

# STRALIS AS/AT/AD

## EURO 4/5

**BODYBUILDERS INSTRUCTIONS**

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# IVECO

**EDITION 2008**



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## STRALIS AS/AT/AD EURO 4/5

Bodybuilders instructions  
Print 603.93.721 - 2<sup>nd</sup> edition  
Base - January 2008

### UPDATE DATA

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

(\*) Specific parts only for OBD I Phase 2.

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

|                      |                      |
|----------------------|----------------------|
| <b>3 - 4 - C - B</b> | <b>Stralis AS</b>    |
| <b>3 - 4 - C</b>     | <b>Stralis AT/AD</b> |

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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 from 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 shall 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](mailto: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.

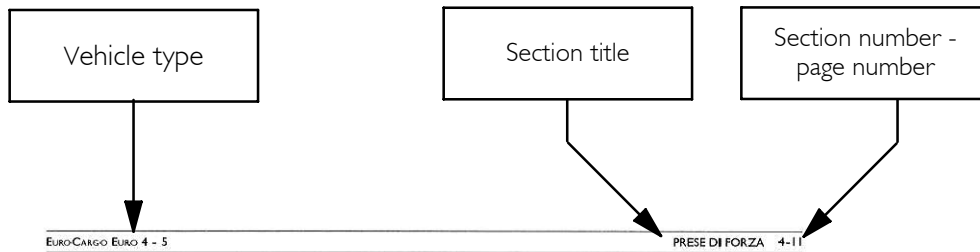


This indicates the correct use of materials in order to make the vehicle as environmentally friendly as possible.

**NOTE** Indicates additional information.



## Page header and footer interpretation



### 4.5 Prese di forza dal motore

In genere l'utilizzo di queste prese di forza è previsto per gli apparecchi che richiedono una alimentazione di tipo continuo.

#### 4.5.1 Prelievo da parte anteriore motore

Il prelievo del moto dalla parte anteriore dell'albero motore avviene, per limitati valori di potenza da prelevare (es.: comandi gruppi di condizionamento), per mezzo di trasmissioni a cinghie; l'utilizzo di alberi cardanici è di norma riservato per prelievi di maggior consistenza (es.: per impieghi municipali).

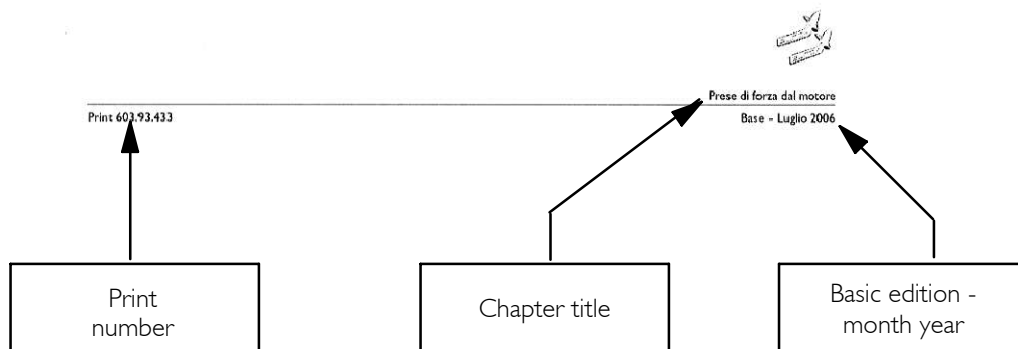
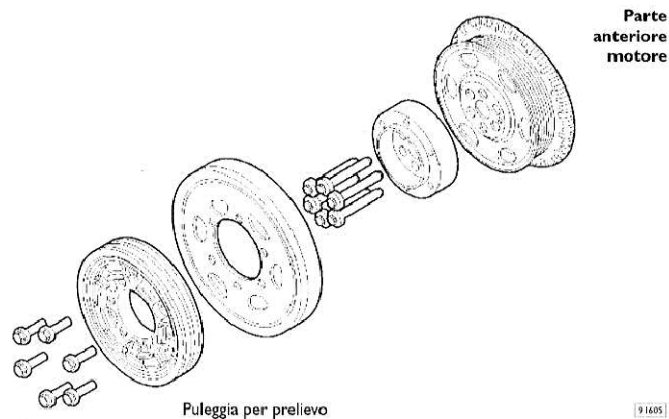
Queste realizzazioni, quando non previste specificamente in origine, richiedono in genere interventi onerosi sulla parte anteriore del veicolo quali modifiche a radiatore, cabina, paraurti, ecc. Occorrerà pertanto porre particolare attenzione:

- al sistema costituito da masse aggiunte e relative rigidzze che deve essere svincolato elasticamente dall'albero motore agli effetti torsionali e flessionali;
- ai valori delle masse aggiunte, ai relativi momenti d'inerzia ed alla distanza del baricentro delle masse dalla mezziera del primo supporto di banco, che dovranno essere contenuti il più possibile;
- a non ridurre la capacità di raffreddamento del radiatore;
- a ripristinare le caratteristiche di rigidzza e resistenza degli elementi modificati (traversa, paraurti, ecc.);
- a non superare negli utilizzi prolungati temperature dell'acqua di raffreddamento motore di 100°C e temperature olio motore (misurate sul condotto principale zona pressostato) di 120°C. Mantenere comunque margini di ca. il 10%. In caso contrario prevedere scambiatori di calore supplementari.

In Tabella 4.3 sono riportati i valori a cui far riferimento per il prelievo.

Sulla parte anteriore del motore è posizionata una puleggia con 2 gole da cui è possibile prelevare potenza. La posizione del prelievo e la dimensione della puleggia sono riportate nella figura che segue.

Figura 4.4



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## SECTION I

**General specifications**

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

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

## **I.2 IVECO “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.



### 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.



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

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

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

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

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

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

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

### **Instruction for added assemblies**

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

## **I.8 Legal Provisions**

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



## 1.9 Prevention of accidents



**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).**



## **I.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

## I.12 Vehicles identification

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

|                               | 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<br><br>AD<br><br>AT |   | PTT-Cab versions<br>(n°/10 → hung in ton)<br><br>PTC-Tractors<br>(with semitrailers)<br>(n°/10 → hung in ton) |   |   | STRALIS | Engine power<br><br>(n° x 10 → HP) |         | T<br><br>X<br>Y<br>Z |            | /TN<br>/P<br>/PT<br>/PS<br>/FP<br><br>/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





## **I.13 Dimensions and weights**

### **I.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.

### **I.13.2 Determining the Centre of Gravity of the Body and Payload**

#### **Positioning on longitudinal plane**

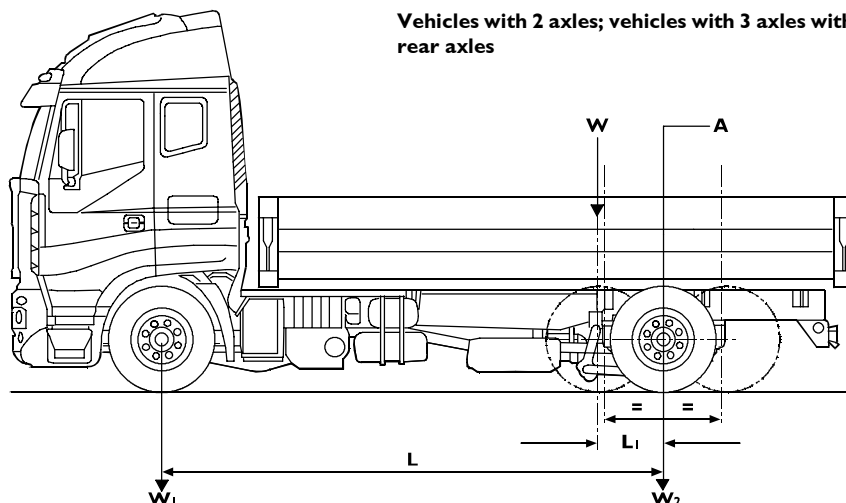
To establish the location of the centre of gravity of the body and payload the following examples below may be used as guidelines. The technical documentation specific to each model (chassis cab drawing) give the positions permitted with the vehicle in its standard form. The weight and positioning of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



Dimensions and weights

Figure I.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<sub>1</sub> = Share of payload on front axle

W<sub>2</sub> = Share of payload on rear axle (or tandem)

L<sub>1</sub> = Distance of centre of gravity from  
centre-line of rear axle  
(or tandem centre-line)

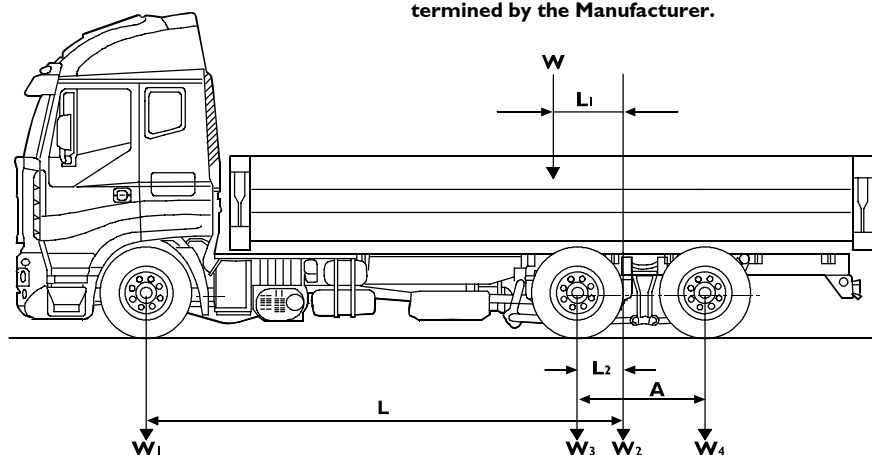
L = Actual wheelbase

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

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

Figure I.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<sub>1</sub> = Share of payload on front axle

W<sub>2</sub> = Share of payload on rear axles

W<sub>3</sub> = Share of payload on first rear axle

W<sub>4</sub> = Share of payload on second rear axle

L<sub>1</sub> = Distance of centre of gravity relative  
calculated centreline

L = Calculated wheelbase (ideal)

L<sub>2</sub> = 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).



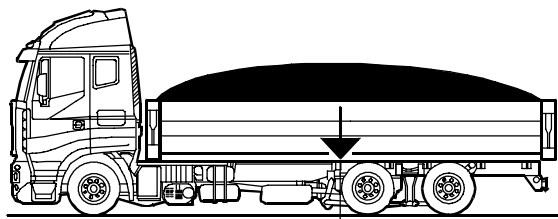
In order to apportion the payload on the axles, it must be uniformly distributed except when the shape of the loading surface itself entails a different distribution of the load.

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

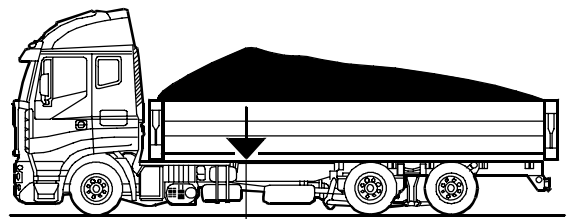
When building bodies or containers, loading and unloading systems for the transported goods must be devised which preclude excessive variations in the distribution of the load and/or excessive loads on the axles, also giving the relevant instructions to the users.

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

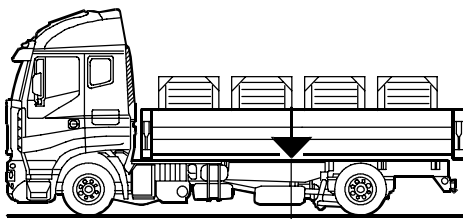
Figure 1.3



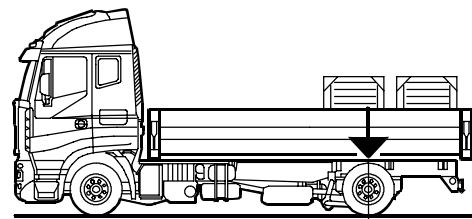
Uniform distribution of the load



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



Uniform distribution of the load



Non-uniform distribution of the 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).

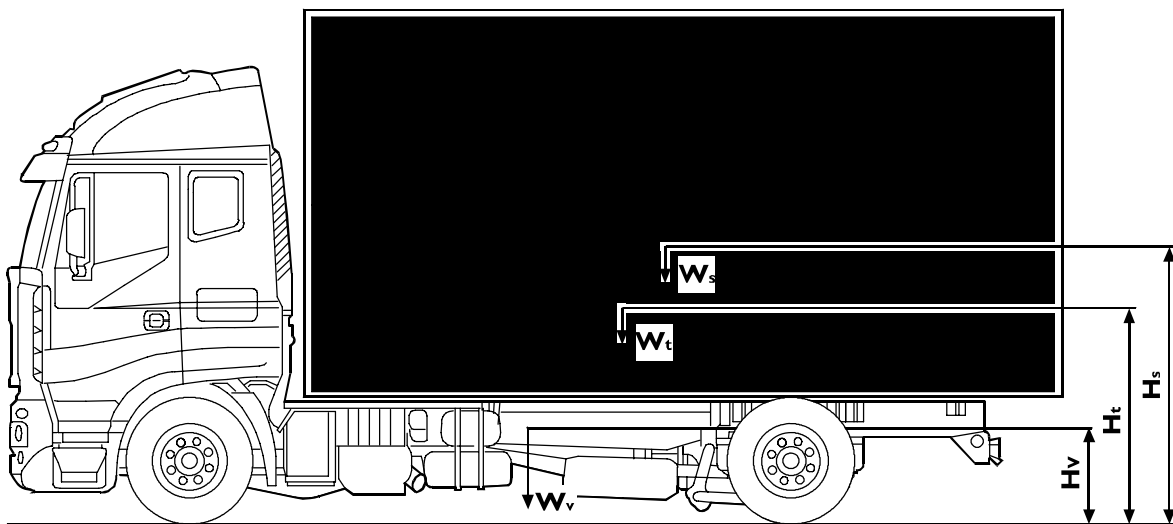
For testing the vehicle complete with superstructure, the bodybuilder must check that the height of the centre of gravity of the equipment including the payload, or of the entire vehicle when fully loaded, falls within the maximum permitted values.

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 I.4

Verification with full load:



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

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

- $W_v$  = Chassis cab vehicle kerb weight  
 $H_v$  = Height of centre of gravity of chassis cab vehicle (laden condition)  
 $W_s$  = Body and payload  
 $H_s$  = Height of centre of gravity of body and payload in relation to ground  
 $W_t$  = Vehicle weight when fully loaded  
 $H_t$  = Height of centre of gravity of vehicle fully laden to gvw

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

The height of the centre of gravity indicated in 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.).

### I.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.



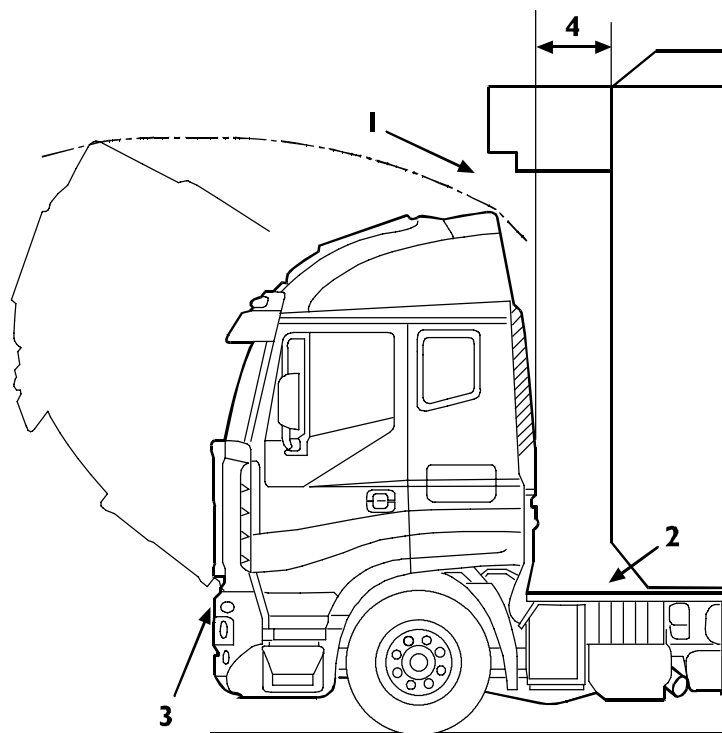
## I.14 Instructions for the Correct Functioning of the Parts of the Vehicle and Accessibility for Maintenance

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

For example:

- Ready access to all parts requiring inspection or maintenance and periodic servicing must be provided. In the case of closed body types suitable opening doors must be provided.
- For tilting cabs, adequate space permitting tilting must be assured. In the case of structures which involve the space above the driver's cab, adequate space for the passage of intake air must be guaranteed (see I.5).

Figure I.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 cowl, 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 3<sup>rd</sup> 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.

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

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

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

IVECO believes it essential for bodybuilders to be equipped 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.

## **I.16 Vehicle maintenance**

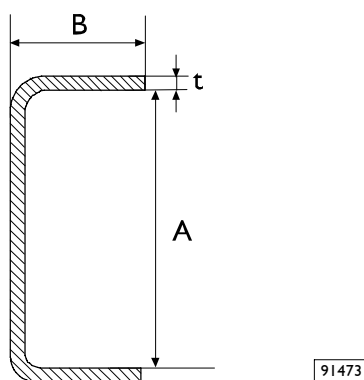
In addition to making the necessary checks on the body/structure in keeping with customary working procedures, the bodybuilder shall perform the checks specified in the "IVECO pre-delivery inspection" list, which can be obtained from the IVECO network, for the aspects affected by the modifications performed.



## I.17 Conventions

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

Figure I.6





**SECTION 2****Chassis modifications**

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## 2.1 General instructions for chassis modifications

Particular attention must be given to the following points:

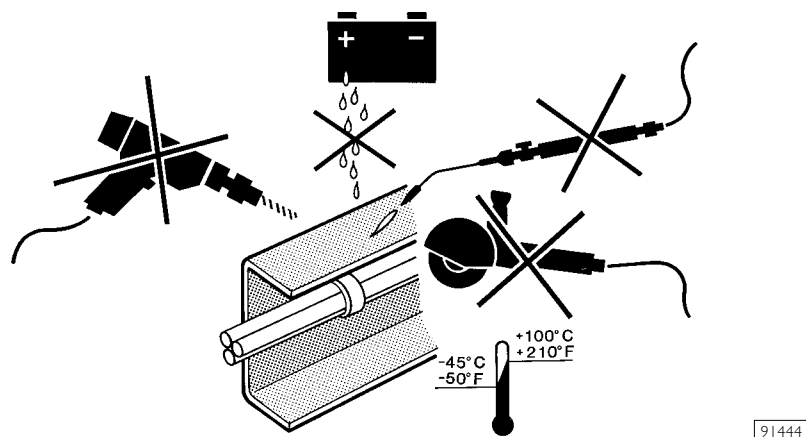
- **Welding to the bearing structures of the chassis is explicitly prohibited** (with the exception of the items described at points 2.3.4, 2.4 e 2.5).
- **Holes in the flanges of the side members are not permitted** (except for the items described at point 3.4).
- Where riveted connections exist and 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.



## 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 - I600 (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<br>GEO 321/8/PL (*)<br>GEO 321/8/PM (*) | (1) | DAC 320/5<br>GEO 321/5 (*)<br>GEO 500/5 (*) | (1) | -<br>-<br>- |
|                 | FE/ZN 12 III       | -                                                    |     | -                                           | yes | yes         |
|                 | FE/ZN 12 IV (*)    | -                                                    |     | -                                           | yes | yes         |
|                 | Zinc treatment     | -                                                    |     | yes                                         | -   | -           |
|                 | FE/ZN 12 V         | -                                                    |     | yes                                         | -   | -           |
| Aluminium       | Anodizing          | yes                                                  |     | yes                                         | yes | yes         |
|                 | Painting           | yes                                                  |     | -                                           | -   | -           |

(\*) Hexavalent chromium-free

(1) I.S. 18-1101

(2) I.S. 18-1102



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

| Description of the cycle phase                                                                     |                                             | Classes |           |     |           |       |
|----------------------------------------------------------------------------------------------------|---------------------------------------------|---------|-----------|-----|-----------|-------|
|                                                                                                    |                                             | A       | B (5)     | BI  | 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 I8-I600 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 <sup>1)</sup>**

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           | x                                  |   | x    |   | 2720                                                                                                    |
| AS/AD/AT 190/P         | x                                  |   | x    |   | 2750                                                                                                    |
| AS/AD/AT 260 Y/TN      | x                                  |   | x    |   | 2740                                                                                                    |
| AS/AD/AT 260 Y/P, Y/PS | x                                  |   | x    | x | 2720                                                                                                    |
| AS/AD/AT 260Z/P        | x                                  |   | x    | x | 2830                                                                                                    |
| AS/AD/AT 260/P         | x                                  |   | x    | x | 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.**

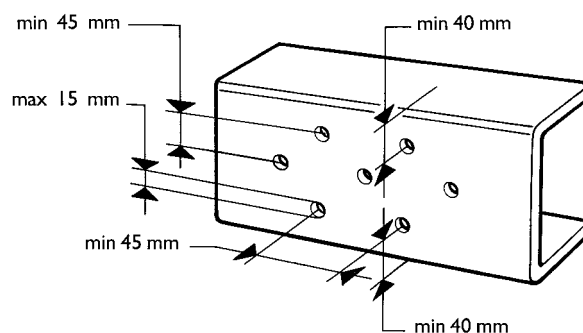
In those cases (installation of shelves, brackets etc.) where it is necessary to drill new holes, they must be drilled on the vertical web of the side member and must be carefully deburred and reamed.

### 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  $\leq 6\text{mm}$ , stainless steel parts are recommended. Approved finishes are Dacromet and zinc coating, as detailed in Table 2.2. A Dacromet finish is not recommended if the screws are to be subjected to welding. If space allows, use screws and nuts with flanged heads. Use self-locking nuts. Nuts must be tightened using a torque wrench set to the correct torque setting for the fixing.



Table 2.7 - Classes of resistance for screws

| Class of resistance | Usage                                                                           | Tensile strength (N/mm <sup>2</sup> ) | Yield point (N/mm <sup>2</sup> ) |
|---------------------|---------------------------------------------------------------------------------|---------------------------------------|----------------------------------|
| <b>4</b> (I)        | Non-load bearing screws                                                         | 400                                   | 320                              |
| <b>5.8</b> (I)      | Low resistance screws                                                           | 500                                   | 400                              |
| <b>8.8</b>          | Medium resistance screws<br>(cross members, cleat plates, brackets)             | 800                                   | 640                              |
| <b>10.9</b>         | High resistance screws<br>(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 <sup>2</sup> ) | Yield point (N/mm <sup>2</sup> ) | 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    |     |     |     |



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 <sup>2</sup> ) $\sigma$ 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 thermally-modified zones, consider a reduction of approx. 15% of the resistance characteristics.



