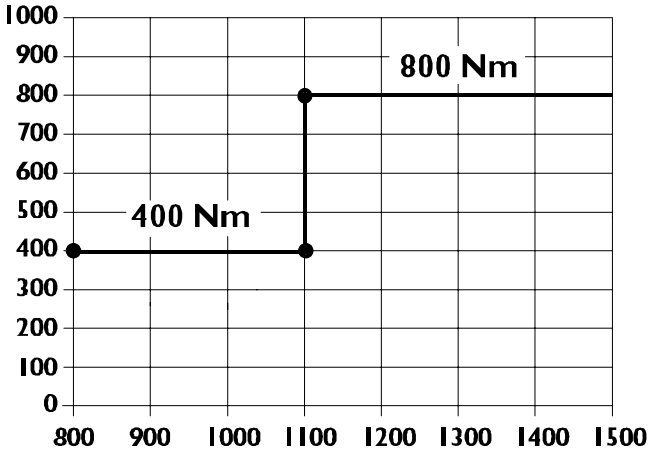
Engine	Power take-off				
	Max. torque available for drawing Nm	Out rpm/engine rpm ratio	Output type		Direction of rotation
			Pump conn.	Flange conn.	
CURSOR 10/13	800	1.12	ISO 4 holes (7653)	DIN 10	Opposite to engine
CURSOR 8	600	1.14	ISO 4 holes (7653)	DIN 10	Opposite to engine

NOTE **PTO can be equipped with a pneumatic disc clutch in oil bath system.**

Power Take-off from Engine

Torque limits available from PTO according to engine speed

Figure 4.6



91527

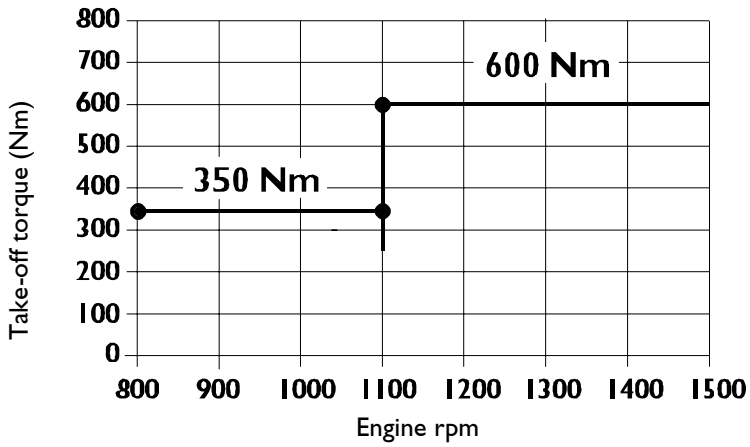
A. Take-off torque - B. Engine rpm

CURSOR 10/13

Vehicle programming

- Vehicle stopped - PTO mode ON
  Take-off of up to 800 Nm of torque is permitted at engine speeds of over 1100 rpm.
- Vehicle running - PTO mode ON
  - no limit to the torque obtainable from the power takeoff according to engine revs;
  - engine idle running set to 700 r.p.m.;
  - the air supply system pressure fot PTO clutch coupling must be above 8.5 bars.

Figure 4.7



91526

CURSOR 8

Vehicle programming

- Vehicle stopped - PTO mode ON
  Torque drawing of 600 Nm is permitted over 1100 r.p.m.
- Vehicle running - PTO mode ON
  - no limit to the torque obtainable from the power takeoff according to engine revs;
  - engine idle running set to 800 r.p.m.;
  - the air supply system pressure for PTO clutch coupling must be above 8.5 bars.

Power Take-off from Engine

4.6 PTO management

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

4.6.1 General Specifications

PTOs are activated electrically by means of a solenoid and their use always involves the programming of 2 control units: Expansion module (EM) and Vehicle Control Module (VCM).
The EM is able to drive up to three PTOs and controls their activation and the activation independently.
PTO management also makes it possible to considerably simplify conversion because it incorporates a set of safety and control functions such as, for example, engagement under certain limit conditions and control during operation.

4.6.1.1 Definitions

The most important aspects of PTO Management are described in detail in the following paragraphs. Firstly, however, some definitions must be given for a better understanding of the explanations given below.

MUX

The term MUX describes a set of two control units: Body Computer (BC) and MET (frame electronic module).
This network is connected to other electronic systems such as the EDC, EBL, 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. PTO engagement, PTO disengagement, intermediate speed activation etc.).
Because the EM and VCM are able to control up to three PTOs, this number may be installed on the switches (from PTOsw1 to PTOsw3).
Each switch is connected to a given pin on connector ST14A.

Connector ST14A

Connector ST14A provided specifically for body builders is located on the passenger side below the electric control unit in the footwell. More detailed information is given in Chapter 5.

PTO Mode x (x=1,2,3)

Following a request from a PTO switch on the dashboard, a PTO mode makes available a set of parameters that allow regular PTO operation. A PTO mode includes:

- a PTO configuration (described below)
- a fast mode (option, described below)

It is possible to activate up to three PTO modes simultaneously.

PTO management

PTO Configuration

The PTO configuration 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 requirements. The PTO configuration may be customised by Iveco Service upon the specific request of customers. The PTO configuration is stored in the EM, VCM control units.

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

A speed mode may be activated as part of a PTO mode (option). This makes available a set of parameters that defines the engine reaction in the event of activation (intermediate speed, min speed, max speed, accelerator deactivation etc.). This configuration is stored in the Vehicle Control Module (VCM).

NOTE Because the engine only acts on the basis of a set of parameters, a choice must be made if more speed modes are requested at a certain point. This takes place on the basis of a scale of priorities. It is absolutely necessary to consider these priorities in management of the conversion!

4.6.1.2 Diagram functions

Two conditions must be met in order for a power take-off to operate:

1) Mechanical engagement of a power take-off

2) Allocation of a speed mode to this power take-off (option). The definition of a speed mode is explained in this Chapter.

The expression "active power take-off" means that the power take-off engaged (active end-travel switch) and a speed mode have been activated.

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

PTO management

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 connection 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 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 allocated to each power take-off via a PTO mode.

If the power take-offs are used without connection to the EM control unit, a logical connection to the status signals, namely 'parking brake applied', 'vehicle parked,' 'reverse not engaged' is absolutely necessary to ensure safe operation of the power take-off and prevent damage.
These signals must be detected by the ST14A interface connector in the cab.
With ADR vehicles, the use of a PTO without connection to the EM control unit is not permitted!

4.6.1.3 PTO switch

The following photograph shows the installation position of a PTO switch (PTOsw 1, right). As already mentioned, up to three PTO switches may be fitted in the dashboard.

PTO switch	Connected to ST14A	Description	IVECO Part Number
PTOsw1	18	PTO1	50409 6567
PTOsw2	19	PTO2	50409 6566
PTOsw3	20	PTO3	50409 6565

NOTE **The command may be also given on vehicles with a Eurotronic transmission directly on ST14A.**
The PTO switches may be purchased directly through IVECO. The table summarises the part numbers.

PTO management

4.6.2 PTO modes

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

1) PTO configuration

2) Speed mode

The terms PTO configuration (4.6.2.1) and speed mode (4.6.3) are explained below.

4.6.2.1 EM - PTO 1, 2, 3 configurable

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 is bound to scrupulously observe mode priority in conversion management and in the event of reprogramming in order to avoid extra expense for subsequent changes to the wiring or reprogramming.

PTO management

4.6.2.2 EM - PTO 1, 2, 3 Programming

PTO programming includes the following function groups:

1) PTO switch functionIdle running actuation

Possibility of choosing between:

- physical activation of PTO only
- physical activation of PTO and activation of speed mode
- activation of speed 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. If the set values are not respected, the speed mode will be deactivated with consequent mechanical deactivation of the PTO. At the same time, a message will be displayed on the IC (instrument cluster).

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 x 1,2,3 .

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:

Table 4.6

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

Each switch is allocated to a 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 (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 status is ignored)
- PTO 1 configuration (PTOsw 1): Minimum priority

As mentioned previously, the bodybuilder is bound to scrupulously observe mode priority in the management of the conversion and in the case of reprogramming in order to avoid additional expenses for subsequent wiring changes or re-programming.

PTO management

2) PTO hardware. The following PTOs may be installed and activated

Table 4.7

Definition
Predisposition, no PTO installed
PTO dependant on engine (PTO engines), controlled via the EM
PTO on manual gearbox, controlled via the EM
Switchable multi-power, controlled by the EM
PTO on Allison transmission, controlled via the EM
PTO n1 on EuroTronic transmission, controlled via the EM
PTO n2 on EuroTronic transmission, controlled via the EM
PTO on distributor gear, controlled via the EM
ZF NMV, controlled via the EM

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

3) Selection of conditions for engagement of a PTO

Table 4.8

Parameter	Option 1	Option 2	Option 3
Service brake	Operated	Not operated	Not controlled
Handbrake	Operated	Not operated	Not controlled
Clutch status	Operated	Not operated	Not controlled
Clutch timeout	secs		
Connector ST 91/92/93 Pin 3	Open	Earthed	Not controlled
Coolant temperature	40 -100°C		Not controlled
Clutch slip limit			Not controlled
Expansion module press switch (not active)			
Min rpm for engagement	650- rpm		Not controlled
Max rpm for engagement	700- rpm		Not controlled
Minimum vehicle speed	0 Km/h		Not controlled
Maximum 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	Engage	Not engaged	Not controlled

The power take-off is engaged only if all conditions are met. If one of the conditions is not met, the EAM displays a warning message within a short space of time (10 seconds standard) and stops the engagement procedure. PTO engagement must be requested again (deactivation and reactivation of the PTO switch).

PTO management

4) Selection of conditions for deactivation of a PTO

Table 4.9

Parameter	Option 1	Option 2	Option 3
Service brake	Operated	Not operated	Not controlled
Handbrake	Engage	Not engaged	Not controlled
Clutch status	Operated	Not operated	Not controlled
Clutch timeout	secs		
Connector ST 91/92/93 Pin 3	Open	Earthed	Not controlled
Coolant temperature	40 -100°C		Not controlled
Clutch slip limit			Not controlled
Expansion module press switch (not active)			
Min rpm for engagement	650- rpm		Not controlled
Max rpm for engagement	700- rpm		Not controlled
Minimum vehicle speed	0 Km/h		Not controlled
Maximum 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	Engage	Not engaged	Not controlled

The PTO is engaged as soon as one of the set conditions is not met, i.e. the speed is reduced and the PTO is mechanically deactivated. At the same time, a message will be displayed on the 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).
Full function in this case too is possible only with the power take-offs operated electrically. If the power take-offs are operated pneumatically, the control unit is not able to control a power take-off in any way.

5) Extended functions (see the following Table 4.10)

Dynamic behaviour in relation to PTO conditions

The EAM control unit expects certain conditions to be met within a certain time period (standard 10 seconds) after the PTO request. Once this period has elapsed, the PTO request is rejected and an error is displayed.
The time interval is programmable (0 - 10s). The PTO switch must then be operated again.

Dynamic behaviour for PTO engagement

Establishes the interval after which a PTO must be mechanically engaged after the request. If the set interval is exceeded, the request is rejected and an error is displayed.

Dynamic behaviour in relation to PTO deactivation conditions

If a deactivation condition arises once a set time interval has elapsed (10 seconds standard), actions are taken for deactivation and an error is displayed. The time interval is programmable (0 - 10s).

PTO management

Dynamic behaviour on PTO deactivation

Establishes the interval after which a PTO must be mechanically disengaged after the request has been made. If the time interval is exceeded, an error message is displayed.

Dynamic behaviour in relation to the clutch 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 transmission).

Dynamic behaviour in relation to error identification

Time that elapses before an error activates Degraded Mode

Dynamic behaviour in relation to Degraded Mode activation (see information below for more details)

If no confirmation is received from the driver within a certain time interval after Degraded Mode activation, PTO operation is discontinued and an error message is displayed on the IC (Instruments Cluster). If the timeout is set to 0, PTO operation is immediately suspended.

Table 4.10

Parameter	Condition 1	Condition 2
Timeout at activation	1 - 10 secs.	Not controlled
Time out at PTO activation conditions	1 - 10 secs.	Not controlled
Timeout at activation via switch	1 - 10 secs.	Not controlled
Time out at PTO deactivation conditions	1 - 10 secs.	Not controlled
Timeout for error identification	1 - 10 secs.	Not controlled

NOTE In general, all the activation and deactivation and Timeout control condition parameters must be set as to "is not controlled" as far as possible in order to rule out unnecessary sources of error.

4.6.3 RPM Mode (to be set in the VCM control unit)

A speed mode may be allocated to a PTO within the centralina VCM. 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).

PTO management

4.6.3.1 RPM 0 mode (driving mode)

When the vehicle speed is below 25 km/h, example, 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 either or by means of the respective inputs of bodybuilder's connector ST14A.
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 alter the following settings

Table 4.11

Parameter	Function
Resume/OFF	Activation/deactivation of the intermediate speed
SET+/SET-	Increase/reduction of the intermediate speed
Conditions leading to deactivation of the intermediate speed	- Brake or clutch pedal depression - Operation of CC Off on the control lever on ST14A - Activation of the engine brake/Intarder
Accelerator	Active
Maximum engine speed with SET+	NLL - 1800 rpm
Maximum engine speed with the accelerator pedal	NLL - 2700 rpm (Cursor 8) NLL - 2340 rpm (Cursor 13)
Engine torque	Maximum torque according to the engine

4.6.3.2 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 imports, it is necessary to determine an import 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 these priorities during management of the conversion and the conversion interface. This is to avoid additional expenses for subsequent changes 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).

PTO management

Table 4.12

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 the 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 handbrake not engaged	Yes	No
Activation of parameters for maximum PTO speed 6)	Yes, by selection	No
Maximum PTO speed (kms/h) 7)	1 Km/h	
Speed deactivation by operating brake pedal 8)	Yes	No
Speed deactivation by driver operating brake pedal 9)	Yes	No
Speed deactivation by driver operating Intarder 10)	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 11)	Yes	No
Speed deactivation if this is lower than that set as minimum speed 12)	Yes	No
Speed deactivation if this is higher than that set as maximum speed 13)	Yes	No
Speed the activation due to an error in the CC module 14)	Yes	No

Table 4.13

Parameter	Option 1	Option 2
Speed deactivation in the event of communication of service brake and parking brake switch error 15)	Yes	No
Deactivation of the accelerator pedal.	Yes	No
Resume function on start-up	Yes	No
Maintenance by key of Resume function of other PTO operating modes 16)	Yes	No
Speed deactivation in the case of a speed sensor error 17)	Yes	No
Speed deactivation in the case of exceeding coolant temperature 18)	Yes, by selection	No
Coolant temperature (°C)	80°C- 110°C	
Speed deactivation with gear engaged 19)	Yes	No
Speed deactivation with reverse engaged 20)	Yes	No
Activation for control of the lowest speed for PTO engagement/disengagement 21)	Yes, by selection	No
Lower speed for speed activation/deactivation	1st-5th gear	
Activation for control of the highest speed for PTO engagement/disengagement 22)	Yes, by selection	No
Highest speed for speed activation/deactivation	1st-5th gear	
CC regulation and memo function 23)	See description	Voir la description
Engine speed via memo 24)	Final speed 550-LL	
Maximum speed by means of Set+ 25)	1 Km/h	
Temporary activation of engine speed increase from another control device 26)	Yes	No
Temporary activation of speed increased by driver 27)	Yes	No

4.6.3.3 Custom settings

Table 4.14

Parameter	Option 1	Option 2
Activation for a reserve speed	Yes, by selection	Not controlled
Reserve speed value (km/h) 28)		
Limitation of torque according to engine speed (rpm)		
Limitation of torque according to torque momentum (Nm)		

PTO management

4.6.3.4 Setting for special functions

Table 4.15

Parameter	Option 1
Increase/reduce speed by operating Set+/Set- (rpm) 29)	
Time required to reach selected speed 30)	
Speed deactivation by means of an external torque momentum request (Nm)	

4.6.3.5 Footnotes on 4.6.3.2/4.6.3.3/4.6.3.4

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 Warning: 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 25.
7 If the set speed is exceeded, the set intermediate speed will return to the value indicated in NOTE 25. 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 25 is also automatically changed.
8 The intermediate speed is deactivated and returns to the value indicated in NOTE 2
9. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
10. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
11. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
12. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
13. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
14. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
15. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
16. If the setting is on "Yes", these 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).
17. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
18 The intermediate speed is deactivated and returns to the value indicated in NOTE 2
19. If the setting is " Yes", fields 20, 21 and 22 are active. If the setting is "No", no input is possible in these fields.
20. -22 becomes an unsatisfied condition. The intermediate speed setting returns to the value in NOTE 2.

23. Three adjustment options are available in this case
    Option 1:
    No possibility of calibration! The speed set at point 19 is fixed and cannot be altered by the driver by means of SET+ SET- .
    Option 2:
    Calibration is possible: The speed set at point 24 is fixed and may be adjusted by the driver using SET +/Set - on the basis of the adjustment range shown in Point 1 and 2.
    Option 3:
    With calibration and possibility of storage: The speed set at point 24 is fixed and may be adjusted by the driver using SET +/Set - on the basis of the adjustment range shown in Point 1 and 2 and stored as a new speed.
24. If a speed is already stored, this will be automatically activated at the time of engagement. This speed may be altered, as described under Point 23
25. Speed that may be achieved at maximum with SET+
26. 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.
27. 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.
28 If a power take-off is used on the universal 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.
29. Possibility of adjustments to alter rpm each time Set+/-is pressed
30 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 pin 18,19,20). This correction time may be shortened in relation to the factory setting (500 ms), down to 100 ms.

PTO management

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

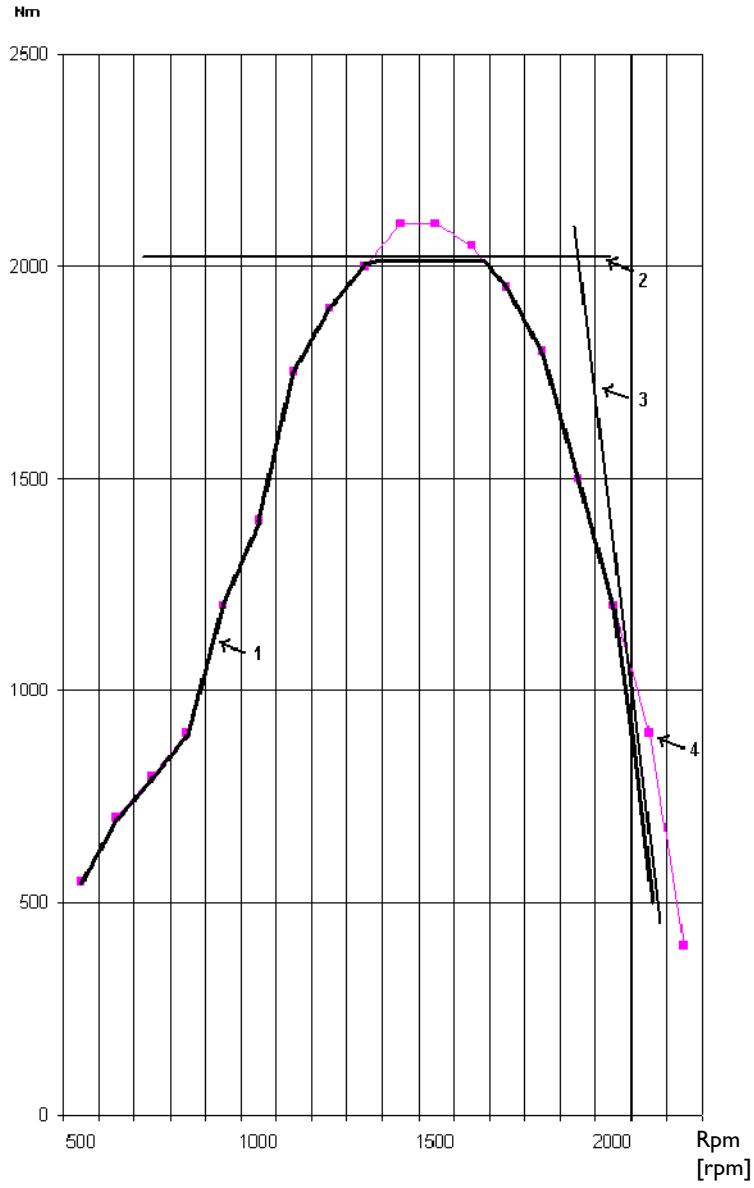
For mechanical power take-off protection, it is possible to limit:

a) **engine torque delivery as a protection against overload**

b) **engine rpm, as a protection against over-speed**

The diagram in fig. 4.8 shows this qualitatively by means of a toque/engine RPM curve (defined by 16 points), a horizontal section (representing torque limitation) and a sloping section (representing over-rev adjustment).

Figure 4.8



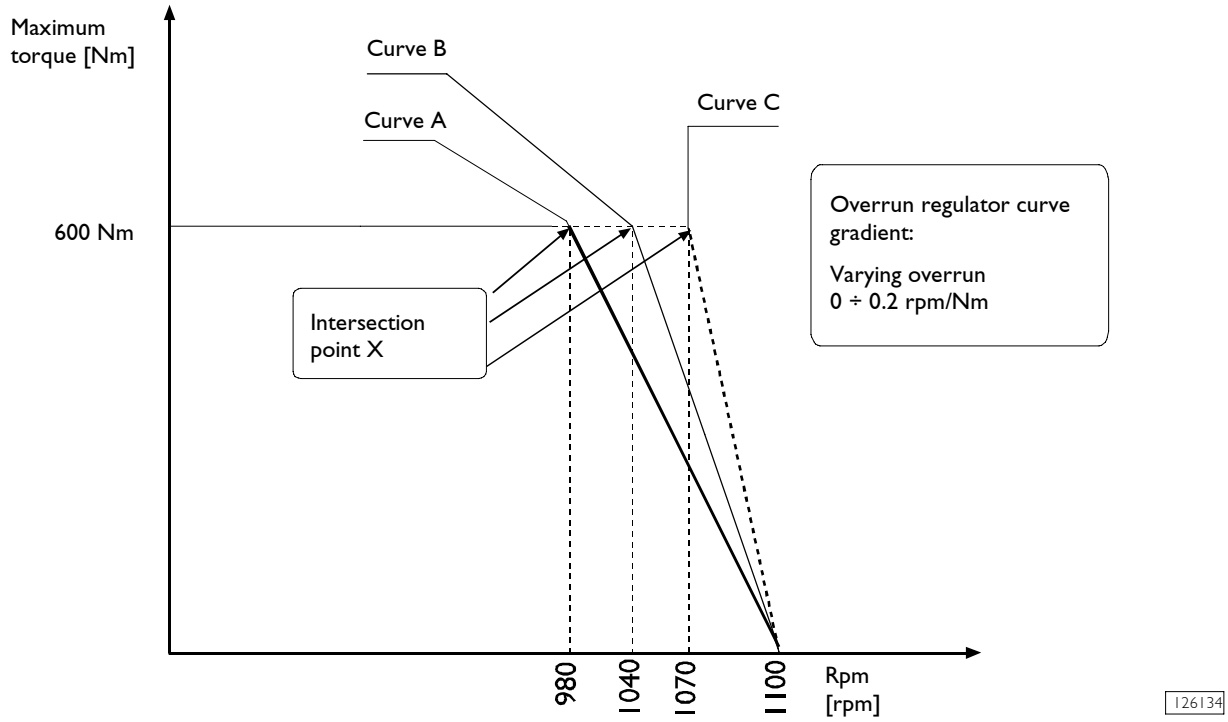
1. Resultant curve - 2. Maximum torque straight limitation line - 3. Out of rev curve - 4. Curve points

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 available according to the use planned for 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 (tab. 4.3 on page 4-11)
- These limitations (maximum 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.

Figure 4.9



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.
- The engine rpm must not exceed 1100 rpm
- The rpm must be calculated for all overrevving rpm regulator gradients

The corresponding power at 1100 rpm and a torque of 600 Nm gives (see equations on page 4-3)

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

The overrevving regulator curve gradient depends on the specific application.
With stationary operation, a steep overrevving rpm adjustment curve is therefore generally sufficient, while in driving mode this may give rise to rapid load changes (which could be a problem).