### 2.3.4 Welding the Chassis

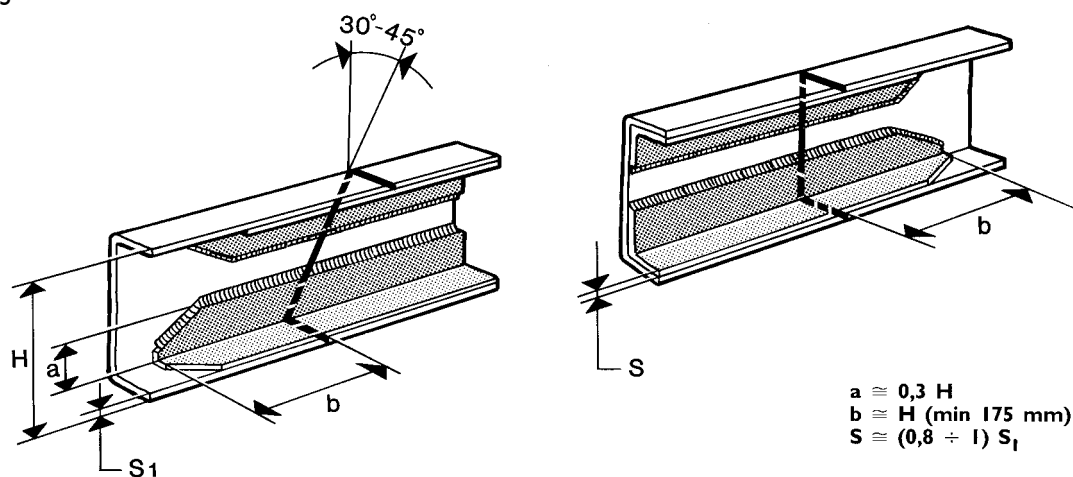


**Welding operations must only be carried out by specialist, trained personnel, using suitable equipment and in a perfectly workmanlike manner. Any intervention on the system not carried out as per instructions provided by IVECO or carried out by unskilled staff, might severely damage the on-board systems, 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



91448

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;

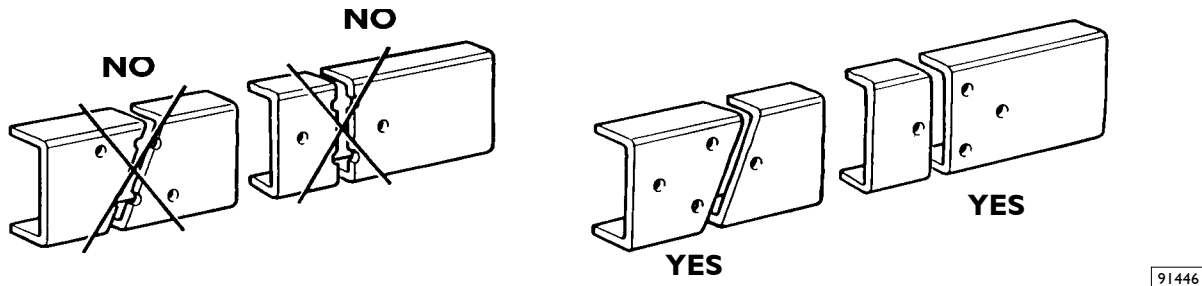


### Operations for welding preparation

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

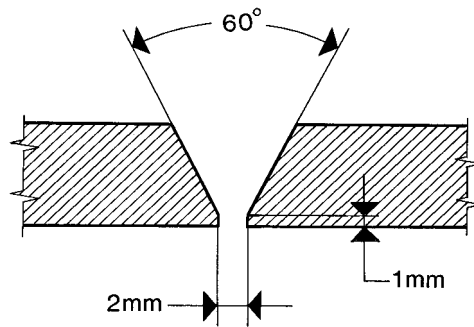


- b)** On the inner side of the side member give the parts that are to be joined a V-shaped chamfer of 60° along the entire length to be welded (see Figure 2.5).
- c)** Arc weld in stretches using carefully dried basic electrodes. The recommended electrodes are:  
 For S 500 MC (FeE490: QStE 500TM)  
 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.





Figure 2.5



91447

- 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<br>(observe tyre carrying capacity) | Max wheelbase value<br>between 1st steering<br>axle and 1st driving<br>axle (mm) | Kingpin offset<br>(mm) | Steering wheel<br>dia. (mm) |
|----------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------|-----------------------------|
| AS/AD/AT 190<br>(without CM)           | 8000                                                        | 6050                                                                             | 120                    | 470                         |
| AS/AD/AT 190/FP-CM                     | 8000<br>8000                                                | 5700<br>6700                                                                     | 120<br>120             | 470<br>510                  |
| AS/AD/AT 260 Y/P, Y/FP<br>(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<br>8000                                                | 4500<br>5100                                                                     | 120<br>120             | 470<br>510                  |
| AS/AD/AT 260 Y/PS, Y/FS<br>(with CM)   | 7500<br>7500<br>8000                                        | 5700<br>6050<br>5700                                                             | 120<br>120<br>120      | 470<br>510<br>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.



### 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

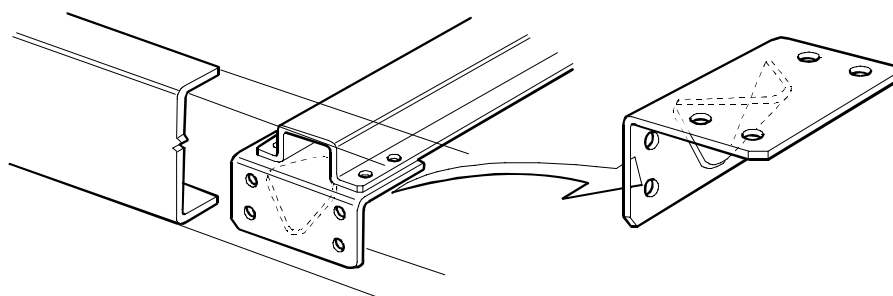
The necessity of applying one or more additional cross members depends on the length of the extension, the location of the transmission shaft support, the welding area, the introduction points of the forces produced by the body and the condition under which the vehicle is to be used.

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.



## 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 there are to be fitted to the modified section are given in Figure 2.3.

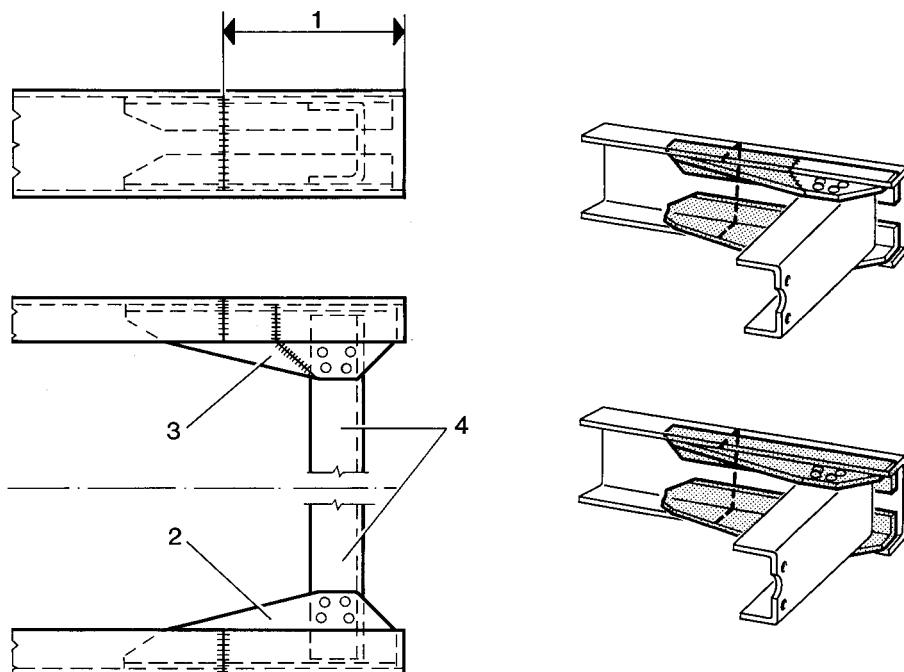
Figure 2.7 shows a typical method of extension for increases of 300 to 350 mm. In this case the reinforcing L-bars, which also serve to connect the cross member and the chassis frame, must be of the same thickness and width as the original gusset plate. The connection of the cross member and the plates,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



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.

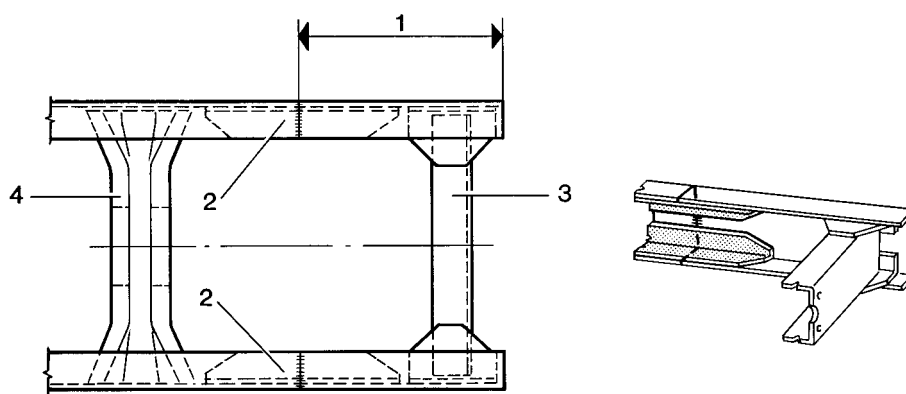
Figure 2.7



91454

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

Figure 2.8



91455

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.



## 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.

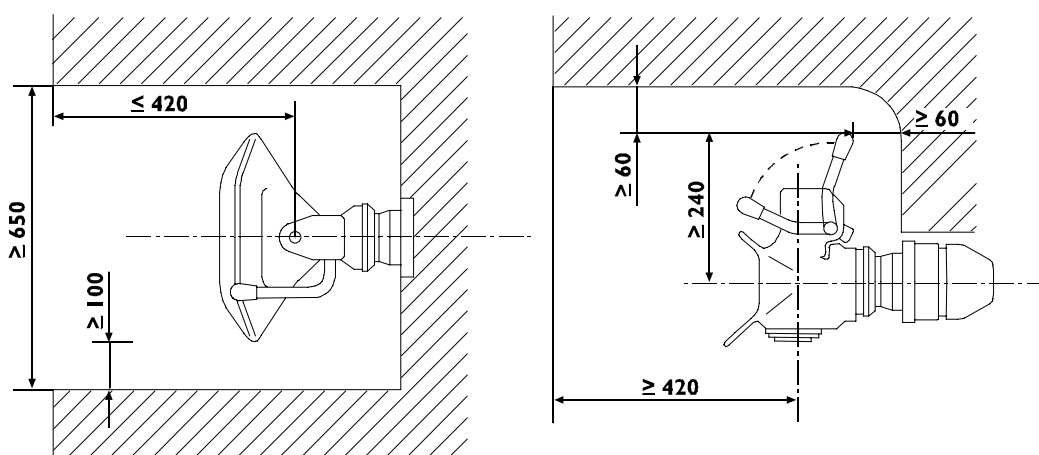


## 2.6.2 Traditional towing hooks

### 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



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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.





### 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:

$$F_v = a \cdot x^2/l^2 \cdot C \cdot 0,6 + S$$

$F_v$  = 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:

- $a = 1.8 \text{ m/sec}^2$  for vehicles with pneumatic suspension (or equivalent)
- $a = 2.4 \text{ m/sec}^2$  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).

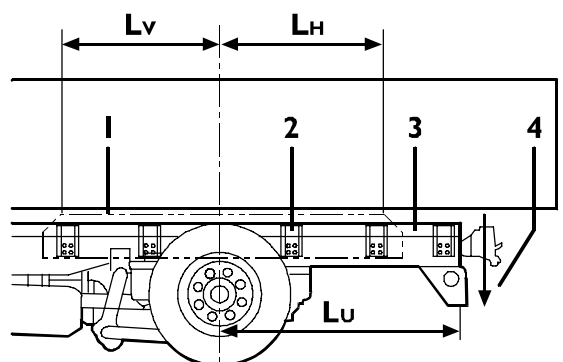
$S$  = Static support load (kN).

0,6 = Deceleration factor.



Figure 2.10

Chassis reinforcement for centre axle trailers



102183

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

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



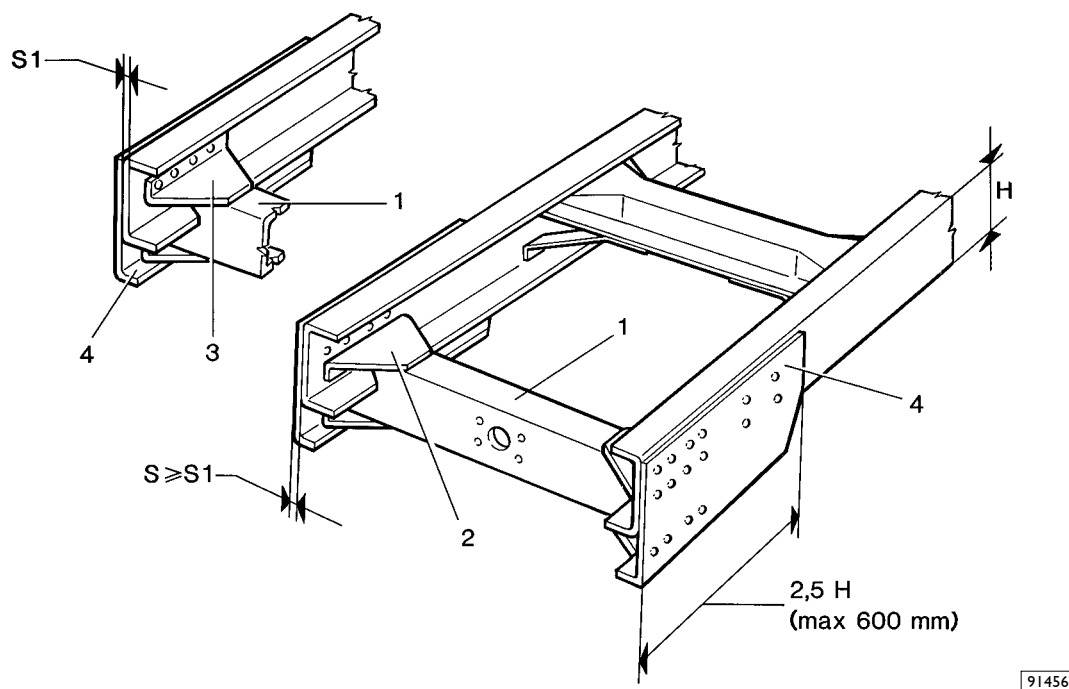
Installing a Towing Device

## 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

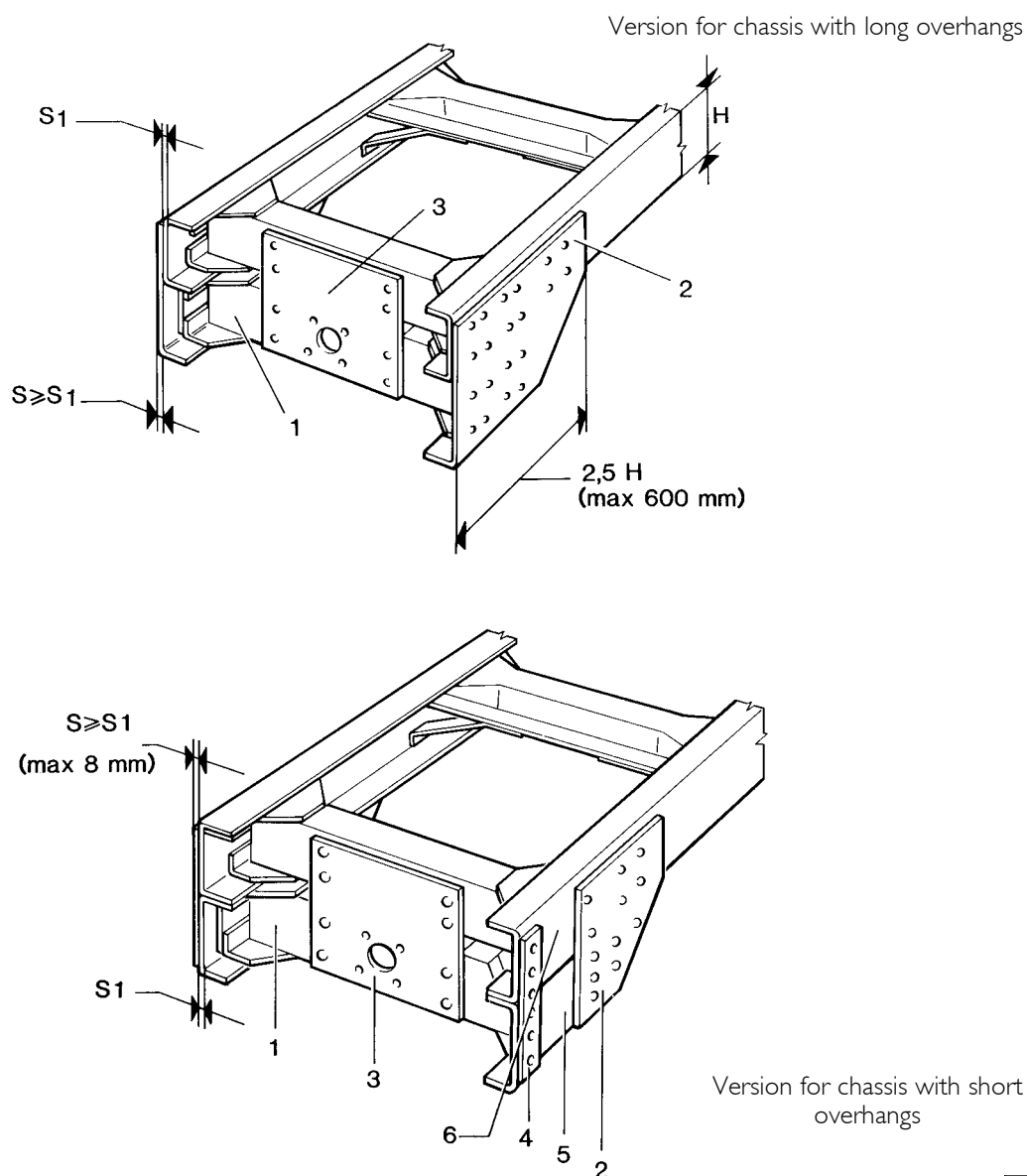
The thickness of the outer reinforcing angles must not be less than the thickness of the side members of the vehicle. They must cover a length which is at least 2,5 times the height of the side member itself (maximum 600 mm) and be made of material with the properties indicated in point 3.1.1. The angles 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



91457

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



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

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



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

| Models<br>(Chassis section)<br>(mm)                                                                        | Wheel<br>base<br>(mm) | Max.<br>body<br>overhang<br>(mm) | Towable weight (R) static load on towhook (S) to centre axle (kg)                                                |     |                     |     |                     |     |                     |     |                             |     |                     |     |                     |     |                     |     |
|------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|-----------------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|
|                                                                                                            |                       |                                  | R≤ 9500<br>S≤ 950                                                                                                |     | R≤ 12000<br>S≤ 1000 |     | R≤ 14000<br>S≤ 1000 |     | R≤ 16000<br>S≤ 1000 |     | R≤ 18000<br>S≤ 1000         |     | R≤ 20000<br>S≤ 1000 |     | R≤ 22000<br>S≤ 1000 |     | R≤ 24000<br>S≤ 1000 |     |
|                                                                                                            |                       |                                  | Section modulus for each longitudinal section of subframe Wx (cm³) depending on the material yield limit (N/mm²) |     |                     |     |                     |     |                     |     |                             |     |                     |     |                     |     |                     |     |
|                                                                                                            |                       |                                  | 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<br>19.0 t rear<br>289/199x80x6,7                                                          | 3805                  | 1757                             | 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                 |     |
|                                                                                                            | 4500                  | 2072                             | 74                                                                                                               | 46  | 89                  | 46  | 105                 | 46  | 105                 | 46  | 105                         | 57  | 119                 | 57  | 135                 | 74  | 150                 |     |
|                                                                                                            | 4800                  | 1712                             | 46                                                                                                               | 46  | 57                  | 46  | 74                  | 46  | 74                  | 46  | 74                          | 46  | 89                  | 46  | 105                 | 46  | 105                 |     |
|                                                                                                            | 4800                  | 2072                             | 89                                                                                                               | 46  | 89                  | 46  | 105                 | 46  | 105                 | 57  | 119                         | 57  | 135                 | 74  | 150                 | 89  | 173                 |     |
|                                                                                                            | 5100                  | 1802                             | 74                                                                                                               | 46  | 74                  | 46  | 74                  | 46  | 89                  | 46  | 105                         | 46  | 105                 | 46  | 105                 | 74  | 105                 |     |
|                                                                                                            | 5700                  | 2432                             | 105                                                                                                              | 46  | 105                 | 74  | 150                 | 74  | 150                 | 74  | 173                         | 74  | 208                 | 89  | 208                 | 105 | 208                 |     |
|                                                                                                            | 6050                  | 2657                             | 150                                                                                                              | 74  | 150                 | 74  | 173                 | 89  | 208                 | 105 | 208                         | 105 | 245                 | 105 | 245                 | 105 | 286                 |     |
| AS 260 S .. Y/PT<br>20.0 t rear<br>289/199x80x6,7                                                          | 3805                  | 1757                             | 57                                                                                                               | 46  | 74                  | 46  | 74                  | 46  | 74                  | 46  | 89                          | 46  | 105                 | 46  | 105                 | 57  | 105                 |     |
|                                                                                                            | 4200                  | 2117                             | 105                                                                                                              | 46  | 105                 | 57  | 119                 | 57  | 135                 | 74  | 150                         | 89  | 173                 | 89  | 173                 | 105 | 208                 |     |
|                                                                                                            | 4500                  | 2072                             | 105                                                                                                              | 46  | 105                 | 57  | 119                 | 74  | 150                 | 74  | 150                         | 89  | 173                 | 89  | 208                 | 105 | 208                 |     |
|                                                                                                            | 4800                  | 1712                             | 74                                                                                                               | 46  | 89                  | 46  | 105                 | 46  | 105                 | 57  | 105                         | 74  | 135                 | 74  | 150                 | 74  | 150                 |     |
|                                                                                                            | 4800                  | 2072                             | 105                                                                                                              | 57  | 119                 | 74  | 150                 | 74  | 150                 | 89  | 173                         | 89  | 208                 | 105 | 208                 | 105 | 208                 |     |
|                                                                                                            | 5100                  | 1802                             | 105                                                                                                              | 46  | 105                 | 57  | 105                 | 74  | 105                 | 74  | 150                         | 74  | 150                 | 74  | 173                 | 74  | 208                 |     |
|                                                                                                            | 5700                  | 2432                             | 150                                                                                                              | 74  | 208                 | 89  | 208                 | 105 | 208                 | 105 | 245                         | 105 | 245                 | 135 | 286                 | 150 | 286                 |     |
|                                                                                                            | 6050                  | 2657                             | 208                                                                                                              | 105 | 245                 | 105 | 245                 | 105 | 245                 | 150 | 286                         | 150 | 286                 | 150 | 317                 | 173 | 343                 |     |
| AS 260 S Y/PT<br>21.0 t rear<br>289/199x80x6,7                                                             | 3805                  | 1757                             | 89                                                                                                               | 46  | 105                 | 46  | 105                 | 57  | 105                 | 74  | 135                         | 74  | 150                 | 74  | 150                 | 74  | 173                 |     |
|                                                                                                            | 4200                  | 2117                             | 150                                                                                                              | 74  | 150                 | 89  | 173                 | 89  | 208                 | 105 | 208                         | 105 | 208                 | 105 | 245                 | 105 | 245                 |     |
|                                                                                                            | 4500                  | 2072                             | 150                                                                                                              | 74  | 173                 | 89  | 208                 | 89  | 208                 | 105 | 208                         | 105 | 245                 | 105 | 245                 | 119 | 245                 |     |
|                                                                                                            | 4800                  | 1712                             | 105                                                                                                              | 74  | 150                 | 74  | 150                 | 74  | 150                 | 74  | 173                         | 89  | 208                 | 89  | 208                 | 105 | 208                 |     |
|                                                                                                            | 4800                  | 2072                             | 173                                                                                                              | 89  | 208                 | 89  | 208                 | 105 | 208                 | 105 | 245                         | 105 | 245                 | 105 | 245                 | 150 | 286                 |     |
|                                                                                                            | 5100                  | 1802                             | 150                                                                                                              | 74  | 150                 | 74  | 173                 | 89  | 208                 | 89  | 208                         | 105 | 208                 | 105 | 245                 | 105 | 245                 |     |
|                                                                                                            | 5700                  | 2432                             | 245                                                                                                              | 105 | 245                 | 105 | 286                 | 150 | 286                 | 150 | 286                         | 150 | 317                 | 173 | 343                 | 208 | 343                 |     |
|                                                                                                            | 6050                  | 2657                             | 286                                                                                                              | 150 | 286                 | 150 | 317                 | 173 | 343                 | 208 | 343                         | 208 | 374                 | 208 | 374                 | 245 | 406                 |     |
| AS/AD/AT 260 S<br>Y/P., Y/FP<br>19.0 t rear<br>Invalid for versions /<br>TN,PT CT and GV<br>289/199x80x6,7 | 3120                  | 722                              | 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                 |     |
|                                                                                                            | 4200                  | 1127                             | 46                                                                                                               | 46  | 57                  | 46  | 57                  | 46  | 57                  | 46  | 74                          | 46  | 89                  | 46  | 89                  | 46  | 89                  |     |
|                                                                                                            | 4200                  | 1622                             | 105                                                                                                              | 46  | 105                 | 57  | 119                 | 57  | 119                 | 74  | 150                         | 89  | 173                 | 89  | 173                 | 89  | 173                 |     |
|                                                                                                            | 4200                  | 2117                             | 150                                                                                                              | 89  | 173                 | 89  | 173                 | 105 | 173                 | 105 | 208                         | 119 | 245                 | 135 | 245                 | 150 | 245                 |     |
|                                                                                                            | 4500                  | 1217                             | 57                                                                                                               | 46  | 74                  | 46  | 74                  | 46  | 89                  | 46  | 89                          | 46  | 105                 | 46  | 105                 | 57  | 105                 |     |
|                                                                                                            | 4500                  | 1622                             | 105                                                                                                              | 57  | 105                 | 57  | 119                 | 74  | 135                 | 89  | 173                         | 89  | 173                 | 89  | 173                 | 105 | 173                 |     |
|                                                                                                            | 4500                  | 1802                             | 119                                                                                                              | 57  | 135                 | 89  | 173                 | 89  | 173                 | 89  | 173                         | 105 | 173                 | 105 | 173                 | 105 | 208                 |     |
|                                                                                                            | 4500                  | 2072                             | 173                                                                                                              | 89  | 173                 | 105 | 173                 | 105 | 173                 | 105 | 208                         | 119 | 245                 | 135 | 245                 | 150 | 245                 |     |
|                                                                                                            | 4800                  | 1487                             | 105                                                                                                              | 46  | 105                 | 57  | 105                 | 57  | 119                 | 74  | 135                         | 74  | 150                 | 89  | 173                 | 89  | 173                 |     |
|                                                                                                            | 4800                  | 1712                             | 119                                                                                                              | 57  | 135                 | 74  | 150                 | 89  | 173                 | 89  | 173                         | 105 | 173                 | 105 | 173                 | 105 | 208                 |     |
|                                                                                                            | 4800                  | 2072                             | 173                                                                                                              | 105 | 173                 | 105 | 173                 | 105 | 208                 | 119 | 245                         | 135 | 245                 | 150 | 245                 | 173 | 245                 |     |
|                                                                                                            | 5100                  | 1802                             | 150                                                                                                              | 89  | 173                 | 89  | 173                 | 105 | 173                 | 105 | 173                         | 105 | 173                 | 119 | 245                 | 119 | 245                 |     |
|                                                                                                            | 5700                  | 2432                             | 105                                                                                                              | 46  | 105                 | 74  | 150                 | 74  | 150                 | 74  | 173                         | 74  | 208                 | 89  | 208                 | 105 | 208                 |     |
|                                                                                                            | 6050                  | 2657                             | 150                                                                                                              | 74  | 150                 | 74  | 173                 | 89  | 208                 | 105 | 208                         | 105 | 245                 | 105 | 245                 | 105 | 286                 |     |