Therefore:

- with regulator at 0.05 rpm/Nm (curve C in figure), a torque of 600 Nm is available up to 1100 - (0.05 x 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;

PTO management

4.7 PTO management

4.7.1 No PTO installed or provisions for PTO:

Default configuration

PTO-Option 5194, 6368, 1483, 1484.

Only the programming of the engine revolutions by the VCM is required.
The switches select the three rpm modes:

Table 4.16

PTO 1	PTO mode 1	900 [tr/min]
PTO 2	PTO mode 2	1100 [tr/min]
PTO 3	PTO mode 3	1300 [tr/min]

4.7.2 PTO Multipower

Default configuration

PTO option: 2395 for all gearboxes.

Only the programming of the engine revolutions by the VCM is required.
The switches select the three rpm modes:

NOTE These conditions can be modified in Customer Service.

Table 4.17 - Activation conditions

State of engine	OFF
Pressure switch	closed
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.18 - Deactivation conditions

Coolant temperature	> 120 [°C]

PTO management

4.7.3 PTO manual gearbox with electric engagement

Default configuration

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

NOTE These conditions can be modified in Customer Service.

Table 4.19 - Activation conditions

State of engine	ON
Coolant temperature	< 120 [°C]

Table 4.20 - Deactivation conditions

State of engine	OFF
Coolant temperature	> 120 [°C]

4.7.4 Allison gearbox PTO

Default configuration

Allison automatic gearbox option: 8292 (PTO included)

NOTE These conditions can be modified in Customer Service.

Table 4.21 - Activation conditions

State of engine	ON
State of gearbox	neutral
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.22 - Deactivation conditions

State of engine	OFF
Coolant temperature	> 120 [°C]

PTO management

4.7.5 PTO FOCSA

Default configuration

PTO option: 5151

NOTE These conditions can be modified in Customer Service.

Table 4.23 - Activation conditions

State of engine	ON (always enabled)

Table 4.24 - Deactivation conditions

State of engine	OFF

4.7.6 PTO engine

Default configuration

PTO options: 5367

NOTE These conditions can be modified in Customer Service.

Table 4.25 - Activation conditions

State of engine	ON
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.26 - Deactivation conditions

State of vehicle	OFF
Coolant temperature	> 120 [°C]

PTO management

4.7.7 PTO Eurotronic 2 transmission

Default configuration

NOTE These conditions can be modified in Customer Service.

Table 4.27 - Activation conditions

State of gearbox	enabled
State of engine	ON
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.28 - Deactivation conditions

State of vehicle	OFF
Coolant temperature	> 120 [°C]

PTO management

4.8 EM (Expansion Module)

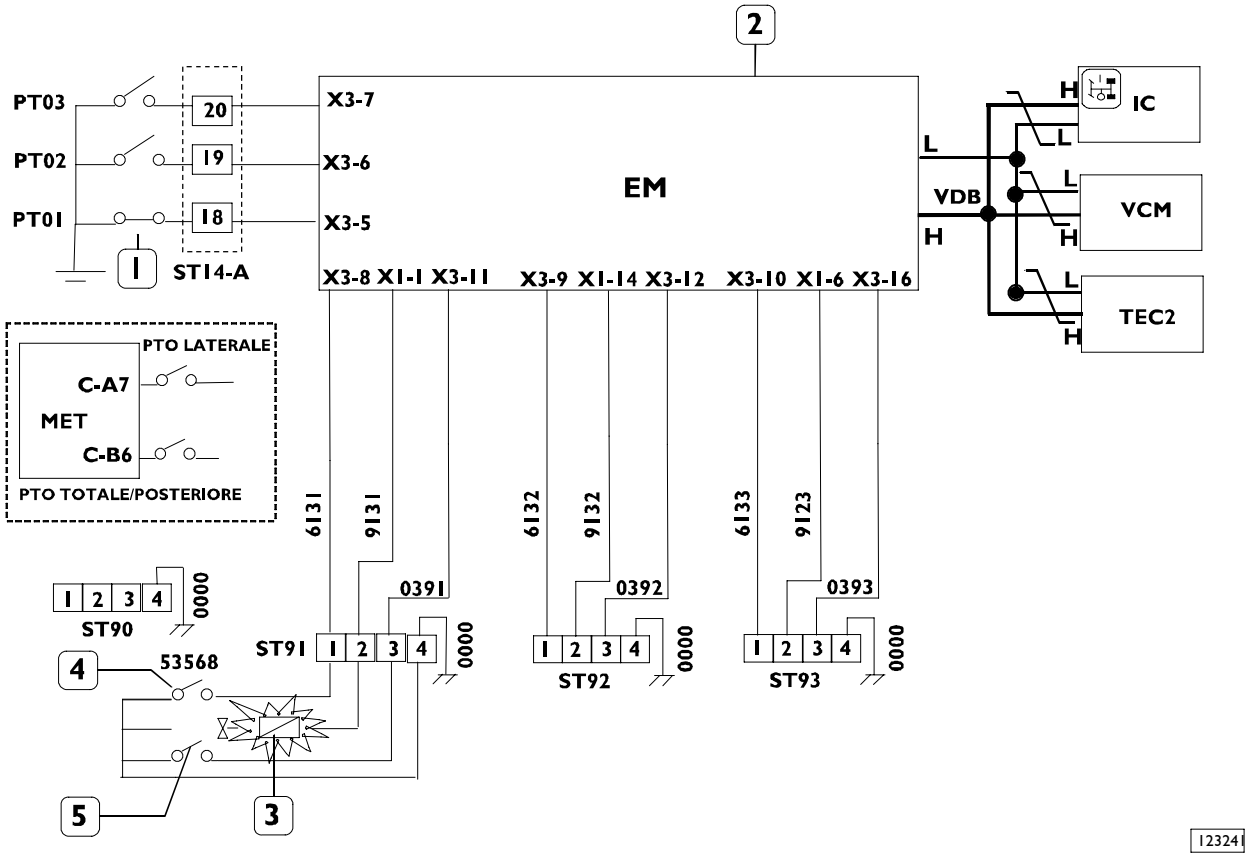
The optional 4572, EM (Expansion Module), is available on all the new Stralis.

The EM control unit can be used for electrical management of the PTO and for special applications. Also provides special gateways such as: trailer interface ISO11992-3 (TT) and CAN OPEN interface (BB in development phase).

Diagnostics is possible via CAN line and K line.

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.

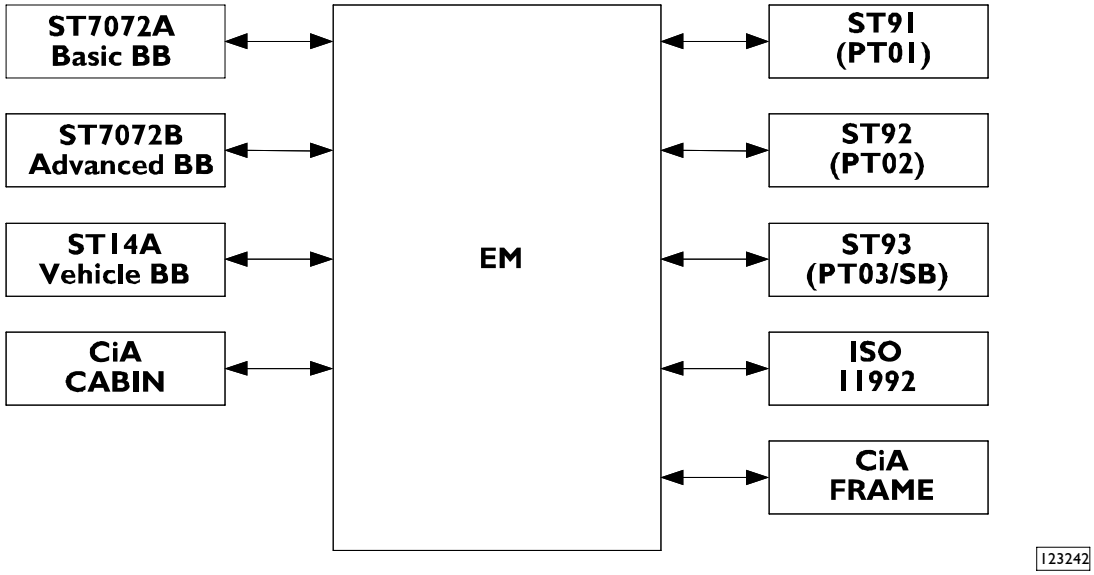
Figure 4.10



1. PTO switch - 2. EM ECU - 3. PTO solenoid valve - 4. PTO on - 5. Configurable PTO enablement.

EM (Expansion Module)

Figure 4.11



The EM control unit allows the PTO activation and deactivation conditions to be set.

The connections on ST91, ST92 and ST93 must be carried out by the fitter so as to activate and display on IC the activation of the PTO.

The predefined set conditions for Stralis Euro 4-5 are:

4.8.1 Connections

Table 4.29 - PTO mode request: ST14A

PTO 1	pin 18
PTO 2	pin 19
PTO 3	pin 20

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

Table 4.30 - PTO IN/OUT: ST91 PTO1, ST92 PTO2, ST93 PTO3

pin 1	PTO feed-back
pin 2	PTO actuator (solenoid valve control)
pin 3	PTO enabling
pin 4	Ground

EM (Expansion Module)

SECTION 5

Special instructions for electronic subsystems

Index

5.1 Electronic systems

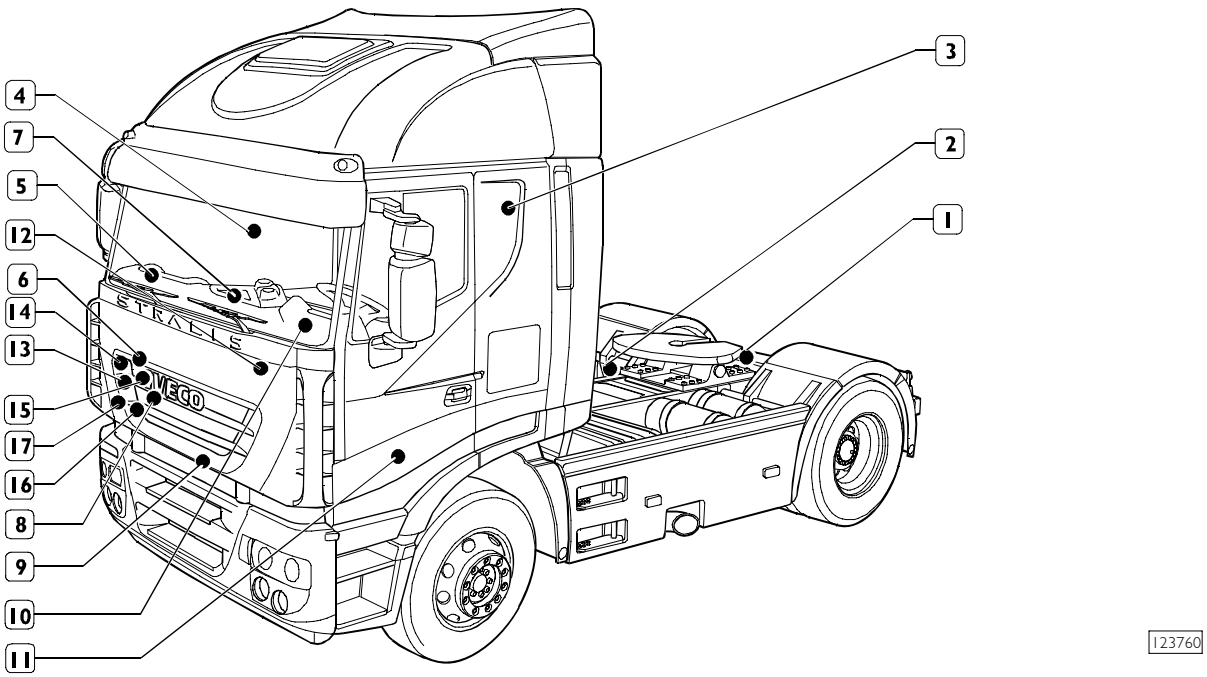
Stralis is equipped with an innovative electronic system, called Multiplex (MUX). The system electronically manages and controls the vehicle subsystems on CAN lines. The most important characteristics of devices are shown in the paragraphs that follow.

5.1.1 Description of ECUs

The location (Figure 5.1) and functions of the ECUs (electronic control units) installed in the vehicle are illustrated below for a better understanding of the Multiplex system.

Devices or electrical circuits cannot be directly connected to the ECUs described below. Always only use the connectors and special interfaces listed in the following paragraphs (bodybuilder connectors 5.2)!

Figure 5.1

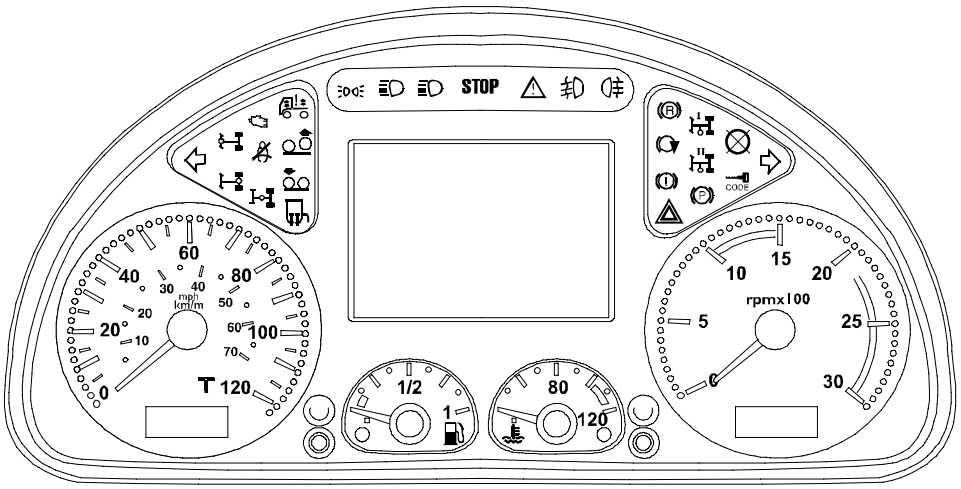


1. RFC on trucks - 2. RFC on tractors - 3. BM Bed Module - 4. AHT.A (additional heater) - 5. BC Body Computer - 6. Terminal board - 7. CC Climate Control - 8. AHT.W (additional coolant heater) - 9. FFC Front Frame Computer - 10. IC Instrument Cluster - 11. DDM Drive Door Module - 12. PDM Passenger Door Module - 13. Cab Module (Ordenador bastidor) - 14 Vehicle Control Module (VCM) - 15. Central locking - 16. Electronically-controlled air suspension (ECAS) - 17. EM (Expansion Module)

5.1.1.1 Instrument Cluster (IC)

The Instrument Cluster (IC) control panel forms the interface between driver and vehicle.
All vehicle statuses such as vehicle speed, engine rpm, coolant temperature and fault reports are indicated via the driver's control panel. It is not possible to select or take individual displays directly (e.g. control warning lights). This is possible only using the appropriate planned connection points.

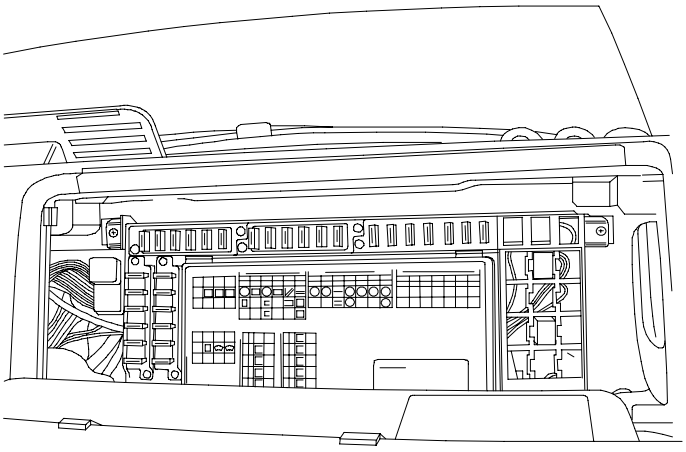
Figure 5.2



5.1.1.2 Body Computer (BC) and Cab Module (CM)

Illustration 5.3 shows the vehicle's central control unit, the Body Computer. All the input and output signals that are important for interaction with individual vehicle systems are processed here.
When non-permitted vehicle states arise, the information is sent from the Body Computer to the Instrument Cluster so that the driver can be informed via the fault warning lights. The fuses and relays are also housed in this sector.

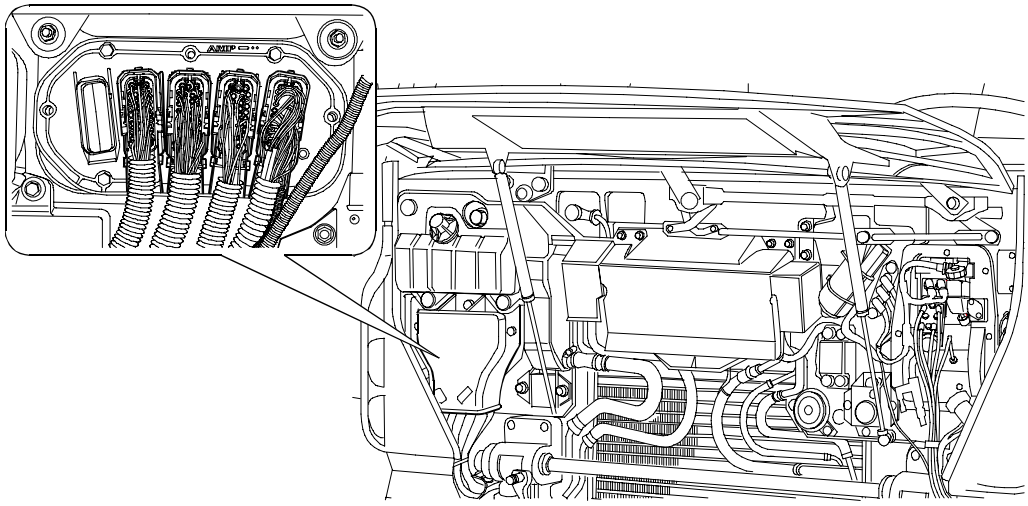
Figure 5.3



5.1.1.3 Bulkhead coupling (passage of electrical wiring)

The subsystems fitted on the body are connected to the ECUs in the cab via the terminal board which is the interface for connectors on body and cab side. It is located under the hood.

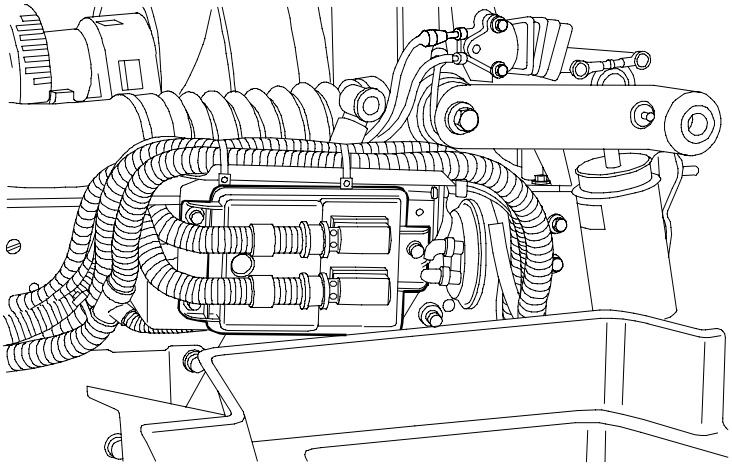
Figure 5.4



5.1.1.4 Front Frame Computer (FFC)

The Front Frame Computer sends and receives information on all components that are arranged in the front part of the vehicle, for example the front lighting system or the brake and engine system sensors.
Information is forwarded by means of the Body Computer to those vehicle systems to which this information is relevant.

Figure 5.5



5.1.1.5 Rear Frame Computer (RFC)

The RFC processes the information from the subsystems and the bodybuilder connectors in the rear part of the body and the signals from the trailer.

In the truck, the RFC is located behind the rear axle, as shown in Figure 5.6, whereas in the on-road tractor unit for half-trailer it is located in the centre of the frame, see Figure 5.7.

Figure 5.6

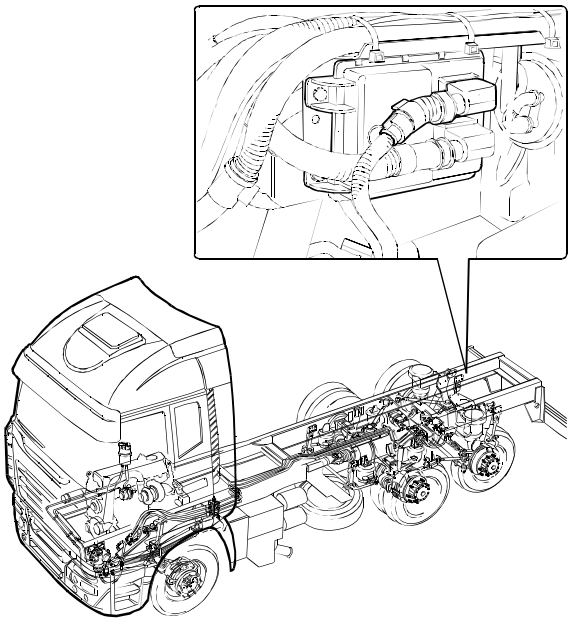
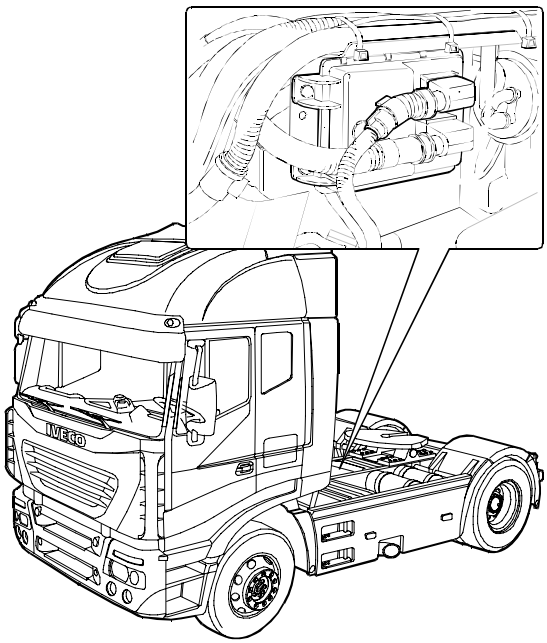


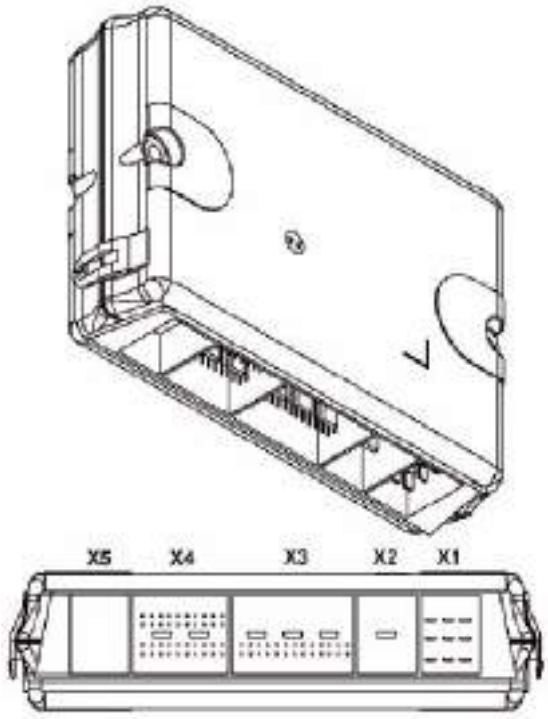
Figure 5.7



5.1.1.6 Expansion module (EM)

The EM (2) replaces the DMI control device used so far with the Trakker and is located in the passenger footwell. This is connected to the request switches, the electromagnetic valves and the PTO feedback switches. All PTO engagement/disengagement functions are now programmed in the EM control not and no longer in the Body Computer. The EM is already equipped with a cable and connectors for future applications that are currently not yet active.