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

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





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

| Models<br>(Chassis section)<br>(mm)                                                            | Wheel<br>base<br>(mm) | Max.<br>body<br>overhang<br>(mm) | Towable weight (R) static load on towhook (S) to centre axle (kg)                                                                          |     |                     |     |                     |     |                     |     |                             |     |                     |     |                     |     |                     |     |
|------------------------------------------------------------------------------------------------|-----------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|-----------------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|
|                                                                                                |                       |                                  | R≤ 9500<br>S≤ 950                                                                                                                          |     | R≤ 12000<br>S≤ 1000 |     | R≤ 14000<br>S≤ 1000 |     | R≤ 16000<br>S≤ 1000 |     | R≤ 18000<br>S≤ 1000         |     | R≤ 20000<br>S≤ 1000 |     | R≤ 22000<br>S≤ 1000 |     | R≤ 24000<br>S≤ 1000 |     |
|                                                                                                |                       |                                  | Section modulus for each longitudinal section of subframe Wx (cm <sup>3</sup> ) depending on the material yield limit (N/mm <sup>2</sup> ) |     |                     |     |                     |     |                     |     |                             |     |                     |     |                     |     |                     |     |
|                                                                                                |                       |                                  | 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<br>Y/FP-GV<br>only with CCM 11954<br>1200 towbar<br>19 t rear<br>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<br>19.0 t rear<br>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<br>50:50 o 60:40<br>21.0 t rear<br>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<br>(Chassis section)<br>(mm)                 | Wheel<br>base<br>(mm) | Max.<br>body<br>overhang<br>(mm) | Towable weight (R) static load on towhook (S) to centre axle (kg)                                                                          |     |                     |     |                     |     |                     |     |                             |     |                     |     |                     |     |                     |     |
|-----------------------------------------------------|-----------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|-----------------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|
|                                                     |                       |                                  | R≤ 9500<br>S≤ 950                                                                                                                          |     | R≤ 12000<br>S≤ 1000 |     | R≤ 14000<br>S≤ 1000 |     | R≤ 16000<br>S≤ 1000 |     | R≤ 18000<br>S≤ 1000         |     | R≤ 20000<br>S≤ 1000 |     | R≤ 22000<br>S≤ 1000 |     | R≤ 24000<br>S≤ 1000 |     |
|                                                     |                       |                                  | Section modulus for each longitudinal section of subframe Wx (cm <sup>3</sup> ) depending on the material yield limit (N/mm <sup>2</sup> ) |     |                     |     |                     |     |                     |     |                             |     |                     |     |                     |     |                     |     |
|                                                     |                       |                                  | 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<br><br>21.0 t rear<br>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<br><br>19.0 t rear<br>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<br><br>20.0 t rear<br>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<br><br>21.0 t rear<br>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<br><br>19.0 t rear<br>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<br><br>20.0 t rear<br>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<br><br>21.0 t rear<br>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 <sup>2</sup> )                                         | ≤ 320                                    | ≤ 320                                    | ≤ 240                                     | ≤ 240                                     | ≤ 360                                     | ≤ 360                                     |
| Max. runner profile height reduction (mm):                                        | 40                                       | 60                                       | 100                                       | 120                                       | 100                                       | 120                                       |
| Combined reinforcements length<br>L <sub>V</sub> :<br>L <sub>H</sub> :            | 0.5.L <sub>U</sub><br>0.6.L <sub>U</sub> | 0.5.L <sub>U</sub><br>0.6.L <sub>U</sub> | 0.8.L <sub>U</sub><br>0.95.L <sub>U</sub> | 0.85.L <sub>U</sub><br>1.0.L <sub>U</sub> | 0.8.L <sub>U</sub><br>0.95.L <sub>U</sub> | 0.85.L <sub>U</sub><br>1.0.L <sub>U</sub> |
| Example: Combined section as an alternative to the channel section C250x80x8 (mm) | 210X80X8                                 | 190X80X8                                 | 150x80x8<br>+ straight section<br>15x80   | 130x80x8<br>+ straight section<br>15x80   | 150x80x8<br>+ angle section               | 130x80x8<br>+ 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 envisaged, do not require particular chassis reinforcing devices. For the sub-frame, the runner profile dimensions indicated for the different types of equipment (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.

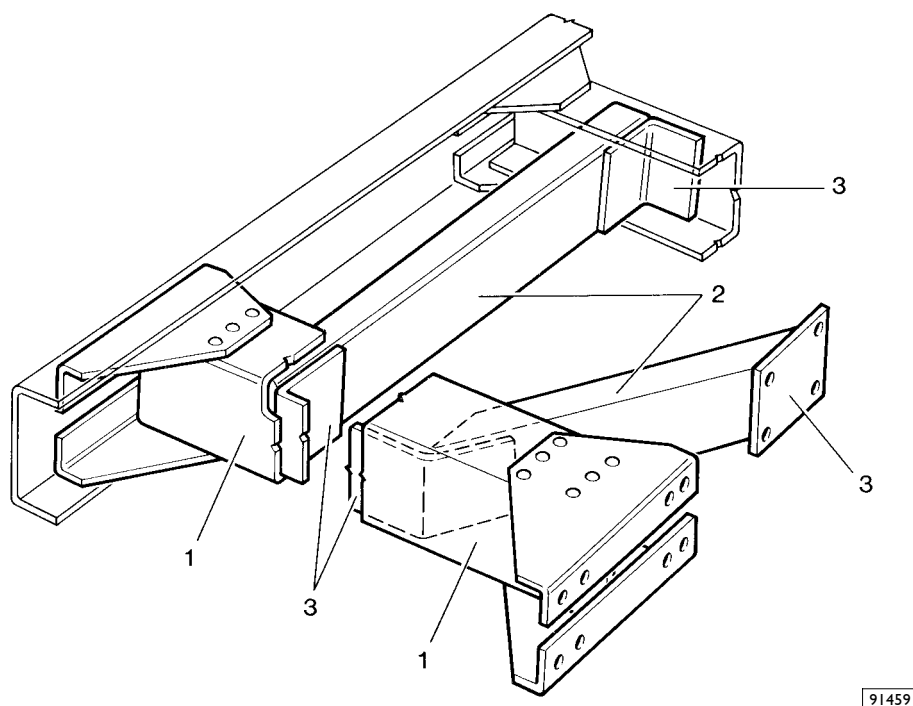
These reinforcements may consist of C-sections mounted on the inside of the cross member. Care must be taken to ensure that the connections between the cross member and the side members are also reinforced following the procedures recommended below, whenever stronger enforcements are required:

- I) 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

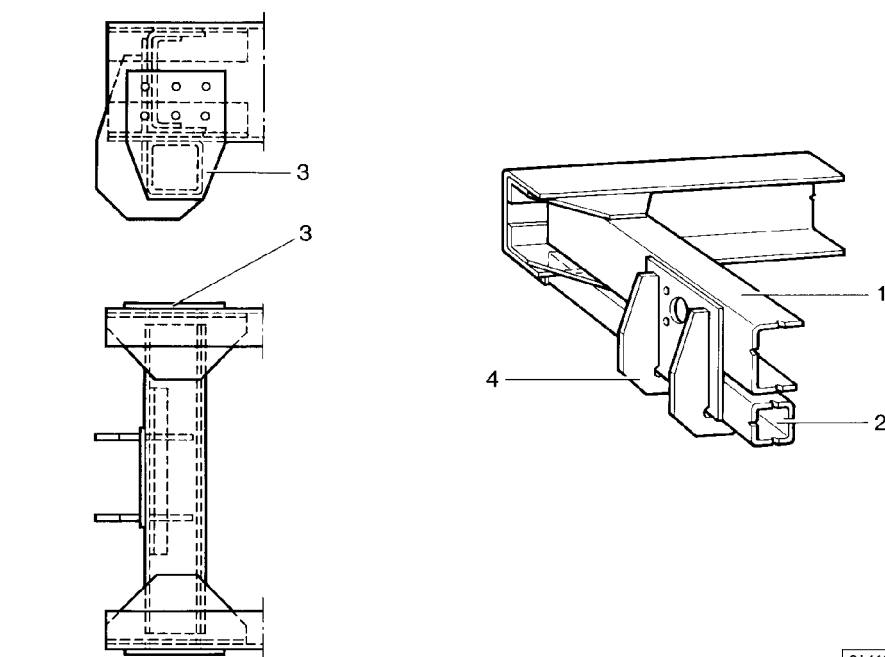
- 2)** Mounting a box section of suitable dimensions underneath the cross member, anchored at the extremities to the vertical web of the side members and joined at the centre of the cross member as shown in Figure 2.14.

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



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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 involves 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.

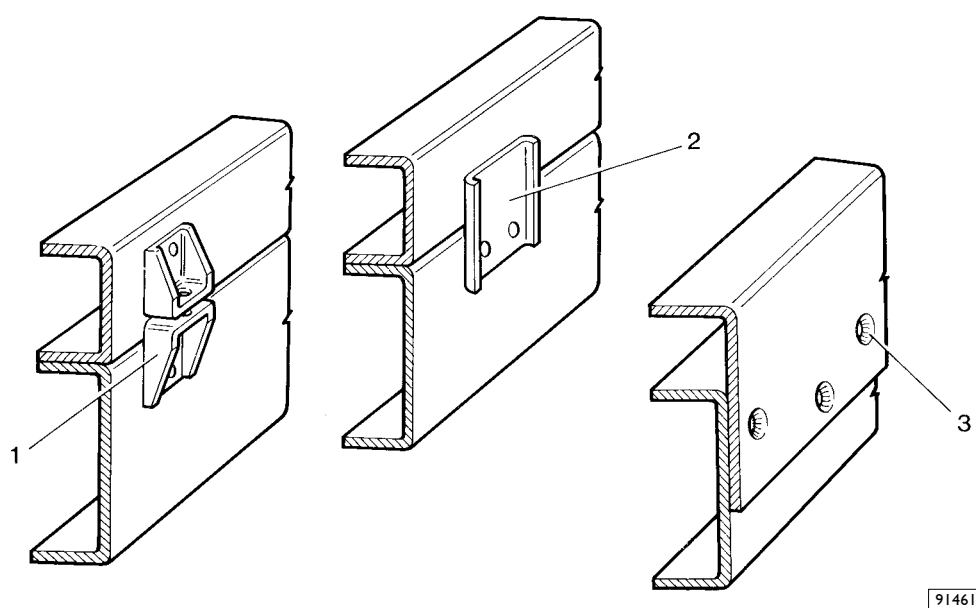
### 2.7.2 Chassis Frame Reinforcement

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.



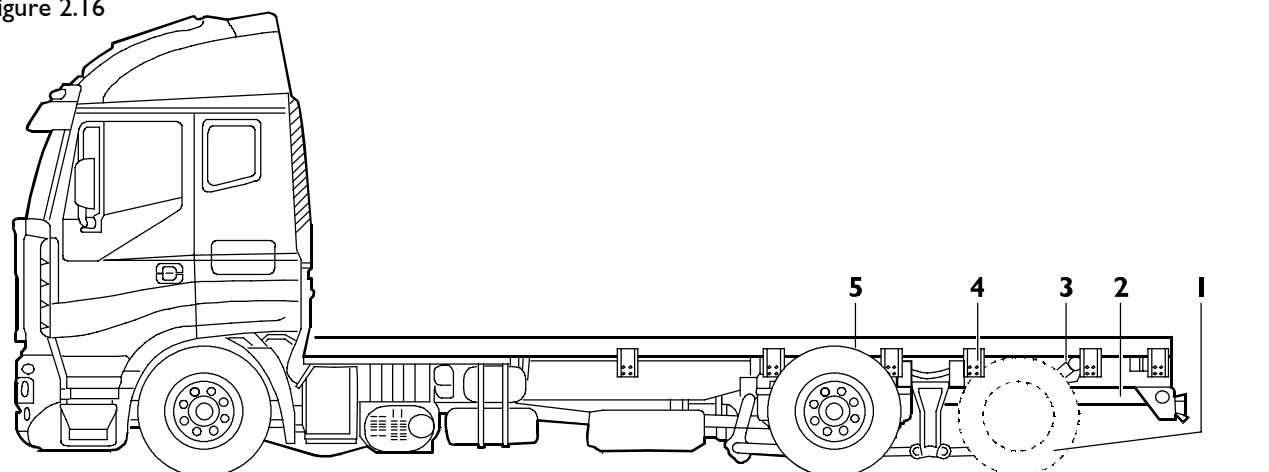
### 2.7.3 Installing a Rear Supplementary Axle

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



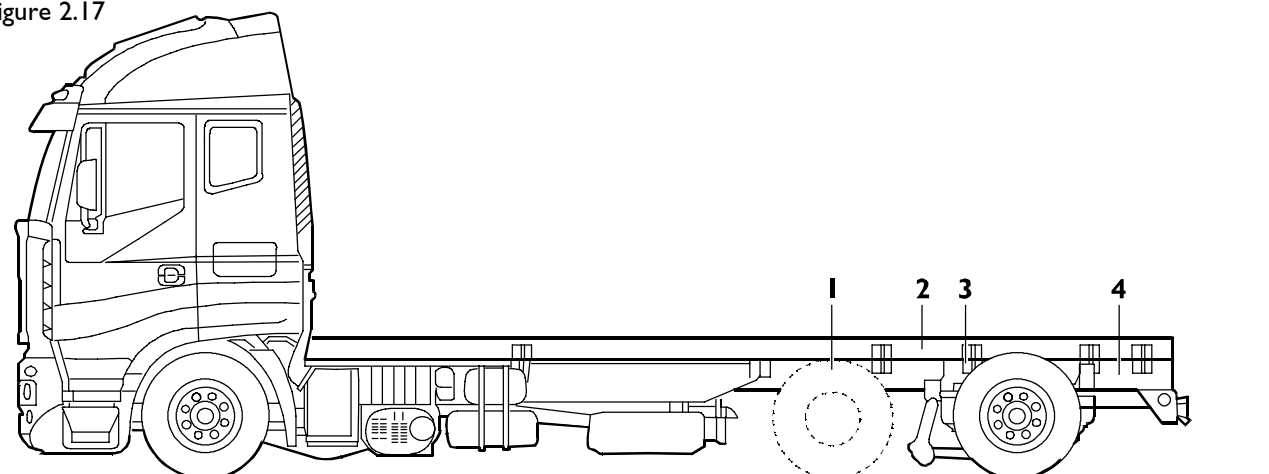
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1. Added supplementary axle - 2. Extension to the overhang - 3. Reinforcements for the modification of the chassis -  
4. Connections - 5. Reinforcing runner

### 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



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





### **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 the 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.



### 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 1.1 3.2 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.



## 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.

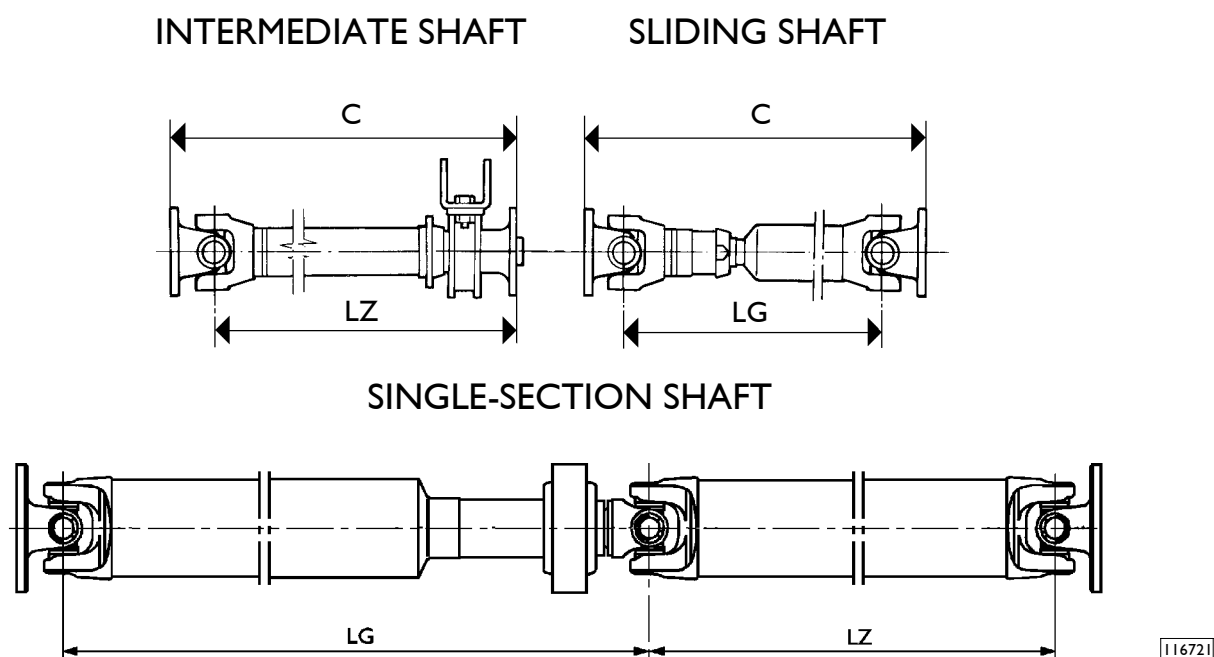
The purpose of the specifications contained in this manual is to ensure the proper functioning of the transmission, to limit its noise and to avoid the build-up of stress transmitted from the engine assembly. In no way does this diminish the responsibility of the body-builder for the work he has completed.

### 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 |





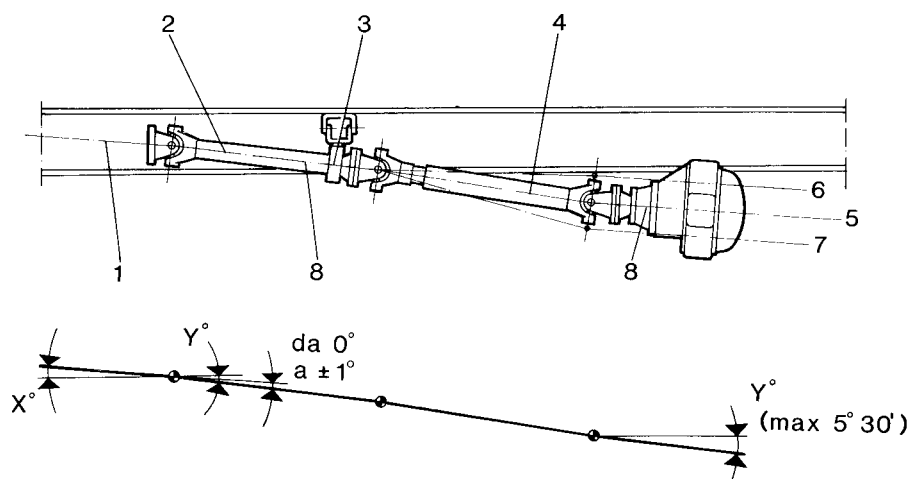
The maximum possible lengths given above refer to the original shafts; plan for shorter lengths (-10%) for shafts obtained for by modification.

## 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



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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



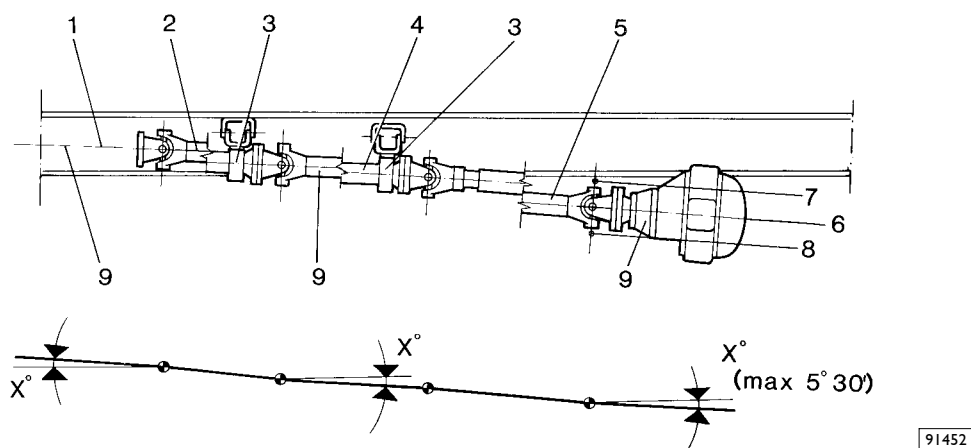
The intermediate shaft and the inclination of the rear axle case must be aligned accurately.

The difference in their inclination relative to the engine-clutch-gearbox axis must not vary more than  $1^\circ$ . 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  $5.5^\circ$ .

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

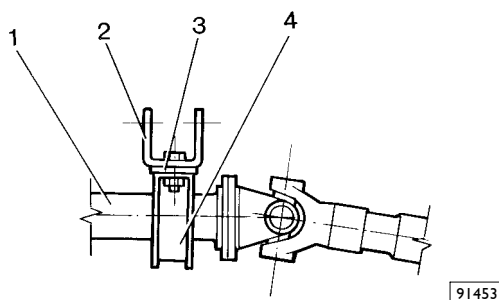


1. Engine, clutch, gearbox axis - 2. 1<sup>st</sup> intermediate shaft - 3. Intermediate shaft support - 4. 2<sup>nd</sup> intermediate shaft - 5. Propeller shaft with splined end - 6. Inclination of rear axle case (static load) - 7. Inclination of rear axle case (max. compression) - 8. Inclination of rear axle case (unladen) - 9. Gearbox, 2<sup>nd</sup> 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<sup>2</sup> (42 kg/mm<sup>2</sup>) 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”.**





## 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 filter 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.



## 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.



## 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.



## **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 integrity 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.



## 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<br>9.0 | 98<br>89                | 105<br>99                   |
| 295/60R22,5                 | 8.25<br>9.0 | 98<br>89                | 105<br>99                   |
| 305/60R22,5                 | 8.25<br>9.0 | 96<br>87                | 103<br>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<br>9.0 | 93<br>84                | 100<br>94                   |
| 315/70R22,5                 | 9.0         | 82                      | 94                          |
| 275/80R22,5                 | 7.5<br>8.25 | 95<br>91                | 95                          |
| 395/080R22.5<br>295/80R22.5 | 8.25<br>9.0 | 89<br>80                | 96<br>91                    |
| 315/80R22,5                 | 9.0         | 79                      | 89                          |

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



## 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 : min. 6 Ø outer dia  
(referred to the pipe centreline)



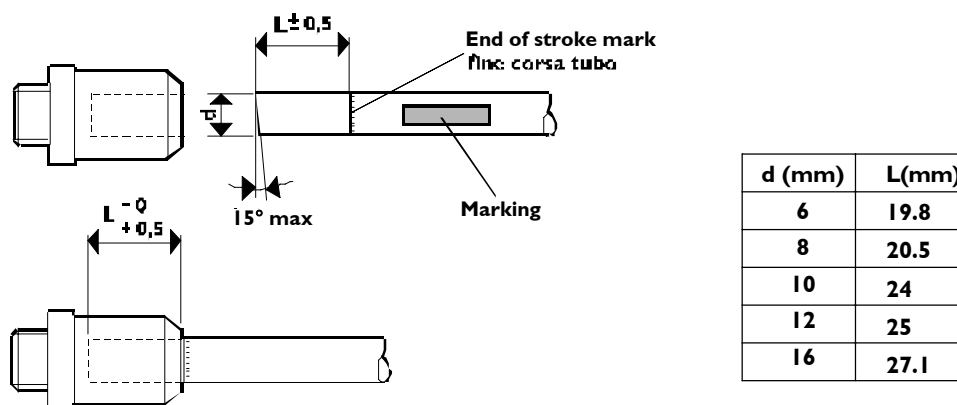


### Preparation and installation (Iveco Standard 17-2403)

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



91463

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

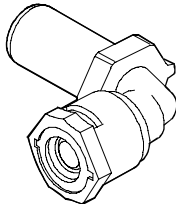
| Type                                                                                            | pipe<br>Ø | coupling<br>Ø | VOSS<br>reference | IVECO<br>reference | GENERAL NOTES<br>Possible couplings with other connectors                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------|-----------|---------------|-------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>SV 214/W | 6         | 6             | 5214010000        | 504149122          | <b>Straight connector Ø 6</b><br>IVECO No. 504148941 with thread M10x1<br>IVECO No. 504148950 with thread M12x1.5<br>IVECO No. 504148962 with thread M12x1.5<br>IVECO No. 504148965 with thread M22x1.5<br><br><b>Intermediate connector Ø 6 - 6</b><br>IVECO No. 504149318 |
|                                                                                                 | 8         | 8             | 5214010200        | 504149132          | <b>Straight connector Ø 8</b><br>IVECO No. 504148948 with thread M10x1<br>IVECO No. 504148956 with thread M12x1.5<br>IVECO No. 504148963 with thread M16x1.5<br>IVECO No. 504148966 with thread M22x1.5<br><br><b>Intermediate connector Ø 8 - 8</b><br>IVECO No. 504149327 |
|                                                                                                 | 6         | 12            | 5214010700        | 504149133          | <b>Straight connector Ø 12</b><br>IVECO No. 504148959 with thread M12x1<br>IVECO No. 504148964 with thread M16x1.5<br>IVECO No. 504149016 with thread M22x1.5                                                                                                               |
|                                                                                                 | 8         |               | 5214010900        | 504149136          |                                                                                                                                                                                                                                                                             |
|                                                                                                 | 12        |               | 5214011100        | 504149139          | <b>Intermediate connector Ø 12 - 6/8/12</b><br>IVECO No. 504149332                                                                                                                                                                                                          |



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

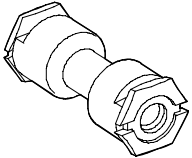
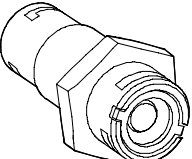
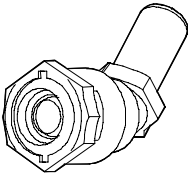
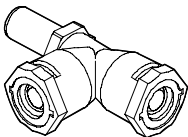
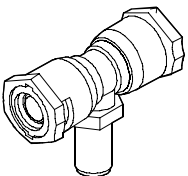
| Type                                                                                            | SW key | pipe<br>Ø  | Receptacle<br>connector<br>thread                                          | VOSS<br>reference | IVECO<br>reference | GENERAL NOTES<br>Possible couplings with other<br>connectors                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------|--------|------------|----------------------------------------------------------------------------|-------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>SV 214/GV   |        | 6          |                                                                            | 5214012000        | 504149318          | <b>90° connector Ø 6</b><br>IVECO No. 504149122 coupling Ø 6                                                                                                                                                                                                                                                                                                                            |
|                                                                                                 |        | 8          |                                                                            | 5214012100        | 504149327          | <b>90° connector Ø 8</b><br>IVECO No. 504149132 coupling Ø 8                                                                                                                                                                                                                                                                                                                            |
|                                                                                                 |        | 12         |                                                                            | 5014012200        | 504149332          | <b>90° connector Ø 6</b><br>IVECO No. 504149133 coupling Ø 12<br><b>90° connector Ø 6</b><br>IVECO No. 504149136 coupling Ø 12<br><b>90° connector Ø 6</b><br>IVECO No. 504149139 coupling Ø 12<br><br><b>45° connector Ø 12</b><br>IVECO No. 504149148 coupling Ø 12<br>L connector Ø 12<br>IVECO No. 504149170 coupling Ø 12<br>T connector Ø 12<br>IVECO No. 504149174 coupling Ø 12 |
| <br>SV 214/GE | 22     | (2x)<br>8  | m16 x 1.5                                                                  | 5214006400        | 504140020          | <b>90° connector Ø 8</b><br>IVECO No. 504149132 coupling Ø 8                                                                                                                                                                                                                                                                                                                            |
|                                                                                                 | 24     | 12         | M18 x 1.5<br>(with sealing<br>taper seat with<br>pipe j 16)<br>on one side | 5214006200        | 504149022          | <b>90° connector Ø 6</b><br>IVECO No. 504149133 coupling Ø 12<br><b>90° connector Ø 8</b><br>IVECO No. 504149136 coupling Ø 12<br><b>90° connector Ø 12</b><br>IVECO No. 504149139 coupling Ø 12                                                                                                                                                                                        |
|                                                                                                 | 28     | (2x)<br>12 | M22 x 1.5                                                                  | 5214006000        | 504149021          | <b>L connector Ø 12</b><br>IVECO No. 504149170 coupling Ø 12                                                                                                                                                                                                                                                                                                                            |
|                                                                                                 | 28     | 12         | M22 x 1.5<br>(inner thread<br>M16 x 1.5)<br>on one side                    | 5214006100        | 504149026          | <b>T connector Ø 12</b><br>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<br>Ø | VOSS<br>reference | IVECO<br>reference | GENERAL NOTES<br>Possible couplings with other connectors                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------|-----------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>SV 214/W  | 12        | 5214011600        | 504149148          | <p><b>Straight connector Ø 12</b><br/> IVECO No. 504148959 with thread M12x1.5<br/> IVECO No. 504148964 with thread M16x1.5<br/> IVECO No. 504149016 with thread M22x1.5</p> <p><b>Receptacle connector Ø 12</b><br/> IVECO No. 504149022 with thread M18x1.5<br/> IVECO No. 504149021 with thread M22x1.5<br/> IVECO No. 504149026 with thread M22x1.5</p> |
| <br>SV 214/L  |           | 5214011200        | 504149170          |                                                                                                                                                                                                                                                                                                                                                             |
| <br>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).

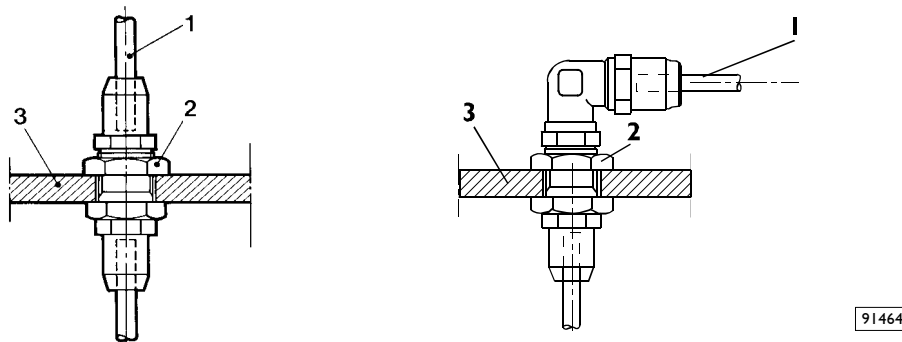
Pipes must be fixed in their correct position. The fixing clips must go right round the pipe. They may be of plastic, metal or rubber. Observe adequate distances between the various fixing elements. As a rule a maximum distance of 500 mm for plastic pipes and 600 mm for metal pipes is applicable.

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.

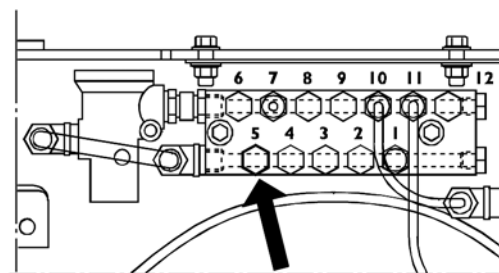
### 2.15.4 Taking air from the system

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**



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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

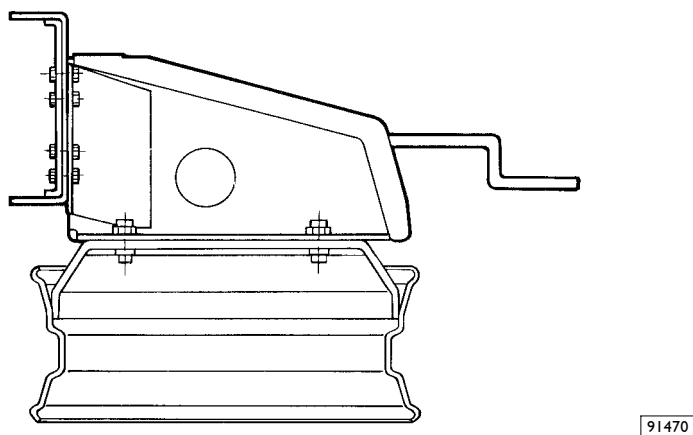
## 2.17 Repositioning Parts and Mounting Auxiliary Assemblies and Equipment

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.

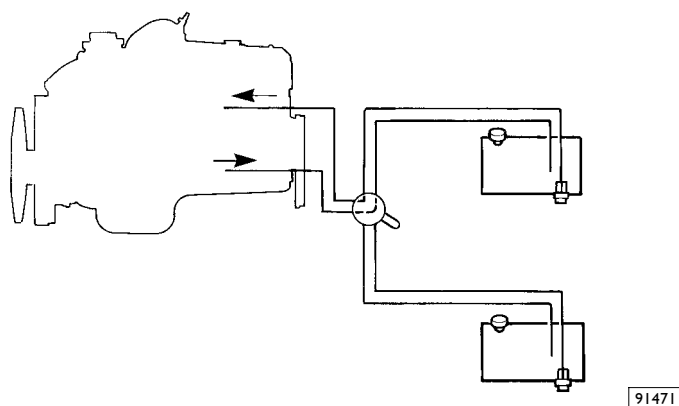
When tank refilling is hindered by the positions of the body structure, the tank mounting brackets may be installed one drilling unit lower (45 mm).



### 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<br>Plastic | 300L<br>Aluminium | 400L<br>Aluminium | 600L<br>Aluminium | 800L<br>Aluminium | 800L+400L<br>Aluminium |
| AT-AD190S<br>AT-AD190S/P<br>AT-AD190S/FP-D                          | S27    | standard        | opt 6170          | opt 6172          | opt 6173          | opt 6177          | -                      |
|                                                                     | S30    |                 |                   |                   |                   |                   |                        |
|                                                                     | S31    |                 |                   |                   |                   |                   |                        |
|                                                                     | S35    | -               | standard          |                   |                   |                   | opt 6172               |
| AT-AD440ST/P<br>AT-AD440ST/P - HR                                   | S31    | -               | standard          | opt 6172          | opt 6173          | opt 6177          | -                      |
|                                                                     | S35    |                 |                   |                   |                   |                   | opt 7855               |
| AT-AD260SY/PT<br>AT-AD260SY/TN                                      | S27    | standard        | opt 6170          | opt 6172          | opt 6173          | opt 6177          | -                      |
|                                                                     | S31    |                 |                   |                   |                   |                   | opt 7855               |
|                                                                     | S35    | -               | standard          |                   |                   |                   |                        |
| AD260SX/P<br>AD260SX/FP                                             | S27    | -               | -                 | -                 | -                 | -                 | -                      |
|                                                                     | S30    |                 |                   |                   |                   |                   |                        |
|                                                                     | S31    |                 |                   |                   |                   |                   |                        |
| AT-AD260SY/P<br>AT-AD260SY/PS<br>AT-AD260SY/FP-D<br>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<br>Aluminium | 400L<br>Aluminium | 600L<br>Aluminium | 300L+300L<br>Aluminium | 800L<br>Aluminium | 600L+300L<br>Aluminium | 800L+400L<br>Aluminium |
| AT-AD190S<br>AT-AD190S/P<br>AT-AD190S/FP-D                                              | standard          | opt 6172          |                   | -                      | opt 6177          | -                      | opt 7855               |
| AT-AD190S/FP-CT                                                                         | -                 | -                 | -                 | standard               | -                 | opt 7854               | -                      |
| AT-AD440ST/P<br>AT-AD440ST/P - HR                                                       | standard          |                   | opt 6173          | -                      |                   | -                      | opt 7855               |
| AT-AD440ST/P - LT                                                                       | -                 | -                 | -                 | standard               | -                 | opt 7854               | -                      |
| AT-AD440ST/P - CT                                                                       |                   |                   |                   |                        |                   |                        |                        |
| AT-AD260SY/PT<br>AT-AD260SY/TN                                                          | standard          | opt 6172          | opt 6173          | -                      | opt 6177          | -                      | opt 7855               |
| AT440S43TZ/P                                                                            | standard          | opt 6172          | opt 6173          | -                      | -                 | -                      | -                      |
| AT-AD260SY/P<br>AT-AD260SY/PS<br>AT-AD260SY/FP-D<br>AT-AD260SY/FS-D<br>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 disconnecter 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 transporting 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.



- 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)** 3<sup>rd</sup> 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.



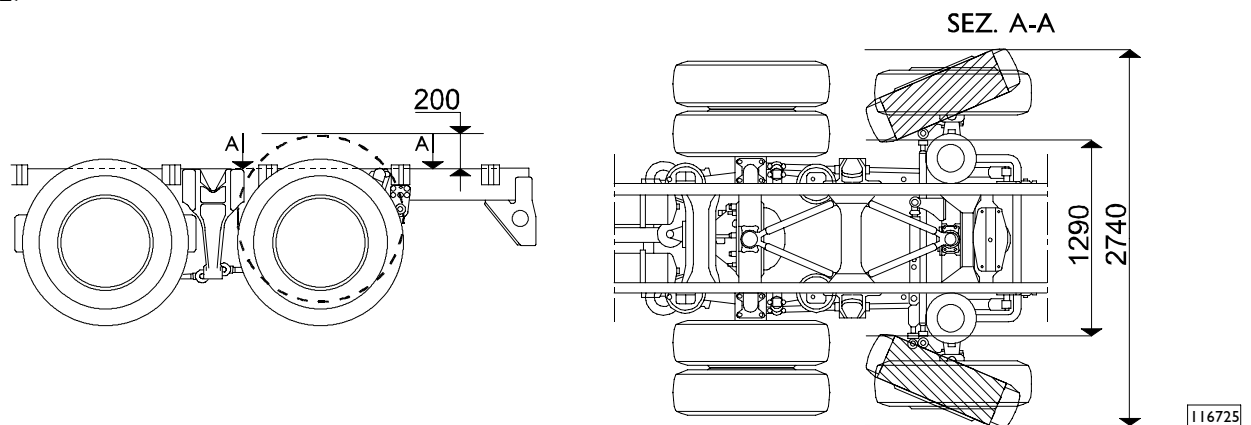
Modifications to the Rear Underrun

## 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

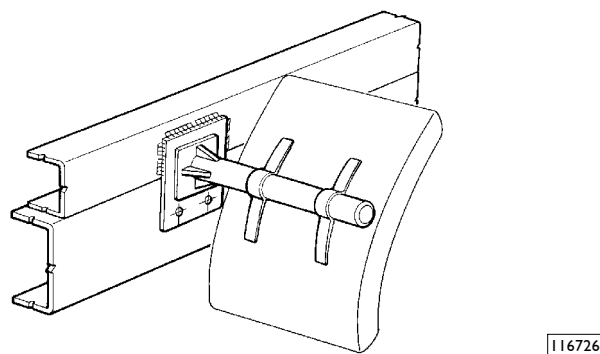


When fitting mudguards or making wheel boxes the following points should be considered:

- 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.

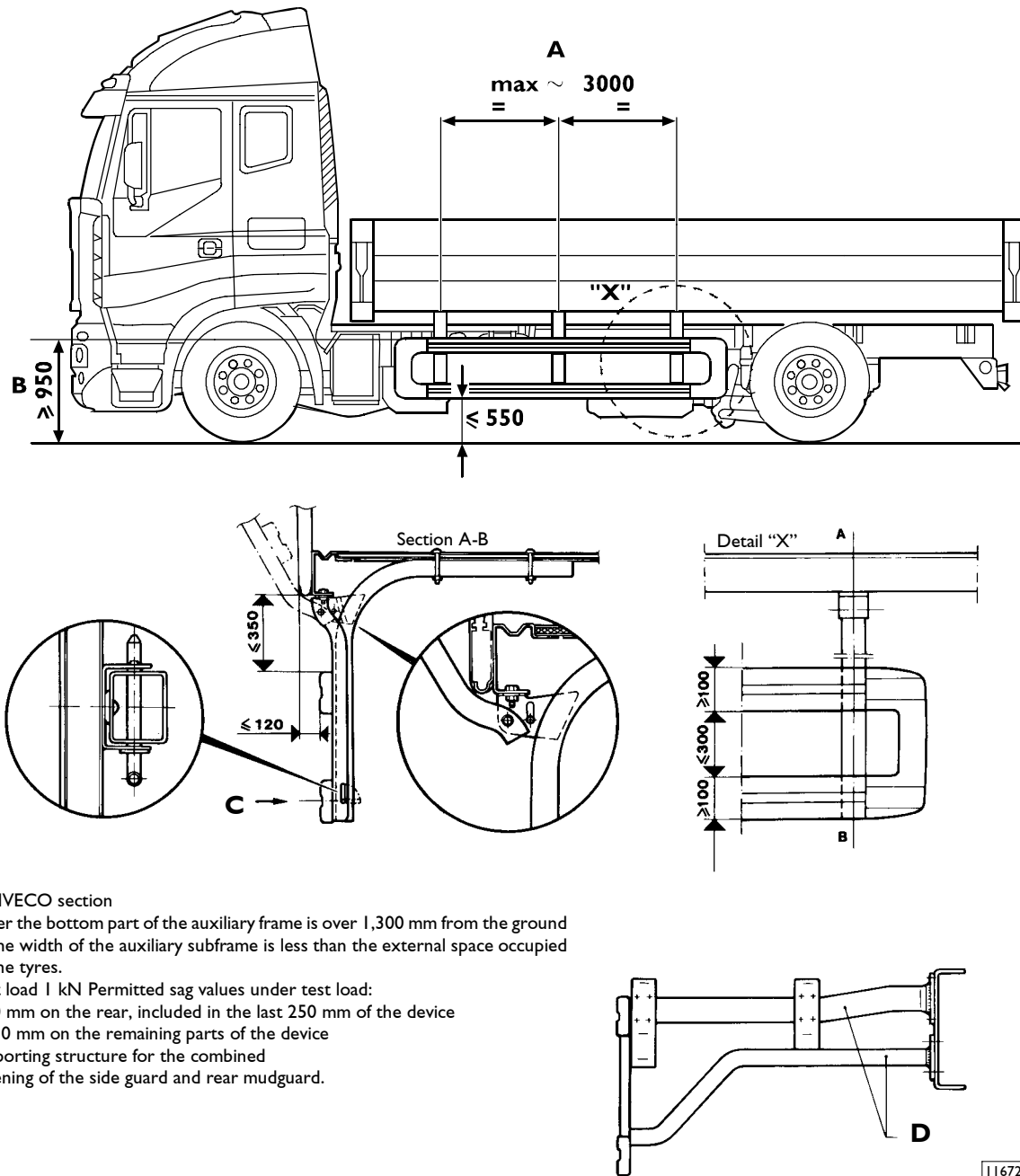
In Figure 2.29 shows a type of side guard designed in compliance with the relevant EC Directive to be fitted to fixed bodies (available on request). The illustration also shows a specimen of a support designed for the combined fastening on the side guard and the rear wheel mudguard which can be fitted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

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## **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**