Figure 5.8



0051469t

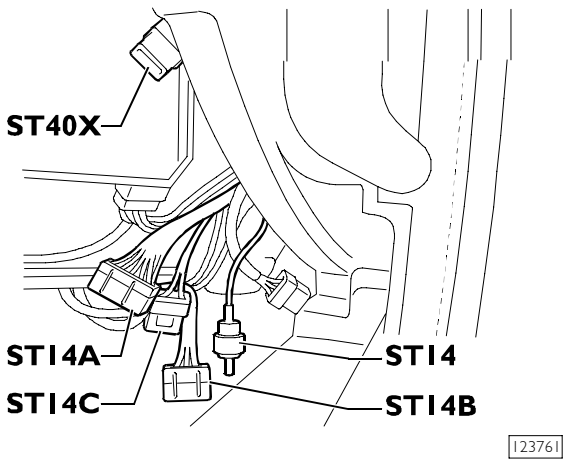
5.2 Bodybuilder connectors

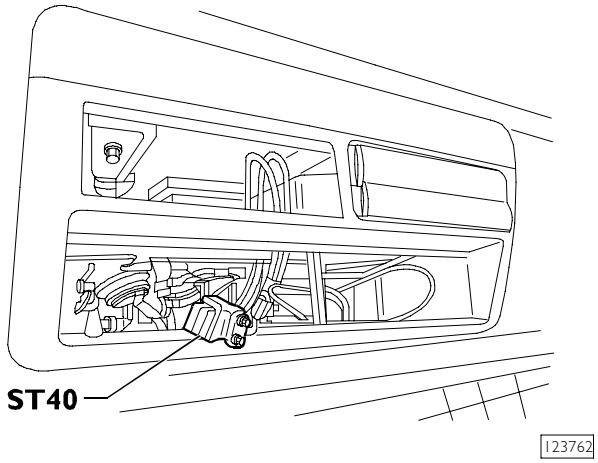
The various connectors for bodybuilders are described in detail in the following paragraphs.

5.2.1 In the cab

The connectors important for bodybuilders are the ST14 outputs. These are divided as follows: ST14, ST14A, ST14B, ST14C, and they are installed in accordance with specific requirements. They are housed behind a cover in the passenger footwell.
The ST40 output (FMS output) is housed above the driver in one of the removable DIN cassettes. Parallel to this in the passenger footwell, a ST40X output is available. Both outputs contain the same CAN communications.

Figure 5.9





21 pin connector (blue): ST14A

Table 5.1 - ST14A Interface connector basic functions

Pin	Description	Wire code	Max. load	Connected to	Remarks
1	Engine Start	8892	10mA	VCM X3-27	Engine cranking; earth = cranks engine (signal must be permanently on until the engine starts); wire open = no action.
2	Engine stop	0151	10mA	VCM X3-26	Engine stopping; Earth = stops engine (short activation sufficient to stop engine); wire open = no action.
3	Service brake	1165	200mA	VCM X1-13	Signal indicating that the service brake is applied. 0 V = service brake not applied +24 V = service brake applied
4	Vehicle standstill	5515	200mA	BC2 J5-1	Vehicle stationary signal 0 V = vehicle stationary +24 V = vehicle moving

Table 5.1 - (Continued) ST14A Interface connector basic functions

Terminal	Description	Wire number	Max. load	Connected to	Remarks
5	Parking brake	6656	200mA	VCM - X1-10	Signal indicating that the parking brake is applied 0 V = disengaged +24V = engaged
6	Reserved				
7	Vehicle speed	5540	10 mA	M/DTCO B7	Pulse signal
8	Engine status	7778	150 mA	BC2 J7-4	+24V at engine running
9	Gearbox neutral	8050	200 mA	VCM X1-7	+24V at neutral engaged
10	Reverse gear	2268	150 mA	BC2 J5-5	+24V at reverse gear engaged
11	K15	8871	3A	BC2 J3-3	K15 (ignition-operated power point)
12	CC Set+	8156	10 mA	VCM X3-33	CC Set+ input Open wire = Set + not activated Close to Ground = Set + activated
13	CC Set-	8157	10 mA	VCM X3-32	CC Set- input Open wire = Set - not activated Close to Ground = Set - activated
14	CC OFF	8154	10 mA	VCM X3-30	CC OFF input Open wire = Off not activated Close to Ground = OFF activated
15	CC Resume	8155	10 mA	VCM X3-31	CC RES input signal Circuit open = RES not activated Connection to ground = RES activated
16	CC driver/BB	0152	10 mA	VCM X3-49	Selection of CC activation by driver or BB Open wire = CC controlled by driver Close to Ground = CC controlled by BB
17	Ground	0000	10A	Wiring	Ground
18	PTO 1 sw	0131	10 mA	VCM X3-47 EM X3-5	PTO mode 1 Open wire = PTO mode 1 not activated Close to Ground = PTO mode 1 activated
19	PTO 2 sw	0132	10 mA	VCM X3-46 EM X3-6	PTO mode 2 Open wire = PTO mode 2 not activated Close to Ground = PTO mode 2 activated
20	PTO 3 sw	0123	10 mA	VCM X3-45 EM X3-7	PTO mode 3 Open wire = PTO mode 3 not activated Close to Ground = PTO mode 3 activated
21	K30	7772	Fusible 10 A	70401-6	K30 (positive from TGC)

9 pin connector (blue): ST14B

Table 5.2 - ST14B Interface connector 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 = 2nd SL not activated + 24V = 2nd SL activated
2	Economy Power	0166	10 mA	VCM X3 - 11	Activation Economy Power (EP) open wire = EP not activated close to Ground = EP activated
3	Clutch status	9963	200 mA	VCM X1 - 12	To ground = clutch activated
4	PTS	5542	200 mA	VCM X1 - 14	Programmable threshold = rpm or vehicle speed +24 V = limit exceeded
5	Emergency Lights	1113	10 mA	BC2 J4 - 4	Close to ground = Emergency lights on Open wire = no action
6	Reserved				
7	Reserved				
8	Engine speed signal	5587	10mA	ECM 33	Pulse Signal
9	K58 external lights	3333	5A	BC2 J1 - 9	+24V at vehicle lights on

NOTE The pinout for connectors ST14A and ST14B indicated in tables 5.1 and 5.2 are specifically for OBD1 Step 2 vehicles.
The eighth digit of the PIC (Product Identification Code) indicates STEP 2 of the vehicle:
3 - 4 - C - B Stralis AS
3 - 4 - C Stralis AT/AD

12 pin connector: ST14C

Table 5.3 - ST14C Interface connector basic functions (Allison Gearbox for Refuse Vehicles)

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	Neutral Indicator for Extra Pto	OUTPUT High Side	"145"	0,5A	ALL 45	Gearbox in neutral: Ground for neutral engaged
2	Refuse Stepper Switch	INPUT	"123"	15mA	ALL 23	1st gear limitation and inhibit reverse Open wire = function activated + 24V = function not activated
3	-		"142"		ALL 42	
4	Pto Enable	INPUT	"143"	15mA	ALL 43	Input from PTO switch Open wire = PTO not requested + 24V = PTO requested
5	Pto Command	OUTPUT High Side	"130"	0,5A	ALL 30	PTO enable: +24 Output for solenoid valve
6	Reserved					
7	Reserved					
8	Automatic Neutral Dual Input	INPUT	"117"	5mA	ALL 17	Automatic Neutral. Logic "and" mode with pin 9 Open wire = function not activated Close to Digital Ground = function activated
9	Automatic Neutral Dual Input	INPUT	"101"	5mA	ALL 1	Automatic Neutral. Logic "and" mode with pin 8 Open wire = function not activated Close to Digital Ground = function activated
10	Digital Ground	POWER	"103"		ALL 3	Digital Ground. Must be used as return for inputs "Close to Digital Ground". Do not connect to -Battery or other grounds
11	Range indicator	OUTPUT Low Side	"113"	0,5A	ALL 13	Gearbox: Ground for neutral not engaged
12	Reserved					

12 pin connector: ST14C

Table 5.4 - ST14C Interface connector basic functions (Allison Gearbox for Fire Fighting Vehicles)

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	Neutral Indicator for Extra Pto	OUTPUT Low Side	"145"	0,5A	ALL 45	Gearbox in neutral: Ground for neutral engaged
2	-		"123"		ALL 23	
3	Auxiliary function Range Inhibit	INPUT	"142	5mA	ALL 42	Hold transmission in Neutral. Logic "and" mode with pin 2. Open wire = function not activated Close to Digital Ground = function activated
4	Pto Enable	INPUT	"143"	15mA	ALL 43	Input from PTO switch Open wire = PTO not requested + 24V = PTO requested
5	Pto Command	OUTPUT High Side	"130"	0,5A	ALL 30	+24 Output to activate PTO by solenoid valve
6	Reserved					
7	Reserved					
8	-		"117"		ALL 17	
9	Auxiliary function Range Inhibit	INPUT	"101"	5mA	ALL 1	Hold transmission in Neutral. Logic "and" mode with pin 3. open wire = function not activated Close to Digital Ground = function activated
10	Digital Ground	POWER	"103"		ALL 3	Digital Ground. Must be used as return for inputs "Close Digital Ground". Do not connect to -Battery or other grounds
11	Range indicator	OUTPUT Low Side	"113"	0,5A	ALL 13	Gearbox: Ground for neutral not engaged
12	Reserved					

9 pin connector: ST40

Table 5.5 - ST40 Interface connector basic functions

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	K30	POWER	7772	5A		K30
2	K15	POWER	8871	5A		K15
3	Vehicle speed	OUTPUT	5541	10 mA	IC 20	Vehicle speed
4	+12	POWER	7712	5A		+12
5	CAN H	Bus	WS/Bi	10 mA	VCM X3-37	CAN H
6	CAN L	Bus	GN/Ve	10 mA	VCM X3-38	CAN L
7	Dashboard light	OUTPUT High Side	4442	1A	BC2 J7-19	Dashboard light
8	Reverse gear	OUTPUT High Side	2268	200mA	BC2 J5-5	+24V at reverse gear engaged
9	Ground	POWER	0000	5A		Ground

6 pin connector: ST 72072A

Table 5.6 - ST 72072A Interface connector basic functions

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	Stopping brake	OUTPUT	Tbd	EM X4-4	6981	Tbd
2	Gearbox neutral	OUTPUT	Tbd	EM X4-5	6983	Tbd
3	Dig Input 11	INPUT	Tbd	EM X3-17	0991	Digital Input
4	External Clutch	OUTPUT	Tbd	EM X1-7	9995	Tbd
5	Reserved					
6	Reserved					

20 pin connector: ST 72072B

Table 5.7 - ST 72072B Interface connector basic functions

Pin	Description	Connections				Remarks
		Type	Max. load	Con-nected to	Wire code	
1	Dig Input 12	INPUT	Tbd	EM X3-18	0992	Digital Input
2	Dig Input 13	INPUT	Tbd	EM X3-19	0993	Digital Input
3	Dig Input 14	INPUT	Tbd	EM X3-20	0994	Digital Input
4	Dig Input 15	INPUT	Tbd	EM X3-21	0995	Digital Input
5	Dig Input 16	INPUT	Tbd	EM X4-6	0996	Digital Input
6	HS Output 5	OUTPUT	Tbd	EM X1-3	6985	High side Output
7	HS Output 6	OUTPUT	Tbd	EM X1-8	6986	High side Output
8	HS Output 7	OUTPUT	Tbd	EM X4-1	6987	High side Output
9	HS Output 8	OUTPUT	Tbd	EM X4-2	6988	High side Output
10	HS Output 9	OUTPUT	Tbd	EM X4-3	6989	High side Output
11	HS Output 10	OUTPUT	Tbd	EM X4-21	6990	High side Output
12	HS Output 11	OUTPUT	Tbd	EM X4-22	6991	High side Output
13	HS Output 12	OUTPUT	Tbd	EM X4-23	6992	High side Output
14	HS Output 13	OUTPUT	Tbd	EM X4-31	6993	High side Output
15	HS Output 14	OUTPUT	Tbd	EM X4-32	6994	High side Output
16	AN IN 1	INPUT	Tbd	EM X4-14	5981	Analog input
17	AN IN 2	INPUT	Tbd	EM X4-15	5982	Analog input
18	AN IN 3	INPUT	Tbd	EM X4-29	5983	Analog input
19	Freq IN 1	INPUT	Tbd	EM X4-16	5991	Frequency input
20	Freq IN 1	INPUT	Tbd	EM X4-38	5992	Frequency input

5.2.2 On frame

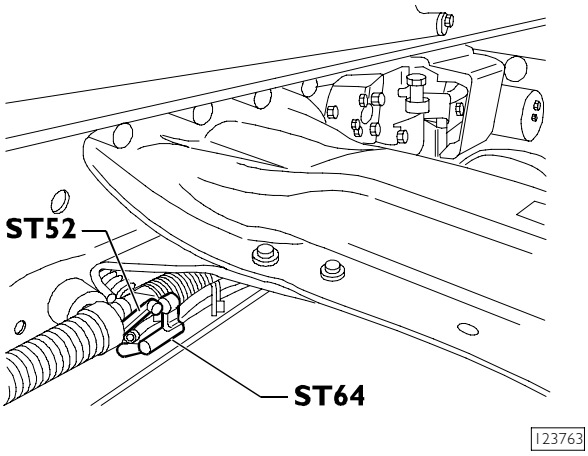
The following plug connections are located in the frame area:

- ST52 (for customer-specific solutions)
- ST64 (for customer-specific solutions)
- ST91 PTO output 1
- ST91 PTO output 2
- ST91 PTO output 3

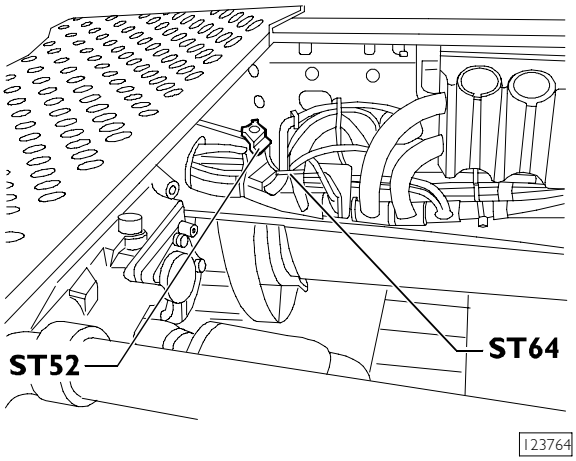
NOTE Output ST 90 (in the case of a manual gearbox), that was introduced with the Stralis construction series is still used, but is no longer supported and may no longer be used for applications! Output St 67 is no longer available!

Figure 5.10

Tractors:

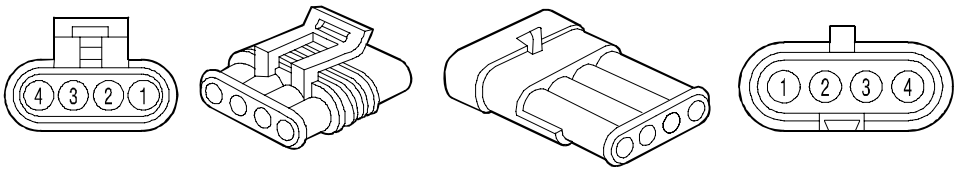


Cabinati:



4 pin connector: ST52

Figure 5.11



101538

Table 5.8 - ST52 Interface connector basic functions

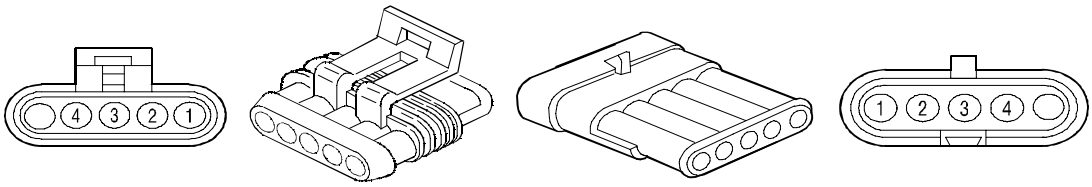
Pin	Function	Cable color code
1	Plus + 15 for special body makers	8871
2	Ground	0000
3 [1)]	Position lights	3333
4	Negative from secondary speed limiter switch	0172

1) +24 V when:

- K15 OFF and side markers on
- K15 ON and side markers on
- K15 ON and lights on (dipped beam and main beam)

5 pin connector: ST64

Figure 5.12



101542

For general use by bodybuilders: four terminals in the 15-pole connector can be used for the trailer.

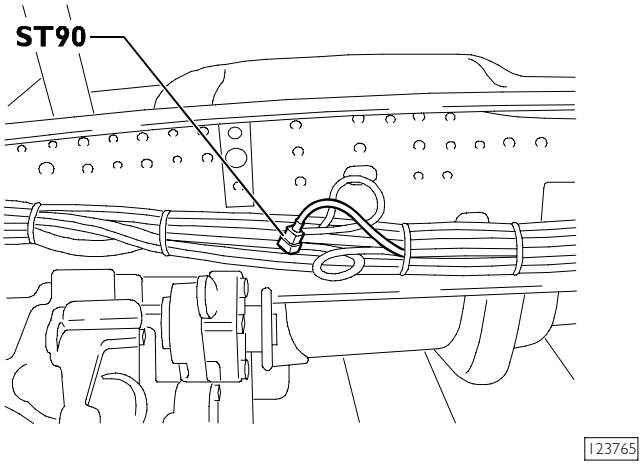
Table 5.9 - ST64 Interface connector basic functions

Pin	Function	Cable color code
1	Current socket supply	8021
2	Current socket supply	7021
3	Connected to trailer output Pin 10	6621
4	Terminal 15 also connected to output ST52 Pin 1	8075
5	Connected to trailer output Pin 11	8075

NOTE ST90 DO NOT use for PTO management.

4 pin connector: ST91 / 92 / 93

Figure 5.13



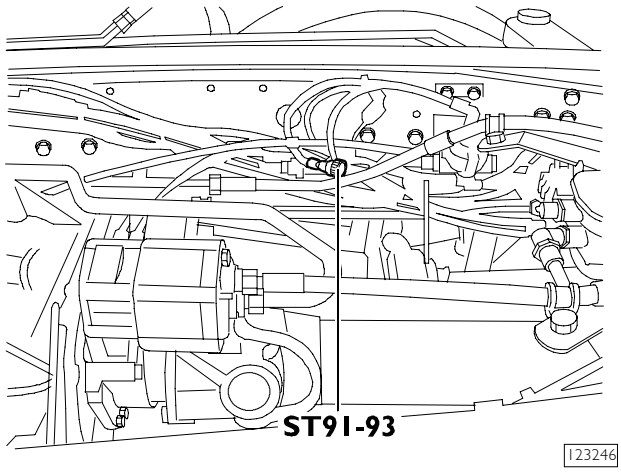


Table 5.10 - ST91 / 92 / 93 Interface connector basic functions

Pin	Description	Wire number	Max. load	Connected to	Remarks
1	PTO feedback signal	6131 (ST91) 6132 (ST92) 6133 (ST93)	-	EM X3-8 EM X3-9 EM X3-10	Connection open = PTO not engaged Earth = PTO engaged
2	PTO activation by means of electromagnetic valve	9131 (ST91) 9132 (ST92) 9133 (ST93)	1,6 A	EM X1-1 EM X1-3 EM X1-6	0 V = Electromagnetic valve not activated +24 V = Electromagnetic valve activated
3	Press switch/digital input	0391 (ST91) 0392 (ST92) 0393 (ST93)	-	EM X3-11 EM X3-12 EM X3-16	The input may be factory programmed 1)
4	Ground	0000	11 A		Ground

1) Two input situations may occur:
A to ground = PTO enabled
B connection open = PTO not enabled
Active condition programmed using Easy programming device
Acquistion of pressure switch installed in the factory with the use of Multipower and engine operation power take-offs (engine PTO)
The input may be freely used for other applications in order to connect a required function in the PTO control

5.2.3 Truck/trailer connectors

Two connectors are provided for connecting the trailer:

- 15-pin for electrical devices in general
- 7-pin for vehicles with EBS, or 5-pin for vehicles with ABS + EBL.

Table 5.11 - 15-pin plug for connecting the trailer

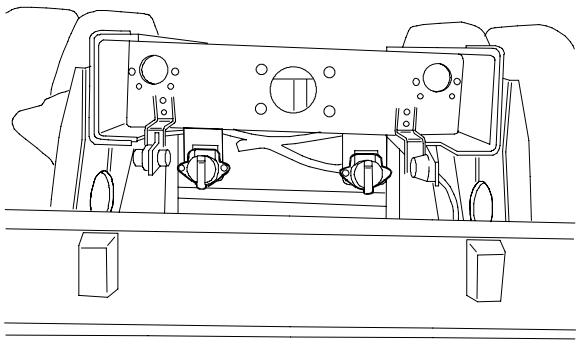
Pin	Code	Maximum load	Transversal cross-section	Use
		A	mm^2	
1	1180	6	0.75	Left trailer indicator
2	1185	6	0.75	Right trailer indicator
3	2283	6	0.75	Rear foglight
4	0000	11	2.5	Ground
5	3339	6	0.75	Right rear marker/left trailer light
6	3330	6	0.75	Left rear marker/right trailer light
7	1179	6	0.75	Trailer brake light
8	2226	6	0.75	Tail-light
9	7790	11	2.5	ADR, terminal 30
10	6021	11	1.0	To ST64
11	8075	11	1.0	ST64 Pin 15
12	6642	11	1.0	Lifting axle signal for trailer in raised position. For bulkhead coupling B Pin 19
13	0000	11	1.0	Ground
14	8081	11	1.0	To ST64 Pin 2
15	9021	11	1.0	To ST64

Remarks

Use connector ST64 described in paragraph 5.2.3 for connecting to terminals 10, 12, 14, 15.

Figure 5.14 shows truck connectors. The arrangement is similar and located behind the cab on tractors.

Figure 5.14



Bodybuilder connectors

Table 5.12 - Component codes

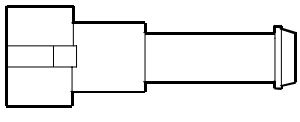
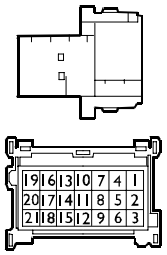
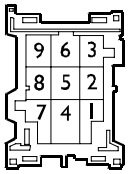
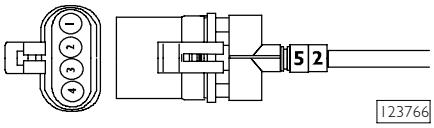
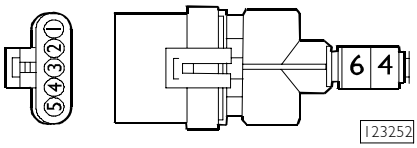
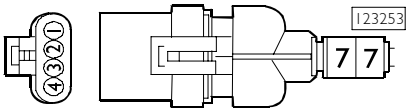
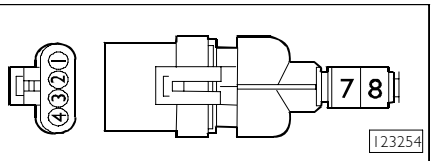
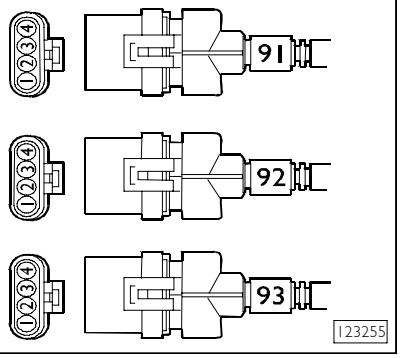
ST14	Connector body component code: 98435333 Connector contact component code: 98457375	 123249
ST14A	Connector body component code: 500314817 Connector contact component code: 500314823 (0.35-0.5 mm^2) 500314824 (0.75-1.5 mm^2)	 123250
ST40X ST14B	Connector body component code: 41118303 Connector contact component code: 41200695	 123251
ST52	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	 123766
ST64	Connector body component code: 9843 5338 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	 123252
ST77	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	 123253

Table 5.12 - (Continued)

ST78	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	
ST91-93	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 98455370 (0.75-1.5 mm^2) Gasket TN 486 1936	

5.3 Electrical circuit modifications

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

IVECO recommends not to change the other electrical circuits and wiring harnesses either.