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**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 values (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<br>(N/mm <sup>2</sup> ) | Yield point<br>(N/mm <sup>2</sup> ) | 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       |                                       |                                     |               |



### 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<sup>2</sup> as against 21,000 kg/mm<sup>2</sup> 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 is 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<br>$W_x$ (cm <sup>3</sup> ) | Recommended C-section profile<br>(mm) |              |              |
|----------------------------------------------|---------------------------------------|--------------|--------------|
| $16 \leq W \leq 19$                          | 80 X 50 X 4                           | 80 X 60 X 4  | 80 X 50 X 5  |
| $20 \leq W \leq 23$                          |                                       | 80 X 60 X 5  |              |
| $24 \leq W \leq 26$                          |                                       | 80 X 60 X 6  |              |
| $27 \leq W \leq 30$                          |                                       | 80 X 60 X 7  | 100 X 50 X 5 |
| $31 \leq W \leq 33$                          |                                       | 80 X 60 X 8  | 100 X 60 X 5 |
| $34 \leq W \leq 36$                          |                                       | 100 X 60 X 6 |              |
| $37 \leq W \leq 41$                          |                                       | 100 X 60 X 7 |              |
| $42 \leq W \leq 45$                          | 80 X 80 X 8                           | 100 X 60 X 8 |              |
| $46 \leq W \leq 52$                          | 120 X 60 X 6                          | 120 X 60 X 7 |              |
| $53 \leq W \leq 58$                          |                                       | 120 X 60 X 8 |              |
| $59 \leq W \leq 65$                          |                                       | 140 X 60 X 7 | 120 X 70 X 7 |
| $66 \leq W \leq 72$                          |                                       | 140 X 60 X 8 | 120 X 80 X 8 |
| $73 \leq W \leq 79$                          |                                       | 160 X 60 X 7 |              |
| $80 \leq W \leq 88$                          |                                       | 180 X 60 X 8 |              |
| $89 \leq W \leq 93$                          | 106 X 70 X 7                          | 180 X 60 X 7 | 140 X 80 X 8 |
| $94 \leq W \leq 104$                         |                                       | 180 X 60 X 8 |              |
| $105 \leq W \leq 122$                        | 200 X 80 X 6                          | 200 X 60 X 8 | 180 X 70 X 7 |
| $123 \leq W \leq 126$                        |                                       | 220 X 60 X 7 |              |
| $127 \leq W \leq 141$                        |                                       | 220 X 60 X 8 |              |
| $142 \leq W \leq 160$                        | 200 X 80 X 8                          | 240 X 60 X 8 |              |
| $161 \leq W \leq 178$                        | 220 X 80 X 8                          | 240 X 70 X 8 |              |
| $179 \leq W \leq 201$                        | 250 X 80 X 7                          | 260 X 70 X 8 |              |
| $202 \leq W \leq 220$                        | 250 X 80 X 8                          | 260 X 80 X 8 |              |
| $221 \leq W \leq 224$                        | 220 X 80 X 8                          | 280 X 70 X 8 |              |
| $225 \leq W \leq 245$                        | 250 X 100 X 8                         | 280 X 80 X 8 |              |
| $246 \leq W \leq 286$                        | 280 X 100 X 8                         |              |              |
| $290 \leq W \leq 316$                        | 300 X 80 X 8                          |              |              |
| $316 \leq W \leq 380$                        | 340 X 100 X 8                         |              |              |
| 440                                          | 380 X 100 X 8                         |              |              |
| 480                                          | 400 X 100 X 8                         |              |              |

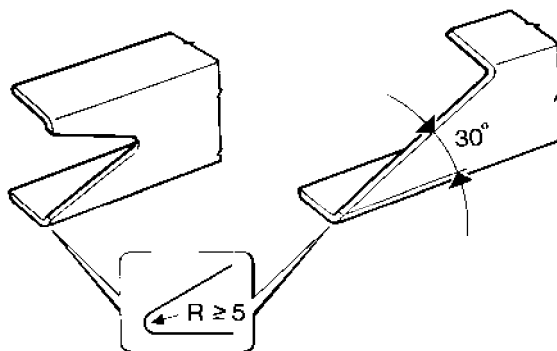


## 3.2 Elements making up the subframe

### 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  $30^\circ$ , or tapered in some other equivalent way (see Figure 3.1), ensuring that the front end in contact with the chassis is suitably connected, min radius 5 mm.

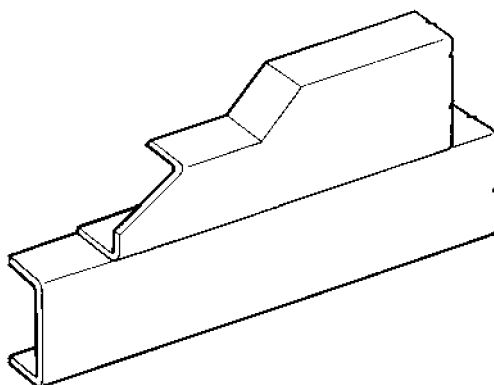
Figure 3.1



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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

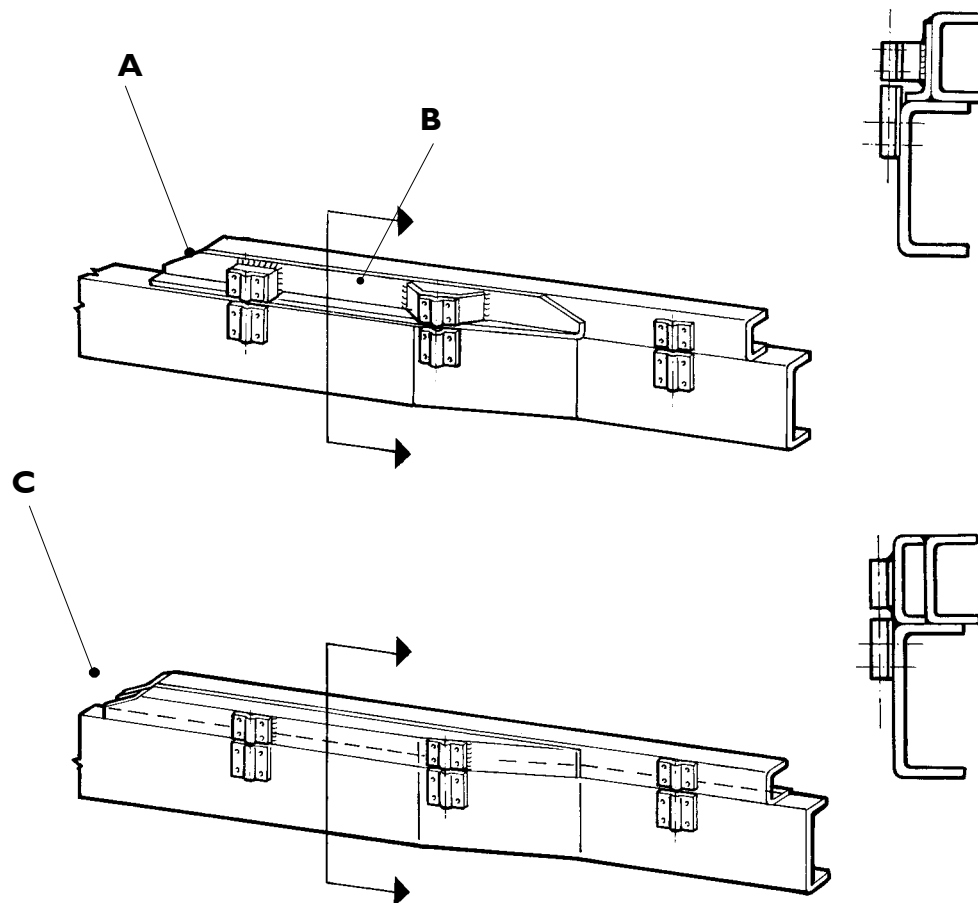
The construction of auxiliary frames either wider or narrower than the chassis structure is permitted only in particular cases (e.g. removable containers sliding on rollers operated by mechanical or hydraulic systems). In these cases a necessary precaution will be that of ensuring a correct transmission 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.





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



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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.

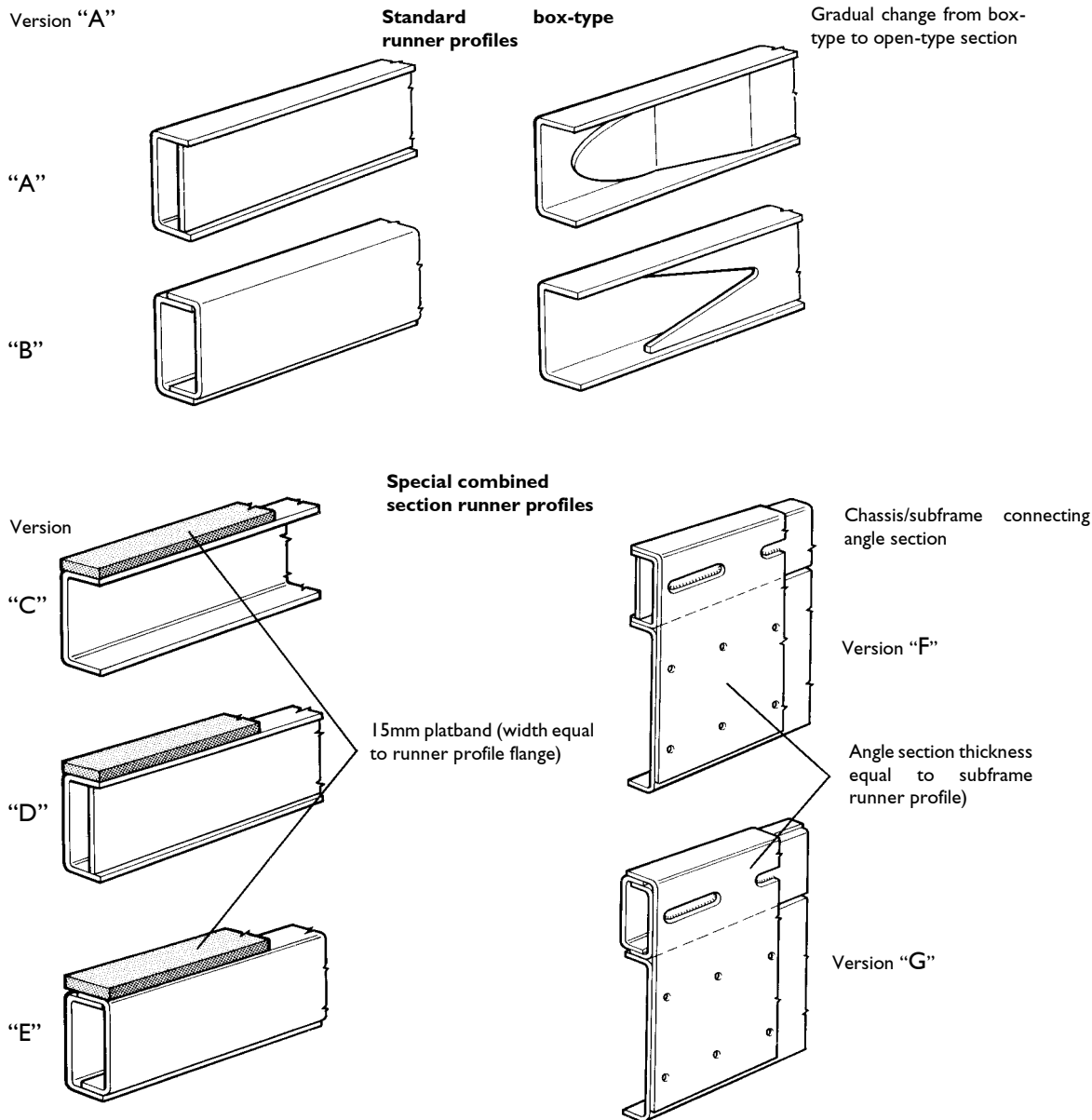
Proper care must be taken to ensure a gradual change from the box- type section to the open type section. Some examples on how this can be achieved are shown in Figure 3.5.

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



Elements making up the subframe

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

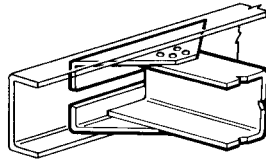
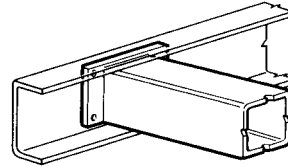


Figure 3.6



### 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, with 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

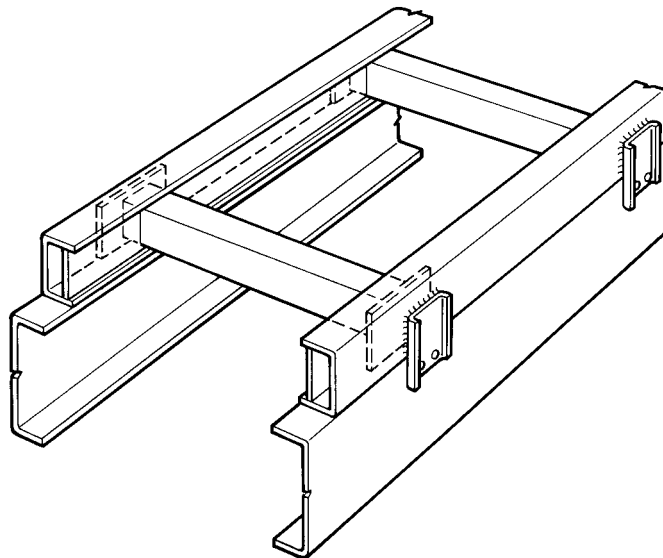
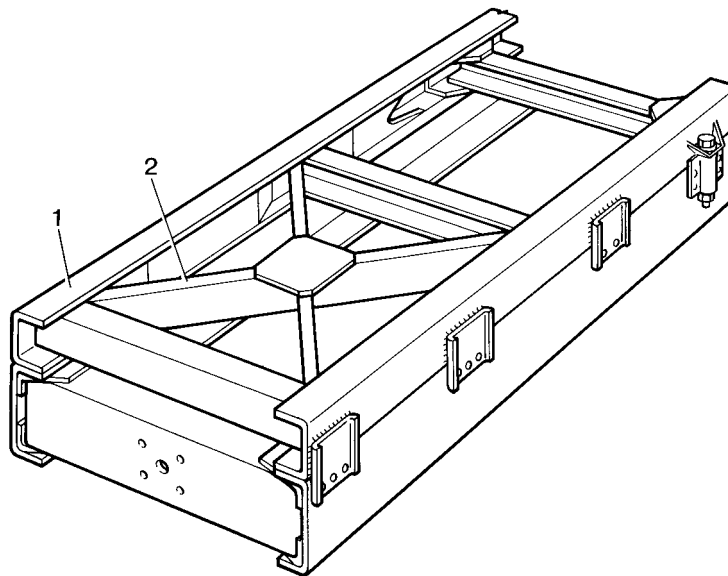
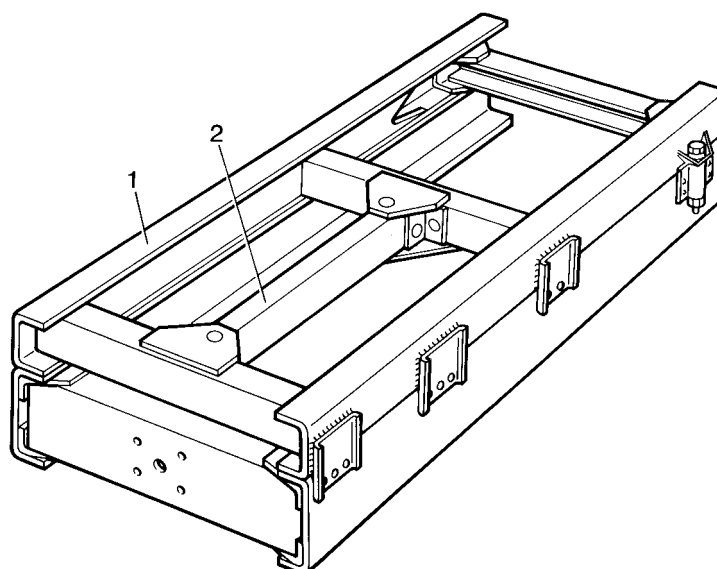


Figure 3.8



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 brackets or clamps. This has the following advantages:

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

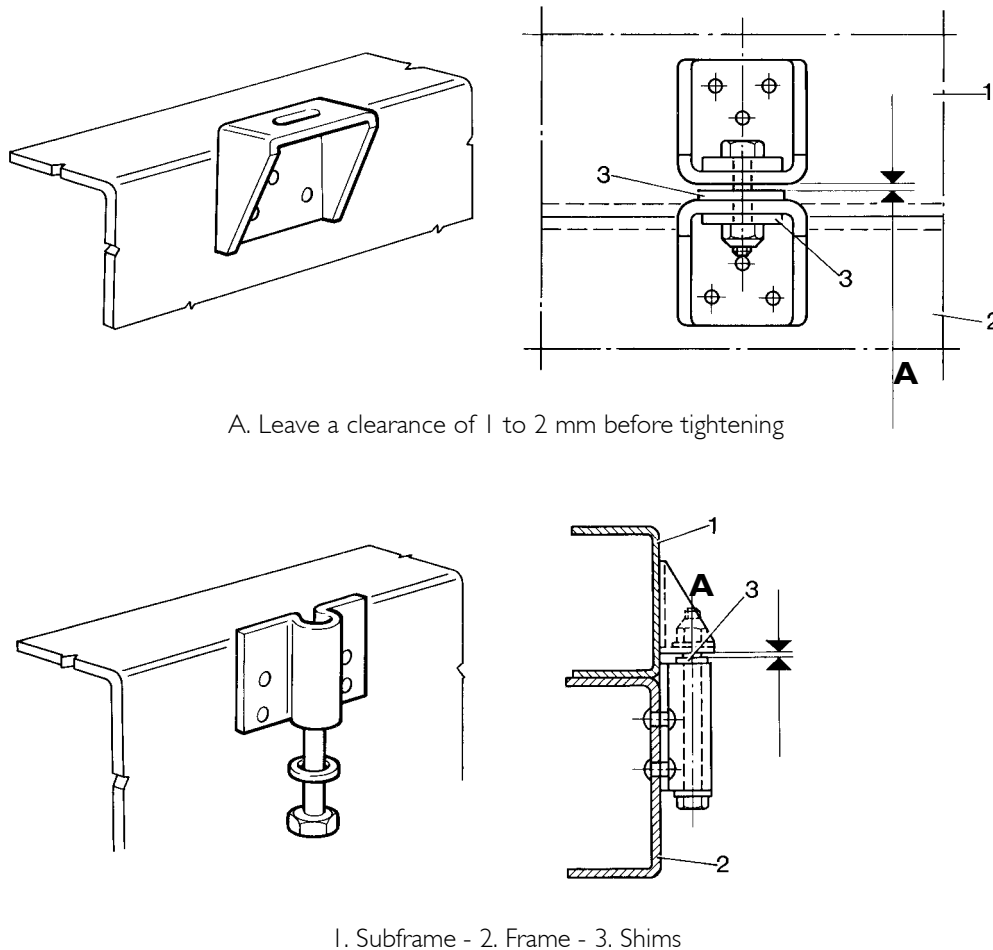


Connections between frame and counterframe

### 3.3.3 Connection with Brackets

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

Figure 3.10



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 springtype (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.



### 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:

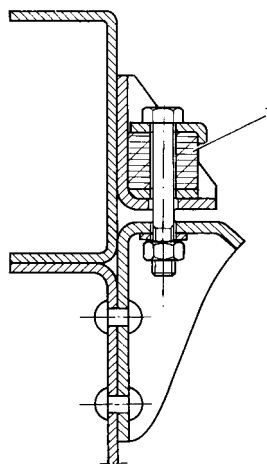
Figure 3.11



- Spring stiffness = 424 N/mm.
- With the longitudinal hard on the top flange there must be a gap 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 to the end of the frame instead of the normal factory body brackets.

On installations where the vehicle is 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.



### 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.

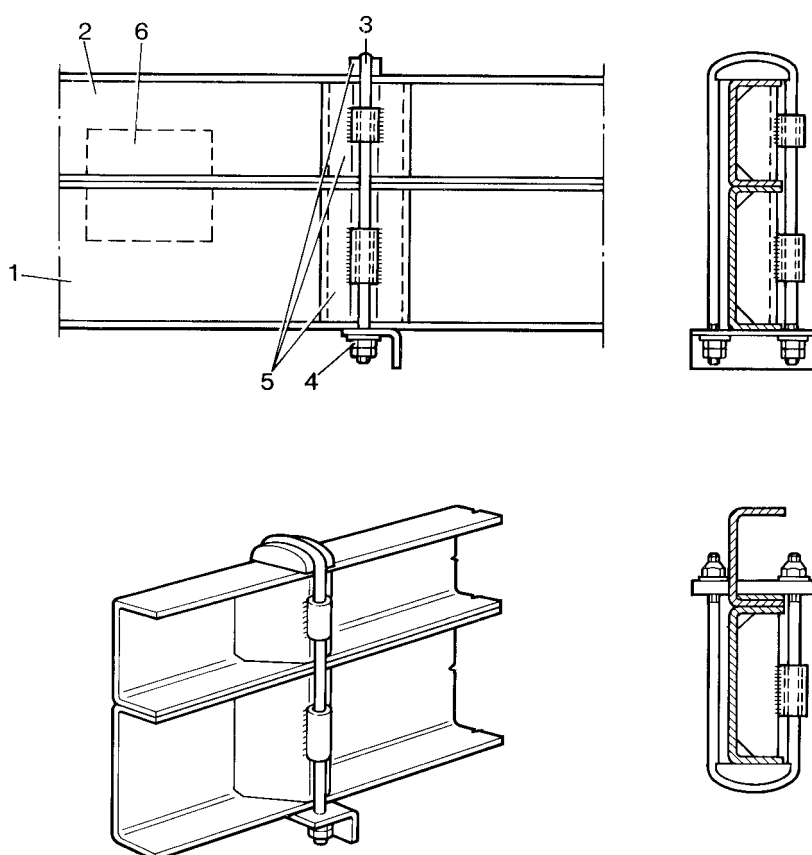
In order to guide and contain transverse movement of the structure attached to the vehicle's chassis, this type of connection must also have guide plates that are attached only to the chassis as shown in Figure 3.13.

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

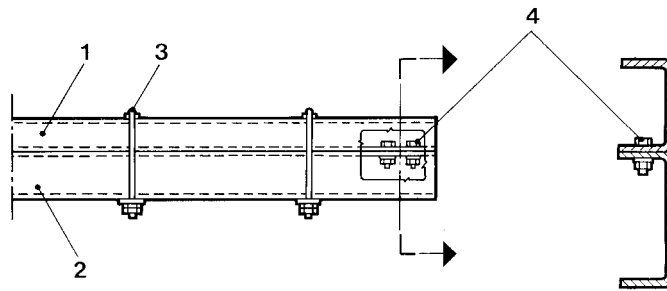


1. Frame - 2. Subframe - 3. U-bolts - 4. Locking with a lock nut -  
5. Spacers - 6. Guide plates (where necessary)





Figure 3.14



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

### 3.3.6 Connection with cleat (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:

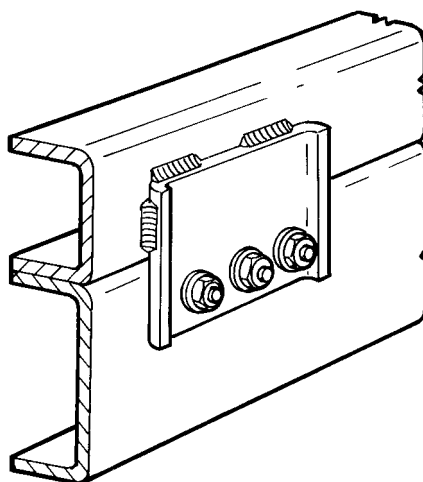
Table 3.3

| Frame/subframe section height ratio | Max. distance between the centreline of the shearing resistant plates <sup>1)</sup> | Min. characteristics of the plates |                                                                         |
|-------------------------------------|-------------------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------|
|                                     |                                                                                     | Thickness (mm)                     | Fixing hardware dimensions (at least 3 screws each plate) <sup>2)</sup> |
| $\leq 1.0$                          | 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 coil springs connections 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)<br>(referring to the driving axle, on<br>vehicles with 3 axles with third<br>rear axle) | Minimum reinforcing runner               |
|--------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------|
|                                      |                                                                                                        | Section modulus Wx<br>(cm <sup>3</sup> ) |
| AS/AT/AD 190; AS 190 <sup>2)4)</sup> | up to 6300 <sup>2)</sup>                                                                               | 89 <sup>3)</sup>                         |
| AS/AT/AD 260                         | up to 6050 <sup>2)</sup>                                                                               | (46) <sup>1)</sup>                       |

- 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<sup>3</sup>); 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/mm<sup>2</sup> 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.