Any modifications on the 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 following the instructions contained in this chapter.

5.3.1 Introduction

The instructions provided by IVECO in paragraph 2.1.1 also refer to Multiplex system wiring harnesses.
IVECO connectors and the respective terminals cannot be modified. Avoid connecting and disconnecting the chassis ECU connectors for more than three times to prevent damaging the gel which ensures tightness of the connections.

5.3.2 Wiring harness length

In Stralis, the MUX CAN line and the traditional 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 ECUs connected to the Multiplex system.

- excessive
- not sufficient

If the length is excessive, fold the wires without forming rings (this could cause undesired electromagnetic effects). Preferably use figures of 8. The wire which connects the ECUs is very stiff. For this reason, it must be replaced when it cannot be folded.

Replace the wiring if the length is not sufficient. Use genuine IVECO spare parts (contact the IVECO service network).

The wire length depends on three factors: wheelbase, overhang and crossmember position. Select one of the variants in the table for replacing the wiring if the modification involves a wheelbase/overhang which already exists in the IVECO range or, conversely, choose the closest variant for the solution (the table only shows the currently produced wheelbase/overhang combinations).

In all cases, the CAN wiring itself cannot be changed. All modifications are expressly forbidden by IVECO.

Table 5.13

Vehicle	Variant	Wheelbase	Overhang
4x2 truck	1	4500	1803
	2	5100	2388
	3	5700	2208
	4	6300	2793
6x2P truck	1	4200	2118
	2	4500	2073
	3	4800	2073
	4	5100	1803
	5	5700	2433
	6	6050	2658
6x4 trucks	1	3800	1488
	2	4200	1848
	3	4500	1982
4x2 tractors	1	3650	1048
	2	3800	1048
6x2C tractors	2	3800	1048

This does not refer to modifications which do not involve the Multiplex wiring (CAN line + electrical wires). For example, when extending the overhang without changing the position of the RFC, simply replace the electrical wires leading from the RFC to the respective utilities.

IVECO recommends replacing traditional electrical wires with genuine components instead of modifying them.

Contact IVECO for particularly difficult cases. Send a diagram with the chassis dimensions and the new ECU positions.

5.3.3 Repositioning ECUs

IVECO recommends to avoid modifications which entails moving ECUs. Follow the instructions below if repositioning ECUs is unavoidable:

- ECUs must be positioned on the chassis or in the cab and secured with a fastening similar to the original one (i.e. bracket). To avoid malfunctions, the ECU in the chassis must not be turned (e.g. to avoid water ingress). Consequently, the original orientation must be preserved;
- ECUs must not be fitted on the subframe;
- the cover must always be refitted;
- avoid subjecting ECUs to knocks from debris and stones from the road when travelling.

Electrical circuit modifications

5.3.4 Disconnecting ECUs

Operations which do not comply with the instructions specified by IVECO or made by non qualified personnel can cause severe damage to on-board systems, effect driving safety and correct operation of the vehicle and cause considerable damage which is not covered by warranty.

Follow the instructions below carefully before disconnecting an ECU:

- turn the ignition key to off, if it is inserted;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light in the button will go out);
- open the TGC;
- isolate the battery by disconnecting the battery cables: disconnect the negative terminal first followed by the positive terminal;
- disconnect the ECU.

5.4 FMS

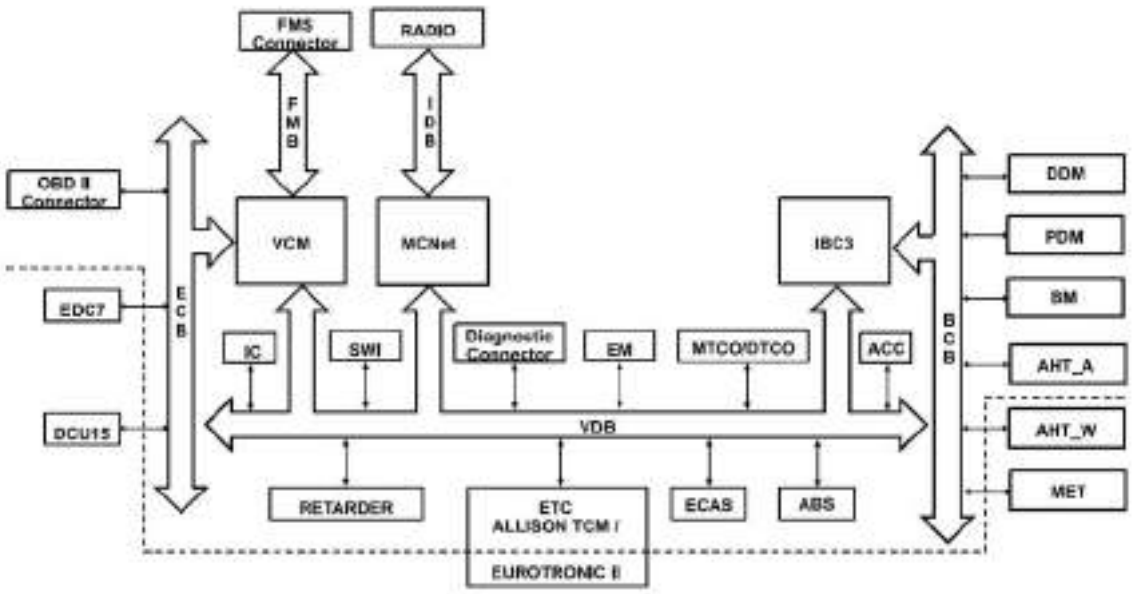
SVDI Vehicle Data Interface, (FMS interface) option 14569

Specific data is made available through the CAN line for vehicles fitted with option 14569. Information is available on:

- Engine speed
- Engine oil temperature
- Engine torque
- Speedometer data
- Current fuel consumption
- Current fuel reserve
- Display of axle load (if option 7306 present, display of axle load)

The exact composition of the data complies with the vehicle equipment (equipment with electronic control devices).
Data may be recalled in real time by installing a PC on board (option). The data format corresponds to FMS standard. The details of this standard may be consulted on the internet at the address www.fms-standard.com.

Figure 5.15 MULTIPLEX SYSTEM ASSEMBLY (OPTION 6873)



11754O

MTCO/DTCO. Tachograph - VCM. Vehicle Control Module - I.C. Cluster - B.C. Body Computer - DIAGNOSTIC CONNECTOR. 30-pin diagnostic connector - EBS II. EBS II control unit - INTARDER. Intarder control unit - ECAS. Air suspension control unit - EU II. Eurotronic II automatic transmission control unit - ACC. Adaptive Cruise Control control unit - ECM. Engine management unit - UDS. Control unit for SCR - OBD supply module. 16 pin coupling for OBD (on board diagnosis) - DDM. Driver Door Module - PDM. Passenger Door Module - BM. Bed Module - CC. Climate Control - FFC. Front Frame Computer - RFC. Rear Frame Computer - HWH. Water heater - AAH. Air heater - CM. Cabin Module - SWI. Steering Wheel Interface - EM (Expansion Module) - Radio. Radio - FMS. FMS (Fire Wall) connector - P.C. Personal Computer

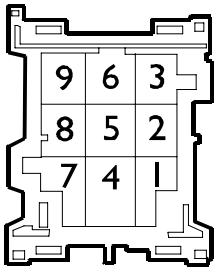
The following analyses may be carried out for subsequent processing of the data on a PC:

- checking of vehicle service data (trip duration, road sections, fuel consumption and speed)
- engine service data (rpm, load conditions)
- estimated oil consumption
- data for analysing brake use by the driver
- breakdown of road sections travelled, speed, breaks in the trip and resumption of trip.

To call up the data through a VDI interface, the onboard PC must be connected to connector ST40.

CAN connection between VDI interface and PC

Figure 5.16



Pin for connector PN 41200695

Table 5.14 - Characteristics of the CAN line

Physical level	Unshielded twisted pair cable compliant with ISO 11898 (SAE J1929/11). Termination of internal bus to cable with 120 Ω resistor.
Data link level	CAN 2.0B, 250 Kbit/sec. Format identifier and multi-packet message management compliant with SAE J1929/21.
Application level	Messages and parameters compliant with SAE J1939/71

The body builder is responsible for installation of the on-board PC, wiring for the ST40, hardware and software for subsequent processing of data.

The information that may be called up via the VDI interface contains an "FMS Standard Interface" message and identifies the version that is supported by the VDI interface installed.

This message is not present if an interface that does not yet support the FMS standard is installed. The vehicle-related data quoted in this paragraph are nevertheless still available in this case.

5.5 Electrical System: Modifications and Drawing-Off Power

5.5.1 General Specifications

The vehicles operate on a 24v electric system for normal requirements and the chassis is an earth return. This acts as a current return wire between relevant components, such as battery and alternator. All component negative terminals are connected through the chassis in the absence of an insulated return wire.

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

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

NOTE For greater details on the vehicle's electrical system, see the specific Workshop Manual, publication no. 603.93.521 (Stralis AT/AD) - publication no. 603.93.531 (Stralis AS).

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

Precautions

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

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

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

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

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

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

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

Never disconnect the connectors from the control units when the engine is running or when the control units are powered.

Never power components interlocked by electronic modules with the rated voltage of the vehicle through wander cables.

Control units equipped with metal sheathes have to be earthed through a screw or bolt unless otherwise specified.

When fitting additional equipment, where necessary, diodes must be fitted to provide protection against any induction current peaks.

The earth signal originating from analogue sensors must only be wired to a specific receiver. Additional earth connections could result in false output signals being emitted from these sensors.

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

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

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

5.5.2 Electromagnetic compatibility

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

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

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

The maximum admissible variation in transient voltage for units powered with 24 V is +80V, as measured at the terminals of the artificial network (L.I.S.N.) during bench tests; otherwise, if the measurements are made on the vehicle, the variation must be determined at the most accessible point in the proximity of the device generating the disturbance.

NOTE The 24 V supplied devices:

- **must be free from immune from negative noises, such as -600V spikes, positive +100V spikes, +/-200V burst.**
- **they must operate correctly during voltage lowering phases to 8V for 40 mS and to 0V for 2 mS.**
- **moreover, they must resist the load dump phenomena up to 58V.**

Max levels measured on bench for radiated and driven emissions generated by 24V devices are shown in Table 5.15.

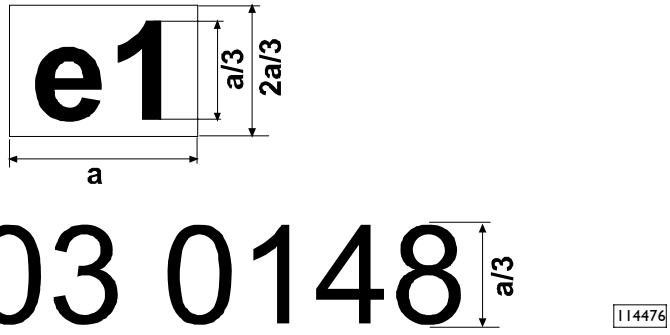
Table 5.15

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

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

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

Figure 5.17



a ≥ 6 mm

If in any doubt, call the IVECO Service Network.

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

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

Two-way radio systems

The most common applications include:

- amateur two-way radio equipment for CB and 2 metre bands.
- two-way radio equipment for mobile phones.
- GPS satellite reception and navigation equipment.

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

Therefore, the ROS (Stationary Wave Ratio), gain and generated electromagnetic field characteristics must be ensured within predefined limits, while impedance, efficient height, efficiency, orientability parameters are contained in manufacturer's technical card.

The installation of 2m amateur CB sets, mobile phones (GSM) and satellite navigation systems (GPS) must use the power system already present on the vehicle. The connection is made directly to terminal 30 of connector ST40 (and 15, where necessary).

Such devices must be legally type-approved and fixed (not portable). The use of two-way radio sets that are not type approved or the application of extra amplifiers could seriously impair the efficient operation of the electric/electronic devices normally fitted to the vehicle, to the detriment of vehicle and/or driver safety.

Amateur equipment for CB and 2m band

The installation of C.B. equipment (27 MHz), 1 m (144 MHz) shall require use of the supply system already installed on vehicle, with connection to terminal 30 of ST40 connector.

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

The antenna must be installed outside the vehicle, possibly on a large metallic base as vertically as possible with the connection wire leading downwards. Follow the instructions and the manufacturer's warnings for assembly (see Figure 5.18).

- The ROS value must be as close as possible to the unit, the recommended value is 1.5 while max acceptable value must never be greater than 2.
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient spatial uniformity, normally with deviations from the average value in the order of 1.5dB in the typical CB radio band (26.965-27.405 MHz).
- The **IRRADIATED FIELD IN CABIN** value must be as low as possible , < 1V/m is recommended as a quality target. In any case, limits set by the applicable European legislations must never be exceeded.
- **For this reason**, the aerial must always be placed out of cabin.

In order to determine the good operation of radio-cable-aerial system and to check whether aerial is properly adjusted, we recommend that following indications be followed:

1) If ROS is greater on low channels than on high channels, the aerial should be extended

2) If ROS is greater on higher channels than on low channels, the aerial should be shortened

After aerial adjustment, it is recommended to check ROS value again on al channels.

Installation at roof center is to be considered the best one as the ground plane is proportional in all directions, while mount on a side or on any other vehicle part makes the ground plane proportional to its mass.

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

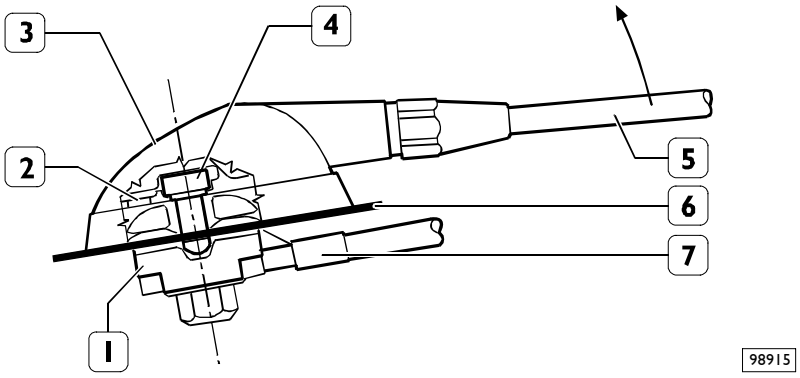
- Use a top-quality, low-loss coaxial antenna cable with the same impedance as the transmitter and the antenna (see Figure 5.19).
- The coaxial cable run must be at a suitable distance (minimum 50 mm) from pre-existing wiring (TV, radio, telephone, amplifiers and other electronic devices) to prevent interference and malfunctioning. Ensure the minimum distance from the metallic structure of the cab. Cable installation on the left or right-hand side is preferable.
- Clean the lower part of the hole made in the body for installing the antenna in fixed position so that the antenna support is perfectly connected to the vehicle earth.
- The coaxial cable connecting the antenna to the radio must be fitted with the utmost care. Avoid curves or bends which can pinch or distort the cable. Avoid tangling. Shorten the wire as much as possible.
  Remember that any imperfections in the coaxial cable will cause severe interference for the radio transmitter.

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

Radio transmitters are typically fitted on the dashboard in the gear lever area or in the header rail above the driver (see Figure 5.20).

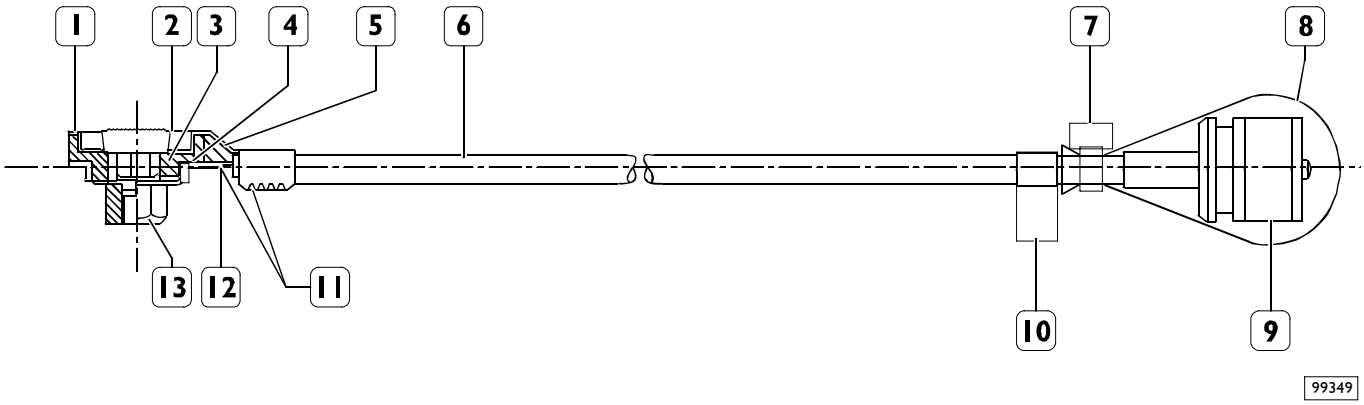
If the equipment uses a 12v power supply, a suitable 24-12V DC/DC converter will have to be fitted (if not already provided). The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.

Figure 5.18



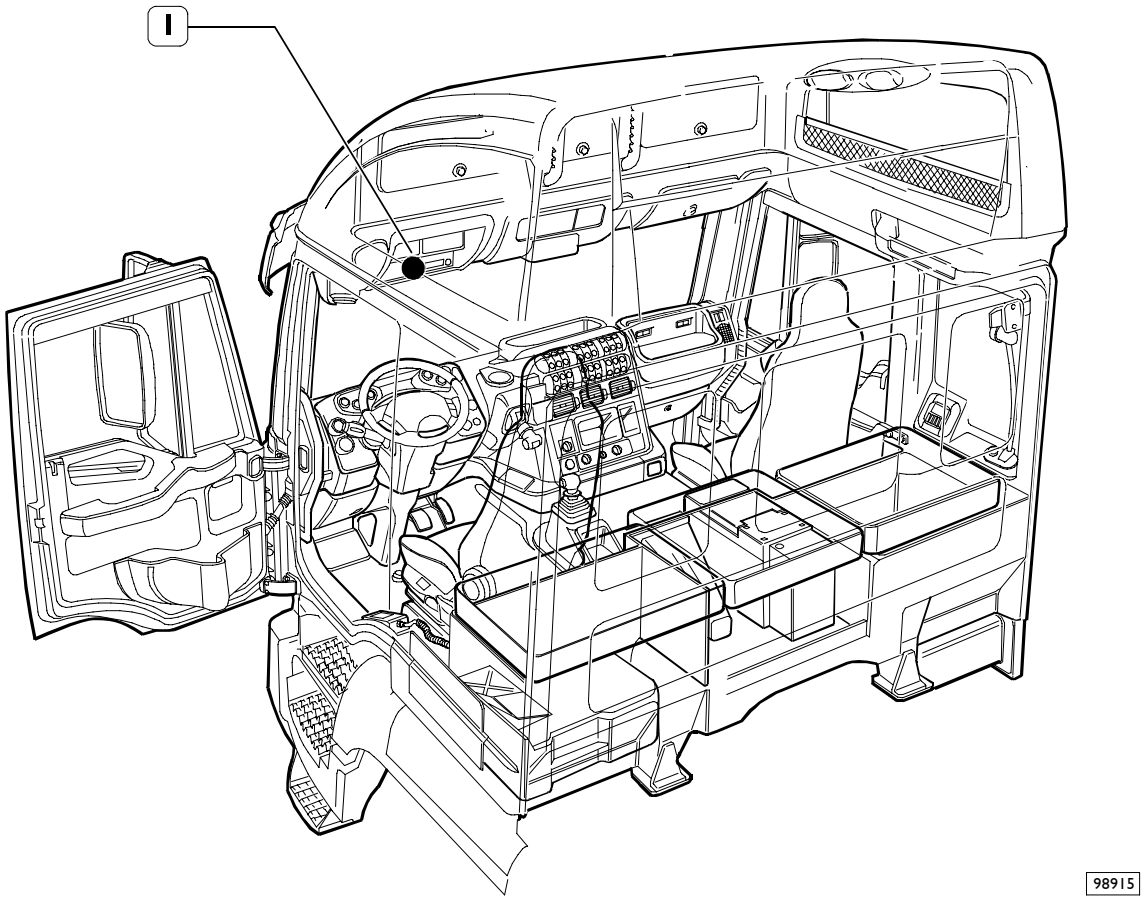
1. Antenna support - 2. Gasket (P/N for spares 244614) - 3. Fixed joint cover (P/N for spares 217522) - 4. Fixing screw M6x8.5 (torque to 2 Nm) - 5. Antenna (spare P/N for complete rod 675120) - 6. Roof - 7. Antenna extension lead

Figure 5.19



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

Figure 5.20



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

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

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

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

- The ROS value must be as close as possible to the unit, the recommended value is 1.5 while max acceptable value must never be greater than 2.
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient space uniformity, featured by 1,5 dB deviations as to average value in 870-960 MHz band and 2dB in the 1710-1880 MHz band.
- The **IRRADIATED FIELD IN CABIN** value must be as low as possible , < 1V/m is recommended as a quality target. In any case, limits set by the applicable European legislations must never be exceeded.
- **For this reason**, the aerial must always be placed out of cabin, possibly on a metallic base with a large surface, installed as vertical as possible, with connection cable turned downward, in compliance with Manufacturer's installation instructions and warnings.

The antenna must be installed outside the vehicle, possibly on a large metallic base as vertically as possible with the connection cable facing down. Follow the instructions and the manufacturer's warnings for assembly.

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

Follow the precautions below when connecting and arranging the wires:

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

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

If the equipment uses a 12v power supply, a suitable 24-12V DC/DC converter will have to be fitted (if not already provided). The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.

GPS antenna cable and navigation system installation

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

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

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

- The ROS value must be as close as possible to the unit, the recommended value is 1.5 while max acceptable value must never be greater than 2 in the GPS frequency range (1575,42 +1,023 MHz).
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient space uniformity, featured by 1,5 dB deviations as to average value in 1575,41±1,023 MHz band.

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

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

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

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

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

Follow the precautions below when connecting and arranging the wires:

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

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

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

If the equipment uses a 12v power supply, a suitable 24-12V DC/DC converter will have to be fitted (if not already provided). The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.

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

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

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

5.5.3 Additional equipment

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

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

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

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

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

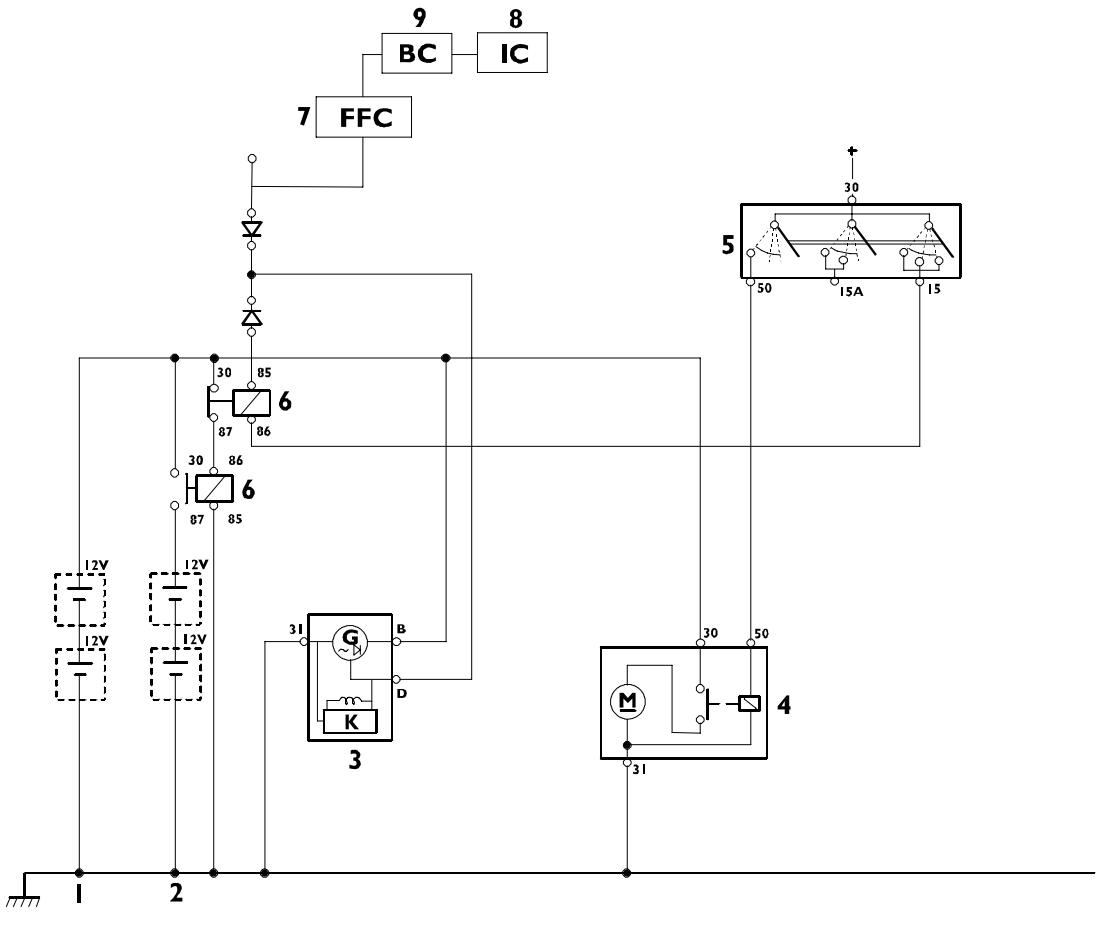
Additional Batteries and Alternators

Installing high power-consumption electric equipment (e.g. electrical motors frequently used or for a long time while the vehicle engine is not running, such as tail lifts) or a great deal of additional electrical equipment, may require power which the vehicle's standard system is unable to deliver. In such cases additional batteries of the appropriate capacity must be used.

Their insertion into the vehicle's circuits must include a separate recharging system (see Figure 5.21) integrated with that of the vehicle. In this case it is advisable to provide supplementary batteries with the same capacity as the batteries originally installed in order to ensure correct recharging of all batteries.

Figure 5.21

Installing additional batteries



1. Standard batteries - 2. Supplementary batteries - 3. Alternator with built-in regulator - 4. Starter motor - 5. Starter key - 6. Relays - 7. Front Frame Computer - 8. Instrument Cluster

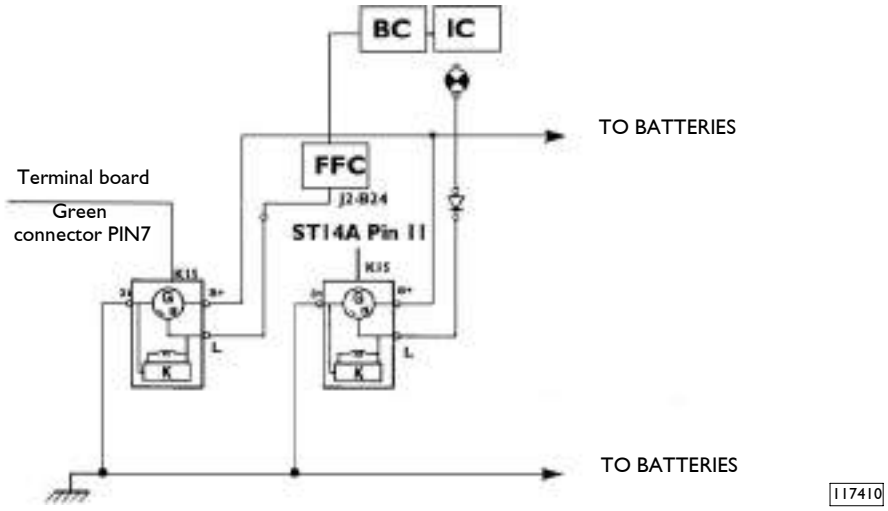
Installing additional batteries involves checking that the alternator is of a sufficient capacity to recharge. If necessary, an alternator with larger power or an additional one must be used. In this case connect up as shown in Figure 5.22.

When using electric motors which are activated only while the vehicle engine is running, instead of supplementary batteries, it could be sufficient to use a larger power alternator or a supplementary one.

Such alternators have to be equipped with Zener diode rectifiers in order to avoid damaging the electrical/electronic systems already fitted which might arise from accidental disconnection of the batteries.

Figure 5.22

Installing an additional alternator



Auxiliary Electric Systems

Special care has to be taken when fitting refrigeration units that are driven by a second engine driven alternator.

These generators, according to their RPM, generate a voltage between 270 to 540 V in the wires that are routed to the cooling unit on the vehicle.

The danger caused by possible electromagnetic interferences between wires from the above mentioned alternator being to close to those already on the vehicle, can easily occur.

Such cases require highly insulated wires routed separately, yet not close to the standard wires of the vehicle.

The electromagnetic output levels previously mentioned have to be complied with for these units.

An error message will appear on the on-board panel in the event of standard alternator failure (e.g. low voltage, no signal).

An additional alternator cannot be connected and programmed to the MUX. Consequently, the MUX will not be capable of detecting which alternator is not working correctly.

5.5.4 Taking current

From TGC (OPT)

For the Stralis, it is forbidden to connect additional electric systems directly on the battery positive pole. In fact, the positive pole is engaged by the cables to the fuse-holder box placed on battery box side (for the ADR vehicles, the fuse-holder box, usually placed on battery box side, is connected on the specific TGC pin).

The fusebox cannot be modified or moved.

Current can be taken from the specific TGC pin (TGC = general current relay, see Figure 5.23). Remove the plastic protection from the free pin and connect the terminal directly to the threaded screw (positive pole). Fasten it with a suitable nut. The earth return is via the chassis. For two or more connections, arrange a suitable shim between the terminals. Always use a suitable corrugated tube to protect the wires. Always refit the plastic protection.

Read paragraph 5.3 on bodybuilders connectors before taking current in the cab. Current consumption must not exceed the maximum load value shown in the paragraph below.

5.5.5 General battery switch

It is normally located on battery box and operated manually. It is a two-pole switch disconnecting battery from underframe letting tachograph (for law requirements), body computer, refrigerator, bed module and instrument cluster operate.

For special changes (e.g. fuel transport, dangerous substance transport) it might be necessary to use a safety switch fully insulating batteries and alternator from the remaining system. Specific solutions for a given market are available on request.

NOTE the parallel connection to diverter output is permitted (max 100 A).

On chassis

Current cannot be taken from the terminal board under the hood. The terminals must neither be disconnected nor modified.

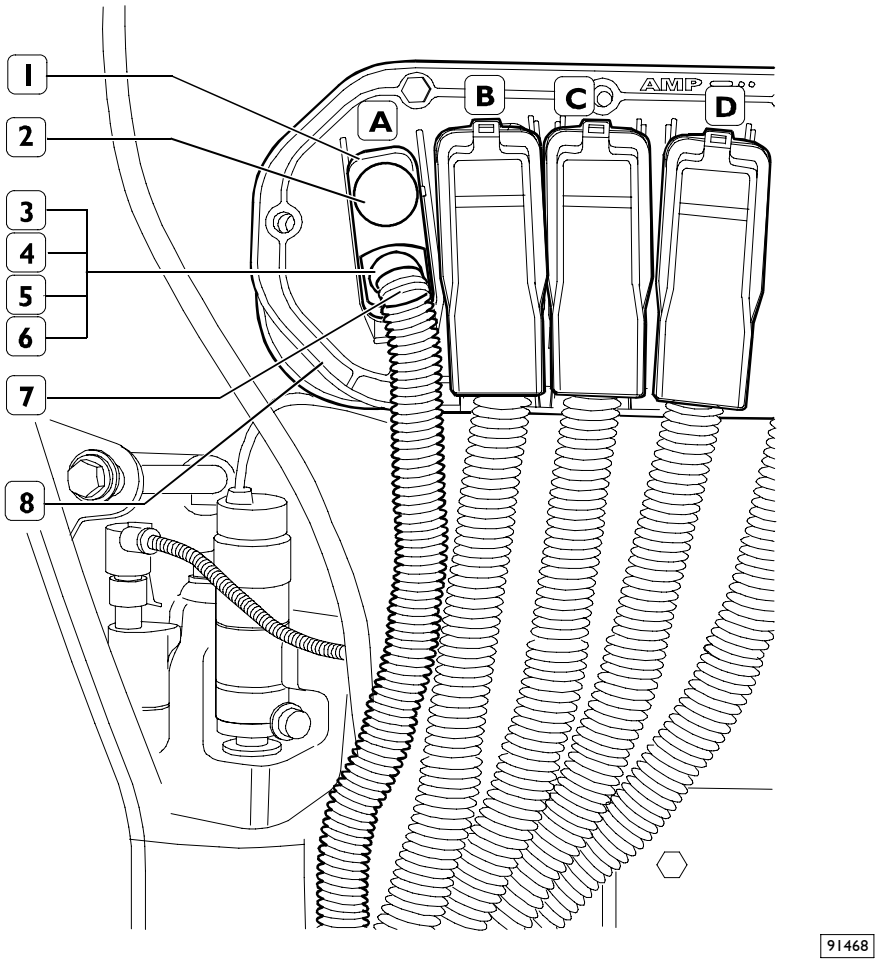
Operations which do not comply with the instructions specified by IVECO or made by non qualified personnel can cause severe damage to on-board systems, effect driving safety and correct operation of the vehicle and cause considerable damage which is not covered by warranty.

Wire passage

The terminal board (component 8 in Figure 5.23) consists of a plate with five housings, four of which are occupied by connectors (B, C, D and E) and one by a plate (A). The four connectors cannot be changed. The plate (component 1 in Figure 5.23) in housing A is provided with two wire passages from the cab outwards and vice versa. A corrugated pipe (7) is fitted on the lower hole of the plate (7) and can be used for passing the wires.

For bodybuilders requiring a second crossing point, disconnect the plate, remove the plug (2) from the plate, insert the specific threaded fitting (3), pass the corrugated pipe containing the electrical wires through (diameter 13 mm) and fasten it to the plate using the specific nut and the two sealed washers (4, 5, 6). Only use genuine IVECO components (contact IVECO Aftersales).

Figure 5.23



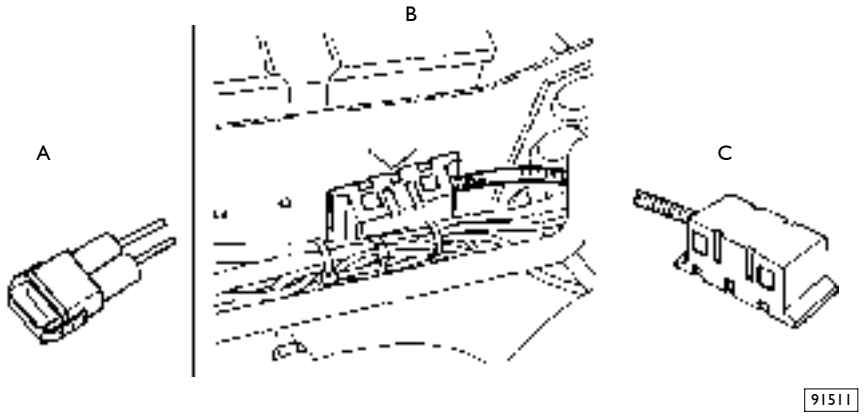
Do not drill the plastic plug to pass the wires. Do not remove the plate. Genuine components ensure water and humidity tightness and must always be used. Operations which do not comply with the instructions specified by IVECO or made by non-qualified personnel can cause severe damage to on-board systems and effect safety and reliability.

Maxifuse and Megafuse fuses

IVECO Shop offers a series of five fuseholder kits to protect high power draw power taps.

The positioning of the fuses (always as close as possible to the output terminal on the battery) must be decided by the bodybuilder in accordance with the space available on the vehicle.

Figure 5.24



A. Maxifuse - B. Battery case - C. Megafuse

Table 5.16 - Maxifuse

Capacity	Reference number of IVECO kit electrical accessories	Body drawing number Fuseholder	Cable cross-section
KIT 40A	4104 0110 KZ	500317518	10 mm^2
KIT 60A	4104 0111 KZ	500317518	10 mm^2

The fuseholder (Part number 500317518) suitable for installation on a production line, must be secured to the chassis with a tightening torque of 2 ± 0.2 Nm.

Table 5.17 - Megafuse

Capacity	Reference number of IVECO kit electrical accessories	Body drawing number Fuseholder	Cable cross-section
KIT 100A	4104 0112 KZ	500315861	25 mm^2
KIT 125A	4104 0113 KZ	500315861	35 mm^2
KIT 150A	4104 0114 KZ	500315861	50 mm^2

The current take-off from the battery positive terminal is to be considered as an alternative to a take-off from the battery isolator switch when this latter is installed on the vehicle.

5.5.6 Additional circuits (fuses and conductor cross-section)

Additional circuits must be segregated and protected form the main vehicle circuit by means of fuses.
The cables utilised must be of a size that is suitable for the relative functions and must be well insulated. They must also be suitable protected in sheaths (not PVC) or routed though flexible conduits in the case of a plurality of functions (we recommended the use of polyamide type 6 plastic for flexible conduits) and they must be correctly installed **in a place where they are protected from impact and heat sources. Take care to avoid any chaffing with other components, particularly with live edges of the bodywork.**
The transit of these cables through structural components (cross members, profiles, etc.) must be executed using suitable cable glands or protections; firstly the cables must be secured separately with insulated cable clamps (e.g. made of nylon) at adequate intervals (approx. 350 mm).
In case of external panels, use a specific sealant both on cable and on panel to avoid water, dust and fume ingress.
Establish suitable distance between electrical wiring harnesses and other components as follows:
- 10 mm from static components;
- 50 mm from moving components (minimum distance = 20 mm);
- 150 mm from components that generate heat (e.g. engine exhaust).

Wherever possible it is good practice to follow a different cable route for signal cables interfering at high absorbed intensity (e.g. electric motors, solenoid valves) and signals that are susceptible to low absorbed intensities such as sensors, maintaining in any event a position as close as possible to the metal structure of the vehicle in both cases.
Plug and terminal connections must be protected, resistant to weathering, and executed using components of the same type as those utilised originally on the vehicle.
Use cables and fuses with the characteristics shown in the following table in accordance with the current draw:

Table 5.18

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 hence the temperature that may be reached in the housing, choose fuses that can be loaded to up to 70%- 80% of their maximum capacity.

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

Precautions

- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).It should be noted that when grouping several cables together, in order to compensate for the lower heat dispersal capacity current intensity must be reduced with respect to the nominal value of a single cable.
- In vehicles subject to frequent engine starts, in the presence of power draws with limited engine running times (e.g. vehicles with refrigerated bodies) periodic battery charges are required to maintain optimal efficiency.

5.5.7 Harness Modifications due to Changes to Wheelbase or 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 components used such as wires, connectors, terminal blocks, conduits etc. must be of the same type as those used originally and be correctly fitted.
See the instructions given in paragraph 2.15.3 for electronic brake control device functionality.

5.5.8 Power Draw-off at a Voltage Different from that of the System

The vehicle electrical system is arranged for powering devices at 12V. A connection with voltage reducer (from 24V to 12V) is fitted in the cab. Do not power devices directly by taking 12V from the battery.

The voltage reducer (supplied by IVECO) is arranged for a maximum current consumption of 20 A at 30°C measured in the device compartment in the header rail above the windscreen.

(Maximum consumption is 10A at 60°C).

Other devices with higher consumption must not be used.

5.5.9 Side Marker Lamps

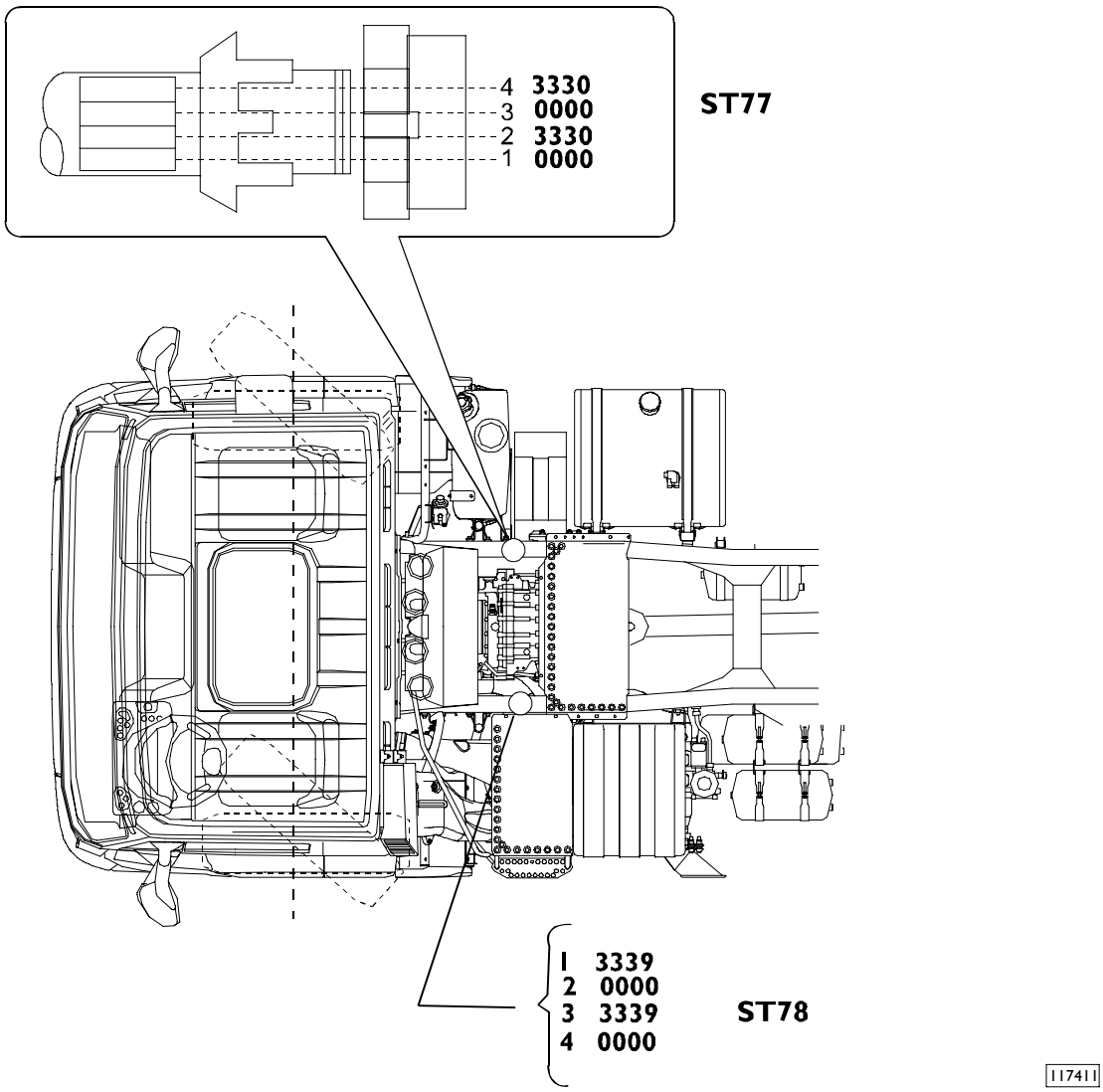
Some national or EC regulations require that vehicle be equipped with side parking light, as a function of its overall length.
The Stralis range vehicles are equipped with specific terminals for the side light power supply connection.
Bodybuilders must fit the lights on the relevant structures and connect to the dedicated terminals (platform, box bodies, etc.).
The position of these terminals is shown below.

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

Electrical System: Modifications and Drawing-Off Power

Two special connectors are used to install side markers lights and are located behind the vehicle cab: ST77 on the right-hand side and ST78 on the left-hand side (Figure 5.25).

Figure 5.25



ST77. Terminal 4 poles per side marker lamp RH side - ST78. Terminal 4 poles per side marker lamp LH side

Connector on the vehicle		Interface to use		
9843 5343	Female connector	9843 5339	Male connector	n° 1
		9844 7233	Half bearing	n° 1
		9843 5370	Cable terminal	n° 6
		486 1936	Seal	n° 6

SECTION 6

Special instructions for -SCR- exhaust system

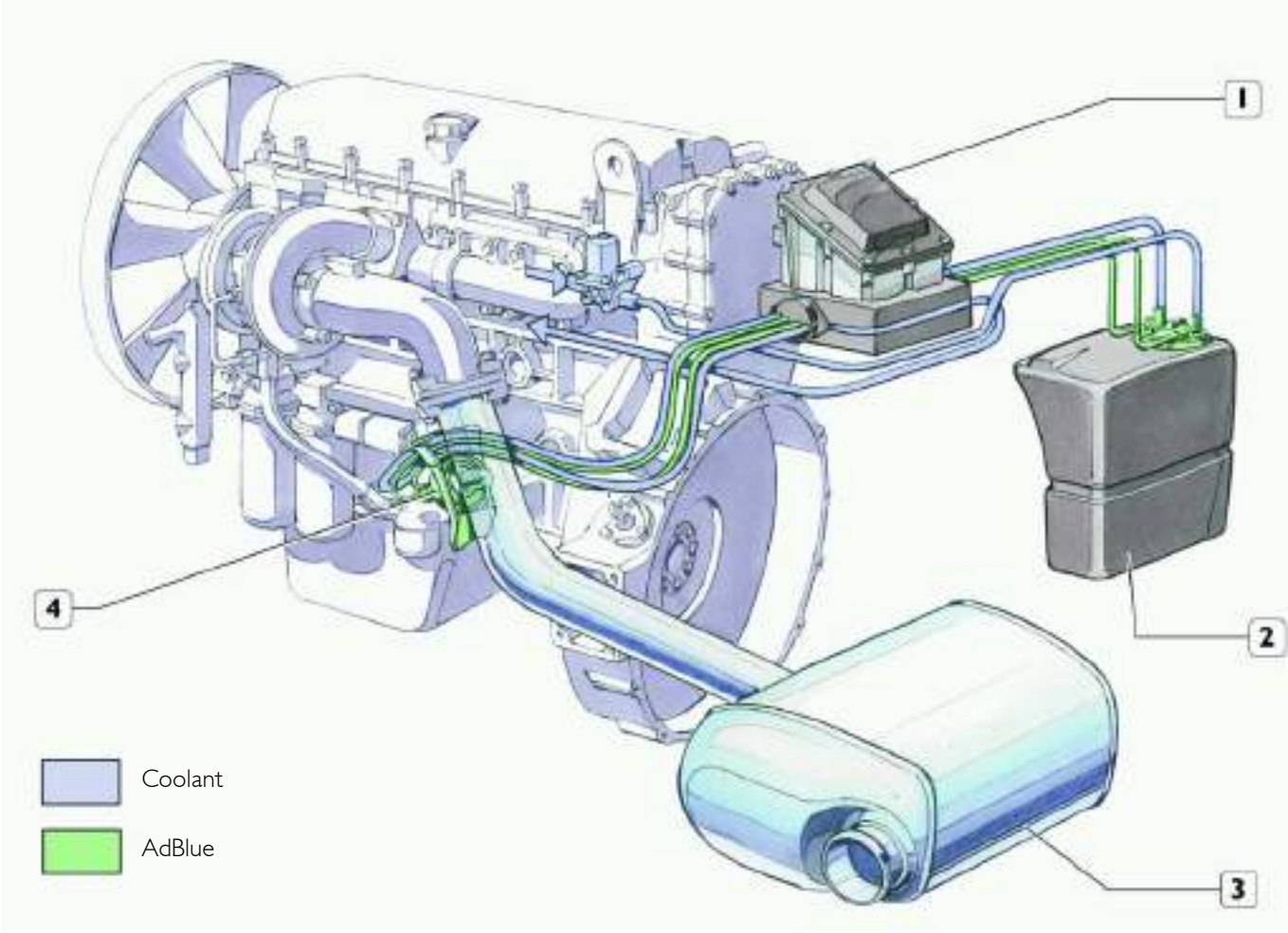
6.1 General specifications

This chapter contains important information on the **-SCR- exhaust systems** fitted on the IVECO series (EuroCargo - Stralis - Trakker).