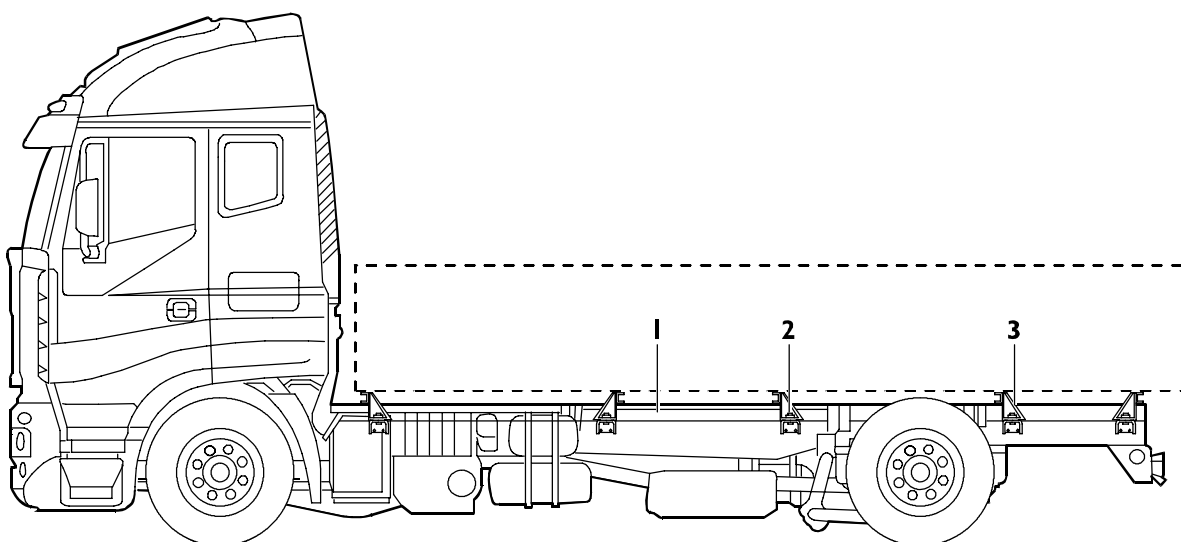
Fitting Box-bodies

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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

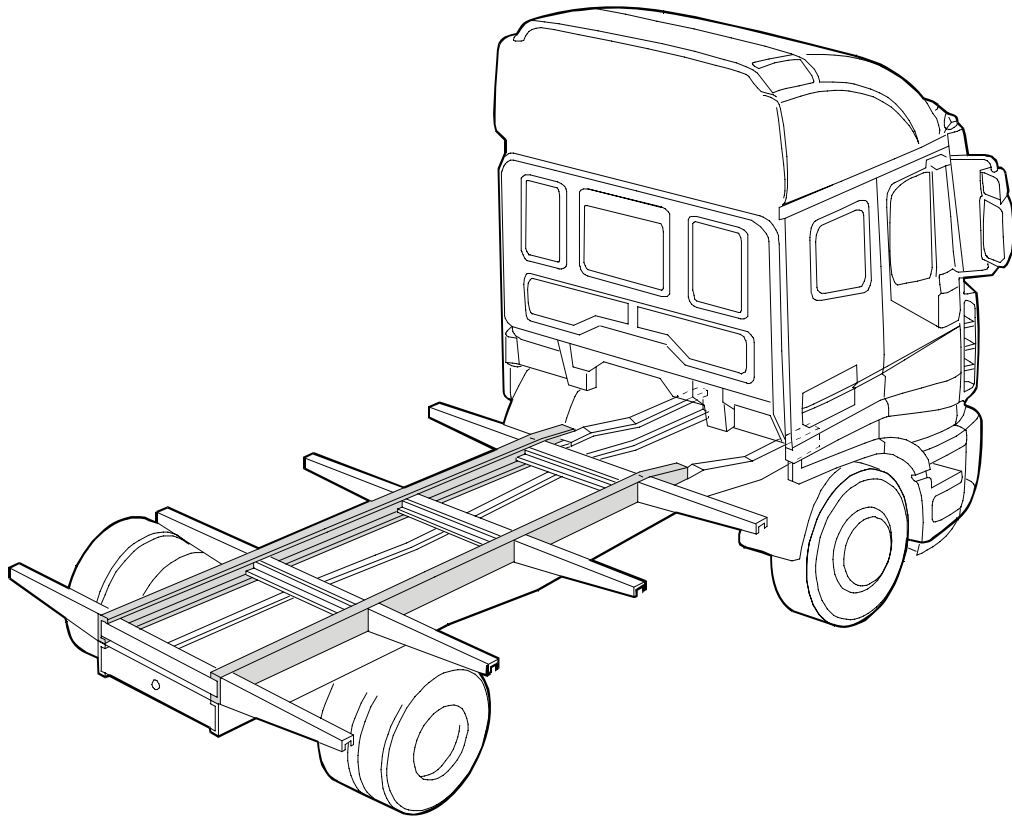
Figure 3.16



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.



### 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.

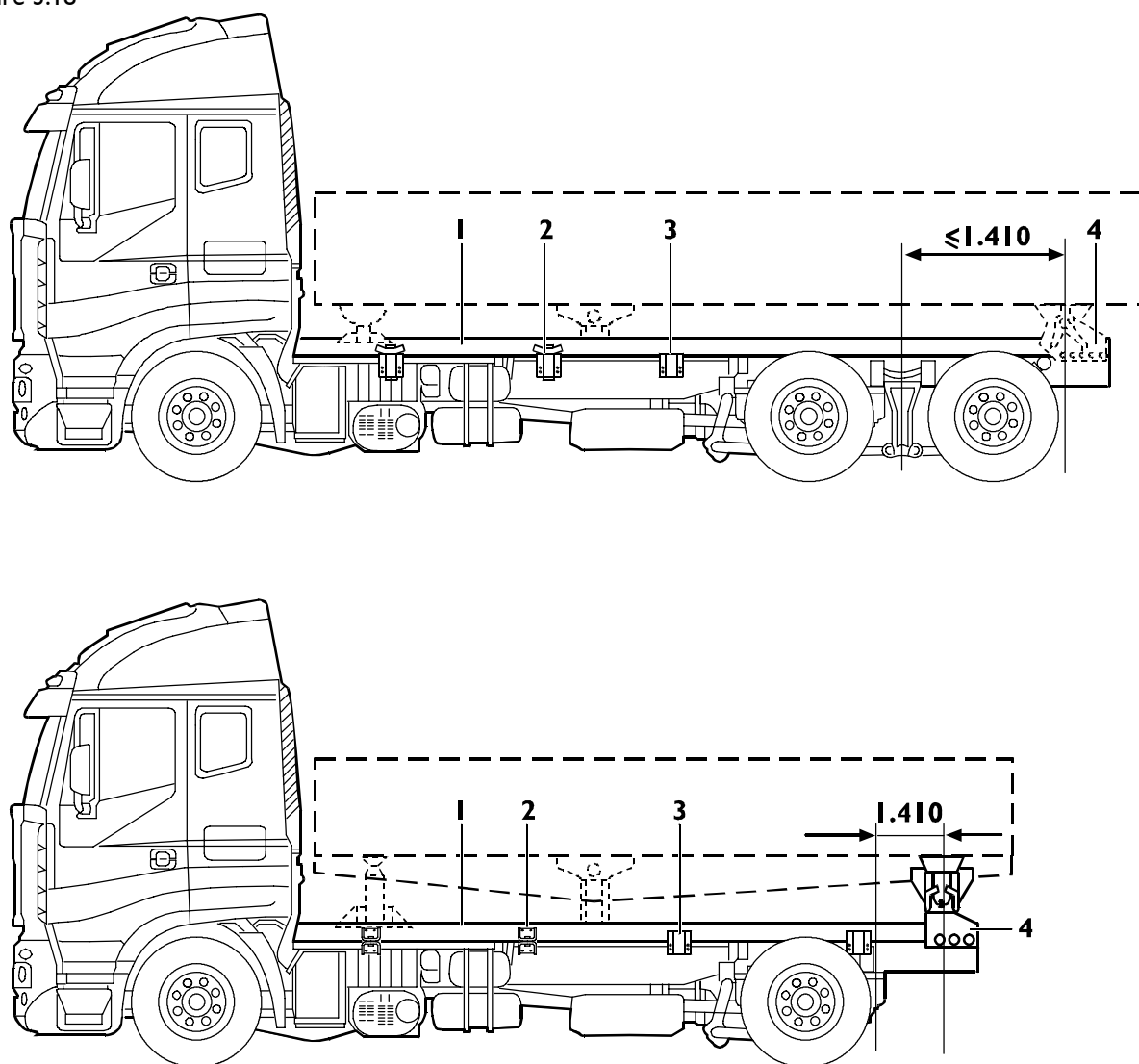
The following points must be kept in mind:

- 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<sup>3</sup> is to be used for excavated material).  
When freight having a low density is transported, the useful volume may be increased within the limits established for the maximum height of the centre of gravity of the payload plus the fixtures.
- The bodybuilders must 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



123840

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<br>(yield limit of the material used)             |     |
|-----------------------|----------------------------------------------------------------------------|-----|
|                       | Section modulus depending on the material yield limit (N/mm <sup>2</sup> ) |     |
|                       | 240                                                                        | 360 |
| AT-AD190              | 46                                                                         |     |
|                       | 89 <sup>(2)</sup>                                                          |     |
| AS/AD/AT260/TN        | 89/110 <sup>(1)</sup>                                                      |     |
| AS/AD/AT260/PT260Z/P  | 150/190 <sup>(1)</sup>                                                     |     |
|                       | 89/110 <sup>(1)</sup>                                                      |     |
| AS/AD/AT260/P(S)FP/FS | 173/222 <sup>(1)</sup>                                                     |     |
|                       | 89/110 <sup>(1)</sup>                                                      |     |

(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 at 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.

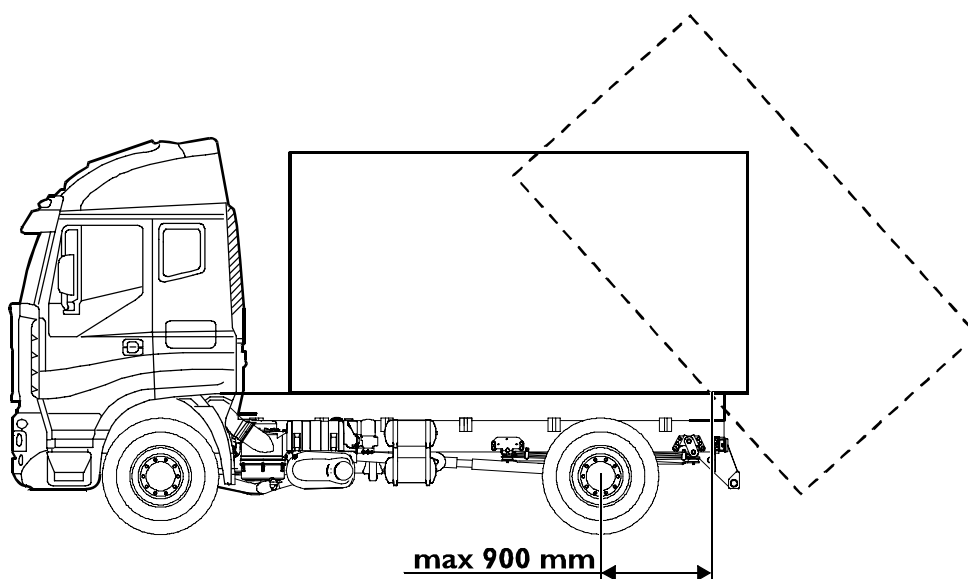
The stability of the vehicle must always be ensured during loading and unloading operations. We recommend fitting the rear ends with supports (stabilisers) that are to be used during loading and unloading operations particularly when roll on, roll off containers are used.

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**



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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.

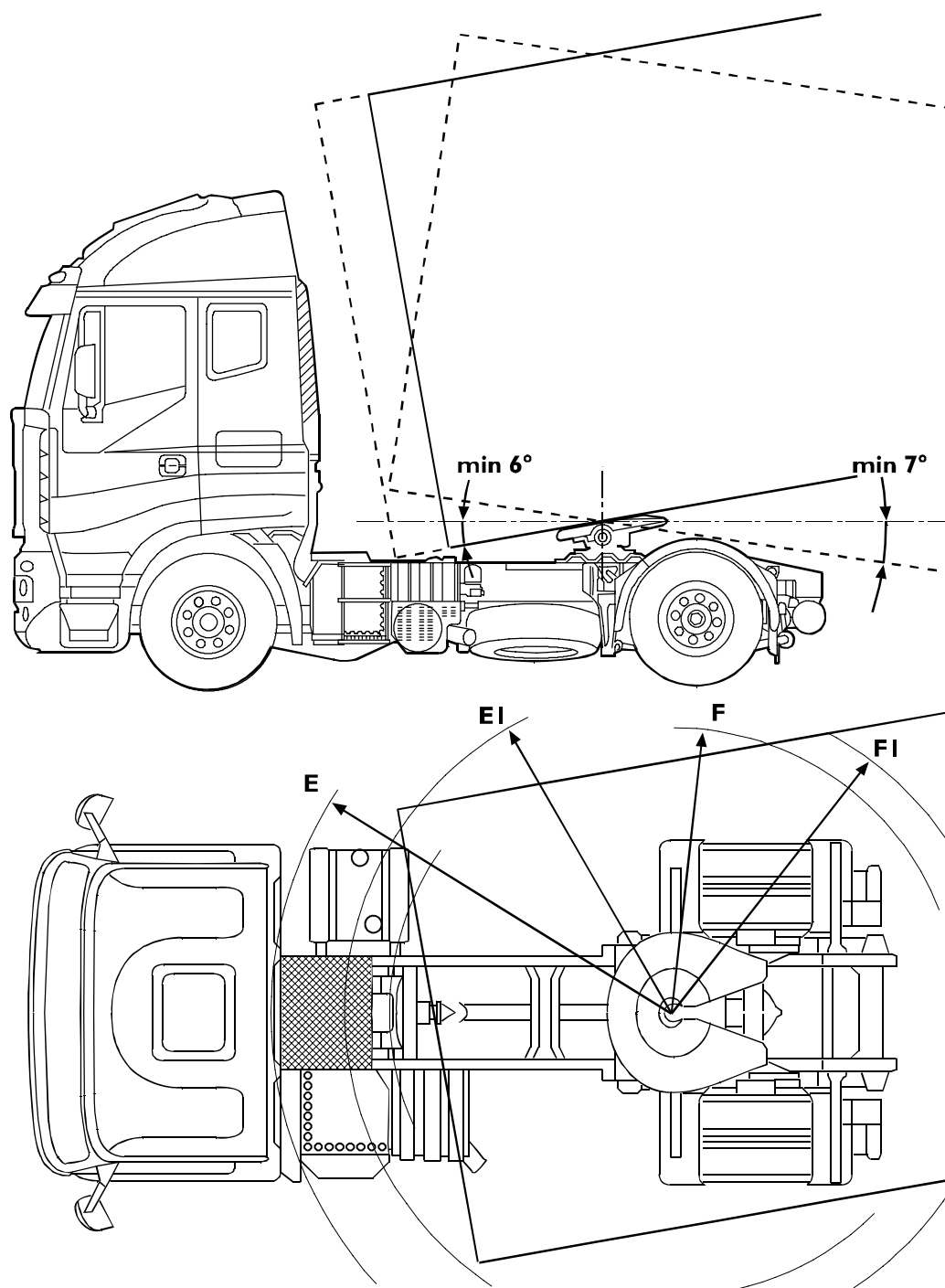
### 3.5.3 Coupling of Tractor and Semitrailer

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 - EI=Front tractor turning radius -  
 F=Rear tractor turning radius - FI =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 arrangement 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 longitudinal 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.



Tractors for Semitrailers

Table 3.6 - Fifth wheels

| <b>Fifth wheel and plate application</b>                 | <b>Tractors 4x2</b> |                   | <b>Tractors 6x2C</b> | <b>Tractors 6x4</b> |
|----------------------------------------------------------|---------------------|-------------------|----------------------|---------------------|
| <b>Fifth wheel mounting plate</b>                        | <b>440T/P</b>       | <b>440T/FP-LT</b> | <b>440TX/P</b>       | <b>440TZ/P-HM</b>   |
| 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



Tractors for Semitrailers

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                                 |

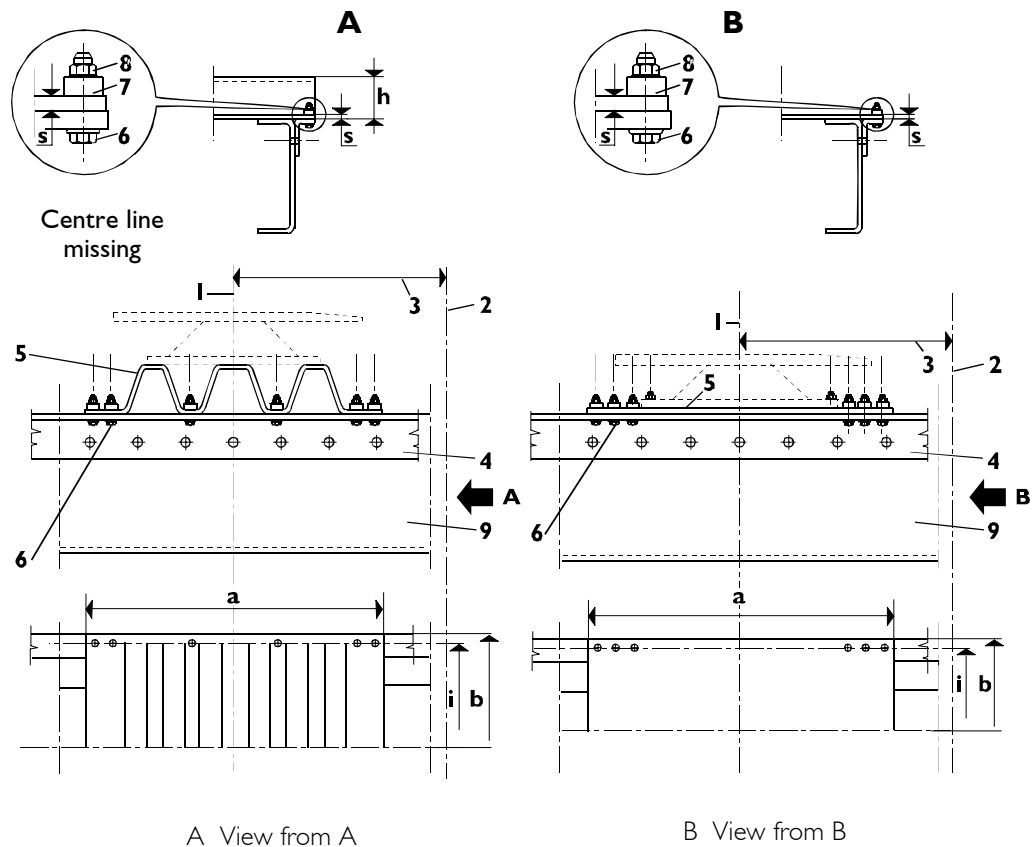
Table 3.8 - Model/type application

| 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)<br><br>140 (O)<br>(SW 06114) | 315 / 80<br>295 / 80<br>315 / 70<br>305 / 70<br>315 / 60<br>295 / 60 | 150<br><br>120       | ~1170<br>~1155<br>~1120<br>~1110<br>~1090<br>~1075 |
| 235                      | 4X2 / P     | 160 (S)                              | 315 / 80<br>295 / 80                                                 | 174                  | ~1205<br>~1190                                     |
| 285                      | 4X2 / P     | 160 (S)                              | 315 / 80<br>295 / 80                                                 | 174                  | ~1255<br>~1240                                     |
| 162                      | 4X2 / P     | 140 (O)<br>(SW 06114)                | 315 / 60<br>295 / 60<br>305 / 70<br>315 / 70                         | 120                  | ~1050<br>~1035<br>~1070<br>~1080                   |
| 140                      | 4X2 / FP-LT | 85                                   | 295 / 60<br>315 / 60                                                 | 120                  | ~960<br>~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



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 ( $h=15\text{mm}$ ) - 8. Self-locking flanged-head nuts - 9. Chassis side members