In order to comply with Euro4 Euro5 standards, IVECO has chosen the SCR (selective catalyst reduction) system to reduce the nitrogen oxide (NOx) emissions produced by exhaust gas.

SCR is an exhaust gas post-treatment system that uses a catalyzer which, by means of a chemical reaction, transforms NOx nitrogen oxyde into nitrogen and water. This chemical reaction is produced by an additive called AdBlue (a solution of urea + water).

Figure 6.1



1. Pumping module - 2. Urea tank - 3. Catalyzer - 4. Dosing module

6.2 The nitrogen oxide catalytic reduction principle. AdBlue

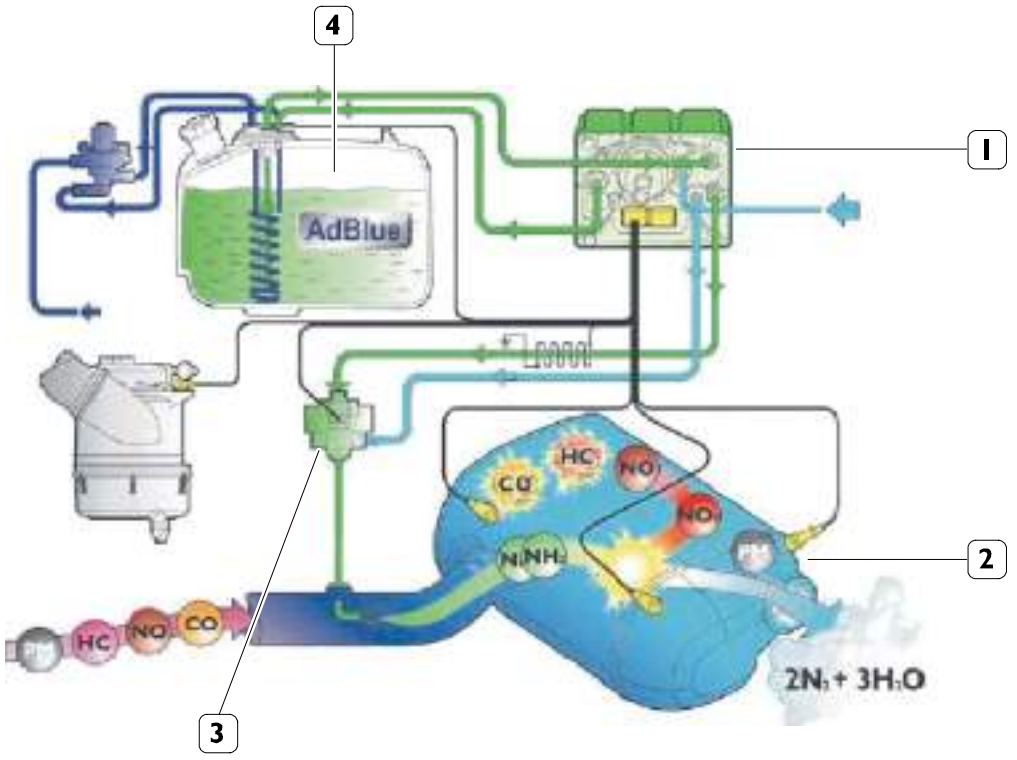
The additive is sent from a dedicated reservoir by means of supply module (1) to dosing module (3), which injects AdBlue into the exhaust pipe.

The mixture thus obtained is then fed to the SCR catalyzer that transforms the NOx into nitrogen and water.

Post-treatment is based on a simple principle: the chemical reaction of ammonia NH_3 with nitrogen oxides NO and NO_2 produces two harmless substances: water vapour H_2O and nitrogen N_2.

The whole system is managed by an electronic control unit.

Figure 6.2



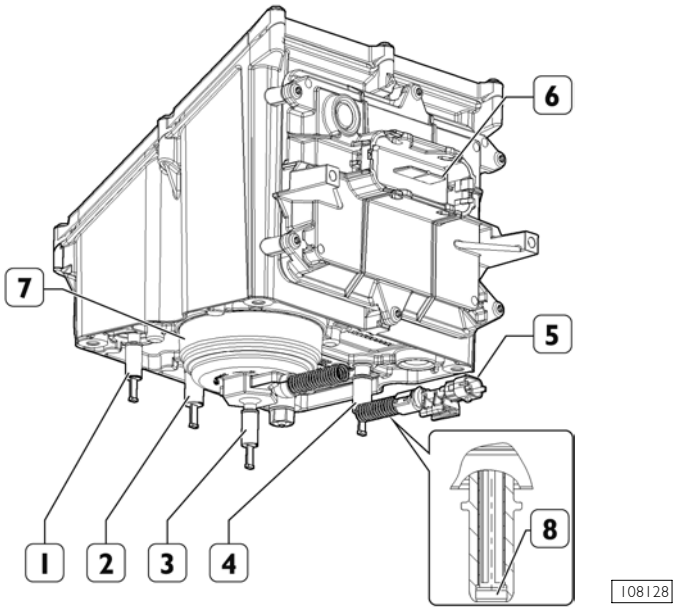
1. Pumping module - 2. Catalyzer - 3. Dosing module - 4. AdBlue reservoir

The nitrogen oxide catalytic reduction principle. AdBlue

Main system components

Pump module

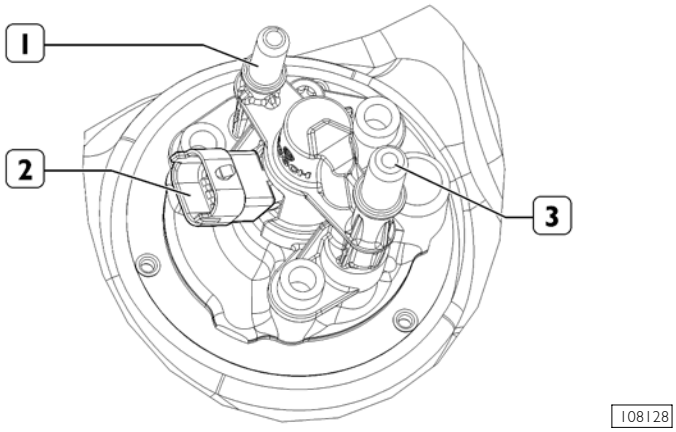
Figure 6.3



1. Ad Blue return Pipe to the tank - 2. Ad Blue return Pipe from Dosing module - 3. Ad Blue solution outlet - 4. Ad Blue solution inlet - 5. Electrical connection - 6. DCU control unit - 7. Filter - 8. Pre-filter.

Dosing module

Figure 6.4



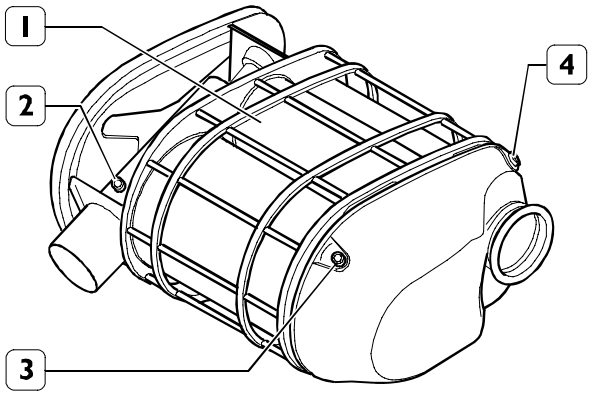
1. Ad Blue inlet - 2. Electrical connection - 3. Ad Blue outlet

Its task is to meter the Ad Blue solution sent to the exhaust pipe upstream of catalyst.

The nitrogen oxide catalytic reduction principle. AdBlue

Catalyzer

Figure 6.5



Catalyst (1), equipped with sound-proofing material, replaces the exhaust silencer.
Inside the catalyst, the exhaust gas nitric oxides are, by reacting with ammonia, converted into free nitrogen and water vapour.
Temperature sensors (2 and 3) and nitric oxide detecting sensor (4) are fitted onto catalyst (1).

AdBlue reservoir

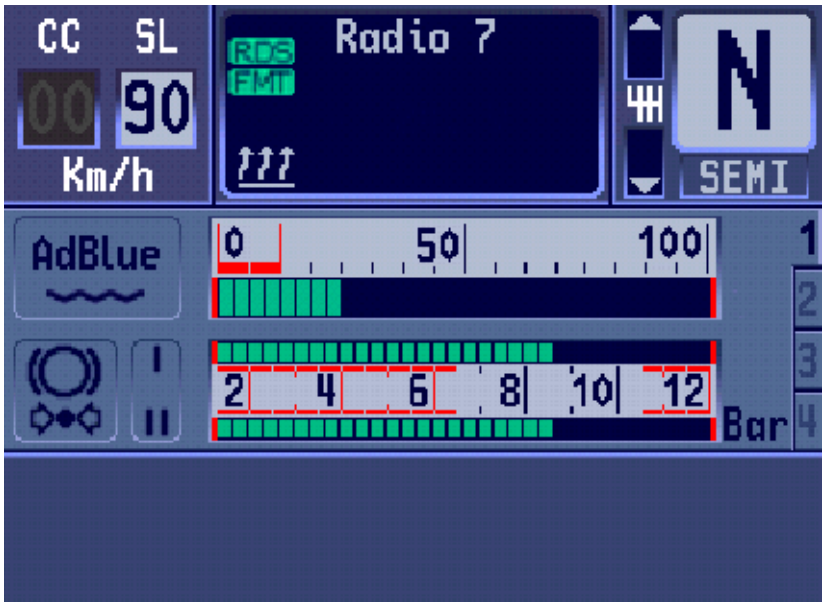
Figure 6.6

The nitrogen oxide catalytic reduction principle. AdBlue

6.3 On-board instruments

The on board diagnostic system checks the tank level continuously and informs the driver on the current AdBlue quantity.

Figure 6.7



6.4 Distribution of the ecological additive AdBlue

The 'AdBlue' denomination is recognized internationally; it is an aqueous solution consisting of high purity urea according to the DIN 70070 standard.

It is absolutely safe, non-toxic and non-flammable.

AdBlue manufacturers can assure the product direct distribution to the transporters with huge vehicle fleets, and the oil companies are also planning to install AdBlue pumps close to diesel fuel pumps within a short time.

In this case it will also be available in tanks. A detailed list of sales outlets throughout Europe is available on the internet site: www.findadblue. com

Figure 6.8

114735

Figure 6.9

114736

Figure 6.10

114737

Distribution of the ecological additive AdBlue

6.5 Specifications for installation and removal

The instructions that follow are intended for the AdBlue injection system of the Bosch DENOX2 type, within the SCR system.

If Bodybuilders make changes to the frame, the following procedures must be followed under all circumstances:

- disassembly: disconnect the hydraulic connectors first and then the electric connectors;
- assembly: connect the electric connectors first and then the hydraulic connectors.

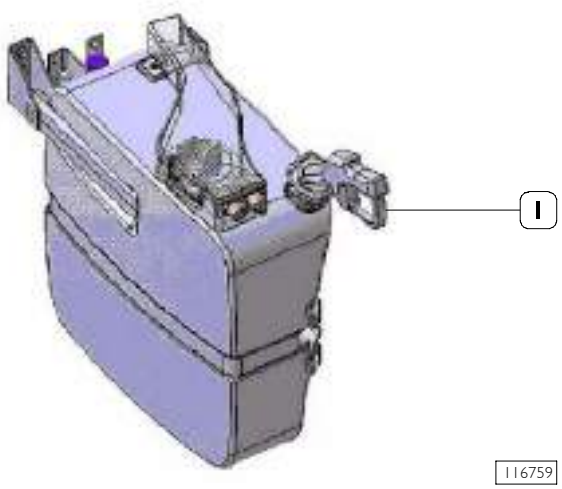
Compliance with this assembly/disassembly procedure will ensure that AdBlue does not come into contact with the electric connectors.

6.5.1 Operations for positioning the AdBlue tank

As regards the AdBlue tank, ensure that:

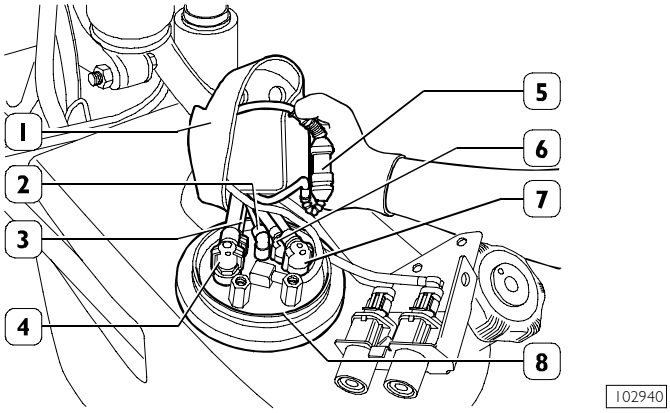
- the tank ventilation pipe is never closed;
- the reservoir must contain at least 5 l of AdBlue at the end of each operation to ensure the dosing module is cooled;
- after each operation, the tank does not contain more than 85% of AdBlue (corresponding to the max reading of the level sensor) with respect to the tank total volume, so as to guarantee enough room for AdBlue to expand during freezing at temperatures below -11 °C;
- the tank and the float are combined and cannot be modified. It is advisable to use a standard tank from the Stralis, Trakker or Eurocargo construction series. 45, 60 and 120 litre tanks are available on the right side of the vehicle and 60 litre tanks on the left. If a smaller tank is required, a 27 litre model is available in the Eurocargo construction series. In this case, note that a specific data adaptation is required due to the shorter float;
- if specific-shaped tanks are available, these must be made out of polyethylene or stainless steel 1.4301, 1.43, in each case the tank height must be respected.
- when fitting equipment onto the chassis, there is enough room for the AdBlue fill gun (1, Figure 6.11) to fit completely and correctly into the tank filler.

Figure 6.11



Removal and refitting of the AdBlue tank

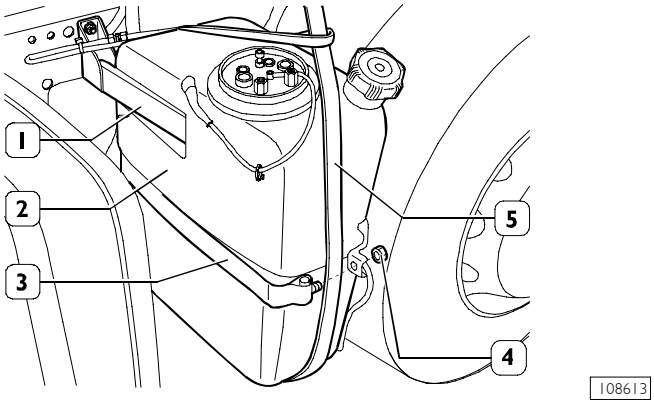
Figure 6.12



1. Cover - 2. Breather pipe - 3. AdBlue outlet pipes - 4. AdBlue heating fluid outlet pipes - 6. AdBlue inlet pipe - 7. AdBlue heating fluid inlet pipe - 8. Level gauge

Remove cover (1) and remove the water/AdBlue pipes shown in the figure.

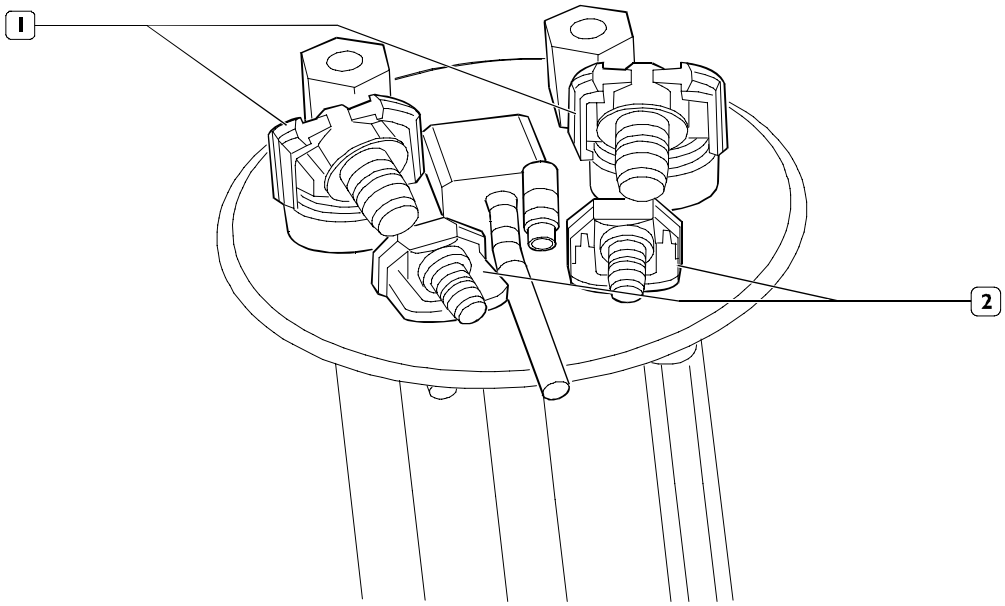
Figure 6.13



Remove nut (4) and dismantle elastic strap (3) securing tank (2). Sling tank (2) with appropriate cable (5) and hook it to the hoister. Remove tank from brackets (1).

Water/AdBlue connectors

Figure 6.14



1. H_2O infeed/outfeed connectors for AdBlue heater - 2. AdBlue infeed/outfeed connectors

The temperature and level sensors are connected to the DCU (Dosing Control Unit); the level sensor is specific to each type of tank, therefore its dimensions cannot be modified.

6.5.2 Operations on AdBlue pipes and heating water

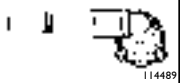
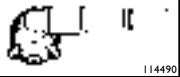
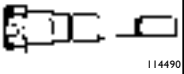
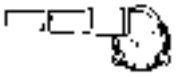
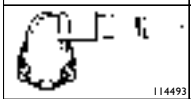
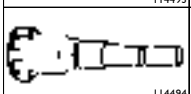
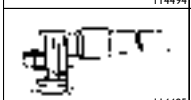
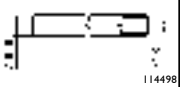
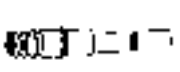
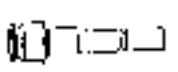
After turning off the engine, the outlet ducts (PL/UPL) and the inlet ducts (IL/UIL) must be drained to prevent the AdBlue freezing in the ducts and components if temperatures are low. The time that elapses is approximately 2 minute and must not be interrupted by premature disconnection or the battery or disconnector. The process may clearly be heard because the AdBlue pump keeps working even after the engine has been turned off.

As far as the pipes connecting reservoir, supply module and dosing module are concerned, ensure that:

- the connection pipes between the AdBlue reservoir and the supply module (delivery or inlet line or return or return line) must be 5 m;
- the connection pipes between the supply module and the dosing module (delivery or pressure line and return or cooling line) must be 3 m.

The pipes may only be modified using the "Voss" fittings described in Table 6.1.

Table 6.1 - AdBlue

	VOSS/IVECO Teil -Nr: Part -No: Codice:	**Benennung**	**Itemname**	**Descrizione**	**Description**	**Descripción**
 114489	5 4 62 07 00 00 4128 3733 EZ 50-7499	Winkelkupplung SV241 5/16" Ausführung links; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 5/16" VERSION LEFT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 5/16" VERSIONE SINISTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 5/16" VERSION GAUCHE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 5/16" VERSION IZQUIERDA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114490	5 4 62 07 56 00 4128 3734 EZ 50-7499	Winkelkupplung SV241 5/16" Ausführung rechts; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 5/16" VERSION RIGHT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 5/16" VERSIONE DESTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 5/16" VERSION DROITE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 5/16" VERSION DERECHA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114490	5 4 62 08 89 00 4128 3735 EZ 50-7499	Geradekupplung SV241 5/16"; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SV241 5/16"; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO SV241 5/16"; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD SV241 5/16", AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION SV241 5/16"; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114492	5 4 62 23 26 00 4128 3736 EZ 50-7499	Winkelkupplung SV241 3/8" Ausführung links; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 3/8" VERSION LEFT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 3/8" VERSIONE SINISTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 3/8" VERSION GAUCHE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 3/8" VERSION IZQUIERDA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114493	5 4 62 23 49 00 4128 3737 EZ 50-7499	Winkelkupplung SV241 3/8" Ausführung rechts; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 3/8" VERSION RIGHT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 3/8" VERSIONE DESTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 3/8" VERSION DROITE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 3/8" VERSION DERECHA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114494	5 4 62 23 50 00 4128 3738 EZ 50-7499	Geradekupplung SV241 3/8"; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SV241 3/8"; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO SV241 3/8"; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD SV241 3/8", AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION SV241 3/8"; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114495	5 4 62 24 70 00 4128 3739 EZ 50-7499	Winkelstecker SV246 NG 8 Öffnungselement weiss; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV246 NG 8 RELEASE CLIP WHITE; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV246 NG 8 ELEMENTO DI APERTURA BIANCO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 8/16" ELEMENT D'OUVERTURE BLANC, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV246 NG 8 ELEMENTO DE APERTURA BLANCO; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114496	5 4 62 27 60 00 4128 370 EZ 50-7499	Winkelstecker SV246 NG 8 Öffnungselement schwarz; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV246 NG 8 RELEASE CLIP BLACK; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV246 NG 8 ELEMENTO DI APERTURA NERO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 8/16" ELEMENT D'OUVERTURE NOIR, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV246 NG 8 ELEMENTO DE APERTURA NEGRO; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114497	5 4 66 12 06 49 4128 3741 EZ 50-7499	Set Verbinder MLT; 1 Verbinder NW6 2 1-Ohr Schellen 1 Montageanleitung ACHTUNG Montageanleitung 9 1 77 00 02 20 beachten	SET CONNECTOR MLT; 1 CONNECTOR NW6 2 RETAINING CLIP 1 ASSEMBLY INSTRUCTION ATTENTION TAKE NOTICE OF ASSEMBLY INSTRUCTION 9 1 77 00 02 20	SET DI RACCORDO; 1 RACCORDO NW6 2 FASCETTA 1 ISTRUZIONE DI MONTAGGIO PRESTARE ATTENZIONE A L'ISTRUZIONE DI MONTAGGIO 9 1 77 00 02 20	SET DE RACCORD ; 1 RACCORD NVV6 2 COLLIER 1 INSTRUCTION DE MONTAGE RESPECTER LES INSTRUCTIONS DE MONTAGE 9 1 77 00 02 20	JUEGO DE CONEXION; 1 RACOR NW6 2 ABRAZADERAS 1 INSTRUCCIONES DE MONTAJE PRESTAR ATENCION A LAS INSTRUCCIONES DE MONTAJE 9 1 77 00 02 20
 114498	5 4 64 11 16 00 4128 3742 EZ 50-7499	Rohr MLT 8.8x1.4 PA0.2 Länge 10m	TUBE MLT 8.8x1.4 PA0.2 LENGTH 10m	TUBO MLT 8.8x1.4 PA0.2 LUNGHEZZA 10m	TUBE MLT 8.8x1.4 PA0.2 LONGUEUR 10m	TUBO MLT 8.8x1.4 PA0.2 LONGITUD 10 m
 114500	5 4 62 35 74 00 4128 3743 EZ 50-7499	Stecker Trennstelle; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SECTION POINT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO PIASTRA DI SEZIONAMENTO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD PLAQUE DE SECTIONNEMENT, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION CHAPA DE SEPARACION; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114501	5 4 62 35 75 00 4128 3744 EZ 50-7499	Kupplung Trennstelle; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SECTION POINT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO PIASTRA DI SEZIONAMENTO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD PLAQUE DE SECTIONNEMENT, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION CHAPA DE SEPARACION; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA