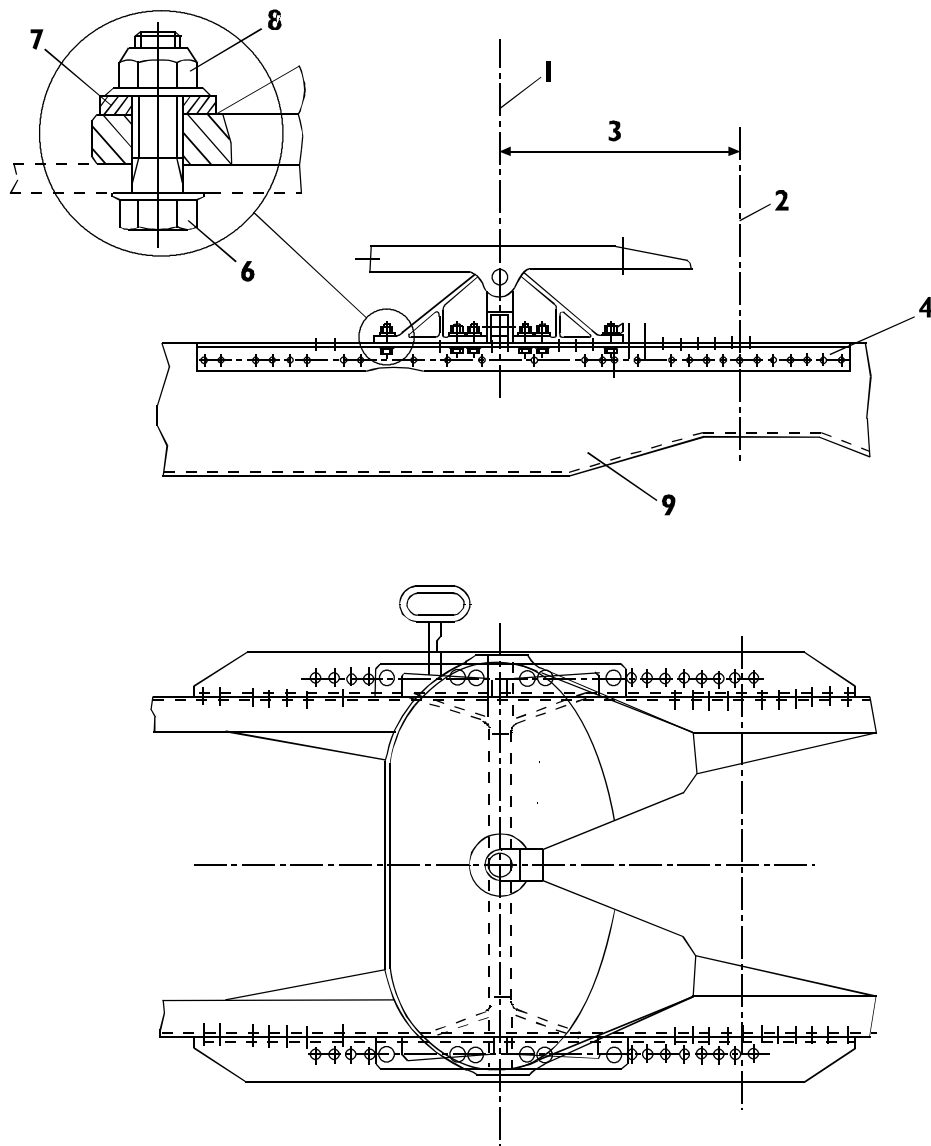
### Bed Plate Fixing

- 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



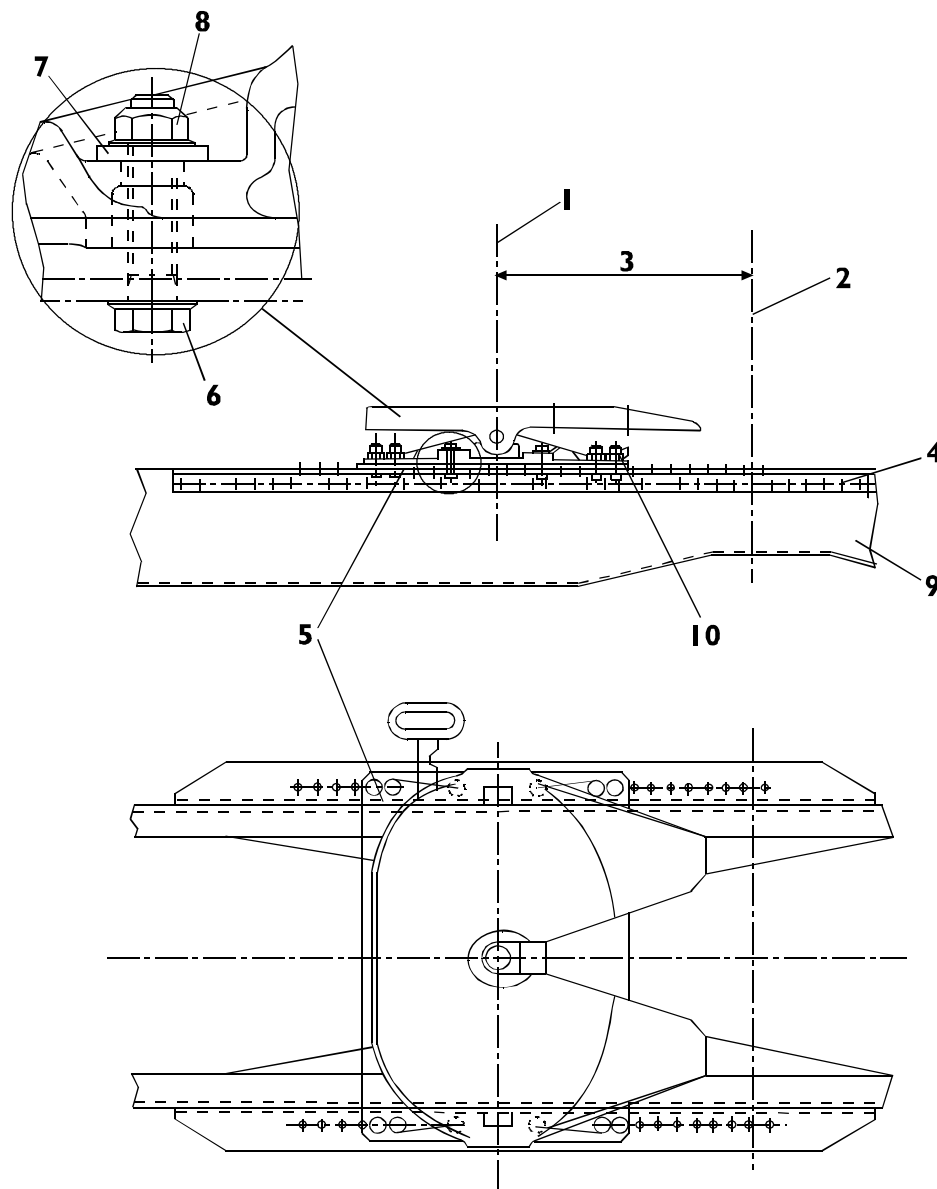
1. Fifth wheel centreline - 2. Rear wheel centreline - 3. Fifth wheel position - 4. Longitudinal Runners - 6. Class 10.9 M16x1.5 screws with flange - 7. Washer (h=6mm) - 8. Self-locking flanged-head nuts - 9. Chassis side members





### 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  $W_x$ .

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.

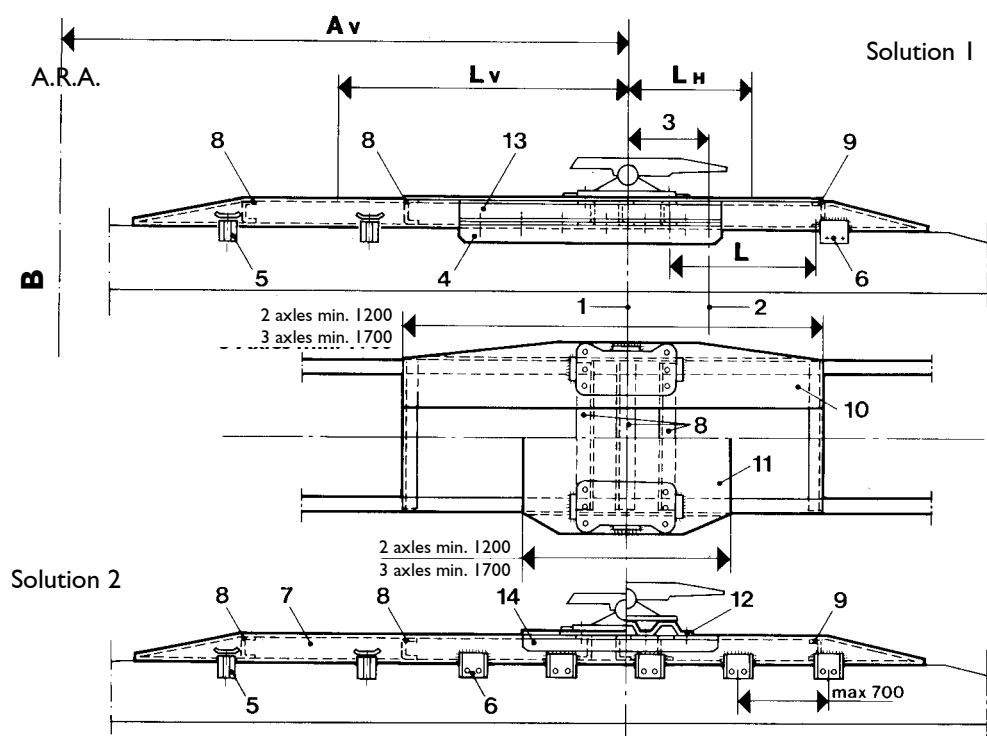
The mounting plate bearing the fifth wheel may be constructed in one of the following ways:

- 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 length when a  $L_H$  = special runner profile (see Table 3.9) is used - 8. Stiffening crossmembers - 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<br>(mm) | Minimum reinforcement profile                                                       |                                         |
|---------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------|-----------------------------------------|
|                                                         |                   | Section modulus based on the<br>yield point of the material<br>(N/mm <sup>2</sup> ) |                                         |
|                                                         |                   | FE240 = S235<br>240                                                                 | FE360 = S355<br>360                     |
| AS/AT/AD 190 <sup>1)</sup>                              | 3200              | 90 <sup>2)3)</sup>                                                                  | 57 <sup>2)5)</sup>                      |
| AS/AT/AD 440 T; T/P; T/FP                               | ≤ 3500            | 150 <sup>2)3)</sup>                                                                 | 57 <sup>2)4)</sup>                      |
|                                                         | ≤ 3800            | 208 <sup>2)3)</sup>                                                                 | 90 <sup>2)4)</sup>                      |
| AS/AD/AT 260/Z/P <sup>1)</sup><br>AS/AD/AT 440 T        | 3200/1380         | 173 <sup>6)</sup><br>208 <sup>2)3)</sup>                                            | 42 <sup>6)</sup><br>150 <sup>2)5)</sup> |
|                                                         | 3500/1380         | 208 <sup>6)</sup><br>208 <sup>2)3)</sup>                                            | 57 <sup>6)</sup><br>208 <sup>2)5)</sup> |
| AS /AD/AT 260/P; /PS; /FP; /FS; /FT; /FT <sup>1)</sup>  | 3200/1395         | 208 <sup>6)</sup>                                                                   | 73 <sup>6)</sup><br>208 <sup>2)5)</sup> |
| AS/AD/AT 260/P; /FP <sup>1)</sup><br>AS/AD/AT 440 TZ/P; | 2800/1395         | 208 <sup>6)</sup>                                                                   | 57 <sup>6)</sup><br>208 <sup>2)5)</sup> |

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)**

|                                                                                             | <b>A</b>                               | <b>B</b>                                    | <b>C o D</b>                            | <b>E</b>                                 | <b>F</b>                                | <b>G</b>                                   |
|---------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------|-----------------------------------------|------------------------------------------|-----------------------------------------|--------------------------------------------|
| Material yield point (N/mm <sup>2</sup> )                                                   | ≤ 320                                  | ≤ 320                                       | ≤ 240                                   | ≤ 240                                    | ≤ 360                                   | ≤ 360                                      |
| Max. runner profile height reduction (mm)                                                   | 40                                     | 60                                          | 100                                     | 120                                      | 100                                     | 120                                        |
| Combined reinforcements length<br>L <sub>V</sub> :<br>L <sub>H</sub> :<br>(see Figure 3.23) | 0.3A <sub>V</sub><br>0.2A <sub>V</sub> | 0.4A <sub>V</sub> V<br>0.22A <sub>V</sub> V | 0.5A <sub>V</sub><br>0.25A <sub>V</sub> | 0.55A <sub>V</sub><br>0.25A <sub>V</sub> | 0.5A <sub>V</sub><br>0.25A <sub>V</sub> | 0.55A <sub>V</sub><br>0.25A <sub>V</sub> V |
| Example:<br>Combined section as an alternative to the channel section (mm):                 | 210X80X8                               | 190X80X8                                    | 150x80x8<br>+ straight section<br>15x80 | 130x80x8<br>+ straight section<br>15x80  | 150x80x8<br>+ angle section             | 130x80x8<br>+ 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.



Tractors for Semitrailers

### **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.



### 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 $W_x$ (cm <sup>3</sup> )<br>(Yield limit of material used=360N/mm <sup>2</sup> ) |
| AS/AD/AT 190 | 46 <sup>1)</sup><br>89 <sup>2)</sup>                                                             |
| AS/AD/AT 260 | 59 <sup>1)</sup><br>89 <sup>2)</sup>                                                             |

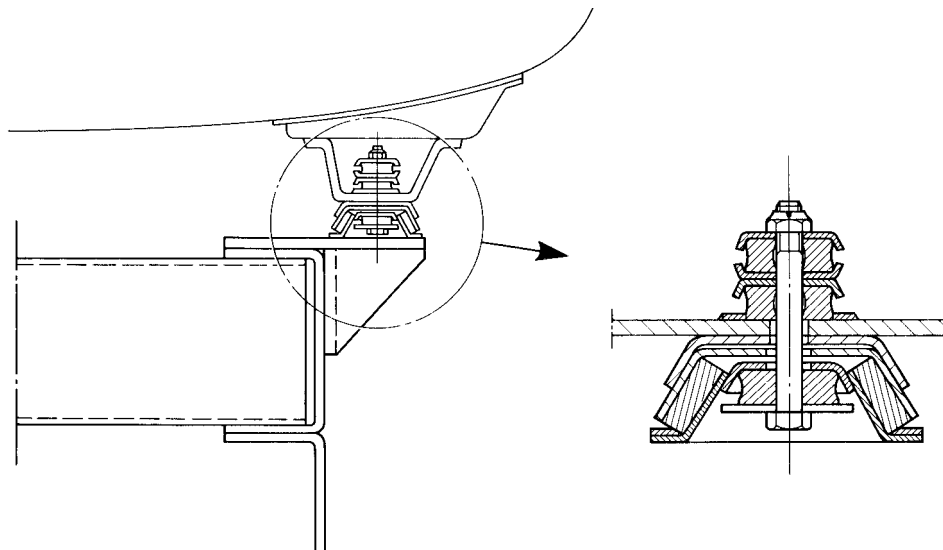
(1) Stiffen the subframe in the area on which the tanks and containers rest;

(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 positioned 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**

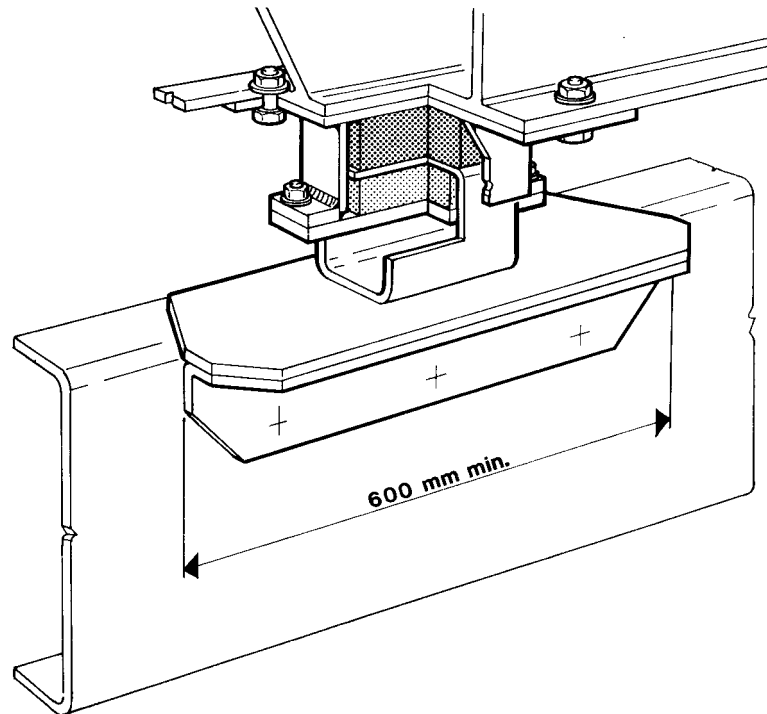
Tanks may be mounted directly onto the vehicle chassis without fitting an subframe under the following conditions:

- 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.

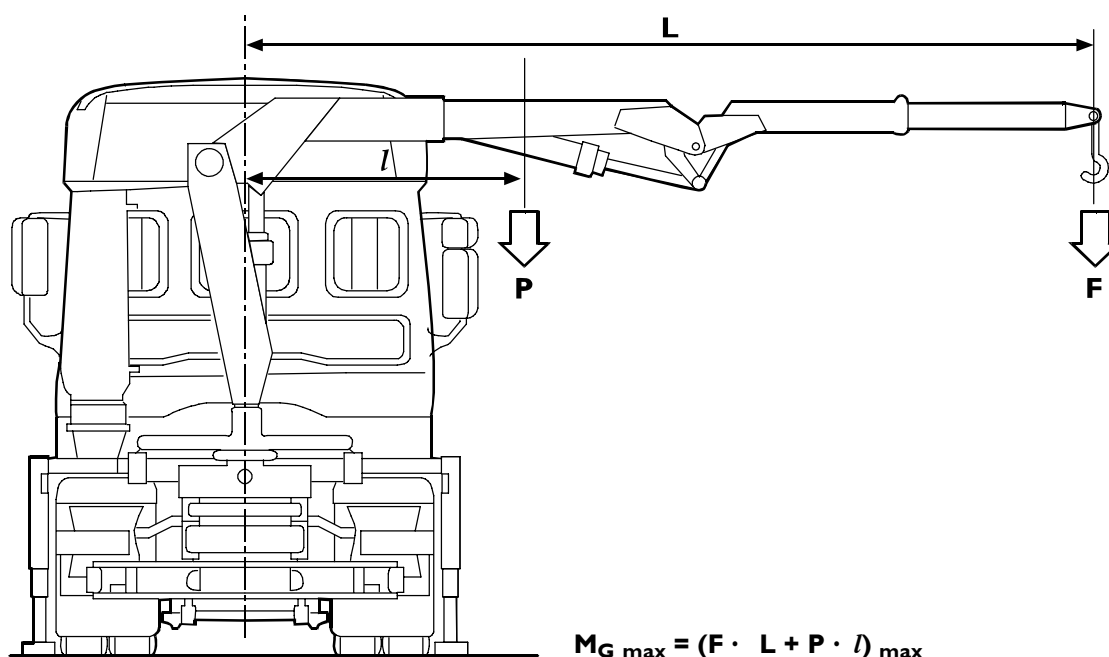
While the crane is operating, the stabilisers (hydraulic if possible) must be used and be in contact with the ground. As a general rule, the installation of a crane requires the use of a suitable subframe, whose construction must taken into account all general specifications relating to it (point 3.1). 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  $M_g$  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.



### 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.

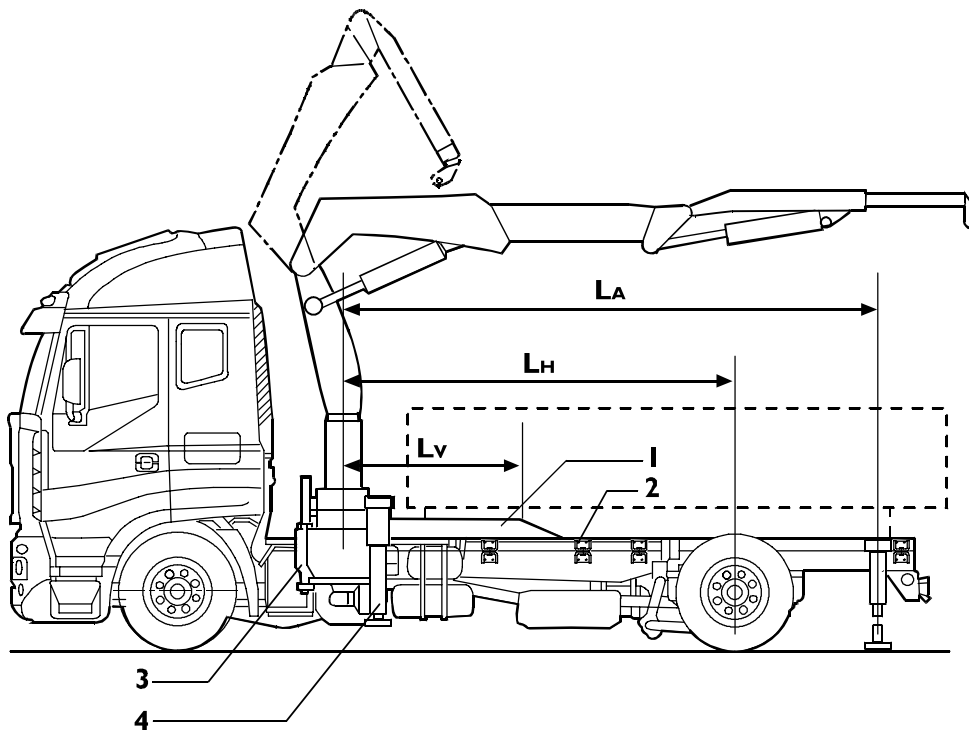
The dimensions and the subframe to be used for this type of installation are specified in Table 3.9.

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 maximum 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 "L<sub>v</sub>" 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