Specifications for installation and removal

Table 6.1 - (cont.) Cooling water

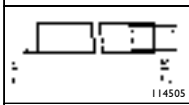
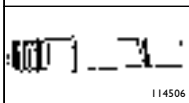
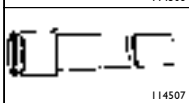
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114502	5 4 62 28 42 00 4128 3745 EZ 50-7499	Winkelstecker SV246 NG 12 Öffnungselement weiss; mit Rohr Grilamicl 13x1.5 Länge 3m	ELBOW CONNECTOR SV246 NG 12 RELEASE CLIP WHITE; WITH GRILAMID TUBE 13x1.5 LENGTH 3m	RACCORDO ANGOLO SV246 NG 12 ELEMENTO DI APERTURA BIANCO; CON TUBO GRILAMID 13x1.5 LUNGHEZZA 3m	RACCORD ANGLE SV246 NG 12 ELEMENT D'OUVERTURE BLANC, AVEC TUBE GRILAMID 13x1.5 LONGUEUR 3m	CONEXION EN ANGULO SV246 NG 12 ELEMENTO DE APERTURA BLANCO; CON TUBO GRILAMID 13x1.5 LONGITUD 3 m
 114503	5 4 62 29 49 00 4128 3746 EZ 50-7499	Winkelstecker SV246 NG 12 Öffnungselement blau; mit Rohr Grilamid 13x1,5 Länge 3m	ELBOW CONNECTOR SV246 NG 12 RELEASE CLIP BLUE; WITH TUBE GRILAMID 13x1.5 LENGTH 3m	RACCORDO ANGOLO SV246 NG 12 ELEMENTO DI APERTURA BLU; CON TUBO GRILAMID 13x1.5 LUNGHEZZA 3m	RACCORD ANGLE SV246 NG 12 ELEMENT D'OUVERTURE BLEU, AVEC TUBE GRILAMID 13x1.5 LONGUEUR 3m	CONEXION EN ANGULO SV246 NG 12 ELEMENTO DE APERTURA AZUL; CON TUBO GRILAMID 13x1.5 LONGITUD 3 m
 114504	0 0 26 11 50 00 4128 3747 EZ 50-7499	Verbinder NW 10	CONNECTOR NW 10	RACCORDO NW 10	RACCORD NW 10	CONEXION NW 10
 114505	5 4 64 19 08 00 4128 3748 EZ 50-7499	Rohr GRILAMID 13x1.5 Länge 10m	TUBE GRILAMID 13x1.5 LENGTH 10m	TUBO GRILAMID 13x1.5 LUNGHEZZA 10m	TUBE GRILAMID 13x1.5 LONGUEUR 10m	TUBO GRILAMID 13x1.5 LONGITUD 10 m
 114506	5 4 62 35 76 00 4128 3749 EZ 50-7499	Stecker Trennstelle; mit Rohr Grilamid 13x1,5 Länge 3m	CONNECTOR SECTION POINT; WITH TUBE GRILAMID 13x1.5 LENGTH 3m	RACCORDO PIASTRA DI SEZIONAMENTO; CON TUBO GRILAMID 13x1,5 LUNGHEZZA 3m	RACCORD PLAQUE DE SECTIONNEMENT AVEC TUBE GRILAMID 13x1,5 LONGUEUR 3m	CONEXION CHAPA DE SEPARACION; CON TUBO GRILAMID 13x1,5 LONGITUD 3 m
 114507	5 4 62 35 77 00 4128 3750 EZ 50-7499	Kupplung Trennstelle; mit Rohr Grilamid 13x1,5 Länge 3m	CONNECTOR SECTION POINT; WITH TUBE GRILAMID 13x1.5 LENGTH 3m	RACCORDO PIASTRA DI SEZIONAMENTO; CON TUBO GRILAMID 13x1,5 LUNGHEZZA 3m	RACCORD PLAQUE DE SECTIONNEMENT AVEC TUBE GRILAMID 13x1,5 LONGUEUR 3m	CONEXION CHAPA DE SEPARACION; CON TUBO GRILAMID 13x1,5 LONGITUD 3 m

Table 6.1 - (cont.) Corrugated pipe

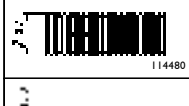
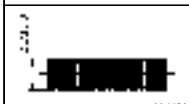
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114479	5 4 66 11 37 00 4128 3751 EZ 50-7499	Wellrohr NW37 Länge 3m	CORRUGATED HOSE NW37 LENGTH 3m	TUBO CORRUGATO NW37 LUNGHEZZA 3m	TUBE ANNELE NW37 LONGUEUR 3m	TUBO CORRUGADO NW37 LONGITUD 3 m
 114480	5 4 66 12 10 00 4128 3752 EZ 50-7499	Wellrohr NW26 Länge 3m	CORRUGATED HOSE NW26 LENGTH 3m	TUBO CORRUGATO NW26 LUNGHEZZA 3m	TUBE ANNELE NW26 LONGUEUR 3m	TUBO CORRUGADO NW26 LONGITUD 3 m
 114481	5 4 66 12 09 00 4128 3753 EZ 50-7499	Wellrohr NW22 Länge 3m	CORRUGATED HOSE NW22 LENGTH 3m	TUBO CORRUGATO NW22 LUNGHEZZA 3m	TUBE ANNELE NW22 LONGUEUR 3m	TUBO CORRUGADO NW22 LONGITUD 3 m

Table 6.1 - (cont.) Breather pipe

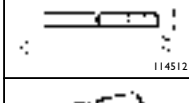
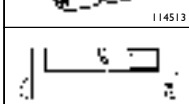
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114511	5 4 66 09 65 00 4128 3757 EZ 50-7499	Verbinder NW 6	CONNECTOR NW 6	RACCORDO NW6	RACCORD NW6	CONEXION NW6
 114512	5 4 64 19 09 00 4128 3758 EZ 50-7499	Rohr 6x1 PA12PHLY Länge 10m	TUBE 6x1 PA12PHLY LENGTH 10m	TUBO 6x1 PA12PHLY LUNGHEZZA 10m	TUBE 6x1 PA12PHLY LONGUEUR 10m	TUBO 6x1 PA12PHLY LONGITUD 10 m
 114513	5 4 66 10 21 00 4128 3759 EZ 50-7499	Verbinder NW 10	CONNECTOR NW 10	RACCORDO NW10	RACCORD NW10	CONEXION NW10
 114478	5 4 64 19 10 00 4128 3760 EZ 50-7499	Rohr 10x1 PA12PHLY Länge 10m	TUBE 10x1 PA12PHLY LENGTH 10m	TUBO 10x1 PA12PHLY LUNGHEZZA 10m	TUBE 10x1 PA12PHLY LONGUEUR 10m	TUBO 10x1 PA12PHLY LONGITUD 10 m

Table 6.1 - (cont.) Components

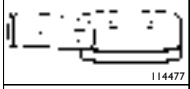
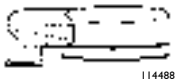
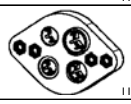
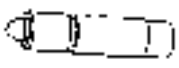
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114477	5 0 99 11 64 00 4128 3761 EZ 50-7499	Schutzkappe Tank 0°	PROTECTION CAP TANK 0°	CAPPA DI PROTEZIONE SERBATOIO 0°	CAPUCHON DE PROTECTION RESERVOIR 0°	COBERTURA DE PROTECCION DEPOSITO 0°
 114488	5 0 99 11 71 00 4128 3762 EZ 50-7499	Schutzkappe Tank 90°	PROTECTION CAP TANK 90°	CAPPA DI PROTEZIONE SERBATOIO 90°	CAPUCHON DE PROTECTION RESERVOIR 90°	COBERTURA DE PROTECCION DEPOSITO 90°
 114499	5 4 66 09 30 00 4128 3763 EZ 50-7499	Faltenbalg	CONVOLUTED RUBBER GAITER	SOFFIETTO	SOUFFLET	RESPIRADERO
 114508	5 4 66 09 64 00 4128 3764 EZ 50-7499	T-Stück für Wellrohr NW37	T-CONNECTOR FOR CORRUGATED HOSE NW37	DISTRIBUTORE A T PER TUBO CORRUGATO NW37	DISTRIBUTEUR EN T POUR TUBE ANNELE NW37	DISTRIBUIDOR EN T PARA TUBO CORRUGADO NW37
 114509	5 3 49 03 21 00 4128 3765 EZ 50-7499	Deckplatte Trennstelle	COVERPLATE SECTION POINT	PIASTRA DI COPERTURA PUNTO DI SEZIONAMENTO	PLAQUE DE COUVERTURE POINT DE SECTIONNEMENT	CHAPA DE COBERTURA PUNTO DE SEPARACION
 114510	5 3 49 03 20 49 4128 3766 EZ 50-7499	Grundplatte Trennstelle	BASE PLATE SECTION POINT	PIASTRA DI BASE PUNTO DI SEZIONAMENTO	PLAQUE DE BASE POINT DE SECTIONNEMENT	CHAPA DE BASE PUNTO DE SEPARACION

Table 6.1 - (cont.) Tools

	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114482	5 9 94 52 14 00 Iveco: 99387101 50-7499	Kunststoffrohr Montagezange	NYLON TUBE MOUNTING PLIERS	PINZA DI MONTAGGIO PER TUBO PLASTICA	PINCE DE MONTAGE POUR TUBE PLASTIQUE	ALICATES DE MONTAJE PARA TUBO DE PLASTICO
	5 9 94 71 53 49 Iveco: 99387102 50-7499	Spannbacken für Rohr MLT 8.8x1.4	CLAMPING JAWS FOR TUBE MLT 8.8x1.4	MORSA PER TUBO MLT 8.8x1.4	GRIFFE DE SERRAGE POUR TUBE MLT 8.8x1.4	MORDAZA PARA TUBO MLT 8.8x1.4
 114484	5 9 94 65 41 00 Iveco: 99387103 50-7499	Spannbacken für Rohr GRILAMID 13x1.5 (08/ 010/ 012/ 013)	CLAMPING JAWS FOR TUBE GRILAMID 13x1.5 (08/ 010/ 012/ 013)	MORSA PER TUBO GRILAMID 13x1.5 (08/ 010/ 012/ 013)	GRIFFE DE SERRAGE POUR TUBE GRILAMID 13x1.5 (08/ 010/ 012/ 013)	MORDAZA PARA TUBO GRILAMID 13x1.5 (08/ 010/ 012/ 013)
 114485	5 9 94 71 55 00 Iveco: 99387104 50-7499	Werkzeugeinsatz Aufnahme für Verbinder NW6 (Harnstoff)	TOOLING INSERT COLLET FOR CONNECTOR NW 6 (AD-BLUE)	INSERTO STAMPO ALLOGIAMENTO PER CONNETTORI NW6 (UREA)	EMPREINTE MOULE LOGEMENT CONNECTEURS NVV6 (UREE)	UTIL ESTAMPACION ALOJAMIENTO PARA CONEXIONES NW6 (UREA)
 114486	5 9 94 69 16 49 Iveco: 99387105 50-7499	Werkzeugeinsatz Aufnahme für Verbinder NW10 (Kühlwasser)	TOOLING INSERT COLLET FOR CONNECTOR NW 10 (COOLING WATER)	INSERTO STAMPO ALLOGIAMENTO PER CONNETTORI NW10 (AQUA DI RAFFREDDAMENTO)	EMPREINTE MOULE LOGEMENT CONNECTEURS NW10 (EAU DE REFROIDISSEMENT)	UTIL ESTAMPACION ALOJAMIENTO PARA CONEXIONES NW10 (AGUA DE REFRIGERACION)
 114487	5 9 94 71 56 00 Iveco: 99387106 50-7499	Aufweitdorn für Rohr MLT 8.8x1.4	WIDENING SPIKE FOR TUBE MLT 8.8x1.4	MANDRINO ALLARGATUBI MLT 8.8x1.4	MANDRIN A DUDGEONNER MLT 8.8x1.4	MANDRIL PARA AVELLANAR TUBOS MLT 8.8x1.4
	9 7 51 00 00 08	Klemmzange für Einohrschelle	CLAMPING PLIERS FOR CLIP RETAINER	MORSETTO PER FASCETTA	CLIP POUR COLLIER DE SERRAGE	UTIL PARA ABRAZADERAS
	5 9 94 84 72 00	Kunstoffrohr-Schneidezange	NYLON TUBE SCISSORS	TRONCHESE PER TUBO IN PLASTICA	TRICOISES POUR TUBE EN PLASTIQUE	CORTADOR DE TUBO DE PLASTICO
	5 9 94 84 74 00	Ersatzklinge für Kunstoffrohr-Schneidezange (2 Stück)	SPARE BLADE FOR NYLON TUBE SCISSORS	LAMA DI RICAMBIO PER TRONCHESE PER TUBO IN PLASTICA	LAME DE RECHANGE DE TRICOISES POUR TUBE EN PLASTIQUE	CUCHILLA DE RECAMBIO PARA CORTADOR DE TUBO DE PLASTICO

- When working on the pipes, it is compulsory to work in a completely dust-free environment to prevent dust reaching the injector.
- Restore all the pipe insulation (water and Urea pipes) to prevent freezing.

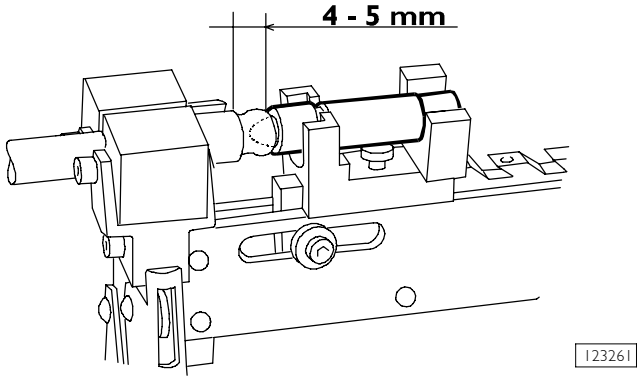
Specifications for installation and removal

6.5.2.1 Instructions for lengthening and shortening the AdBlue ducts on the vehicle

1) Mark the delivery and returns ducts before separating them to ensure that they are correctly positioned during subsequent assembly. The maximum permitted length for ducts must not exceed 5 m from the reservoir to the supply module and 3 m from the supply module to the dosing module.

2) Cut the AdBlue duct (MLT Rehau - VOSS HWL 8.8 x 1.4 PA wall thickness 0.2 mm and 0.4 mm PA/PUR) with the appropriate pipe cutting clippers in order to ensure an accurate cutting area. For reasons of space, it is advisable to divide the AdBlue delivery and return ducts along the length of the line.

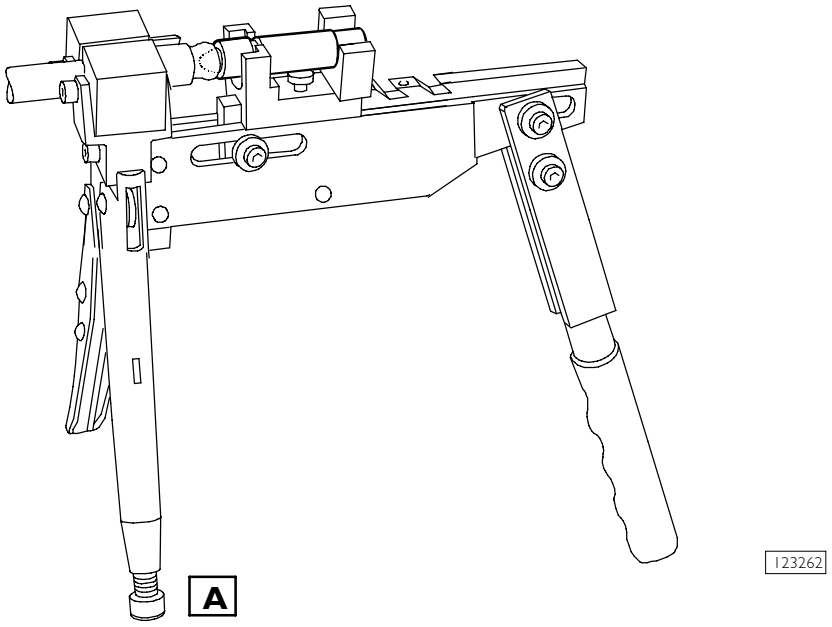
Figure 6.15



3) The special band is pushed by the fitting toward the end of the pipe.

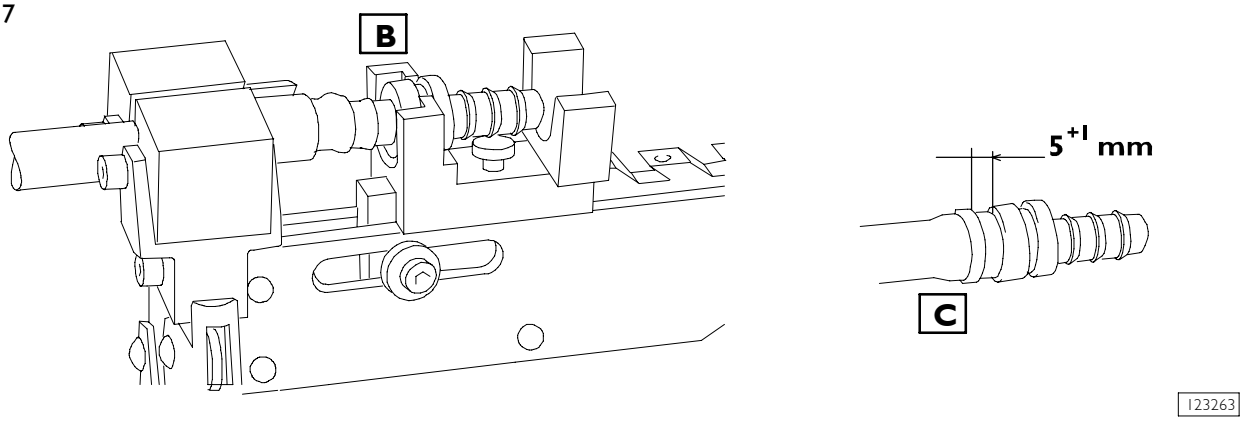
4) The pipe is inserted in the pipe jaws and secured by clips. The end of the duct should extend 4-5 mm from the clips. The tightening force must be adjusted using adjustment screw (A) (the distance of the jaws without the pipe must be approximately 1-2 mm).

Figure 6.16



5) Fit expanding pin (B) in the tool element and push the transport bar mechanically toward the pipe until the pin cone fits fully into the pipe. Then pull the bar back and remove the expansion plug.

Figure 6.17



6) The expanded side of the joint on the duct to be fitted must be moistened with water to above the O-Ring and fitted into the tool insert. The connector must be pressed toward pipe by hand through the transport bar until the profile of the pipe expander is centred within the inner diameter of the pipe.

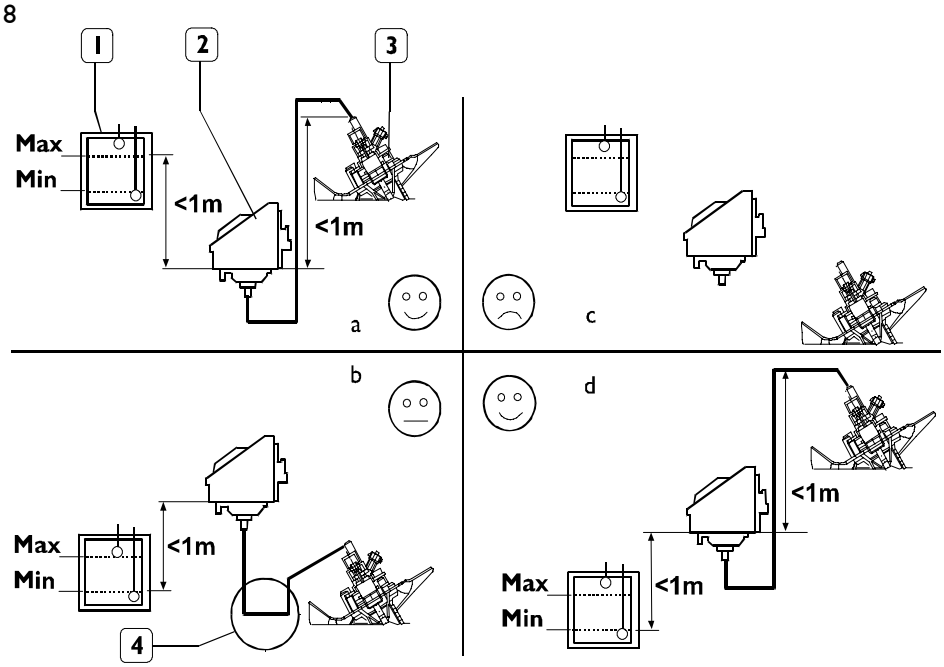
7) Use the appropriate lever to push the connector into the pipe to the end of the expansion pin. It is advisable to exercise continuous pressure while doing this.

8) Release the locking jaws, position the special bands up to 5+ 1 mm from the collar and press using the manual pliers (C.)

6.5.3 Altering the supply module position

On some body models or for some types of service, it is necessary for components of the AdBlue system such as the AdBlue tank, the dosing module or the supply module to be fitted in another part of the vehicle.
When moving the AdBlue components, take particular care over the height differences between them. Relevant examples are shown in the following figures.

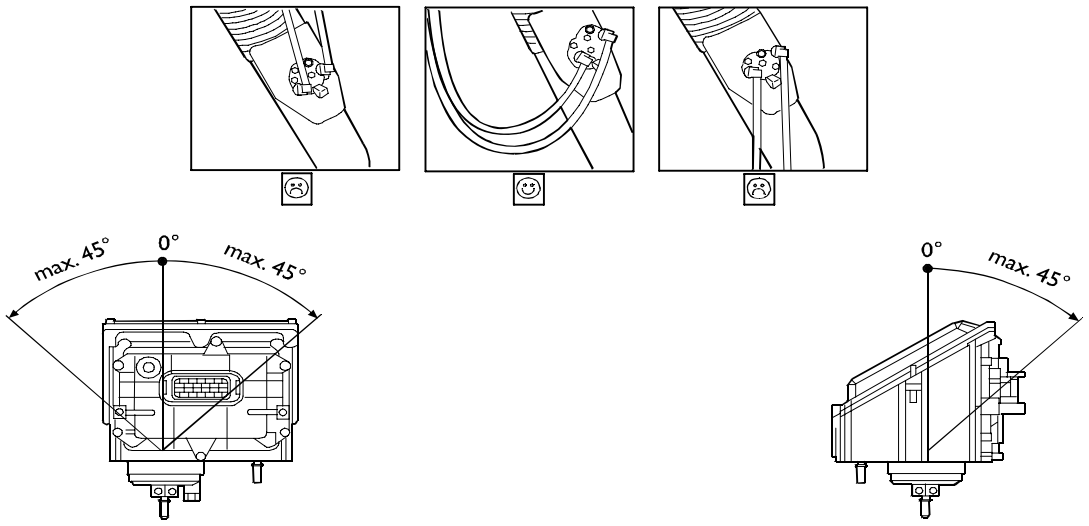
Figure 6.18



1. AdBlue reservoir - 2. Pumping module - 3. Dosing module - 4. Siphon compulsory

The supply module must be fitted on a fixed base. The preferred fitting position of the supply module is vertical with the attachments facing down. A different position is possible within the measurements shown below. The fitting position on Stralis vehicles corresponds to layout in version b. When connecting the AdBlue pipe to the DM, ensure that the pipe is fitted leading upwards just before the DM (illustration below).

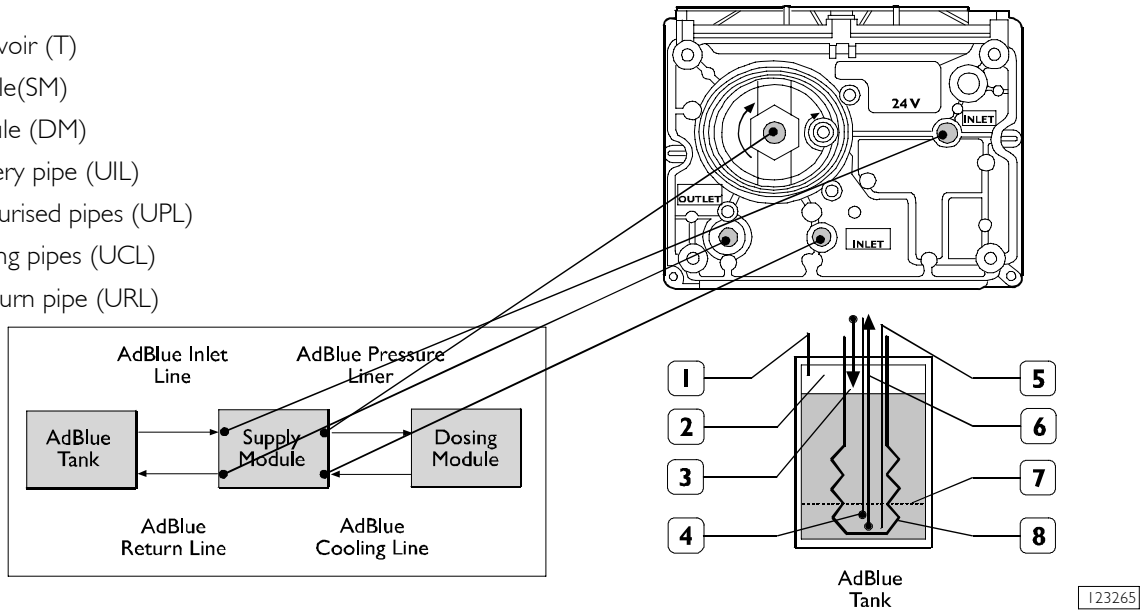
Figure 6.19



If the position of the supply module (SM) is altered, a check must be carried out to ensure that the environmental temperature corresponds
to that of the original installation. In case of doubt, it is advisable to re-check the temperatures.
The following abbreviations may be used in the description of the component position:

Figure 6.20

- AdBlue reservoir (T)
- Supply module(SM)
- Dosing module (DM)
- AdBlue delivery pipe (UIL)
- AdBlue pressurised pipes (UPL)
- AdBlue cooling pipes (UCL)
- A AdBlue return pipe (URL)

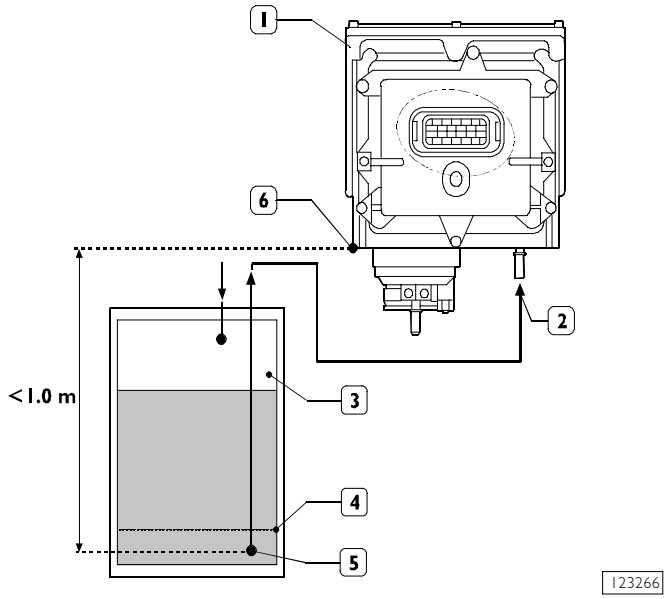


1. Reservoir ventilation - 2. Residual air - 3. Return line - 4. Temperature sensor - 5. AdBlue level sensor - 6. Delivery line - 7. Reservoir minimum level - 8. Reservoir heater.

The AdBlue reservoir is lower than the supply module(SM):

The maximum intake height corresponds to the difference between reference point (6) = lower edge of the supply module and the lower edge of the intake duct (5). The intake height must not exceed 1 m.

Figure 6.21

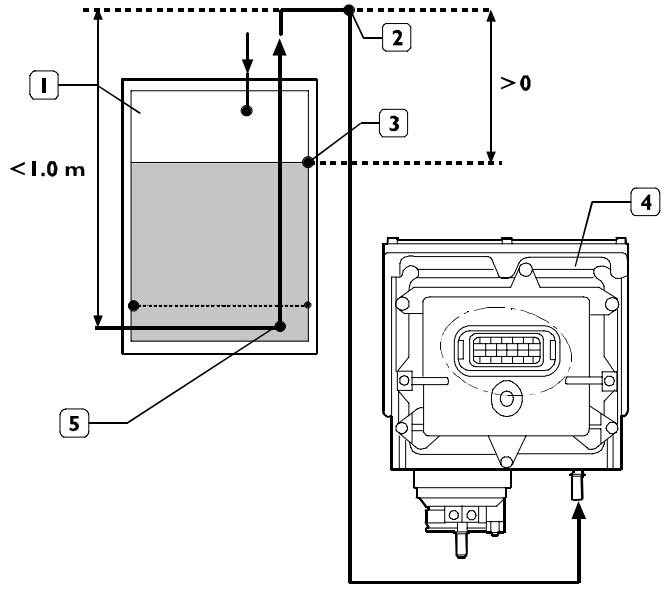


1. Supply module (SM) - 2. Supply line - 3. AdBlue reservoir - 4. AdBlue minimum level - 5. Intake duct lower edge - 6. Lower edge of supply module.

The AdBlue reservoir is higher than the supply module(SM):

The maximum intake height corresponds to the difference between the lower edge of intake pipe (5) and the highest point of intake duct (2). This height must not exceed 1 m.

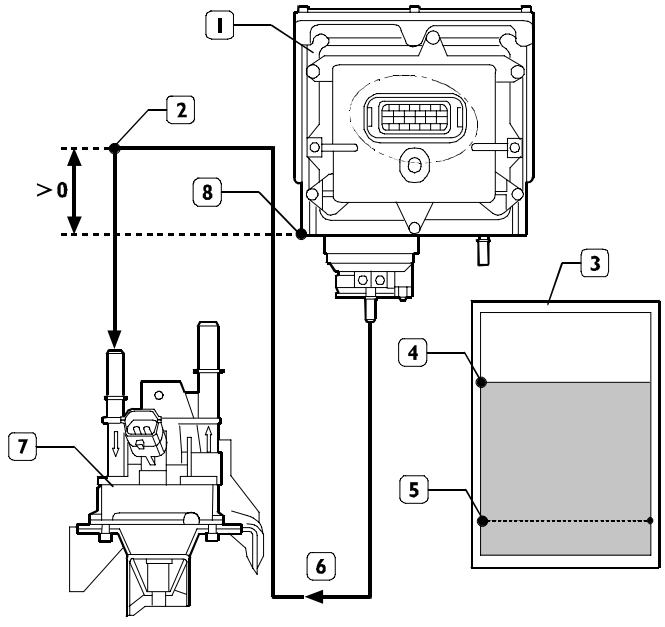
Figure 6.22



1. AdBlue reservoir - 2. Upper edge of intake pipe - 3. Level of AdBlue in reservoir - 4. Supply module - 5. Lower edge of intake pipe.

Dosing module (DM) is lower than supply module (SM):

The upper edge of delivery duct (2) must be located above reference point (8).



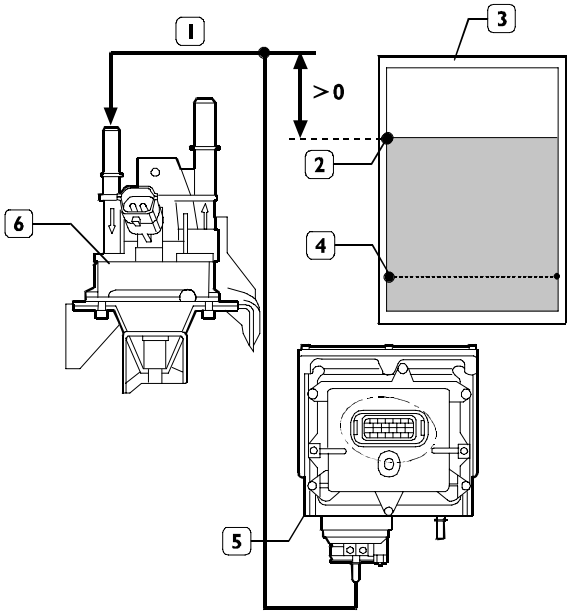
1. Supply module - 2. Upper edge of intake duct - 3. AdBlue reservoir - 4. Level of AdBlue in reservoir - 5. AdBlue minimum level - 6. Siphon - 7. Dosing module (DM) - 8. Lower edge of supply module.

Specifications for installation and removal

The AdBlue reservoir is higher than the supply module (SM):

The upper edge of delivery duct (1) must be located above reference point (5).

Figure 6.23



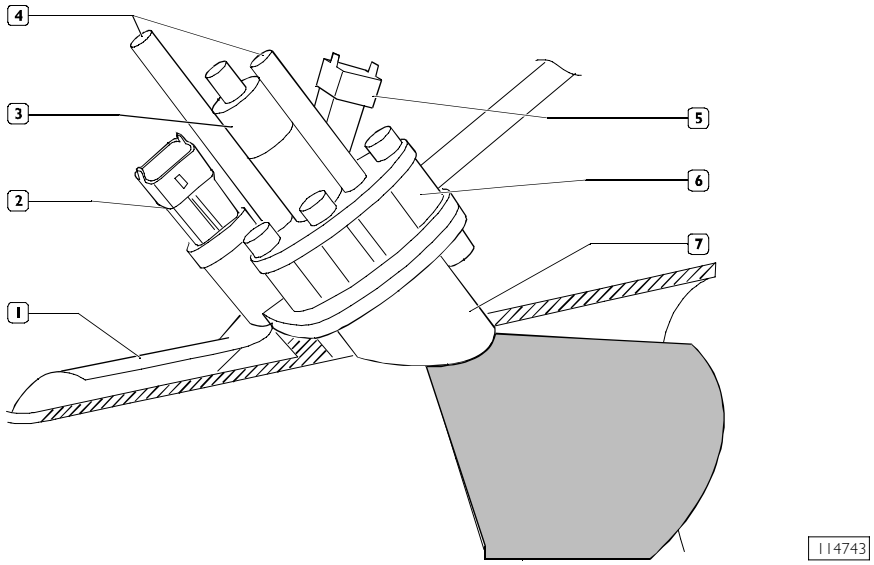
1. Pressurised pipe - 2 AdBlue level - 3. AdBlue reservoir - 4. Minimum level of AdBlue - 5. Lower edge of supply module.

Specifications for installation and removal

6.5.4 Operations on the dosing module

When the dosing module requires repositioning, note some important precautions.

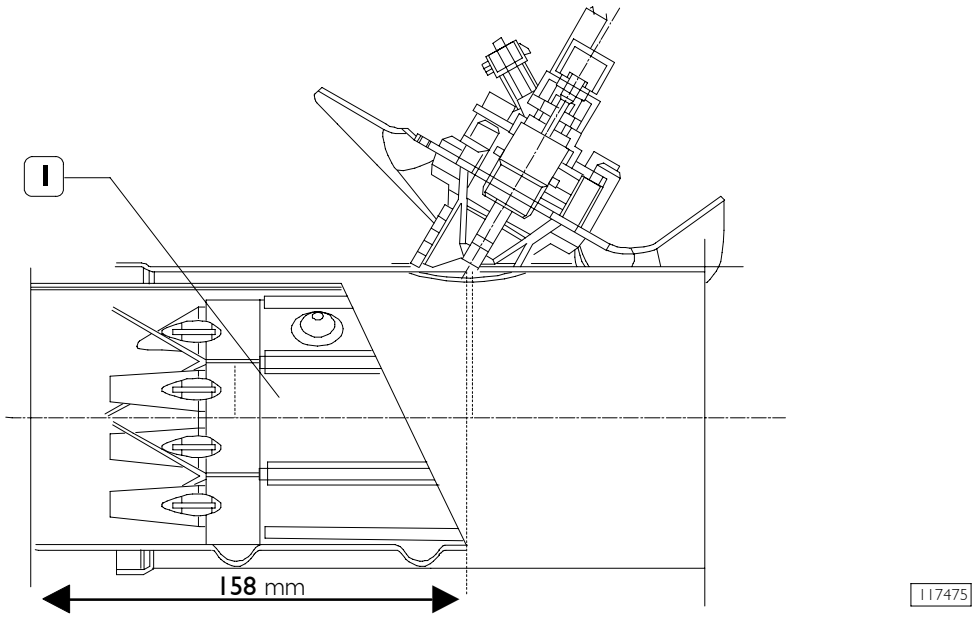
Figure 6.24



STRUCTURE OF THE MEASURING MODULE

1. Heatshield - 2. Temperature sensor - 3. Valve holder - 4. AdBlue connectors - 5. Dosing valve - 6. Cooling adapter - 7. Insulation

Figure 6.25

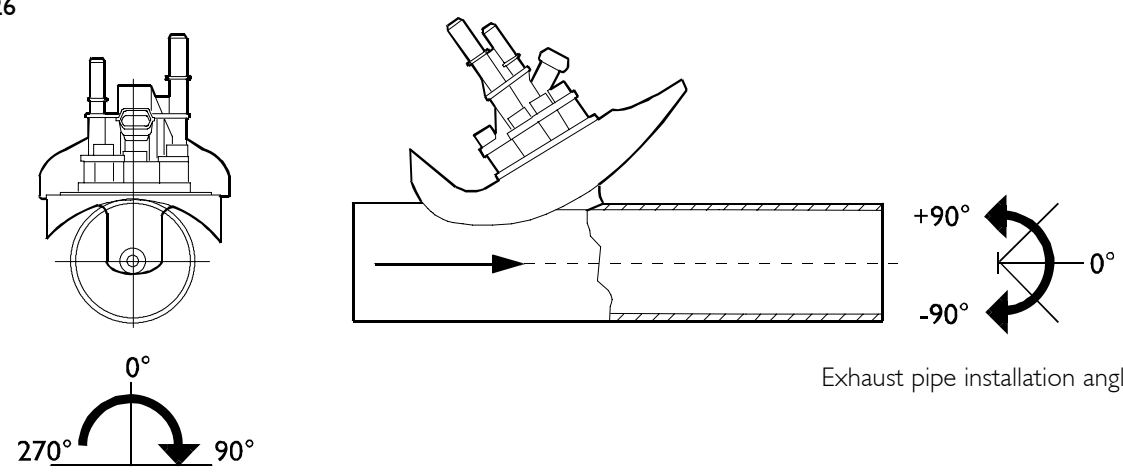


- Inside the exhaust gas pipe is placed a diffuser (1) therefore the pipe interested cannot be modified.

Orientation of dosing module (DM) in the exhaust pipe:

When positioning the DM, a distinction is drawn between the positioning rotation angle in the exhaust pipe and the exhaust pipe installation angle (see following figure).

Figure 6.26



Exhaust pipe installation angle

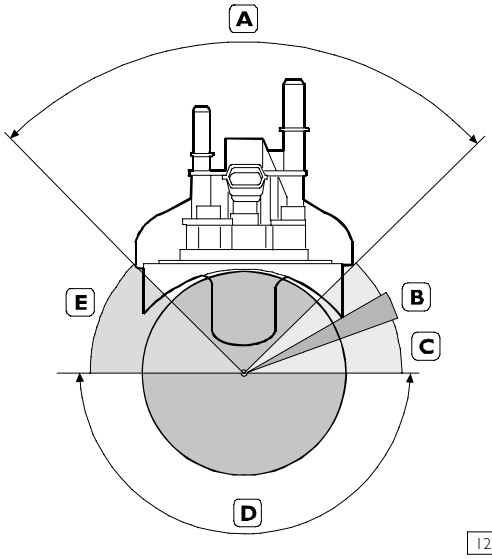
Angle of rotation of DM in exhaust pipe

123270

Orientation of dosing module (DM) in relation to angle of rotation in exhaust pipe:

To prevent operating errors and damage to the DM, the following positions must be respected during installation:

- 315° - 45° (A)
  The increasing heat in the exhaust pipe may damage the DM or cause it to malfunction. In this case, a heat shield must be installed under all circumstances.
- 90° - 270° (D)
  The AdBlue fluid contained in the dosing module. In If temperatures are very low, this may freeze and damage the module.
- 45° - 90° and from 270° to 315° (C - E)
  In this position installation is possible, a minimum quantity of AdBlue remains in the module.
- 60° - 70° (B)
  This is the idea position for installing the DM and must be absolutely preferred if conditions permit.



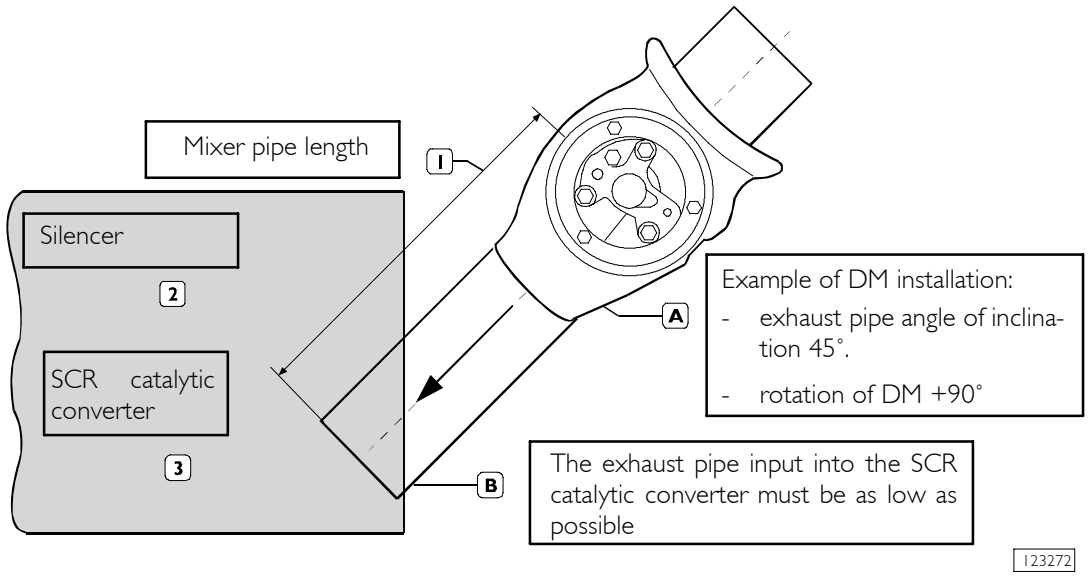
123271

Exhaust gas pipe installation angle:

The installation angle must be between +45° and -90°.

Installation of the form of dosing in relationship to the catalyst SCR:

Figure 6.27



NOTE The exhaust pipe input into the SCR catalytic converter must be located as low as possible. If the catalytic converter is turned so that the exhaust pipe input is located in the upper part, there is a danger of the hot exhaust gases going back into the dosing module if the engine stalls, with a consequent risk of damage.

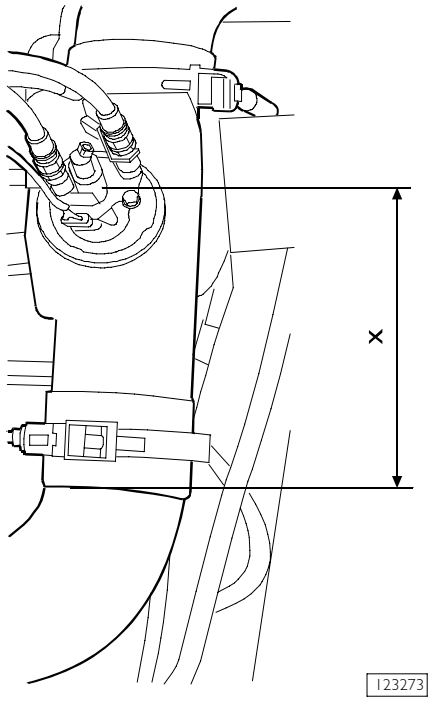
Distance of the DM from the SCR catalytic converter:

On IVECO Cursor engines, the distance of the DM from the SCR catalytic converter must not be less than 1200 mm. Lower distances must be checked and authorised in each individual case.
In some conversions, it may be necessary to locate the SCR catalytic converter in a new position on the vehicle. Taking into consideration the above conditions, the exhaust gas (start or mixer pipe to the inlet of the SCR plug) may be extended up to 3 m.
A further extension of the exhaust gas pipe makes it absolutely necessary to insulate the pipe to avoid excessive heat dispersion with a possible consequent malfunction of the SCR system SCR.

An overall exhaust pipe length of 6 m must not be exceeded under any circumstances.
The distance (X) between the DM and the next bend depends on the angle and the following distances must be complied with:

- 30° bend > distance 150 mm
- 45 bend > distance 200 mm
- 90° bend > distance 300 mm

If an adaptation should be necessary due to the tubomixer, the following requirements must be observed:
To prevent the formation of sediment in the exhaust pipe behind the mixer due to sharp edges or welds, a connection to the mixer must be created at least 10 mm before the end of its internal duct.



NOTE If the dosing module is moved, the pipes and electrical wiring must be modified.

6.5.5 Operations on exhaust pipes

NOTE The exhaust pipe layout cannot be changed without the approval of IVECO.

The exhaust pipe can be modified paying attention to the following warnings:

- Type approved (homologated) counter-pressures must be respected when determining the exhaust pipe route. Form bends with angles greater than 90° and radius of curvature greater than 2.5 times the pipe diameter. Keep the exhaust pipe far enough away from rubber or plastic parts and fit heat shields if necessary.
- It is not permitted to use pipes with diameters, thicknesses and materials other than those used for the original equipment.
- It is permitted to use hoses with limited lengths.
- In some conversions, it may be necessary to locate the SCR catalytic converter in a new position on the vehicle. Taking into consideration the above conditions, exhaust gas pipe (start of mixer pipe to the SCR plug intake) may be extended up to 3 m.
- A further extension of the exhaust gas pipe makes it absolutely necessary to insulate the pipe to avoid excessive heat dispersion with a possible consequent malfunction of the SCR system.

An overall exhaust pipe length of 6 m must not be exceeded under any circumstances.

Electrical wiring:

- It is only possible to lengthen cables for the temperature sensors.
- It is not possible to alter the length of the Nox sensor cable.

6.6 Wiring for positioning of SCR system components

If the SCR system components are moved (e.g. total or partial movement of the rails and lengthening of wheelbase), Iveco makes available replacement material and wiring to ensure final product quality.

Table 6.2 - Replacement of cables for repositioning of SCR system components

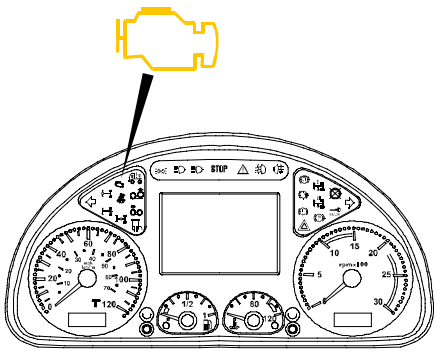
Basic pump module cable (for movement of the SCR Supply Module within the frame, on the left side).	dis. n° 41244952
2 m pump module movement cable. (To be added to the basic cable, in longer wheelbases and in cases where the wheelbase is lengthened)	dis. n° 41244954
P/N 4 m pump module movement cable. (To be added to the basic cable, in longer wheelbases and in cases where the wheelbase is lengthened)	dis. n° 41244955
Electrical cable for heated pre-filter (For movement of the heated prefilter to the left side of the frame	dis. n° 41245115
Fuel tank electrical cable (For movement of the tank to the left side of the frame)	dis. n° 41245116

6.7 OBD 1 - Stage 2

The Emissions Directive introduced on 1 October 2007 obliges industrial vehicle manufacturers to reduce engine performance if Nox emissions do not meet requirements laid down by the regulation during use of the vehicle.
When driving with the AdBlue reservoir empty (AdBlue level below the minimum operating level for the dosing unit) or with other causes that do not permit the vehicle to respect the NOx emission levels specified in the regulations, the engine will undergo a reduction in performance (derating) indicated in advance by the yellow OBD warning light coming on the instrument panel (see Figure 6.28).

This drop in performance is activated on the first occasion that vehicle speed is reduced to zero and persists until the emission control devices are restored to normal operating conditions, allowing the vehicle to comply with an NOx emissions again (e.g.: If the AdBlue reservoir is empty, it should simply be refilled) and has no effect on vehicle reliability.
Note also that the on-board control unit is legally bound to record such events so that they may be made available during any future police checks.

Figure 6.28

CONDITION	CONSEQUENCE	SYMBOL
AdBlue remains approximately 10% below the tank capacity	Driver notified (warning light flashes)	YELLOW warning light  125201
Non-compliance with Nox values established in standards: • AdBlue tank empty • Dosing stopped • Any deviation greater than 50% of average AdBlue consumption	AdBlue warning light comes on with continuous light, reduction in engine performance and fault code stored for 400 days or 9600 hours of engine operation	

OBD 1 - Stage 2