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

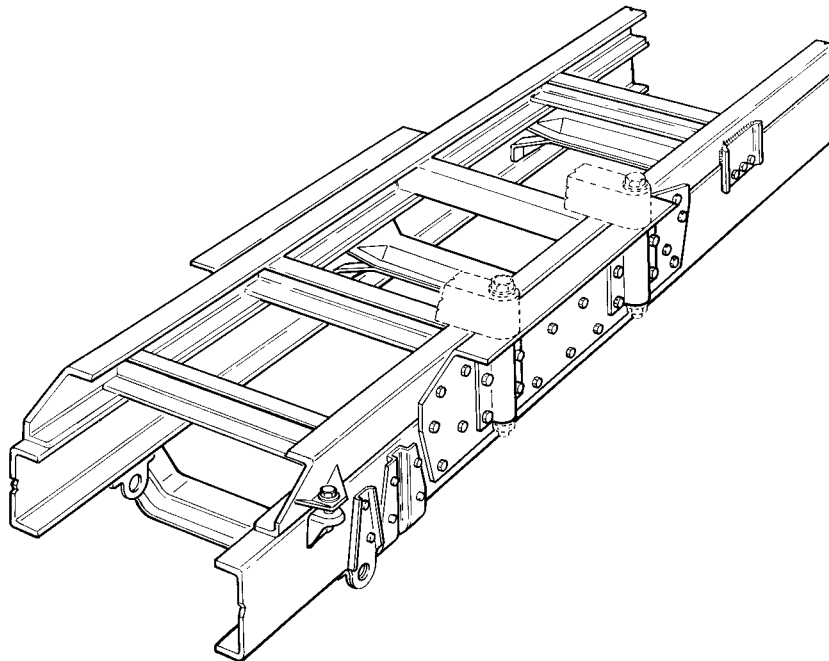
| Models                        | Wheelbase (mm)                                        | Crane capacity MG max (kNm)                                     |    |    |    |    |    |    |    |     |     |                  |                  |     |     |     |     |     |     |     |   |
|-------------------------------|-------------------------------------------------------|-----------------------------------------------------------------|----|----|----|----|----|----|----|-----|-----|------------------|------------------|-----|-----|-----|-----|-----|-----|-----|---|
| (Chassis frame section in mm) | Yield point of subframe material (N/mm <sup>2</sup> ) |                                                                 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90  | 100 | 120              | 140              | 160 | 180 | 200 | 220 | 240 | 260 | 280 |   |
|                               |                                                       |                                                                 | -  | -  | -  | -  | -  | -  | -  | -   | -   | -                | -                | -   | -   | -   | -   | -   | -   | -   | - |
|                               |                                                       | 20                                                              | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 120 | 140              | 160              | 180 | 200 | 220 | 240 | 260 | 280 | 300 |   |
|                               |                                                       | Minimum value of subframe Section Modulus Wx (cm <sup>3</sup> ) |    |    |    |    |    |    |    |     |     |                  |                  |     |     |     |     |     |     |     |   |
| AS 190                        |                                                       | 240                                                             | A  | A  | A  | A  | A  | A  | A  | A   | A   | 21 <sup>1)</sup> | 89               | 343 | 439 | E   | E   | E   | E   | E   |   |
| AS 260                        |                                                       | 360                                                             | A  | A  | A  | A  | A  | A  | A  | A   | A   | 21 <sup>1)</sup> | 89               | 119 | 150 | 245 | 374 | 439 | E   | E   |   |
| (289X80X6,7)                  |                                                       | 420                                                             | A  | A  | A  | A  | A  | A  | A  | A   | A   | 21 <sup>1)</sup> | 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                | 21 <sup>1)</sup> | 89  | 406 | E   | E   | E   | E   | E   |   |
| AS 260 Z/P                    | 6050/1395                                             | 360                                                             | A  | A  | A  | A  | A  | A  | A  | A   | A   | A                | 21 <sup>1)</sup> | 89  | 119 | 150 | 245 | 374 | 474 | E   |   |
| (289X80X7,7)                  |                                                       | 420                                                             | A  | A  | A  | A  | A  | A  | A  | A   | A   | A                | 21 <sup>1)</sup> | 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 3.1 I) 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)  | Yield point of subframe material (N/mm <sup>2</sup> ) | Crane capacity MG max (kNm)                                                   |    |     |     |     |     |     |     |                  |                  |                  |                  |                  |                  |     |     |     |     |
|---------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------|-------------------------------------------------------------------------------|----|-----|-----|-----|-----|-----|-----|------------------|------------------|------------------|------------------|------------------|------------------|-----|-----|-----|-----|
|                                                                                             |                 |                                                       | 20                                                                            | 30 | 40  | 50  | 60  | 70  | 80  | 90  | 100              | 120              | 140              | 160              | 180              | 200              | 220 | 240 | 260 | 280 |
| (Chassis frame section in mm)                                                               |                 |                                                       | -                                                                             | -  | -   | -   | -   | -   | -   | -   | -                | -                | -                | -                | -                | -                | -   | -   | -   | -   |
|                                                                                             |                 |                                                       | 20                                                                            | 30 | 40  | 50  | 60  | 70  | 80  | 90  | 100              | 120              | 140              | 160              | 180              | 200              | 220 | 240 | 260 | 280 |
|                                                                                             |                 |                                                       | Minimum value of subframe Section Modulus Wx (cm <sup>3</sup> ) <sup>1)</sup> |    |     |     |     |     |     |     |                  |                  |                  |                  |                  |                  |     |     |     |     |
| AS 190                                                                                      | up to 6300      | 240                                                   | A                                                                             | A  | A   | A   | A   | A   | A   | A   | 31 <sup>1)</sup> | 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 <sup>1)</sup> | 46               | 89               | 89               | 135 | 150 | 173 | 208 |
| (289X80X6,7)                                                                                |                 | 420                                                   | A                                                                             | A  | A   | A   | A   | A   | A   | A   | A                | A                | A                | 31               | 36 <sup>1)</sup> | 89               | 89  | 105 | 135 | 150 |
| AS 260 Y/P                                                                                  | 5700/1395       | 240                                                   | A                                                                             | A  | A   | A   | A   | A   | A   | A   | A                | 31 <sup>1)</sup> | 36 <sup>1)</sup> | 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 <sup>1)</sup> | 36 <sup>1)</sup> | 89               | 89  | 105 | 135 | 150 |
| (289X80X7,7)                                                                                |                 | 420                                                   | A                                                                             | A  | A   | A   | A   | A   | A   | A   | A                | A                | A                | A                | A                | 31 <sup>1)</sup> | 46  | 89  | 89  | 105 |
| Section modulus Wx (cm <sup>3</sup> ) 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 |
|                                                                                             |                 | 360                                                   | 48                                                                            | 72 | 96  | 120 | 143 | 167 | 191 | 215 | 238              | 286              | 334              | 381              | 429              | 477              | 524 | 572 | 619 | 667 |
|                                                                                             |                 | 420                                                   | 40                                                                            | 60 | 80  | 100 | 120 | 140 | 160 | 180 | 200              | 240              | 280              | 320              | 360              | 400              | 440 | 480 | 520 | 560 |
|                                                                                             |                 | 490                                                   | 34                                                                            | 50 | 67  | 84  | 100 | 117 | 134 | 150 | 167              | 200              | 234              | 267              | 300              | 334              | 367 | 400 | 434 | 467 |

\* 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 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 3.13). 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)**

|                                                                                              | <b>A</b>      | <b>B</b>            | <b>C o D</b>                            | <b>E</b>                                | <b>F</b>                    | <b>G</b>                    |
|----------------------------------------------------------------------------------------------|---------------|---------------------|-----------------------------------------|-----------------------------------------|-----------------------------|-----------------------------|
| Material yield point (N/mm <sup>2</sup> ):                                                   | ≤ 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) $L_V =$                                     | 0.25 $L_h$ or | $L_A$ 0.35 $L_h$ or | $L_A$ 0.4 $L_h$ or                      | $L_A$ 0.45 $L_h$ or                     | $L_A$ 0.55 $L_h$ or         | $L_A$ 0.6 $L_h$ or $L_A$    |
| Example:<br>Combined section as an alternative to the channel section (mm):<br>C250x80x8 mm: | 210x80x8      | 90x80x8             | 150x80x8<br>+ straight section<br>15x80 | 130x80x8<br>+ straight section<br>15x80 | 150x80x8<br>+ angle section | 130x80x8<br>+ 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 not 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  $L_V$  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.

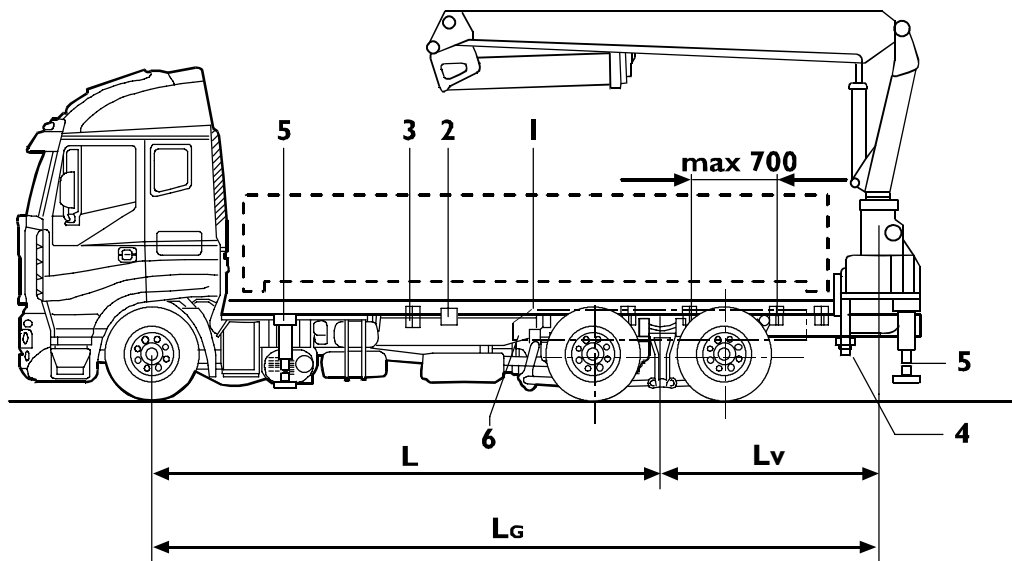
The rear overhang of the crane (length  $L_u$ , see Figure 3.30) must be limited as much as possible in order to preserve the good driving characteristics of the vehicle and acceptable stress conditions. This value must not exceed 50% of the wheelbase.

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/mm <sup>2</sup> )                                  | 20                                                                            | 30          | 40          | 50          | 60          | 70          | 80                         | 90                         | 100                                                      | 120                                        | 140                                         | 160                           | 180              | 200               | 220               | 240              | 260               | 280             |     |  |
|                                                                                            |                                                                                        | 30                                                                            | 40          | 50          | 60          | 70          | 80          | 90                         | 100                        | 120                                                      | 140                                        | 160                                         | 180                           | 200              | 220               | 240               | 260              | 280               | 300             |     |  |
|                                                                                            |                                                                                        | Minimum value of subframe Section Modulus Wx (cm <sup>3</sup> ) <sup>1)</sup> |             |             |             |             |             |                            |                            |                                                          |                                            |                                             |                               |                  |                   |                   |                  |                   |                 |     |  |
| AS 190/P<br>AS 260/P; /PS;<br>/FP; /FS<br>AS 260/PT<br>(289x80x6,7)                        | up to 6300<br>up to 5100/1395<br>up to 5100/1395<br>up to 5100/1395<br>up to 5100/1395 | 240<br>360<br>420                                                             | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A | 23 <sup>1)</sup><br>A<br>A | 32 <sup>1)</sup><br>A<br>A | 42 <sup>1)</sup><br>23 <sup>1)</sup><br>23 <sup>1)</sup> | 57<br>32 <sup>1)</sup><br>23 <sup>1)</sup> | 110<br>42 <sup>1)</sup><br>32 <sup>1)</sup> | 135<br>71<br>42 <sup>1)</sup> | 173<br>110<br>71 | 222<br>135<br>110 | 246<br>173<br>135 | E<br>222<br>173  |                   |                 |     |  |
| AS 260 Y/P<br>AS 260 Z/P<br><br>(289X80X7,7)                                               | 5700/1395<br>up to 5700/1380<br>up to 6050/1395<br>up to 6050/1380                     | 240<br>360<br>420                                                             | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A | A<br>A<br>A                | A<br>A<br>A                | A<br>A<br>A                                              | A<br>A<br>A                                | 42<br>23<br>23                              | 71<br>32<br>23                | 110<br>42<br>23  | 135<br>57<br>42   | 173<br>110<br>57  | 222<br>110<br>71 | 222<br>135<br>110 | E<br>135<br>135 |     |  |
| Section modulus Wx (cm <sup>3</sup> ) required for the chassis + subframe combined section | 240<br>360<br>420<br>490 } *                                                           | 63                                                                            | 94          | 125         | 157         | 188         | 219         | 250                        | 282                        | 313                                                      | 375                                        | 438                                         | 500                           | 563              | 625               | 688               | 750              | 813               | 875             | 938 |  |
|                                                                                            |                                                                                        | 48                                                                            | 72          | 96          | 120         | 143         | 167         | 191                        | 215                        | 238                                                      | 286                                        | 334                                         | 381                           | 429              | 477               | 524               | 572              | 619               | 667             | 715 |  |
|                                                                                            |                                                                                        | 40                                                                            | 60          | 80          | 100         | 120         | 140         | 160                        | 180                        | 200                                                      | 240                                        | 280                                         | 320                           | 360              | 400               | 440               | 480              | 520               | 560             | 600 |  |
|                                                                                            |                                                                                        | 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 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>B</b> | <b>D</b>                                | <b>G</b>                    |
|----------------------------------------------------------------------------------------------|----------|-----------------------------------------|-----------------------------|
| Material yield point (N/mm <sup>2</sup> )                                                    | 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:<br>Combined section as an alternative to the channel section (mm) : 220 x 80 x 8 mm | 200x80x8 | 160x80x8<br>+ straight section<br>15x80 | 140x80x8<br>+ 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

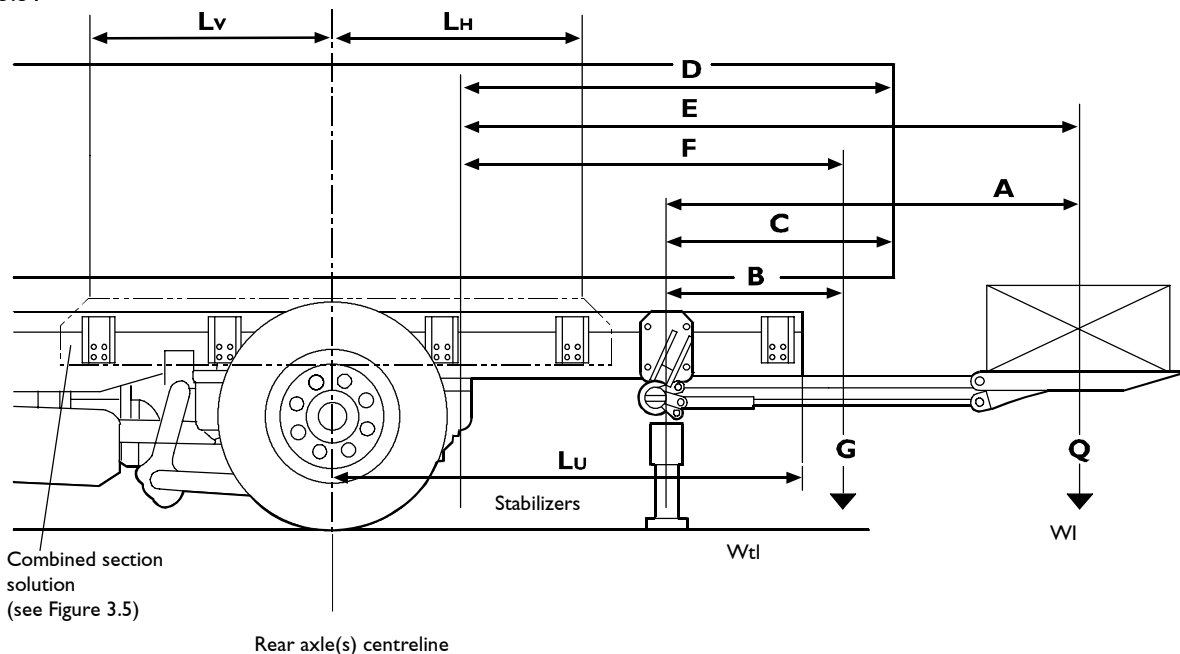
The stress to be distributed over the chassis of the vehicle.

#### 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



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$W_{TL}$  = 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.





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)                                                                                                            |                                                                    |                                                                      |                                                                    |                                                                        |                                                                       |                                                                       |                                                                   |                                                                                 |                                                             |                                                                     |                                                                     |                                                                |                                                              |                                                           |                                                               |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------|
| (Chassis frame section in mm)                                          | Wheelbase<br>(mm)                                                                    | 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 <sup>3</sup> ) as a function of the yield point of the material (N/mm <sup>2</sup> ) |                                                                    |                                                                      |                                                                    |                                                                        |                                                                       |                                                                       |                                                                   |                                                                                 |                                                             |                                                                     |                                                                     |                                                                |                                                              |                                                           |                                                               |
|                                                                        |                                                                                      |                                                                                      |                                                                                      | 240                                                                                                                                   | 360                                                                | 240                                                                  | 360                                                                | 240                                                                    | 360                                                                   | 240                                                                   | 360                                                               | 240                                                                             | 360                                                         | 240                                                                 | 360                                                                 | 240                                                            | 360                                                          | 240                                                       | 360                                                           |
| AS 190/P                                                               | 3800<br>4200                                                                         | 1847<br>2072                                                                         | 2275<br>2500                                                                         | A<br>A                                                                                                                                | A<br>A                                                             | A<br>A                                                               | A<br>A                                                             | A<br>A                                                                 | A<br>A                                                                | A<br>57                                                               | A<br>A                                                            | 57<br>89                                                                        | A<br>46                                                     | 89<br>105                                                           | 46<br>57                                                            | 89<br>135                                                      | 46<br>89                                                     | 135<br>150                                                | 89<br>89                                                      |
| AS/AD/AT 260/P; /PS; /PT<br>(302,4/212,4x80x6,7)                       | 3800<br>4200<br>4500<br>4800<br>5100                                                 | -<br>-<br>-<br>-<br>-                                                                | 2207<br>2567<br>2522<br>2522<br>2252                                                 | 89<br>89<br>89<br>89<br>89                                                                                                            | 46<br>46<br>46<br>46<br>46                                         | 89<br>105<br>105<br>105<br>89                                        | 46<br>57<br>57<br>57<br>46                                         | 89<br>135<br>135<br>135<br>89                                          | 46<br>89<br>89<br>89<br>46                                            | 135<br>150<br>150<br>150<br>135                                       | 89<br>89<br>89<br>89<br>89                                        | 135<br>150<br>150<br>150<br>135                                                 | 89<br>89<br>89<br>89<br>89                                  | 135<br>173<br>173<br>173<br>135                                     | 89<br>105<br>105<br>105<br>89                                       | 150<br>208<br>208<br>208<br>150                                | 119<br>135<br>135<br>135<br>119                              | 208<br>286<br>286<br>286<br>208                           | 135<br>150<br>150<br>150<br>135                               |
| AS/AD/AT 260/TN<br>AS/AD/AT 260/PT<br>(P. 5700/1380)<br>(302,4x80x6,7) | bis 5700<br>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;<br>(302,4/212,4x80x6,7)                           | 4471<br>4471<br>5101<br>5101<br>5101<br>5101<br>5686<br>5686<br>6271<br>6271<br>6271 | 1307<br>1802<br>1577<br>1982<br>2207<br>2387<br>1982<br>2207<br>2027<br>2387<br>2792 | 1760<br>2250<br>2030<br>2430<br>2660<br>2840<br>2430<br>2660<br>2480<br>2840<br>3240 | A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>89                                                                                  | A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>46 <sup>1)</sup> | A<br>A<br>A<br>A<br>A<br>57<br>A<br>A<br>A<br>57 <sup>1)</sup><br>89 | A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>A<br>46 <sup>1)</sup> | A<br>A<br>A<br>A<br>A<br>89<br>A<br>89<br>A<br>46 <sup>1)</sup><br>105 | A<br>A<br>A<br>A<br>A<br>46<br>A<br>A<br>A<br>57 <sup>1)</sup><br>135 | A<br>A<br>A<br>A<br>A<br>89<br>A<br>89<br>A<br>46 <sup>1)</sup><br>89 | A<br>A<br>A<br>A<br>A<br>46<br>A<br>89<br>46 <sup>1)</sup><br>105 | A<br>A<br>A<br>A<br>A<br>89<br>A<br>46 <sup>1)</sup><br>57 <sup>1)</sup><br>135 | A<br>A<br>A<br>A<br>A<br>46<br>89<br>46 <sup>1)</sup><br>89 | A<br>A<br>A<br>A<br>A<br>89<br>105<br>89<br>46 <sup>1)</sup><br>135 | A<br>A<br>A<br>A<br>A<br>89<br>105<br>89<br>46 <sup>1)</sup><br>135 | 89<br>46<br>89<br>105<br>150<br>105<br>105<br>135<br>89<br>150 | 46<br>89<br>46<br>57<br>89<br>173<br>135<br>89<br>150<br>208 | 135<br>89<br>135<br>89<br>173<br>105<br>150<br>208<br>245 | 46<br>89<br>46<br>89<br>150<br>105<br>89<br>150<br>208<br>150 |
| AS/AD/AT 260/P; /FP; /FS; /PS<br>(302,4/212,4x80x6,7)                  | 4201<br>4201<br>4471<br>4471<br>4786<br>4786<br>4786<br>5101                         | 1127<br>1622<br>1217<br>1622<br>1487<br>1712<br>2072<br>1802                         | 1580<br>2070<br>1670<br>2070<br>1940<br>2160<br>2520<br>2250                         | A<br>57<br>A<br>57<br>A<br>89<br>89<br>89                                                                                             | A<br>A<br>A<br>A<br>A<br>46<br>46<br>46                            | A<br>89<br>A<br>89<br>A<br>89<br>46<br>89                            | A<br>46<br>A<br>46<br>A<br>46<br>46<br>105                         | A<br>89<br>A<br>89<br>A<br>89<br>46<br>57                              | A<br>46<br>A<br>46<br>A<br>46<br>46<br>105                            | A<br>89<br>A<br>89<br>A<br>89<br>46<br>135                            | A<br>46<br>A<br>46<br>A<br>46<br>46<br>89                         | 89<br>105<br>89<br>105<br>89<br>135<br>89<br>135                                | 46<br>89<br>46<br>89<br>105<br>89<br>135<br>150             | 89<br>135<br>89<br>135<br>89<br>89<br>105<br>105                    | 46<br>89<br>46<br>89<br>150<br>173<br>207<br>173                    | 105<br>89<br>105<br>105<br>89<br>105<br>135<br>105             | 57<br>208<br>135<br>208<br>150<br>208<br>286<br>208          | 89<br>208<br>89<br>208<br>135<br>150<br>286<br>135        |                                                               |
| AS/AD/AT 260/P; /FP<br>(304,4 X 80 X 7,7)                              | 5686<br>6050                                                                         | -                                                                                    | 2432<br>2660                                                                         | A<br>A                                                                                                                                | A<br>A                                                             | A<br>A                                                               | A<br>A                                                             | A<br>46                                                                | A<br>A                                                                | A<br>46                                                               | A<br>A                                                            | 46<br>46                                                                        | A<br>A                                                      | 46<br>46                                                            | A<br>A                                                              | 46<br>46                                                       | 46<br>46                                                     | 46<br>73                                                  | 46<br>46                                                      |
| AS/AD/AT 260 Z/P-HM<br>(304,4 x 80 x 7,7)                              | 3796<br>3796<br>4201<br>4201<br>4201<br>4201<br>4471                                 | 1127<br>1487<br>1127<br>1487<br>1622<br>1847<br>1982                                 | 1580<br>1940<br>1580<br>1940<br>2070<br>2300<br>2430                                 | A<br>A<br>A<br>A<br>A<br>A<br>A                                                                                                       | A<br>A<br>A<br>A<br>A<br>A<br>A                                    | A<br>A<br>A<br>A<br>A<br>A<br>A                                      | A<br>A<br>A<br>A<br>A<br>A<br>A                                    | A<br>A<br>A<br>A<br>A<br>A<br>A                                        | A<br>A<br>A<br>A<br>A<br>A<br>A                                       | A<br>A<br>A<br>A<br>A<br>A<br>A                                       | A<br>A<br>A<br>A<br>A<br>A<br>A                                   | A<br>A<br>A<br>A<br>A<br>A<br>A                                                 | A<br>A<br>A<br>A<br>A<br>A<br>A                             | A<br>A<br>A<br>A<br>A<br>A<br>A                                     | A<br>A<br>A<br>A<br>A<br>46<br>89                                   | A<br>A<br>A<br>A<br>A<br>A<br>A                                | A<br>A<br>A<br>A<br>A<br>A<br>A                              | A<br>A<br>A<br>A<br>A<br>89<br>89                         | A<br>A<br>A<br>A<br>A<br>A<br>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 $W_x$ (cm <sup>3</sup> ) of subframe runner <sup>2)</sup>                       |         |         |         |         |         |         |         |         |         |         |
|------------------------------------|------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Chassis frame section (mm)         | Wheelbase (mm)                     | Subframe material yield point (N/mm <sup>2</sup> ) | 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<br>up to 5100/1395      | 240                                                | 55.2                                                                                                 | 61.3    | 65.6    | 63.3    | 67.6    | 74.7    | 78.4    | 82.7    | (102.6) | (109.2) | (110.7) |
|                                    |                                    | 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<br>(289x80x6.7)       | up to 5700/1395<br>up to 6050/1395 | 240                                                |                                                                                                      |         |         |         |         |         |         |         |         |         |         |
|                                    |                                    | 360                                                |                                                                                                      |         |         |         |         |         |         |         |         |         |         |
|                                    |                                    | 420                                                |                                                                                                      |         |         |         |         |         |         |         |         |         |         |
| AS/AD/AT 260 (6X4)<br>(289x80x7.7) | 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) |
|                                    |                                    | 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 $W_x$ (cm <sup>3</sup> ) of subframe runner <sup>2)</sup>                       |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------------------------------|------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Chassis frame section (mm)                        | Wheelbase (mm)                     | Subframe material yield point (N/mm <sup>2</sup> ) | 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<br>AS/AD/AT 260<br>(199x80x6.7 rear) | up to 6300<br>up to 5100/1395      | 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) |
|                                                   |                                    | 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) |
|                                                   |                                    | 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<br>(289x80x6.7)                      | up to 5700/1395<br>up to 6050/1395 | 240                                                |                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |
|                                                   |                                    | 360                                                |                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |
|                                                   |                                    | 420                                                |                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |
| AS/AD/AT 260 (6x4)<br>(289x80x7.7)                | 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) |
|                                                   |                                    | 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